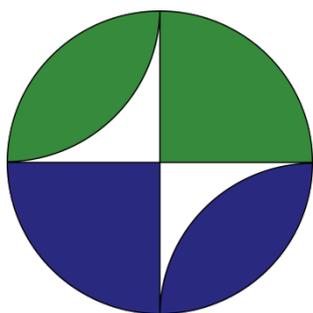


**INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS**  
**UNION GEODESIQUE ET GEOPHYSIQUE INTERNATIONALE**

# **Annual Report 2019**



**INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS**  
UNION GEODESIQUE ET GEOPHYSIQUE INTERNATIONALE

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# INTRODUCTION

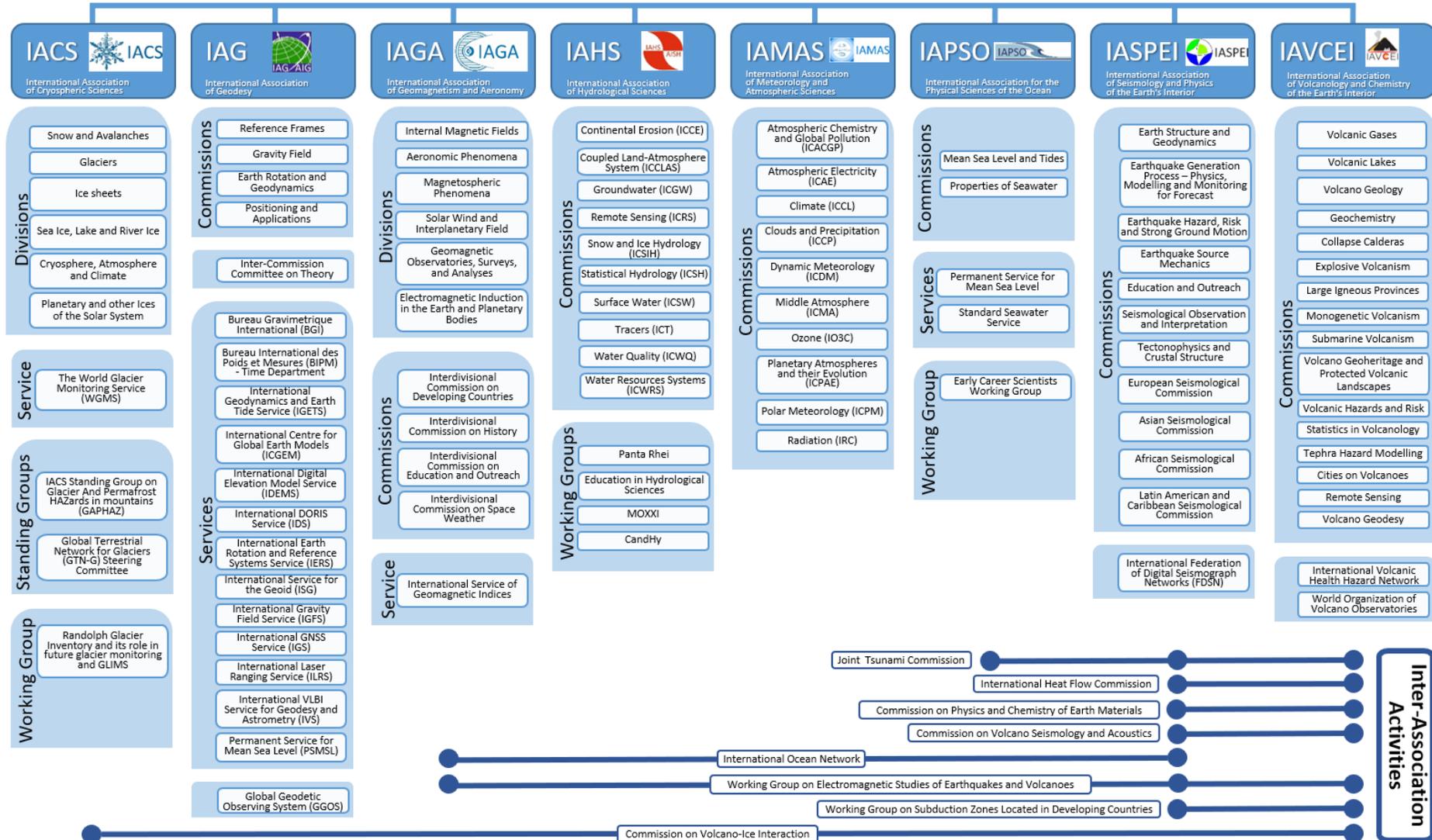
Established in 1919, the International Union of Geodesy and Geophysics (IUGG) is an international, non-governmental, non-profit organization dedicated to advancing, promoting, and communicating knowledge of the Earth system, its space environment, and the dynamical processes causing change. Through its constituent associations, commissions, and services, IUGG convenes international assemblies and workshops, undertakes research, assembles observations, gains insights, coordinates activities, liaises with other scientific bodies, plays an advocacy role, contributes to education, and works to expand capabilities and participation worldwide. Data, information, and knowledge gained are made openly available for the benefit of society – to provide the information necessary for the discovery and responsible use of natural resources, sustainable management of the environment, reducing the impact of natural hazards, and to satisfy our need to understand the Earth's natural environment and the consequences of human activities. IUGG Associations and Union Commissions encourage scientific investigation of Earth science and especially interdisciplinary aspects. Each Association establishes working groups and commissions that can be accessed by using the links on our website (see also the IUGG chart on the following page).

IUGG is one of 40 scientific unions adhering to the International Science Council (ISC). ISC provides a global forum for scientists to exchange ideas and information and to develop standard methods and procedures for all fields of research. IUGG brings expertise on Earth studies from researchers in its International and Inter-Association Commissions. As a member of ISC, IUGG strongly supports its policy of non-discrimination by affirming the rights and freedom of scientists throughout the world to engage in international scientific activity without limitation by such factors as citizenship, religion, creed, political stance, ethnic origin, race, color, language, age or gender.

IUGG has initiated and/or vigorously supported collaborative efforts that have led to highly productive world-wide interdisciplinary programs and projects, such as the International Geophysical Year (1957-58), the Upper Mantle Project (1964-70), the International Hydrological Decade (1965-74), the Geodynamics Project (1972-79), the Global Atmospheric Research Program (1967-80), the International Lithosphere Program, the World Climate Research Programme, the International Decade for Natural Disaster Reduction, Integrated Research on Risk Disasters, the International Heliophysical Year (2007-2009), the Electronic Geophysical Year (2007-2008), the International Year of Planet Earth (2007-2009), the International Polar Year (2007-2008), Extreme Natural Hazards and Societal Implications (2010-2014), International Year of Deltas (2013-2014), and the International Geosphere-Biosphere Programme (1987-2015). These programs have set a model for international, interdisciplinary cooperation. Representing all geophysical disciplines, IUGG is involved in the projects and programs related to climate change, global warming, and related environmental impacts.

# International Union of Geodesy and Geophysics (IUGG)

## Associations

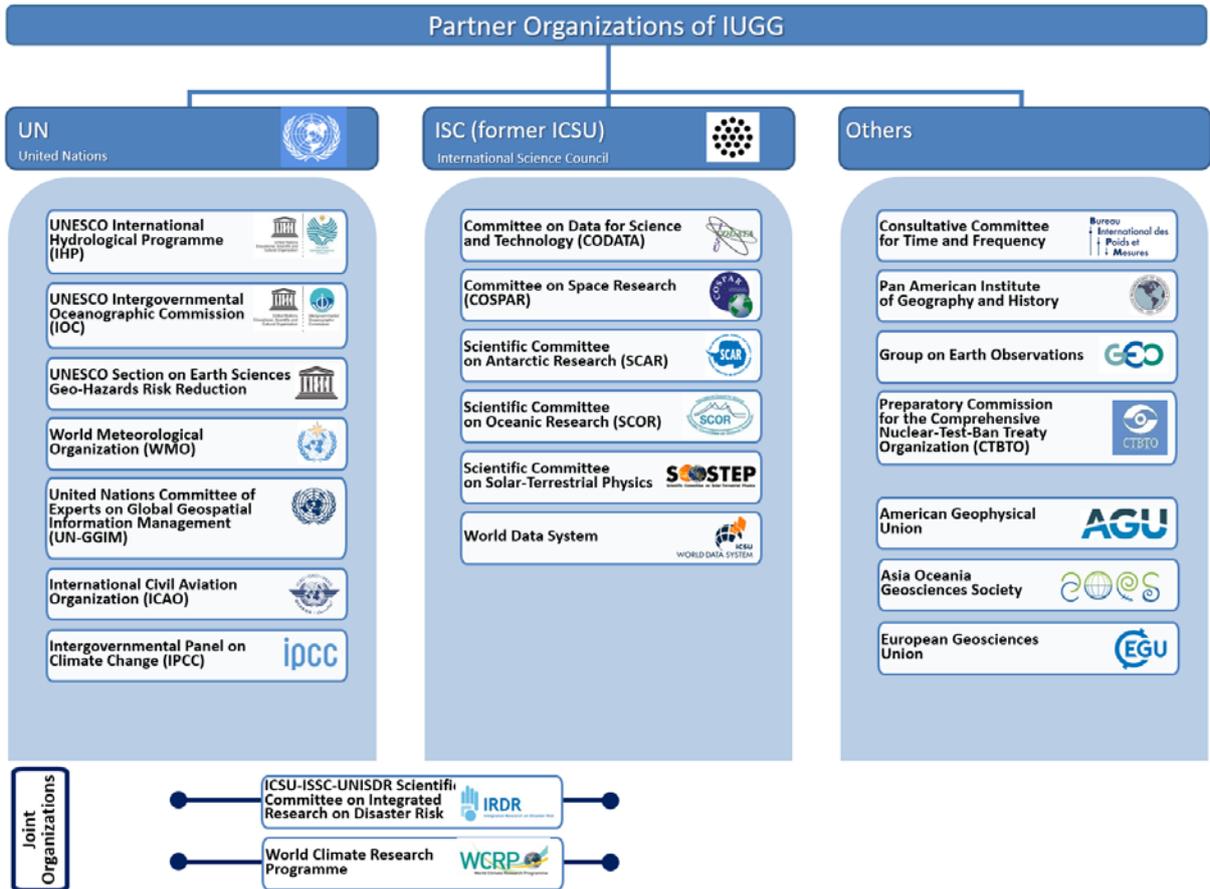


IUGG supported and supports initiatives by ISC, especially those in which Earth sciences have a role to play. IUGG cooperates with the United Nations Educational, Scientific and Cultural Organization (UNESCO) in the study of hydrological (through IAHS) and oceanographic (through IAPSO) research; with the World Meteorological Organization (WMO) to promote studies in atmospheric sciences and

Current	Past
<ul style="list-style-type: none"> <li>• <b>International Lithosphere Program</b> (ILP, a joint IUGS-IUGG activity)</li> <li>• <b>Global Geodetic Observing System</b> (GGOS, an IAG program)</li> <li>• <b>World Climate Research Programme</b> (WCRP)</li> <li>• <b>Integrated Research on Disaster Risk</b> (IRDR)</li> <li>• <b>International Year of Global Understanding</b> (IYGU)</li> <li>• <b>Mathematics of Planet Earth</b> (MPE)</li> <li>• <b>World Data System</b> (WDS)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>International Geosphere-Biosphere Programme</b> (IGBP, 1987-2015)</li> <li>• <b>International Year of Deltas</b> (IYD, 2013-2014)</li> <li>• <b>Extreme Natural Hazards and Societal Implications</b> (ENHANS, 2010-2014)</li> <li>• <b>International Year of Planet Earth</b> (IYPE, 2007-2010)</li> <li>• <b>Electronic Geophysical Year</b> (eGY, 2007-2008)</li> <li>• <b>International Polar Year</b> (IPY, 2007-2008)</li> <li>• <b>International Heliophysical Year</b> (IHY, 2007-2008)</li> <li>• <b>International Decade for Natural Disaster Reduction</b> (IDNDR, 1990-1999)</li> <li>• <b>Geodynamics Project</b> (1972-1979)</li> <li>• <b>Global Atmospheric Research Program</b> (1967-1980)</li> <li>• <b>International Hydrological Decade</b> (1965-1974)</li> <li>• <b>Upper Mantle Project</b> (1964-1970)</li> <li>• <b>International Geophysical Year</b> (IGY, 1957-1958)</li> </ul>

*Programs and Projects initiated and/or supported by IUGG*

meteorology (through IAMAS) as well as in hydrology (through IAHS). Together with the International Civil Aviation Organization (ICAO) and WMO, IUGG promotes the studies, the monitoring and the modelling of volcanic ashes (through IAMAS and IAVCEI). IUGG also cooperates with the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) in the studies related to seismology (through IASPEI), hydroacoustics, atmospheric transport modelling, and meteorology. In addition, IUGG places particular emphasis on the scientific problems of economically less-developed countries by sponsoring activities relevant to their scientific needs, e.g. Geosciences in Africa, eGY in Africa, Water Resources, Health and Well-Being etc.



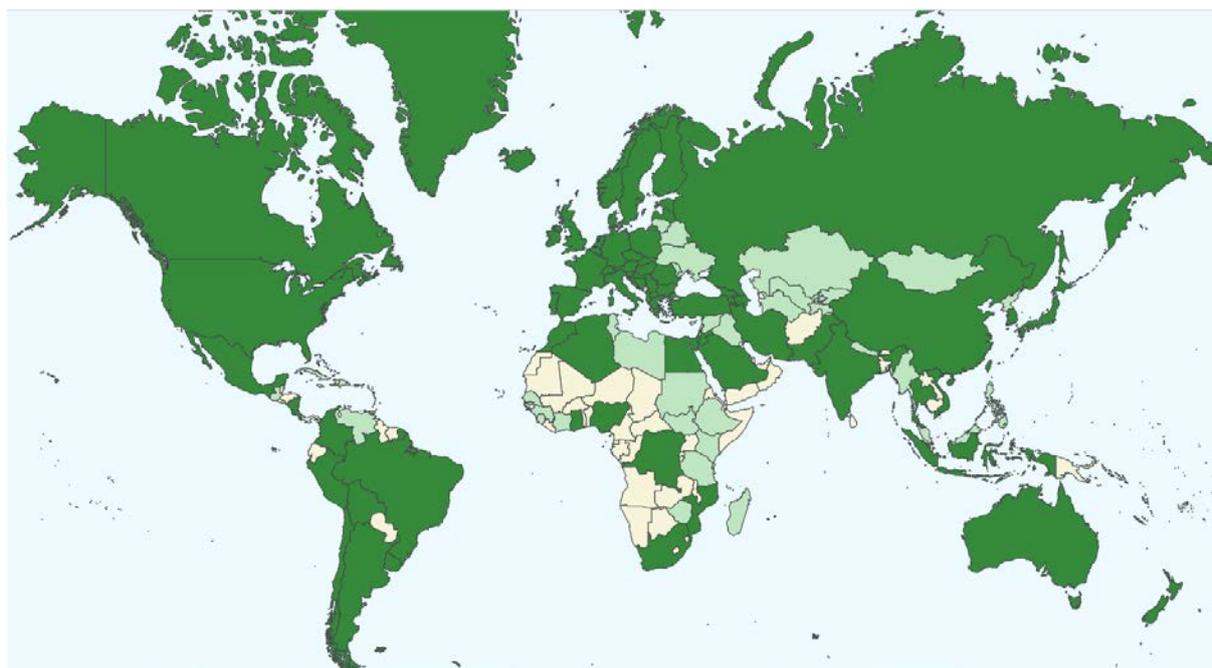
*Scientific Partner Organizations of IUGG*

# GENERAL INFORMATION

## MEMBERSHIP & FINANCE

By their very nature, geodetic and geophysical studies require a high degree of international co-operation. IUGG is critically dependent on the scientific and financial support of its member Adhering Bodies. The list of present and past IUGG Adhering Bodies is published in the IUGG Yearbook and posted on the website. Each Adhering Body establishes a National Committee for IUGG, and names Correspondents to each Association (as appropriate).

As of 31 December 2019, IUGG has 73 National Members including 58 countries in paying status. The paying members are placed in categories from 1 to 14 depending on their financial contribution to the Union (the membership dues rise with increasing category number). At present, the highest category used is category 11. The members pay dues according to a number of units assigned to their category (in category 1 the number of units is 1, and in category 11 the number is 35). According to a decision of the XXII IUGG General Assembly (Boulder, USA, 1995), the price of 1 unit is determined every year using an inflator index obtained from the Bureau of Labor Statistics, U.S. Department of Labor. In 2020, the price of 1 unit will be US\$ 2,055. The 58 paying members represent a total of 276 units, which is equivalent to a total income of US\$ 567,180. The funds received as dues are the basis for IUGG's operations as a scientific union, although Union associations may have their own funds earned via book selling or donations. The funds are spent to support (i) international scientific programs, projects and services, (ii) general and scientific assemblies, symposia, workshops, and schools; (iii) travel of students, early career scientists, and scientists from developing countries to attend scientific meetings; (iv) scientific activities of Union Associations and Commissions, (v) the International Lithosphere Program, (vi) the International Science Council, and (vii) administration and management.



*Regional distribution of current (dark green) and former (light green) IUGG Member Countries (as of 31.12.2019)*

## STRUCTURE

Responsibility for directing the Union's affairs is vested in the IUGG Council by the Statutes and Bylaws. The IUGG Council consists of the Council Delegates, who are designated by the Adhering Body of their respective countries. The Council is convened at each quadrennial General Assembly but can make decisions by electronic voting in between General Assemblies. A Bureau, an Executive Committee and a Finance Committee administer IUGG affairs between Council meetings. The Executive Committee has the particular responsibility of overseeing the scientific programs of the Union. The IUGG Secretariat is located at the German Research Centre for Geosciences (GFZ) in Potsdam, Germany, and assists in the implementation of the decisions of the Bureau, Executive Committee and the Council.

### Associations

The Union brings together eight semi-autonomous Associations, each responsible for a specific range of topics or themes within the overall scope of the Union's activities and each with a sub-structure. The Associations convene their own assemblies and sponsor scientific symposia, often in partnership with one another. Within its own discipline each Association is responsible for determining its own program of investigations and for supporting the activities of its own component parts. All Earth scientists, worldwide, are eligible to participate in IUGG and Association activities, assemblies, workshops, and symposia, although only scientists from member countries with dues paid may serve as Association Presidents.

The eight International Associations are listed below, and short reports on their 2019 activities are included here. Additional information about each Association is given on their websites, which can be accessed from the IUGG [website](#).

- International Association of Cryospheric Sciences (IACS)
- International Association of Geodesy (IAG)
- International Association of Geomagnetism and Aeronomy (IAGA)
- International Association of Hydrological Sciences (IAHS)
- International Association of Meteorology and Atmospheric Sciences (IAMAS)
- International Association for the Physical Sciences of the Oceans (IAPSO)
- International Association of Seismology and Physics of the Earth's Interior (IASPEI)
- International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI)

### Union Commissions

Owing to the interactive nature of the subject fields addressed by the Union's Associations, a number of Union Commissions have been established that promote the study of particular interdisciplinary problems. In 2019, the following bodies were active:

- Commission on Climatic and Environmental Changes (CCEC)
- Commission on Mathematical Geophysics (CMG)
- Commission on Geophysical Risk and Sustainability (GRC)
- Commission on the Study of the Earth's Deep Interior (SEDI)
- Commission for Data and Information (UCDI)
- Commission on Planetary Sciences (UCPS)

## Inter-Unions Commission

The International Lithosphere Program, guided by the Scientific Committee on the Lithosphere (SCL), was established in 1980 as the Inter-Unions Commission on the Lithosphere (ICL) by the International Council for Science (ICSU), at the request of IUGG and the International Union of Geological Sciences (IUGS). The name was formally changed to the Scientific Committee on the Lithosphere in 1999. According to Decision 8.4 from the 2005 ICSU General Assembly, ICSU decided "to withdraw ICSU sponsorship from SCL/ILP and to recommend that responsibility would then shift to IUGG and IUGS". Since that time, IUGG and IUGS have reaffirmed the ILP mission and have collaborated to re-define ILP as an Inter-Unions body.

## GENERAL ASSEMBLIES OF THE UNION

General Assemblies have been held since 1922 and, since 1963, at 4-year intervals. These assemblies provide an extraordinary opportunity for Earth scientists from around the world to gather and share expertise, research data, and results. Past IUGG General Assemblies are listed in the IUGG Yearbook and on the website. The most recent General Assembly was held in Montreal, Canada, 8-18 July 2019. The next IUGG General Assembly will take place in Berlin, Germany, 11-20 July 2023.

## OTHER SCIENTIFIC MEETINGS

Each Association organizes its own scientific assembly in the 4-year interval between Union General Assemblies in order to report scientific progress and conduct Association business. Associations sometimes meet jointly with the purpose of promoting interdisciplinary science. Topical and regional symposia and workshops are organized on other occasions by the Associations to provide opportunity for geodesists and geophysicists worldwide to discuss their respective methodologies, results and hypotheses and to plan collaborative research projects. The symposia, often held in less-visited, geophysically interesting locales, are intended to be attractive to the younger scientists from the developing countries of the world.

## IUGG OFFICERS FOR 2019-2023

### IUGG Bureau

President:	Kathryn Whaler	UK
President-Elect:	Chris Rizos	AUSTRALIA
Secretary General:	Alexander Rudloff	GERMANY
Treasurer:	Niels Andersen	DENMARK
Members:	Stephen McNutt	USA
	Eduard Petrovsky	CZECH REPUBLIC
	Yun Xia	CHINA

### IUGG Executive Committee

#### IUGG Bureau Members

Immediate Past President:	Michael G. Sideris	CANADA
IACS President:	Regine Hock (2019-2021)	USA
	Liss M. Andreassen (2021-2023)	NORWAY

IAG President:	Zuheir Altamimi	FRANCE
IAGA President:	Mioara Manda	FRANCE
IAGS President:	Günter Blöschl (2019-2021) Berit Arheimer (2021-2023)	AUSTRIA SWEDEN
IAMAS President:	Joyce Penner	USA
IAPSO President:	Trevor McDougall	AUSTRALIA
IASPEI President:	Kenji Satake	JAPAN
IAVCEI President:	Patrick Allard	FRANCE

### **IUGG Finance Committee**

Chair:	Corina Risso	ARGENTINA
Members:	Jozsef Adam Priscilla Grew	HUNGARY USA

### **Association Secretaries General**

IACS Secretary General:	Richard Essery	UK
IAG Secretary General:	Markku Poutanen	FINLAND
IAGA Secretary General:	Monika Korte	GERMANY
IAGS Secretary General:	Christophe Cudennec	FRANCE
IAMAS Secretary General:	Steven Ackerman	USA
IAPSO Secretary General:	Stefania Sparnocchia	ITALY
IASPEI Secretary General:	Johannes Schweitzer	NORWAY
IAVCEI Secretary General:	Roberto Sulpizio	ITALY

### **Union Commission Officers**

#### Union Commission on Climatic and Environmental Changes (CCEC)

Chair:	Jianping Li	CHINA
Secretary:	Tonie van Dam	LUXEMBOURG

#### Union Commission on Mathematical Geophysics (CMG)

Chair:	Alik Ismail-Zadeh	GERMANY/RUSSIA
Secretary:	Ilya Zaliapin	USA

#### Union Commission on Geophysical Risk and Sustainability (GRC)

Chair:	John LaBrecque	USA
Secretary:	Katia Kontar	USA

#### Union Commission on Studies of Earth's Deep Interior (SEDI)

Chair:	Christine Thomas	GERMANY
Secretary:	Michael Bergman	USA

#### Union Commission for Data and Information (UCDI)

Chair:	Sateesh Sheno	INDIA
Vice Chair:	Anatoly Soloviev	RUSSIA

#### Union Commission on Planetary Sciences (UCPS)

Chair:	Shuanggen Jin	CHINA
Secretary:	Scot Rafkin	USA

**Inter-Unions Commission: International Lithosphere Program (ILP)**

President:	Hans Thybo	TURKEY/NORWAY
Secretary General:	Magdalena Scheck-Wenderoth	GERMANY

# MESSAGE FROM THE PRESIDENT

I took over as President at the end of the General Assembly in Montreal in July 2019, so this report covers only part of the year, the first few months of my term of office. My first significant and remarkable duty as President, for which I feel enormously privileged, was at the IUGG centennial day at the UNESCO headquarters in Paris, France under the theme 'International Cooperation in Earth and Space Sciences'. The program of the day can be found [here](#). The immense groundwork for this unique event was done by my predecessor as President, Michael Sideris, and especially our past Secretary-General, Alik Ismail-Zadeh. During the Opening Ceremony we heard from a number of distinguished guests, and we presented commemorative plaques to other Unions and agencies with which we cooperate and collaborate. His Serene Highness Prince Albert II of Monaco accepted Honorary Membership of the Union, and spoke eloquently and movingly about the history of the Union, including the involvement of his great-great-grandfather, Prince Albert I, and his own interest in protecting the world's oceans. There were sessions on 'Earth and Space Sciences and Society' and 'Earth Science for Sustainable Development' followed by lively moderated panel discussions on 'Strengthening International Cooperation in Science and Education in a Multi-Cultural World' and '21<sup>st</sup> Century's Triad: Sustainable Development, Climate Change and Disaster Risk Reduction', again with distinguished contributors. We presented all attendees with a Special Issue of the journal 'History of Geo- and Space Sciences', entitled '[The International Union of Geodesy and Geophysics: from different spheres to a common globe](#)', guest edited by Alik Ismail-Zadeh (Secretary-General 2007-2019) and Jo Ann Joselyn (Secretary-General 1999-2007), covering the history of the Union, prospects for its next century, and articles about each of the eight Union Associations. After my closing remarks, we were treated to a musical performance by the PhiloGaïa Orchestra of Institut de Physique du Globe de Paris, led by Dr Nobuaki Fuji, entitled 'We love our Planet!', with accompanying video images. The day concluded with a cocktail reception. UNESCO's press release on the event can be found [here](#). [Photos](#) and [video recordings](#) are also available. UNESCO was a wonderful venue, and we were very well looked after by the staff there. We have received a Centenary Scroll from Royal Society of London, the UK adhering body, and many letters of thanks for the commemorative plaques.



Paris then provided a convenient venue for a [GeoUnions](#) meeting the day after the centenary event, hosted at the International Science Council (ISC) offices, with IUGG represented by myself and Alik Ismail-Zadeh. Our busy Agenda included discussion of ISC priorities ('Challenge Domains') and how the GeoUnions map onto them, and the Sustainable Development Goals (SDGs). We agreed to continue working towards a joint scientific initiative, most likely around one or more of the themes of

- Earth and Space Education and Outreach
- Geoscience & Space science and developing nations
- Early career scientists in geo & space sciences
- Women in geo & space science
- Data-driven earth and space science

Within this context, the President of the International Union of Geological Sciences (IUGS), Qiuming Cheng, presented an updated document on their 10-year big science project Deep-time Digital Earth (DDE), which aligns well with ISC priorities, the SDGs and common GeoUnions science themes. The

intention is that this will become an ISC-recognized Big Science Programme. Orhan Altan, previous Vice-President of the International Society for Photogrammetry and Remote Sensing, summarized contributions in the areas of remote sensing and radio science to assessing, monitoring and managing disasters and risk, including the Geodata for Disaster Management (Gi4DM) conference that subsequently took place in Prague, Czech Republic in September 2019, and the book that had been published on the 2018 conference. The GeoUnions agreed to establish an ad hoc Working Group on disasters and risk, to broaden the areas of science participating in such activities. One of its tasks will be to coordinate the Gi4DM series of conferences. In response to an Agenda item on ISC Budget Audits Approval, the meeting was also joined by Charles Erkelens, ISC Operations Director, who explained the rather opaque ISC budget we had been presented with. He promised that the budget would be more descriptive in subsequent years. The next GeoUnions meeting will be during the European Geosciences Meeting (EGU) in Vienna, Austria in May 2020.

The Union signed a new Memorandum of Understanding (MoU) with the International Centre for Theoretical Physics (ICTP) in Trieste, Italy in September 2019, during an Advanced Workshop on Earth Mechanics: Theory, Simulation and Observations, which the Union sponsored. I had intended to sign the MoU myself, but family illness meant I had to cancel my trip at short notice. It was signed instead by Alik Ismail-Zadeh on behalf of the Union, and he also gave a lecture during the Workshop on 'IUGG, natural hazards and society'. The MoU covers the period 2020-2023.

In October 2019, I spent 5 days as guest of the National Geophysical Research Institute in Hyderabad, India. I met their leadership team in a round table discussion, and toured much of the site visiting individual facilities and their researchers. I was Guest of Honour at their Foundation Day and gave a keynote lecture, and participated in the triennial Federation of Indian Geosciences Associations Congress they hosted afterwards, where 100 years of IUGG and AGU were celebrated both during the inaugural session and at a special plenary session of the meeting. The theme of the Congress was 'Geosciences for Sustainable Development Goals' and I appreciated material on this from the Associations that contributed to my presentation in the special session.

In November 2019, I attended the [World Science Forum](#) (WSF) in Budapest, Hungary. There I participated in events as part of the UNESCO Anniversary Year of Roland Eötvös' death: co-moderating a WSF side event entitled 'Outcomes of the Roland Eötvös Commemorative Year', with formal presentations and discussion, followed by the launch of the book 'The Eötvös experiment in its historical context', and attending the Opening Ceremony of the Eötvös 100 University Exhibition, with a tour of the exhibition. I was presented with a commemorative coin minted to mark the year, and also received a copy of 'The Eötvös experiment in its historical context' as well as 'The Roland Eötvös commemorative album', which was launched the following week. At the WSF, I (and Alik Ismail-Zadeh) had a meeting with ISC CEO Heide Hackmann and Senior Communications Officer Alison Meston to discuss matters such as the ISC 2019-2021 Action Plan, IUGG priorities, relations between IUGG and ISC, our shared vision, and IUGG's longer term expectations of the ISC. I also met the new Director of ICTP, Atish Dabholkar, who took up his post that month, and caught up with Daya Reddy, ISC President, whom I had met at the IUGG General Assembly in Montreal, Canada. Finally, I spent an afternoon talking with researchers and visiting the facilities at the Budapest Seismological Observatory, hosted by István Kovács, Director of the Geodetic and Geophysical Institute in Hungary. The Institute is responsible for the geodetic and geophysical observatory network in Hungary.

I was unable to attend the 2019 Fall Meeting of the American Geophysical Union (AGU) where both our centenary years were celebrated, but Secretary General Alex Rudloff attended several events on my behalf and will report separately.

I was invited to join the Science Board of the DDE programme, and attended its first meeting in Busan, Rep. of Korea, in January 2020, following an Executive Committee of IUGS. Past-President Harsh Gupta is also a member. Over two days we had several presentations, and discussions over the direction and detailed content of the proposed programme, the call for proposals, and how those proposals should be evaluated. We made extensive comments on the draft of the DDE White Paper. DDE will be launched at IGC in New Delhi, India in March 2020. There could be many opportunities for collaboration on IUGG-related science within the programme.

IUGG joined the Sendai Landslides Partnership in 2015. A new partnership, Kyoto Landslide Commitment 2020 (KLC2020), was approved by the initial 57 organizations at UNESCO Headquarters last year. I will be signing the new Commitment on behalf of IUGG to be presented at the second signatory meeting in April 2020 in Kyoto, Japan, the day before the World Landslides Forum 5 (WLF5) organizing committee meeting. WLF5 will be held in Kyoto in November 2020. IUGG supported WLF4 and the previous Secretary-General was Honorary Chairperson. I have accepted an invitation to be Honorary Chairperson for WLF5, together with executive heads of UNESCO, UNDRR, WMO, FAO, ISC and others. Through our GeoRisk Commission (GRC), we will support WLF5, and GRC is planning to sponsor a symposium.

IUGG has been approached to be part of a proposed International Year in 2022, to be known as either the International Year of Basic Sciences for Sustainable Development or the International Year of Basic Sciences for Sustainable Development (IYBSSD). It will be led by the International Union of Pure and Applied Physics (IUPAP). It has already garnered support from a number of Unions and the ISC. The resolution for the proclamation of an IYBSSD in 2022 was adopted by the UNESCO Executive Board in October 2019 and the UNESCO General Conference in November 2019. It was also welcomed by the World Science Forum 2019 in Budapest, Hungary. It will have to be proclaimed by the United Nations General Assembly. I participated in a webinar with representatives of a number of other relevant Unions and entities in December 2019, led by the President of the IUPAP. IUGG Bureau will discuss the matter further at its meeting in June 2020, but we have indicated our support in principle. We already undertake or sponsor a good many activities that could be part of the International Year and thereby gain more visibility.

Through an approach to Alik Ismail-Zadeh, the IUGG liaison to the UNESCO Earth Science Section, from Ozlem Adiyaman of UNESCO, IUGG has received a request to co-sponsor UNESCO's International Geoscience Program. Our Centenary event at UNESCO last July, which the Earth Sciences section of UNESCO supported financially, raised the profile of IUGG in UNESCO. This would be an opportunity to build on that visibility, and I am keen for IUGG to accept the invitation if it is affordable. I have asked Alik to indicate to UNESCO our agreement in principle. The Bureau will add the matter to the Agenda for its meeting in June 2020. In the meantime, the Secretary-General will participate in discussions with Alik and Ozlem when they all attend the International Geological Congress meeting in New Delhi, India in March 2020.

Many thanks to everyone who completed the survey of the Montreal General Assembly. We had a good response with many thoughtful comments, and the Local Organizing Committee for the IUGG General Assembly 2023 in Berlin, Germany are taking them on board. The Bureau plans to look at various aspects of the results in detail, and it will be an Agenda item for its meeting in June 2020.

The Statutes and Bylaws Committee, of which I am a member, has continued its work in developing possible updates to the Statutes and Bylaws. I hope that a paper from the Committee will be ready for consideration at the Bureau meeting in June 2020, when Bureau can discuss whether changes can be recommended to Council.

This year, we are preparing for the International Lithosphere Probe (ILP) 40<sup>th</sup> anniversary that will be celebrated at the EGU General Assembly in May 2020 in Vienna, Austria. ILP is a hugely successful joint program between IUGG and IUGS. I will attend, as will Harsh Gupta, the Union's long-standing and very active liaison to the Program.

Finally, a warm thank you to everyone who has contributed to the activities of the Union and its Associations over the past year. In particular, I would like to express my very sincere thanks to all those involved in the preparation for our centenary General Assembly and event at UNESCO last July, and the Task Force 100 and Visioning Committee that did so much work in the planning for the events.

In closing, I would like to thank all colleagues in the outgoing and new Bureau and Executive Committee of the IUGG for their support and cooperation in 2019, and the Secretariat of IUGG for their unstinting commitment to the Union.

Kathy Whaler



*29 July 2019*

*To the International Union of Geodesy and Geophysics.*

*The Royal Society wishes IUGG every success for the future and offers its most sincere and hearty congratulations on this occasion.*

*It is the Royal Society's privilege to express its earnest and heartfelt wish that IUGG may long continue to carry on its work enabling excellence in the international promotion and coordination of scientific studies of Earth (physical, chemical, and mathematical) and its environment in space.*

*The Royal Society salutes the continuous and outstanding work undertaken by all those who have contributed to the promotion and strengthening of research cooperation through IUGG's interdisciplinary and transdisciplinary programmes.*

*President*

# MESSAGE FROM THE SECRETARY GENERAL

Elected at the 27th General Assembly in Montreal in July 2019, I took up my duties only a few days later. After a very short holiday break at the southern tip of Europe, I had the privilege to attend the IUGG Centennial Day at the UNESCO headquarters in Paris on 29th July 2019. This was a remarkable event, which allowed me to meet both old and new friends. Thanks to everyone who prepared and contributed, especially to our President, Kathy Whaler, and to my predecessor and current ISC Secretary, Alik Ismail-Zadeh.



By 1st September 2019, I had taken over the “ex-officio” task of chairing the Editorial Board of our monthly IUGG eJournal. A challenging job, fortunately perfectly supported by my team members: Tom Beer (former President and a “constant”), Chris Rizos (who stepped in as President-Elect) and, of course, Franz Kuglitsch. The latter works like a “Swiss watch” to assure that all subscribers receive the eJournal every 1st of the month, without any exception!

With eJournal October 2019 we introduced a new category called “People at the forefront”. It aims to present our readers with a lively portrait of the faces, hearts and souls of IUGG’s leadership. The Editorial Board hopes that you enjoy it.

