

Report on UK activities related to the International Union of Geodesy and Geophysics (IUGG) during 2020

Overview

Kate Heal, University of Edinburgh, Chair UK Committee for IUGG

UK scientists hold positions of responsibility centrally in the IUGG and within most of its Associations. Senior positions for 2019-2023 include:

- IUGG President: Kathryn Whaler (University of Edinburgh);
- IUGG Liaison Officers: UNESCO Intergovernmental Oceanographic Commission - Denise Smythe-Wright (National Oceanography, NOC), ISC Scientific Committee on Antarctic Research - John Turner (British Antarctic Survey, BAS), Group on Earth Observations - Kathryn Whaler;
- IUGG Capacity Building & Education Committee Chair: Thorsten Wagener (University of Bristol);
- IACS Secretary General: Richard Essery (University of Edinburgh);
- IAPSO Early Career Scientist Working Group Chair; Alejandra Sanchez-Franks (NOC).

Additionally, 10 IUGG Fellows are from the UK. Senior positions within the individual Associations of IUGG that are currently held by UK scientists include: IAGA and IASPEI Executive Committees; IAMAS Past-President, President/President-Elect of four of IAHS' 10 Commissions, IAHS Treasurer.

The IUGG Bureau (led by Kathryn Whaler) is reviewing IUGG activities and how IUGG operates to ensure that IUGG continues to best support Earth sciences research, innovation, impact and networking internationally, especially for early career scientists and in developing countries, during and after the COVID-19 pandemic.

The IUGG grants program has continued, with the latest awards in July 2020. Key priority areas for grants include creation of new knowledge in Earth and space sciences; dissemination of knowledge, data and information; and Geoscience for sustainable development, policy, education and outreach.

The UK hosts/leads IUGG and IUGG Association services to the international science community

- Permanent Service for Mean Sea Level (PSMSL) of IAG responsible for the collection, publication, analysis and interpretation of sea level data from the global network of tide gauges. Based at NOC, Liverpool, under the current directorship of Lesley Rickards.
- International Seismological Centre (ISC) an international non-governmental body with strong links with IASPEI, under the current directorship of Dmitry Storchak. In 2019 the ISC Seismological Dataset Repository was launched, which allows individual researchers or groups to submit seismological data to be openly available to the scientific community.
- The IAPSO Standard Seawater Service is the only internationally recognised standard for the calibration of salinity measurement devices, ensuring the quality and comparability of salinity data worldwide. The service has been hosted since 1989 by an SME in Hampshire, Ocean Scientific International Limited (OSIL). The demand for IAPSO standard seawater remains strong and the service is currently contributing to groups globally involved with the S.I. traceability relating to density.
- International GNSS Service working group on Satellite Vehicle Orbital Dynamics chaired by Marek Ziebart (UCL).
- Peter Clarke (University of Newcastle) is a member of the IGS (International GNSS Service) Reference Frame Working Group.
- The IAHS office (employing 4 staff) is based at the UK Centre for Ecology & Hydrology (Wallingford).

Activities of the UK Committee for IUGG

In line with the four-year membership cycle of the UK Committee for IUGG, in early 2020 the Chair – Joanna Haigh (Imperial College London) - and Secretary – Goodwin Gibbins (Imperial College London) – stood down and were succeeded by Kate Heal (University of Edinburgh) as Chair, and Mike Simpson (HR Wallingford) as Secretary. Also in 2020, Peter Clarke (University of Newcastle) came to the end of term as the UK National Representative for the International Association of Geodesy (IAG), and was succeeded by Richard Walters (University of Durham). The contributions of outgoing UK Committee members is gratefully acknowledged.

Although the COVID-19 pandemic meant that in person IUGG and Association meetings, summer schools, etc. from March 2020 were moved online, postponed or cancelled, UK scientists have been active in contributing to the re-formatting of these meetings and in participating.

The annual meeting of the UK Committee for IUGG was held online in May 2020, including special invitees of UK scientists with positions of responsibility centrally in the IUGG. In addition to reporting on recent and planned activities, participants gave feedback on the IUGG General Assembly in July 2019 and discussed priorities for IUGG activities in the next few years, including how best to engage with scientists worldwide when in person activities are restricted.

