

Report on UK activities related to the International Union of Geodesy and Geophysics (IUGG) during 2022

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 Centre, NOC), ISC Scientific Committee on Antarctic Research - John Turner (British Antarctic Survey, BAS), Group on Earth Observations - Kathryn Whaler;
- 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 & IAPSO Past-Presidents, President/President-Elect of four of IAHS' 10 Commissions, IAHS Treasurer, Chair of International Permafrost Association Nominations & Awards Committee.

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. IUGG and Association postholders have contributed strongly to planning and populating the scientific programme for the 28th IUGG General Assembly being held in Berlin, 11-20 July 2023. A new special session "Big Themes" format is being launched at the Assembly. These are condensed 90 minutes discussion-focussed sessions on topics of wide contemporary interest, such as Open Science, Early Career Scientists, Diversity, Equality, Inclusion, and Contributions to Disaster Risk Reduction.

The IUGG 2020-2023 grants program had its final call in 2022 dedicated to the 2022 International Year of Basic Science for Sustainable Development.

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

- Permanent Service for Mean Sea Level (PSMSL) of IAPSO 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 Elizabeth Bradshaw.
- 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.
- The International GNSS Service working group on Satellite Vehicle Orbital Dynamics is 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 2022, Ekbal Hussein (British Geological Survey) filled the vacancy for the UK National Representative for the International Association of Geodesy (IAG). In line with the maximum eight-year term for UK National Representatives, Mark Clilverd (British Antarctic Survey) came to the end of term as the UK National Representative for the International Association of Geomagnetism and Aeronomy (IAGA) and was replaced by Jonathan Rae (Northumbria University). The contributions of outgoing UK Committee members is gratefully acknowledged and new Committee members are welcomed.

With the easing of travel restrictions after the COVID-19 pandemic, in person IUGG and Association meetings, summer schools, etc. resumed in 2022. UK scientists have been active in contributing to the organisation of these meetings and in participating.

The annual meeting of the UK Committee for IUGG was held online in May 2022, with a focus on infrastructure for IUGG science. Each UK National Representative identified the international science infrastructure associated with their particular Association and also highlighted UK infrastructure needs. A broad definition of “infrastructure” was used, including field observatories, equipment, scientific services, data and data products and centres. Infrastructure was identified available through international collaborations and scientific community, and also through UKRI-funded facilities accessible to UK scientists. It was noted that future science infrastructure needs to consider personnel and data handling, archiving and access, as well as equipment.

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 2022 meeting focused on “Risks to the future of forests”.

UK Annual Reports

In the following pages are presented the annual reports for 2022 from the UK national representatives to the IUGG Associations.

2022 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF CRYOSPHERIC SCIENCES (IACS)

Isabel Nias, University of Liverpool, UK National Representative to IACS

The current Secretary General of IACS, to serve until 2023, is Richard Essery of the University of Edinburgh.

Several UK scientists are contributing members of the three active IACS working groups:

- Regional Assessments of Glacier Mass Change (RAGMAC) (2019-2023): Tobias Bolch, Gregoire Guillet, Owen King (University of St Andrews), Robert McNabb (Ulster University), Noel Gourmelen (University of Edinburgh)
- Randolph Glacier Inventory (RGI) and its role in future glacier monitoring and GLIMS (2020-2023): James Lea (University of Liverpool), Tobias Bolch (University of St Andrews)
- Debris Covered Glaciers (2018-2022): David Quincey (University of Leeds)

Two UK scientists are on the committee of the Joint IACS-IAPSO Commission on Ice-Ocean Interactions (JCIOI), representing IACS: Isabel Nias (University of Liverpool) is serving as co-chair and Donald Slater (University of Edinburgh) is a vice-chair. In October 2022 JCIOI hosted an international online workshop, which included invited keynote speakers and participants from the UK.

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).

**2022 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION
OF GEODESY (IAG)**

No report submitted

2022 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF GEOPHYSICS AND AERONOMY (IAGA)

Jonathan Rae, Northumbria University, UK National Representative to IAGA

The main event of 2022/23 for IAGA was the preparation for the 28th IUGG Assembly in Berlin, to be held 11-20 July 2023, including the discussion by the Executive Committee on nominations for the IUGG Early Career Scientist Award.

