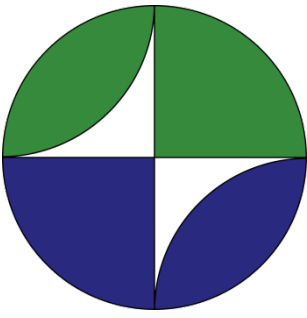


INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS
UNION GEODESIQUE ET GEOPHYSIQUE INTERNATIONALE

Annual Report 2021



INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS
UNION GEODESIQUE ET GEOPHYSIQUE INTERNATIONALE

v.06-2022

No ISSN: 1038-3846

TABLE OF CONTENTS

TABLE OF CONTENTS	1
INTRODUCTION	2
GENERAL INFORMATION	5
MESSAGE FROM THE PRESIDENT	10
MESSAGE FROM THE SECRETARY GENERAL	12
IUGG ACTIVITIES	14
ACTIVITIES OF THE UNION ASSOCIATIONS	30
International Association of Cryospheric Sciences (IACS)	31
International Association of Geodesy (IAG)	35
International Association of Geomagnetism and Aeronomy (IAGA)	42
International Association of Hydrological Sciences (IAHS)	47
International Association of Meteorology and Atmospheric Sciences (IAMAS)	50
International Association for the Physical Sciences of the Oceans (IAPSO).....	61
International Association of Seismology and Physics of the Earth’s Interior (IASPEI)	66
International Association of Volcanology and Chemistry of the Earth’s Interior (IAVCEI)	70
ACTIVITIES OF THE UNION COMMISSIONS	73
Union Commission on Climate and Environmental Change (CCEC).....	73
Union Commission on Mathematical Geophysics (CMG)	75
Union Commission on Geophysical Risk and Sustainability (GRC).....	78
Union Commission on the Study of the Earth’s Deep Interior (SEDI)	81
Union Commission on Data and Information (UCDI)	83
Union Commission on Planetary Sciences (UCPS).....	87
THE INTER-ASSOCIATION WORKING GROUP: Electro-magnetic Studies of Earthquakes and Volcanoes (EMSEV)	89
THE INTER-UNIONS COMMISSION: International Lithosphere Programme (ILP)	95
IUGG FINANCIAL REPORT	99
ADDITIONAL UNION MATTERS	106
Awards and Honors	106
Obituary.....	109
LIST OF ACRONYMS	111

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.

The IUGG is comprised of eight semi-autonomous International Associations, each responsible for a specific range of topics or themes within the overall scope of the Union activities. Each Association establishes commissions, divisions, services, working groups, or other entities. In addition, IUGG establishes Union Commissions and other activities to conduct inter-association science (see page 3).

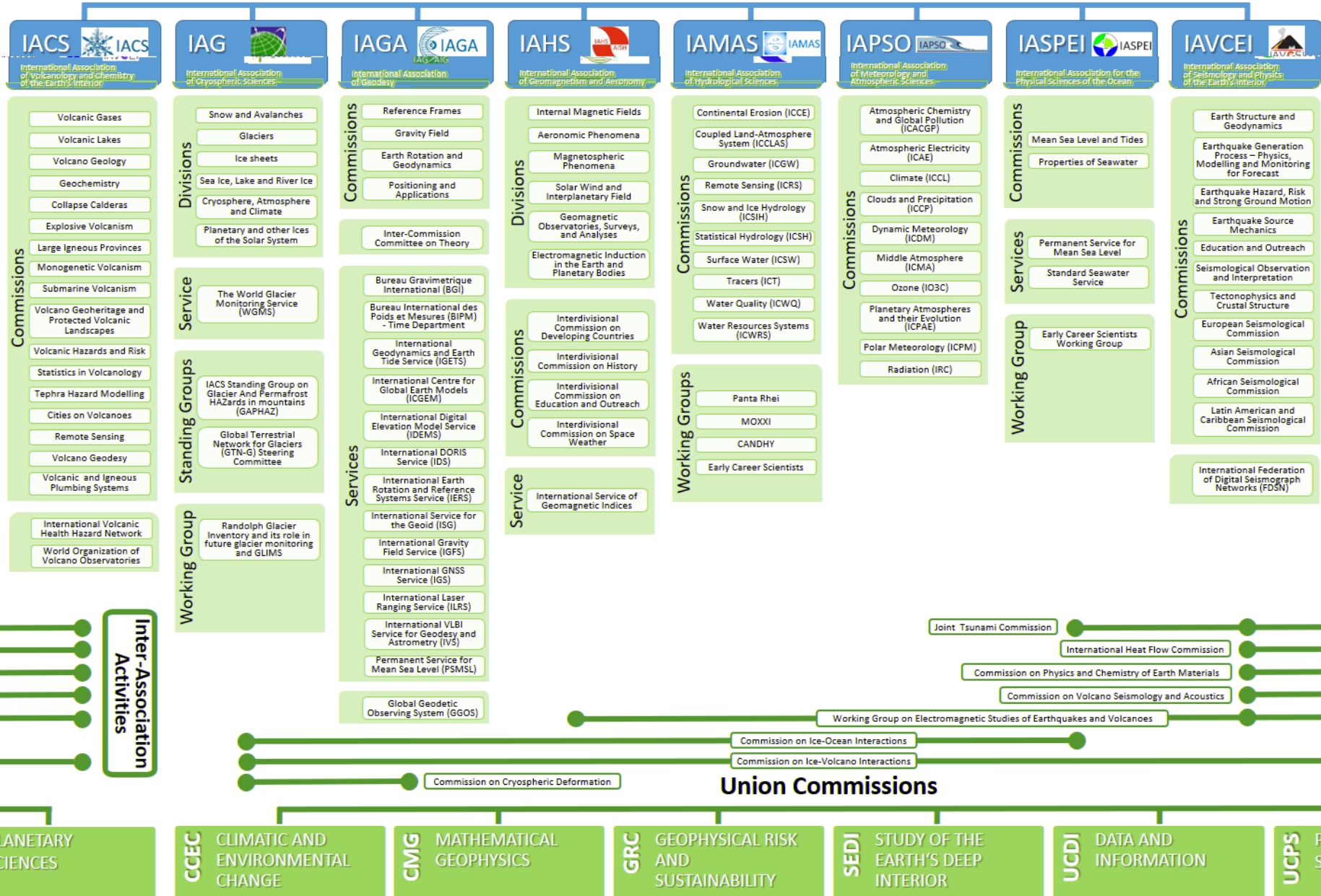
IUGG is one of over 40 scientific unions adhering to the International Science Council (ISC). ISC provides a global forum for scientists to exchange ideas and information and to develop standard methods and procedures for all fields of research. IUGG brings expertise on Earth studies from researchers in its International Associations and 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. These programs have set a model for international and interdisciplinary cooperation in geosciences (see page 4).

The work of IUGG is related to that of many other scientific organizations. Some of these are inter-governmental such as those affiliated with the United Nations (UN); some are Interdisciplinary Bodies of ISC, and others are organizations of particular interest to specific Associations (see page 4).

International Union of Geodesy and Geophysics (IUGG)

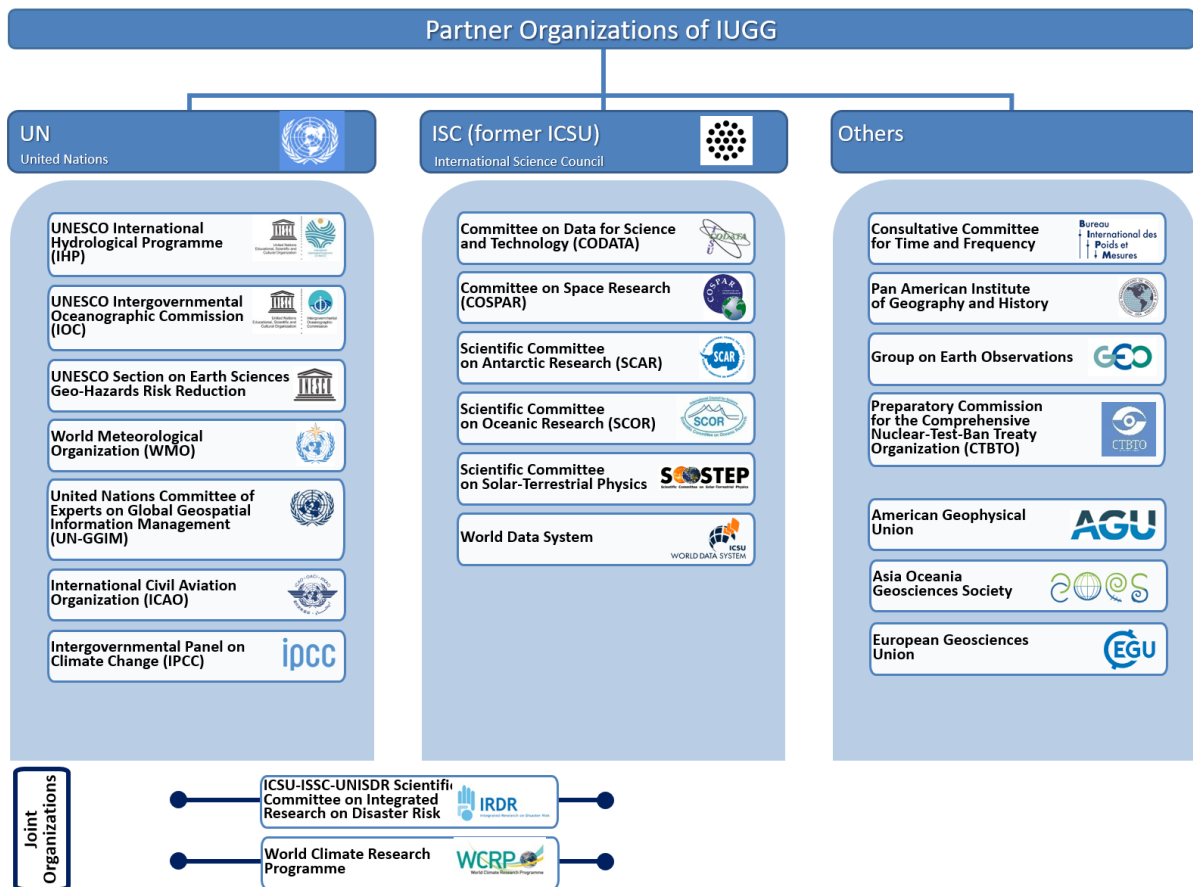
Associations



Programs and Projects initiated and/or supported by IUGG

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

Programs and Projects initiated and/or supported by IUGG



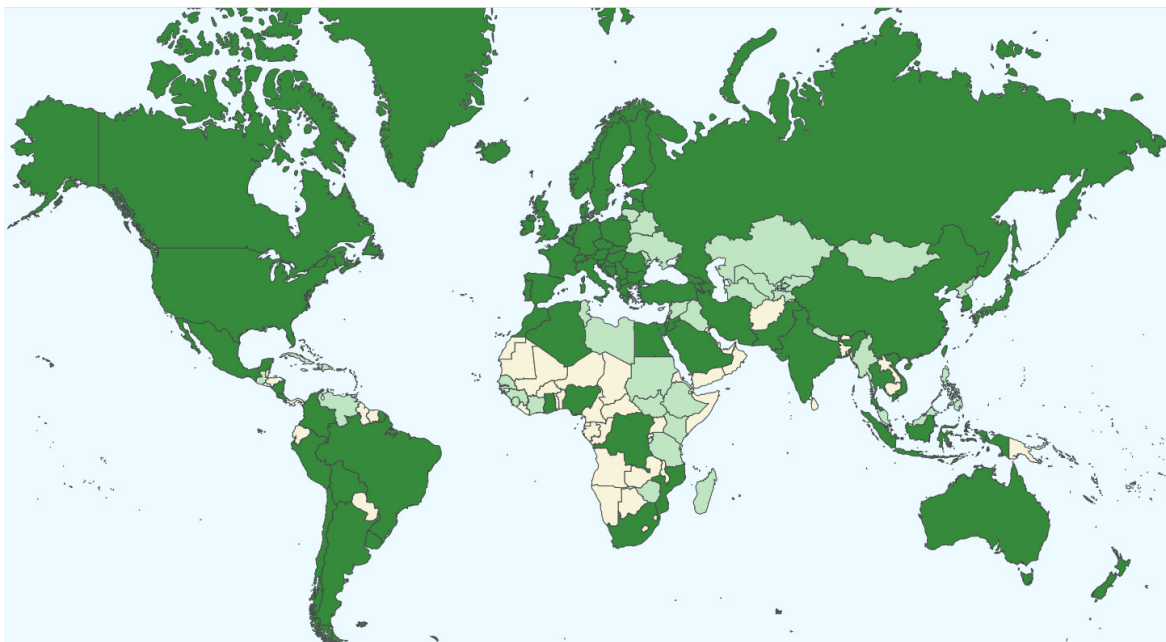
Partner Organizations of IUGG

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 2021, 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 2021, the price of 1 unit was US\$ 2,080. The 58 paying members represent a total of 276 units, which is equivalent to a total income of US\$ 574,080. 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 31.12.2021)

Several IUGG National Committees have published Annual and Quadrennial Reports on their activities over the last years. All reports are available [here](#).