September 16th/17th I visited Copenhagen, Denmark and met both the new and old Treasurer, Niels Andersen and Aksel Hansen. These two half days built a solid basement for a continued trustful cooperation.

On 7th November 2019 I had my inaugural visit with the National Committee of IUGG and IUGS of Germany, in Frankfurt/Main at the Senckenberg Museum and reported on the 27th GA and its outcomes. And, once again, I met many old friends from earlier joint experiences and projects.

November 18th, I had a day trip to the Federal Institute for Geosciences and Resources (BGR) in Hanover. BGR is Germany’s adhering body to IUGG. Here, I met with the President of BGR, Ralph Watzel, the National Delegate, Christian Bönnemann and the Secretary of the National Committee to IUGG, Thomas Plenefisch.

December, 7th until 13th 2019 I attended the Fall Meeting of the American Geophysical Union (AGU) in San Francisco, where AGU celebrated its centennial. I had the honour of representing IUGG on behalf of our President on several occasions, starting with the AGU’s President Reception on Sunday. Another highlight was definitely the AGU’s Honours Ceremony and Honours Banquet, on Wednesday night. It was an impressive ceremony, which I attended with Priscilla Grew: Alik Ismail-Zadeh received the Ambassador Award, Barbara Romanowicz and Ulrich Christensen were awarded medallists; Zuheir Altamimi, Jonathan Bamber, Jean Braun, Taras Gerya, Hosuke Heki, and Alan Jones were nominated fellows, among many others. The last meeting, in addition to many chats in the hallways of the Moscone Centre and around the exhibition area, was AGU’s International Societies Meeting, on Thursday morning. This was a high-level breakfast meeting attended by representatives from AGU, AOGS, DGG, EGU, FIGA, GSL, JGU, MGU, and WCRP. After being absent for several years, I was highly impressed by the size and dynamic of AGU’s Fall Meeting. And it still remains a miracle to me how many people, out of 25,000, I met just by running into them – without any appointment.

For 2020, we are preparing for the International Lithosphere Program's (ILP) 40th anniversary, planned to be celebrated at the International Geological Congress (IGC) in Delhi/India, originally scheduled for March 2020, and at the EGU General Assembly in May 2020 in Vienna, Austria. ILP is a very successful joint program of both the IUGG and IUGS. From 2007 until 2019, I had the honour and pleasure to serve the ILP community as Executive Secretary and Head of the ILP office at GFZ.

Further plans foresee my participation at several meetings and conference throughout 2020, which will start with a trip to Ljubljana/Slovenia on 29th/30th January 2020, on the occasion of the 25th Anniversary of the membership of the Slovenian National Committee in the IUGG.

Finally, I want to thank all colleagues in the outgoing and new Bureau and Executive Committee of the IUGG for their support and cooperation in 2019, and my colleagues in the Secretariat of IUGG at the GFZ, especially Franz G. Kuglitsch for his incredible commitment to the Union.

Alex(ander) Rudloff

# IUGG ACTIVITIES

## IUGG SECRETARIAT

The [IUGG Secretariat](#) is located at the German Research Centre for Geosciences in Potsdam (GFZ). The Secretariat is managed by the IUGG Secretary General Alexander Rudloff and the IUGG Executive Secretary Franz Kuglitsch, with a support from Katrin Gundrum. The Secretariat is responsible for implementing the day-to-day operations of IUGG; this includes (i) maintenance of daily correspondence and communication with IUGG National Committees, Adhering Organizations, Union Associations, Executive and Financial Committees, Union Commissions and Committees; (ii) maintenance of IUGG electronic databases and technical documents; (iii) supervision of the IUGG webmaster and preparation of updates for the IUGG website and social media in timely fashion; (iv) development of IUGG Yearbooks and Annual Reports; (v) negotiations with companies for production of IUGG-related publications, medals, pins etc.; (vi) publication of the IUGG E-Journal (monthly issues); (vii) assistance in technical screening of IUGG grant applications, medal and awards nominations; (viii) preparation work for IUGG General Assemblies, Council, Executive Committee, and Bureau Meetings; and some other activities.

The IUGG Secretariat is co-sponsored by the **GFZ** and the **German Research Foundation (DFG)**. IUGG thanks the GFZ and DFG for the financial support of the Secretariat.

**IUGG Yearbook.** The Secretariat maintains the data related to the IUGG and its Association and produce annually a Yearbook which is available [here](#). By the decision of the IUGG Bureau only the current Yearbook should be linked to the IUGG website.

**IUGG website and social media.** The [IUGG website](#) was maintained and regularly updated by the IUGG webmaster Dmitry Krupsky. In addition, the new website dedicated to the [100<sup>th</sup> anniversary of IUGG](#) was further developed. To learn more about IUGG and to keep individuals updated on Union's activities, the IUGG Secretariat maintains social media accounts on

[FACEBOOK](#)

[FLICKR](#)

[TWITTER](#), and

[YOUTUBE](#)

**IUGG Electronic Journal.** The [E-Journal](#), an informal newsletter, was published and distributed monthly keeping IUGG Member National Committees informed about the activities of IUGG, its Associations and Commissions, and the actions of the IUGG Secretariat. Also, the journal publishes feature articles, news from the International Science Council (ISC), news and reports related to IUGG scientific programs and co-sponsored scientific meetings, and a calendar of scientific meetings.

## IUGG'S CENTENNIAL ANNIVERSARY

Formed in Brussels, Belgium, on 28 July 1919, the International Union of Geodesy and Geophysics (IUGG) celebrates its 100th anniversary in 2019. The centennial year marks an important milestone for IUGG. Since its inception as a union of international scientific associations, IUGG has evolved into a prominent scientific organization promoting Earth and space sciences worldwide in the complex political, economic and scientific landscapes of the 20th and the beginning of the 21st centuries.

IUGG's mission is to advance, strengthen and promote Earth and space sciences for the benefit of humanity through international research cooperation and education, and to communicate the knowledge to governments and policymakers. For the decades ahead, IUGG envisions a future Earth that is environmentally sustainable and where societies are resilient against natural hazards. We celebrate the IUGG centennial not only to remind geoscientists how important international scientific cooperation is and how IUGG science and science diplomacy have developed over the last century, but also to think collectively about future scientific developments, international scientific initiatives, and finding solutions to the urgent problems of our society, especially to those related to the 2030 UN Agenda for Sustainable Development. We are looking at the past in order to develop a new future for Earth and space sciences and to promote science for the benefit of all.

To celebrate the Centennial of the Union, IUGG established a Task Force to develop a program for celebrations around the world in 2018-2019. In 2019, the following major events were organized to celebrate IUGG.

- 27<sup>th</sup> IUGG General Assembly, Montreal, Canada, 8-18 July 2019;
- Celebration of the IUGG Centennial at UNESCO, Paris, France, 29 July 2019.
- Several dedicated meetings in Europe, Asia, America, and the Middle East;

In addition, a special volume on "The International Union of Geodesy and Geophysics: From Different Spheres to a Common Globe" was published as a part of the peer-reviewed journal *History of Geo- and Space Sciences* (for more details see page 27).

As a part of this program, a [website](#) dedicated to the IUGG Centennial has been developed to learn more about the history of IUGG.

### **IUGG General Assembly 2019**

The 27th General Assembly of the International Union of Geodesy and Geophysics (IUGG) held from 8 – 18 July 2019 in Montreal, Canada, was a big success. The IUGG Executive Committee thanks the Montreal Local Organising Committee, the Canadian Geophysical Union (CGU), the Canadian Meteorological and Oceanographic Society (CMOS), and JPdL International, the professional conference organiser, for excellent management and hospitality provided to the almost 4,000 participants of the assembly.

The IUGG General Assembly consisted of three important parts: (i) an open Scientific Assembly, (ii) a meeting of the duly accredited Delegates of the IUGG Member Countries and guests invited in accordance with the By-Laws (referred to as the Council Meeting); and (iii) business meetings of the IUGG, its Associations, and their scientific bodies.

[Photos](#) and [videos](#) of the XXVIIth IUGG General Assembly 2019 (IUGG2019) are available for download. Please give proper credit to IUGG if you use or publish some of them. Thank you!

### ***Scientific Assembly***

The Scientific Program of the General Assembly consisted of 234 symposia, 18 workshops, and 558 sessions in total. Among the more than 4,580 presentations at the General Assembly there were 9 Union Lectures (see below), 437 invited presentations, 2,329 oral presentations, and 1,814 poster presentations.

Nine distinguished speakers delivered the Union Lectures.

11 July 2019:

- *“Earth Sciences as the Underlying Pillars to Meet Societal Challenges in the Next Century”* by David Grimes (Canada)
- *“Bridging the Science-Policy Gap to address India’s Water Crisis: Insights from Cauvery Basin Research”* by Veena Srinivasan (India)
- *“The Ocean’s Role in Atmospheric Carbon Dioxide Changes During Ice Age Cycle”* by Karen Kohfeld (Canada)



David Grimes



Veena Srinivasan



Karen Kohfeld

13 July 2019:

- *“Exploring and Understanding Earth from Space: The Power of Perspective”* by Waleed Abdalati (USA)
- *“Improving Atmospheric Reconstructions for Historical Extreme Events by Rescuing Lost Weather Observations”* by Ed Hawkins (UK)
- *“Hunting the Magnetic Field”* by Lisa Tauxe (USA)



Waleed Abdalati



Ed Hawkins



Lisa Tauxe

16 July 2019:

- *“Geodesy Sharpens You Up”* by Kosuke Heki (Japan)
- *“Singing Seismograms: Harmonic Tremor Signals in Seismological Records”* by Vera Schlindwein (Germany)
- *“Volcanic Giants - What We Know, What We Think We Know, What We Can’t Know About Cataclysmic Super-Eruption”* by Paolo Papale (Italy)



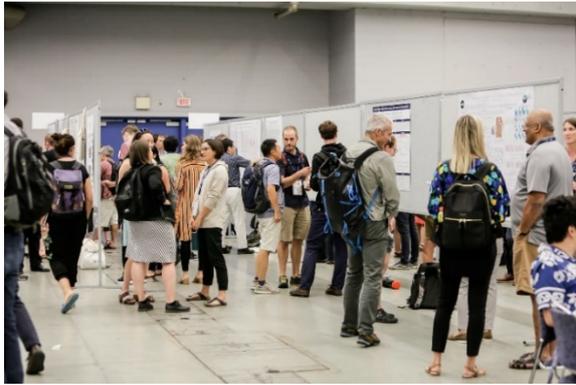
Kosuke Heki



Vera Schlindwein



Paolo Papale



*At poster and oral sessions*



*Enjoying Canadian food*



*Between sessions*

### **Council Meeting 2019**

The Council Meeting was held in Montreal, Canada, from 10 to 16 July 2019. At three sessions of the meeting, the Council delegates representing 40 Member countries discussed various topics and approved/ratified the following decisions:

- Admission of Algeria as a Regular National Member, and Serbia and Uruguay as Associate Members; and the transfer of North Macedonia to Associate membership.
- Least Developed Countries (as defined by the United Nations) can become IUGG Regular Members in Category 1 paying annual contributions at the level of 25% of the Category 1 membership dues.

- New IUGG Officers were elected (see pages 8-9).
- The budget for 2019-2023 was approved (see page 22).
- Berlin, Germany was selected as the venue for the 28<sup>th</sup> IUGG General Assembly in 2023.
- Official IUGG Liaisons to various intergovernmental and international scientific bodies were appointed (see page 23).
- Three resolutions were passed (see page 24).



*Group photo of the IUGG Council Delegates and IUGG Executives at the 27<sup>th</sup> General Assembly (photo: IUGG2019)*

### ***Union Budget for 2020-2023***

The activities of IUGG are based on payment of membership dues plus other direct and indirect contributions. IUGG has 73 members, 58 of them are Regular members paying dues. The annual amount of dues is about \$550K (the budget is in US\$; K means thousands). Expected balance on 1 January 2020 is ~\$662K. Income in the period of 2020-2023 is estimated to be \$2,226K, making ~\$2,888K in total. Planned expenditures is \$2,315K, and hence an expected balance on 31 December 2023 would be ~\$573K. Half of IUGG funds goes to Union Associations (\$1,082K), the remaining part to the Union Grants program and support of scientific meetings (\$75K), travel grants for the next general assembly (100K), Science and Education Program (\$280K), Union activities (\$156K), International Science Council (\$128K), and administration (\$494K). The approved IUGG Budget for 2020-2023 can be accessed [here](#).

### ***Location of the 28<sup>th</sup> IUGG General Assembly in 2023***

The IUGG Council selected *Berlin (Germany)* as the site of the 28<sup>th</sup> IUGG General Assembly to be held from 11 to 20 July 2023.

### ***Liaison Officers (2019-2023) to international and intergovernmental organizations***

The Council approved the following Liaison Officers

<b>Name of the Organization</b>	<b>Liaison Officer (country)</b>
ISC Committee on Data for Science and Technology (CODATA)	Alena RYBKINA (RUSSIA)
ISC Committee on Space Research (COSPAR)	Andrew W. YAU (CANADA) Christopher KOTSAKIS (GREECE)
ISC Scientific Committee on Antarctic Research (SCAR)	Ian ALLISON (AUSTRALIA) John TURNER (UK)
ISC Scientific Committee on Oceanic Research (SCOR)	Trevor MCDOUGALL (AUSTRALIA) Joyce PENNER (USA)
ISC Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)	Renata LUKIANOVA (RUSSIA) Peter PILEWSKIE (USA)
ISC World Data System (WDS)	Toshihiko IYEMORI (JAPAN) Aude CHAMBODUT (FRANCE) Carey NOLL (USA)
UNESCO Section on Earth Sciences and Geo-Hazards Risk Reduction	Alik ISMAIL-ZADEH (GERMANY/RUSSIA) Harsh GUPTA (INDIA)
UNESCO International Hydrological Program (UNESCO-IHP)	Christophe CUDENNEC (FRANCE) Charles FIERZ (SWITZERLAND)
UNESCO Intergovernmental Oceanographic Commission (UNESCO-IOC)	Denise SMYTHE-WRIGHT (UK) Satheesh SHENOI (INDIA)
World Meteorological Organization (WMO)	Roger PULWARTY (USA) Christophe CUDENNEC (FRANCE) Charles FIERZ (SWITZERLAND) Jens WICKERT (GERMANY) Hua ZHANG (CHINA)
United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM)	Harald SCHUH (GERMANY)
International Civil Aviation Organization (ICAO)	David SCHNEIDER (USA) Larry MASTIN (USA)
Intergovernmental Panel on Climate Change (IPCC)	Franz KUGLITSCH (GERMANY/AUSTRIA)
World Climate Research Programme (WCRP)	Lisa ALEXANDER (AUSTRALIA)
Consultative Committee for Time and Frequency (CCTF)	Claude BOUCHER (FRANCE) Gerard PETIT (FRANCE)
Pan American Institute of Geography and History (PAIGH)	Laura SANCHEZ (GERMANY/COLOMBIA)
Group on Earth Observations (GEO)	Michael SIDERIS (CANADA) Chris RIZOS (AUSTRALIA) Kathryn WHALER (UK)

### ***Resolutions***

The Council approved 3 Resolutions as listed below. The text of the Resolutions can be accessed [here](#).

- Resolution 1: Reducing the Carbon Footprint by the Research Community
- Resolution 2: The International Terrestrial Reference Frame (ITRF)
- Resolution 3: Thanks

## IUGG Centennial Celebration Day

IUGG celebrated its 100th anniversary at UNESCO headquarters in Paris, France on 29 July 2019. More than 150 people joined the event. The program of the Day can be found [here](#).

Since 1919, IUGG has been advancing, promoting, and communicating knowledge of the Earth system, its space environment, and the dynamical processes causing change. IUGG envisions a future Earth that is environmentally sustainable and where societies are resilient against natural hazards. To achieve this goal, participation in global networks of interdisciplinary programs is vital. IUGG places particular emphasis on the scientific problems of economically less-developed countries by sponsoring activities relevant to their scientific needs. In addition to the many beneficial relationships that IUGG Associations develop with partners, IUGG as a whole also develops and maintains formal contacts with a wide range of organizations, including the International Science Council (ISC) and its international scientific unions and interdisciplinary bodies, UNESCO, and the World Meteorological Organization (WMO).



*Participants of the IUGG Centennial Celebration Day at UNESCO (photo: IUGG/C. Vallentin)*

The Centennial Celebration Day started with the Opening Ceremony attended by senior representatives of ISC, UNESCO, WMO, the United Nations Office for Disaster Risk Reduction (UNDRR), the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), and the guest of honour H.S.H. Prince Albert II of Monaco. In her opening remarks, IUGG President Kathryn Whaler mentioned: *“The underpinning fundamental science we all do is as important to-day as it was a century ago, but the research landscape in which we operate and the societal issues we aim to address have transformed the way we work – supercomputers (even computers!), the space age and satellite observations, the world-wide web, sustainable development goals, the Sendai Framework for Disaster Risk Reduction, climate change, ecosystem services and many other terms familiar to today’s scientists were unknown then. Over the intervening century, the Unions and other international organisations have enabled scientists to collaborate and co-operate more effectively, and brought a spectrum of ideas to bear on the question of how to solve the world’s most serious problems. The need for the IUGG and its counterparts is as great as ever as we move into our second century.”*

*“The earth sciences hold the record of our small planet, a record stretching back 4,600 million years”* reminded Shamila Nair-Bedouelle, UNESCO Assistant Director-General for the Natural Sciences. *“Humanity has been here just for a tiny fraction of that time, yet it is increasingly obvious the threat we pose to life on earth. We have a short time to transform modern society in order to secure a sustainable future for all and our collaboration with the IUGG and several other scientific unions and*

*associations is of vital importance for us.”* Heide Hackmann, ISC Chief Executive Officer, Elena Manaenkova, WMO Deputy Secretary-General, Ricardo Mena, UNDRR Chief of Support and Monitoring of Sendai Framework Implementation, and Lassina Zerbo, CTBTO Executive Secretary welcomed the conference participants, spoke about cooperation between their organization and IUGG, and congratulated the Union on its Centennial anniversary.

The Opening ceremony was followed by the award ceremony. President Whaler presented Centennial Memorial Plaques to IUGG Founding Members [Australia, Belgium, Canada, France, Italy, Japan, Portugal, the United Kingdom, and the United States of America] and to its Partner organizations.

H.S.H. Prince Albert II of Monaco received IUGG Honorary Membership for his “outstanding contributions to the promotion of climate change, water, biodiversity and oceanographic research”, handed over by the IUGG President. In His speech, H.S.H. Prince Albert II mentioned: *“On the occasion of the centenary of your international union, I am very honoured and proud that you have granted me honorary membership. I see it as both a recognition for the secular action of my country in the field of oceanography and as an encouragement to continue and extend my personal commitment, faithful to the ideas of the person who brings us together today, Prince Albert I.”* (Prince Albert I was Vice President of IUGG 1919-1922).



*IUGG President Kathryn Whaler and H.S.H. Prince Albert II of Monaco (photo: IUGG/C. Vallentin)*

On the occasion of the Centennial Celebration, IUGG organized four topical sessions. The 1<sup>st</sup> Session with contributions to “Earth and Space Sciences and Society” was chaired by President Kathryn Whaler. Presentations were given on “Centennial of the International Cooperation in Earth and Space Sciences” by Alik Ismail-Zadeh (IUGG), “Climate and our Planet” by Valérie Masson-Delmotte (Intergovernmental Panel on Climate Change, IPCC), and “Disasters and Society” by Marcia McNutt (National Academy of Sciences, USA).



*Speakers: M. McNutt, A. Montanari, and A. Aoudia (photos: IUGG/C. Vallentin)*

The 2<sup>nd</sup> Session, chaired by IUGG President-Elect Chris Rizos, consisted of contributions on the topic “Earth Science for Sustainable Development” from Sierd Cloetingh (Utrecht, The Netherlands), from Kurt Lambeck (ANU, Australia), Vladimir Ryabinin (IOC/UNESCO), Alberto Montanari (Bologna, Italy and EGU President) and Abdelkrim Aoudia (ICTS, Trieste, Italy).

The 3<sup>rd</sup> Session, entitled “Strengthening International Cooperation in Science and Education in a Multi-Cultural World”, was organized as a panel discussion and moderated by IUGG Immediate Past President Michael Sideris. Panelists were Robin Bell (Columbia University, USA and AGU President), Paul Arthur Berkmann (Tufts University, USA), Anny Cazenave (L'Observatoire Midi-Pyrénées, France), Athena Coustenis (Paris Observatory, France), and Ligia Pérez Cruz (UNAM, Mexico and President of the Mexican Geophysical Union).



*Panelists: R. Bell, P.A. Berkmann, A. Cazenave, A. Coustenis, L. Pérez Cruz, and H. Langenberg (photos: IUGG/C. Vallentin)*

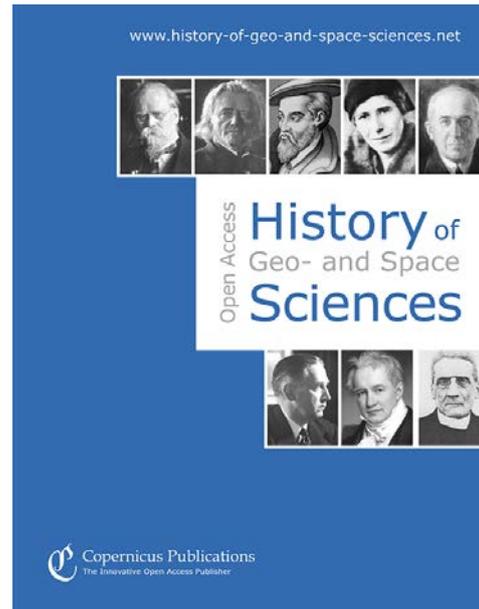
The 4<sup>th</sup> Session, also a panel discussion, was focused on the “21<sup>st</sup> Century Triad: Sustainable Development, Climate Change and Disaster Risk Reduction”, and moderated by Alik Ismail-Zadeh, the Immediate Past Secretary-General of IUGG. Michael Rast (European Space Agency), Harsh Gupta (National Geophysical Research Institute, Hyderabad, India) Heike Langenberg (Nature Geoscience), Detlef Stammer (University of Hamburg, Germany, and World Climate Research Program) and Kristof Vandenberghe (UNESCO) participated in the panel discussion.

The celebrations closed with a performance by the PhiloGaïa Orchestra, of compositions based on geophysical images, entitled “We love our planet!” More information on the event is available [here](#).

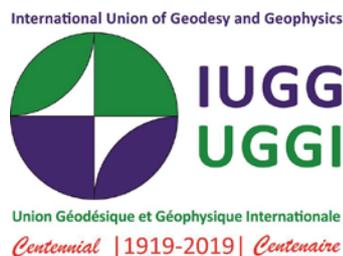
## The International Union of Geodesy and Geophysics: from different spheres to a common globe

This [special issue](#) (SI) of the peer-reviewed journal *History of Geo- and Space Sciences* is comprised of 11 articles describing the history of the IUGG and its eight International Associations. The SI is dedicated to the centennial anniversary of the Union, which has been coordinating and promoting international efforts in Earth and space sciences since 1919.

The purpose of this SI is not to relay a definitive history of the development of international cooperation in geosciences, but to summarize IUGG's remarkable role during the 100-year span of its existence. The first three articles present the history of IUGG from its founding through the years of extraordinary development of geophysical sciences and the concurrent evolution of the Union's structure and programs extending up to its advances at the beginning of the 21st century. Outstanding histories of each of the IUGG Associations are then presented.



## AGU and IUGG to celebrate their centennial with a series of meetings on disaster science



In honour of the Centennial year 2019 which they both shared, AGU and IUGG co-organised two successful interdisciplinary symposia with the collaboration of the U.S. National Committee for IUGG: the AGU-IUGG Centennial Symposium on Disaster Science at the December 2018 AGU Fall Meeting in Washington DC, USA, and the Centennial Symposium on Georisk Reduction: Science, Resources, and Governmental Action at the IUGG General Assembly in Montreal, Canada. AGU leadership also attended the IUGG Centennial Ceremony at UNESCO in Paris, France, on 29 July 2019. Like IUGG, AGU is committed to fostering scientific discovery for the benefit of humanity, and supports global cooperation to promote a sustainable and resilient future. The AGU leaders said that they are honored to be working alongside IUGG and other scientific organisations around the globe to collectively advance the Earth and space science community.

### ***IUGG-AGU Centennial Celebration in India***

A special symposium to celebrate the centennial of IUGG and AGU was held during the Federation of Indian Geosciences Associations' triennial congress at CSIR's National Geophysical Research Institute (NGRI) in Hyderabad, India, from 13th to 16th October 2019 on "Geosciences for sustainable development goals". The IUGG President, Kathy Whaler, spoke about IUGG in the last century and going forward, and how it is helping to address the Sustainable Development Goals (SDGs) both in the inaugural session on 13th October and the centenary session itself on 14th October. The AGU

President sent a video address for the inaugural session and presented her contribution to the symposium via a skype call. IUGG Past President Harsh Gupta also spoke in the centenary session, highlighting Indian scientists' contributions to the two Unions. Besides attending the Congress, the IUGG President was Guest of Honour at CSIR's Foundation Day at NGRI on 11th October, where she met its senior management team and a number of other scientists during a tour of its laboratories and scientific observatories, and gave the Foundation Day lecture. She also visited the Hyderabad International Convention Centre, where the joint IAGA-IASPEI Scientific Assembly will be held in 2021.



*Kathy Whaler (IUGG President 2019-2023) together with Harsh Gupta (IUGG President 2011-2015) and the organisers of Federation of Indian Geosciences Associations' triennial congress*

### **AGU International Societies Meeting**

A high level breakfast meeting was held during the AGU Fall Meeting 2019, with more than 20 attendees representing AGU, AOGS, DGG, EGU, FIGA, GSL, IUGG, JGU, MGU, and WCRP. The AGU leadership was fully present! IUGG was represented by Secretary General Alexander Rudloff. The current AGU Centennial's Legacy was discussed as well as a Global Participation at Meeting and Joint Activities, and AGU's Position Statements on Climate and Data. A final point was how to Broadening Coverage of Science Media and News. A follow-up meeting is planned on the occasion of the EGU General Assembly 2020.



*AGU International Societies Meeting during the AGU Fall Meeting 2019*

***U.S. Senate passes AGU Centennial Resolution recognising the role of IUGG***



On 19 December 2019, the U.S. Senate passed [S. Res. 460](#), congratulating the American Geophysical Union (AGU) on its centennial. The resolution recognises IUGG and the critical role Earth and space sciences and scientists play in society.

**IUGG Centennial grant awards**

The IUGG Grants Program aims to support projects, of importance to the international geophysical and geodetic community, which explore new scientific ideas, develop future international initiatives, and promote geoscience education. The year 2019 is the centennial year of the founding of the IUGG. The IUGG Bureau decided to dedicate the 2018 call to the IUGG Centennial and to award funds to proposals addressing international cooperation in Earth and space sciences and highlighting the importance of science for sustainable development of society. On 1 May 2018, the IUGG Bureau announced the winners of the IUGG grants and awarded US\$ 52,000 to the following projects:

- IUGG Centennial Celebration Activities in China;
- Implementation of the United Nations’ Resolution on the Global Geodetic Reference Frame (UN-GGRF) for Sustainable Development in Latin America;
- Geoscience education and outreach for sustainable transformational change in the Middle East and North Africa region;
- IAMAS-iCACGP/IGAC Early Career Short Course on atmospheric sciences and climate;
- Knowing Planet Earth: geoscience awareness across cultures and languages; and
- Fostering developed-developing country partnerships for the advancement of global volcano science.

## UNION MEMBERSHIP

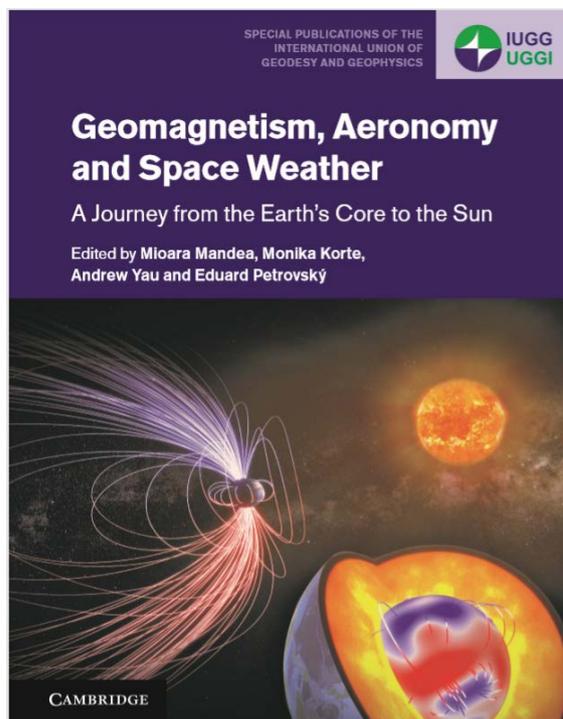
### IUGG welcomes Latvia

An application for the admission of Latvia to IUGG as an Associate Member was received from the Latvian Academy of Sciences. The IUGG Executive Committee welcomed this application, and it was placed before the IUGG Adhering Bodies in regular status (dues paid) for a vote by correspondence. The vote is now complete, and the application was accepted unanimously. According to the IUGG Statutes and By-Laws, the membership of Latvia is provisional until the approval of the vote by the IUGG Council. Congratulations to the new officers of the Latvian National Committee for Geodesy and Geophysics! They are Janis Kaminskis (President and IAG Correspondent), Armands Celms (Secretary General), Kristaps Lamsters (IACS), Gunārs Silabriedis (IAG), Juris Burlakovs (IAGA and IAVCEI), Uldis Bethers (IAHS), Tija Sīle (IAMAS), Vilnis Frišfelds (IAPSO), and Janis Karušs (IASPEI).

## IUGG SPECIAL PUBLICATION SERIES

The new book "[\*Geomagnetism, Aeronomy and Space Weather. A Journey from the Earth's Core to the Sun\*](#)" edited by Mioara Manda, Monika Korte, Andrew Yau, and Eduard Petrovsky was published

by the Cambridge University Press (CUP). On the centenary of the IUGG, this book reviews the state-of-the-art research in geomagnetism, aeronomy and space weather. Written by eminent researchers from these fields, it summarises the advances in research over the past 100 years, and looks ahead to current and emerging studies on Earth's magnetic field. It provides a comprehensive overview of the generation of the Earth's magnetic field, its history and its response to external forces. Starting at the centre of the Earth, the reader is taken on a journey from the interior core and mantle, through the upper atmosphere and magnetosphere, before reaching the Sun's atmosphere and corona. The applications of this research are also discussed, particularly the societal impact of solar activity on critical infrastructures in our increasingly technologically dependant society. This book provides a valuable resource and reference to academic researchers and students in geomagnetism and aeronomy.



This book is the fourth volume of the [IUGG Special Publication Series](#) published by CUP.

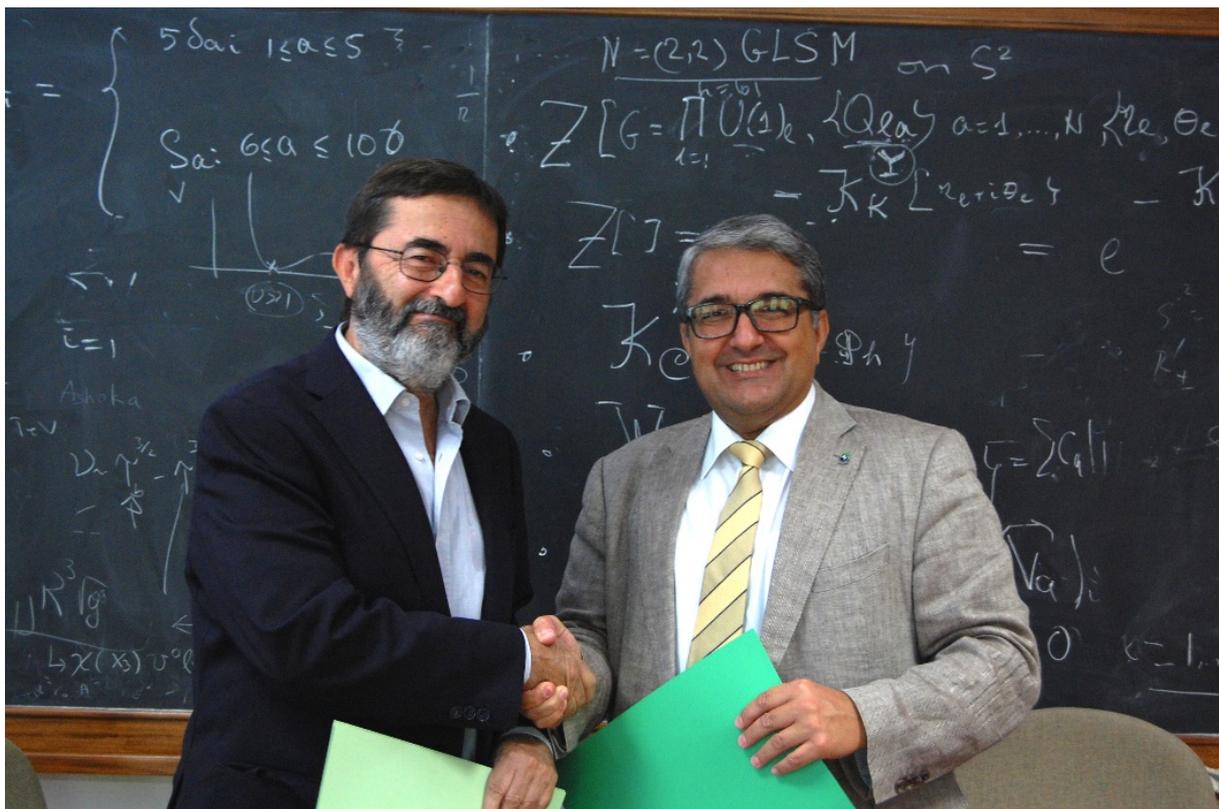
## GEOSCIENCE EDUCATION

### The collaboration between IUGG and ICTP

Founded in 1964 by the late Nobel Laureate Abdus Salam and co-sponsored by UNESCO, IAEA, and the Italian government, the Abdus Salam International Centre for Theoretical Physics ([ICTP](#), Trieste, Italy) seeks to accomplish its mandate by providing scientists from developing countries with the continuing education and skills that they need to enjoy long and productive careers. ICTP has been a

major force in stemming the scientific brain drain from the developing world. The impact of ICTP extends well beyond the Centre's facilities to virtually every corner of the Earth. The Earth System Physics (ESP) Section of ICTP studies a wide spectrum of the Earth-system, from its fluid components (oceans and the atmosphere) to the planet's interior. In 2011, IUGG and ICTP agreed to enhance geophysical and geodetic education and science collaboration and signed the first Memorandum of Understanding to promote educational programs related to geodesy and geophysics for 2012-2015. In 2015, the second MoU was signed to extend cooperation between IUGG and ICTP for the next quadrennial (2016-2019).

On 5 September 2019, ICTP Director Fernando Quevedo and Alik Ismail-Zadeh, on behalf of IUGG President Kathryn Whaler, signed a Memorandum of Understanding (MoU) to continue the cooperation in geosciences education and to promote educational programs related to geodesy and geophysics for 2020-2023. The agreement encourages collaboration in the organisation of advanced schools/workshops in geodesy and geophysics at ICTP or in economically less developed countries.



*ICTP Director F. Quevedo (left) and A. Ismail-Zadeh (right) after the MoU signing*

### **IUGG grants to support geoscience education events in 2019**

IUGG awarded six grants (US\$15,000 in total) to support workshops and training schools organized by the Abdus Salam International Centre for Theoretical Physics (ICTP, Trieste, Italy) in 2019 as recommended by the IUGG Committee on Capacity Building and Education and in accordance with the Memorandum of Understanding between IUGG and ICTP signed in 2015. The list of the events co-sponsored by IUGG is as follows:

- International Space Weather Initiative Workshop, 20-24 May 2019, ICTP, Trieste, Italy
- Workshop on Water Resources in Developing Countries, 27 May – 7 June 2019, ICTP, Trieste, Italy

- Advanced School on Evaluating, Monitoring and Communicating Volcanic and Seismic Hazards in Sub-Saharan Africa, June 2019, Kigali, Rwanda
- Advanced School on American Monsoons - Progress and Future Plans, 19-23 August 2019, Sao Paulo, Brazil
- Advanced Workshop on Earthquake Fault Mechanics, 2-14 September 2019, ICTP, Trieste, Italy
- Workshop on Distilling Climate Information for Sectoral Applications, 2-6 December 2019, Manila, Philippines

In 2018, IUGG co-sponsored several workshops and schools organized by ICTP, and below are brief reports on the events.