Several topical meetings were held in 2022 with significant UK involvement. The main IAGA-related workshops were the 11th Workshop on Long-term Changes and Trends in the Atmosphere (Helsinki, Finland), and the 8th IAGA/ICMA/SCOSTEP Workshop on Vertical Coupling in the Atmosphere/Ionosphere System (Sopron, Hungary), both hybrid meetings with significant IAGA contributions and 40-60 participants across both platforms. Each workshop agreed to a special issue in “Frontiers in Astronomy and Space Science” and “Atmospheric Chemistry and Physics”, respectively. The annual International School of Space Science was held in L’Aquila, Italy, on “Radiation Belt Dynamics and Remote Sensing of the Earth’s Plasmasphere” and attracted 15 leading scientists to present an overview of the key physical processes surrounding this space weather hazard to 33 students and early career researchers across the world, many of which were from the UK. IAGA have also since 2021 engaged with the International Association for Physics Students (IAPS) to encourage students to build connections inside and outside of academia and break social and cultural barriers within the field and promoting IAGA-led research across the IAPS membership.

2022 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES (IAHS)

Adie Collins, Rothamsted Research, UK National Representative to IAHS

Report provided by Kate Heal, University of Edinburgh

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) Past President, Chris White (University of Strathclyde) is Secretary of ICCLAS (International Commission on Coupled Land-Atmosphere Systems), Melody Sandells (CORES) is President of ICSIH (International Commission on Snow and Ice Hydrology), Wouter Buytaert (Imperial College, London) is Past 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. Honeyah Iravani (UCL) was the early career representative for ICSW until the mandate of the 2nd Early Career Committee of IAHS began in June 2022. 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.

In person meetings resumed in 2022 after cancellations/postponements or online meetings in 2020 and 2021 due to the COVID-19 pandemic. The major IAHS activity in 2022 was the XIth IAHS Scientific Assembly 30 May-3 June 2022 in Montpellier, France. It was a very successful in-person meeting with over 600 attendees from 65 countries. The Scientific Assembly was the opportunity to celebrate the 100-year anniversary of IAHS, to look forward to the end of the Panta Rhei decade which will close in 2023, to accelerate progress on the 23 UPHs - Unsolved Problems in Hydrology, and support Agenda 2030 in water-related fields. The Assembly included workshops targeted at early career scientists and also at Open Science and Equality, Diversity and Inclusion (ED&I). UK-based hydrologists organised a number of Symposia within the programme and contributed talks and posters.

Adrian Collins (Rothamsted Research) continued to be on the international scientific organisation committee for the ICCE stand-alone conference on “River sediment quality and quantity – environmental, geochemical and ecological perspectives”. The meeting was finally held 17-21 October 2022 in Bydgoszcz, Poland, in hybrid format, following postponement from May 2020 due to the COVID-19 pandemic. The UK Centre for Ecology & Hydrology prepared and advertised the Hydro-Jules winter school (10-14 January 2022).

The 13th Annual Catchment Science Summer School (28 August –23 September 2022) was delivered in person again, and involved a number of UK scientists including David Hannah (University of Birmingham) and Chris Soulsby (Aberdeen University).

Looking forward to 2023, UK-based hydrologists have contributed to the design of Symposia within the IAHS programme during the 28th IUGG General Assembly in July 2023 in Berlin, Germany.

2022 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

2022 has seen normality return to IAMAS activity after COVID. One positive legacy has been several online seminar series that have been set up by individual commissions (International Commission on Planetary Atmospheres, International Commission on Polar Meteorology and the International Commission on Clouds and Precipitation). These seminar series have proved very popular and will hopefully carry on.

Preparations for the 28th IUGG General Assembly in Berlin are well advanced with several UK scientists convening sessions.

Tracy Moffat-Griffin (British Antarctic Survey) continues as secretary of the International Commission on Polar Meteorology.