IUGG National Committees are invited to [submit](#) their annual/quadrennial reports at any time.

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 2020 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 2021, 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
Executive Secretary: (a non-voting member of the Bureau)	Franz G. Kuglitsch	GERMANY

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)	AUSTRIA
	Berit Arheimer (2021-2023)	SWEDEN
IAMAS President:	Joyce Penner	USA
IAPSO President:	Trevor McDougall	AUSTRALIA
IASPEI President:	Kenji Satake	JAPAN
IACVCEI President:	Patrick Allard	FRANCE

IUGG Finance Committee

Chair:	Corina Risso	ARGENTINA
Members:	Jozsef Adam	HUNGARY
	Priscilla Grew	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
IACVCEI 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 Shenoi	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:	Mian Liu	USA

IUGG SECRETARIAT

The IUGG Secretariat is the informational centre of IUGG. It implements the organization plans, organizes the daily management of the Union, prepares business meetings, represents the Union at conferences, publishes documents (e.g., Newsletters, Yearbooks, Annual Reports) and helps National Members to be engaged in the Union's and its Associations activities.

Since the year 2013, the IUGG Secretariat is located at

Helmholtz Centre Potsdam
GFZ German Research Centre for Geosciences
Telegrafenberg, A17
14473 Potsdam
GERMANY

<i>Executive Secretary:</i>	Franz G. Kuglitsch	GERMANY
<i>Assistant:</i>	Katrin Gundrum	GERMANY
<i>Webmaster:</i>	Dmitry Krupsky	RUSSIA

MESSAGE FROM THE PRESIDENT

All my activities in 2021 were online, providing both a challenge and an opportunity (to participate in events where I could not have justified the cost and carbon footprint of travel).

We held a number of IUGG Bureau, and senior leadership, meetings over the year to discuss regular business. We also held a meeting of the Executive Committee in September, shortened to treat essential business only, with much of the material only available online rather than being presented. Frustratingly, although we started some interesting discussions, the restricted time available meant these were curtailed prematurely.



I participated in the Extraordinary General Assembly of the International Science Council ([ISC](#)), convened to discuss constitutional and related matters. The Assembly voted on a number of changes to ISC Statutes and Rules of Procedure (including those proposed by IUGG), and also elected an Elections Committee. Later in the year, I participated, with the President-Elect as I was unable to join all the sessions, in the ISC General Assembly, voting for the Officers and Ordinary Members of a new Governing Board (covering the period until 2024, when the next General Assembly will take place). Unfortunately, our nominee was not successful, but there are a number of representatives from the geosciences on the new Board.

The International Union of Geological Sciences ([IUGS](#)) launched its Deep-Time Digital Earth ([DDE](#)) flagship 10-year program in 2020. As part of the management of the program, IUGS sought a partnership with IUGG, similar to that under which our joint International Lithosphere Program ([ILP](#)) is run. The Secretary General and I held a number of meetings concerning the structure, representation and organisation for this, including how it relates to the other organisational aspects of DDE, and we have now agreed the Terms of Reference for an Advisory Board, to which IUGG will nominate a representative, providing independent scrutiny of the program.

A major effort led to the proclamation by the United Nations in December of the International Year of Basic Sciences for Sustainable Development ([IYBSSD](#)); as a founding member of the IYBSSD, I represent IUGG on its Steering Committee. We now look forward to a series of events, beginning with the Opening Ceremony at the United Nations in Paris in July. I am pleased to learn that proposals for activities are being discussed by the IUGG community, and look forward to seeing grant applications linked to the International Year.

Another initiative has been the formation of a number of Task Teams of the Global Geoscience Societies. Spearheaded by the American Geophysical Union ([AGU](#)) at a meeting it convened in June, four Teams covering Inclusion and Representation in Geoscience, Advocate for the Earth Sciences in Global and Domestic Policies, Public Engagement and Outreach to Increase Earth Sciences Awareness, and Early Career and Student Communities, were formed. The Secretary General and I have been attending these monthly meetings whenever possible, and at least one of us has always been present. The progress and interim conclusions of each of the Teams was reported at the Global Geoscience Societies Leadership Committee Meeting, held as a hybrid event during the Fall AGU meeting, which the Secretary General and I attended virtually. The Committee agreed the Teams should continue working in their current format for another six months, when progress would be reviewed again and further consideration given to if and how the Teams should continue. AGU has been providing the facilitation for the Teams, and has set up the means to share information and edit documents online.

I made a speech during the Opening Session of the 4th Congress of China Geodesy and Geophysics on behalf of IUGG in July. I also made a speech on behalf of IUGG during the Opening Ceremony of the 5th World Landslides Forum in November; IUGG is sponsoring the Kyoto Landslide Commitment 2020 which organised the Forum.

Through our Memorandum of Understanding with the International Centre for Theoretical Physics ([ICTP](#)), the IUGG and ICTP jointly organise Workshops of interest to the geophysics and geodesy community. The latest in the series, held online in October on Data Assimilation and Inverse Problems in Geophysical Sciences, was organised primarily by our former Secretary General, Alik Ismail-Zadeh, and I gave a speech during the Opening Session.

I also addressed the Inaugural Ceremony of the IAGA-IASPEI joint scientific assembly in August, organised by the Council of Scientific and Industrial Research – National Geophysical Research Institute in Hyderabad, India. It is a tribute to the efforts of many individuals and organisations that a number of our Associations have held successful Scientific Assemblies under the trying circumstances imposed by the pandemic.

One of our partner organisations in the [ISC GeoUnions](#), the International Union of Radio Science ([URSI](#)), held a hybrid General Assembly in Rome, and I attended the Opening Ceremony in August virtually. Richard Horne, who is well-known to many in the IAGA community, received URSI's Appleton Medal at the Ceremony "For leadership and theories of charged particle dynamics in the Earth and planetary magnetospheres leading to practical space weather forecasting of their high energy particle environment".

I conclude by mentioning an informal activity which gave me great pleasure. Alik Ismail-Zadeh celebrated a milestone birthday in 2020, and the President-Elect and I recorded a short greeting to him, mentioning a few of his numerous contributions to the IUGG and his devotion over so many years of service.

Kathryn Whaler

MESSAGE FROM THE SECRETARY GENERAL



If 2020 was "a very special year", what should we call 2021?

A (first) whole year under COVID-19 conditions???

I am still aware that by now several of you have probably gone through or been affected by an infection. Many have lost relatives, friends and acquaintances who have died with or from the COVID-19 virus in all its variants. My deepest sympathy goes out to them!

First of all, we should also look at the benefits: The vast majority of us have now received one or more vaccinations. This has given us a first perspective on life with and after a pandemic. Hopefully another one will not immediately follow!

Virtual and hybrid meetings have become a regular reality over the year, with the consequences of one meeting chasing another, numerous scheduling conflicts and overbooking, etc. This has led to a new form of exhaustion: "zoomed out" at the end of a single working day!

The flagship of IUGG communications, our monthly E-Journal, appeared twelve times, and — more importantly — absolutely reliable on the first day of every month! My thanks go to my colleagues on the Editorial Board. I hope we have continued to delight you with the ongoing series of portraits of the IUGG leadership and all the other reports and short articles.

My work as IUGG Delegate — and now elected Co-chair — of the **ISC GeoUnions Standing Committee on Disaster Risk Reduction (DRR)** has been quite demanding. In 2021, we held a total of eight full virtual meetings. As products, we published a handful of "policy briefs", polished up the [website](#) and launched social/professional media activities via [LinkedIn](#) and [ResearchGate](#).

As our President already mentioned in her message, another milestone was the work in the task forces of the **AGU & Global Geoscience Societies**. The topics were quite focused and the teams are very diverse in many ways: we both tried to keep the IUGG flag flying high in (really) almost every meeting. I think the IUGG presence and contribution was very well received. We would like to express our gratitude to the professional management team of the AGU for facilitating the sessions, the material and the background information.

My personal IUGG highlight of the year was our visit to Trieste: The Executive Secretary and I had discovered a small window of opportunity for us at the end of October 2021. We travelled to Istria to visit the **ICTP = International Centre for Theoretical Physics**, also known as the Abdus Salam Institute. The ICTP was founded in 1964, and operates under a triparty agreement between the Italian Government, UNESCO and the IAEA. Besides other fields its expertise covers Earth System Physics.

Together with Abdelkrim "Karim" Aoudia we exchanged ideas for our joint (*to be specified*) programme and were able to briefly introduce ourselves to the new director, Atish Dabholkar. And then, coincidentally, on the second day, we were invited to a lecture entitled "The Value of Science" by Giorgio Parisi, Nobel Laureate in Physics in 2021. Truly impressive!



Celebrating the “Value of Science” at ICTP, Trieste with Alexander Rudloff, Giorgio Parisi, and Abdelkrim Aoudia

Besides the challenges mentioned, my team in the secretariat — thank you Katrin and Franz — and I have always tried to be of service to you in the best possible way. Please forgive us for any small shortcomings or delays, we will continue to try our best!

Alexander 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, and supported by 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, Committees, Partner Organizations, and others; (ii) maintenance of IUGG electronic databases and technical documents; (iii) supervision of the IUGG web-master 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. 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 BUSINESS MEETINGS 2021

Due to the ongoing COVID-19 pandemic, the 2021 meetings of the IUGG Bureau, Executive Committee (EC), Finance Committee (FC), and the Scientific Programme Committee (SPC) for the XXVIII IUGG General Assembly ([IUGG2023](#)) were held online.

The FC (incl. its chair and two members) met with the IUGG Treasurer and its consultant on 23 August 2021 to discuss the IUGG financial report, to review the IUGG accounts, and to take an overview of administrative matters and membership, IUGG grants, and allocations.

The Bureau (President, President-Elect, Secretary General, Treasurer, Executive Secretary, and three members at large) met together with the Chair of the Local Organizing Committee (LOC) for IUGG2023 on 31 August 2021 to prepare for the upcoming IUGG EC Meeting. The IUGG EC Meeting was held on

15 and 16 September 2021. The EC is comprised of the IUGG Bureau, the immediate Past President of IUGG, and the Presidents of the Union Associations. The Association Secretaries General, the Chairs of the FC, the LOC, the SPC for IUGG2023, and representatives from the professional conference organizer (C-IN) and the venue of IUGG2023 (Messe Berlin) were invited to attend the EC Meeting.

The EC Meeting started with a welcome speech given by Charlotte Krawczyk, director of the German Research Centre's (GFZ) Geophysics Department. The GFZ acts, on behalf of the German National Committee, as the host of IUGG2023. The IUGG President, the Secretary General, the Treasurer, the Chair of the FC, and the Presidents of the Union Associations reported on activities since the last EC Meeting (Montreal, Canada, July 2019). The IUGG President-Elect reported on the activities of the Union Commissions. The IUGG Executive Secretary reported on the newly established Union Committees. Other topics on the agenda included: (i) preparations for IUGG2023 in Berlin (LOC Chair Harald Schuh and SPC Chair Jürgen Müller reported on the activities of their committees), (ii) IUGG's involvement in international programmes and collaboration with other organisations, and (iii) IUGG's involvement in activities of the International Science Council (ISC). In addition, there was time for open discussion.

On 15 September 2021, a few members of the IUGG Bureau and the LOC met with representatives from Messe Berlin and C-IN for an on-site tour of the IUGG2023 venue. The members of the EC and the Association Secretaries General were invited to join an online discussion afterwards.

The SPC for the IUGG2023 met on 16 September 2021. The SPC is comprised of the Chair (Jürgen Müller), the IUGG Secretary General, and the Association Secretaries General. The Chair, the Vice Chair of the LOC and a representative of C-IN were invited to join the SPC Meeting. The tentative draft of the science programme was discussed, including topics for Union and inter-Association symposia.



Participants of the IUGG EC Meeting on 16 September 2021

PREPARATIONS FOR THE IUGG GENERAL ASSEMBLY 2023

Welcome to Berlin!



Welcome from the Local Organizing Committee (LOC)



Harald Schuh, Chair LOC IUGG2023

The 28th IUGG General Assembly ([IUGG2023](#)) will be held from 11 to 20 July 2023 at the CityCube in Berlin, Germany.

This General Assembly is a special opportunity for participants from around the world to come together and discuss the full range of geodetic and geophysical themes, and further enhance the important interdisciplinary collaboration for a better understanding of our Earth System. IUGG2023 will provide a platform for personal meetings, exchange of ideas and developing new

concepts for international science collaboration, all of which have suffered a setback during this pandemic crisis. IUGG2023 will help to create a new spirit to address pressing large societal challenges such as global environmental change and natural hazards and to stimulate novel geoscience research.

The Berlin-Brandenburg region has one of the largest geoscientific clusters in the world. Participants will have a unique opportunity to meet their scientific partners from many projects in person, here in Berlin, or to combine this with a visit to the research organisations GFZ, AWI or DLR. We are planning an exciting excursion program, in particular, an attractive program for young scientists to provide them with opportunities for exchange, presentation and discussion beyond the sessions.