The Chair of the UK Committee for IUGG input to the Global Environment Research Committee (GERC) of the Royal Society (as an Ex-Officio member) at their 2020 meetings focused on “Climate change and biodiversity” and “Technology for the Environment”.

Kate Heal liaised with the IUGG Secretariat to submit applications for the UK membership dues to IUGG to the new International Organisation Membership Fees Grant scheme administered by the Royal Society. Funding has been awarded for 2020 and 2021, and the application for 2022 membership dues has been submitted.

UK Annual Reports

In the following pages are presented the annual reports for 2020 from the UK national representatives to the IUGG Associations.

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF CRYOSPHERIC SCIENCES (IACS)

Bryn Hubbard, University of Aberystwyth, UK National Representative to IACS

The current Secretary General of IACS, to serve until 2023, is Richard Essery of the University of Edinburgh. Richard chaired IACS' virtual Annual Meeting in November 2020.

In 2020, the IACS established a new Joint IACS-IAPSO Commission on Ice-Ocean Interactions. The Commission's Working Group is to be co-chaired by Isabel Nias (University of Liverpool).

In 2020, the IACS renewed the Working Group on the Randolph Glacier Inventory. Working Group Members include Tobias Bolch (University of St Andrews) and James M. Lea (University of Liverpool).

UK-based scientists were integral to the Working Group on Glacier ice thickness estimation, which has now completed its term and continued to publish high-quality outputs through 2020. G. Hilmar Gudmundsson (Northumbria University) served on the WG's Advisory Board, while Jonathan Carrivick (University of Leeds), Julian Dowdeswell (Scott Polar Research Institute), William James (University of Leeds), Carlos Martin (British Antarctic Survey), and Ann Rowan (University of Sheffield) all served as Working Group Members.

The IACS supported the attendance of Jacqueline Campbell (University College London) to attend the (IACS supported) Seventh International Conference on Mars Polar Science and Exploration, held January 13-17, 2020 in Ushuaia, Argentina. Jacqueline presented "Hyperspectral Mapping of the Martian South Polar Residual Cap Using Laboratory Analogues and Orbital Imagery".

IACS continues to operate and liaise closely with several professional bodies, including the International Permafrost Association (IPA), the International Arctic Scientific Committee (IASC), the Scientific Committee for Antarctic Research (SCAR), Climate of the Cryosphere (CliC), and the International Glaciological Society (IGS).

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF GEODESY (IAG)

Richard Walters, University of Durham, Incoming UK National Representative to IAG
Peter Clarke, University of Newcastle, Outgoing UK National Representative to IAG

The Mission of the Association is the advancement of geodesy. IAG implements its mission by furthering geodetic theory through research and teaching, by collecting, analyzing, modelling and interpreting observational data, by stimulating technological development and by providing a consistent representation of the figure, rotation and gravity field of the Earth and planets, as well as their temporal variations. (www.iag-aig.org)

The annual IAG EUREF Symposium (www.euref.eu) was cancelled due to COVID-19. The UK's national mapping agencies continue to base their respective GNSS datums on the ETRF89 which in turn derives from the IAG's International Terrestrial Reference Frame.

Similarly the IGS Workshop (www.igs.org) due to be held in Boulder, Colorado in August 2020 was postponed until March 2021 (provisionally). Peter Clarke (Newcastle University) continues as a member of the IGS Reference Frame Working Group.

Marek Ziebart (UCL) continues as chair of the International GNSS Service working group on Satellite Vehicle Orbital Dynamics.

John Elliott (University of Leeds) has been awarded the 2020 John Wahr Early Career Award (formerly the Geodesy Section Award) by the American Geophysical Union.

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF GEOPHYSICS AND AERONOMY (IAGA)

Mark Clilverd, British Antarctic Survey, UK National Representative to IAGA

The International Association of Geomagnetism and Aeronomy (IAGA) is subdivided into the following Divisions and Commissions with working groups on subjects of interest: Division I: Internal Magnetic Fields; Division II: Aeronomic Phenonema; Division III: Magnetospheric Phenonema; Division IV: Solar Wind and Interplanetary Field; Division V: Geomagnetic Observatories, Surveys and Analyses; Division VI: Electromagnetic Induction in the Earth and Planetary Bodies. The UK is one of about 70 member countries.