***Integrated Environmental Health Impact Assessment (IEHIA) of Air Pollution and Climate Change in Mediterranean Areas***

The school was organized at ICTP in Trieste, Italy from 23 to 27 April 2018 and co-sponsored by ICTP, IUGG, Chemistry-Aerosol Mediterranean eXperiment, ENVI-MED, ARCHIMEDES, and France.



*Group photo (photo: ICTP)*

CONTEXT: The Mediterranean is a hotspot for climate change and air pollution. Climate change will significantly impact the regional air quality by reinforcing the hot, sunny and dry Mediterranean climate. Mediterranean inhabitants are already regularly exposed to pollutant loads well above WHO (World Health Organization) air quality recommendations standards and will be further exposed. Additional exposures to air pollution and warm conditions will result in an excess of premature deaths, but we still lack quantification of the impact in southern and eastern countries. Thus, there is a need to promote and develop Integrated Health Impact assessment (IHIA) approach by empowering scientists from around the Mediterranean basin.

**OBJECTIVES:** The objective of the training school was to strengthen incountry scientists and stakeholders capacity to face the health challenges posed by environmental stressors. It aimed at giving early-stage researchers a good understanding of risk and uncertainty matched to a set of practical skills in facing the environmental health issues related to evaluating the health impact of air pollution and climate change. Students have been trained to the practice of exposure assessment, epidemiology and integrated health impact assessment.

**CONTENTS:** The school introduced state of the art knowledge on air pollution and climate change in the Mediterranean region, as well as methodologies of health impact assessment. It has given students knowledge of protocols, tools, sources of data and has made them practice on case studies specifically designed for the school in order to enable them performing air quality and climate health impact studies including economic valuation. The school has also given insights on how to identify public health priorities for research and preventive actions. The teaching has been provided by recognized experts in atmospheric chemistry, climate, epidemiology, toxicology, economics and other fields. Participants have been able to interact and communicate with all these experts.

More information can be found [here](#).

### ***Summer School on Modelling Tools for Sustainable Development - OpTIMUS***

The summer school was organized at ICTP in Trieste, Italy from 4 to 29 June 2018 and co-sponsored by ICTP, IUGG, United Nations Development Programme (UNDP), UN Department of Economic and Social Affairs (UNDESA), The World Bank, Royal Institute of Technology (KTH), University of Cambridge, and A Global Community of Practice (OpTIMUS)

This school combined lectures and hands-on exercises in the use of open source modeling tools integrating climate, land-use, energy and water systems, electricity access and investment issues for model-informed policy formulation towards the implementation of the 2030 Agenda for Sustainable Development. Leading academics and researchers working in the field of model-informed development strategies provided four weeks of intensive training of government officials from countries participating in projects on analysis and modelling capacity development sponsored by UNDESA, UNDP, World Bank Group and other development organizations. Participants worked on their modeling and analysis skills about the operation and extension of their national models, incorporating and testing new and evolving policy issues and contributing to the practice of evidence-based policy formulation regarding national sustainable development policies. The suite of OpTIMUS modelling tools used includes the geospatial electricity access model OnSSET, the energy system and investment model OSeMOSYS and CLEWS - the integrated Climate, Land, Energy and Water System model. More information can be found [here](#).

### ***ICTP Summer School on Theory, Mechanisms and Hierarchical Modelling of Climate Dynamics: Multiple Equilibria in the Climate System and WCRP Grand Challenge on Clouds, Circulation and Climate Sensitivity: 2nd Meeting on Monsoons and Tropical Rain Belts***

The summer school and workshop were organized at ICTP in Trieste, Italy from 25 June to 5 July 2018 and co-sponsored by ICTP, IUGG, Climate Variability and Predictability Program (CLIVAR), European Geosciences Union (EGU), and World Climate Research Programme (WCRP).

The climate community is still faced with large uncertainties in estimating possible climate changes in the next decades and quantifying the relative role of anthropogenic contribution to climate change. Although most modern climate models are able to reproduce reasonably well global climatologies and patterns of interannual variations, they still struggle with pervasive biases and the representation of

some of the climate phenomena involving the interaction and coupling between the atmosphere, the ocean and the cryosphere. The problem is compounded by the limited understanding of some of the physical mechanisms giving rise to both our present mean climate and its natural variability at different time scales.

One possible way forward is the use of a hierarchy of models to tackle the most pressing questions in climate dynamics and modeling. Key among them, is whether the climate is stable, or whether internal feedbacks could lead to tipping points, abrupt changes, and transitions to fundamentally different equilibria. Changes in the oceanic overturning, ice-albedo effects, land-surface and vegetation coupling to the atmosphere, and radiativeconvective properties of the atmosphere have all been suggested as possible causes of instability in the climate system. Advances in our understanding, quantification, and modelling of these processes are necessary both for the interpretation of the paleoclimate record and for the projection of possible future climate states. A variety of studies have found that multiple equilibria exist both in highly idealized and more comprehensive models of the climate system. Whether multiple equilibria do exist in state-of-the-art climate models is still a subject of controversy.



*Group photo (photo: ICTP)*

A fundamental understanding of key processes within a hierarchical modeling framework will eventually translate into a better representation and simulation within state-of-the-art climate models, as it brings new insights for process-based evaluation of climate model reliability and fit for purpose. The use of hierarchies additionally promotes the use of standardized performance metrics and highlights instances when post-processing approaches (e.g. bias correction) or diverse model tuning practices should be explored.

The school has been based on lectures on theoretical aspects of atmosphere, ocean and climate dynamics, with a focus on the present state of established knowledge and relevant mechanisms. The topic of the school, Multiple Equilibria in the Climate System, has been the subject of afternoon

lectures, giving an overview of the most recent progress and hypotheses suggesting the existence of multiple equilibrium states, and consequences for past and future climates. Afternoons have also been devoted to practical sessions, involving the use of simplified climate models and analysis of relevant data sets.

The school was followed by the workshop WCRP Grand Challenge on Clouds, Circulation and Climate Sensitivity: 2nd Meeting on Monsoons and Tropical Rain Belts.



*Group photo (photo: ICTP)*

Reliable projections of tropical rainfall changes are key to any climate adaption efforts in a warming world. Yet, our global climate models are a subpar tool for the task: their spatial resolution is too coarse to reproduce the deep convection that produces most rainfall in the tropics, and current parametrizations are inadequate – as signified by persistent biases in the simulation of the annual and diurnal cycles of rainfall in large areas of the oceans and continents, as well as the response to forcing of the past. Nonetheless, tropical rainfall is organized in the large-scale structures of the monsoons and the ITCZ whose dynamics are shaped by large-scale energetic and momentum constraints that involve the global circulation of both the ocean and the atmosphere. This suggests that building a coherent understanding of tropical rainfall can benefit from an understanding of these large-scale influences and their coupling with small scale cloud and precipitation processes.

Making this link across scales to improve our understanding and our ability to anticipate future tropical rainfall changes is a key question in climate science.

The workshop, building on the knowledge and practical skills acquired during the school, aimed to bring together expertise on large-scale atmospheric and oceanic dynamics, small scale cloud and

precipitation processes, hierarchical climate modeling and observation. The aim was to both review recent progress on tropical rainfall dynamics and to identify areas where progress is most amenable in the future given the existing and emerging modelling tools and theoretical frameworks.

More information can be found [here](#).

### ***The Coastal Ocean Environment Summer School in Ghana***

The summer school was organized in Accra, Ghana from 30 July to 4 August 2018 and co-sponsored by ICTP, IUGG, Coastal Ocean Environment Summer School Ghana, U.S. National Science Foundation (NSF), and University of Michigan.

The size and scope of the 2018 school was comparable to the 2016 and 2017 schools. The school was lengthened to six days, and included a larger contingent of participants from African countries outside of Ghana (Nigeria, Cote d'Ivoire, Mali, and Benin). At the 2018 school, we introduced a "project track" for participants who wanted to focus on a project. The participant projects were presented on the last day of the school. ICTP provided expertise and significant funding for the 2018 school. Three US graduate students and one US undergraduate participated in the school. More information can be found [here](#).



*Group photo (photo: ICTP)*

### ***Second Workshop on Regional Climate Modeling and Extreme Events over South America***

The workshop was organized in Sao Paulo, Brazil from 5 to 9 November 2018 and co-sponsored by ICTP, IUGG, National Scientific and Technical Research Council (CONICET), São Paulo Research Foundation (FAPESP), Universidade Estadual Paulista (UNESP), Núcleo de Apoio à Pesquisa – Mudanças Climáticas (INCLINE), Universidad de Buenos Aires (UBA), and Universidade de São Paulo (USP).

The main focus of the workshop was the application of different dynamical (RegCM4) and ESD models for the generation of high resolution climate experiments in the framework of the SESA-Flagship Pilot Study of the Coordinated Regional Downscaling Experiment (CORDEX). One of the objectives of the study is to investigate multi-scale aspects, processes and interactions that result in extreme precipitation events using dynamical models (high resolution, convection permitting and coupled models) and statistical models and to compare and validate ESD and RCM products exploring the added value of downscaling. The workshop made the participants aware of the available climate data in South America, and trained them to analyze and downscale these data to an adequate resolution needed to reproduce a particular phenomenon of interest. Lectures and hands-on sessions on these

tools applied to climate change studies provided a background for regional climate modelling focused on the South America region. More information can be found [here](#).



*Group photo (photo: ICTP)*

### ***Earthquakes and Tsunami: Modeling and Observations***

The international school was organized in Tunis, Tunisia from 19 to 30 November 2018 and co-sponsored by ICTP, IUGG, Université de Tunis El Manar, Regione Friuli Venezia Giulia, Ecole Nationale d'Ingénieurs de Tunis, and North African Group for Earthquake and Tsunami studies.

The two-week international school brought together international experts and trained Master & PhD students and early career scientists in Earthquake and Tsunami Physics so that each participant has a better understanding of the range of circumstances and knowledge related to seismic hazard in the region. The aim was to raise national capability in the vulnerable countries and increase their resilience, through an ad-hoc advanced training and also favor international cooperation among the school participants also in the framework of the North African Group for Earthquake and Tsunami studies. More information can be found [here](#).

## **IUGG AND THE INTERNATIONAL SCIENCE COUNCIL (ISC)**

### **Science and Policy Forum at the United Nations Global Platform for Disaster Risk Reduction**

The Science and Policy Forum was held at the United Nations Office in Geneva, Switzerland, 13-14 May 2019 and attracted 400 participants to discuss advances in science that support the implementation of the Sendai Framework and to identify critical knowledge needs on an integrated approach to disaster risk reduction (DRR). The Forum was organized by the International Science Council (ISC), the United Nations Office on Disaster Risk Reduction (UNDRR), and the Integrated Research on Disaster Risk (IRDR) programme as a side event of the United Nations Global Platform for DRR (GP2019).

The Forum launched a UNDRR-ISC facilitated technical working group on hazards terminology to develop a common definition and language across the full scope of hazards covered by the Sendai framework. The panel on hazards terminology highlighted the need to put more emphasis on the study of how different types of hazards are interlinked, and may cascade across sectors, time and geographical scales. The Sendai framework focuses on understanding risks which require engagement with local communities that face risks and need to cope with them.



*Panel discussion. From left: chair Alik Ismail-Zadeh (Karlsruhe Institute of Technology, Germany); Ravi Sinha (Indian Institute of Technology Bombay, India), Markus Reichstein (Max-Planck Institute for Biogeochemistry Jena, Germany); Noboru Takamura (Fukushima University, Japan); Wenjian Zhang (World Meteorological Organization); Virginia Murray (Public Health England, UK); John Handmer (University of Melbourne, Australia); and Jonathan Abrahams (World Health Organization) (photo: I. Alcántara-Ayala)*

Addressing the challenges around the lack of data, big data, data quality, use and interoperability are critical to enhance capacities for the use of data meaningfully and for better understanding and managing risks. Major advances in the use of technology for disaster management and major potentials for future deployments were discussed at the Forum; particularly, the use of drones in disaster situations helps to assess damage, guide first responders, deliver equipment, medicine, etc. It was mentioned that there is a need for international cooperation and regulations for disruptive technologies, and systems-wide resilience to address technological hazards. Strengthening resilience and achieving DRR requires collaboration among and between science, policy-makers, and society to meet short term information needs to anticipate and mitigate long-term impacts.

Scientific contribution to DRR was recognized in the Summary Report of co-Chairs of the GP2019: “An interconnected approach is required to address systemic risks supported by multi-hazard and multidisciplinary risk assessment. The Global Risk Assessment Framework will facilitate this approach. Experts from science, the United Nations, and the private sector launched a new technical working group to develop a definitions’ list for the Sendai Framework hazards. These, among others, will contribute to enhancing understanding of the new dimensions of disaster risk. Such efforts will increase our understanding of risk, inform decision-making, and transform behaviour.”

## The High-Level Dialogue at GP2019

Progress made in implementing the Sendai Framework was a topic of the High-level dialogue at GP2019. Moderator Beatrice Marshall, Kenyan news anchor, opened the dialogue introducing the purpose of the session. In a keynote speech, Malini Mehra, Chief Executive of GLOBE International, outlined statistics on the increasing number of disasters, which have caused the displacement of some 265 million people since 2008, more than three times as many as those caused by conflicts. She called for society to address not only natural hazards but also the man-made risks of technologies such as artificial intelligence and geoengineering. Kirsi Madi, Director of UNDRR, further commented on the impacts of disasters in displacing people and costing USD 500 billion to economies worldwide.



*Alik Ismail-Zadeh speaks at the High-Level Dialogue of the GP2019 (photos: I. Alcántara-Ayala)*

Ulziisaikhan Enkhtuvshin, Deputy Prime Minister, Mongolia, summarized his regional platform's emphasis on resilient infrastructure and risk-informed development. Feliks Tsolakyan, Minister of Emergency Situations, Armenia, highlighted the relevance of reducing risk to promote further infrastructure development. Edoardo Rixi, Minister of Transport and Infrastructure, Italy, announced the establishment of a regional coalition to discuss safety of infrastructure and emerging risks such as threats to cybersecurity. Ambassador Walid Doudech, Tunisia, highlighted two regional ministerial declarations and the focus on dedicated funding to advance implementation of the Sendai Framework. Eduardo José González Angulo, Director-General, National Unit for Disaster Risk Management, Colombia, highlighted work in his country and region on financial protection and the reduction of financial vulnerability in the face of disaster. Alik Ismail-Zadeh, Secretary of the International Science Council, talked about the need for collaboration across science, policymakers and society for success in DRR.

## Report on the TROP ICSU Workshop for Teachers in Bhutan

The TROP ICSU ("Trans-disciplinary Research Oriented Pedagogy for Improving Climate Studies and Understanding") project is funded by the International Science Council (former ICSU), led by the International Union of Biological Sciences (IUBS) and the International Union for Quaternary Research (INQUA), and supported by several other scientific unions and organizations including IUGG and its Associations. More information on the project can be found at: <https://tropicsu.org>.

In the framework of this project, the TROP ICSU Workshop "Climate across the curriculum: Educational resources for teachers" was organized in Thimphu, Bhutan, on 14-15 February 2019. A 2-day workshop for university lecturers and school teachers was conducted in collaboration with the Commission on

Education and Outreach, International Association of Seismology and Physics of the Earth's Interior (IASPEI) of IUGG, and the Center for Disaster Risk Reduction and Community Development Studies (CDRR &CDS), Royal University of Bhutan.

The workshop was attended by 66 school teachers and university lecturers from Bhutan. The participants included a representative from the Young Earth System Scientists (YESS) community, the principal of a school, and the vice-principal of a school. The objective of the workshop was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, Geosciences and Humanities using climate-related examples, case studies, and activities. In addition, participants were invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans (*submitted by Raju Sarkar, the Workshop's organizer*).



*Workshop's participants (photos: R. Sarkar)*

### **Report on the TROP ICSU Working Group Meeting in France**

Keith Alverson represented the IUGG at a TROP ICSU working group meeting at the Acedemie des Science, Institut de France, 14-15 October 2019. TROP ICSU is an ISC funded three-year project to integrate climate change education across the core curricula at High School and University level globally. The project is led by the International Union of Biological Sciences, with participation of several international unions, including IUGG, national academies and national research centers, and United Nations agencies. It aims to improve awareness of climate change and the science behind it among students by developing teaching aids for teachers at the secondary and undergraduate levels. These educational resources are locally rooted but globally relevant and designed to promote interdisciplinary thinking.

The TROP-ICSU project portal ([www.tropicsu.org](http://www.tropicsu.org) and <https://climatescienceteaching.org/>) contains a suite of teaching resources that integrate climate studies within the curriculum in various disciplines and subjects. The use of these teaching resources enables educators to teach a topic in a particular discipline with the help of examples, case studies, and exercises related to climate change. These resources can be used globally by educators in the classroom or by students for independent learning. This integrated approach will help increase climate awareness among students. The goal is not to introduce climate education as a stand-alone topic, but to integrate it within core curricula in science,

mathematics, social sciences and humanities, thereby exposing a wider range of students to climate change information.

IUGG also participated in the two previous (2017 and 2018) meetings of the group, though remotely by Skype in order to avoid greenhouse gas emissions. This was the final meeting of the group, and discussions therefore focused on finalization of the educational tools, including translation into local languages, future dissemination and maintenance of the website and portal as well as possible support mechanisms for the project beyond 2019.

## **GeoUnions**

The GeoUnions (GUs) is a network of representatives of the international scientific unions of the International Science Council (ISC) dealing with Earth and space sciences. The GUs established a Steering Committee in 2004 (in Paris, France) to promote the sciences worldwide, to communicate and to coordinate scientific activities of individual unions, and to speak on behalf of GUs members to ICSU Executive Board, ICSU Members and its interdisciplinary bodies and at international level, especially to the United Nations organizations and other global stakeholders. The current Members of the GUs are:

- the International Astronomical Union (IAU),
- the International Cartographical Association (ICA),
- the International Geographical Union (IGU),
- the International Union for Quaternary Research (INQUA),
- the International Society for Photogrammetry and Remote Sensing (ISPRS),
- the International Union of Geodesy and Geophysics (IUGG),
- the International Union of Geological Sciences (IUGS),
- the International Union of Soil Sciences (IUSS), and
- the International Union of Radio Science (URSI).

More information on GeoUnions can be found at: <http://www.icsu-geounions.org>

## **IUGG at the World Science Forum 2019**

The IUGG President, Kathy Whaler, attended the [World Science Forum](#) 2019 in Budapest, Hungary, from 20-23 November 2019, where she co-moderated a [Special Session](#) as part of the UNESCO year celebrating the centenary of the death of Roland Eötvös. She also attended the opening of an exhibition dedicated to his life and work at ELTE University Library, with interactive exhibits and commentary in Hungarian and English. More information on Roland Eötvös and the centenary can be found [here](#).



*Kathy Whaler, IUGG President, receiving commemorative coins from László Szarka, Chair, Eötvös 100 Coordination Committee*

# ACTIVITIES OF THE UNION ASSOCIATIONS

The following reports, prepared by the Secretaries General of the eight Associations of IUGG:

International Association of Cryospheric Sciences (IACS)

International Association of Geodesy (IAG)

International Association of Geomagnetism & Agronomy (IAGA)

International Association of Hydrological Sciences (IAHS)

International Association of Meteorology & Atmospheric Sciences (IAMAS)

International Association for the Physical Sciences of the Oceans (IAPSO)

International Association of Seismology and Physics of the Earth's Interior (IASPEI)

International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI)

illustrate the impressive range of activities within each Association as well as their dedication to supporting science within developing countries.

# International Association of Cryospheric Sciences (IACS)



IACS website: [www.cryosphericciences.org](http://www.cryosphericciences.org)

## INTRODUCTION

The International Association for Cryospheric Sciences (IACS) is the Association of the International Union of Geodesy and Geophysics (IUGG) concerned with snow and ice science and provides expert advice on cryospheric issues to governmental and non-governmental organisations. The objectives of IACS are to:

- promote studies of cryospheric subsystems of the Earth and solar system;
- encourage research in the above subjects by members of the cryospheric community, national and international institutions and programmes, and individual countries through collaboration and international coordination;
- provide an opportunity on an international basis for discussion and publication of the results of the above research;
- promote education and public awareness on the cryosphere, and facilitate the standardisation of measurement or collection of data on cryospheric systems and of the analysis, archiving and publication of such data;
- promote and support diversity, inclusion and equality within the field of cryospheric science, including but not limited to career stage, gender, racial and ethnic identities, and geographic origin.

## ADMINISTRATION

A Bureau of 12 elected officers manages the business of IACS. The current IACS Bureau was elected at the IACS Plenary Administrative Meeting during the 27<sup>th</sup> IUGG General Assembly in Montreal. It consists of *Regine Hock* (President), *Liss Andreassen* (President Elect), *Richard Essery* (Secretary General), *Minghu Ding* (Vice President), *Stanislav Kutuzov* (Vice President), *Andrew Mackintosh* (Vice President), *Takenobu Toyota* (Head, Sea ice, lake and river ice), *Christine Schøtt Hvidberg* (Head, Planetary and other ices of the solar system), *Gwenn Flowers* (Head, Glaciers), *Sophie Nowicki* (Head, Ice sheets), *Charles Fierz* (Head, Snow and avalanches) and *Anais Orsi* (Head, Cryosphere, atmosphere and climate). The former division Glaciers and Ice Sheets was split into two separate divisions following an update of the IACS Statutes.

To run the day to day business of IACS, an Executive Committee (EC) consisting of the President, Secretary General and President Elect holds regular teleconferences, in which all Bureau members are welcome to join.

## ACTIVITIES

### 27th IUGG General Assembly, Montreal

IACS organized 15 sessions and 15 joint symposia with other Associations at the IUGG General Assembly in Montreal. Waleed Abdalati gave the IACS union lecture and Marie Dumont gave the IACS early-career award lecture; both were well attended. The three active Working Groups of IACS (Glacier ice thickness estimation, Debris covered glaciers, and the Randolph Glacier Inventory) and the Global Terrestrial Network for Glaciers (GTN-G) steering group held meetings. National delegates elected a new bureau at the IACS open plenary administrative meeting.



*The newly-elected IACS Bureau for 2019-2023:  
Back row, l-r: Minghu Ding, Andrew Mackintosh, Anaïs Orsi, Takenobu Toyota.  
Front row, l-r: Charles Fierz, Christine Schøtt Hvidberg, Regine Hock, Gwenn Flowers (on screen), Liss  
Andreassen, Richard Essery.  
Not present: Stanislav Kutuzov, Sophie Nowicki*

### IACS Bureau Meeting

The outgoing and incoming IACS Bureaus met over two days during the Montreal IUGG General Assembly. The meeting was attended in person by nine Bureau members, with another member attending by video link. We intend to expand the use of videoconferencing for business meetings to better accommodate busy work schedules and home responsibilities, and to minimise greenhouse gas impacts associated with air travel.

### IACS Statutes and By-Laws

Substantially revised IACS Statutes and By-Laws were approved by the IUGG Council in September 2019. The revisions were necessary to account for the individual membership category introduced in 2017, electronic voting and the establishment of a new 'Ice sheets' division. The revised Statutes also emphasize commitments to promoting and supporting diversity within cryospheric science and within IACS.

IACS homepage (<https://cryosphericsscience.org/>)

An entirely revamped and modernized IACS was launched in February 2019 and is being continuously updated. The page is now hosted at the World Glacier Monitoring Service in Zurich and is also linked to twitter account @iacscryo (<https://twitter.com/iacscryo>).

#### IACS Working and Standing Groups

IACS facilitates the transfer of research methods and explores new avenues in cryospheric science through Standing Groups and Working Groups devoted to a theme or subject and composed of experts in the particular field of study. The currently active IACS Working Groups are:

- Randolph Glacier Inventory and its role in future glacier monitoring and GLIMS (2020-2023). RGI has become a pillar of glaciological research at global and regional scales, for estimates of recent and future glacier changes, glacier mass balance, and glacier contribution to sea-level rise.
- Regional Assessments of Glacier Mass Change (2019-2023). This new working group brings together the research community that is assessing regional glacier mass changes from various observation technologies to come up with a new consensus estimate of global glacier mass changes and related uncertainties.
- Debris Covered Glaciers (2018-2022) aims to advance our ability to map debris thickness, to identify the level of model complexity required to estimate sub-debris melt, and to coordinate knowledge exchange.

The IACS/IPA Standing Group on Glacier and Permafrost Hazards in High Mountains (GAPHAZ) aims to:

- improve international scientific communication on glacier and permafrost hazards;
- compile knowledge related to glacier and permafrost hazards in high mountains;
- work towards greater transfer of information and improved communication between the scientific and governmental communities;
- signpost sources of advice to international and national agencies, responsible authorities and private companies;
- act as a focal point for information for international media during relevant crises.

IACS and IAVCEI have agreed to wind up the Joint Commission on Volcano-Ice Interactions after a period of inactivity and are now exploring new areas for collaboration. Plans are underway to establish joint commissions with IAPSO on ice-ocean interactions and with IAG on cryospheric deformation.

IACS is part of the Global Terrestrial Network for Glaciers (GTN-G) Steering Committee. GTN-G is a framework for internationally coordinated monitoring of glaciers jointly run by the US National Snow and Ice Data Center, the Global Land Ice Measurements from Space initiative, and the World Glacier Monitoring Service.

#### IPCC Special Report on the Ocean and Cryosphere in a Changing Climate

IACS bureau members played key roles in the IPCC SROCCC, with Regine Hock as a Coordinating Lead Author and Andrew Mackintosh and Stanislav Kutuzov as Lead Authors. Several other past IACS bureau members and IACS award winners also served as lead authors or review editors, including Hiroyuki Enomoto, Xiao Cunde, Georg Kaser and Ben Marzeion. Valerie Masson Delmotte is serving as IPCC Working Group 1 co-chair.

## IACS awards

The IACS Early Career Scientist Awards for 2019 went to Dr Doug Brinkerhoff (University of Montana, USA) and Dr Denis Felikson (NASA Goddard Space Center, USA).

An award in memory of Graham Cogley was established in 2019 with generous support from the Cogley family. The award recognizes Graham's substantial and outstanding contributions to glaciology, in particular to studies of glacier mass balance, his sustained service to scientific organizations and the broader glaciological community, and his collegiality, kindness and extraordinary work ethic. Graham also chaired several IACS working groups. The award will be given annually to recognize excellence in cryospheric research by Early-Career Scientists, with recipients selected by IACS and the International Glaciological Society in alternating years. The inaugural Graham Cogley Awards were presented at the IUGG General Assembly in July 2019 to Caroline Aubry-Wake (University of Saskatchewan, Canada) and Eric Keenan (University of Boulder, USA).

## Co-sponsored events and activities

IACS supports events that are of interest to the cryospheric community. Our contributions typically cover part of the travel costs for early career scientists and scientists from developing countries attending cryosphere related events, or IACS awards for scientists in these categories. Sponsorships in 2019 included:

- WMO High Mountain Summit, Geneva, Switzerland 29-31 October
- Workshop on computational methods for snow and avalanche release mechanics, Aussois, France, 30 September - 1 October
- Glacial Isostatic Adjustment Training School, Gävle, Sweden, 26-30 August
- Cryo Connect database development and website integration

Three IACS newsletters were published in 2019. The newsletters are typically four pages long and feature IACS activities: <https://cryosphericsscience.org/newsletter/>

## **FUTURE ACTIVITIES**

To facilitate the review of requests for support, IACS has introduced three deadlines per year on 1 February, 1 June and 1 October. Funding requests must be submitted for a deadline at least two months prior to the event that is to be supported (for example, the funding request for an event in July must be received by 1 February). Proposers will be informed of decisions approximately two weeks after the deadline.

Events already selected for sponsorship in 2020 include:

- International Summer School in Glaciology, McCarthy, Alaska, 6-16 June
- 6th Snow Science Winter School, Col du Lautaret, France, 16-22 February
- 7th International Conference on Mars Polar Science and Exploration, Ushuaia, Argentina, 13-17 January

IACS has started planning its next assembly (18-23 July 2021 in Busan, Republic of Korea) in conjunction with IAMAS and IAPSO.

Andrew Mackintosh, IACS Secretary General

# International Association of Geodesy (IAG)



International Association  
of Geodesy

IAG website: [www.iag-aig.org](http://www.iag-aig.org)

## INTRODUCTION

Geodesy is the discipline that deals with the measurement and representation of the Earth (geometry, physics, and temporal variations). The mission of the International Association of Geodesy (IAG) is the advancement of geodesy by furthering geodetic theory through research and teaching, by collecting, analysing, modelling and interpreting observational data, by stimulating technological development, and by providing consistent, time-dependent geometric and physical parameters for global change research.

The structure of IAG comprises a number of components: four Commissions, the Inter-Commission Committees on Theory (ICCT), Climate Research (ICCC), and Marine Geodesy (ICCM), Project Novel Sensors and Quantum Technology for Geodesy (QuGe), twelve International Scientific Services, the Global Geodetic Observing System (GGOS), and the Communication and Outreach Branch (COB).

The Commissions are divided into Sub-commissions, Study Groups and Working Groups. The Inter Commission Committees (ICCs) and the Project investigate scientific geodetic-related problems in close cooperation with the Commissions. The Services generate scientific products by means of Operation, Data and Analysis Centres.

The Global Geodetic Observing System GGOS is a component of IAG which works with the IAG Services to provide the geodetic infrastructure necessary for monitoring the Earth system and global change research. GGOS ensures the basis to maintain a stable, accurate and global reference frame, which is crucial for all Earth observation.

The COB provides communication, public information and outreach links, in particular via the IAG Website and the monthly Newsletters.

The IAG General Assembly, the Council, the Executive Committee, and the Office carry out the administration of IAG. The Council is composed by the delegates appointed by the national adhering bodies; the Bureau comprises the IAG President, Vice-President and Secretary General; the Executive Committee consists of 17 elected members; and the Office assists the Secretary General in fulfilling his duties. The COB is responsible for the promotional activities of the IAG and the communication with its members. The detailed programme of the IAG is published in the quadrennial Geodesist's Handbook, and reports are published in the bi-annual IAG Reports (Travaux de l'AIG).



*The structure of IAG 2019-2023*

## ADMINISTRATION

### IAG Council

The IAG Council meets bi-annually at the IUGG General Assemblies and at the IAG Scientific Assemblies. The Council meetings during the IUGG General Assembly in Montreal, Canada, took place on July 10 and July 16, 2019. Main topics were the election of the members of the IAG Executive Committee (done by e-mail voting before the Assembly), the review and approval of the IAG Statutes and Bylaws, approval of the IAG budget 2020-2023, and the decision on the venue of the next IAG Scientific Assembly 2021, which will be in Beijing, China, June 28 – July 2, 2021.

The IAG Office and the COB keep close contact to the Council by e-mails, Newsletters and publications. Council delegates and EC officers gain free access to IAG's Journal of Geodesy published by Springer.

### IAG Executive Committee (EC)

The EC 2015-2019 held two meetings in 2019 during the IUGG GA in Montreal, on July 9 and 15, 2019. Important topics were the assessment of the IAG Services, the activity reports of the EC members and the editors of the Journal of Geodesy and the IAG Series (published by Springer), the preparation of the Symposia at the General Assembly, and the new structure for 2019-2023.

The new EC 2019-2023 had two meetings, first during the IUGG GA in Montreal, on July 18, 2019, and second in San Francisco on December 7, 2019. Most important items were organizational topics of the new EC, structure and plan of Commissions and other components, and appointment of IAG representatives to scientific bodies. The EC meeting summaries are available at the IAG web page.



*First meeting of the IAG Executive Committee 2019-2023 during the IUGG General Assembly in Montreal.*

### **IAG Bureau**

The IAG Bureau discussed the day-to-day decisions by e-mail exchange, Skype meetings and met in person before the EC meetings. It decided, e.g., on IAG representations at external events and on travel award applications of young scientists for participation and presentation at IAG sponsored Symposia (see below).

### **IAG Office**

The IAG Office managed the current work of the Association including the finances, the activities concerning the IUGG, the IAG EC and Bureau, and the regular contact with the IAG components. The Secretary General started the organisation of the General Assembly in Montreal, Canada within the IUGG 2019 Scientific Program Committee. Minutes of the Council and EC meetings were written for internal use, and meeting summaries published at the IAG Homepage and in the IAG Newsletter (see COB below). The individual IAG membership and travel awards for young scientists were handled.

## **ACTIVITIES**

### **Commissions, Inter-Commission Committees, and Services**

The four IAG Commissions (Reference Frames, Gravity Field, Earth Rotation and Geodynamics, Positioning and Applications), the Inter-Commission Committees, and the twelve Services maintain their individual Webpages (all accessible via the IAG Homepage). They held business meetings at several occasions (in general coinciding with AGU and EGU assemblies), and organised symposia and workshops together with their sub-components (Sub-Commissions, Working and Study Groups, and Coordinating Boards, Directing Boards or Governing Boards, respectively; see below).

### **Global Geodetic Observing System (GGOS)**

GGOS Days is the annual meeting of GGOS during which the different components of GGOS meet and report on their activities during the past year and their plans for the coming year. GGOS Days 2019 was held November 12-14, 2019 in Rio de Janeiro, Brazil, in conjunction with the SIRGAS 2019 Symposium. The first day session on Nov. 12 was joint with SIRGAS 2019 and the other sessions were

held in parallel with the SIRGAS sessions at a nearby location. The meetings were focused on strategic discussions and future plans of GGOS.



*Participants of SIRGAS Symposium and GGOS Days, November 12-14, 2019, Rio de Janeiro, Brazil*

### **Communication and Outreach Branch (COB)**

Main activities of the COB included the publication of the monthly Newsletter, and the maintenance of the IAG Homepage ([www.iag-aig.org](http://www.iag-aig.org)). The major effort during the latter half of the year 2019 was total renewal of the IAG web site and transferring all pages in the COB server which were previously maintained by the IAG Secretary General.

### **Important Meetings of IAG Components and IAG Sponsored Meetings in 2019**

2019 03 14-20	24th Meeting of the European VLBI Group for Geodesy and Astronomy (EVGA) and 18th IVS Analysis Workshop	Las Palmas, Gran Canaria, Spain
2019 04 15-17	IGS 2019 Analysis Workshop	Potsdam, Germany
2019 05 05-09	10th IVS Technical Operations Workshop	Westford, MA, USA
2019 05 15-17	4th Joint International Symposium on Deformation Monitoring (JISDM)	Athens, Greece
2019 05 22-24	EUREF 2019 Symposium	Tallinn, Estonia
2019 07 08-19	27th IUGG General Assembly	Montreal, Canada
2019 07 29	Centennial International Cooperation in Earth and Space Sciences [IUGG/UNESCO meeting]	Paris, France
2019 08 07-09	Ninth Session of UN-GGIM	New York, USA
2019 09 16-20	Workshop for the Implementation of the GGRF in Latin America	Buenos Aires, Argentina
2019 09 18-20	Munich Remote Sensing Symposium 2019 (MRSS19)	Munich, Germany
2019 09 19-20	CODATA 2019: Towards next-generation data-driven science: Policies, practices and platforms	Beijing, China
2019 09 30-01	DORIS Analysis Working Group meeting	Paris, France
2019 10 01	ILRS Analysis Standing Committee (ASC) meeting	Paris, France
2019 10 01-04	5th IAG Symposium on Terrestrial Gravimetry: Static and Mobile Measurements (TG SMM 2019)	Saint Petersburg, Russia
2019 10 02-04	GGOS/IERS Unified Analysis Workshop	Paris, France
2019 10 07-09	Journées 2019: Astrometry, Earth Rotation and Reference Systems in the Gaia era	Paris, France

2019 10 10	BIPM Workshop on Advanced Time and Frequency Transfer	Sèvres, France
2019 10 21-25	2019 ILRS Technical Workshop	Stuttgart, Germany
2019 11 11	International Symposium on the occasion of 80 <sup>th</sup> Anniversary of Prof. Erik Grafarend	Stuttgart, Germany
2019 11 11-14	GGOS Days 2019	Rio de Janeiro, Brazil
2019 11 11-14	SIRGAS Symposium 2019	Rio de Janeiro, Brazil



*International Workshop for the Implementation of the Global Geodetic Reference Frame in Latin America, Buenos Aires, Argentina, September 16 – 20, 2019*



*Participants of 5th IAG Symposium on Terrestrial Gravimetry: Static and Mobile Measurements (TG-SMM 2019), 1-4 October 2019, Saint Petersburg, Russia*

## **Cooperation with other Organisations**

IAG maintains close cooperation with several organisations outside IUGG: Advisory Board on the Law of the Sea (ABLOS, presently with IAG presidency), Group on Earth Observation (GEO), ICSU Commission on Space Research (COSPAR, Sub-commission B2 and PSD), International Astronomical Union (IAU, Commission A2, with IAG presidency), International Standards Organisation (ISO, TC211 Geographic Information / Geomatics), United Nations Initiative on Global Information Management (UN-GGIM), United Nations GGIM Geospatial Societies (UN-GGIM-GS), United Nations Offices for Outer Space Affairs (UNOOSA, with Space-based Information for Disaster Management and Emergency Response, UN-SPIDER, and International Committee on Global Navigation Satellite Systems, ICG).