After the fall of the Berlin Wall in 1989, the city of Berlin changed significantly, transforming into the dynamic, creative and highly innovative cosmopolitan capital of today's Germany. As a visitor you come to understand why Berlin is ranked as one of the most liveable cities, with its many sights, attractions and UNESCO World Heritage Sites, and experience its extensive, fast and secure public transportation system and its lush natural environment. Summer in Berlin offers the best conditions to enjoy the city after an exciting conference day, with July temperatures averaging around 20-24°C. The local organisers of IUGG2023 will consider, irrespective of the further development of the COVID19 pandemic situation, a hybrid assembly taking place both in Berlin and online so that the advantages of the current development of digital conferencing can be shared by many more colleagues in the scientific community.

On behalf of the LOC of IUGG2023, I welcome you to Berlin.

Harald Schuh, Chair LOC IUGG2023

Welcome from the Science Program Committee (SPC)

On behalf of the German National Committee of Geodesy and Geophysics (NKG), and as Chair of the Science Program Committee (SPC), I welcome you to the 28th IUGG General Assembly in Berlin ([IUGG2023](#)). The General Assembly will give us the opportunity to present Germany and the Berlin-Brandenburg region as a showcase of an innovative research community.



Jürgen Müller, Chair SPC IUGG2023

Geosciences explore the complex Earth System through interdisciplinary and international cooperation. Since its formation in 1919, the IUGG has sought to foster international collaboration between the geoscience disciplines. From the time when Germany joined the IUGG in 1951, the country has actively worked on the realisation of joint international activities. Today, Germany is an excellent location for science that offers outstanding research infrastructure and many opportunities for scientists from all around the world. All eight associations of the IUGG have a strong anchor in German research institutes. Of the multitude of institutions, I would just like to mention a few here: the Helmholtz Centre Potsdam – GFZ German Research Centre for Geosciences, the Helmholtz Centre for Polar and Marine Research – Alfred Wegener Institute (AWI), the GEOMAR Helmholtz Centre for Ocean Research Kiel, the German Aerospace Centre (DLR), a large number of German universities, and, last but not least, some federal agencies such as the Federal Institute for Geosciences and Resources (BGR).

I wish to draw attention to one example of fruitful cooperation between the various geoscience disciplines. German geodesy has taken a lead role in developing and realising gravimetry satellite missions such as GOCE, GRACE and GRACE-FO. Their data have contributed remarkably to globally determine the Earth's gravity field with unprecedented accuracy and resolution. In collaboration with all other geosciences, such as the hydrologic, oceanographic, cryospheric sciences and geophysics, mass variations and interactions in the Earth System could be studied and better understood, including critical phenomena such as ice melting in Greenland and Antarctica, regional sea level variations, and ground water loss due to climate change.

On behalf of the NKG and as Chair of the SPC, I believe that the IUGG2023 in Berlin will further enhance the interdisciplinary collaboration necessary for a better understanding of our Earth System. It will help create a new spirit to address pressing societal challenges such as global environmental change and natural hazards, and to stimulate novel geoscience research. In addition, Berlin is especially attractive for early career geoscientists.

Looking forward to meeting you in Berlin in 2023.

Jürgen Müller, Chair SPC IUGG2023

Committees for IUGG2023 appointed

The IUGG President appointed members to several Union Committees for the [28th IUGG General Assembly](#) (Berlin, Germany, 11-20 July 2023) responsible for (i) the selection of candidates to be included in the election of the IUGG Bureau and Finance Committee Members 2023-2027 (Nominating Committee); (ii) for the comparison of the sites proposed for the IUGG General Assembly 2027 (Site Comparison Committee); (iii) for the resolutions of the IUGG General Assembly 2023 (Resolution Committee); as well as three award committees: (iv) the Gold Medal Committee; (v) the Fellow Selection Committee; and (vi) the Early Career Scientist Award Committee. The membership of the committees is the following:

Nominating Committee

Harsh Gupta (India, IASPEI), Chair
Anny Cazenave (France, IAG)
Hugo Delgado Granados (Mexico, IAVCEI)
Alberto Montanari (Italy, IAHS)

Resolution Committee

Michael G. Sideris (Canada, IAG), Chair
Atalay Ayele (Ethiopia, IASPEI)
Athena Coustenis (France, IAMAS)
Masahito Nosé (Japan, IAGA)
Denise Smythe-Wright (UK, IAPSO)

Site Comparison Committee

Fiona Darbyshire (Canada, IASPEI), Chair
Isabelle Ansorge (South Africa, IAPSO)
Kosuke Heki (Japan, IAG)
Andrew Mackintosh (Australia, IACS)
Stefania Sparnocchia (Italy, IAPSO)
Eduard Petrovsky (Czech Republic, IUGG, ex-officio)

Gold Medal Committee

Tom Beer (Australia, IAMAS), Chair
Zuheir Altamimi (France, IAG)
Günter Blöschl (Austria, IAHS)
Kumiko Goto-Azuma (Japan, IACS)
Emma Hill (Singapore, IASPEI)
Catherine Johnson (Canada, IAGA)
Jan Marie Lindsay (New Zealand, IAVCEI)
Hans van Haren (Netherlands, IAPSO)
Alexander Rudloff (Germany, IUGG, ex-officio)

Fellow Selection Committee

Andrew Yau (Canada, IAGA), Chair
Agatha de Boer (Sweden, IAPSO)
Georg Kaser (Austria, IACS)
Allison Kealy (Australia, IAG)
Barbara Romanowicz (USA/France, IASPEI)
Dan Rosbjerg (Denmark, IAHS)
Mary Scholes (South Africa, IAMAS)
Roberto Sulpizio (Italy, IAVCEI)
Steve McNutt (USA, IUGG, ex-officio)

Early Career Scientist Award Committee

Katrin Schröder (Italy, IAPSO), Chair
Keith Alverson (Japan, IAMAS)
Marie Dumont (France, IACS)
Julia Eychenne (France, IAVCEI)
Michelle Grobbelaar (South Africa, IASPEI)
Paola Passalacqua (USA, IAHS)
Prasanta Patro (India, IAGA)
Peiliang Xu (Japan/China, IAG)
Thorsten Wagener (Germany, IUGG, ex-officio)

ASSOCIATION SCIENTIFIC ASSEMBLIES 2021

IAG Scientific Assembly 2021

The Scientific Assembly of the International Association of Geodesy (IAG) was held in Beijing, China and online from 28 June to 2 July 2021. Due to the COVID-19 pandemic, the Assembly was organised as a hybrid event for the first time. The main local organiser was the Chinese Society for Geodesy, Photogrammetry and Cartography (CSGPC) with more than 20 co-organisers in China.

An unknown factor in the planning was the effect of the COVID-19 pandemic on the number of participants and the number of abstracts. As a surprise, the number of registered participants was 1,269 which is an all-time record in the history of IAG meetings - more than twice that of the previous record. 435 (34%) of the participants were students and early-career scientists. This is a very good number, and we have to continue efforts also in the future meetings to attract young people to participate.

A total of 615 abstracts were submitted which was also more than twice the expected number. The length of the oral talks was limited to five minutes. In each session, about half of the time was reserved for questions and discussions, which was meant to mitigate the lack of personal contacts. There were three parallel oral sessions and one poster session running each day, allowing about 150 daily presentations of which about 42% were orals.



IAG President Zuheir Altamimi giving his speech at the Opening Ceremony of the IAG Scientific Assembly

The theme of the Assembly was "Geodesy for a Sustainable Earth" with a total of seven symposia.

The topics were the following:

1. Reference Frames,
- 2a. Earth's Static Gravity Field,
- 2b. Earth's Time-variable Gravity Field,
3. Earth Rotation and Geodynamics,
4. Positioning and Applications,
5. Global Geodetic Observing System (GGOS), and
6. The ICC symposium with three Inter-Commission Committees and the IAG Project.

During the five days, a total of 36 sessions were organised under the themes. The most popular sessions were related to emerging observing techniques, climate change related topics and geodetic observations of geohazards, in addition to the traditional geodetic topics on reference frames, gravity and deformations.

The technical arrangements went extremely well, thanks to the Local Organisers and skilful technical personnel in Beijing. Sincere thanks to all who made this assembly a great success. Also, many thanks to the symposium organisers, session conveners and chairpersons for the smooth guiding of the program in spite of these exceptional conditions and very busy schedule. We are looking forward to the IAG and IUGG General Assembly 2023 in Berlin, hopefully back to the regular format.

Markku Poutanen, IAG Secretary General

IAGA-IASPEI Joint Scientific Assembly 2021

The International Association of Geomagnetism and Aeronomy (IAGA) and the International Association of Seismology and Physics of the Earth's Interior (IASPEI) had planned to have a joint Scientific Assembly in August 2021 in Hyderabad, India. In the midst of the preparations in 2020 it became clear that a normal in-person meeting will likely not be possible in summer 2021 due to the COVID-19 pandemic. The two Associations and the local organisers decided together to convene the meeting as a virtual event at the originally planned dates.

Thus, the virtual Joint Assembly was held from 21 to 27 August 2021, hosted by the Indian National Academy (INSA) and the CSIR-NGRI with the support from other Earth science institutes of the Indian Governments' Department of Science & Technology, CSIR and Ministry of Earth Sciences. The meeting attracted 828 participants from 53 countries, over 500 from IAGA and nearly 300 from IASPEI and included 212 students from 37 different countries. These numbers are quite satisfying, although a somewhat higher participation was originally expected for an in-person meeting.

The programme did not differ much from the originally planned one, and included three joint plenary talks, eight joint sessions, 27 IAGA and 17 IASPEI symposia with altogether 778 abstracts for oral and poster presentations. It was preceded by the NGRI-CSIR Diamond Jubilee Symposium, which celebrated the 60th anniversary of the institute with eight invited lectures.

During its Opening Plenary, IASPEI presented the IASPEI Medal 2021 to Barbara Romanowicz with a laudation given by Guy Masters. Furthermore, IAGA held its award ceremony where this year's Shen Kuo Medalist, Jay Johnson, gave a well-received lecture entitled "From microphysics to system science: Approaches to understanding dynamics from the sun to Saturn".

Due to the COVID-19 pandemic the Asian Seismological Commission (ASC), one of IASPEI's Regional Commissions, could not hold its General Assembly in 2020. Therefore, the ASC took the opportunity of the Joint Assembly with many participants from Asian countries and organised a General Assembly during the conference.

The Joint Assembly was preceded by the IAGA and IASPEI Schools for Early Career Scientists and a GIFT Workshop to educate teachers from India and neighbouring countries on IAGA and IASPEI topics (see

special reports below). All these also were organised for the first time in virtual formats. The International Association of Physics Students, IAPS, that signed a memorandum of understanding for collaborations with IAGA earlier this year, organised another virtual event (IAPS@IAGA) where Early Career Scientists could discuss in small groups with international experts in different fields of IAGA sciences.



The opening ceremony of the IAGA-IASPEI Joint Scientific Assembly 2021 was attended in person by selected local participants and streamed online for all others

The challenge to accommodate all global local times for the presentations at the Joint Assembly led to a concentration of sessions in the period 16:45 to 22:15 IST (10:45 to 16:45 UTC), which resulted in some unfortunate overlaps of sessions. However, all presentations were recorded (either pre-recorded or recorded during live session) and are available for later viewing. The live oral sessions included some lively discussions despite the online limitations, and after some initial difficulties the Association business meetings, an important part of the IAGA and IASPEI Scientific Assemblies, also went well. The only aspect solved less satisfactorily were the poster sessions, which could not be arranged as live discussions.

Overall the technical arrangements worked well. Our Indian colleagues had done a tremendous job to set up the fully virtual environment in less than a year. We sincerely thank the local organisers and the personnel from the professional conference organising company for their dedication. We thank all who made this first virtual IAGA-IASPEI Joint Assembly a great success, including the IAGA and IASPEI officers, symposia organisers, session conveners and chairpersons, who all faced new challenges with the conversion to the virtual format.

IAGA and IASPEI plan to organise another Joint Assembly in Lisbon, Portugal for 2025. We are looking forward to hopefully have this, as well as the IUGG General Assembly in 2023 in Berlin, Germany, as regular meetings with in-person participation.

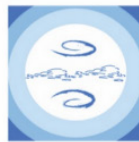
Monika Korte, IAGA Secretary General
Johannes Schweitzer, IASPEI Secretary General

IACS-IAMAS-IAPSO Symposia Series 2021



IACS

International Association
of Cryospheric Sciences



IAMAS

International Association of Meteorology
and Atmospheric Sciences



International Association
for the Physical Sciences of the Oceans

In place of the Busan Atmosphere-Cryosphere-Ocean (BACO-21; IAMAS-IACS-IAPSO Joint Scientific Assembly), which had to be cancelled due to travel restrictions, IAMAS, IACS and IAPSO arranged a Virtual Atmosphere-Cryosphere-Ocean seminar series (VACO-21) from 19 to 23 July 2021. IAMAS President Joyce Penner, IACS President-Elect Liss Andreassen and IAPSO President Trevor MacDougall introduced 17 invited speakers, including the recipients of the IAMAS, IACS and IAPSO early career awards for 2021. Over the week, 187 individuals joined the audience. Although the event is now over, recordings of the excellent presentations are available [here](#). In recognition of the large amount of work that the Local Organising Committee had already put into planning BACO-21 before its cancellation, the associations have agreed to hold their July 2025 Joint Scientific Assembly in Busan, Republic of Korea, as BACO-25.