During 2020 IAGA has been preparing for a Joint Scientific Assembly of two Associations of the IUGG, IAGA and IASPEI, to be hosted by the Indian National Science Academy in Hyderabad (India), August 21-27, 2021. Unfortunately due to COVID-19 the meeting has recently taken the decision to move online. Although details are limited at present, the IAGA part of the scientific assembly will involve many UK scientists as convenors. There is also UK representation on the IAGA executive committee (1 out of the 11 members), and via chairs of working groups (5 chairs or co-chairs).

Typically during alternate years when there are no IUGG or IAGA meetings scheduled – which includes 2020 – IAGA co-sponsors smaller workshops in related fields. Almost all of the sponsored workshops listed for 2020 were postponed until 2021 or 2022 because of the global corona virus situation. However, IAGA did sponsor one workshop that went ahead in 2020, i.e., the 9th workshop of the URSI/IAGA Joint Working Group on ELF/VLF Remote Sensing of Ionospheres and Magnetospheres (VERSIM) hosted online by Kyoto University, Japan, in November 2020, which involved UK participants, and a UK chair.

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES (IAHS)

Adie Collins, Rothamsted Research, UK National Representative to IAHS

UK-based scientists continue to play prominent roles in various International Association of Hydrological Sciences (IAHS) scientific commissions: Adrian Collins (Rothamsted Research) is the ICCE (International Commission on Continental Erosion) President, Chris White (University of Strathclyde) is Secretary of ICCLAS (International Commission on Coupled Land-Atmosphere Systems), Melody Sandells (CORES) is the ICSIH (International Commission on Snow and Ice Hydrology) President-Elect, Wouter Buytaert (Imperial College, London) is President of ICWQ (International Commission on Water Quality) and Stefan Krause (University of Birmingham) Vice-President, and in the ICSW (International Commission on Surface Water) David Hannah (University of Birmingham) is President-Elect and Honeyah Iravani (UCL) is the early career representative. In addition, Kate Heal (University of Edinburgh) is IAHS Treasurer and Chair of IAHS Ltd and Helen Houghton-Carr (UK Centre for Ecology & Hydrology) is IAHS Ltd Secretary.

Adrian Collins (Rothamsted Research) was on the international scientific organisation committee for the ICCE stand alone conference on River sediment quality and quantity – environmental, geochemical and ecological perspectives to be held in Bydgoszcz, Poland. This meeting was originally planned for June 1-5 2020 but given the COVID-19 pandemic, has now been postponed to 2022. The UK Centre for Ecology & Hydrology also planned the Hydro-JULES summer school on Modelling hydrology and global change in July 13-17), but this was also postponed (to 2021) due to the COVID-19 pandemic. Des Walling was on the international scientific organising committee for the International Conference on the Status and Future of the World's Large Rivers planned for August (3-7) in Moscow. This has now been postponed till August (2-6) 2021. The planned 11th Annual Catchment Science Summer School (September 30 – September 4) which involves UK scientists including David Hannah (University of Birmingham) was likewise postponed till 2021 (August 219 – September 3). Adrian Collins (Rothamsted Research) and Carline Clason (University of Plymouth) both contributed talks to MEGAPOLIS 2020 - The School for Young Scientists on "Pollutant and sediment mobility in river systems: monitoring studies to identify human impacts" which was held online November 25-27, 2020. Ian Foster (University of Northampton) was guest editor for a special issue in the international journal *Catena* organised on behalf of ICCE following an ICCE-led session at IUGG 2019 in Montreal. This special issue is entitled "Using fingerprinting, monitoring and modelling to explore erosion, connectivity and transfers in catchment sediment systems".