## **Individual IAG membership**

By the end of 2019, there were 173 members, of which 14 were student members.

## **Publications**

Based on the agreement with Springer Verlag, IAG Symposia Series will be open access, and free of charge to the Symposia participants. Volumes 148 (International Symposium on Gravity, Geoid and Height Systems 2016) and 149 (International Symposium on Advancing Geodesy in a Changing World) appeared in 2019. Volume 150 (Fiducial Reference Measurements for Altimetry) will appear in 2020, and next two are under preparation.

## **Awards, Anniversaries, Obituaries**

Levallois Medal was presented to Professor Christoph Reigber in Potsdam on the occasion of the 80th Anniversary and a Geoscientific Colloquium.

IAG Guy Bomford Prize was awarded to Michal Šprlák on the occasion of the IUGG General Assembly in Montreal, Canada.

On the occasion of the IUGG General Assembly in Montreal, Canada, two young authors' awards were granted. The IAG Young Authors Award 2017 is granted to Minghui Xu for the article "The impacts of source structure on geodetic parameters demonstrated by the radio source 3C371", and the 2018 award to Athina Peidou for the article "On the feasibility of using satellite gravity observations for detecting large-scale solid mass transfer events"

Travel awards with a total amount of 5500 EUR were granted to 9 young scientists for participating and presenting research results at 4 IAG sponsored Symposia.

An International Colloquium at GFZ, Potsdam, in honour of Professor Helmut Moritz on the occasion of his 85<sup>th</sup> anniversary.

An international Symposium was held in Stuttgart in the occasion of 80<sup>th</sup> Anniversary of Professor Erik Grafarend.

One obituary was published in IAG Newsletter in 2019.

The IAG President and Secretary General represented IAG in various symposia, meetings and anniversaries.

## **FUTURE ACTIVITIES**

Main activities in 2020 concern the preparation of the IAG Scientific Assembly in Beijing, China, June-July 2021, and implementation of the IAG strategy and the new structure of the IAG 2019-2023. Cooperation in the Subcommittee on Geodesy of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) will continue. IAG is represented in the UN-GGIM permanent Subcommittee on Geodesy where the main activity is planning and establishment of the Centre of Excellence.

Emerging new techniques in geodesy, new needs and practices following this development, and improving of the global geodetic infrastructure to meet new requirements are as well in scope of coming years. These include advances in Global Satellite Positioning Systems (GNSS), usage of SAR technique in geodetic observations, advances in VGOS (VLBI Global Observing System) and SLR (Satellite Laser Ranging), and plans for dynamic reference frames in positioning. These will affect work of IAG Services but also future development of IAG structure and strategy to improve and sustain the global geodetic reference frame.

Markku Poutanen, IAG Secretary General

# International Association of Geomagnetism and Aeronomy (IAGA)



International Association  
of Geomagnetism and Aeronomy

IAGA website: [www.iaga-aiga.org](http://www.iaga-aiga.org)

## INTRODUCTION

**IAGA**, the International Association of Geomagnetism and Aeronomy (AIGA - Association Internationale de Géomagnétisme et d'Aéronomie) is one of the eight Associations of the International Union of Geodesy and Geophysics (IUGG). It is a non-governmental body funded through the subscriptions paid to IUGG by its Member Countries. IAGA has a long history and can trace its origins to the Commission for Terrestrial Magnetism and Atmospheric Electricity, part of the International Meteorological Organisation, which was established in 1873.

IAGA is the premier international scientific association promoting the study of terrestrial and planetary magnetism, and space physics. IAGA is concerned with the understanding and knowledge that result from studies of the magnetic and electrical properties of:

- the Earth's core, mantle and crust
- the middle and upper atmosphere
- the ionosphere and the magnetosphere
- the Sun, the solar wind, the planets and interplanetary bodies.

More information on IAGA is provided on its websites: [www.iaga-aiga.org](http://www.iaga-aiga.org).

## ADMINISTRATION

Since 2015, IAGA is organised in six Divisions and four Inter-divisional Commissions, each led by a Chair and a Co-Chair. Each Division may form Working Groups in given specialised topics and elects officers to run the business of the Working Groups. The terms of office are linked to the IUGG General Assemblies, and new officers were elected during the XXVII IUGG General Assembly in Montréal in July 2019. Lists of the Division/Inter-divisional Commission leadership and the Working Group names and officers can be found on the following website: [www.iaga-aiga.org/about/](http://www.iaga-aiga.org/about/).

IAGA is administered by an Executive Committee on behalf of IUGG Member Countries in accordance with the Association's Statutes and By-Laws. The election process was conducted by a Nominations Committee chaired by Toshihiko Iyemori and approved by the Conference of Delegates. According to a change of IAGA Statutes and By-Laws adopted in 2017 the Executive Committee now additionally contains a second Vice President, a Treasurer, and an Early Career Scientist (ECS) and overall consists of 13 members. The newly elected Executive Committee members are:

**President:** Mioara Manda (France)

**Vice-presidents:** Alan Thomson (UK), Andrew Yau (Canada)

**Secretary General:** Monika Korte (Germany)

**Treasurer:** Aude Chambodut (France)

**Members:** Kusumita Arora (India), Loren Chang (ECS, Taiwan), Anna Kelbert (USA), Michael Kosch (South Africa), Huixin Liu (Japan), Klaus Spitzer (Germany), Ricardo Trindade (Brazil)

IAGA communicates with Member Countries through National Correspondents nominated by appropriate National Bodies. Member Countries are represented at IAGA Assemblies by accredited Chief Delegates who may vote on matters, according to the voting rules set out in the Statutes and By-Laws, at meetings of the Conference of Delegates. Information on the EC members and National Correspondents are found at: [www.iaga-aiga.org/about/](http://www.iaga-aiga.org/about/).

## ACTIVITIES

### IUGG General Assembly

The main event in 2019 was the participation in the 27<sup>th</sup> IUGG General Assembly in Montréal, Canada, where IAGA activities contributed from July 12 to 18. IAGA was very well represented with 22 own symposia, 12 joint ones led by IAGA and contributions to another 6. Nearly 400 participants from 36 countries gave IAGA as their main affiliation.

The IAGA programme efficiently ran in a conference centre which provided an excellent space, giving us the chance to catch up with latest developments in our own research specialities, as well as take in some of the more inter-disciplinary topics. The meeting provided many opportunities for scientists to discuss different topics over breaks, poster sessions, and the IAGA dinner.

At the IAGA Ceremony, introduced in 2017, the IAGA awards are presented and the Shen Kuo Medalist gives an invited lecture. This year the Ceremony took place on July 15, with an exciting lecture on planetary magnetism entitled "The Magnetic Field of Mars: Progress and Puzzles" by Catherine Johnson.

### IAGA Awards and Honours

The following awards were presented at the IAGA Ceremony during the IUGG General Assembly:

#### Shen Kuo Medal

Catherine Johnson (Canada), for intrinsically interdisciplinary contributions, targeted at a holistic understanding of bodies throughout the Solar System, especially with respect to the magnetic field of the planet Mercury, and the Earth's magnetic field within the past five million years.

#### Long Service Medal

Martin Berg (Norway), for his dedicated continuous efforts to produce the highest quality geomagnetic field data and for his devoted work at the Dombas observatory for over 35 years.

#### Young Scientist Award

Tomasz Gonet (UK), Deepak Kumar Karan (India), Kseniia Tlatlova (Russia), Evgenii Shirokov (Russia)

### IAGA Honorary Members

Archana Bhattacharyya (India) and Toshihiko Iyemori (Japan) were appointed new Honorary Members of IAGA at the first Conference of Delegates during the IUGG General Assembly.



*The awardees with IAGA EC members at the IAGA Ceremony in July 2015. From left to right: M. Korte (IAGA vice president), C. Johnson (Shen Kuo Medalist), D. K. Karan and T. Gonet (Young Scientist Awardees), M. Manda (IAGA Secretary General), K. Tlatova and E. Shirokov (Young Scientist Awardees), M. Berg (Long Service Medalist), E. Petrovsky (IAGA President) [photo: J. Simkanin]*

### **4th IAGA School**

The 4<sup>th</sup> IAGA School, prior to the IUGG General Assembly in Montréal, Canada, was held at the Station de biologie des Laurentides (SBL), ca. 80 km NW of Montreal. The School was attended by 20 students, with 5 from Europe (France, Germany, Poland), 3 from Russia, 5 from Asia (India, Japan, China), 6 from North America (USA, Mexico, Canada) and 1 from South America (Brazil). Topics across all the disciplines of IAGA were covered by lectures given by experts in their fields, and both the students and the lecturers gave very positive feedback on the event.



*Group photo taken at the 4<sup>th</sup> IAGA School*

### **Sponsored Topical Meetings**

Traditionally, IAGA provides few or no sponsoring during years of IUGG General Assemblies, such as 2019. This year, IAGA sponsored three topical meetings. Reports from them are published in the IAGA Newsletter which can be found at [www.iaga-aiga.org/publications](http://www.iaga-aiga.org/publications).

Workshop Title	Date	Location	Organiser /Support Applicant
AGS Conference on Space Weather	25-28 March	Cairo, Egypt	Ayman M. Mahrous
6 <sup>th</sup> Latinmag*	18-22 November	Rancagua, Chile	Fernando Poblete
III PANGEO	11-15 November	Pilar and Cordoba, Argentina	Camila Farias

\*note: The 6<sup>th</sup> Latinmag had to be cancelled at short notice due to unexpected developments in the socio-political situation in Chile. III PANGEO also was cancelled due to infrastructure problems.

### **Publications**

#### *IAGA Newsletters*

The latest issue of the annual IAGA Newsletter, no. 56, was distributed in December. It can be downloaded from the IAGA website [www.iaga-aiga.org](http://www.iaga-aiga.org).

#### *Contribution to IUGG Centennial Special Issue*

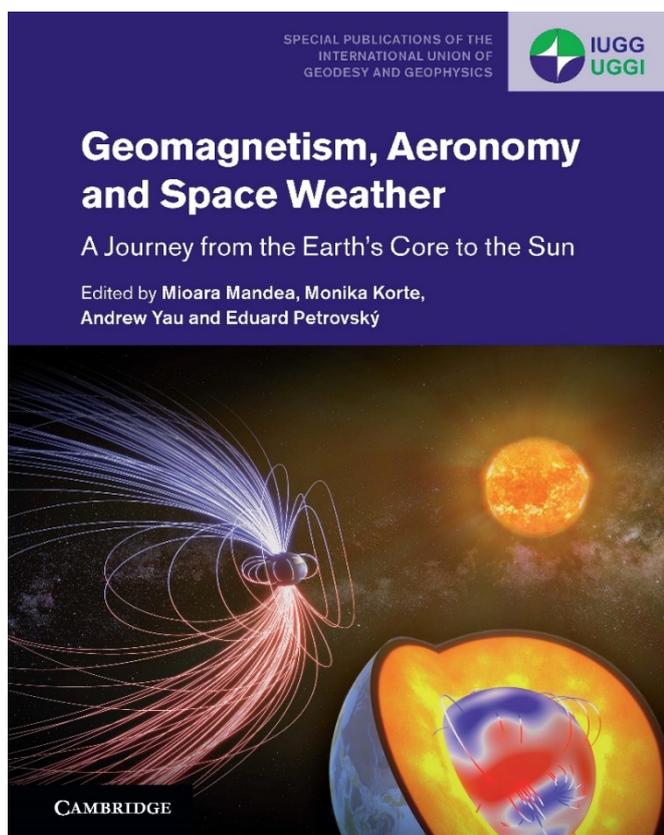
A special issue of the open access journal History of Geo- and Space Sciences (HGSS) was published on the occasion of the IUGG centennial in 2019. The IAGA contribution is authored by M. Mandea and E. Petrovsky, entitled "IAGA: A major role in understanding our magnetic planet" (Hist. Geo Space. Sci., 10, 163–172, <https://doi.org/10.5194/hgss-10-163-2019>).

### *IGA Books*

On the occasion of the IUGG centennial IAGA published a book with Cambridge University Press providing a comprehensive overview of the IAGA fields of research. The volume, edited by M. Manda, M. Korte, A. Yau and E. Petrovsky and entitled "Geomagnetism, Aeronomy and Space Weather – A Journey from Earth's Core to the Sun" was published in November 2019.

### *IGA Flyer and Poster*

Current versions of an IAGA Flyer and Poster are also available on the website.



## **FUTURE ACTIVITIES**

In 2020 IAGA will be involved in organising several topical meetings, as well as in preparing an attractive programme for the 2021 IAGA-IASPEI Joint Scientific Assembly.

From December 2019 on IAGA is now advertising its activities also on Facebook, Twitter and Instagram:

- Facebook: <https://www.facebook.com/IAGAandAIGA/>
- Twitter: [https://twitter.com/IAGA\\_AIGA](https://twitter.com/IAGA_AIGA)
- Instagram: [https://www.instagram.com/iaga\\_aiga/](https://www.instagram.com/iaga_aiga/)

Monika Korte, IAGA Secretary General

# International Association of Hydrological Sciences (IAHS)



International Association  
of Hydrological Sciences

IAHS website: <http://iahs.info>

## INTRODUCTION

IAHS promotes the study of all aspects of hydrology through discussion, comparison, and publication of research results and through the initiation of research that requires international cooperation. IAHS Press publishes the Hydrological Sciences Journal, the Proceedings of IAHS (PIAHS, open access, successor of the Red Book Series), the Benchmark Paper series, and other specialised publications. IAHS maintains strong connections with the International Hydrological Programme of UNESCO and with the Hydrology and Water Resources Programme of the World Meteorological Organisation (WMO), and is partner of the UN Water coordination mechanism.

The following International Commissions, Working Groups and Initiative of IAHS conduct conferences, symposia, workshops, courses, and research programmes:

- International Commission on Continental Erosion (ICCE)
- International Commission on the Coupled Land-Atmosphere System (ICCLAS)
- International Commission on Groundwater (ICGW)
- International Commission on Remote Sensing (ICRS)
- International Commission on Snow and Ice Hydrology (ICSIH)
- International Commission on Statistical Hydrology (ICSH)
- International Commission on Surface Water (ICSW)
- International Commission on Tracers (ICT)
- International Commission on Water Quality (ICWQ)
- International Commission on Water Resources Systems (ICWRS)
- Working Group MOXXI on Measuring and Observing in the XXIst century
- Working Group CANDHY on Citizens AND Hydrology
- Working Group on Education
- Decadal Initiative Panta Rhei 2013-2022.

## ADMINISTRATION

The main event of the year was the IUGG General Assembly in Montreal, July where IAHS organized a comprehensive programme of inter-commission sessions, and co-convened transversal sessions with sister Associations and Union Symposia. IAHS invited several partner organizations to co-convene sessions of common interest, in particular UNESCO, WMO, UNU. Members of the new Early Career Committee have been strongly involved in this programme and organized specific workshops. The

Union Speaker from IAHS has been Veena Srinivasan, India, who addressed important issues of socio-hydrology with key challenges in development contexts.

IAHS organized its elections during the Assembly for the whole set of officers. As per the statutes, acting Presidents remain in position until 2021 for the Association and every commissions, while Presidents elect come onboard for a transition period; whereas all other elected officers take office immediately. Berit Arheimer (Sweden) has been elected as the next President of the Association. All other elected individuals are listed at [iahs.info](http://iahs.info).

The administrative plenary decided on some changes in the statutes and opened a debate about individual membership and shared responsibilities with National representatives, which led to online voting during winter 2019-2020 with a decision of no-change.

The bureau also endorsed the nomination of Dan Rosbjerg (Denmark) as Honorary President, which led to his online election during winter 2019-2020 in that position until the IUGG Assembly 2023.

IAHS hosted its annual Award Ceremony during the Assembly. The Tison Award for Young Hydrologists has been granted to Sandra Pool and Marc Vis (Switzerland). The IAHS-UNESCO-WMO International Hydrology Prize medals have been bestowed to Alberto Montanari (Italy) – Dooge Medal, and Jan Szolgay (Slovakia), Volker Medal.

The SYSTA (Sivapalan Young Scientists Travel Awards) travel award scheme set up in 2018 has been implemented for the first time for the Montreal Assembly with 15 individuals selected for full support (travel organized and bought by the IAHS secretariat, living forfait, registration, visa), from a range of countries in Asia (India 4, Thailand 1), South America (Colombia 1, Ecuador 1) and Africa (Ivory Coast 3, Nigeria 1, Rwanda 1, Senegal 1, Togo 1, Tunisia 1). IAHS also used the quota from IUGG and the LOC to support many other individuals from low-income countries with registration waivers and/or the living forfait. Many grantees (including two of the 15 SYSTA Awardees) could not attend the Montreal Assembly despite many efforts because of visa denials.

## ACTIVITIES

Other highlight events of 2019 are the following conferences:

- MOXXI-CANDHY workshop, joint with the WMO Hydorhub, New York City, USA
- STAHY Meeting, Nanjing, China

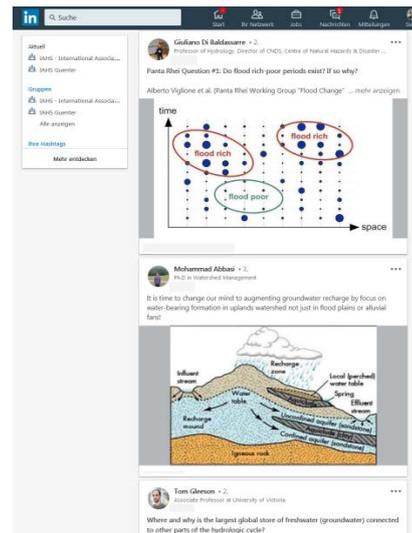
IAHS Ltd based in England is the legal and finance entity of the International Association of Hydrological Sciences. It is chaired by Kate Heal, IAHS Treasurer. It employs 3 staff, coordinated by Claire Lupton, essentially for the Publication activity and general support to the Association, who are hosted by CEH in Wallingford, England.

IAHS Ltd publishes the *Hydrological Sciences Journal - HSJ* with Taylor & Francis; the online journal is made available free of charge to libraries and IAHS members in financially disadvantages countries. IAHS also publishes the proceedings of some IAHS and other symposia and workshops in the online, open access Proceedings of the IAHS (PIAHS) series with Copernicus. The online library of IAHS publications, available free to view at the IAHS website, was expanded further in 2019 with the rescanning of volumes which were previously only available as digital images rather than text.

Performance indicators of *HSJ* are stable. Promotion by “features articles” continues, with details disseminated in press releases and via IAHS social media. Featured articles and Tison Award papers

### Twenty-three unsolved problems in hydrology (UPH) – a community perspective

Günter Blöschl<sup>1</sup>, Marc F.P. Bierkens<sup>2</sup>, Antonio Chambel<sup>3</sup>, Christophe Gudenne<sup>4</sup>, Georgia Destouni<sup>5</sup>, Aldo Fiori<sup>6</sup>, James W. Kirchner<sup>7</sup>, Jeffrey J. McDonnell<sup>8</sup>, Hubert H.G. Savenij<sup>9</sup>, Munge Su. Savijani<sup>10</sup>, Suvapala<sup>11</sup>, Christine Stumpff<sup>12</sup>, Elena Toti<sup>13</sup>, Bena Volpi<sup>14</sup>, Gemma Carr<sup>15</sup>, Claire Lugton<sup>16</sup>, José Salinas<sup>17</sup>, Borbála Széles<sup>18</sup>, Alberto Viglione<sup>19</sup>, Hafzullah Aksoy<sup>20</sup>, Scott T. Allen<sup>21</sup>, Anam Amin<sup>22</sup>, Vazken Andréassian<sup>23</sup>, Berit Arheimer<sup>24</sup>, Santosh K. Aryal<sup>25</sup>, Victor Baker<sup>26</sup>, Earl Bardsley<sup>27</sup>, Marlies H. Barendrecht<sup>28</sup>, Alena Bartosova<sup>29</sup>, Olke Batelaan<sup>30</sup>, Wouter R. Berghuijs<sup>31</sup>, Keith Beven<sup>32</sup>, Theresa Blume<sup>33</sup>, Thom Bogaard<sup>34</sup>, Pablo Borges de Amorim<sup>35</sup>, Michael E. Böttcher<sup>36</sup>, Gilles Boulet<sup>37</sup>, Korbinian Breinl<sup>38</sup>, Mitja Brilly<sup>39</sup>, Luca Brocca<sup>40</sup>, Wouter Buytaert<sup>41</sup>, Attilio Castellani<sup>42</sup>, Andrea Castelletti<sup>43</sup>, Xiaohong Chen<sup>44</sup>, Yangbo Chen<sup>45</sup>, Yunfang Chen<sup>46</sup>, Peter Chiffari<sup>47</sup>, Pierluigi Claps<sup>48</sup>, Martyn P. Clark<sup>49</sup>, Adrian L. Collins<sup>50</sup>, Barry Croke<sup>51</sup>, Annette Dath<sup>52</sup>, Paula C. David<sup>53</sup>, Felipe P. J. de Barros<sup>54</sup>, Gerrit de Rooij<sup>55</sup>, Giuliano Di Baldassarre<sup>56</sup>, Jessica M. Driscoll<sup>57</sup>, Doris Duethmann<sup>58</sup>, Ravindra Divedi<sup>59</sup>, Ebru Eris<sup>60</sup>, William H. Farmer<sup>61</sup>, James Feicabrino<sup>62</sup>, Grant Ferguson<sup>63</sup>, Ennio Ferrari<sup>64</sup>, Stefano Ferraris<sup>65</sup>, Benjamin Fersch<sup>66</sup>, David Finger<sup>67</sup>, Laura Foglia<sup>68</sup>, Keirnan Fowler<sup>69</sup>, Boris Gartsman<sup>70</sup>, Simon Gascoirn<sup>71</sup>, Eric Gaume<sup>72</sup>, Alexander Gelfan<sup>73</sup>, Josie Geris<sup>74</sup>, Shevran Gharari<sup>75</sup>, Tom Gleeson<sup>76</sup>, Miriam Glendell<sup>77</sup>, Alena Gonzalez Bevacqua<sup>78</sup>, Maria P. Gonzalez-Dugo<sup>79</sup>, Salvatore Grimaldi<sup>80</sup>, A. B. Gupta<sup>81</sup>, Bjorn Guse<sup>82</sup>, Davei Hai<sup>83</sup>, David Hannah<sup>84</sup>, Adrian Harpold<sup>85</sup>, Stefan Haun<sup>86</sup>, Kate Heal<sup>87</sup>, Kay Helfricht<sup>88</sup>, Mathew Hermegier<sup>89</sup>, Matthew Hipsey<sup>90</sup>, Hana Hlaváčková<sup>91</sup>, Clara Hohmann<sup>92</sup>, Ladislav Holko<sup>93</sup>, Christopher Hopkinson<sup>94</sup>, Markus Hrachowitz<sup>95</sup>, Tissa H. Illangasekare<sup>96</sup>, Azhar Inam<sup>97</sup>, Camyla Innocente<sup>98</sup>, Erkan Istanbuluoglu<sup>99</sup>, Ben Jarrah<sup>100</sup>, Zahra Kalantar<sup>101</sup>, Andis Kalvas<sup>102</sup>, Sonu Khana<sup>103</sup>, Sina Khatami<sup>104</sup>, Jens Kiesel<sup>105</sup>, Mike Kirkby<sup>106</sup>, Wouter Knoben<sup>107</sup>, Krzysztof Kochanek<sup>108</sup>, Silvia Kohnova<sup>109</sup>, Alla Kolechkina<sup>110</sup>, Stefan Krause<sup>111</sup>, Heidi Kreibich<sup>112</sup>, Harald Kunstmann<sup>113</sup>, Holger Lange<sup>114</sup>, Margada L. R. Liberato<sup>115</sup>, Eric Lindqvist<sup>116</sup>, Timothy Link<sup>117</sup>, Junguo Liu<sup>118</sup>, Daniel Peter Loucks<sup>119</sup>, Charles J. Madden<sup>120</sup>, Gil Mahé<sup>121</sup>, Olga Makarieva<sup>122</sup>, Julien Malard<sup>123</sup>, Shamshagul Mashtayeva<sup>124</sup>, Shreedhar Maskey<sup>125</sup>, Josep Mas-Pla<sup>126</sup>, Maria Mavrou-Gulguinovaa<sup>127</sup>, Maurizio Mazzoleni<sup>128</sup>, Sebastian Memild<sup>129</sup>, Bruce Dudley Misiar<sup>130</sup>, Alberto Montanari<sup>131</sup>, Hannes Müller-Thomy<sup>132</sup>, Alireza Nabizadeh<sup>133</sup>, Fernando Nard<sup>134</sup>, Christopher Neale<sup>135</sup>, Natalia Nesterova<sup>136</sup>, Bakhran Nurtaev<sup>137</sup>, Vincent O. Odiogo<sup>138</sup>, Subhabrata Panda<sup>139</sup>, Sahet Pandey, Zhonghe Pang<sup>140</sup>, Georgia Papanikolaou<sup>141</sup>, Charles Perrin<sup>142</sup>, Laurent Pfister<sup>143</sup>, Rafael Pimental<sup>144</sup>, Maria J. Poljanec<sup>145</sup>, David Post<sup>146</sup>, Cristina Prieto Sierra<sup>147</sup>, Maria-Helena Ramos<sup>148</sup>, Mark Renner<sup>149</sup>, José Eduardo Reynolds<sup>150</sup>, Elena Ridolfi<sup>151</sup>, Riccardo Rigon<sup>152</sup>, Monica Riva<sup>153</sup>, David E. Robertson<sup>154</sup>, Renzo Rosso<sup>155</sup>, Tirthankar Roy<sup>156</sup>, João H.M. Sá, Gianfausto Salvadori<sup>157</sup>, Mel Sandel<sup>158</sup>, Bettina Schaeffli<sup>159</sup>, Andreas Schumann<sup>160</sup>, Anna Scolobig<sup>161</sup>, Jan Seibert<sup>162</sup>, Eric Sevati<sup>163</sup>, Mojtaba Shafiee<sup>164</sup>, Ashish Sharma<sup>165</sup>, Mousa Sidibe<sup>166</sup>, Roy C. Sidle<sup>167</sup>, Thomas Skaugen<sup>168</sup>, Hugh Smith<sup>169</sup>, Sabine M. Spies<sup>170</sup>, Lina Stein<sup>171</sup>, Ingefin Steinsland<sup>172</sup>, Ulrich Stasser<sup>173</sup>, Bob Su<sup>174</sup>, Jan Szolgay<sup>175</sup>, David Tarboton<sup>176</sup>, Flavia Taura<sup>177</sup>, Guillaume Thiéff, Fuqiang Tian<sup>178</sup>, Rui Tong<sup>179</sup>, Kamshat Tupsupova<sup>180</sup>, Hristos Tyralis<sup>181</sup>, Remko Uijlenhoet<sup>182</sup>, Rens van Beek<sup>183</sup>, Ruud J. van der Ent<sup>184</sup>, Martine van der Ploeg<sup>185</sup>, Anne F. Van Loon<sup>186</sup>, Ija van Meerveld<sup>187</sup>, Ronald van Nooijen, Pieter R. van Oel<sup>188</sup>, Jean-Philippe Vidal<sup>189</sup>, Jana von Freyberg<sup>190</sup>, Sergiy Vorogushyn<sup>191</sup>, Przemyslaw Wachniew<sup>192</sup>, Andrew J. Wade<sup>193</sup>, Philip Ward<sup>194</sup>, Iida K. Westerberg<sup>195</sup>, Christopher White<sup>196</sup>, Eric F. Wood<sup>197</sup>, Ross Woods<sup>198</sup>, Zongxue Xu<sup>199</sup>, Koray K. Yilmaz<sup>200</sup> and Yongqiang Zhang<sup>201</sup>



A community process to identify the 23 Unsolved Problems in Hydrology (UPH): From online consultation and community hierarchisation and formulation, to the agenda setting paper

are made free to view. All papers in volumes more than two years old automatically become open access. Any other paper can be open access, on Author's paying principle. One special issue was included in *HSJ* vol. 64: *Hydrological change in Chinese rivers*, Guest Editors Y. Chen, Y. Jian and M. Borga.

The continuation of the Panta Rhei initiative is well under way with a transition of the coordinating team between the 2017-2019 and the 2019-2023 biennia (Resp. Chairs Giuliano Di Baldassarre, Italy, Sweden and Fuqiang Tian, China), stand alone and joint events.

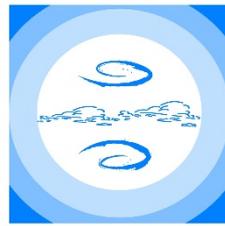
One volume of the open access PIAHS have been published in 2019: Volume 381, Land use and climate change impacts on erosion and sediment transport, Proceedings of the ICCE Symposium 2018, Moscow, Russia, 27-31 August 2018, edited by S. Chalov, V. Golosov., A. Collins and M. Stone.

We coordinated the final steps of the corporate process to identify the list of Unsolved Problems of Hydrology, led by Günter Blöschl, President (Austria), relying on an online forum, meetings and a Symposium in April 2018 within EGU assembly and in Vienna TU, articulation with IAH - AGU - EGU divisions of hydrology, a special session during the Montreal Assembly, and the collective writing of a community agenda setting open access article: 'Twenty-three Unsolved Problems in Hydrology (UPH) – a community perspective', published in *HSJ* doi:10.1080/02626667.2019.1620507

The close cooperation of IAHS with UNESCO, WMO and the UN Water mechanism has been continued. We have contributed to the World Water Development Reports WDRR 2019 (Noone behind) and 2020 (Water and climate change), the UN-Task Force on Water and Climate (and its Policy brief); and attended the WMO CHy Advisory Working Group Meeting, the WMO HydroHub Innovation committee meetings, the WMO council including contributions to the Public-Private Platform and the Hydrological Assembly (Geneva, Switzerland and remote); UN Water meetings (Roma, Italy, and remote).

Christophe Cudennec, IAHS Secretary General

# International Association of Meteorology and Atmospheric Sciences (IAMAS)



**IAMAS**

International Association of Meteorology  
and Atmospheric Sciences

IAMAS website: [www.iamas.org](http://www.iamas.org)

## INTRODUCTION

IAMAS is the specialized association of the International Union of Geodesy and Geophysics (IUGG) that deals with all aspects of the gaseous envelope around the Earth and other planets. The main research work is carried out, coordinated and communicated through IAMAS's ten International Commissions (IC), which are in alphabetical order the:

- International Commission on Atmospheric Chemistry and Global Pollution (ICACGP)
- International Commission on Atmospheric Electricity (ICAE)
- International Commission on Climate (ICCL)
- International Commission on Clouds and Precipitation (ICCP) including the Committee on Nucleation and Atmospheric Aerosols (CNAA)
- International Commission on Dynamical Meteorology (ICDM)
- International Commission on the Middle Atmosphere (ICMA)
- International Commission on Planetary Atmospheres and their Evolution (ICPAE)
- International Commission on Polar Meteorology (ICPM)
- International Ozone Commission (IOC)
- International Radiation Commission (IRC)

All the ICs, and IAMAS as a whole, play a leading role in global coordination, communication and discussion of the latest research through organization of and participation in a wide range of scientific meetings that are open to all scientists.

## ADMINISTRATION

The 2019 Bureau and Executive Committee meetings were held over 8–18 July 2019 during the 27<sup>th</sup> General Assembly of the International Union of Geodesy and Geophysics (IUGG) in Montréal, Québec, Canada. Minutes from the IAMAS assembly meetings are forth coming. The Bureau and Executive Committees reviewed the IAMAS financial status and activities and discussed and approved a new strategic plan. The financial audit was discussed and approved. In addition, elections for President, Secretary General, 2 Vice Presidents, and 5 new Members at Large were held.

In addition, the IAMAS Executive Committee agreed that the term of the Secretary General should be four years, instead of eight years. A few other minor changes were made to the IAMAS Statutes.

Elections were conducted by some commissions and new commission officers were elected as shown below.

## ACTIVITIES

The IAMAS Executive Committee approved the IO3C Resolution on the Role of Ozone and Ozone Depleting Substances for the Environment

[http://www.io3c.org/sites/io3c.org/files/upload/news/Ozone\\_IUGG\\_resolution\\_v1\\_approved.pdf](http://www.io3c.org/sites/io3c.org/files/upload/news/Ozone_IUGG_resolution_v1_approved.pdf)

A new website design was developed for IAMAS to modernize the look and support user needs. With the change in leadership, the official website of IAMAS is now being migrated to a secure web server.

A new email address was set up, [iamas.org@gmail.com](mailto:iamas.org@gmail.com)

To improve visibility, there will be a IAMAS booth at the May, 2020 EGU meeting [https://egu2020.eu/exhibition/list\\_of\\_exhibitors.html](https://egu2020.eu/exhibition/list_of_exhibitors.html)

### Awards:

- Dr. Lei Bi, Department of Atmospheric Sciences School of Earth Sciences, Zhejiang University, awarded the 2019 IAMAS Early Career Scientist Medal.
- Dr. Warren Washington, was a winner of the 'Nobel Prize for the Environment', the Tyler Prize for Environmental Achievement.

### IAMAS EXECUTIVE COMMITTEE 2019-2023

President:	Joyce E. Penner	USA
Vice-Presidents:	John Burrows	GERMANY
	Mary Scholes	SOUTH AFRICA
Past President:	John Turner	UK
Secretary General:	Steven Ackerman	USA
Deputy Secretary General:		
Assistant Secretary General:	Leanne Avila	USA
Members at large:	Lisa Alexander	AUSTRALIA
	Keith Alverson	USA / JAPAN
	Iracema Cavalcanti	BRAZIL
	Mu Mu	CHINA
	Michiel R. van den Broeke	NETHERLANDS

### IAMAS COMMISSIONS

Atmospheric Chemistry and Global Pollution (ICACGP), [www.icacgp.org](http://www.icacgp.org)

President:	Melita Keywood	AUSTRALIA
Vice-President:	Mary Barth	USA
	Christian George	FRANCE
	Stuart Piketh	SOUTH AFRICA
	Tong Zhu	CHINA
Secretary:	James R. Drummond	CANADA

Atmospheric Electricity (ICAE), <http://icae.jp>

President:	Xiushu Qie	CHINA
Secretary:	Weitao Lyu	JAPAN

Climate (ICCL), [www.iccl-iamas.net](http://www.iccl-iamas.net)

President:	Jianping Li	AUSTRALIA
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Secretary:	Quizhen Yin	CHINA
Clouds and Precipitation (ICCP), <a href="http://www.iccp-iamas.org">www.iccp-iamas.org</a>		
President:	Andrea Flossmann	FRANCE
Vice-President:	Greg McFarquhar	USA
Secretary:	Darrel Baumgardner	MEXICO
Committee on Nucleation and Atmospheric Aerosols (ICNPAA), <a href="http://www.icnaa.org">www.icnaa.org</a>		
Chair:	Markku Kulmala	FINLAND
Dynamic Meteorology (ICDM), <a href="http://icdm.atm.ucdavis.edu/ICDM.html">http://icdm.atm.ucdavis.edu/ICDM.html</a>		
President:	Thomas Spengler	NORWAY
Secretary:	Craig Bishop	AUSTRALIA
Middle Atmosphere (ICMA), <a href="http://www.icma-iamas.org">www.icma-iamas.org</a>		
President:	Bernd Funke	SPAIN
Vice-President:	Natalia Calv	SPAIN
Ozone (IO3C), <a href="http://www.io3c.org/">http://www.io3c.org/</a>		
President:	Sophie Godin-Beekmann	FRANCE
Vice-President:	Paul A. Newman	USA
Secretary:	Irina Petropavlovskikh	USA
Planetary Atmospheres and their Evolution (ICPAE), <a href="http://icpae.iaps.inaf.it/">http://icpae.iaps.inaf.it/</a>		
President:	Feng Tian	CHINA
Vice-President:	Ann Carine Vandaele	BELGIUM
Secretary:	Christina Plainaki	ITALY
Polar Meteorology (ICPM), <a href="http://www.icpm-iamas.org">www.icpm-iamas.org</a>		
President:	Matthew Lazzara	USA
Secretary:	Tracy Moffat-Griffin	UK
Radiation (IRC), <a href="http://www.irc-iamas.org">www.irc-iamas.org</a>		
President:	Byung-Ju Sohn	KOREA
Vice-President:	Peter Pilewskie	USA
Secretary:	Marcia Akemi Yamasoe	BRAZIL

## Highlights from the IAMAS International Commissions

### ICACGP (<http://www.icacgp.org/>)

iCACGP convened several sessions at the 27th IUGG Assembly in Montreal in July 2019. These included M08 - Air Quality in the Changing Anthropocene, M09 - The Arctic in the 21st Century: A Hotbed of Global Change and the joint session, JM02 - Anthropogenic changes in Chemistry and Physics of the Atmosphere: Evidence and Attribution Studies (IAMAS, IAVCEI, IAG). All sessions were well attended, with the M08 session extending to 9 time slots. The commission also held its annual meeting in Montreal, which was attended by 23 commissioners who developed the strategic direction for iCACGP over the 2019-2021 period. iCACGP working with IGAC, SOLAS, and GAW have been successful in the submission of several proposals for sessions at the Sustainable Research and Innovation 2020 conference focusing on atmospheric chemistry and the Sustainability Development Goals <https://sri2020.org/>.