Richard Essery, IACS Secretary General
Steve Ackerman, IAMAS Secretary General
Stefania Sparnocchia, IAPSO Secretary General

Due to the COVID-19 pandemic, the Scientific Assemblies of IAHS and IAVCEI were postponed to 2022 and 2023, respectively.

ASSOCIATION JOURNALS

The IUGG, through some of its Associations, regularly publishes a number of peer-reviewed journals covering various topics of Earth and space sciences. Here, we would like to introduce you to the major journals of our Associations.

International Association of Geodesy (IAG)

The [Journal of Geodesy](#) is the official journal of the IAG concerned with the study of scientific problems of geodesy and related interdisciplinary sciences. It presents peer-reviewed papers on theoretical or modelling studies, and on results of experiments and interpretations. In addition to original research papers, the journal includes commissioned review papers on topical subjects, occasional short notes on topics with broad significance to the readership, and special issues arising from scientific symposia or workshops. The journal covers the whole range of geodetic science and reports on theoretical and applied studies in research areas such as positioning; reference frame; geodetic networks; modelling and quality control; space geodesy; remote sensing; gravity fields, and geodynamics. The Journal of Geodesy is published by Springer. Five year impact factor: 4.781 (2020).

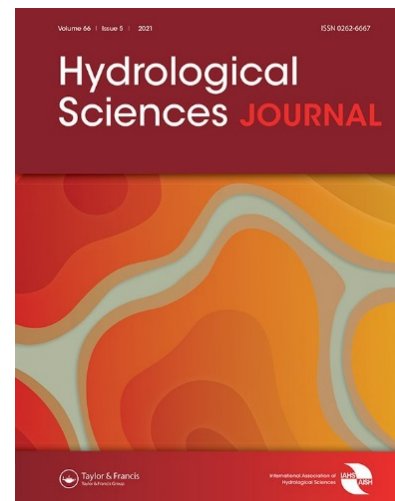


- An international journal examining scientific problems of geodesy and related interdisciplinary sciences.
- Covers the entire range of geodetic science.

- Presents peer-reviewed papers on theoretical or modelling studies, and on the results of experiments and interpretations.
- Reports on theoretical and applied studies in research areas such as positioning; reference frame; geodetic networks and more.
- 97% of authors who answered a survey reported that they would definitely publish or probably publish in the journal again.

International Association of Hydrological Sciences (IAHS)

The [Hydrological Sciences Journal](#) is the official Journal of the IAHS and provides a forum for original papers and for the exchange of information and views on significant developments in hydrology worldwide. The Hydrological Sciences Journal is published by Taylor & Francis. Five year impact factor: 3.502 (2020).



The scope of the journal includes:

- The hydrological cycle.
- Surface water, groundwater, snow and ice, in all their physical, chemical and biological processes, their interrelationships, and their relationships to geographical factors, atmospheric processes and climate, and Earth processes including erosion and sedimentation.
- Hydrological extremes and their impact.
- Measurement, mathematical representation and computational aspects of hydrological processes.
- Hydrological aspects of the use and management of water resources and their change under the influence of human activity.
- Water resources systems, including the planning, engineering, management and economic aspects of applied hydrology.

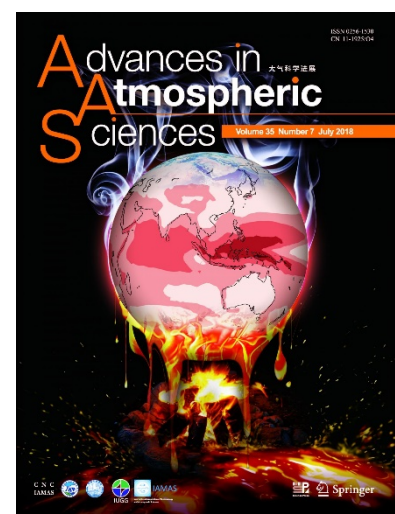
International Association of Meteorology and Atmospheric Sciences (IAMAS)

[Advances in Atmospheric Sciences](#), launched in 1984, offers rapid publication of original scientific papers on the dynamics, physics and chemistry of the atmosphere and ocean. It reports on the latest achievements and developments in the atmospheric sciences, including marine meteorology and meteorology-associated geophysics, as well as the theoretical and practical aspects of these disciplines.

The coverage includes weather systems, numerical weather prediction, climate dynamics and variability, satellite meteorology, remote sensing, air chemistry and the boundary layer, clouds and weather modification. Papers describing the application of new mathematics or new instruments are also collected here.

Advances in Atmospheric Sciences is sponsored by the Chinese Committee for IAMAS, the Institute of Atmospheric Physics at Chinese Academy of Sciences and Chinese Meteorological Society.

It is the associated journal of IAMAS and is published by Springer. Five year impact factor: 3.033 (2020).

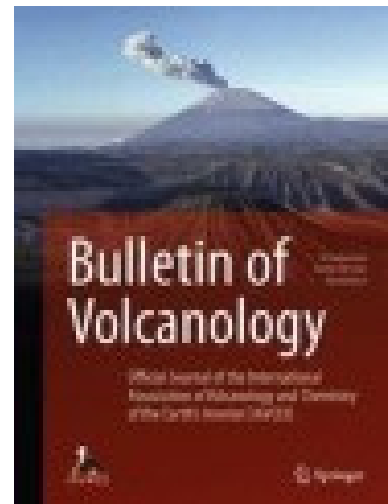


- This journal presents original scientific papers on the dynamics, physics and chemistry of the atmosphere and ocean.

- Covers weather systems, numerical weather prediction, climate dynamics and variability, satellite meteorology, remote sensing, and more.
- Free app available on iTunes and Google Play Store.

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

The [Bulletin of Volcanology](#) was founded in 1922, as Bulletin Volcanologique, and is the official journal of the IAVCEI. The Bulletin of Volcanology publishes papers on volcanoes, their products, their eruptive behaviour, and their hazards. Papers aimed at understanding the deeper structure of volcanoes, and the evolution of magmatic systems using geochemical, petrological, and geophysical techniques are also published. Material is published in four sections: Review Articles; Research Articles; Short Scientific Communications; and a Forum that provides for discussion of controversial issues and for comment and reply on previously published Articles and Communications. The Bulletin of Volcanology is published by Springer. Five year impact factor: 2.806 (2020).



SCIENTIFIC MEETINGS SELECTED FOR IUGG SUPPORT IN 2021

IUGG co-sponsors symposia and workshops appropriate to Union disciplines of study. IUGG allocated US\$8,000 to assist the following scientific meetings in 2021 supporting the participation of young and female scientists and scientists from developing countries (the IUGG Association that endorsed the meeting is indicated in brackets):

- 43rd COSPAR Scientific Assembly, Sydney, Australia, 28 January-4 February (IUGG)
- International Conference on Clouds and Precipitation, Virtual, 3-7 August (IAMAS)
- 13th General Assembly of the Asian Seismological Commission, Virtual, 21-27 August (IASPEI)
- 37th General Assembly of the European Seismological Commission, Virtual, 19-24 September (IASPEI)
- International Ozone Commission Quadrennial Ozone Symposium, Virtual, 3-9 October (IAMAS)

GEOSCIENCE EDUCATION

The collaboration between IUGG and ICTP

Since 2011, the Abdus Salam International Centre for Theoretical Physics ([ICTP](#), Trieste, Italy) and IUGG have been working together to enhance geophysical and geodetic education and science collaboration. IUGG annually awards grants (48 awards between 2011 and 2019) to support science education events, such as workshops and training schools, organized by ICTP.

Founded in 1964, by the late Nobel Laureate Abdus Salam, ICTP 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.

IUGG grants to support geoscience education events in 2020 and 2021

Due to the COVID-19 pandemic, most of the ICTP scientific meetings planned for 2020 and 2021 were cancelled or postponed. The 2020 and 2021 IUGG contributions will be used to support future ICTP/IUGG projects.

The major 2021 event was the [Joint ICTP-IUGG Workshop on Data Assimilation and Inverse Problems in Geophysical Sciences](#), which was organized online from 18 to 29 October 2021.



Group photo (source: ICTP)

Joint ICTP-IUGG Workshop on Data Assimilation and Inverse Problems in Geophysical Sciences – Report

Understanding the complex operation of the Earth system requires an interdisciplinary approach and international collaboration. Data assimilation and modern methods of solving inverse problems provide unique opportunities to exploit such approach and collaboration by integrating data and information from disciplinary sources. These techniques become major forecasting tools in meteorology, oceanography, atmospheric chemistry, hydrology, and recently they started to be applied to solid Earth problems. To discuss state-of-the-art, applications, and perspectives of data assimilation and inverse problems in major IUGG disciplines, the Union Commission on Mathematical Geophysics (CMG) in cooperation with the Abdus Salam International Centre for Theoretical Physics (ICTP) and the East African Institute for Fundamental Research (EAIFR) organised the workshop hosted by ICTP in Trieste, Italy, virtually from 18 to 29 October 2021. workshop participants received welcome addresses from Kathryn Whaler, IUGG President, and Atish Dabholkar, ICTP Director and Assistant Director General of UNESCO. World leading scientists from Australia, Canada, Germany, Italy, Republic of Korea, Russia, Spain, Switzerland, and USA lectured at the workshop and discussed with participants the topics in relation to specific geophysical disciplines.

96 of 117 applications received were selected, and the applicants were invited to attend the workshop. Among them, 32% were female participants; 79% (12%) were participants from developing (least developed) countries, namely, from Africa and Middle East 33%, Asia 35%, Latin America 19%, and Oceania 3%. The workshop had two sessions (morning and afternoon) every working day allowing lecturers from different parts of the world to attend and deliver lectures. Three sessions (two oral and one poster) were dedicated to presentations by the workshop's participants, whose abstracts were selected for presentation by workshop's directors. These sessions highlighted the research on data assimilation, direct and inverse problems in geosciences, and quantitative modelling done by the participants from Argentina, Brasil, Cameroon, Cuba, Ethiopia, Ghana, Hungary, India, Indonesia, Iran, Italy, Mexico, Nepal, Nigeria, Rwanda, Senegal, Sudan, Turkey, and UK. All the presentations were judged, and three best papers were selected. Maibys Sierra Lorenzi (Cuba; female scientist), Maria Alejandra Vesga Ramirez (Argentina; female scientist), and Hari Ram Thapa (Nepal) received the best paper awards. The workshop was supported in by IUGG (via grant to CMG) and ICTP.

More information on the workshop (scientific programme, list of participants, lecture notes and videos) can be found [here](#).

Alik Ismail-Zadeh and Ilya Zaliapin, Co-Directors of the Workshop

COOPERATION WITH THE INTERNATIONAL SCIENCE COUNCIL (ISC)

ISC Extraordinary General Assembly 2021



**International
Science Council**

The Extraordinary General Assembly 2021 of the International Science Council (ISC) was held online from 1 to 5 February 2021. The agenda can be downloaded [here](#). IUGG was represented by President Kathy Whaler and Secretary General Alexander Rudloff.

ISC Members, including IUGG were invited to discuss and vote on the proposed changes to the ISC Statutes and Rules of Procedure and to elect the 2021 Elections Committee.

The new ISC Statutes and Rules of Procedure are available [here](#).

The composition of the 2021 Elections Committee is available [here](#).

ISC Annual Report 2020

The International Science Council's 2020 Annual Report is now available [here](#). 2020 was an unprecedented year for the scientific community and for the world. The COVID-19 pandemic caused widespread disruption, but also created new opportunities and demonstrated the importance of international scientific collaboration.

ISC Governing Board 2022-2024

At the 2nd General Assembly of the International Science Council (ISC), a new Governing Board (2022-2024) was appointed to lead the ISC, an international nongovernmental organisation (and umbrella organisation of IUGG) that works to provide a global voice for science. The Governing Board is the central decision-making body of the Council, which was formed in 2018 by the merger of the International Council of Science (ICSU), representing the natural sciences, and the International Social Science Council (ISSC).

The ISC Members elected four Officers of the Governing Board and ten Ordinary Members to join the incoming President of the ISC, Peter Gluckman, who takes up his presidency at the conclusion of the 2021 General Assembly.

Motoko Kotani (Mathematics; Japan) has been elected President-Elect, assuming the Presidency at the next General Assembly in 2024.

Anne Husebekk (Medicine; Norway) has been elected Vice-President for Freedom and Responsibility in Science, **Salim Abdool Karim** (Medicine; South Africa) Vice-President for Outreach and Engagement, and **Sawako Shirahase** (Sociology; Japan) Vice-President for Finance of the Council.

The elected Ordinary Members of the Governing Board are: **Karina Batthyany** (Sociology; Uruguay); **Françoise Baylis** (Bioethics, Philosophy; Canada); **Geoffrey Boulton** (Geology; UK); **Melody Burkins** (Geology, Ecosystem Studies; USA); **Mei-Hung Chiu** (Chemistry, Science Education; China-Taipei); **Pamela Matson** (Environmental Science; USA); **Helena Nader** (Biomedical Sciences; Brazil); **Walter**

Oyawa (Civil Engineering; Kenya); **Maria Paradiso** (Geography; Italy); and **Martin Visbeck** (Oceanography; Germany). The Chief Executive Officer, Heide Hackmann, is an ex-officio Member of the Governing Board.