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF METEOROLOGY AND ATMOSPHERIC SCIENCES (IAMAS)

Tom Lachlan-Cope, British Antarctic Survey, UK National Representative to IAMAS

COVID-19 has meant several of the symposium that were due to take place during 2020 have been postponed until 2021. In particular the International Conference on Clouds and Precipitation that was due to take place in India in August 2020 will now take place a year later. Also, the International Radiation Symposium in Greece has been postponed until June 2021. Finally the 2021 IAMAS-IAPSO-IACS Assembly will now be virtual and held over the original dates of 18-23 July 2021 with a limited programme.

The International Commission on Polar Meteorology secretary is Tracy Moffat-Griffin from the British Antarctic Survey. The immediate past president of IAMAS is John Turner also from the British Antarctic Survey.

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION FOR THE PHYSICAL SCIENCES OF THE OCEANS (IAPSO)

Michael Meredith, British Antarctic Survey, UK National Representative to IAPSO

The IAPSO Early Career Scientist (ECS) Working Group was founded in 2018, and has developed and extended its activities through 2019/2020. Under the leadership of Alejandra Sanchez-Franks (UK) and Malin Ödalen (Sweden), this group contributed strongly to the IUGG General Assembly in 2019, and has extended its virtual reach with the creation of a website (<https://www.iapsoecs.org>) and a twitter account (https://twitter.com/iapso_ecs?s=20) where newsletters, job opportunities, cruise opportunities and ECS-related events are regularly posted. There are now over 100 members in this group. The IAPSO ECS Working Group organized and submitted a review of the Second Order Draft of the Working Group I (WG1) contribution to the sixth IPCC Assessment Report.

A new joint commission between IAPSO and IACS is being established on the interactions between ice (both sea ice and ice shelves) and the ocean. Two co-chairs have been identified (Felicity McCormack, Monash University Melbourne, and Isabel Nias, University of Liverpool), who are now working to populate the joint commission with members from across the relevant scientific communities. This development has the potential to generate significant new advances concerning some of the most rapid and important changes in the Earth system relevant to the ocean.

IAPSO endorsed the following two scientific meetings that were supported by IUGG:
Workshop on Sea Level Data Archaeology, which took place in Paris, France, 10-12 March 2020.
Tsunamis in Latin America and the Caribbean: Recent Developments and Plans for the Future, Quito, Ecuador, 3-5 August 2020. This meeting has been postponed due to the COVID pandemic.

Following their initiation in 2019, IAPSO has now begun to fund IAPSO Best Practice Study Groups, expecting to fund one of these per year. An IAPSO Best Practice Study Group will address an issue whose resolution will assist in the conduct of oceanographic research. In carrying out oceanographic research, a choice must frequently be made between a few 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 are usually not published or well known. Each Best Practice Study Group will receive up to US\$10,000 towards the costs of a meeting. In January 2020, the first two such IAPSO Best Practice Study Groups were funded (out of nine quality applications), one led by the UK National Oceanography Centre (NOC) and concerned with the use of data from moored CTD instruments, and the other with the measurement accuracy and interpretation of pH measurements.

2021 Assembly: IAPSO had been actively organizing the IAPSO-IAMAS-IACS Joint Assembly in Busan, South Korea, 18-23, July 2021, but in early June 2020, it was decided to cancel this in-person joint assembly, due to the COVID-induced uncertainty surrounding international travel. There are now active discussions regarding what IAPSO on-line activity might occur on these same dates in 2021, and/or whether the meeting in Busan might simply be postponed by twelve months.

2023 General Assembly: The next General Assembly of IUGG is scheduled for Berlin, 12-19 July 2023, at which IAPSO will actively participate.

There are many ongoing discussions concerning activities that should be prioritised within the UN Decade of the Ocean for Sustainable Development, and several IAPSO representatives are giving input to these. For example, the Royal Society's GERC convened a meeting in October 2020 to scope the UK's priorities for actions under the Decade, with Mike Meredith and other IAPSO members participating and chairing sessions/breakouts. Themes that emerged included sea level rise (causes, projections, impacts, responses), the response of the ocean to multiple stressors, the deep ocean, and so on. It is hoped that the creation of strategic funding bids can flow from these scoping activities.