Meetings:

- The ICACGP/IGAC joint International Atmospheric Chemistry Conference took place in Manchester in September 2022.
- The Quadrennial International Radiation Symposium took place in Greece in July 2022.
- 11th International Workshop on Long-Term Changes and Trends in the Atmosphere in Finland in May 2022 (sponsored by IAMAS)
- Workshop on Vertical Coupling in the Atmosphere-Ionosphere System July 2022 in Hungary (sponsored by ICMA)

2022 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION FOR THE PHYSICAL SCIENCES OF THE OCEANS (IAPSO)

Katy Sheen, University of Exeter, UK National Representative to IAPSO

IAPSO Early Career Scientist Working Group

The IAPSO Early Career Scientist (ECS) Working Group was established in 2018, chaired by Alejandra Sanchez-Franks (United Kingdom) and co-chaired by Malin Ödalen (Sweden). Along with other international committee members is Marina Azaneu from the UK. The IAPSO ECS group website (<https://www.iapsoecs.org>) and twitter account, with 492 followers, (https://twitter.com/iapso_ecs?s=20) continue to be active with newsletters, job and research cruise opportunities, ECS-related events and educational videos routinely updated.

IAPSO Best Practice Study Groups

IAPSO continues to fund Best Practice Study Groups, groups of experts of temporary duration that support aspects in relation to measurement, analysing and processing data or modelling systems. Currently there are four groups all with UK members which are listed here: <https://iapso-ocean.org/activities/best-practice-study-groups.html>. The next call will be released in Autumn of 2023.

IAPSO/IACS joint Commission on Ice-Ocean Interactions

The joint commission between IAPSO and IACS which focusses on the interactions between ice (both sea ice and ice shelves) and the ocean is now well established. In terms of UK representation on the committee, Isabel Nias (University of Liverpool) is a co-chair and Donald Slater (University of Edinburgh) a vice-chair. The commission has a website on which relevant workshops, events, papers and conferences are posted (<https://sites.google.com/view/jcioi/home>)

CoP27

Numerous IAPSO members were involved in the United Nations Framework on Climate Change (UNFCCC) Conference of Parties 27 in Egypt.

IAPSO Medals

Calls for the IAPSO Albert I medal 2023 and Early Career Scientist medal 2023 were issued earlier in the year. Presentation of awards will be made at the IUGG 2023 General Assembly in Berlin.

Permanent Services

The Permanent Service for Mean Sea Level (PSMSL), based at the National Oceanography Centre in Liverpool, UK, and the IAPSO Standard Seawater Service contracted to OSIL in Havant, UK both continue as vital oceanographic services. In addition, the Joint Committee on the Properties of Seawater (JCS), on which there are UK members, continues as a permanent group of experts, providing a 'point of contact' for seawater questions and maintenance of the knowledge and software for the marine community (www.teos-10.org).

2022 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 saw the return to more normal UK IASPEI activities, with a number of in person meetings allowing the community to come together once more. The highlight was the British Geophysical Association sponsored British Seismology Meeting held at Cambridge from September 12-14, followed immediately by the BGA Postgraduate Research in Progress meeting 15-16 September. The meeting covered many areas of seismology from the deep Earth, earthquakes, cryosphere, machine learning and geophysical inversion to instrumentation. 111 seismologists from the UK and further afield attended the BSM, with 43 students and 17 other geophysicists attending the PGRIP meeting (including many seismologists from all career stages attending both meetings). The next BSM meeting will be organized by the International Seismological Centre in 2024 with the location for PGRIP 2023 currently undecided. Other meetings of interest to UK seismology included the 38th general assembly of the European Seismological Commission, where, together with an excellent science programme, two UK seismologists were elected to the executive committee (Dmitry Storchak, President. and Illaria Mosca, Member).

Alongside regular EGU and AGU meetings, a highlight on the calendar for 2023 is the IUGG meeting in Berlin. This includes many sessions led by UK seismologists including S01: Observational Seismology, S02: International, National, Regional and Local Networks and Earthquake Data Centers: Highlights and Challenges, S12: Recent Devastating Earthquakes, JS01: Cryoseismology, JA01: Machine Learning in Geo-, Ocean and Space Sciences, JA02: Data Assimilation and Statistical Learning in Earth and Space Sciences, JA03: Analogue Data for the future: Preservation and utilization of historical data in the geosciences, JV04: Volcano Seismology, JV05: Strain Localisation and volcanic hazards,