A summary of the 2nd ISC General Assembly is available [here](#).

ISC Global Risk Perception Report 2021

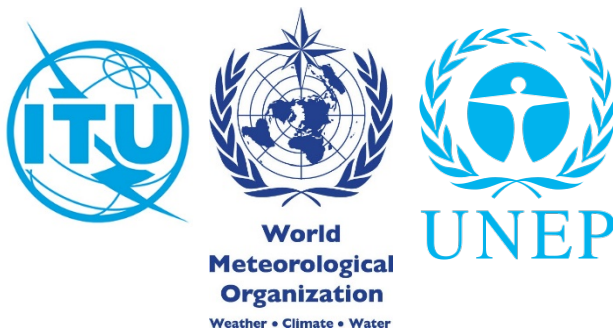


The International Science Council (ISC) published the [Global Risk Perceptions Report 2021](#), which reports about the global risk perceptions of leaders from business, economics, and government. The publication aims to contribute to the discourse that has been shaped through the respective work of the World Economic Forum and to spark dialogue, identify knowledge gaps, and support the growth of a multi-sectoral scientific community working to better understand and provide solutions to global risks.

ISC also published [A Framework for Global Science in Support of Risk-informed Sustainable Development and Planetary Health](#). This document takes stock of recent developments in disaster risk science and provides a compelling set of directions for research and scientific collaboration for a more holistic and collaborative approach to understanding and managing risks.

COOPERATION WITH INTERNATIONAL AND INTERGOVERNMENTAL ORGANIZATIONS

IUGG to be involved in ITU/WMO/UNEP Focus Group on AI for Natural Disaster Management

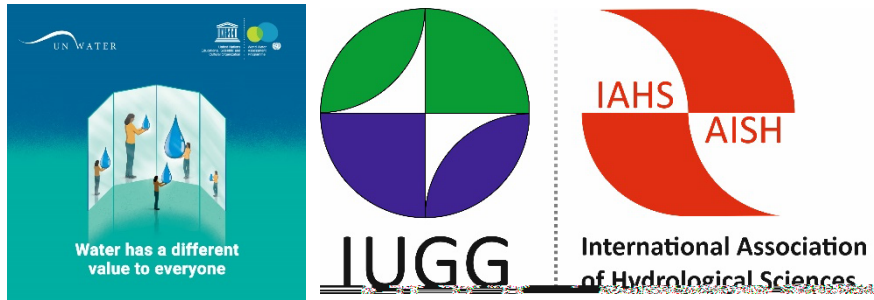


The IUGG is pleased to announce the initiation of the [ITU/WMO/UNEP Focus Group on AI for Natural Disaster Management](#) (FG-AI4NDM). The focus group is building a community of experts and stakeholders to explore current practices (and untapped potential) in the use of AI to support:

- data (collection/monitoring, handling),
- modelling (reconstructing, forecasting, and projecting), and
- communication (early warning systems, etc.) of natural disasters.

All scientists under the umbrella of the IUGG are welcome to participate! Please [join](#) the (low volume) mailing list.

UN World Water Development Report 2021 on Valuing Water



On 22 March 2021, the [United Nations World Water Development Report 2021 on Valuing Water](#), the UN-Water flagship Report on water issues, was published by UNESCO and coordinated by the UNESCO World Water Assessment Programme.

The Report assesses the current status of and challenges to the valuation of water across differing sectors and perspectives and identifies ways in which valuation can be promoted as a tool to help achieve sustainability.

IAHS contributed to chapter 5 (Food and agriculture) and chapter 11 (Knowledge, research and capacity development as enabling conditions).

The [Report](#) is available for free download, in English, French and Italian. The [Executive Summary](#) is available in 11 languages. The [Audiobook](#) of the Executive Summary is available in 4 languages.

Open Science and the UNESCO Initiative

The UNESCO recommendation on Open Science was unanimously adopted by Member States during the Science Commission plenary. The road to the Open Science Recommendation being adopted commenced with a resolution from the [40th session of UNESCO's General Conference](#) in 2019, where 193 Member States tasked UNESCO with the development of an international standard-setting instrument.

That instrument, the [UNESCO Recommendation on Open Science](#), has now been adopted by Member States at the Science Commission plenary at its 41st General Conference, paving the way for it to be passed at the full General Conference. As reported in the [IUGG E-Journal Vol. 21. No. 8](#) (item 5), the International Science Council (ISC) supported this initiative with a delegation. IUGG was represented by Christophe Cudennec and Nilay Dogulu (both IAHS).



IUGG at the Global Geoscience Societies Meeting 2021

On 30 June 2021, the American Geophysical Union (AGU) organised the Global Geosciences Societies Meeting. Representatives from 11 societies including the AGU, the African Geophysical Society (AGS), the German Geophysical Society (DGG), the European Geosciences Union (EGU), the Geological Society of America (GSA), the Indian



Geophysical Union (IGU), the International Union of Geodesy and Geophysics (IUGG), the Japan Geoscience Union (JpGU), the Korea Geoscience Union (KGU), the Mexican Geophysical Union (UGM), and the American Geosciences Institute (AGI) attended the meeting. IUGG was represented by the President, Secretary General, and Executive Secretary.

Following up on the [Declaration of the Significance of Geoscience Expertise to Meet Global Societal Challenges](#), which was signed by many geoscience societies in May 2020, the representatives of the societies agreed on establishing task groups dealing with strengthening the societies common goals, including (i) support of early-career scientists and student communities, (ii) advocacy for Earth and space sciences in global and domestic policy-making, (iii) public engagement and outreach to increase Earth and space sciences awareness, and (iv) inclusion and representation in Earth and space sciences.

International Year of Basic Sciences for Sustainable Development 2022

On 2 December 2021, the United Nations General Assembly proclaimed 2022 as the International Year of Basic Sciences for Sustainable Development ([IYBSSD 2022](#)).

The IYBSSD 2022 will focus on the links between basic sciences and the [Sustainable Development Goals](#). It was proposed by a consortium of international scientific unions and scientific organisations including IUGG, led by the International Union of Pure and Applied Physics ([IUPAP](#)).

With this [resolution](#), the United Nations General Assembly “invites all [its] Member States, organisations of the United Nations system and other global, regional and subregional organisations, as well as other relevant stakeholders, including academia, civil society, inter alia, international and national non-governmental organisations, individuals and the private sector, to observe and raise awareness of the importance of basic sciences for sustainable development, in accordance with national priorities”.

IUGG is delighted to be a founding partner of the IYBSSD. Science within the remit of IUGG is a close match to the Sustainable Development Goals (see [Mapping IUGG to Sustainable Development Goals](#)), so we can look forward to making a major contribution, through our own activities and in liaison with other organisations, to addressing the goals and celebrating the achievements of the International Year.



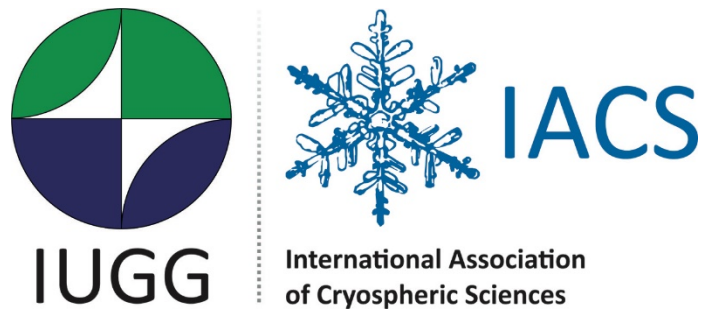
ACTIVITIES OF THE UNION ASSOCIATIONS

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

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 organizations. 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 programs, 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 standardization 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

In the absence of an in-person assembly in 2021 (following the cancellation of BACO-21), the IACS Annual Bureau Meeting (6 and 13 September) and Open Plenary Meeting (17 November) were held online. The plenary meeting included reports from all of the IACS Working Groups, Standing Groups and Joint Commissions, and presentations were recorded for the benefit of IACS members who could not attend. We have found that repeating these online meetings twice to suit different time zones is an efficient and inclusive way to conduct IACS business while reducing carbon footprint.

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.

Liss Andreassen succeeded Regine Hock as IACS President at the end of the Annual Bureau Meeting on 13 September 2021.

The IACS Terms of Reference were modified by Bureau action to clarify the structure of IACS joint bodies in collaboration with organizations outside IUGG. One such joint body was established in 2021:

the Joint Body on the Status of Mountain Snow Cover with the Mountain Research Initiative and the WMO Global Cryosphere Watch.

ACTIVITIES

IACS communications

The IACS homepage (<https://cryosphericsscience.org/>) is hosted at the World Glacier Monitoring Service in Zurich, Switzerland, and is linked to twitter account @iacscryo (<https://twitter.com/iacscryo>). IACS newsletters feature announcements and reports of IACS activities (<https://cryosphericsscience.org/newsletter/>). Three newsletters were published in 2021.

IACS resolutions

An action plan (<https://cryosphericsscience.org/about/resolutions/>) was approved at the IACS Annual Bureau Meeting on 6 September 2022 to implement IUGG Resolution 1: “Reducing the carbon footprint by the research community”. Among other measures, the plan regulates IACS business travel by air. A summary of the IACS action plan was published in the IUGG Electronic Journal Volume 21, No. 10 (October 2021).

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) has the objective of automating the process of generating digital glacier outlines to support research in glacier mass balance and contributions to sea level rise.
- Regional Assessments of Glacier Mass Change (RAGMAC, 2019-2023) 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.

RAGMAC produced a Frontiers in Earth Sciences Research Topic “Observational Assessments of Glacier Mass Changes at Regional and Global Level” with an editorial and 11 research articles (<https://www.frontiersin.org/research-topics/9957>).

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.

A GAPHAZ community effort on reconstruction of the 7 February 2021 Chamoli, India, landslide and flooding disaster resulted in a Science publication with 53 authors (<https://www.science.org/doi/10.1126/science.abh4455>).

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.

IACS Joint Commissions

Joint Commissions with other IUGG Associations aim to foster collaboration and coordination on topics of overlapping interests. IACS currently has three Joint Commissions:

- IACS-IAG Joint Commission on Cryospheric Deformation
- IACS-IAPSO Joint Commission on Ice-Ocean Interactions
- IACS-IAVCEI Joint Commission on Volcano-Ice Interactions.

Cooperation between IACS and IAVCEI was revitalized in 2021 by new leadership for the Joint Commission on Volcano-Ice Interactions after a period of inactivity. IACS worked with the Ice-Ocean Interactions and Volcano-Ice Interactions commissions to develop their Terms of Reference during 2021.

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. Funding requests must be submitted for deadlines on 1 February, 1 June and 1 October and at least two months prior to the event that is to be supported. Proposers are informed of decisions approximately two weeks after the deadline. No requests were received in 2021 due to international pandemic travel restrictions, but two events with funding held over from 2020 went ahead:

- Third Annual Meeting of the Chilean Cryosphere Society (SOChiCri), online, 18-19 March 2021
- Juneau Icefield Research Program 2021, Alaska

To replace the cancelled BACO-21 IACS-IAMAS-IAPSO assembly, the three Associations ran an online seminar series with invited speakers and early career award winners over the same period (19-23 July 2021). IACS organized the registration and the meeting platform. Recorded presentations can be viewed at <https://www.youtube.com/channel/UCP3bCxu-NiGllNmeoHgGxEQ/videos>

Awards

The IACS Early-Career awards for 2021 went to David Bigelow (Simon Fraser University, Canada) and Giulia Mazzotti (WSL Institute for Snow and Avalanche Research, Switzerland). This prize is awarded every two years to two early career scientists who have published the best scientific papers on cryospheric subjects as assessed by an independent evaluation committee.

IACS Immediate Past President Regine Hock received the International Glaciological Society Richardson medal at the IGS Nordic Branch meeting on 5 November 2021, and has been awarded the European Geophysical Union Julia and Johannes Weertman Medal for 2022.

Obituaries

Lowell Allan (Al) Rasmussen passed away on 13 February 2021, in Seattle WA, USA, at age 83. Al was deeply involved in the development of the widely used glossary of mass balance terms published in 2011 - a major outcome from the IACS working group on "Mass balance terminology and methods". His tireless input and fastidious care for detail were instrumental to the quality of the publication.

FUTURE ACTIVITIES

The Standing Group on Glacier and Permafrost Hazards in High Mountains (GAPHAZ) and the Joint Body on the Status of Mountain Snow Cover will run focus sessions at the International Mountain Conference, 11-15 September 2022.

The Secretary General is representing IACS on the steering committee for the fourth International Conference on Arctic Research Planning (Boulder CO, USA, 2025).



The IACS Bureau.