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF SEISMOLOGY AND PHYSICS OF THE EARTH'S INTERIOR (IASPEI)

James Hammond, Birkbeck, University of London, UK National Representative to IASPEI

This year has been dominated by the COVID-19 pandemic meaning many activities planned have been postponed or cancelled. Of particular note was the postponement of the European Seismological Commission (ESC) 37th General Assembly in Corfu, Greece to 19-24 September 2021. Some meetings moved online, such as the European Geosciences Union (EGU) meeting nominally held in Vienna. Based on affiliation the UK had the 2nd highest participation (2624 people), second only to Germany (4,169). A second meeting that moved online was SEDI 2020 (Study of the Earth's Deep Interior). At this meeting, 23% of participants (42 people) were affiliated with UK institutions. A further online meeting is the American Geophysical Union conference from 1-17 December, which as usual was well represented by UK scientists. It is also worth noting here that the 2021 joint IAGA-IASPEI meeting in Hyderabad, India in August 2021 will be a virtual meeting.

Within the UK, 2020 saw the publication of a community led document sponsored by the British Geophysical Association (BGA) on 'the future of broadband passive seismology'. This aims to describe the key science drivers for passive seismology and the equipment and facilities needed to deliver this. The aim is to build support for new infrastructure in the future. The full report can be found here: <https://geophysics.org.uk/outreach/supporting-uk-passive-seismology/>.

The United Kingdom (Oxford University) continues to host the International Seismological Centre (ISC) that acts under the supervision of IASPEI/IUGG. During 2020, the ISC has been registered as a charitable incorporated organization (CIO) under the Charity Commission for England and Wales. During the past year, by collaboration with ~150 institutions in ~100 countries, the ISC continued with production and update of a number of products that are widely used by UK and international scientific community and referenced in several hundred research publications (ISC Bulletin (1964-2020), ISC-EHB database (1964-2017), ISC-GEM catalogue (1904-2016), IASPEI reference event list (1964-2018), ISC event bibliography (1904-2020), International seismological contacts (2005 – present) and ISC seismological dataset repository (open access archive of datasets)).

2020 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF IAVCEI

Sally A. Gibson, University of Cambridge. UK National Representative to IAVCEI

The Volcanic and Magmatic Studies Group (VMSG), chaired by Sally Gibson, is a joint special interest group of the Mineralogical Society of Great Britain and Ireland, and the Geological Society of London, and is the official UK representative for IAVCEI.

UK-based scientists continue to play prominent roles in numerous *International Association of Volcanology and Chemistry of the Earth's Interior* (IAVCEI) scientific commissions: Kathy Whaler (University of Edinburgh) is the IUGG President and co-leader of IASPEI/IAVCEI Joint Commission on Physics and Chemistry of Earth Materials; Dr Claire Horwell (Durham University) is sole lead on the International Volcanic Health Hazard Network (IVHHN); Dr Mike Widdowson (University of Hull) is Vice-Chair of the Commission on Large Igneous Provinces; Prof Jurgen Neuberg (University of Leeds) is co-leader of the IASPEI/IAVCEI Commission on Volcano Seismology and Acoustics; Carina Fearnley (UCL) is Secretary of the Cities and Volcanoes Commission of IAVCEI, and co-founded and leads the World Organisation of Volcanoes (WOVO) Volcano Alert Level Working Group; Janine Kavanagh (University of Liverpool) is co-leader of Commission on Volcano and Igneous Plumbing Systems. James Hickey has been serving on the committee of the IAVCEI ECRNet and helped to organise several virtual panel events related to careers in and outside academia.

Three UK volcanologists (Prof Kathy Cashman, University of Bristol; Dr Mike James, University of Lancaster; Dr Richard Brown, Durham University) serve on the editorial board of IAVCEI's journal, the *Bulletin of Volcanology*. Members of the VMSG community have also been involved in the successful nomination of organisations for IAVCEI awards, e.g. IG-EPN for the IAVCEI Surveillance Award.

Due to the COVID-19 pandemic, the Cities on Volcanoes Commission of IAVCEI postponed its meeting in Greece until June 2021. The Scientific Organising Committee for this meeting contains several VMSG members (Profs Tamsin Mather & David Pyle, University of Oxford & Dr Claire Horwell, University of Durham).