### ICAE (<http://icae.jp/>)

- 1) The new ICAE Commission started its new term in 2019. Four new members joined the ICAE commission and five members became honorary members.
- 2) ICAE organized one session for IUGG2019 in Montreal.
- 3) ICAE published 2 issues of newsletters in 2019. All the two ICAE newsletters were distributed to a mailing list of around 800 ICAE colleagues from nearly 50 countries.
- 4) The new website for ICAE is being constructed at [www.icae-iamas.org](http://www.icae-iamas.org).
- 5) The ICAE mailing list has been updated.

## Plan for 2020

- 1) Transfer the content of the former ICAE website, [www.icae.jp](http://www.icae.jp), to the new ICAE website, [www.icae-iamas.org](http://www.icae-iamas.org), and regularly update it.
- 2) Issue two newsletters, one in spring and one in the fall.
- 3) Update the ICAE colleague mailing list as needed.

## ICCL (<http://www.iccl-iamas.net/>)

27th IUGG General Assembly in Montreal, Quebec, Canada. July 8 - 18, 2019

During the centennial IUGG conference, the ICCP commission ran the M01 - Cloud-Precipitation-Aerosol session. Talks and poster sessions covered four entire conference days and special talks honored the recently deceased giants of our field Roland List and John Hallett. Joint sessions with ICPM on polar clouds and with ICCLAS (IAHS) on precipitation and hydrological aspects were conducted. Also, an ICCP business meeting was held.

International Workshop on Airborne Instrumentation and Data Processing, Beijing, China. June 26 - 28, 2019

This workshop was hosted by the Key Laboratory of Cloud and Fog Physics and Laboratory of Weather Modification and Airborne Measurement, Chinese Meteorological Agency (CMA). It was attended and supported by many members of the ICCP. Sessions on cloud probes, processing techniques for cloud probes, research aircraft, and past data sets were held.

Preparation of the 18th International Conference on Clouds and Precipitation, in 2020 to be held in Pune, India

The bureau and the local organizing committee prepared the venue and web portal for the conference and the associated workshops.

Other information: webpage (<http://www.iccp-iamas.org/>) + presence on LinkedIn; Facebook page (over 550 likes): <http://www.facebook.com/pages/ICCP/318220008285622>

## ICDM (<http://icdm.atm.ucdavis.edu/ICDM.html>)

In 2019 ICDM developed 9 symposiums (7 IAMAS, 2 Joint) at the 26th IUGG Assembly in Montreal. ICDM also promoted (with IAMAS and IUGG assistance) the first TEAMx Workshop in Rovereto, Italy (August). Formed in late 1967, ICDM chose to celebrate our 50th Anniversary at the Montreal Assembly with a small reception, a memento, and dinner at a local, fine restaurant. Thomas Spengler was elected the new ICDM President and Craig Bishop elected the new ICDM Secretary. Five members reached the end of their terms and five new members were elected.

## ICMA (<http://icma.iaa.es/>)

The International Commission on the Middle Atmosphere (ICMA) mandate is to foster international cooperation in research into the science of the middle atmosphere and its coupling with the climate system. ICMA is part of the Inter-Association (IAGA/ICMA/SCOSTEP) Working Group II-F: Long-term Trends in the Mesosphere, Thermosphere and Ionosphere.

### *Assembly symposia*

ICMA organized two symposia at the 27<sup>th</sup> IUGG General Assembly, 8 - 18 July 2019, Montreal, Canada: The Middle Atmosphere Science symposium (M06) lasted 3 days (10 sessions) and had 55 abstracts. The Stratosphere Couplings to the Troposphere and Ocean symposium (M07) lasted 3 days and had 37 abstracts. ICMA was also involved in the organization of the inter-association symposia JA5 Solar Influence on the Atmosphere and JC2 Atmosphere-Ocean-Sea Ice Interactions: Local Processes and Global Implications, and co-sponsored a few other symposia with IAGA (A03 and A06).

### *Business meetings*

During the IUGG Assembly, ICMA held its business meeting on 12.07.2019 with the election of the Vice President and 13 new members for the term 2019-2023. The current ICMA EC is composed by Bernd Funke (President), Natalia Calvo (Vice President), and Elisa Manzini (Past President).

### *ICMA sponsored Workshops*

ICMA sponsored the Atmospheric circulation in a changing climate - DynVarMIP workshop which was organized jointly with SPARC/DynVar and SPARC/SNAP. It took place on 22-25 October 2019 in Madrid and attracted 94 scientists from 17 countries. A detailed workshop report will appear in the next SPARC newsletter, January 2020 (Report on the joint DynVarMIP/CMIP6 and SPARC DynVar & SNAP Workshop Atmospheric Circulation in a Changing Climate, Karpechko et al.)

### **IO3C** (<https://ioc.atmos.illinois.edu/>)

1) The SPARC/IO3C/WMO LOTUS Report was prepared for analyses of stratospheric ozone trends and included a new approach for uncertainty analyses of the combined trends. IO3C leads the SPARC activity group to organize trend analyses. The report was published in 2019 and contributed to the WMO/UNEP Ozone assessment, <https://www.sparc-climate.org/publications/sparc-reports/sparc-report-no-9/>

SPARC Report N°9 (2019) of The SPARC LOTUS Activity: SPARC/IO3C/GAW Report on Long-term Ozone Trends and Uncertainties in the Stratosphere. Prepared by the SPARC LOTUS Activity, edited by I. Petropavlovskikh, S. Godin-Beekmann, D. Hubert, R. Damadeo, B. Hassler, and V. Sofieva. [www.sparc-climate.org](http://www.sparc-climate.org)

- 2) IO3C organized a session for the IAMAS Session M21 - Celebrating the Montreal protocol in Montreal: assessing ozone layer recovery in an evolving climate at 27th International Union of Geodesy and Geophysics (IUGG) General Assembly, 8 - 18 July 2019, Montreal, Canada.
- 3) At the recent IAMAS meeting during the IUGG general Assembly in Montreal, Canada, IO3C proposed and presented the Resolution on the Role of Ozone and Ozone Depleting Substances for the Environment. The Resolution was accepted by IAMAS.
- 4) Quadrennial ozone symposium (QOS2020) in Seoul, South Korea, was announced in the fall of 2019, the Local Organizing committee was formed, IO3C invited keynote speakers and QOS2020 webpage was created. It is now open for abstract submission, [qos2020.yonsei.ac.kr](http://qos2020.yonsei.ac.kr)
- 5) IO3C prepared and distributed a Press Release on September 16, 2019: The International Ozone Commission, on the 32th anniversary of the Montreal Protocol, reports success in healing of the ozone layer, <http://www.io3c.org/press-release-international-ozone-commission-32th-anniversary-montreal-protocol-reports-success>
- 6) IO3C has a very successful Facebook page, with 470 members and many important discussions, meeting announcements and sharing of materials.
- 7) IO3C members contributed to the SPARC organized CFC-11 Symposium on 25-27 March 2019, <https://www.sparc-climate.org/meetings/meetingscfc-11-workshop-march-2019-in-vienna/>

### **ICPAE** (<http://icpae.iaps.inaf.it/>)

ICPAE participated in the IUGG general Assembly in Montreal, Canada but otherwise did not organize meetings or workshops in 2019. ICPAE focused increasing the membership of ICPAE members and are planning for a workshop in 2021.

### **ICPM** (<http://www.icpm-iamas.aq/>)

The International Commissions on Polar Meteorology (ICPM) endorsed the first workshop on Quantifying the Indirect Effect: From Sources to Climate Effects of Natural and Transported Aerosol in

the Arctic held in Cambridge, United Kingdom in April 2019. In June 2019, the commission endorsed the 14th Workshop on Antarctic Meteorology and Climate, which was held in Charleston, SC. The SCAR Operational Meteorology meeting was also held as part of this workshop as was the Year of Polar Prediction in the Southern Hemisphere (YOPP-SH) meeting. The workshop went extremely well and was attended by ~55 people from 10 different countries. The workshop also resulted in a meeting summary paper in a special issue of *Advances in Atmospheric Sciences on Antarctic Meteorology and Climate: Past, Present and Future* (Lazzara et al, 2020).

During the 27th IUGG General Assembly in Montreal, ICPM members were conveners or co-conveners of the following five sessions: Polar Atmospheric Instrumentation, Cloud-Precipitation-Aerosol, First Results from the YOPP-SH, Future Evolution of the Polar Atmospheres, and Polar Modelling (Polar CORDEX). New members were elected to the commission from Canada and China expanding membership that covers interest and skills over both polar regions as well as a first step toward meeting our membership goal of having representation from across the globe. Efforts are already underway to convene seven sessions for the BACO-21 meeting planned for Busan, in 2021.

Lazzara, M. A., and Coauthors, 2020: The 13th and 14th Workshops on Antarctic Meteorology and Climate. *Adv. Atmos. Sci.*, 37(4), <https://doi.org/10.1007/s00376-019-9215-6> (in press)

**IRC** (<http://www.irc-iamas.org/>)

The IRC convened two sessions at the 27<sup>th</sup> IUGG General Assembly 2019 in Montreal: Current Progress in Atmospheric Radiation and Earth's Energy Budget; and three joint sessions: Solar Influences on the Atmosphere and Climate, Remote Sensing and Modelling of the Atmosphere, and Innovative Monitoring and Observation Techniques. We congratulate IRC Officer Lei Bi, Department of Atmospheric Sciences School of Earth Sciences, Zhejiang University, on being awarded the 2019 IAMAS Early Career Scientist Medal. The IRC Business Meeting 2019 was held on 10 July 2019, where we had 12 IRC Working Group presentations as well as continuing discussions on reformulating the IRC Working Groups and adding new ones. Since then, many of the important preparations for the International Radiation Symposium 2020 in Thessaloniki, Greece were conducted. An attendance of approximately 500 scientists is anticipated.

## **FUTURE ACTIVITIES**

Planning is underway for the IAMAS-IACS-IAPSO joint assembly to be held in the (International Association of Cryospheric Sciences, IACS; the International Association for the Physical Sciences of the Oceans, IAPSO), in the city of Busan, Republic of Korea, during the period of July 18-23, 2021. (BACO-21 [http://baco-21.org/2021/english/main/index\\_en.asp](http://baco-21.org/2021/english/main/index_en.asp) )

Submitted by  
Steven A Ackerman, IAMAS Secretary-General

# International Association for the Physical Sciences of the Oceans (IAPSO)



International Association  
for the Physical Sciences of the Oceans

IAPSO website: <http://iapso.iugg.org>

## INTRODUCTION

IAPSO has the prime goal of 'promoting the study of scientific problems relating to the oceans and the interactions taking place at the sea floor, coastal, and atmospheric boundaries insofar as such research is conducted by the use of mathematics, physics, and chemistry.' IAPSO works mainly through 1) biennial scientific assemblies; 2) working groups; 3) commissions; 4) services and 5) website information. Of special importance to IAPSO is the involvement of scientists and students from developing countries in oceanographic activities.

IAPSO maintains formal liaison with other scientific commissions and committees. These include the ISC's Scientific Committee on Oceanic Research (SCOR), and UNESCO's Intergovernmental Oceanographic Commission (IOC).

For more information see <http://iapso.iugg.org/>.

## ADMINISTRATION

The IAPSO Bureau was renewed in July 2019 during the IUGG General Assembly in Montreal. It comprises:

President: Trevor McDougall (Australia)  
Past President: Denise Smythe-Wright, (UK)  
Secretary General: Stefania Sparnocchia (Italy)  
Treasurer: Ken Ridgway (Australia)

The Executive Committee comprises the Bureau members and

Vice-Presidents: Agatha de Boer (Sweden)  
Hans van Haren (The Netherlands)

Members: Edmo Campos (Brazil)  
Juliet Hermes (South Africa)  
Yukio Masumoto (Japan)  
Jae-Hun Park (Republic of Korea)

Christa von Hildebrandt-Andrade (USA and Puerto Rico)  
Peter Zavialov (Russia)

The IAPSO office is located at the Institute of Marine Science of the National Research Council of Italy, Trieste and day-to-day business is managed by Secretary General (SG), Stefania Sparnocchia. The SG is responsible for the IAPSO website. A page on the Facebook social network is also active with the aim of facilitating the spreading of information in the community (see <https://www.facebook.com/iapso.iugg.org>).

IAPSO finances are managed by the Australian-based Treasurer, Ken Ridgway.

IAPSO business meetings were conducted in July 2019, during the IUGG General Assembly in Montreal, Canada. These included three meetings of the Executive Committee, on 8, 9 and 14 July, and one General Business meeting (GBM) also involving National Correspondents or their Delegates on 11 July. In this last meeting the election of new Executive Committee Members for 2019-2023 took place and changes to the IAPSO Statutes for the introduction of electronic voting were approved.

## ACTIVITIES

### 2019 Assembly and Awards

The principal activity during the year was participation in the 27th IUGG General Assembly in Montreal, Canada, from 8-18 July, 2019. The Assembly attracted about 4,000 participants from 94 countries, 346 of them registered as IAPSO. The IAPSO scientific sessions were held from 9-14 July and included 11 IAPSO symposia (216 oral presentations and 94 posters) and 5 IAPSO-lead Association Joint symposia (111 oral presentations and 51 posters). IAPSO also co-sponsored 12 Joint symposia led by another Association (189 oral presentations and 104 posters). The program details can be found on the Assembly's website: [www.iugg2019montreal.com/p.html](http://www.iugg2019montreal.com/p.html). There were many quality presentations and much networking in the corridors.

IAPSO highlights during the assembly included

- the Union Lecture 'The Ocean's Role in Atmospheric Carbon Dioxide Changes During Ice Age Cycles' given by Prof. Karen Kohfeld (Simon Fraser University, Canada);
- the Prince Albert I, 2019 lecture 'Decadal variability in the ocean CO<sub>2</sub> sink' given by Prof. Corinne Le Quéré (University of East Anglia, United Kingdom), who was awarded the Prince Albert I Medal in connection with the lecture;
- the ECS Medal in Physical Oceanography, 2019 talk 'Overturning variability with observations' given by Gerard McCarthy (Maynooth University, Ireland);
- the ECS Medal in Chemical Oceanography, 2019 talk 'Nitrogen fixation across scales' given by Mar Benavides (Mediterranean Institute of Oceanography, France).

IAPSO also awarded the Eugene LaFond Medal 2019 to Mr. Rohith Balakrishnan, for his oral presentation 'Basin-wide sea level coherency in the tropical Indian Ocean driven by Madden-Julian oscillations'. This was given on July 11, 2019 within the IAG-IAPSO joint symposium 'Monitoring Sea Level Changes by Satellite and In-Situ Measurements'.

Prof. Philip L. Woodworth was awarded the IUGG Honorary Membership for his for his significant advancement of sea-level science and outstanding contributions to international scientific cooperation, and especially his leadership of the Permanent Service for Mean Sea Level (PSMSL).

A first planning meeting was held in Montreal, involving IAPSO, IAMAS and IACS officers for the organization of the Joint Assembly in Busan, South Korea, from 18-23, July 2021. Information about the conference will be posted at [www.baco-21.org](http://www.baco-21.org).



*Prof. Le Quéré, Dr. McCarthy and Dr. Benavides at the Medal Award Ceremony, Montreal, July 12, 2019 (Photo courtesy – Denise Smythe-Wright)*

### **IAPSO Best Practice Study Groups**

IAPSO sent out a call (in early September 2019) to fund Best Practice Study Groups. These will address an issue that, when resolved, will assist in the conduct of oceanographic research. Often in carrying out research, a choice must be made between options for measuring data, analysing data, processing software, or modelling a system. The reasons for choosing between competing methods are often not well documented and the relative strengths and weaknesses of these routes not published or well known. Each IAPSO Best Practice Study Group will receive up to US\$10,000 towards the costs of a meeting. We expect to fund one of these per year.

IAPSO received nine proposals, and the five members of the evaluation committee felt that most of these were of a very high calibre and deserving of funding. However, we were only able to fund two in this first round and the selected proposals are:

- ✓ Best Practice Study Group on moored CTD measurements
- ✓ Best Practice Study Group to identify approaches to be recommended for seawater pH measurement

## SCOR Administration

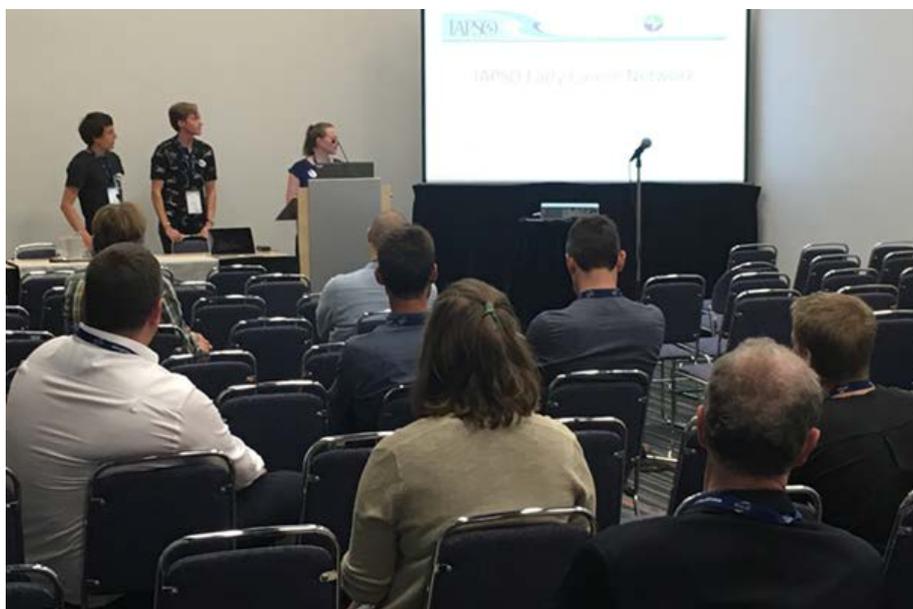
IAPSO has maintained its formal relations with SCOR during the year. The EC members were involved in the evaluation of the 2019 Working Group proposals and the President, Trevor McDougall attended the 2019 SCOR Annual Meeting in Toyama, Japan, 23-25 September 2019. While much of the business centred around reports from current SCOR working groups and affiliated organizations, substantial time was devoted to the evaluation of six working group proposals submitted for the 2019 round of funding. The IAPSO President presented the IAPSO views alongside those of other organizations and after robust discussion it was decided to fund two proposals:

- Coordinated Global Research Assessment of Seagrass System (C-GRASS). See <https://scor-int.org/group/coordinated-global-research-assessment-of-seagrass-system-c-grass/> for further details
- Roadmap for a Standardised Global Approach to Deep-Sea Biology for the Decade of Ocean Science for Sustainable Development (DeepSeaDecade). See <https://scor-int.org/group/roadmap-for-a-standardised-global-approach-to-deep-sea-biology-for-the-decade-of-ocean-science-for-sustainable-development-deepseadecade/> for further details

## ACTIVITIES OF ASSOCIATION COMMISSIONS, WORKING GROUPS

### IAPSO Early Career Scientist Working Group

Established during 2018, the IAPSO Early Career Scientist Working Group had its first networking event on 9 July, 2019, in Montreal. About 30 young scientists participated. The website <https://www.iapsoecs.org/>, is active for scientists who are interested in the IAPSO Early Career Scientist Network, managed by the Working Group. For becoming a member of the Early Career Network, people can register at the website The ECS Network is also available on Twitter (@iapso\_ecs). The Working Group is chaired by Alejandra Sanchez-Franks (United Kingdom) and co-chaired by Malin Ödalen (Sweden/USA) and its Term of References are available on the IAPSO website (<http://iapso.iugg.org/working-groups.html>).



*Malin Ödalen, Kay McMonigal and Casimir de Lavergne giving the opening welcome at the ECS networking event, Montreal, July 9, 2019 (Photo courtesy – Christa von Hildebrandt-Andrade)*

### **Joint Committee on the Properties of Seawater (JCS)**

The Joint SCOR/IAPWS/IAPSO Committee on the Properties of Seawater (JCS) is a permanent group with limited membership whose purpose is to act as an international "point of contact" for seawater questions. It supports and promotes research activities related to the properties of seawater (field, lab, numerical) and is chaired by Rich Pawlowicz (Canada) and co-chaired by Rainer Feistel (Germany), and Steffen Seitz (Germany).

An update of its activities was presented to the IAPSO GBM in Montreal by Rich Pawlowicz who showed the impressive distribution of TEOS-10 resources to the community. Workshops on Salinity/density, pH, RH and Future of JCS, attended by ~16 participants each, were held at the 17th international Conference on the Properties of Water and Steam (ICPWS 17).

### **Commission on Mean Sea Level and Tides (CMSLT)**

The IAPSO Commission on Mean Sea Level and Tides (CMSLT) aims to support research into applications of sea level measurements. In addition to sponsoring meetings, the CMSLT is the body that the Permanent Service for Mean Sea Level formally reports to. The CMSLT has always had a policy of considering as members any researchers who express interest in the topics of mean sea level and tides. It is chaired by Gary Mitchum (US).

The Commission met on July 13, 2019 in Montreal, for the review of PSMSL, whose report and work were appreciated. The meeting also endorsed suggested future PSMSL activities. There was some discussion of protocols for incorporating into data banks sea level data recovered from historical records and the general consensus was that this should be examined by a working group. A reconstitution of the commission was also discussed. This will be formally initiated by the IAPSO President, in consultation with the present chair Gary Mitchum. This reconstitution could potentially include the development of a set of new activities. Suggestions from the meeting included: Tides, Extremes, Data archaeology, sea level technology and GPS/GNSS applications. Reconstitution would also entail renewing membership and encouraging new members with an interest in the CMSLT portfolio of activities.

### **Tsunami Commission (Joint with IASPEI and IAVCEI)**

The IUGG Tsunami Commission (IUGG/TC) is an Inter-Association Commission responsible for international coordination of tsunami related meetings, research, and publications. It is jointly sponsored by IASPEI, IAPSO and IAVCEI and was established at the 12th General Assembly of IUGG in Helsinki, Finland in 1960 to promote the exchange of scientific and technical information about tsunamis. The membership comprises an international group of scientists concerned with various aspects of tsunamis, including an improved understanding of the dynamics of generation, propagation and coastal run-up and the consequences to society of the tsunami hazard.

During IUGG 2019 the board was renewed and the current officers are, Chair: Yuichiro Tanioka (Japan); Vice-Chairs: Maria Ana Baptista (Portugal), Diana Greenslade (Australia), Alexander Rabinovich (Russia); Secretary: Mohammad Heidarzadeh (Iran/UK). In 2019, members of the Tsunami Commission actively participated in the organization of numerous tsunami sessions at AGU, EGU, AOGS. It should be noted that tsunami sessions at these meetings have recently been amongst the largest suggesting that the interest in tsunami research remains to be strong. Numerous regional and national workshops and conferences have also been organized and participated in by the Commission members, such as the National Tsunami Conference in Russia on May 16-17, 2019 entitled "Tsunamis: modeling,

monitoring and forecasting”, and the First World Conference on Meteotsunamis, Split, Croatia, 8-11 May 2019.

### **Permanent Service for Mean Sea Level (PSMSL)**

The Permanent Service for Mean Sea Level (PSMSL) is the internationally recognised global data bank for long-term sea level data and also provides a wider Service to the sea level community. The PSMSL was established in 1933 by Joseph Proudman who became its first Secretary. Since then, the PSMSL continues to be responsible for the collection, publication, analysis and interpretation of sea level data. It is hosted by the National Oceanography Centre (NOC) with funding provided by the UK Natural Environment Research Council. PSMSL reports to several bodies which operate under the auspices of the International Science Council (ISC). During 2019, the direction of the service passed from Lesley J. Rickards (UK) to Elizabeth Bradshaw (UK).

General activities include responding to requests for information from national tide gauge agencies, decision makers, the media, members of the public; involvement in training courses, supporting small island states; development of products and code (Prototype automatic quality control of tide gauge data).

In 2019 PSMSL received funding from the European Union Horizon 2020 EuroSea project to create an international archive to preserve and deliver Global Navigation Satellite Systems Interferometric Reflectometry (GNSS-IR) data and to integrate these data with existing sea level observing networks.

Andy Matthews attended OceanObs’19 where we focused on ongoing efforts to ensure distributed data follow the FAIR data management principles (i.e. making data findable, accessible, interoperable, reusable).

In September 2019 the Intergovernmental Panel on Climate Change published the special report on the Ocean and Cryosphere in a Changing Climate, which made use of the PSMSL dataset.

### **IAPSO Standard Seawater Service**

The IAPSO Standard Sea-Water Service is the only internationally recognized standard for the calibration of salinity measurement devices. Its widespread use over 100 years of IAPSO history has been of great importance to the quality and comparability of salinity data worldwide. Since 1989 IAPSO has established an agreement with the Ocean Scientific International Limited (OSIL) for the production and supply of ampoules of standard sea-water to the oceanographic community through this IAPSO service.

The demand for IAPSO standard sea water remains strong and OSIL have continued to invest heavily in the upkeep and replacement of the equipment necessary to operate and produce the standards. The Service is currently contributing to groups globally involved with the S.I. traceability relating to density. Significant steps have been made towards producing a density standard in terms of the stability of the sea water inside a unique coated bottle.

## **FUTURE ACTIVITIES**

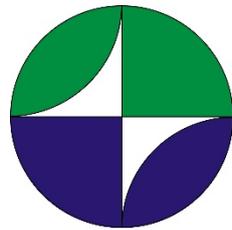
The following activities are scheduled for 2020 and beyond:

- Organization of the next Joint Assembly with IAMAS and IACS in Busan, Republic of Korea, in 2021.
- Workshop on Sea level Data Archaeology, IOC/UNESCO, Paris, France, 10-12 March 2020.

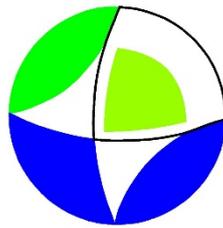
- The workshop is convened under the auspices of the Intergovernmental Oceanographic Commission of UNESCO and its Global Sea Level Observing System (GLOSS), and co-sponsored by the IHO Tides, Water Level and Currents Working Group (TWCWG) and the IUGG/IAPSO ([http://www.ioc-unesco.org/index.php?option=com\\_oe&task=viewEventRecord&eventID=2567](http://www.ioc-unesco.org/index.php?option=com_oe&task=viewEventRecord&eventID=2567)).
- Tsunamis in Latin America and the Caribbean: Recent Developments and Plans for the Future, Quito, Ecuador, 3-5 August 2020 (<http://www.lacsc2020.com/>).
- Tsunami Session at EGU, Vienna, Austria, May 4-8, 2020, <https://meetingorganizer.copernicus.org/EGU2020/session/34852>.
- National Tsunami Conference in Russia on June 16-17, 2020 titled “Tsunamis: modeling, monitoring and forecasting”, [http://ocean.phys.msu.ru/tsu\\_conf/](http://ocean.phys.msu.ru/tsu_conf/) (in Russian).

Stefania Sparnocchia, IAPSO Secretary General  
Trevor McDougall, IAPSO President

# International Association of Seismology and Physics of the Earth's Interior (IASPEI)



IUGG



IASPEI

International Association of Seismology  
and Physics of the Earth's Interior

IASPEI website: <http://iaspei.org>

## INTRODUCTION

The International Association of Seismology and Physics of the Earth's Interior (IASPEI) is the leading international association promoting studies in seismology, earthquake processes, and structure and ongoing geodynamical processes within the Earth's interior. IASPEI achieves its goals primarily through scientific conferences organized by IASPEI and its Commissions, but also sponsors other international initiatives, fosters international cooperation, both in monitoring of seismic sources and research, and education activities, especially in countries that are working towards full scientific development.

Most of the IASPEI efforts during 2019 were directed towards the IUGG General Assembly in Montréal, and in particular the IASPEI Symposia and the IASPEI-led Inter-Association Symposia. However, several ongoing projects also continued.

## ADMINISTRATION

### EC & Bureau meetings

The IASPEI Bureau met together with the IASPEI Executive Committee during the IUGG General Assembly in Montréal in July 2019. Several e-mails regarding important questions on financial support or business to be solved immediately have been exchanged with the members of the Bureau and ExeCom throughout the year.

### Other matters

*Website.* The IASPEI website has the address <http://iaspei.org>.

*Statutes.* The statutes were not changed in 2019. IASPEI is registered as a Norwegian organization (Norwegian Org. Number 916 047 495).

*Newsletters.* IASPEI Newsletters have been regularly sent as PDF-file attachments to more than 3000 e-mail addresses. The Newsletters are also available for downloading from the IASPEI website. Five Newsletter issues were distributed in 2019.



*Some former and newly elected members of the IASPEI Executive Committee after the IASPEI closing plenary of the General Assembly in Montréal*

## ACTIVITIES

### **Scientific Assemblies, Workshops/Symposia etc.**

#### *2019 IUGG General Assembly in Montréal*

IASPEI participated actively in the conference, 494 of the officially registered participants associated themselves with IASPEI, with 58 participants had been supported financially with grants. The scientific program included 26 IASPEI and 26 Inter-Association symposia with IASPEI participation (of which 10 had been led by IASPEI). IASPEI also contributed to the Union program with one Union Lecture and participated in the Union Symposia.

### **Activities of Association Commissions, Working Groups, Divisions, Services etc.**

Some 2,000 hard copies of the first printed edition of the IASPEI New Manual of Seismological Observatory Practice (NMSOP, 2002) are currently being used in more than 100 countries at seismological observatories, data and analysis centers, and for teaching, research, and field applications. In addition, it is used as basic material within national and international seismology training courses, or by private enterprises and individual scientists. In 2014, a rigorously updated and amended electronic second edition, NMSOP-2, was completed and put online, thanks to the efforts of the late Peter Bormann. This version, as well as future ones, are professionally maintained, further developed and edited by the GFZ German Research Centre for Geosciences under a long-term commitment and the auspices of IASPEI and its Commission on Seismological Observation and Interpretation (CoSOI). All versions are freely available and downloadable from the web-site of the GFZ Library (<http://bib.telegrafenberg.de/publizieren/vertrieb/nmsop/>).

## Scientific Programs, Projects, Publications

The IDEA (International Digital Earthquake Archives) project of the Committee for Preservation of WWSSN and Historical Seismograms (also called *Seismoarchives: Seismogram Archives of Significant Earthquakes of the World*), continued its mission on a very low level. In 2019, IASPEI continued to financially support the work of the Inter-Association Working Group on Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV).

## Awards/Anniversaries/Obituaries

### Awards

The IASPEI Medal is awarded for distinguished contributions in seismology: for sustaining IASPEI goals and activities and for scientific merits in the field of seismology and physics of the Earth's interior. The Medal is awarded every 2<sup>nd</sup> year during the IASPEI Assemblies. During the Opening Plenary of the IASPEI General Assembly in Montréal, the fourth IASPEI medal was awarded to Prof. Brian Kennett.

In 2016, the IASPEI Bureau established an IASPEI Early Career Scientist Award program aimed at engaging excellent young researchers in the IASPEI community. Each of the four IASPEI Regional Commissions was asked to select one Early Career researcher (graduate student, postdoctoral research, pre-tenure faculty member) from their commission at each even-year Assembly of that Regional Commission. Two of the IASPEI Early Career Scientist Awardees participated in the IUGG General Assembly in Montréal.

*Obituaries* for prominent scientists were regularly published in the IASPEI Newsletters and on the IASPEI web-page.

## FUTURE ACTIVITIES

In 2020, the IASPEI main activity will be again concentrate on the General Assemblies of the four regional commissions of IASPEI (AfSC, ASC, ESC, LACSC).

- ASC will hold its 13th General Assembly in Sharm el-Sheikh (Egypt) in June.
- AfSC will hold its 3rd General Assembly in Kasane (Botswana) in June/July.
- LACSC will hold its 4th General Assembly in Quito (Ecuador) in August.
- ESC will hold its 37th General Assembly on Corfu (Greece) in September.

The 2021 Scientific Assembly of IASPEI is planned as a joint Assembly together with IAGA, to be held in Hyderabad, India in August 2021 (<http://www.iaga-iaspei-india2021.in/>).

Johannes Schweitzer, IASPEI Secretary General

# International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI)



International Association of Volcanology  
and Chemistry of the Earth's Interior

IAVCEI website: [www.IAVCEIvolcano.org](http://www.IAVCEIvolcano.org)

## INTRODUCTION

At the First General Assembly of IUGG (Rome, 1922), the *Section de Vulcanologie* became one of the constituent sections of the Union. This name was changed into *Association Internationale de Vulcanologie* at the Fourth General Assembly (Stockholm, 1930) and then extended as *International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI)* at the Moscow General Assembly (1971).

The IAVCEI is the primary international focus for research in volcanology and for efforts to mitigate volcanic disasters. Researches conducted by IAVCEI scientists involve various disciplines, such as igneous geochemistry and petrology, geochronology, volcanogenic mineral deposits, remote sensing, modeling, and the physics of magma genesis and ascent from the upper mantle to the surface. Work is carried out in the following special Commissions:

- Chemistry of Volcanic Gases
- Arc Magmatism
- Collapse Calderas
- Explosive Volcanism
- Large Igneous Provinces
- Monogenetic Volcanism
- Remote Sensing
- Submarine Volcanism
- Tephra Hazard Modelling
- Volcanic Lakes
- Volcanic Hazards and Risk
- Volcanogenic Sediments
- Volcano Geoheritage and Protected Volcanic Landscapes
- Volcano Geology
- Volcano Geodesy
- Cities and Volcanoes
- COSIV-Statistics in Volcanology
- International Volcanic Health Hazard Network
- Working Group on Volcano Acoustics
- World Organisation on Volcano Observatories

Elected members of the Executive Committee for the 2019-2023 term are:

President	Patrick Allard	France
Secretary General	Roberto Sulpizio	Italy
Vice-President	Masato Iguchi	Japan
Vice-President	Jan Lindsay	N. Zealand
Immediate Past President	Donald Bruce Dingwell	Germany
Members	Lizzette Rodriguez	Puertorico
	Eisuke Fujita	Japan
	José Viramonte	Argentina
	Fidel Costa Rodriguez	Singapore
	Julia Eychenne	France

## ADMINISTRATION

### IAVCEI Executive Committee activities

- Revision of IAVCEI Finances, funding support, and potential funding sources and strategies.
- Update of the IAVCEI Commissions and Working Groups, conducted by the two Vice-Presidents and approved by the EC, in which commissions activity is evaluated and recommendations are proposed for either merging or deactivation. IAVCEI is currently engaged in reducing its overall number of Commissions and in renewing/restructuring its WOVO (World Organization of Volcano Observatories).
- Revision and publication of rules for IAVCEI Prizes and awards. Creation of a new Award for Volcano Surveillance and Crisis Management, presented every 2 years.
- Signature of Memorandum of Understanding with different regional and international associations.
- Continuous updating and professionalisation of the IAVCEI website. Publication of a Facebook page and Twitter messages.
- Creation of sub-domains in the IAVCEI volcano domain for hosting the commission's webpages.
- Update of the Editorial Board of Bulletin of Volcanology.
- Creation of a sub-domain for BV in the IAVCEI volcano domain.