*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.
Inset, l-r: Marie Dumont, Alex Fraser, Stanislav Kutuzov, Sophie Nowicki, Lauren Vargo*

Richard Essery, IACS Secretary General

International Association of Geodesy (IAG)



IAG website: www.iag-aig.org

INTRODUCTION

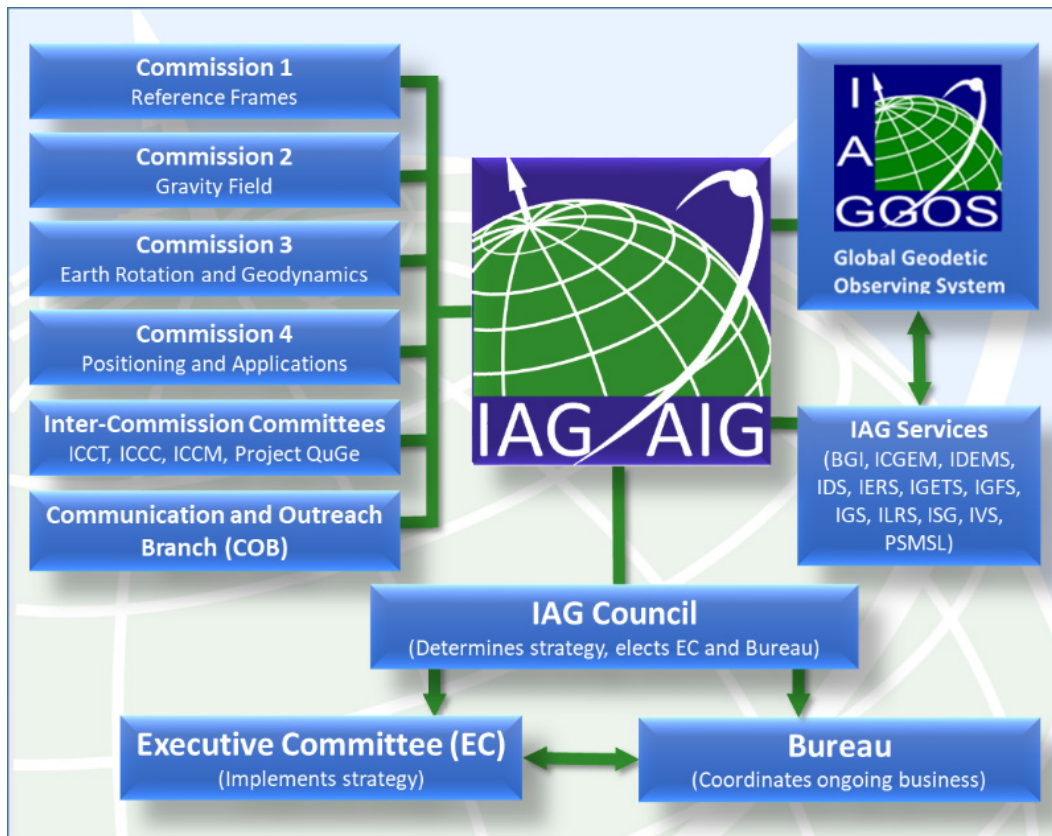
The structure of IAG comprises several components: four Commissions, the Inter-Commission Committees on Theory (ICCT), Climate Research (ICCC), and Marine Geodesy (ICCM), Project Novel Sensors and Quantum Technology for Geodesy (QuGe), twelve International Scientific Services, the Global Geodetic Observing 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 utilizing Operation, Data and Analysis Centres.

The Global Geodetic Observing System GGOS is a component of IAG that 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, Bureau, and the Office carry out the administration of IAG. The Council is composed of 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; 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 the latest one published in the November 2020 issue of Journal of Geodesy. Further reports are published in the bi-annual IAG Reports (Travaux de l'AIG), in connection with the IAG Scientific Assembly. The final version of 2021 will be available on the IAG website Q1/2022.



IAG Structure

ADMINISTRATION

IAG Council

The IAG Council meets bi-annually at the IUGG General Assemblies and the IAG Scientific Assemblies. The meeting was planned during the IAG Scientific Assembly in Beijing, China, 28 June – 2 July 2021. However, due to the COVID-19 pandemic, it was not possible to organize a physical meeting. Instead, there was a virtual meeting on 30 September 2021, the purpose of which was to elect the venue of the 2025 IAG Scientific Assembly. The Council made the decision using electronic voting from 1 to 7 October 2021. The next regular Council meeting is planned for 2023 at the IUGG General Assembly.

IAG Executive Committee (EC)

The EC 2019-2023 held three meetings in 2021. Due to the pandemic, those were organized as online meetings, on 23 and March, 24 June and 28 June in connection with the IUG Scientific Assembly, and on 8 December. In addition to the regular reports of components and sub-entities, the main topic to discuss was the Scientific Assembly in Beijing on June-July 2021, and in the December meeting, the arrangements and symposia of the IUGG2023.



Group photo of IAG Executive Committee online meeting on 8 December 2021

IAG Bureau

The IAG Bureau (President, Vice President, Secretary General) discussed the day-to-day decisions by e-mail exchange and regular monthly Zoom meetings.

IAG Office

The IAG Office (Secretary General, with the Treasurer and the “IAG Secretariat”, registered Society concerning financial matters) managed the Association finances, membership matters, daily contacts to IAG, IUGG and other external contacts, correspondence to Council and preparing meetings, minutes and notes of Council, Executive Committee and Bureau meetings.

ACTIVITIES

Due to the COVID-19 pandemic, all meeting-related activities are lower than normal. Most meetings, symposia and workshops were either cancelled, postponed or arranged as web meetings.

IAG Scientific Assembly, Beijing, China

The Scientific Assembly of the International Association of Geodesy (IAG) was held in Beijing, China from 28 June to 2 July 2021. The main local organizer was the Chinese Society for Geodesy, Photogrammetry and Cartography (CSGPC) with more than 20 co-organizers in China. Due to the COVID-19 pandemic, the Assembly was organized as a hybrid conference with a possibility for the Chinese participants physical meeting in Beijing.

The number of registered participants was 1,269 which is a record in the history of IAG meetings, more than twice the previous record. Of these, 435 were students and early-career scientists which is about 1/3 of all participants.

A total of 615 abstracts were submitted for the Assembly. The length of the oral talks was restricted to five minutes and in each session, there was reserved about half of the time for questions and

discussions, which was meant to mitigate the lack of personal contacts. There were three parallel oral sessions and one poster session running each day, allowing about 150 daily presentations of which about 42% were orals.

The theme of the Assembly was "Geodesy for a Sustainable Earth". A total of 36 sessions were organized under seven symposia, the topics of which were

1. Reference Frames,
- 2a. Earth's Static Gravity Field,
- 2b. Earth's Time-variable Gravity Field,
3. Earth Rotation and Geodynamics,
4. Positioning and applications,
5. Global Geodetic Observing System (GGOS), and
6. The ICC symposium with three Inter-Commission Committees and the IAG Project.

IAG offered a possibility to submit a full paper of the presentation in the IAG renowned Symposia Series published by Springer. This series is Open Access, fully peer-reviewed, and the papers will be online shortly after the paper is accepted. The Open Access fees for the IAG Scientific Assembly participants are covered by the IAG. A total of 59 manuscripts were submitted by the deadline in October 2021, and the review process is going on. The book will be published in 2022.



IAG President Zuheir Altamimi opens the IAG Scientific Assembly

IAG Mid-term report (Travaux 2019-2020)

The Mid-Term Report, Travaux 2019-2020, was prepared during the year 2021. Material for the report was prepared by the Commissions, Services and other IAG entities before the IAG Scientific Assembly and collected by the Secretary General. Contents of the report were discussed at the meetings of the EC, and some complements and additions to the activities were asked. The full report with more than 700 pages will be published on the IAG website in Q1 of 2022.

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 Webpages (all accessible via the IAG Homepage). The main activities in 2021 were related to the organisational aspects of the SA2021, and plans for 2022. The pandemic situation was difficult for the whole of 2021 preventing most planned activities. Many of them were postponed to 2022.

Commission 1 and its sub-commission activities include on

- Organizing the Symposium 1 Reference Frames in the SA2021.
- REFAG (Reference Frames for Applications in Geosciences) symposium was decided to be organized in October 2022 jointly with GGOS UAW (Unified Analysis Workshop) in Thessaloniki, Greece.

Commission 2 and its sub-commission related activities include

- The Commission organized two Symposia in SA2021, Earth's Static Gravity Field, and Earth's Time-variable Gravity Field.
- JWG 2.1.1 (establishment of International Gravity Reference System/Frame) held a virtual meeting in October.
- IGRF Workshop is planned for April 2022 in Leipzig, Germany.
- GGHS Symposium at the University of Texas at Austin is planned for September 2022.

Commission 3 and its sub-commission related activities include

- The Commission organized Symposium Earth Rotation and Geodynamics in SA2021.
- Subcommission 3.1 meeting The Geodynamics and Earth Tides meeting was held 23-26 June 2021 in Wuhan, China, one week before the IAG Scientific Assembly. Three medalists for the Paul Melchior medal were awarded to David Crossley, Gerhard Jentzsch, and Walter Zürn.
- Several activities of SubCommissions and other entities were anticipated for 2022.

Commission 4 and its sub-commission related activities include

- The Commission organized Symposium Positioning and applications in SA2021.
- The commission 4 Symposium is planned for September 2022 in Potsdam, Germany.

The Inter-Commission Committees (ICCT, ICC, ICCM) and the Project (QuGe) jointly organized the Symposium in the SA2021

- The ICCT will organize X. Hotine-Marussi Symposium on Mathematical Geodesy on June 2022 at the Politecnico di Milano, Milan, Italy.
- The ICC and its subentities have organized online activities and seminars. An ICC workshop is planned for 2023.
- The activities of the ICCM has renewed the organization during the year and organized Marine Geodesy and Undersea Navigation Symposium on 18 July in Qingdao, China.

IAG Services continued their activities almost normally. Meetings, workshops and other activities were organized online

- IERS reported the release of the new ITRF2020 which will happen early 2022.
- IGS organized a series of virtual workshops in 2021, and a physical meeting is planned for June 2022.
- IVS organized a virtual Analysis Workshop. General Meeting and VLBI Training School are planned in March 2022 in Helsinki, Finland as online events.
- ILRS Virtual tours to several SLR stations were very popular and there is a plan to continue this in the future. 22nd International Workshop on Laser Ranging is planned for October-November 2022 in Kunming, China.

Global Geodetic Observing System (GGOS)

- GGOS organized the Symposium in SA2021. It also organized the online virtual conference, GGOS days on October 2021.
- The website was renewed and a GGOS short film "Why Geodesy is important? How Geodesy contributes to society?" was prepared.
- Unified Analysis Workshop (in connection with Comm. 1 REFAG) and GGOS days are planned for 2022.

Communication and Outreach Branch (COB)

The main activities of the COB included the publication of the monthly Newsletter, GIM International and the maintenance of the IAG website (www.iag-aig.org). Renewal and development of the IAG website continued. The IAG Newsletter is published monthly also in the Journal of Geodesy as an open access paper.

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), ISC 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), Subcommittee on Geodesy of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), related Global Geodetic Centre of Excellence, 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).

IAG membership

By the end of 2021, there were a total of 237 members, of which 81 were student and 45 retired members. Students and retired members are free of the annual fee.

Publications

Based on the agreement with Springer Verlag, IAG Symposia Series will be open access, and free of charge to the Symposia participants. There were 59 submissions for the IAG SA2021 volume which will be published in 2022.

The number of submissions to the Journal of Geodesy remained well above 300, and the impact factor of the Journal is 4.2 (2020). The JoG is within the top ten geosciences related journals.

Awards, Anniversaries, Obituaries

No young scientist travel awards were given in 2021. This is due to the COVID-19 pandemic because the physical meetings were cancelled or held virtual.

The IAG Young Authors Awards for the best paper published in the Journal of Geodesy were presented in connection with the SA2021.

- The IAG Young Authors Award 2019 is presented to Dr.-Ing. *Susanne Glaser* for her paper: Susanne Glaser, Rolf König, Karl Hans Neumayer, Tobias Nilsson, Robert Heinkelmann, Frank Flechtner & Harald Schuh (2019): On the impact of local ties on the datum realization of global terrestrial reference frames, *Journal of Geodesy*, 93: 655–667.
- The IAG Young Authors Award 2020 is presented to Dr *Khosro Ghobadi-Far* for his paper: Ghobadi-Far, K., Han, SC., Allgeyer, S., Tregoning, P., Sauber, J., Behzadpour S., Mayer-Guerr T., Sneeuw N. and Okal E. (2020): GRACE gravitational measurements of tsunamis after the 2004, 2010, and 2011 great earthquakes. *Journal of Geodesy* 94: 65.

The following obituaries were published in the IAG Newsletter

- Ahmet Aksoy (1932-2020)
- Dezső Nagy (1930-2020)
- Tadahiro Sato (1945-2021)
- Andrzej Borkowski (1959 - 2021)

FUTURE ACTIVITIES

Planning of the IAG contribution for the IUGG General Assembly 2023 in Berlin, Germany was started. In addition to the science program, two committees were established to consider possible changes in the structure and bylaws of IAG. If any, those will be amended in the Council meeting during the General Assembly.

The venue of IAG Scientific Assembly 2025 was decided in the online meeting and electronic voting of the Council in September-October 2021. Out of five candidates, the Council elected Rimini, Italy, to host the SA2025.

Markku Poutanen, IAG Secretary General

International Association of Geomagnetism and Aeronomy (IAGA)



International Association
of Geomagnetism and Aeronomy

IAGA website: 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: <http://www.iaga-aiga.org>.