Finally, the UK (Oxford University, The Royal Society) continue to host the International Seismological Centre (ISC) that acts under the supervision of IASPEI/IUGG. During past year, by collaboration with ~150 institutions in ~100 countries, the ISC continued with production and update of the following products that are widely used by UK and international scientific community and referenced in several hundred research publications:

- ISC Bulletin (1964-2022)
- ISC-EHB Dataset (1964-2019)
- ISC-GEM catalogue (1904-2018)
- IASPEI Reference Event List (Ground Truth list) (1964-2020)
- ISC Event Bibliography (1904-2022)
- International Seismological Contacts (started in 2005 following the Great Sumatara Earthquake, with support and encouragement from IUGG)
- ISC Seismological Dataset Repository - allows individual researchers or groups to submit seismological datasets that they wish to be openly available to scientific community for a long period of time, especially to assist free access to data used in scientific publications.
- ISC Electronic archive of printed station/network bulletins (1904 - circa 1970)

In addition, the ISC continued to host, maintain and update the IASPEI website (<http://www.iaspei.org/>) as a service to the international research community.

2022 REPORT FOR UK IUGG COMMITTEE ON THE INTERNATIONAL ASSOCIATION OF VOLCANOLOGY AND CHEMISTRY OF THE EARTH'S INTERIOR (IAVCEI)

*Tamsin Mather, University of Oxford. UK National Representative to IAVCEI and
Janine Kavanagh, University of Liverpool, Secretary, VMSG*

Volcanic & Magmatic Studies Group (VMSG) report on UK involvement in IAVCEI in 2022

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 (Edinburgh) is the IUGG President and co-leader of IASPEI/IAVCEI Joint Commission on Physics and Chemistry of Earth Materials;
- Dr Claire Horwell (Durham) is Director of the International Volcanic Health Hazard Network (IVHHN);
- Dr Mike Widdowson (Hull) is co-leader of the Commission on Large Igneous Provinces;
- Prof Jurgen Neuberg (University of Leeds) is leader of the IASPEI/IAVCEI Commission on Volcano Seismology and Acoustics;
- Dr. 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;
- Dr. Sam Mitchell (University of Bristol) leads the IAVCEI Commission on Submarine Volcanism
- Dr. Janine Kavanagh (University of Liverpool) is Chair of the Commission on Volcano and Igneous Plumbing Systems.
- Dr. Andrew Bell (Edinburgh) leads the IAVCEI Commission on Statistics in Volcanology;
- Dr. Paul Albert (Swansea) is the leader of the IAVCEI Commission on tephrochronology;
- Jamie Farquharson (Lancaster University) and Ailsa Naismith (Bristol University) have been serving on the committee of the IAVCEI ECRNet and helped to organise some recent ECR webinars.

Input of UK scientists to IAVCEI activities in 2022

Three UK volcanologists (Dr Mike James (Lancaster); Dr. John Smellie (Leicester); Dr. Carmen Solana (Portsmouth)) serve on the editorial board of IAVCEI's journal, the Bulletin of Volcanology.

In the past year a new IAVCEI ECR Reading Group was started and this is being led by UK volcanologists Thomas Aubry (Exeter), Hannah Buckland (Swansea), Nick Barber (Cambridge), Isabel Fendley (Oxford), Anna Brookfield (Oxford) and Alice Paine (Oxford).

The IAVCEI Commission on VIPS has a regular blog series called "Focus on VIPS" which is led by UK volcanologists Caitlin Chalk (Liverpool), Kerys Meredith (Birmingham), Michal Camejo-Harry (Oxford) and Jade Hrintchuk (Liverpool).

The UK had a strong presence at IAVCEI's Cities on Volcanoes conference which was held in Crete this summer. In total 65 UK volcanologists attended, leading pre- and post-conference workshops, chairing sessions and giving oral and poster presentations. Dr Claire Horwell (Durham) gave a plenary lecture and Dr. Carina Fearnley (UCL) was a key organiser of the conference. Prof. Ralf Gertisser (Keele) led a post-conference fieldtrip to Santorini.

2023 will see important contributions from UK volcanologists to the IAVCEI General Assembly in New Zealand (January) and IUGG in Berlin (July).