### Discussion on the current state of IAVCEI and its relationships with IUGG

- Adoption of the Principle of Freedom of Participation in Learned Societies following the submission of Proposal to Modernize IUGG, focusing on adoption of self-governance of the associations.
- Agreement on the need to reintroduce compulsory individual membership fees along the lines of AGU membership fee structure, which allowed us to stop the dramatic decline in financial reserves experienced between 2013 and 2014.

## ACTIVITIES

### Members

Since the end of 2018 the IAVCEI memberships have remained stable at around 1,000. These include about 600 regular members, 100 Life members, and about 300 students

### Webpage

After a complete redrawn of our web page in 2015, the refurbishment of IAVCEI web page has been continued. The site now contains more info about IAVCEI activities, structure and initiatives. New action was undertaken for a completely new website in 2020.

### Newsletters

Four issues of the newsletter "IAVCEI News" have been published in 2019 through the website

### 2019 Meetings, workshops and courses

The following meetings, workshops, and courses have been (co-) organized or sponsored by one (or more) of the IAVCEI commissions in 2019:

- IUGG meeting, July 8-18 2019, Montreal, Canada
- 5th Volcanic Geology Workshop, Palmerston North and Ohakune (New Zealand) 25 February – 4 March 2019. [www.massey.ac.nz/iavcei2019](http://www.massey.ac.nz/iavcei2019)
- 12th International AIV summer school, August 28-September 4, 2018, Bolsena, Italy
- 1st ALVO congress, Antofagasta, Chile, November 3-7, 2019 (postponed to 20-26 March, 2020)
- 10th Workshop of the IAVCEI Commission on Volcanic Lakes, Taupo-Rotorua, New Zealand, 17-25 March 2019
- 8th International Post-graduate Course of Volcanology, Olot, Girona, Spain, 12-25 October 2018 [http://www.gvb-csic.es/CURSO/CURSO\\_OLOT/Home.html](http://www.gvb-csic.es/CURSO/CURSO_OLOT/Home.html)
- 7th International Maar Conference, May 21-28, 2018, Olot, Catalunya, Spain
- XXV Edition of International Central Andes Volcanological Field Course, Salta, Argentina, October 27-November 3, 2019
- IAVCEI Developing Nations Network Working Group meeting: "Fostering developed-developing country partnerships for the advancement of global volcano science" 4-7 June 2019, University of the West Indies, St. Augustine Campus, Trinidad
- 2nd Young Latin American Volcanologists internship program: linking universities and volcano observatories (in collaboration with ALVO)
- 4th VOBP (Volcano Observatory Best Practice) Workshop, Mexico, CENAPRED, November 19-23, 2019.

## FUTURE ACTIVITIES

### Foreseen activities for 2020:

- Publication of 4 IAVCEI newsletters.
- Reduction of overall Commissions number through proposed merging or deactivation.
- Restructuring of the World Organization of Volcano Observatories (WOVO) and strengthening of the links between IAVCEI and worldwide volcano observatories
- Funding of workshops and meetings
- Renewal of IAVCEI website
- Promotion of gender equity within IAVCEI instances

### Meetings in 2020:

- COV11, Heraklion, Crete, May 20-26, 2020
- 14th CCVG Field Workshop, Hokkaido (Japan), May 30-June 5
- 1st Workshop of IAVCEI/IAG Volcano-Geodesy Joint Commission, Yellowstone, USA
- Commissions on Explosive Volcanism and Tephra dispersal modelling. Workshop on Explosive processes and products on Santorini (Greece), May 16-22
- Soufrière Hills Volcano 25 Years On Conference - Opportunities from Disaster: Lessons from 25 years living with the volcano, July 20-24
- 8th International Maar Conference, Petropavlosk Kamchatski, August 24-27
- 8th Commission on Collapse Calderas Workshop. Santorini, Greece, September 2020

Roberto Sulpizio, IAVCEI Secretary General

# ACTIVITIES OF THE UNION COMMISSIONS

The following reports illustrate the impressive range of activities within each Union Commission as well as their dedication to supporting science within developing countries. Each Union Commission has a website where much more information can be found.

## Union Commission on Climate and Environmental Change (CCEC)



CCEC website: [www.ccec-iugg.org](http://www.ccec-iugg.org)

### INTRODUCTION

The history and purpose of CCEC may be found on the CCEC website at: [www.ccec-iugg.org](http://www.ccec-iugg.org)

### ADMINISTRATION

The CCEC membership rotated at 27<sup>th</sup> IUGG General Assembly in Montreal in July 2019. New officers and members of the Commission are as follows:

Chair:	Jianping Li	CHINA	ljp@ouc.edu.cn
Vice-Chair:	Keith Alverson	USA/JAPAN	keith.alverson@unep.org keith.alverson@gmail.com
Secretary-			
Treasurer:	Tonie Van Dam	LUXEMBOURG	tonie.vandam@uni.lu
Commission:	Andrew Mackintosh	AUSTRALIA	Andrew.Mackintosh@monash.edu
	Harry Bryden	UK	H.Bryden@noc.soton.ac.uk
	Mark Cliverd	UK	macl@bas.ac.uk
	Domenico Giardini	SWITZERLAND	domenico.giardini@sed.ethz.ch
	Joyce Penner	USA	penner@umich.edu
	Alan Robock	USA	robocock@envsci.rutgers.edu
	Alberto Montanari	ITALY	alberto.montanari@unibo.it
	Dan Rosbjerg	DENMARK	daros@env.dtu.dk
	Annette Eicker	GERMANY	annette.eicker@hcu-hamburg.de
Immediate Past Chair:	Tom Beer	AUSTRALIA	tom.beer@safesystemsolutions.com.au

## ACTIVITIES

### IUGG General Assembly (Montreal)

The IUGG General Assembly was held in Montreal in July 2019. The CCEC coordinated the Union Session U01 “Achieving Sustainable Development: The Role for Earth Sciences”. Speakers from all IUGG associations and earth systems disciplines whose work is relevant to measuring progress towards, or helping to achieve, sustainable development goals participated. The CCEC organized several other symposia as well, including JM01 (IAMAS, IAHS, IACS) “Adapting in the Anthropocene”, JM03 (IAMAS, IAHS) “Advances and Frontier Challenges in Global Monsoon Studies: Dynamics, Convection and Interactions with Hydrological and Land Surface Processes” and M20 (IAMAS) “EL NIÑO/Southern Oscillation and its Regional and Global Impacts”.

CCEC held a Business Meeting during the General Assembly and elected a new Executive as noted above. Tom Beer summarized the Quadrennial Report that had been submitted to IUGG, Keith Alverson gave the Report of the Secretary/Treasurer.

### Workshops and sessions

We successfully organized the 14th “General Circulation Model Simulations of the East Asian Climate (EAC)” workshop in City University of Hong Kong on 27-29 April, 2019. The theme of the workshop is East Asian Climate under Global Warming: Understanding and Projection. There are four sessions, Detection and Attribution, Climate Variability, High-Impact Weather and Extremes, and Predictability, Prediction and Projection. More than 100 participants attended the workshop.

In addition, we organized a global monsoon session at EGU 2019.



*14th EAC workshop in City University of Hong Kong*

## **FUTURE ACTIVITIES**

We will organize a 3<sup>rd</sup> scientific workshop in 2020 or 2021. We, the CCEC members, will organize CCEC related symposia during the Association Scientific Assemblies in 2021, e.g., will run sessions on Plastic in the Ocean, Atmosphere and Cryosphere, global monsoon and weather and climate extremes at the IAMAS/IACS/IAHS meeting in Busan in 2021. In addition, IUGG GeoRisk Commission (GRC) will organize a workshop in Hyderabad in 2020, and we will work together with GRC. GRC will work with CCEC together to organize some relevant symposium that CCEC organizes in Busan in 2021.

We will organize 15<sup>th</sup> EAC (East Asian Climate) Workshop in State University of New York at Albany (ASRC), USA, in 2021, with theme on “East Asia and North America” under Global Climate Changes: Understanding and Projection”, which was originally planned on 5-7 October 2020 and was finally postponed to 2021 due to the COVID-19 crisis. We will organize CCEC related symposia and sessions at some important General Assemblies in 2020, for instance, a monsoon session at EGU 2020, and etc.

Jiangping Li, CCEC Chair  
Keith Alverson, CCEC Vice-Chair  
Tonie Van Dam, CCEC Secretary-Treasurer

# Union Commission on Mathematical Geophysics (CMG)

## INTRODUCTION

During 2019 the commission held a Union Symposium “*Mathematics of Planet Earth: The Science of Data*” at the 2019 IUGG General Assembly in Montreal, Canada. The commission has been working on organizing the 33rd biennial CMG meeting and developing a book proposal to the Cambridge University Press – IUGG Special Publication Series.

## ADMINISTRATION

*Membership.* The CMG membership rotated in 2019. **Chair:** Alik Ismail-Zadeh (Germany); **Vice-Chairs:** Ute Herzfeld (USA) and Malcolm Sambridge (Australia); **Secretary:** Ilya Zaliapin (USA); **Past Chair:** Yehuda Ben-Zion (USA).

## ACTIVITIES

### IUGG General Assembly

The Commission organized and conveyed a Union Symposium “*Mathematics of Planet Earth: The Science of Data*” at the 2019 IUGG General Assembly in Montreal, Canada, July 8-18, 2020.

The goal of symposium was to highlight the elemental role that mathematical and statistical ideas play in the geosciences and encourage further research answering fundamental questions about our planet and dynamic environment. The symposium showcases how different elements of Earth System science – including observations, data analysis, mathematical, physical, and computer modeling – facilitate a predictive understanding the Earth’s surface, interior, oceans and atmosphere. A particular focus was on the emergence of data science and the ways artificial intelligence and machine learning play in data-driven geophysical knowledge discovery.

Convener: Ilya Zaliapin (CMG, USA); Co-Conveners: Yehuda Ben-Zion (CMG, USA), Malcolm Sambridge (IASPEI, Australia), Gordon Swaters (IAPSO, Canada), Shin-Chan Han (IAG, Australia); Invited Speakers: Felix Herrmann (Canada), Kenneth Golden (USA), Anya Reading (Australia), Simon Papalexiou (Canada), Michel Stein (USA), Jürgen Kusche (Germany, IAG)

### The 33<sup>rd</sup> biennial CMG meeting

The Commission has been actively preparing to hold the 33th CMG meeting at the Seoul National University, South Korea during June 22-26, 2020. The meeting web site has been launched at <http://www.cmg2020.org/>. The conference aims to discuss key theoretical and observational aspects of solid earth, ocean, atmosphere, cryosphere, climate and other contemporary topics in mathematical geophysics. The conference’s overall theme is “*Mathematics and Computer Science for Earth and Space Sciences*”. The Scientific Program of the Conference (<http://www.cmg2020.org/index.php/scientific-program/>) is organized around six main themes:

#### **Theme 1: Data Sciences, Machine Learning and Artificial Intelligence**

*[Lead Conveners: Sang-Mook Lee and Enamudram Chandrasekhar]*

Session 1.1 *Nonlinear Signal Processing Techniques for Geophysics*

Session 1.2 *Nonlinear analysis and simulation of intermittent space and/or time fields*

Session 1.3: *Inverse problems and machine learning*

## **Theme 2: Geophysical Fluid Dynamics**

*[Lead Conveners: William Dewar, Annick Pouquet and Ilya Zaliapin]*

Session 2.1 Hydrologic connectivity in river channel and deltaic systems

Session 2.2 Magma and lava flows

## **Theme 3: From the Core to the Space: Different Spheres with Common Mathematics**

*[Lead conveners: Roberto Carniel, Alexander Fournier, and Shin-Chan Han]*

## **Theme 4: Mathematics for Natural Hazards Science**

*[Lead conveners: Alik Ismail-Zadeh and Salvatore Grimaldi]*

Session 4.1: Interactions between urban and geophysical systems

## **Theme 5: Geophysical Inversion: Theory, Algorithms, and Applications**

*[Lead conveners: Malcolm Sambridge and Alik Ismail-Zadeh]*

Session 5.1: Probabilistic approaches to inversion

Session 5.2: Advances in Geophysical imaging and applications

## **Theme 6: Mathematics for Climate Science**

*[Lead conveners: Dick Peltier and Ute Herzfeld]*

After careful consideration of various scenarios related to the CMG2020, the IUGG Conference on Mathematical Geophysics (CMG2020) in Seoul, Republic of Korea (22-26 June 2020) has been postponed due to the COVID-19 pandemic. The next CMG conference will be held at the same place in 2022.

## **The Cambridge University Press Book Proposal**

A Book Proposal has been submitted to the Cambridge University Press - IUGG Special Publication Series for an edited monograph "*Data Assimilation and Inverse Problems in Geophysical Sciences*". This will be a comprehensive volume based on the outcomes of several IUGG meetings organized and co-organized by the commission. The book will set out basic principle of inverse problems and data assimilation and present applications of the data assimilation and inverse problems in all disciplines of IUGG. The principal goal of the proposed book is to highlight the importance of research in data assimilation for understanding dynamical processes of the Earth and its space environment and for predictability. The book will summarize relevant newest advances in the field of data assimilation and inverse problems related to different geophysical fields. As outcomes of data assimilation contribute to scientific understanding and prediction of natural hazard events, this interdisciplinary book will provide a broader knowledge to those who are dealing with hazard assessment and subsequent risk mitigation/reduction. It will also provide guidance on future research directions to experts and early career scientists including PhD candidates.

### **Editors:**

**Alik Ismail-Zadeh**, Karlsruhe Institute of Technology, Karlsruhe, Germany / Russian Academy of Sciences, Moscow, Russia (Solid Earth); [alik.ismail-zadeh@kit.edu](mailto:alik.ismail-zadeh@kit.edu)

**Craig Bishop**, U.S. Naval Research Laboratory, Washington, DC, USA, and University of Melbourne, Victoria, Australia (Meteorology/Oceanography); [craighuntlybishop@gmail.com](mailto:craighuntlybishop@gmail.com)

**Fabio Castelli**, University of Florence, Florence, Italy (Hydrology); [fabio.castelli@unifi.it](mailto:fabio.castelli@unifi.it)

**Sabrina Sanchez**, Max Planck Institute for Solar System Research, Göttingen, Germany (Planetary sciences); [sanchezs@mps.mpg.de](mailto:sanchezs@mps.mpg.de) (early career scientist)

The Editors will be supported by an Editorial Advisory Board consisting of the Members of the Executive Committee of the IUGG Commission on Mathematical Geophysics:

- **Yehuda Ben Zion**, USA (IASPEI)
- **Roberto Carniel**, Italy (IAVCEI)

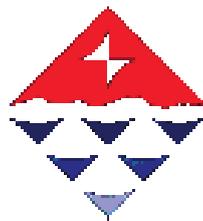
- **Enamudram Chandrasekhar**, India (IAGA)
- **William Dewar**, USA (IAPSO)
- **Alexandre Fournier**, France (IAGA)
- **Salvatore Grimaldi**, Italy (IAHS)
- **Shin-Chan Han**, Australia (IAG)
- **Ute Herzfeld**, USA (IACS)
- **Sang-Mook Lee**, Republic of Korea (IUGG)
- **Annick Pouquet**, USA (IAMAS)
- **Malcolm Sambridge**, Australia (IASPEI)
- **Ilya Zaliapin**, USA (IUGG)

## **FUTURE ACTIVITIES**

The commission plans to continue working on the CUP book, and organizing the 33<sup>rd</sup> (postponed) CMG conference in Korea. Due to its international and multi-institutional structure, the commission has a solid experience of remote communication. This experience has proven valuable during the COVID-19 pandemics. The commission plans to continue remote communication within the foreseeable future.

Ilya Zaliapin, CMG Secretary

# Union Commission on Geophysical Risk and Sustainability (GRC)



GRC website: [www.iugg-georisk.org](http://www.iugg-georisk.org)

## INTRODUCTION

The IUGG Commission on Geophysical Risk and Sustainability (IUGG GeoRisk Commission, or GRC) established by the IUGG Bureau in August 2000 is dedicated (i) to promoting scientific studies applied to the reduction of risk from natural hazards in an increasingly urbanized world and sustainability and (ii) to reducing death and destruction from natural and technological hazards by providing hazards data and information to emergency managers, policy-makers, scientists and the general public in the most timely and effective manner as possible. This includes the integration of knowledge concerning environmental, social and economic processes. The fundamental scope of this Commission is to facilitate communications between scientists via meetings, workshops and publications, as well as between scientists and decision makers, between scientists and the public, and between scientists and schools.

## ADMINISTRATION

The GeoRisk Commission held its quadrennial business meeting on July 16 during the 2019 General Assembly in Montreal, Canada. The meeting included the election of new officers and identified a number of new initiatives for the coming years. During the course of early 2019, several telecons amongst members were held to prepare for the **Symposium on GeoRisk Reduction: Science, Resources, and Governmental Action**.

### GRC Executive Committee:

- **Chair:** John LaBrecque (IAG, USA) [jlabrecq@mac.com](mailto:jlabrecq@mac.com)
- **Vice-Chair:** Vyacheslav Gusiakov (IAPSO, RUSSIA) [gusiakov@gmail.com](mailto:gusiakov@gmail.com)
- **Vice-Chair:** Chun-Chieh Wu (IAMAS, CHINA: ACADEMY OF SCIENCES IN TAIPEI) [cwu@typhoon.as.ntu.edu.tw](mailto:cwu@typhoon.as.ntu.edu.tw)
- **Secretary:** Yekaterina Kontar (IACS, USA) [ykontar@nsf.gov](mailto:ykontar@nsf.gov)
- **Treasurer:** Linda Rowan (IAVCEI, USA) [rowan@unavco.org](mailto:rowan@unavco.org)
- **Past Chair:** Joan Marti (IAVCEI, SPAIN) [joan.marti@ictja.csic.es](mailto:joan.marti@ictja.csic.es)
- **Association Representative:** Mohsen Ghafory-Ashtiany (IASPEI, IRAN) [mohsen.ashtiany@gmail.com](mailto:mohsen.ashtiany@gmail.com)
- **Association Representative:** Michael Krautblatter (IACS, GERMANY) [m.krautblatter@tum.de](mailto:m.krautblatter@tum.de)
- **Association Representative:** Christa von Hillebrandt-Andrade (IAPSO, PUERTO RICO) [christavon@gmail.com](mailto:christavon@gmail.com)
- **Association Representative:** Kosuke Heki (IAG, JAPAN) [heki@sci.hokudai.ac.jp](mailto:heki@sci.hokudai.ac.jp)
- **Association Representative:** George Balasis (IAGA, GREECE) [gbalasis@noa.gr](mailto:gbalasis@noa.gr)
- **Association Representative:** Roberto Sulpizio (IAVCEI, ITALY) [roberto.sulpizio@uniba.it](mailto:roberto.sulpizio@uniba.it)

(Note: The GeoRisk Commission Terms of Reference state that the Executive Committee is comprised of the elected officers and Representatives of all Eight Associations, however the IAMAS and IAPSO did not submit nominations.)

#### Members in Active Advisory Capacity:

- Harsh Gupta (IASPEI, INDIA) harshg123@gmail.com
- Alik Ismail-Zadeh (IASPEI, GERMANY/ RUSSIA) Alik.Ismail-Zadeh@kit.edu
- Tom Beer (IAMAS, AUSTRALIA) tom.beer@safesystemsolutions.com.au
- Kuniyoshi Takeuchi (IAHS, JAPAN) takeuchi@yamanashi.ac.jp
- Gordon McBean (IAMAS – IAHS, CANADA) gmcbear@uwo.ca
- Stephen McNutt (IAVCEI, USA) smcnutt@usf.edu
- Ramesh Singh (IASPEI, USA) rsingh@chapman.edu
- Web Master: Farshad Jalili Pirani: (Dept. of Civil and Environmental Engineering, Western University, Canada – IUGG early career member) fjalilip@uwo.ca

## ACTIVITIES

1. A major effort was expended by the GRC in recognition and celebration of the Centennial Years 2018-2019 of the IUGG, AGU, and the US National Committee for Geodesy and Geophysics (USNC-GG). The AGU-IUGG agreed to jointly sponsor two successive meetings during the AGU 2018 Fall Meeting in Washington, D.C., USA, 10-14 December 2018 and the 27th IUGG General Assembly in Montreal, Canada, 8-18 July 2019. The GRC lead the organization of the sequel joint AGU-IUGG-US National Academy Centennial Disaster Science meeting as a daylong Union Symposium during the IUGG General Assembly in Montreal on July 14, 2019. The union symposium entitled “**Georisk Reduction: Science, Resources, and Governmental Action**” included four panel discussion sessions with strong audience interaction. the agenda, video recordings and a brief summary of the findings of the Centennial Workshop can be accessed here:

**Symposium 1: AGU-IUGG Centennial Symposium on Disaster Science: Risk Reduction, Resilience, Response, and Recovery**

( <https://www.dropbox.com/sh/rk6bgrwocpv442a/AAAMsovtvPJ-J-fi1Ab4FRzna?dl=0> )

**Symposium 2: Symposium on GeoRisk Reduction: Science, Resources, and Governmental Action**

( <https://www.dropbox.com/sh/ypqqt6kobjtg51/AACDXB4hRlniToiqbW8sO2oda?dl=0> ).

2. A business meeting of the GRC was held on July 16, 2019 for the purpose of the election of new officers for the period 2019-2023. A report of the meeting can be accessed here: ([https://www.dropbox.com/s/epfr2x29ezijsng/GRC%202019%20Meeting%20Notes%20-%20Draft 1 8 2020.pdf?dl=0](https://www.dropbox.com/s/epfr2x29ezijsng/GRC%202019%20Meeting%20Notes%20-%20Draft%201%208%202020.pdf?dl=0) )
3. A poster briefly summarizing the two Centennial Disaster Science symposia was presented at the 2019 AGU Fall Meeting. The poster can be viewed here: (<https://www.dropbox.com/s/1g44tmy8bnsyz0k/Centennial%20Poster%20v2.pdf?dl=0> )
4. The GRC and the Global Geodetic Observing System of the IAG have jointly sponsored a report published as a supporting paper in the GAR-19 report of the United Nations Office for Disaster Risk Reduction. The paper presents the findings and recommendations of the GTEWS2017 workshop on GNSS Enhancement to Tsunami Early Warning Systems and the implementation of the IUGG 2015 General Assembly Resolution #4. The GAR-19 supporting paper can be accessed here: <https://www.preventionweb.net/publications/view/66779>

5. Photos of the Second Centennial Disaster Science Symposium (27th IUGG General Assembly, Montreal, Canada)

**Centennial Symposium on GeoRisk Reduction: Science, Resources, and Governmental Action**

(<https://www.dropbox.com/sh/ypqqt6kobjtg51/AACDXB4hRlniToiqbW8sO2oda?dl=0> )



**Panel 1: Hazard Models for Risk Management:** Left to Right: Ning Lin (Princeton University, USA), Kenji Satake (Earthquake Research Institute, U. Tokyo, Japan) , Shunichi Koshimura (International Research Institute of Disaster Science, Tohoku Univ, Japan), David Boteler (Canadian Space Weather Forecast Centre, Canada)



**Panel 2: Vulnerability and Disaster Risk:** Left to Right: Mohsen Ghafory-Astiani( International Institute of Earthquake Engineering and Seismology, Iran), Toshio Koike ( International Centre for Water Hazard and Risk Management, Japan), ZHANG Yongxia (Institute of Earthquake Forecasting, China), Roger Pulwarty (NOAA, USA)



**Panel 3: Role of International and Intergovernmental Organizations in Advancing the Sendai Framework for Disaster Risk Reduction:** Left to Right: Gordon McBean (Professor Emeritus, Western University, London, Canada ) , Shuaib Lwasa (Makerere University, Uganda), Christa von Hillebrandt-Andrade (NOAA,Puerto Rico), Alik Ismail-Zadeh Secretary General, IUGG



**Panel 4: Data Sharing and Infrastructure Development for Disaster Risk Reduction:** Left to Right: James Norris (GEO, Switzerland), Allison Craddock (Director GGOS CB, USA) , Zuheir Altamimi (President IAG, France)



**Symposium Summary Panel:** Left to Right: Katia Kontar (GRC Secretary), Ester Szein (NRC), Robin Bell (President AGU), Stephen McNutt (Chair, USNC-GG), Michael Sideris (President, IUGG), Alik Ismail-Zadeh (Secretary General, IUGG)

## 6. Terms of Reference for the GeoRisk Commission

<https://www.dropbox.com/s/5im3x7n91kf112m/GeoRisk%20ToR.pdf?dl=0>

### FUTURE ACTIVITIES

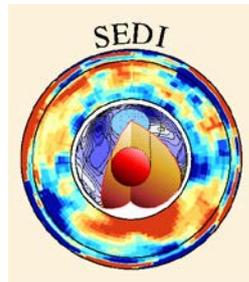
The GeoRisk Commission is leading an effort to produce a white paper that will summarize key findings of the Centennial Symposia on Disaster Science. The white paper is planned for publication in mid-2020.

The GeoRisk Commission had a total of \$14,170.35 in financial assets on December 31, 2019. Following decisions made by Executive Committee on January 14, 2020, these funds were allocated to the support of two GeoRisk Commission projects. The two projects are: The Kyoto Landslide Commitment 2020 to which the IUGG has become a signatory and the Implementation of Resolution #4 of the 26<sup>th</sup> IUGG General Assembly that supports the implementation of the GNSS Tsunami Early Warning Systems within the Indo-Pacific Region. The plans for these activities was disrupted by the COVID-19 pandemic of 2020 but efforts continue to support these two activities. These activities seek to support the UNDRR call for support of the **Sendai Framework for Disaster Risk Reduction 2015-2030**.

- Funds totalling \$3500 have been allocated to support the attendance of Vice Chair Vyacheslav Gusiakov to present a key note address during the World Landslide Forum- 5 scheduled for November 2-6, 2020 in Kyoto, Japan. The GeoRisk Commission will work within the Kyoto Landslide Commitment to increase the support for these activities in the coming decade.
- The GeoRisk Commission is in discussions with the Global Geodetic Observing System/IAG and other organizations to support a Meeting of the Principals to develop a GNSS Real Time Consortium (GNSS-RTC) within the Geodesy for Sendai community activity of the Group for Earth Observation. The Global Geodetic Observing System and the GEO leads for the Geodesy for Sendai are formulating plans on how to organize such a meeting within the next few months. The purpose of the GNSS-RTC is to advance the implementation of Resolution #4 of the 26<sup>th</sup> IUGG General Assembly calling of GNSS Augmentation to Tsunami Early Warning for the Indo-Pacific Region with the purpose of decreasing regional tsunami risk.
- The GRC executive is leading the development with the AGU of a white paper on the findings of the two IUGG-AGU Centennial Symposia on Disaster Science held during the AGU 2019 Fall meeting and the 27th IUGG General Assembly in July, 2020.
- The GRC will institute a rebuilding of it web site in 2020. The previous site had fallen into disrepair in previous years and had not been updated to include new activities and leadership. The Exec committee has discussed a general outline for website content and Farshad Jalili Pirani (Dept. of Civil and Environmental Engineering, Western University, Canada – IUGG early career member) has volunteered to undertake this activity.
- Finally, the GRC has resolved to conduct business virtual meetings via internet (Zoom) or email whenever possible. We have also been informed that both the GTEWS 2020 WLF5 has been postponed to 2021 and the KLC2020 signing ceremony will be conducted as a virtual meeting. Despite these efforts GRC will continue to advance both our KLC2020 landslide and GTEWS tsunami warning programs through cooperative activities within the IAG and GEO Geodesy4Sendai community activities.

John LaBrecque, GRC Chair

# Union Commission on the Study of the Earth's Deep Interior (SEDI)



SEDI website: [www.sedigroup.org](http://www.sedigroup.org)

## INTRODUCTION

**SEDI** is an international scientific organization dedicated to the **Study of the Earth's Deep Interior**. The scope of SEDI includes the core and lower mantle, but interest may extend to the surface. The scientific questions and problems of interest to SEDI include: 1) the investigation of the origin, evolution, structure, geochemical and mineralogical composition of the inner core, outer core, mantle and crust, 2) the theoretical and observational investigation of core magnetohydrodynamics at all time scales, and the more general investigation of fluid rotational dynamics that can affect the core, 3) the investigation of mantle dynamics, both from a theoretical point of view and observational point of view, 4) the investigation of mechanical, electromagnetic, thermal and chemical interactions between the inner-core, outer core, mantle, crust and possibly the oceans and atmosphere on a planetary scale, with a particular emphasis on region boundaries, with the aim of understanding the Earth as a globally interacting system, 5) the thermodynamics of the Earth and the investigation of its long-term thermal evolution, and how it differs and compares to other planetary bodies.

Since 1987, SEDI has been a Union Commission of the International Union of Geodesy and Geophysics ([IUGG](#)). As such, it cuts across the traditional discipline-oriented bounds of the Associations of the IUGG [such as the International Association of Geodesy ([IAG](#)), the International Association of Geomagnetism and Aeronomy ([IAGA](#)), the International Association of Seismology and Physics of the Earth's Interior ([IASPEI](#)), and the International Association of Volcanology and Chemistry of the Earth's Interior ([IAVCEI](#))], which normally study the Earth from a particular point of view. The intent of SEDI is to amalgamate all sources of data and all points of view to generate the most coherent and consistent picture of the workings of the Earth's deep interior.

## ADMINISTRATION

SEDI is currently chaired by Christine Thomas (WWU Münster, Germany) who took over from Jonathan Aurnou (UCLA, USA) at IUGG2019: Vice-chair is now Mathieu Dumberry (U. Alberta, Edmonton, Canada), with Michael Bergman (Simon's Rock College, USA) acting as Secretary-General. SEDI has a membership of about 600, as recorded on the email list used to broadcast information related to SEDI activities, upcoming meetings, funding opportunities, and academic openings.

## ACTIVITIES

### IUGG General Assembly 2019:

At last summer's IUGG 2019 Centennial meeting in Montreal, a union session (U05) on Discoveries in the Deep Earth as well as multidisciplinary session (JA01) linked between IAGA/IASPEI/IAG was organized and co-chaired by the SEDI officers and Carla Braitenberg (Italy, IAG), George Helffrich (Japan, IASPEI). The sessions went well with invited speakers Sanne Cottaar, Magali Billen, Jennifer

Jackson, Roland Pail, Chris Finlay, Binod Sreenivasan and Quentin Williams covering all aspects of SEDI interests.

The poster session was co-organized by members of SEDI community in a joint symposium: Geophysical Constraints on the Earth's Core and Its Relation to the Mantle (co-organised by IAGA, IASPEI, IAG).

The SEDI Business Meeting was also held at IUGG 2019 as well. There Christine Thomas became Chair and Mathieu Dumberry (University of Alberta, Canada) became Vice-Chair and the future SEDI location was introduced (Taipei).

### **Update activities 1.1.2020-5.5.2020**

Due to the spread of the corona virus and subsequent travel restrictions, the LOC and the officers of SEDI decided to cancel the meeting scheduled for 2020. The meeting will be held in 2022 in Taipei. A shift to 2021 seemed difficult due to funding, possible travel restrictions into the next year as well as a large number of conferences being shifted to 2021. In addition an overlap with the CIDER meeting on deep Earth was to be avoided.

At the moment we are looking into the possibility of holding a virtual, condensed meeting in early September 2020, with a smaller number of research presentations and posters. We are currently testing the possibility for support for such an online conference.

We are discussing the future of SEDI meetings with a combination of online/physical attendance. We feel, however, that as a small conference SEDI fosters strong collaborations/interactions and is a good way for young scientists to present their work, and a physical meeting is therefore the best form for SEDI meetings in the future.

## **FUTURE ACTIVITIES**

In **2022, the SEDI meeting** will be held in Taipei, at the National Taiwan University at the Institute of Earth Sciences (Academia Sinica). The local organizing committee is comprised of Frederic Deschamp and Ban-Yuan Kuo (co-leads) along with Wen-Che Yu, Wen-Pin Hsieh and Kenny Vilella. This is SEDI's first meeting held in Taipei.

The **web site for SEDI** has been renewed. The new site went online in early 2020. Some content is still to be filled such as the job postings and SEDI related papers.

Christine Thomas, Chair, SEDI  
Mathieu Dumberry, Vice-Chair, SEDI  
Michael Bergman, Secretary-General, SEDI

# Union Commission on Data and Information (UCDI)



UCDI website: [www.iugg-ucdi.org](http://www.iugg-ucdi.org)

## Report on the activities of UCDI during 2018-2019

### INTRODUCTION

In 2008 the IUGG established the Union Commission on Data and Information (hereafter UCDI) as an entity for the eight Associations of IUGG to deal with data and information issues at the Union level and engage with similar bodies in other Unions and Societies. Accordingly, UCDI is expected to enable a high level of cooperation within and between scientific communities. This cooperation is needed in order to ensure the availability of modern data and information systems and services, which are globally distributed, provide universal open access, and are sustainable. Hence, UCDI targets to provide a focused and single voice within IUGG, connecting all IUGG Associations and inter-Association bodies, connect IUGG and its scientists to other bodies/agencies/initiatives that have interest and responsibility on matters of geo-data, advocate and facilitate research and development in the growing field of informatics to improve data and information systems and practices, and promote open access to data and adoption of interoperable data sets.

### ADMINISTRATION

**Membership:** Following the approval of the Bureau of IUGG met in Montreal in July 2019, the President of IUGG reconstituted the Executive Committee of Union Commission on Data and Information (UCDI) as follows.

Chair: Satheesh Shenoi (India, IAPSO)  
Vice-Chair: Anatoly Soloviev (Russia, IAGA)  
Members: Sonia Maria Alves Costa (Brazil, IAG)  
Ellen Clarke (UK, IAGA)  
Michelle Guy (USA, IASPEI)  
Silvia Massaro (Italy, IAVCEI)  
Yasuhiro Murayama (Japan, IAMAS)  
Bruce H. Raup (USA, IACS)  
Satoshi Taguchi (Japan, IAGA)  
Alena Rybkina (Russia, CODATA Representative), Co-opted member

**Business Meetings:** The earlier and newly appointed committee had its first meeting on 11 and 12 July at Montreal on the side lines of the 27<sup>th</sup> meeting of IUGG General Assembly. Seven members of UCDI attended the meeting. They are:

1. Mr. Satheesh C. Shenoi      Chair
2. Mr. Anatoly Soloviev      Vice-Chair
3. Mr. Bruce Raup              Member

- |                          |        |
|--------------------------|--------|
| 4. Ms. Ellen Clarke      | Member |
| 5. Mr. Robert Key        | Member |
| 6. Ms. Michelle Guy      | Member |
| 7. Mr. Yasuhiro Murayama | Member |

The meeting discussed on the major items like the activities to be taken up by UCDI during the next two years, collaborations with other organizations, symposia/conferences to be organised by UCDI or in collaboration with other organisations, how to encourage the individual scientists to share the data possessed by them, etc. It was decided that, the web site of UCDI should be more informative and should the information of ongoing and planned activities. It was also decided to constantly interact with WDC, CODATA, Global Partnership for Sustainable Development of Data, etc. It was also decided to encourage the earth scientists to publish in data journals. During 2020, the UCDI/the members will organise special sessions in the following conferences/symposia.

- i. a session on data at IASA conference "Systems analysis in Eurasia" to be held in Moscow, Russia during 21-23 April 2020. Dr. Anatoly will lead this effort,
- ii. a session on " Management of the Volcanological Data: from the production to the curation" at Cities on Volcanos 11 (COV11) to be held at Crete, Greece during 23-27 May 2020 (Ms. Silvia Massaro will lead),
- iii. a session on ocean observations and data management at the International Indian Ocean Science Conference-2020 (IIOSC-2020) to be held in Goa, India during 16-20 March 2020 (Satheesh Shenoi to lead).