ADMINISTRATION

Since 2015, IAGA is organized in six Divisions and four Inter-divisional Commissions. Each Division may form Working Groups in given specialized topics and elects officers to run the business of the Working Groups. The terms of office are linked to the IUGG General Assemblies. Lists of the Division/Inter-divisional Commission leadership and the Working Group names and officers can be found on the following website: <http://www.iaga-aiga.org/about/>. There were no changes to the IAGA Divisions, Commissions and Working Groups in 2021.

IAGA is administered by an Executive Committee (EC) on behalf of IUGG Member Countries in accordance with the Association's Statutes and By-Laws. The 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 (Early Career Representative, Rep. of China), Anna Kelbert (USA), Michael Kosch (South Africa), Huixin Liu (Japan), Klaus Spitzer (Germany), Ricardo Trindade (Brazil)

The EC had virtual meetings in February, June and December 2021 and communicated frequently by e-mail. Three additional virtual EC meetings were part of the Joint IAGA-IASPEI Scientific Assembly in August, which had to be held fully virtual due to the ongoing COVID-19 pandemic (see below).

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: <http://www.iaga-aiga.org/about/>.

ACTIVITIES

The IAGA-IASPEI Joint Scientific Assembly 2021



The opening ceremony of the IAGA-IASPEI Joint Assembly 2021 was attended in person by selected local participants and streamed online for all others

Science

IAGA and the International Association of Seismology and Physics of the Earth's Interior (IASPEI) had planned to have a joint scientific assembly in August 2021 in Hyderabad, India. In the midst of the preparations in 2020 it became clear that a normal in-person meeting would likely not be possible in summer 2021 due to the COVID-19 pandemic. The two associations and the local organisers decided together to organize the meeting as a virtual event on the originally planned dates.

Thus, the virtual Joint IAGA-IASPEI Scientific Assembly was held from 21 to 27 August 2021 hosted by the Indian National Academy (INSA) and the CSIR-NGRI with support from other Earth science institutes of the Department of Science & Technology, Gol, CSIR and the Ministry of Earth Sciences, Gol. Our Indian colleagues have done a tremendous job in working with a professional conference organizer to set up the fully virtual environment in less than a year. The meeting attracted 828 participants, over 500 from IAGA and nearly 300 from IASPEI. The participants came from 56 countries and included over 200 students. These numbers are quite satisfying, although a somewhat higher participation was originally expected for a normal meeting.

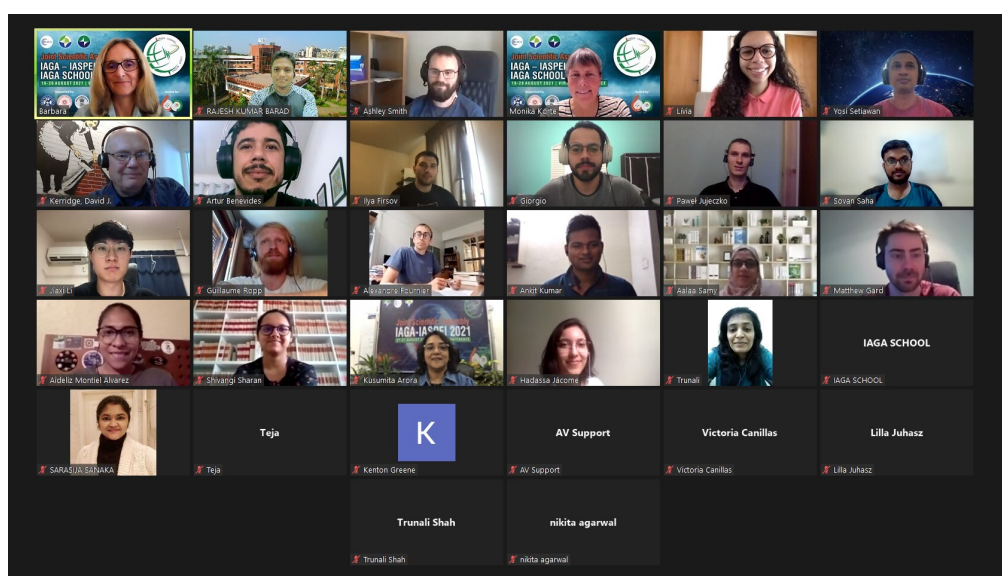
The program did not differ much from the originally planned one, and included 3 plenary talks, 8 joint sessions and 27 IAGA and 17 IASPEI symposia. It was preceded by the NGRI-CSIR Diamond Jubilee Symposium which celebrated the 60th anniversary of the institute with 8 invited lectures. Moreover,

IGA held its award ceremony where this year's Shen Kuo Medalist, Jay Johnson, gave a well-received lecture entitled "From microphysics to system science: approaches to understanding dynamics from the sun to Saturn". The Joint Assembly was preceded by the IAGA and IASPEI Schools for early career scientists and a GIFT workshop to educate teachers from India and surrounding countries on IAGA and IASPEI topics. All these also were organized for the first time in virtual formats. The International Association of Physics Students, IAPS, organized another virtual event (IAPS@IGA) where early career scientists could discuss in small groups with international experts in different fields of IAGA sciences.

Business

Three executive committee meetings, two Conferences of Delegates and most of the Division, Commission and Working Group Business meetings were also held virtually as part of the Joint Scientific Assembly. Three resolutions were passed by the Conference of Delegates.

5th IAGA School 2021



"Group photo" from the virtual 5th IAGA School

The IAGA Schools aim at providing excellent early career scientists with a good basic understanding of a wide range of the scientific topics covered by IAGA. The fifth IAGA School was planned in the week before the IAGA-IASPEI Joint Assembly in Hyderabad, but like this Scientific Assembly had to be turned into a fully virtual format due to the COVID-19 pandemic.

It thus was held from 16 to 20 August, organized by IAGA's Interdivisional Commission on Education and Outreach (ICEO) with assistance from the Joint Assembly local organizers. For lectures and part of the practicals the main conference software was used. However, in addition to gaining scientific knowledge, networking among the participants has always been an important aspect of the IAGA Schools. To mimic as best as possible the usual personal interactions, the Gather software (<https://gather.town>) was used for a social event and during breaks, and for distribution of information and further interactions an instant messenger group was set up. This combination of virtual tools worked well and the participants mostly gave quite a positive feedback.

The 5th IAGA School was attended by 34 students from 16 countries. Seven international lecturers provided 10 lectures of 90 minutes each, and practicals on three topics using, e.g., Jupyter notebooks with Python programs.

IAGA Awards

The **Shen Kuo Medal for interdisciplinary achievements** was given to Jay Johnson (USA). The Award recognizes and acknowledges outstanding scientists whose activities and achievements cross several fields of research covered by IAGA.

The **IAGA Long Service Award** in recognition of valued services to the IAGA community over many years was given to Nataliya Sergeyeva (Russia).

The **IAGA Early Career Award** is given to early career scientists who have made outstanding contributions at specialist meetings and topical workshops for which IAGA is a sponsor. Due to the fact that most of the regular topical workshops from 2020 were cancelled or postponed to 2022, there was only one recipient of the IAGA Early Career Scientist Award in 2021. It went to Man Hua (China), nominated from the VERSIM (VLF/ELF Remote Sensing of Ionosphere and Magnetosphere) workshop held online from 15 to 20 November 2020.



Virtual IAGA Awards Ceremony: IAGA President Mioara Mandea and Secretary General Monika Korte (top left and right) with Shen Kuo Medalist Jay Johnson (USA) and Long Service Awardee Natalia Sergeyeva (Russia) (bottom left and right)

Memorandum of Understanding with IAPS

On 18 May 2021, IAGA established a formal collaboration with the **International Association of Physics Students, IAPS**. IAPS is an international, student-run educational association, which aims to encourage physics students in their academic and professional growth by developing an ever-growing worldwide community within which peaceful relations are established in a collaborative, diverse and friendly social environment. The objective of the Memorandum of Understanding is to promote and strengthen collaboration between the two associations, by, e.g. organizing common online seminars or workshops at conferences.

The first collaborative activities included a talk by IAGA's 2015 Shen Kuo medalist Dan Baker at the 2021 PLANCKS (Physics league across numerous countries for kick-ass students) event, an exam-based physics competition for bachelor's and master's students, and a virtual meeting event for physics students with IAGA experts related to the Joint IAGA-IASPEI Scientific Assembly.

Publications and outreach

The latest issue of the annual IAGA Newsletter, nr. 58, was distributed in December 2021. It can be downloaded from the IAGA website <http://www.iaga-aiga.org/publications>. Current versions of a IAGA Flyer and Poster are also available on the website.

IAGA operates websites at <http://www.iaga-aiga.org> and is active on the following social media
www.facebook.com/IAGAandAIGA/
www.twitter.com/IAGA_AIGA
www.instagram.com/iaga_aiga/
<https://iaga-aiga.blogspot.com/>

FUTURE ACTIVITIES

Current and future activities include the preparation of the programme for the 2023 IUGG General Assembly in Berlin, Germany, and discussions on intensifications of collaborations with IAPS to attract the next generation of scientists to IAGA activities.

Monika Korte, IAGA Secretary General

International Association of Hydrological Sciences (IAHS)



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

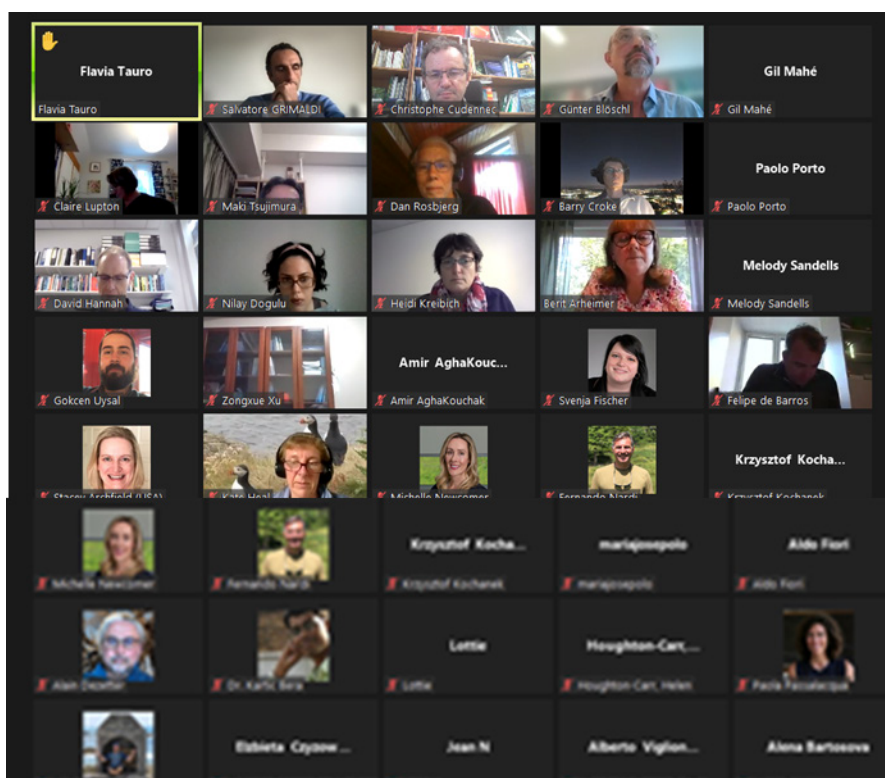
INTRODUCTION

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 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.

ADMINISTRATION

The following International Commissions, Working Groups and Initiatives 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
- Decadal Initiative Panta Rhei 2013-2022
- Unsolved Problems in Hydrology (UPH) initiative



IAHS Online Bureau meeting, 18 October 2021

ACTIVITIES

As in every odd year between IUGG General Assemblies, an IAHS Scientific Assembly was to be held in 2021 – in Montpellier, France. Because of the Covid pandemic, this Assembly has been postponed towards spring 2022. Few events had been postponed from 2020 and two materialized: the ICSH conference on statistical hydrology (STAHY), organized online in September from Valencia, Spain; and the ICSW – UNESCO Friend conference on Great Rivers in Africa in November in Cotonou, Benin with a hybrid option. The IAHS co-convended sessions on Panta Rhei and UPH at the EGU Assembly online organized from Vienna, Austria.

Two bureau meetings have been held online in June and October. Presidents elect of the Association and the 10 commissions became Presidents, and Presidents became past Presidents at the June meeting, in agreement with elections held in Montreal, Canada, 2019 and the 2-years shift pattern.

The Tison Award for Young Hydrologists has been granted to Svenja Fischer and Philipp Bühler (Germany). The IAHS-UNESCO-WMO International Hydrology Prize medals have been bestowed to Taikan Oki (Japan) – Dooge Medal, and Harry Lins (USA) – Volker Medal. The ceremony was rescheduled together with the postponed IAHS Scientific Assembly in 2022.

The SYSTA (Sivapalan Young Scientists Travel Awards) travel award scheme has been implemented for the two conferences. Two SYSTA awardees from 2020 and an additional one were funded to participate in the virtual STAHY meeting. 16 awards were made to participate in the 4th International Conference of the Great Rivers of Africa, 3 keeping benefit of awarding in 2020 and 13 new applicants selected (from Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Morocco, Rwanda, Senegal, Togo, Tunisia).