## ACTIVITIES

- (i) UCDI Chair, Dr. Satheesh Shenoi attended the "Data and management workshop" held at the International Indian Ocean Science Conference 2018 in Jakarta, Indonesia during 18-23 March 2018. The workshop discussed about the ocean data management, common data formats, QC procedures and standards, interoperability and free exchange of data sets, etc.
- (ii) UCDI Vice-Chair, A.A. Soloviev participated in the 32nd Conference on Mathematical Geophysics (CMG) of the International Union of Geodesy and Geophysics (IUGG) and delivered an invited talk on the mathematical tools for analysis of ground based and satellite geomagnetic data streams for advanced monitoring of the Earth's magnetic field.
- (iii) UCDI Vice-Chair, A.A. Soloviev is actively involved with The Earth Science Data Base project (<http://esdb.wdcb.ru/>) developed in cooperation with the CODATA Task Group "Data Citation Standards and Practices". The project aims at assigning Digital Object Identifiers (DOI) to geophysical and other relevant data sets (geomagnetism, seismology, space physics, etc.).
- (iv) Ms. Silvia Massaro represented UCDI at the International CODATA 2018 Conference session on "Data collection and analysis for the study of the Earth's system" held in Botswana during 5-8 November 2018.
- (v) Drs. Aude Chambodut and Yasuhiro Murayama participated in "Latin America and the Caribbean Scientific Data Management Workshop" at Brazilian Academy of Science, Rio de Janeiro, during 17-18 April 2018. (<http://lacworkshop.icsu-wds.org/>). Aude chaired a session chair at the workshop.
- (vi) Michelle Guy participated in the U.S. Geological Survey ISO Metadata Standard Workshop organized to propose content specifications to assist in authoring metadata records in

the ISO 19115 family of standards for the U.S. Geological Survey and for the broader scientific community. The Workshop was held in Fort Collins, Colorado, USA during 10-12 July 2018.

- (vii) Organised a union symposium titled "Data-driven science for Earth and Space exploration" (U04) at the XXVII General Assembly of the IUGG on 10 July 2019 at the 27<sup>th</sup> meeting of IUGG General Assembly. Lead convenor – Dr. Satheesh Shenoi (UCDI), Co-convenors - Sonia Costa (IAG, Brazil), Ellen Clarke (IAGA, UK), Michelle Guy (IASPEI, USA), Robert M. Key (IAPSO, USA), Silvia Massaro (IAVCEI, Italy), Yasuhiro Murayama (IAMAS, Japan), Bruce Raup (IACS, USA), Ashish Sharma (IAHS, Australia). The symposium had 7 invited talks, 2 contributed talks and 7 posters.

The invited speakers and their talks are listed below:

- (i) Ganguly Auroop (USA), Intelligent climate adaptation and resilient engineering for urban sustainability (I-CARE-4-US): The need for innovative data-driven science paradigams,
- (ii) Frainotti Daniel (Switzerland), Outcomes and lessons-learned from community effort to compile and model Global glacier Ice thickness,
- (iii) Kelbert Anna (USA), Building a cyber infrastructure for the Geosciences: Progress and Lessons from the NSF's EarthCube programme,
- (iv) Brun Fanny (France), Region wide estimate of glacier volume changes for the period 2000-2018,
- (v) Chandler Cynthia (USA), Big data, open data and better science: marine science as a case study,
- (vi) Gallagher Sarah (Canada) Big data in space: The role of a space agency
- (vii) Diggs Stephen (USA) Total fail of Holy Grail: The missing link of data Rescue and Recovery.

## **FUTURE ACTIVITIES**

Organise special sessions in the following conferences/symposia:

- (i) a session on data at IASA conference "Systems analysis in Eurasia" to be held in Moscow, Russia during 21-23 April 2020.
- (ii) a session on " Management of the Volcanological Data: from the production to the curation" at Cities on Volcanos 11 (COV11) to be held at Crete, Greece during 23-27 May 2020.
- (iii) a session on ocean observations and data management at the International Indian Ocean Science Conference-2020 (IIOSC-2020) to be held in Goa, India during 16-20 March 2020.
- (iv) advocate on crediting the individual scientists for sharing the data in their possession on similar lines of citation index, H-factor, etc.

Satheesh Shenoi, UCDI Chair

# Union Commission on Planetary Sciences (UCPS)

UCPS website: <http://202.127.29.4/geodesy/ucps>

## INTRODUCTION

The IUGG Union Commission on Planetary Sciences (UCPS) was established by the IUGG Executive Committee in June 2015 to promote and coordinate scientific (physical, chemical, and mathematical) studies of planets in the solar system and around other stars. UCPS intends to advance planetary science through advocacy of solar system and extrasolar exploration, seeking insights on the origin, formation and evolution of planets and systems, including a search for habitable worlds beyond Earth. The UCPS together with other IUGG associations will share knowledge through scientific research and comparative studies between planetary objects and the Earth in the fields of atmosphere, surface and interior science.

Additional information about UCPS can be found at <http://202.127.29.4/geodesy/ucps>.

### Objectives:

- To advance and foster the study of scientific problems in the planetary sciences;
- To promote and coordinate international cooperation in planetary science, and promote planetary science activities in developing countries;
- To facilitate, on an international basis, discussion and publication of the results of the studies, research and work indicated above;
- To contribute to coordinating activities for future space missions.

## ADMINISTRATION

### Executive Committee

Shuanggen Jin (IAG, China) (Chair)  
Nader Haghighipour (University of Hawaii, USA) (Vice-Chair)  
Paul Hartogh (MPI, Germany) (Vice-Chair)  
Scot Rafkin (IAMAS, USA) (Secretary/Treasurer)

## ACTIVITIES

### **The 2nd International Workshop on GNSS Ionosphere (IWGI2019) - Theory, Algorithms, Modelling and Applications, 23-25 September 2019, Neustrelitz, Germany**

The International Workshop on GNSS Ionosphere (IWGI2019)-Theory, Algorithms, Modelling and Applications is jointly sponsored by the German Aerospace Center (DLR) and Shanghai Astronomical Observatory (SHAO), CAS, China. Ionospheric refraction is considered as one of the major accuracy limiting factors in microwave space-based geodetic techniques such as the GPS (Global Positioning System), SLR (Satellite Laser Ranging), VLBI (Very Long Baseline Interferometry), DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) and satellite altimetry. All trans-ionospheric microwave signals are subject to ionospheric refraction and subsequent delays in the travel time. The use of multi-frequency and multi-GNSS observations enables precise remote sensing of the ionosphere and thus mitigation of ionospheric effects in numerous applications. This leads to unprecedented accuracy improvement in GNSS applications. Moreover, precise time and frequency transfer may lead to new applications in navigation, Earth observation, solar system science and telecommunications.

The International Workshop on GNSS Ionosphere 2019 (IWGI2019) provided a platform for scientists and engineers to communicate and exchange their views on ionospheric theory, methods, technologies, applications and future challenges. The workshop is open to all scientists who may have the latest results and developments in ionospheric scintillation, reconstruction, modelling, monitoring techniques and prediction methodologies as well as ionospheric propagation effects on microwave space-based geodetic techniques such as the GPS, SLR, VLBI, DORIS etc. and their mitigation using multi-frequency, multi-sensors observations.

Topics:

- Ground Based Ionosphere Monitoring and Modelling
- Space Based Ionosphere Monitoring and Modelling
- Ionosphere / Plasmasphere Coupling and Radio Occultation
- Ionospheric Effects on Navigation and Positioning
- Ionospheric / Thermospheric Coupling Processes
- Space Weather Impact on Earth/Space systems and infrastructures
- Multi-GNSS, Current Status and Advances

Co-Chairman:

- Mainul Hoque, German Aerospace Center (DLR), Germany
- Jens Berdermann, German Aerospace Center (DLR), Germany
- Norbert Jakowski, German Aerospace Center (DLR), Germany
- Shuanggen Jin, Shanghai Astronomical Observatory, CAS, China



*Group photo of the second International Workshop on GNSS Ionosphere (IWGI2019), 23-25 September 2019, Neustrelitz, Germany*

Organizers:

- Shanghai Astronomical Observatory, Chinese Academy of Sciences
- German Aerospace Center (DLR)

The topics were focused on GNSS ionospheric theory, methods, technologies, applications and future challenges. About 70 participants attended IWGI2019 with two-day oral talk. The IWGI2019 provided a very good platform for communication and discussion on GNSS ionospheric theory, algorithms, modelling and applications.

**AOGS Session: Science and Exploration of Mars and Venus, 30 July 2019, Singapore**

<http://www.asiaoceania.org/aogs2019>

This session covers the study of the ionosphere, atmosphere, surface and interior of Mars and Venus. We invite abstracts on results from ground-based observations as well as recent and ongoing missions to Mars and Venus (eg., ExoMars Mars Express, Venus Express, Mars Odyssey, MRO, MERs, Phoenix, Mars Science Laboratory, MAVEN, Indian Mars mission, etc.).

We envisage having presentations on measurements and theoretical models dealing with the ionospheric environment and its interaction with the solar wind (e.g. Photochemistry); the influence of atmospheric dust on the atmosphere and ionosphere of Mars; the model of Martian atmosphere.

The session will also include presentations on various aspects (like their scientific goals, long-term plans, technology etc.) of future missions and missions about to be launched to Mars and Venus (e.g , InSight, ExoMars Rover, Mangalyan-2, 2020 Chinese Mars Mission, Mars 2020, etc.). We also invite abstracts on comparative planetology of terrestrial planets. Both solicited talks and contributed presentations will be included in the program.

Conveners:

- Prof. Varun Sheel (Physical Research Laboratory, India)
- Prof. Shuanggen Jin (Shanghai Astronomical Observatory, CAS, China)



*Prof. Peter Read (Oxford University, UK) was given a Distinguished Lecture at AOGS2020, Singapore*

## FUTURE ACTIVITIES

### **Session: Science and Exploration of Mars and Venus at AOGS 17th Annual Meeting, 28 Jun to 4 Jul 2020, Hongcheon, South Korea**

This session covers the study of the ionosphere, atmosphere, surface and interior of Mars and Venus. We invite abstracts on results from ground-based observations as well as past, recent and ongoing missions to Mars and Venus. We propose to have presentations on measurements and theoretical models dealing with the ionospheric environment and its interaction with the solar wind; the atmospheric composition, dynamics and climate; the surface morphology, geology, geochemistry and mineralogy; the deep interior and subsurface structure of both Mars and Venus. The session will also include presentations on various aspects (like their scientific goals, long-term plans, technology etc.) of future missions and missions about to be launched to Mars and Venus. We also invite abstracts on comparative planetology of terrestrial planets. Both solicited talks and contributed presentations will be included in the program.

Conveners:

Dr. Varun Sheel (Physical Research Laboratory, India)

Dr. Takeshi Imamura (The University of Tokyo, Japan)

Prof. Shuanggen Jin (Shanghai Astronomical Observatory, CAS, China)

### **4th International Symposium on Lunar and Planetary Science (ISLPS 2020), June 14-17, 2020, Wuhan, China**

Planetary science is rapidly growing thanks to -recent successful space missions to our solar system bodies including LRO, Kaguya, Chandrayaan-1, 2, Chang'E series, Dawn, Hayabusa-1, 2, Rosetta, Stardust-NExT, Cassini, InSight, and OSIRIS REx. To accelerate scientific output and student training, regular and efficient academic discussions and exchanges are very important. Following the three International Symposium on Lunar and Planetary Sciences (ISLPS) in 2014 (Macau), 2016 (Wuhan), 2018 (Macau), we are going to hold the 4th ISLPS in 2020, Wuhan, China.

The Local Organizing Committee, in collaboration with related national/international organizations and research institutes, cordially invites you to the 4th ISLPS. This Symposium offers an open forum for planetary scientists, engineers and students to meet, and exchange ideas on a wide range of topics related to planetary sciences, exploration and education. We hope that such an exchange and integration will accelerate the development of planetary sciences. More information can be found at <http://psi.cug.edu.cn/info/ISLPS2020.htm>

Shuanggen Jin, UCPS Chair  
Nader Haghighipour, UCPS Vice-Chair

# THE INTER-ASSOCIATION WORKING GROUP: Electro-magnetic Studies of Earthquakes and Volcanoes (EMSEV)



EMSEV website: [www.emsev-iugg.org/emsev](http://www.emsev-iugg.org/emsev)

## INTRODUCTION

EMSEV ('Electromagnetic Studies of Earthquakes and Volcanoes') is an Inter-Association Working Group of the International Union of Geodesy and Geophysics (IUGG). The three International IUGG Associations of Geomagnetism and Aeronomy (IAGA), Volcanology and Chemistry of the Earth's Interior (IAVCEI), and Seismology and Physics of the Earth's Interior (IASPEI) powerfully support EMSEV and promote its activities.

During the past 20 years of activity, EMSEV has continuously investigated tectonic and geological setting of active faults and active volcanoes and has constantly worked for a better knowledge of the physical and dynamical processes leading to fault rupture and volcanic eruptions. Based on the expertise of a worldwide community of more than 350 researchers, engineers and students, EMSEV sustains innovative researches and findings in electromagnetism (EM), integration of new EM methodologies with other geophysical data to describe, monitor, analyse, and model fault systems and volcanoes.

EMSEV scientists have really expanded methodologies, increased ground observations, satellite observations and carried out laboratory measurements for understanding earthquake and volcanic processes.

EMSEV objectives are: (1) evaluation and endorsement of advanced studies in the electromagnetic field through international cooperation, conferences and workshops, and high levels international publications, (2) integration of electromagnetic methods together with other geophysical techniques to identify physical processes on all scales before, during and after earthquakes and volcanic eruptions, (3) organization and management of international and regional workshops including sponsorship of sessions at international meetings that describe these results and (4) participation in educational and field programs relating to observed results and the reduction of an earthquake and volcanic hazards.

## ADMINISTRATION

In 2018, the structure of the EMSEV changed significantly. From 1999, date of EMSEV building, the EMSEV body consisted of the 1) Executive Bureau, 2) Working Group Members that included all scientists interested and involved in EMSEV activities, 3) National Representatives (about two per

country) and 4) EMSEV collaborators that included all interested scientists from other geophysical disciplines. The executive bureau is elected every four-years.

From 2007 to 2019, every four years Chairperson (J. Zlotnicki), Vice-Chairperson (M.J.S. Johnston), and Secretary (T. Nagao) were elected for driving EMSEV bureau and community. J. Zlotnicki and M.J.S. Johnston asked to renew the bureau and a new election was organized during and after the biennial 2018 EMSEV meeting in Italy.

The EMSEV body will now consist of the 1) Bureau, 2) Country Liaison Members, 3) EMSEV members and 4) EMSEV Collaborators.

**EMSEV bureau.** Since March 2019, Toshiyasu Nagao (Japan) assumes the EMSEV Chair, Valerio Tramutoli (Italy) was elected as Vice-Chairperson, and Jann-Yeng Liu (Taiwan) was selected as Secretary.

EMSEV bureau gathers the following association liaison members:

- IAVCEI: Takeshi Hashimoto from Hokkaido University (Japan),
- IASPEI: Qinghua Huang from Beijing University (China),
- IAGA: Jann-Yeng Liu from the National Central University (Taiwan),

At this moment, EMSEV bureau contains 15 members from 10 countries. Detailed member list is presented on <http://www.emsev-iugg.org/emsev/profile.html>.

**Country liaison members.** Country liaison members are representative scientists from each country (about two per country) who promote electromagnetic studies related to earthquakes and volcanoes and contribute to EMSEV activities in their country and internationally. 36 scientists from 16 countries represent this EMSEV sub-body. Detailed country liaison list is available on <http://www.emsev-iugg.org/emsev/profile1.html>.

**EMSEV Members.** An EMSEV Member is anyone who has an interest and participates in EMSEV activities. Exchange of information is facilitated through EMSEV meetings, which are organized every two years, and/or IUGG General Assemblies (including IAGA, IASPEI, and IAVCEI meetings) and EMSEV mailing list.

**EMSEV Collaborators.** They are active scientists working in Natural Hazards in any related field of research whose expertise does not primarily belong in the EM field but are interested in and involved in the development of new geophysical knowledge. They are interested in participating in EMSEV activities, including cross-disciplinary analysis of observations and understanding of physical processes from different perspectives. Two collaborations, one in Seismology and one in Geochemistry, are already active. These groups will be developed in the next future.

Business meetings will continue to be regularly organized at the EMSEV meetings and International General Assemblies. Minutes of the meetings will be distributed through EMSEV mailing list as usual. Information, activities, and annual and business meetings reports are kept on the EMSEV website that is mainly managed by T. Nagao ([webmaster@emsev-iugg.org](mailto:webmaster@emsev-iugg.org)). Messages and information on activities are also distributed by T. Nagao through the EMSEV mailing list.

## ACTIVITIES

### CONFERENCE ACTIVITIES

In 2019, EMSEV activities continued to be numerous and rewarding for the benefit of the scientific community. EMSEV was involved in several international meetings, organizing sessions devoted to EM phenomena. EMSEV paid close attention to research achieved and published in international journals in which the sponsorship of EMSEV and the support of IUGG and EMSEV are clearly mentioned.

### MEETINGS AND WORKSHOPS

Important sessions at international conferences that were sponsored or organized by EMSEV members and, for which, a high level of participation occurred are:

#### **EGU, Vienna, Austria (April 7-12, 2019)**

NH4.3: Short-term Earthquakes Forecast (StEF) and multi-parametric time-Dependent Assessment of Seismic Hazard (t-DASH), Co-organized as AS4.62/EMRP2.40/ESSI1.7/GI2.13/SM3.9, Co-sponsored by JpGU. Convener: Valerio Tramutoli. Co-conveners: Mariano Lisi, Pier Francesco Biagi, Katsumi Hattori, Filippos Vallianatos.

#### **JpGU, Chiba, Japan (May 26-30, 2019)**

M-IS04, Interdisciplinary studies on pre-earthquake processes, Conveners: K. Hattori, J. Y. Liu, D. Ouzounov, Q. Huang.

#### **IWEP6, Chiba, Japan (May 31-June 1, 2019)**

6th International Workshop on Earthquake Preparation Process, Chiba, Japan (Co-sponsored by Chiba University, Tokai University, National Central University, Chapman University)

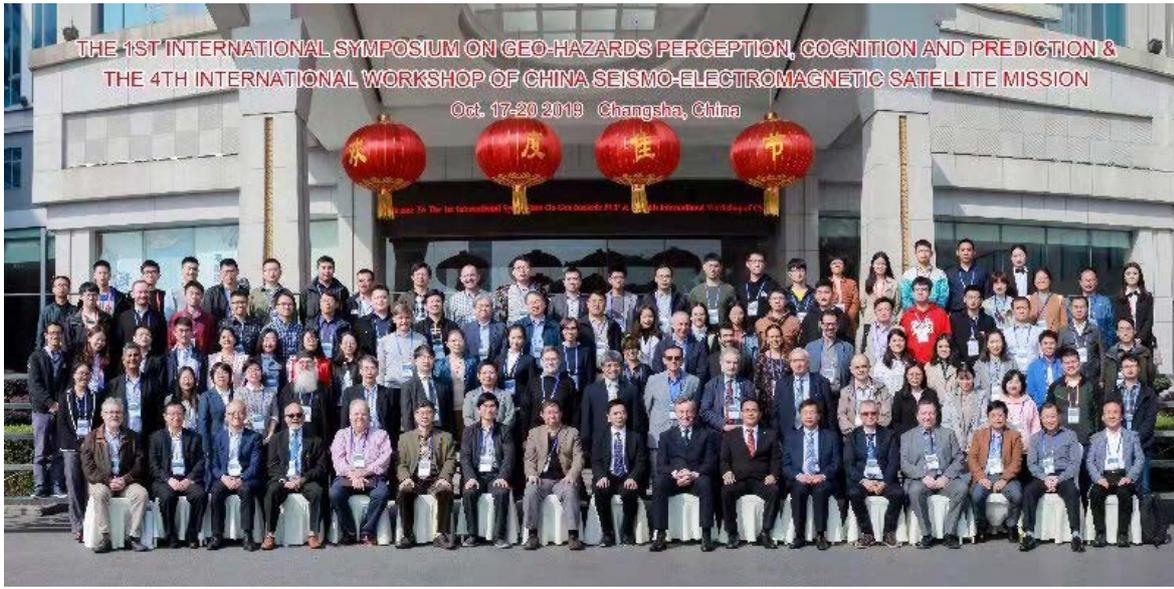
#### **IUGG GA, Montreal, Canada (July 8-18, 2019)**

**S15**, Interdisciplinary Observations of Pre-Earthquake Processes: A New Approach Towards Earthquake Prediction Studies, Convener: Dimitar Ouzounov, Co-Conveners: Sergey Pulnits, Katsumi Hattori, Patrick Taylor.

**JA10**, Electromagnetic Signals Generated by Volcanic Eruption/Activity, Fluid Pressure, Earthquakes and Aseismic Fault Slip (IAGA, IAVCEI, IASPEI), Convener: Jacques Zlotnicki (IAGA), Co-Conveners: Malcolm Johnston (IAGA/IASPEI), Takeshi Hashimoto (IASPEI/IAVCEI), Xuhui Shen (IASPEI), Yoichi Sasai (IAVCEI)

## The 4<sup>th</sup> International Workshop of CSES Mission, Changsha, China (Oct. 17-20, 2019)

<http://geohazard-cses-2019.com/>



## AGU Fall meeting, San Francisco, USA (Dec. 9-13, 2019)

NH029 - Multi-sensor observations of pre-earthquake signals, geo-hazards, and space weather from space and ground observations. Conveners: Dimitar Ouzounov, Tiger Liu, Livio Conti, Patrick Taylor. The principal focus of the session was on the latest satellite missions to study Earth EM environment, pre-earthquake processes, and the Space weather. During both Oral and Poster sessions, a total of 19 papers were presented. Two presentations were solicited - Prof. Pergiorgio Picozza on behalf of CSES mission and Dr. Fu-Yuan Chang on behalf of FORMOSAT-7/COSMIC-2 mission. Two young scientists, Dr.F.-Y. Chang (NCU, Taiwan) and Ms. Weiyun Xie (Chiba University, Japan) were recognized for their excellence in the presentations and were awarded travel support grants from EMSEV.



## JOINT INTERNATIONAL ACTIVITIES

### EMSEV activity on volcanoes

A cooperative program on Taal volcano between EMSEV and the Philippines Institute of Volcanology and Seismology (PHIVOLCS <http://www.phivolcs.dost.gov.ph/>) evolved from a Workshop in Manila, the capital of the Philippines, in 2003. Taal volcano is a very dangerous and hazardous volcano which may cause serious death and devastation in Luzon Island. Taal Volcano is classified as “DECADE VOLCANOES” by IAVCEI. There have been 33 recorded eruptions at Taal from 1572 to 1977. It means

that during the last 40 years, no eruptive activity was recorded. Taking into account the past eruption history, it is quite an unusual quiescence.

EMSEV applied electromagnetic methods for imaging the 3-dimensional structure of the volcano then combined later with geodetic and other geophysical monitoring systems for monitoring the ongoing activity. Structural information indicates a shallow magmatic source located at a depth between 4 and 6 km below the current Main Crater Lake (MCL) on Volcano Island. Volcano Island is surrounded by Taal Lake that fills the prehistoric caldera of Taal Volcano.

To monitor this system, EMSEV and PHIVOLCS installed a number of multi-parameter stations. These stations recorded magnetic, electric, tilt, resistivity, ground and water temperature data with continuous data telemetry to PHIVOLCS (leading EMSEV team, J. Zlotnicki, Y. Sasai, M.J.S. Johnston, T. Nagao). Migrating intrusions at depths of 5 km to 2.5 km with accompanying seismic, uplift, electromagnetic, hydrologic, thermal and geochemical activity occurred during 2010 under the North edge of the Main Crater Lake (Zlotnicki et al., 2019). More recently, ash and lava eruptions (VEI 4) occurred initially from this shallower source location in January 2020 with accompanying high seismicity (see Addendum below). These latest results clearly indicate that further large episodes of eruptive activity ( $VEI \geq 4$ ) are likely to occur within MCL and from subsidiary cones surrounding the Main Crater.

This international cooperative program has involved teams from Japan, France, USA, Greece, Italy, and Belgium. During the past 15 years of cooperative work, EMSEV provided training to PHIVOLCS members on the installation techniques, analysis of electromagnetic data and the best way to monitor the volcano. Further education of the PHIVOLCS team has included scholarships in Japan (PhD in Japan directed by T. Nagao and Y. Sasai) and Belgium. These skilled scientists from PHIVOLCS can now take over the monitoring tasks and EMSEV will continue to deliver expertise to PHIVOLCS when requested. A number of articles have been jointly published and some others are still in process.

The joint research between EMSEV and PHIVOLCS was evaluated by the Japanese government. As a result, from 2009 to 2014, comprehensive research including electromagnetic studies of Taal volcano was adopted ([SATREPS](#); Science and Technology Research Partnership for Sustainable Development), and various observation networks were renewed. The project strengthened not only electromagnetic observations but also broadband seismometer networks and GNSS observation networks. Furthermore, in FY2016, a new 3-year international research program was adopted by JSPS (project leader; Toshiyasu Nagao), and studies on gravity measurement and volcanic gas were added.

### **EMSEV activity related to Earthquake Processes**

In 2011, EMSEV started a new research effort focused on understanding fault failure and failure mechanisms of earthquakes. This was developed through a cooperative research program with Bishkek Research Station (Bishkek RS) in Kyrgyzstan, Russian Academy of Sciences where outstanding research on the relation between EM phenomena and electrical resistivity changes with earthquakes has been being carried out during the last 30 years.

The cooperative agreement between EMSEV and the Bishkek Research Station was initially signed in November 2011 and renewed during EMSEV workshop in Athens in April 2015.

During the IUGG GA in Montreal, EMSEV and the Bishkek Research Station decided to continue further cooperation not only on electromagnetic study but also seismicity study by using the Kyrgyz seismic network catalog.

## Chinese Seismo-Electric Satellite mission and EMSEV

Following the promising results obtained during the DEMETER mission between 2006 and 2010 (<https://demeter.cnes.fr/en/DEMETER/index.htm>, <http://demeter.cnrs-orleans.fr/>) on the possible statistical significant occurrence of the ionospheric disturbances a few hours prior to large earthquakes (Magnitude above 5), the Chinese Earthquake Administration has implemented a new satellite monitoring program in which a flotilla of dedicated satellites should be regularly launched. The first EM satellite has been launched from China in February 2018. Professor Xuhui Shen, Head Scientist and Coordinator of China Earthquake-related Satellite Missions and Director of the Center of Earthquake Observation from Space, is an EMSEV Country liaison member.

A Memorandum of Agreement between Institute of Crustal Dynamics (CEA) and EMSEV was signed during the *International Conference for the Decade Memory of the Wenchuan Earthquake* held in Chengdu in May 2018 (<http://www.4thicce.com/>).

The purpose of this Agreement is to provide scientific and technical interaction between the two sides for collaborative research on active faults and volcanoes, for theoretical and experimental investigations into physical processes related to earthquakes and volcanic eruptions, for promoting new investigations using electromagnetic and other geophysical methods and to enhance data processing and analyses.

Actually, at the 4<sup>th</sup> CSES meeting in Changsha, more than 20 EMSEV members attended the meeting.

## FUTURE ACTIVITIES

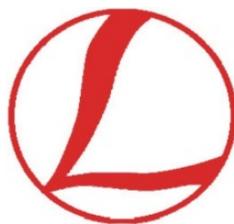
In 2020 EMSEV biennial meeting will be held in Taiwan (<https://irsl.ss.ncu.edu.tw/emsev2020>). Furthermore, EMSEV plans to deeply work in two directions. The first one is to keep strong participation in international meetings such as EGU, AOGS, JpGU, CSES, AGU. In addition, a number of EMSEV members will organize regional meetings and educational workshops as in the Philippines or Kyrgyzstan. The second direction is to strengthen EMSEV activities through international cooperation. This will be achieved by the pursuit of cooperation with Philippines (JPSP-KAKENHI program), Bishkek-Research station, Russian Academy of Sciences (EMSEV) and the development of EMSEV's involvement in the Chinese satellite mission (CSES mission).

### **Addendum: Latest information on January, 2020 Taal Volcano eruption**

On January 12, 2020, the Taal volcano erupted again, 43 years after the 1977 eruption. The eruption started almost suddenly in the main crater on Volcano Island. Before the eruption, local seismic activities were increased. Furthermore, CO<sub>2</sub> gas increased since last September. At the time of the eruption, the population of the Volcano Island was about 8,000. However, in advance, PHIVOLCS provided information on Taal Volcano activity. Therefore, no fatalities were reported. Really PHIVOLCS did a great job.

Toshiyasu Nagao, EMSEV Chair  
Valerio Tramutoli, EMSEV Vice-Chair  
Jann-Yeng Liu, EMSEV Secretary

# THE INTER-UNIONS COMMISSION: International Lithosphere Programme (ILP)



ILP website: <https://www.scl-ilp.org/>

## INTRODUCTION

The International Lithosphere Program (ILP) is a joint project of IUGG and IUGS and receives additional funding from several member states (see financial report). ILP seeks to elucidate the nature, dynamics, origin and evolution of the lithosphere through international, multidisciplinary geoscience research projects –Task Forces (TF) and Regional Coordinating Committees (CC) addressing **major ILP themes: I. Geoscience of global change, II. Contemporary dynamics and deep processes, III. Continental lithosphere, IV. Oceanic lithosphere.**

All TF and CC are led by international teams and supported by ILP with 4,000 Euro per year over a period of 5 years. This “seed money” is used by the project leaders to raise additional funds and build strong interfaces with other projects (ICDP, TOPO-EUROPE, MEDYNA, etc.).

## ADMINISTRATION

ILP operates on the base of terms of reference and has an international Bureau. They meet regularly to monitor the progress and to select new projects in close consultation with the representatives of National Committees. The Bureau is chaired by the President with support from the Secretary General. The ILP Secretariat is located in the German Research Centre for Geosciences in Potsdam (GFZ-Potsdam, Germany). The current ILP Bureau membership is presented below:

President:	H. Thybo	Turkey
Secretary General	M. Scheck-Wenderoth	Germany
Representative of IUGG	H. Gupta	India
Representative of IUGS	K. Asch	Germany
Chair Committee National Representatives:	A. Tibaldi	Italy

On decision of the Bureau 2018 an Advisory Board to ILP has been established that includes the following members: Ö. Adiyaman Lopes (UNESCO), S. Dong (China), C. Ebinger (USA), D. Mueller (Australia), H. Sato (Japan).

The Bureau is also supported by the past president S. Cloetingh (The Netherlands) and by the lifetime members M. von Knorring (Sweden) and H. Gupta (India), by Honorary President A. Green (Switzerland) and ILP Fellow J.F.W. Negendank (Germany).

## Bureau and Business meetings of ILP

An ILP bureau meeting was held that was attended by the president, the SG, the Executive Secretary, the representatives of IUGG and IUGS and the past president of ILP. Major decisions taken include (1) to establish a new TF on “Minerals” and a new CC on the “Himalayan”, (2) to issue an open call for proposals of TF and CC starting with funding in 2021 and (3) to organize sessions at IGC in Delhi and at EGU 2020 for the 40<sup>th</sup> anniversary of ILP.

The annual business meeting was held following the meeting of the ILP bureau at EGU. It was attended by most of the PIs in ILP as well as by guests from IUGG and IUGS. The minutes are available on request. A short report has been given by the president and SG as well as by representatives of IUGG and IUGS on new developments and all active TF and CC reported on their activities and future plans. The second E. Burov medal (2019) was awarded to Luc Lavier from USA. Alexander Koptev (Tübingen, Germany) received the Flinn Hart Award 2018 during the Business Meeting. The minutes were distributed among the Bureau Members and are available on request. The next bureau and business meetings will take place at EGU 2020 in Vienna, Austria are scheduled for Thursday, 8 May 2020, 16:15-18:00 and 18:00 - 19:30.

Dr. Alexander Rudloff, who acted as Executive Secretary for ILP from 2007 on, was elected Secretary General of IUGG at the General Assembly in Montréal, July 2019. Therefore from 2020 onwards he is leaving the secretariat of ILP. Nomination of a new Executive Secretary for ILP will be discussed at the next ILP Bureau meeting, at EGU 2020 in Vienna.

## ACTIVITIES

### Scientific meetings, developments for the different TF and CC:

As every year most of the ILP TF and CC have been visible at the large international meetings EGU AGU, etc. Moreover, most TF and CC contributed to specific conferences within their thematic fields and held dedicated smaller international workshops. The publication activity was significant for most teams and some TF and CC produced Special Issues in peer-reviewed journals.

**TF1** *Lithosphere structure and mineral resources*: This new TF was approved 2019 and thus in the start-up phase. The activities centered at planning TF meetings for the year 2020.

**TF2** *Structural and rheological constraints on magma migration, accumulation and eruption through the lithosphere (Chairs: A. Tibaldi, Italy and A. Gudmundsson, U.K.)*: The efforts during this last year of activity were mostly devoted: 1) to produce funded research projects, and 2) to carry on the various researches under an active international collaboration. In regards to point 1), a new major project started under Horizon 2020 with 5.4 million Euro of funding, including 20 institutions of 9 European countries. The full publication list of TF2: [www.ilptaskforce2.unimib.it](http://www.ilptaskforce2.unimib.it).

**TF3** *The seismic cycle at continental transforms from seismological observation and forward simulation (Chairs: M. Bohnhoff, Germany and O. Heidbach, Germany)*: Plans for the GONAF observatory extension ([gonaf-network.org](http://gonaf-network.org)) towards the entire Marmara region are terminated; drilling will start 2020 on two islands. The seismic network SMARTnet on the Armutlu peninsula has been deployed in January 2019. It consists of 40 stations for two years and with the focus to study the seismotectonic setting of the Armutlu peninsula. Furthermore, with the monitoring of the only offshore segment of the NAFZ in the Marmara region a specific question is to investigate if this segment is creeping or not.

**TF 4** *Fate of the subducted continental lithosphere: insight through analytical mineralogy and microstructures (Chairs: L. Dobrzhinetskaya, U.S.A. and J. Zhang, China)*: established interactive international network with scientists/educators through AGU e-platform to promote Earth sciences

student engagements in online education and increasing non-Earth sciences students' interaction with online virtual field and virtual laboratory experiences.

**TF 6:** *Sedimentary Basins (Chairs: L. Matenco, Netherlands and F. H. Nader, France):* The 14th Workshop of the ILP TF VI on Sedimentary Basins "Understanding the multi-scale formation and evolution of orogens and sedimentary basins" took place with great success 15-19 October 2019, Heviz, Hungary, dedicated to the memory of Frank Horvath with 120 international participants (<https://ilp19.webnode.hu>). A special issue in Global and Planetary Change will document the results of this workshop and is currently in progress.

**TF 8:** *Lithosphere dynamics: interplays between models and data (Chair: T. Gerya, Switzerland):* The TF 8 networking activities in 2019 were devoted toward building a bio-geodynamical numerical modelling community aimed at creating new computational tools for simulating influences of geodynamic processes on life evolution. First meeting of the group has taken place on 13 June 2019 and involved 7 scientists from geodynamics, tectonics, computational ecology, computational biology and astronomy. It has been decided to prepare a dedicated ILP Task Force proposal on "Bio-geodynamics of the lithosphere" that has been submitted to ILP.

**TF 9:** *Subduction across scales (SAS) (Chair: P. Agard, France):* A new International Training Network (ITN) project with new researchers and industrial partners is planned to be submitted 2020. A number of new members joined the team and the 2019 workshop held in Pisa, November 2019, dedicated to shallow subduction with additional financial support (5000€) by the university of Pisa.

**CC TOPOEUROPE:** *(Chairs: S. Cloething, Netherlands and S. Willett, Switzerland):* In 2019 the ILP Regional Coordinating Committee was involved in a number of research initiatives, publication activities and organisation of research conferences. These activities engaged a large number of young researchers and created new funding opportunities, allowing employment of a number of young researchers in new projects carried out in the framework of TOPO-EUROPE. Development of initiatives include follow-up of ITN networks TOPO-MOD and Subitop for submission to EU Marie-Curie ITN program, requesting funding for research networks of PhD students.

## FUTURE ACTIVITIES

- Further implement science plan developed during the 35th ILP Anniversary Workshop and the subsequent Bureau Meeting for 2016-2020
- Decide which new Task Forces/Coordinating Committees will be funded 2021-2025
- Anniversary symposia at the IGC meeting 2020 in New Delhi, India, and the EGU 2020 general assembly.
- Several sessions with TF and CC contributions at EGU-GA Vienna, 2020
- Several workshops of individual task forces
- ILP Business and bureau meetings at EGU-GA in Vienna, 2020
- Strengthen links with other IUGG and IUGS programs

## BUDGET REQUEST FOR 2020

To assure continuity and enable us to support our Task Forces and Coordinating Committees we ask for the annual IUGG subvention of 15,000.00 USD.

submitted by  
Hans Thybo, ILP President  
Magdalena Scheck-Wenderoth, ILP Secretary General

# IUGG FINANCIAL REPORT

## INTRODUCTION

In short, this report describes the status of the IUGG finances for the year 2019, the fourth and last year of the IUGG quadrennium 2016-19. The report will be presented at the next Bureau meeting.

The 2016-19 budget was approved at the Council meeting in Prague, July 2015.

The price of 1 unit in 2019 was USD 2,020.

By the end of 2019/beginning of 2020 IUGG has 73 members representing 276 units. 15 members are associate members. On page 117 one can find more details about memberships.

The membership dues paid by members are the economical basis for the activities of IUGG. The situation is right now relatively steady in the sense that the union has a constant number of members and thereby also a constant income basis. There is an ongoing debate of value for money regarding memberships of scientific organizations like IUGG. Therefore, IUGG continues to have focus on the membership issue.

The IUGG accounts are audited by a chartered auditor, PricewaterhouseCoopers (PwC).

The accounting method is a cash flow system, with the money kept in three bank accounts. Therefore, the 4-year accounting for the full budget period gives a more precise description of the financial status of the union than the individual accountings year by year.

In Montreal at the IUGG General Assembly 2019 (IUGG2019) a new Treasurer was elected, Dr. Niels Andersen. This report is prepared by Dr. Aksel Walløe Hansen, Treasurer 1999-2019. A student assists with the keeping order in the IUGG files, writing letters etc. There was no Assistant Treasurer in 2019.

### Content:

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General comments and highlights	page 114
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Membership information and statistics	page 117

# SUMMARY OF THE IUGG ACCOUNTS IN US DOLLARS FOR 2019



## SUMMARY OF IUGG ACCOUNTS 2019

US dollars	Accounts	Budget
<b>RECEIPTS</b>		
1. Membership Subscription	526.626,01	553.500,00
2. ICSU Grants	0,00	
3. Assembly Surcharge	0,00	20.000,00
4. Sales of Publications	824,28	200,00
5. Miscellaneous		
a. Interest	36,86	
b. Gain on exchange	4.272,86	
c. Other	163.252,79	
d. Associations, surcharge	0,00	
6. Total Receipts	695.012,80	573.700,00
7. Cash in hand	700,00	0,00
8. Bank balance on 1/1 2019	798.911,62	544.000,00
9. Check Sum	1.494.624,42	1.117.700,00
<b>EXPENDITURES</b>		
11. Administration		
11.1 Personnel	14.905,03	15.000,00
11.2 Equipment	252,39	1.000,00
11.3 Supplies	102,86	4.000,00
11.4 Communications	1.061,21	5.000,00
11.5 Travel, Administration only	97.824,90	85.000,00
11.6 Miscellaneous	37.035,58	5.000,00
11.6a surcharge	0,00	0,00
11.7 Travel, representation	14.442,71	
12. New initiatives		
12.1 Education and outreach	15.000,00	20.000,00
12.2 Science	19.661,10	20.000,00
13. General Assemblies		
13.1 Organization	312.645,12	10.000,00
13.2 Travel	2.000,00	60.000,00
13.3 Other Travel Grants	2.000,00	40.000,00
14. Symposia	0,00	0,00
15. Annual allocations		
15.1 Annual allocations	186.052,36	272.700,00
16. Dues and Grants		
16.1 ICSU	26.455,54	30.000,00
17. ICSU grants		
17.1	0,00	0,00
18. Union activities		
18.1 GRC, SEDI, CMG, UCIDI	8.000,00	26.000,00
18.2 Inter-Union Science (ILP)	15.211,35	15.000,00
18.3 Liaison Officers	9.089,08	10.000,00
18.4 International Scientific Programs	0,00	6.000,00
18.5 New commissions	0,00	5.500,00
19. Countries in need		
19.1 Travel Grants, General Assemblies	0,00	
20. Fees		
20.1 Professional services	3.187,22	5.000,00
20.2 Bank fees	2.751,08	3.000,00
21. Contingencies	0,00	2.500,00
22. Loss on exchange	0,00	
23. Total Expenditures	767.677,54	640.700,00
24. Balance on 31/12 2019	726.946,88	477.000,00
25. Check sum	1.494.624,41	1.117.700,00
Check sum balance	<b>0,00</b>	

	<b>USD/DKK</b>	
	Exchange rates Line 8	<b>6,536</b> =DEC 31, 2018
January 1, 2020	Line 22	<b>6,688</b> =DEC 31, 2019
Aksel Walloe Hansen	Other	<b>6,667</b> average
	<b>USD/EUR</b>	
	Line 8	<b>0,876</b> =DEC 31, 2018
	Line 22	<b>0,896</b> =DEC 31, 2019
	Other	<b>0,893</b> average

## GENERAL COMMENTS AND HIGHLIGHTS

The annual balance of the IUGG economy is of the same size or bigger than 1 year's turnover. In 2019 IUGG ended up with a deficit of the order USD 70K. This number, however, should be viewed in the light of the delay of the final accounting for IUGG2019. It is also emphasized that IUGG does the accounting in the form of a cash flow system. Therefore, the summary for a full period will be a more robust sign of the economy of IUGG than the individual years.

The summary of the IUGG accounts is shown in USD. It is the sum of three different Danske Bank accounts in USD, EUR and DKK respectively. In addition, IUGG also has a Mastercard account which is used mostly in connection with traveling. Finally, the Treasurer possesses a small amount of cash in US dollars.

A new account has been opened to handle the economy of the Union Commission on Climatic and Environmental Change (CCEC). But this account is not included in the present report. The balance on December 31, 2019 was USD 13,217.02.

The final settlement of the IUGG2019 accounting was delayed. As the money transactions involved the IUGG associations the delay is reflected in several lines in the accounting sheet for 2019: line 3, 5c and 13.1 plus 15.1. In the 2019 accounting these numbers are temporary numbers. The necessary changes according to the IUGG2019 accounting completed in January/February 2020 will be given in the 2020 IUGG accounting.

### Some highlights:

#### Receipts

##### **Line 1, Membership Subscription**

Right now (May 6, 2020) IUGG has received payments equivalent to a total of 203 units for 2019. This number includes payments received in 2020 for 2019. But this money is not included in the account summary shown here. The number 203 is relatively low, but is expected to increase during 2020.

##### **Line 3, Assembly Surcharge**

IUGG received a total of USD 6,210 from IUGG2019. In view of the delay mentioned above the surcharge will be shown in the 2020 accounting.

##### **Line 4, Sales of Publications**

IUGG has signed a contract with Cambridge University Press that gives a small royalty fee.

##### **Line 5.a, Interest**

In 2019 Danske Bank again paid a small amount of interest on the balance of the US dollar account

##### **Line 5.b, Gain on exchange**

This line together with the corresponding line 22 is used to balance the accounts for the particular year. In reality the loss/gain is not necessarily realized in the given year. In 2018 there was a loss. But in 2019 it was a gain. Therefore, in the long run the gain/loss will tend to cancel each other. We lose on exchange when we keep money in EURO and Danish Kroner when the dollar goes up. It should also be noticed that I use an averaged exchange rate during the year.

## Expenditures

By and large there is a good correspondence between accounting and budget although there are some specific deviations.

### **Line 11, Administration**

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### **Line 12, New Initiatives**

Two grants have been paid in 2019, all related to centennial celebrations, line 12.2. In line 12.1 there is only one payment: the agreement with ICTP to organize special outreach/teaching activities.

### **13, General Assemblies**

As already mentioned the accounting for IUGG2019 was not completed by the end of 2019. The final numbers will be included in the 2020 accounting instead.

### **Line 14, Symposia**

In a General Assembly year IUGG does not award meeting grants.

### **Line 15.1, Annual allocations to Associations**

The annual IUGG allocation to the associations (50% of the dues paid the year before) is installed when the financial reports for the previous year are received. The distribution percentages for the period 2016-2019 and the allocations in 2019 are shown in the following table:

	%	2019 amounts in USD
IACS	10.46	28,167
IAG	11.68	31,452
IAGA	15.19	40,904
IAHS	12.39	33,364
IAMAS	15.81	42,574
IAPSO	10.82	29,136
IASPEI	13.19	35,519
IAVCEI	10.46	28,167
		<u>269,283</u>

By definition IACS will get the same contribution as that of IAVCEI.

The amount shown in line 15.1 of the account summary, page 113, is not the same as given by this table. Due to delays in the accounting of IUGG2019 not all payments to the associations were done in 2019.

### **Line 17, ISC grants**

No ISC grant was received in 2019. This line will be taken out of the budget/accounting as of 2020.

### **Line 18, Union activities**

The total number of liaison officers travelling on behalf of IUGG may be higher, but in some cases people are able to other sources of funding. IUGG appreciates this very much.

See page 113 for more details.

### **Line 22, Loss on exchange**

See line 5.b for explanatory details.

## OVERVIEW OF IUGG GRANTS AND ALLOCATIONS

IUGG is supporting science in different ways:

- i) Annual allocation to Associations, line 15 (see further comments on page 115)
- ii) New initiatives, line 12
- iii) Smaller scientific meetings, line 14
- iv) Special grants with ISC, line 17
- v) Union activities, line 18
- vi) Travel grants in connection with General Assemblies, line 13.2

Here follow some main figures for the amounts (in USD) allocated for 2019:

<b>i) Line 15.1 (Associations)</b>		
8 Associations		<b>269,283</b>
<b>ii) Line 12 (New initiatives)</b>		
12.1 ICTP training course activities	15,000	
12.2 2 IUGG grants, in connection with the centennial year	<u>20,000</u>	
Total		<b>35,000</b>
<b>iii) Line 14 (Symposia grants)</b>		
No grants were paid in 2019 (A General Assembly year)		
Total		<b>0</b>
<b>iv) Line 17 (ISC grants)</b>		
No ISC grant in 2019		<u>0</u>
Total		<b>0</b>
<b>v) Line 18 (Union activities)</b>		
18.1 GRC, CCEC	8,000	
18.2 ILP	15,000	
18.3 Liaison officers	5,289	
18.4 No payment in 2019	0	
18.5 UCPS	<u>0</u>	
Total		<b>28,289</b>
<b>vi) Lines 13.2 (Grants in connection with General Assemblies)</b>		
IUGG2019, general contribution CAD 100,000	76,185	
Other IUGG grants/awards in connection with IUGG2019	11,850	
Total		<b>88,035</b>
<b>Grand total</b>		<b>420,607</b>

## MEMBERSHIP INFORMATION AND STATISTICS

As of December 31, 2019, IUGG has 73 members representing 276 units. In 2019 Latvia and Nicaragua were admitted as cat A members.

As of January 1, 2020, 58 members are paying members, 15 members are in associate status. 16 paying members representing 25 units were in observer status on that day. As of today, May 6, 2020 one observer has already paid its dues in arrears, not listed here. Consequently, 15 members are today in observer status, representing 24 units.

In 2019 IUGG welcomed Latvia as a new member.

### In category 1, 8 members, 8 units

Iran (9. year as observer)                      special situation  
 Azerbaijan (5. year as observer)  
 Indonesia (5. year as observer)  
 Vietnam (4. year as observer)  
 Jordan (3. year as observer)  
 Colombia (1. year as observer)  
 Costa Rica (1. year as observer)  
 Mozambique (1. year as observer)

### In category 2, 5 members, 10 units

Nigeria (6. year as observer)  
 Saudi Arabia (4. year as observer)  
 Pakistan (2. year as observer)  
 Chile (1. year as observer)  
 Egypt (1. year as observer)

### In category 3, 2 member, 6 units

Brazil (1. year as observer)  
 Argentina (1. year as observer)

In summary, the membership overview is

Category	No. of members	No. of units/ member	Total units
11	1	35	35
8	3	20	60
7	1	15	15
6	5	10	50
5	3	7	21
4	6	5	30
3	5	3	15
2	16	2	32
1	18	1	18
A	15	0	0
In total	73		276

# ADDITIONAL UNION MATTERS

## Awards and Honors

### IUGG AWARDS

(presented at the IUGG2019)

**IUGG Gold Medal** is bestowed on **William Richard Peltier** (University of Toronto, Canada) for “his scientific contributions that have been pioneering and profound in deep earth physics and climate system processes, and for his unselfish contributions to international scientific collaboration”, in the words of the jury’s citation.

### IUGG Fellows (Honorary Members)

Elected:

**Anny Cazenave** (France) for her invaluable research and tireless contributions to the science of understanding the Earth system evolution, including mean sea level variations;

**Sierd Cloetingh** (Netherlands) for his outstanding contributions to the study of lithosphere dynamics and tectonics, and his active promotion of international science cooperation in Earth and space sciences;

**Shuanggen Jin** (China) for his contribution to satellite navigation and space geodesy and his active promotion of international cooperation in Earth and space sciences;

**Barbara Romanowicz** (France/USA) for her seminal contribution in seismological studies from crust to inner core, including obtaining robust 3-D models of inelasticity on a global scale, locating the origin of the Earth’s hum and launching GEOSCOPE, the first global broadband seismological network;

**Soroosh Sorooshian** (USA) for his exceptional contributions and international cooperation leadership in hydrologic sciences from basic to applied research and to operational use worldwide;

**Philip Woodworth** (UK) for his significant advancement of sea-level science and outstanding contributions to international scientific cooperation, and especially his leadership of the Permanent Service for Mean Sea Level (PSMSL);

**Jun Xia** (China) for his outstanding contributions to hydrological science including the basis for sustainable water utilization by developing a nonlinear time-variant system approach, and international cooperation for sustainable water management as an engine for social and economic sustainable growth.

Conferred:

**IUGG:** Nasser Abou-Assour (Egypt), Isabelle Ansorge (South Africa), Tom Beer (Australia), Harsh Gupta (India), Zoltan Hajnal (Canada), Pierre Hubert (France), Alik Ismail-Zadeh (Germany/Russia), Jan Krynsky (Poland), David Rhoades (New Zealand), Kenji Satake (Japan)

**IACS:** Charles Fierz (Switzerland), Andrew Mackintosh (Australia)

**IAG:** Hermann Drewes (Germany)

**IAHS:** Hubert Savenije (Netherlands)

**IAMAS:** Athena Coustenis (France), Teruyuki Nakajima (Japan), John Turner (UK), Hans Volkert (Germany)

**IAPSO:** Eugene Morozov (Russia), Johan Rodhe (Sweden), Denise Smythe-Wright (UK)

**IASPEI:** Domenico Giardini (Switzerland), Thorne Lay (USA), Peter Suhadolc (Italy)

**IAVCEI:** Ray Cas (Australia), Donald Dingwell (Germany/Canada), Joan Marti (Spain)

**IUGG Early Career Scientist Awardees**

**Juan Carlos Afonso** (Australia), Seismology

**Amir AghaKouchak** (USA), Hydrology

**Emilie Capron** (UK), Climatology

**Ira Didenkulova** (Russia), Oceanography

**Marie Dumont** (France), Cryospheric Sciences

**Binbin Ni** (China), Aeronomy

**Katrin Schröder** (Italy), Oceanography

**Flavia Tauro** (Italy), Hydrology

**Takeshi Tsuji** (Japan), Seismology

**Qiuzhen Yin** (Belgium), Climatology

The IUGG President presented the Union awards to the Gold Medalist, the elected Fellows, and the Early Career Scientists Awardees on 13 July 2019 at the Award Ceremony, and to the conferred Fellows on 17 July 2019 at the Closing Ceremony of the 27th IUGG General Assembly.



After the Award Ceremony. First row (from the left to the right) – Executive Secretary Franz Kuglitsch, Secretary General Alik Ismail-Zadeh, Vice-President Kathryn Whaler, President Michael G. Sideris, Gold Medalist William Richard Peltier; IUGG Fellows: Anny Cazenave, Barbara Romanowicz, Soroosh Sorooshian, and Jun Xia. Second row (from left to right) – Early Career Scientist Awardees: Juan Carlos Afonso, Amir AghaKouchak, Emilie Capron, Ira Didenkulova, Marie Dumont, Binbin Ni, Katrin Schröder, Takeshi Tsuji, and Qiuzhen Yin

## ASSOCIATIONS AWARDS

(presented at the IUGG2019)

### IACS Awardees

- **Dough Brinkerhoff** (USA) and **Denis Felikson** (USA) were awarded the 2019 Early Career Scientist Award

### IAG Awardees

- **Christoph Reigber** (Germany) was awarded the 2019 Levallois Medal
- **Michal Sprlak** (Australia) was awarded the 2019 Guy Bomford Prize
- **Minghui Xu** (China) was awarded the 2017 Young Authors' Award
- **Athina Peidou** (Canada) was awarded the 2018 Young Authors' Award

### IAGA Awardees

- **Catherine Johnson** (Canada) was awarded the 2019 Shen Kuo Award for Interdisciplinary Achievements
- **Martin Berg** (Norway) was awarded the 2019 Long Service Medal
- **Tomasz Gonet** (UK), **Deepak Kumar Karan** (India), **Evgenii Shirokov** (Russia), and **Kseniia Tlatova** (Russia) were awarded the 2019 Young Scientist Awards

### IAHS Awardees

- **Sandra Pool** (Switzerland), and **Marc Vis** (Switzerland) were awarded the 2019 Tison Award

#### IAMAS Awardee

- **Lei Bi** (China) was awarded the 2019 Early Career Scientist Medal

#### IAPSO Awardees

- **Corinne Le Quéré** (UK) was awarded the 2019 Prince Albert I Medal
- **Gerard McCarthy** (Ireland) was awarded 2019 Early Career Scientist medal in physical ocean science
- **Mar Benavides** (France) was awarded the 2019 Early Career Scientist medal in chemical ocean science

#### IASPEI Awardee

- **Brian L. N. Kennett** (Australia) was awarded the 2019 Medal

#### IAVCEI Awardees

- **Madeleine Humphreys** (UK) was awarded the 2019 Wager Medal
- **Fabian Wadsworth** (UK), and **Damien Gaudin** (Germany) were awarded the 2019 Walker Price

#### OTHER AWARDS

The **American Geophysical Union** (AGU) awarded the following scientists who have been active in IUGG at the 2019 AGU Fall Meeting in San Francisco CA, USA:

**Amir AghaKouchak** (USA), IUGG Early-Career Scientist Awardee, received the James B. Macelwane Medal.

**Zuheir Altamimi** (France), President of IAG, was elected AGU Fellow.

**Benjamin F. Chao** (China-Taipei), former IAG National Correspondent for China-Taipei, was elected AGU Fellow.

**Ulrich R. Christensen** (Germany), Executive Committee Member of SEDI, received the Inge Lehmann Medal.

**Véronique M. A. Dehant** (Belgium), Vice-President of the IUGG National Committee for Belgium delivered the William Bowie Lecture (Geodesy Section).

**Efi Foufoula-Georgiou** (USA), IAHS National Correspondent for the USA delivered the Walter B. Langbein Lecture (Hydrology Section).

**Kosuke Heki** (Japan), former Secretary of the IUGG National Committee for Japan, was elected AGU Fellow.

**Gauthier Hulot** (France), Executive Committee Member of SEDI delivered the Edward Bullard Lecture (Geomagnetism, Paleomagnetism, and Electromagnetism Section).

**Alik Ismail-Zadeh** (Germany), IUGG Secretary General (2007-2019), received the Ambassador Award.

**Alan G. Jones** (Ireland), IAGA National Correspondent for Ireland, was elected AGU Fellow.

**Kuo-Fong Ma** (China-Taipei), Secretary of the IUGG National Committee for China-Taipei, was elected AGU Fellow.

**Barbara A. Romanowicz** (USA/France), IUGG Fellow and former Executive Committee Member of IASPEI, received the William Bowie Medal.

**Chunmiao Zheng** (China), former President of the IAHS International Commission on Groundwater (ICGW), was elected AGU Fellow.

The **European Geosciences Union** (EGU) awarded the following scientists who have been active in IUGG at the 2019 EGU General Assembly in Vienna, Austria:

**Daniel N. Baker** (USA), former Member of the IAGA Executive Committee, was awarded the Hannes Alfvén Medal.

**Günter Blöschl** (Austria), President of IAHS, was awarded the John Dalton Medal.

**Andreas Kääb** (Norway), former Member of the GRC Executive Committee, was awarded the Louis Agassiz Medal.

**Tonie van Dam** (Luxembourg), Member of the CCEC Executive Committee, was awarded the Vening Meinesz Medal.

The **Mexican Geophysical Union** (UGM), awarded **Hugo Delgado Granados** (Mexico), President of the Mexican IUGG National Committee, the 2019 Manuel Maldonado Koerdell Medal at the 2019 UGM Annual Meeting in Puerto Vallarta, Mexico.

The **European Research Council** (ERC) awarded 2 of its current 37 prestigious research prizes to: (i) **Veronique Dehant**, Vice-President of the Belgian IUGG National Committee, **Anne Cazenave**, IUGG Fellow, and **Mioara Manda**, IAGA President, for “GRACEFUL - Probing the deep Earth's interior by synergistic use of observations of the magnetic and gravity fields, and of the rotation of the Earth”, and (ii) **Domenico Giardini**, IASPEI Past President, **Massimo Cocco**, IASPEI National Correspondent for Italy, and colleagues for “FEAR – Fault Activation and Earthquake Rupture”.

**Anny Cazenave** (France), IUGG Fellow, was a joint winner of the 2019 **BBVA Foundation** Frontiers of Knowledge Award in Climate Change.

**Sierd Cloetingh** (Netherlands), IUGG Fellow, was elected honorary Fellow of the **Royal Astronomical Society**.

**Priscilla Grew** (USA), Member of the IUGG Finance Committee, celebrated 50 years as a member of **AGU** with the AGU leadership at the AGU Headquarters in Washington DC, USA.

**Valérie Masson-Delmotte** (France), IACS Executive Committee Member and co-Chair of the IPCC WG1, was selected by **Nature** (journal) as one of ten people who mattered in the year 2018.

## Roland List (1929-2019)



Professor Roland List passed away on 26 January 2019. He was a distinguished cloud physicist and Secretary General (1995-2007) of the International Association of Meteorology and Atmospheric Sciences (IAMAS) of IUGG. Roland had a long and highly successful career in the atmospheric sciences and contributed to international cooperation and coordination of meteorology through his service to the IAMAS community and via the World Meteorological Organization (WMO), where he was Deputy Secretary General in the 1980s. Roland was born in Frauenfeld, Switzerland in 1929 and graduated from ETH Zurich before working for the Swiss Federal Institute for Snow and Avalanche Research in Davos.

In 1963 he moved to the University of Toronto where he established a world-leading cloud physics group that thrived under his leadership. During his time at the University of Toronto, he supervised 44 Masters and 33 PhD students, many of whom have gone on to have distinguished careers of their own in the atmospheric sciences. Roland served IUGG as a Liaison Officer to WMO and the World Climate Research Programme. He had a long association with the IAMAS International Commission on Clouds and Precipitation, of which he was an honorary member. One of the IAMAS tasks that Roland took great pride in carrying through was offering funding and assistance for young scientists with limited funding to come to IAMAS and IUGG assemblies, building the global scientific community. He really enjoyed bringing people together and arranging times for the newly and long-graduated to mix and learn from each other.

The atmospheric sciences community lost a bright colleague, good friend and wonderful man. We extend our condolences to his family.

*(written by John Turner, IAMAS President 2015-2019 and  
Michael MacCracken, IAMAS President 2003-2007)*

## Walter H. Munk (1917-2019)



Walter H. Munk passed away on Friday, 8 February 2019 at his home in La Jolla, California, at the age of 101. Munk was born on 19 October 1917 in Vienna, Austria-Hungary, and in 1932, his family sent him to New York for school. After spending a few years working for a banking company, Munk decided that banking was not for him and he applied to and was accepted at the California Institute of Technology. Here he received a bachelor's degree in physics in 1939 and a master's degree in geophysics in 1940. Most of his working life was spent at Scripps Institution of Oceanography, California.

Walter was one of the foremost oceanographers of the 20th century. His interests in the environment were widespread. Saying himself, "During my career I have worked on rather too many topics to have

done a thorough job on any one of them”. Many of us would disagree with his assessment of the impact that he made on our understanding of the oceans. A geophysicist by initial training, he pioneered work on waves, tides, acoustics, ocean circulation, mixing and internal waves to name just a few.

In 2001, during the joint IAPSO/IABO assembly in Mar del Plata, Argentina, IAPSO awarded Walter its inaugural Prince Albert I Medal. There was little doubt that Walter was one of the ‘fathers of oceanography’ and nobody was more deserving than him to receive the award. Many oceanographers will remember the occasion, when Munk gave a wonderful lecture entitled “The evolution of physical oceanography in the last hundred years”, which not only covered the science, but also many anecdotes from his scientific career. Throughout the Assembly he was often seen exuberantly chatting away to younger scientists and more mature colleagues.

Despite his advancing years, he continued to support IAPSO and in 2015, at the age of 98, he was invited to give two talks, one on acoustics and the other on internal waves, at the IUGG/IAPSO Assembly in Prague. It is a mark of the esteem in which he was held that Walter attracted a large audience, many from the other disciplines of the IUGG family. His breadth of knowledge of colleague’s work was outstanding, and we are sad that we will no longer be able to listen to his brilliant talks except through historical recordings.

Munk was elected to the U.S. National Academy of Sciences in 1956 and to the Royal Society of London in 1976. In 1983, Munk was awarded the U.S. President’s National Medal of Science, and in 1999, the Kyoto Prize in Basic Sciences for his fundamental contributions to the field of oceanography. In 2018, Munk received the French Legion of Honor with the rank of Chevalier (Knight) for his exceptional contributions to oceanography.

His passing is a great loss to oceanography, but he was and will continue to be an inspiration to young and old. The IAPSO community will always remember meetings and interaction with this ‘Einstein of the oceans’ (a term used by the New York Times after his receipt of the Kyoto Prize); scientific discussions with Walter were always of great value. Further information about Walter is given in the [obituary](#) posted by Scripps Institution of Oceanography.

*(written by Denise Smythe-Wright, IAPSO President 2015-2019)*

## **Sergey A. Fedotov (1931-2019)**



On 20 August 2019, we lost a renowned Russian geophysicist, seismologist and volcanologist, Doctor of Physical and Mathematical sciences, Professor of Geophysics Academician Sergey Alexandrovich Fedotov.

Sergey Fedotov was born 19 March 1931 in Leningrad, USSR. After graduating from the Department of Geology at the Lomonosov Moscow State University in 1953, Sergey Fedotov was accepted to the graduate program at the Schmidt Institute of Physics of the Earth (IPE) of the Russian Academy of Sciences, and since then his scientific career and research were closely tied to Russian geophysics.

Field work in the Kuril Islands defined the professional trajectory of Sergey Fedotov – his entire life was dedicated to studying the volcanic activity and seismicity of the Kuril-

Kamchatka trench. He went from a graduate student at IPE to leading the IPE Pacific seismic team in 1959 – 1970, to head of laboratory of Pacific belt seismicity at IPE in 1969 – 1993, to director of the Institute of Volcanology and Seismology of the Far East branch of the Russian Academy of Sciences (IVS FEB RAS) in 1971 – 2004. The outstanding results of research in seismic hazards of the Kamchatka region and the study of mechanisms of volcanic activity gave Sergey Fedotov acclaim in national and global scientific communities. In 1992 he was elected a full member of the Russian Academy of Sciences (RAS). In 1979 – 1983 he served as president of the International Association of Volcanology and Chemistry of the Earth's Interior. He was a member of the presidium of the Russian Academy of Sciences, head of the scientific council of volcanology and seismology RAS and held the office of the head of the Earthquake prediction council at IVS FEB RAS and the Kamchatka branch of the RAS Geophysical Survey. In 1978 Sergey Fedotov founded the Volcanology and Seismology journal and remained its editor-in-chief for many years.

Research in Kamchatka seismicity allowed Fedotov to create a proprietary technique for long-term seismic hazard prediction which is being actively developed in the works of his like-minded colleagues and mentees. Sergey Fedotov introduced the concept of seismic cycle in seismology. It was due to his pronounced expert opinion and citizen activism that a nuclear power plant was not built in the Petropavlovsk-Kamchatsky region.

Fedotov was the author of about 400 scientific papers, patents, and monographs.

His professional enthusiasm and enormous advocacy efforts that Fedotov made to ensure seismic safety of the population and human made structures of Kamchatka through scientific justification of emergency measures to increase safety of residential and industrial buildings in the most seismically hazardous region of Russia are well known in the academic community and at the highest levels of political authority. Successful resolution of these problems is directly connected to the economic development of Kamchatka and national security. Fedotov's contributions to public safety on the federal level were granted multiple national awards.

The memory of Sergey A. Fedotov will remain a highlight page in the history of global and national geophysics.

*(written by Alexey Zavyalov, Russian Academy of Sciences)*

## **Alexey V. Nikolaev (1934-2019)**



On 20 November 2019 a grave disease claimed the life of deputy editor-in-chief of the *Volcanology and Seismology* journal, corresponding member of the Russian Academy of Sciences Alexey Vsevolodovich Nikolaev - a prominent member of the national and global geophysical community who made a significant contribution to research in seismology, earthquake prediction, geodynamics, and other areas of theoretical and applied geophysics.

An internationally acclaimed scientist, Alexey V. Nikolaev developed original geophysical methods and techniques for studying the structure and the dynamics of the Earth and received with their help a series of outstanding results in fundamental geophysics. He held a rightful place in the top echelons of Russian and global geophysics.

Alexey Nikolaev was born 29 October 1934 in Moscow, USSR. In 1957, he graduated from the department of geology at the Lomonosov Moscow State University and was assigned to the Schmidt Institute of Physics of the Earth of the Academy of Sciences of the USSR, with which he was affiliated throughout his entire life and where he rose from a lab technician to head of department of Physical Basics of Exploration Geophysics and, later on, director of the Specialized Institute for Experimental Geophysics. Nikolaev's research interests were broad and encompassed seismicity of random media, geophysical monitoring, nonlinear geophysics, earthquake prediction, seismic tomography, vibroseismic research, induced seismicity, vibration influence on oil deposits, geophysical metrology, and other areas of contemporary geophysics. Alexey Nikolaev was a participant in the Chernobyl accident clean-up effort. Days after the 26 April 1986 disaster, he traveled to the contaminated area of the Chernobyl power plant to conduct the necessary research under high-risk radiation exposure levels. His scientific achievements were honored by his election to the Academy of Sciences of the USSR as a corresponding member in 1990.

Alexey Nikolaev made a significant contribution to training the next generation of scientists. He was a talented teacher, a brilliant lecturer, a friendly and responsive person. Aleksey Vsevolodovich was an opponent of dozens of dissertations, both doctoral and candidate works. And the number of reviews of dissertations and reviews of various kinds cannot be calculated. His numerous grateful PhD students and followers work fruitfully in many scientific organizations of Russia and the former Soviet Union countries.

Alongside research, Alexey Nikolaev conducted multifaceted scientific administrative work. For many years he led the Russian expert council of earthquake prediction and seismic risk and hazard assessment with the Ministry for Civil Defense, Emergency Management, and Disaster Response and the Russian Academy of Sciences. He maintained close ties with researchers from many countries globally and was elected to serve on governing bodies of several international scientific structures. In 1983 – 1991 he served as vice-president and in 1991 – 1995 as president of the International Association of Seismology and Physics of the Earth's Interior – IASPEI.

Alexey Nikolaev authored over 400 scientific papers and innovations. In 1998 he was awarded the title of Laureate of the Prize of the Government of the Russian Federation in the field of science and technology.

We knew Alexey Nikolaev not only as a gifted scholar, but as a wonderful, friendly, compassionate person with incredible integrity and sense of humor that helped him to preserve optimism and stamina even during the final days of his illness.

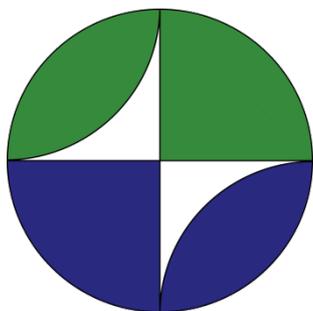
Alexey Nikolaev's scientific research will remain a bright spot in global and national geophysics and the memory of this outstanding scientist and exceptional person will always be in our hearts.

*(written by Alexey Zavyalov, Russian Academy of Sciences)*

# LIST OF ACRONYMS

AAAS	American Association for the Advancement of Science
AGU	American Geophysical Union
AOGS	Asia Oceania Geosciences Society
APECS	Association of Polar Early Career Scientists
CAST	China Association for Science and Technology
CCEC	Commission on Climatic and Environmental Changes
CCTF	Consultative Committee for Time and Frequency
CEA	China Earthquake Administration
CMG	Commission on Mathematical Geophysics
CNC-IUGG	Chinese National Committee for Geodesy and Geophysics
CODATA	Committee on Data for Science and Technology
COSPAR	Committee on Space Research
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
DFG	German Research Foundation
EGU	European Geosciences Union
EMSEV	IAGA/IASPEI/IAVCEI Inter-Association Working Group on Electromagnetic Studies of Earthquakes and Volcanoes
GEO	Group on Earth Observation
GGOS	Global Geodetic Observing System
GOOS	Global Ocean Observing System
GRC	Commission on Geophysical Risk and Sustainability
IACS	International Association of Cryospheric Sciences
IAEA	International Atomic Energy Agency
IAG	International Association of Geodesy
IAGA	International Association of Geomagnetism and Agronomy
IAHS	International Association of Hydrological Sciences
IAMAS	International Association of Meteorology and Atmospheric Sciences
IAPSO	International Association for the Physical Sciences of the Ocean
IASPEI	International Association of Seismology and Physics of the Earth's Interior
IAU	International Astronomical Union
IAVCEI	International Association of Volcanology and Chemistry of the Earth's Interior
ICACGP	International Commission on Atmospheric Chemistry and Global Pollution
ICAE	International Commission on Atmospheric Electricity
ICAO	International Civil Aviation Organization
ICCL	International Commission on Climate
ICCP	International Commission on Clouds and Precipitation
ICDM	International Commission on Dynamical Meteorology
ICMA	International Commission on the Middle Atmosphere
ICPAE	International Commission on Planetary Atmospheres and their Evolution
ICPM	International Commission on Polar Meteorology
ICSU	International Council for Science
ICTP	Abdus Salam International Centre for Theoretical Physics
IGCP	International Geoscience Programme
IGOS-P	Integrated Global Observing Strategy Partnership
IGU	International Geographical Union
IHP	International Hydrological Programme
ILP	International Lithosphere Program
INQUA	International Union for Quaternary Research

INTERMAGNET	International Real-time Magnetic Observatory Network
IOC	UNESCO Intergovernmental Oceanographic Commission
IOC	International Ozone Commission
IRC	International Radiation Commission
IRDR	Integrated Research on Disaster Risk
ISC	International Science Council
ISC	International Seismological Centre
ISPRS	International Society for Photogrammetry and Remote Sensing
ISSC	International Social Sciences Council
IUGG	International Union of Geodesy and Geophysics
IUGS	International Union of Geological Sciences
IUSS	International Union of Soil Sciences
IUTAM	International Union of Theoretical and Applied Mechanics
JBGIS	Joint Board of Geospatial Information Societies
NKGG	German National Committee for Geodesy and Geophysics
OECD	Organisation for Economic Co-operation and Development
ÖNK	Austrian National Committee for IUGG
PAIGH	PanAmerican Institute of Geography and History
PHIVOLCS	The Philippines Institute of Volcanology and Seismology
ROA	ISC Regional Office for Africa
ROAP	ISC Regional Office for Asia & the Pacific
ROLAC	ISC Regional Office for Latin America and the Caribbean
SCAR	Scientific Committee on Antarctic Research
SCOR	Scientific Committee on Ocean Research
SCOSTEP	Scientific Committee on Solar-Terrestrial Physics
SEDI	Study of the Deep Interior of the Earth
UCDI	Union Commission on Data and Information
UCPS	Union Commission on Planetary Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISDR	United Nations International Strategy on Disaster Reduction
UNOOSA	United Nations Office for Outer Space Affairs
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
URSI	International Union of Radio Science
WCRP	World Climate Research Programme
WDS	ISC World Data System
WMO	World Meteorological Organization
WPMG	Western Pacific Geophysics Meeting
WSF	World Science Forum
VAACs	Volcanic Ash Advisory Centers
VASAG	Joint WMO-IUGG Volcanic Ash Scientific Advisory Group



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