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 disadvantaged countries. Performance indicators of *HSJ* have increased. Promotion by “features articles” continues, with details disseminated in press releases and via IAHS social media. Featured articles and Tison Award papers 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 running special issue *Advancing socio-hydrology: A synthesis of coupled human-water systems across disciplines*, guest edited by S. Pande *et al.*, accommodated numerous articles along the year, <https://www.tandfonline.com/toc/thsj20/65/S3?nav=toCList>. A conceptual community paper has been published on Citizen Science: Nardi F. *et al.* Citizens AND Hydrology (CANDHY): conceptualizing a transdisciplinary framework for citizen science addressing hydrological challenges. HSJ, <https://doi.org/10.1080/02626667.2020.1849707>. And support has been provided to WMO for an article reaching out to the science community about the innovative operational monitoring sensors and networks: Dixon H. *et al.* Intergovernmental cooperation for hydrometry – what, why, how? HSJ, <https://doi.org/10.1080/02626667.2020.1764569>.

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. Volume 381 of PIAHS has been published for the Cotonou conference, edited by Amoussou *et al.*, in partnership with UNESCO, <https://piahs.copernicus.org/articles/384/index.html>

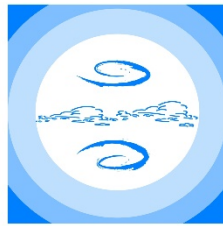
The close cooperation of IAHS with UNESCO, WMO and the UN Water mechanism has been continued. We have contributed to the World Water Development Reports WWDR 2021 (*Values of water*); and attended online meetings of the UNESCO IHP drafting strategy, the WMO Hydrological Coordination Panel, the WMO HydroHub Innovation committee and think tank, the WMO Capacity Development Panel, the WMO SYMET Conference on Education, the WMO research strategy, the GRDC steering committee, UN Water and the preparation of the UN 2023 Water Conference, the UNESCO Recommendation on Open Science (in the ISC delegation).

FUTURE ACTIVITIES

Much (re)organisation work has been dedicated to the postponed IAHS Scientific Assembly in Montpellier, 2022; the IAHS 100 Anniversary in 2022; the IUGG General Assembly in Berlin, Germany, 2023; and the final steps of the Panta Rhei Decade.

Christophe Cudennec, IAHS Secretary General

International Association of Meteorology and Atmospheric Sciences (IAMAS)



International Association of Meteorology and Atmospheric Sciences

IAMAS website: www.iamas.org

INTRODUCTION

IAMAS is a research association of the International Union of Geodesy and Geophysics (IUGG) that focuses on all aspects of the gaseous envelope around the Earth and other planets. The main work is conducted, coordinated, and communicated through IAMAS's 10 International Commissions (IC), which, in alphabetical order, are 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), and
- International Radiation Commission (IRC).

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

The global COVID-19 pandemic continued through 2021 and necessitated the cancellation or postponement of conferences, workshops and field programs (<https://www.iamas.org/meetings/>).

ADMINISTRATION

IAMAS Bureau Meetings

Regular administrative meetings have all been held virtually. Face-to-face meetings were not conducted to minimize health concerns.

Improving the engagement of early career scientists in IAMAS

An IAMAS goal is to engage early career scientists in our activities. IAMAS now has an early career committee (<https://www.iamas.org/ecs/>) to advocate for and build a community among this critical group. In addition to the committee, an early-career scientist sits on the IAMAS Bureau, with the same responsibilities as other IAMAS Bureau members (see <http://iamas.org/bureau/>). The term of appointment is two years. Dr. Jing Li of Peking University, China currently serves in this role and is involved in a leadership role of our association – helping to promote the activities of IAMAS and its commissions amongst the next generation of atmospheric scientists. Dr. Sarah Perkins-Kirkpatrick, from Climate Change Research Centre at UNSW, collaborates and assists Dr. Li in IAMAS early career scientist activities.

In addition, the commissions are encouraged to bring ECSs into their membership and management groups to ensure that the views and requirements of the next generation of scientists are considered.

Funding

As with last year, the pandemic led to many meetings and conferences moving to virtual formats or postponing to a later date. Funds approved for commission workshops and meetings, were approved for use next year.

We have legally incorporated IAMAS in the U.S.A. and are in the final processes of acquiring a not-for-profit status in the U.S.A. Once finalized, we will set up a bank service to facilitate the distribution of IAMAS funds to our commissions in support of their approved scientific activities.

IAMAS EXECUTIVE COMMITTEE 2019-2023

President:	Joyce E. Penner	USA
Vice-Presidents:	John P. Burrows	GERMANY
	Mary Scholes	SOUTH AFRICA
Past President:	John Turner	UK
Secretary General:	Steven Ackerman	USA
Early Career Scientist:	Jing Li	CHINA
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

President:	Melita Keywood	AUSTRALIA
Vice-President:	Mary Barth	USA
	Christian George	FRANCE
	Stuart Piketh	SOUTH AFRICA
	Tong Zhu	CHINA

Atmospheric Electricity (ICAE). http://www.icae-iamas.org		
President:	Xiushu Qie	CHINA
Secretary:	Weitao Lyu	CHINA
Climate (ICCL). http://www.iccl-iamas.net/		
President:	Jianping Li	CHINA
Secretary:	Quizhen Yin	BELGIUM
Clouds and Precipitation (ICCP). www.iccp-iamas.org		
President:	Greg McFarquhar	USA
Vice-President:	Heike Wex	USA
Secretary/Treasurer:	Martina Kraemer	MEXICO
Committee on Nucleation and Atmospheric Aerosols (ICNA). www.icnaa.org		
Chair:	Markku Kulmala	FINLAND
Dynamic Meteorology (ICDM). https://www.iamas.org/icdm/		
President:	Thomas Spengler	NORWAY
Secretary:	Craig Bishop	AUSTRALIA
Middle Atmosphere (ICMA). www.icma-iamas.org		
President:	Bernd Funke	SPAIN
Vice-President:	Natalia Calvo	SPAIN
Ozone (IO3C). http://www.io3c.org/		
President:	Sophie Godin-Beekmann	FRANCE
Vice-President:	Paul A. Newman	USA
Secretary:	Irina Petropavlovskikh	USA
Planetary Atmospheres and their Evolution (ICPAE). http://icpae.iaps.inaf.it/		
President:	Feng Tian	CHINA
Vice-President:	Ann Carine Vandaele	BELGIUM
Secretary:	Yeon Joo Lee	GERMANY
Polar Meteorology (ICPM). www.icpm-iamas.org		
President:	Matthew Lazzara	USA
Secretary:	Tracy Moffat-Griffin	UK
Radiation (IRC). www.irc-iamas.org		
President:	Peter Pilewskie	USA
Vice-President:	Manfred Wendisch	GERMANY
Secretary:	Hajime Okamoto	JAPAN

ACTIVITIES

The IAMAS-IACS-IAPSO virtual assembly was held during the week of 19-23 July 2021. The virtual assembly comprised invited speakers (Table 1) selected to speak for a limited period each day to enable all members of IAMAS around the world to hear simultaneously the selected talks. While 550 individuals registered, 187 individuals joined the seminars at one time or another over the week. The presentations were recorded and are available on a YouTube playlist at: <https://www.youtube.com/channel/UCP3bCxu-NlglNmeoHgGxEQ/videos>.

Planning is underway for the IUGG General Assembly in Berlin, Germany during 11-20 July 2023. While vaccines helped make 2021 more sociable, the new approaches to virtual formats of meeting will continue and in addition, will likely influence face-to-face meetings.

In 2019, a new IAMAS website design was developed to modernize the look and support user needs. The official website was also migrated to a secure web server. We are now in the process of moving the web pages of our commissions to the same server. To date, ICMA, ICCP, ICDM, ICPAE, and ICPM have moved their web sites to this host. Thanks to Bill Bellon, Maria Vasys and Leanne Avila of the University of Wisconsin–Madison Space Science and Engineering Center for their assistance with the transfers. We anticipate this will provide for better continuity in the websites moving forward as the commissions' leadership change.

Table 1. Invited speakers for the IAMAS-IACS-IAPSO virtual assembly

Monday 19 July	Remote sensing of the atmosphere, ocean and cryosphere				
Pepijn Veefkind	NL	UTC+2	15:15 UTC	17:15 local	IAMAS
Paolo Cipollini	UK	UTC+1	15:45 UTC	16:45 local	IAPSO
Byongjun Hwang	UK	UTC+1	16:15 UTC	17:15 local	IACS
Tuesday 20 July	Field observations of the atmosphere, ocean and cryosphere				
Laura Stevens	UK	UTC+1	15:15 UTC	16:15 local	IACS
Markus M. Frey	UK	UTC+1	15:45 UTC	16:45 local	IAMAS
Joellen Russell	USA	UTC-7	16:15 UTC	09:15 local	IAPSO
Wednesday 21 July	IAMAS-IACS-IAPSO Early Career Scientist Awards				
Marta Abalos	Spain	UTC+2	15:00 UTC	17:00 local	IAMAS
Thomas Wahl	USA	UTC-4	15:20 UTC	11:20 local	IAPSO
Jessica Fitzsimmons	USA	UTC-5	15:40 UTC	10:40 local	IAPSO
Giullia Mazzotti	Switzerland	UTC+2	16:00 UTC	18:00 local	IACS
David Bigelow	Canada	UTC-8	16:20 UTC	08:20 local	IACS
Wednesday 21 July	Coupled changes and variability in the atmosphere, ocean and cryosphere				
Elizabeth Barnes	USA	UTC-6	16:45 UTC	10:45 local	IAMAS
Thursday 22 July	Coupled changes and variability in the atmosphere, ocean and cryosphere				
Ruzica Dadic	NZ	UTC+12	12:15 UTC	00:15 local	IACS
Matthew England	AU	UTC+10	12:45 UTC	22:45 local	IAPSO
Friday 23 July	Modelling atmosphere, ocean and cryosphere interactions				
Cecile Agosta	France	UTC+2	15:15 UTC	17:15 local	IACS
Jenny Mecking	UK	UTC+1	15:45 UTC	16:45 local	IAPSO
Doug Smith	UK	UTC+1	16:15 UTC	17:15 local	IAMAS

Awards

- Prof. Ayako Abe-Ouch (ICCL) was awarded the Milutin Milankovic Medal at EGU 2021.
- Dr. Emilie Capron (ICCL) was awarded the AXA Award 2021 for Climate Science from the AXA Research Fund.
- Dr. Luis Ladino (ICCP) received the Marcos Moshinsky award for young scientists.

Activities of the Early Career Scientist (ECS) Committee

The IAMAS ECS Committee was officially formed in January 2021, with 10 members representing 10 IAMAS commissions. The main activities in 2021 included:

- Established a website under the IAMAS website;
- Established a mailing list with a sign-up form on the website;
- Reactivated and maintained the IAMAS Twitter account.
- Started a monthly webinar in June 2021, and a YouTube channel to store the recorded talks. The speakers and talks were:
 - June 22, Joyce Penner, An introduction to IAMAS
 - June 22, Jiale Lu, South Pacific Ocean climate dynamics and predictability
 - August 25, Edward Gryspeerdt, Quantifying the human impact on climate by doing experiments on clouds
 - September 21, Xi Zhang, Diverse clouds and hazes in planetary atmospheres
 - October 20, Fernando Iglesias-Suarez, On the multi-decadal variability of the tropical stratosphere
 - November 23, Georgios Gkatzelis, Knowns and unknowns on the impacts of COVID-19 lockdowns on urban air quality: A glimpse into what the future may hold
- Held a zoom meeting with YESS (Young Earth System Scientists)
- Held a zoom meeting with W2W (Waves to Weather) ECS committee
- Attended the W2W ECS annual meeting and gave a presentation about IAMAS and IAMAS ECS on Dec 8.

Highlights from the IAMAS International Commissions

iCACGP (<http://www.icacgp.org/>)

As the pandemic continued into 2021, iCACGP, like many other groups, modified our activities to adapt to the restrictions imposed by the pandemic. This meant we held three virtual meetings throughout 2021 to discuss business in lieu of the face-to-face meeting that would have occurred at BACO. iCACGP convened the session “The Atmosphere - the “forgotten” domain in the Sustainable Development Goals?” at the Sustainability Research & Innovation Congress 2021 (SRI2021, <https://sri2021.org/>) where the importance of the atmosphere in the UNSDGs (United Nations Sustainability Development Group) was discussed. Progress has been made on the transfer of the iCACGP website to the IAMAS hosted website. Planning continued for the 15th iCACGP Quadrennial Symposium & 17th IGAC Science Conference which will hopefully take place in Manchester 2022 and commenced for the IUGG conference in Berlin, Germany, 2023; iCACGP has proposed a session “Atmospheric Chemistry in the Anthropocene: from the urban to global scales” which has been accepted for inclusion in the program and will be convened by Mark Lawrence.

ICAE (<http://www.icae-iamas.org>) activities in 2021:

- Maintenance of the website for ICAE (<http://www.icae-iamas.org>).
- Online publication of two newsletter issues in 2021. Both newsletters were distributed to the ICAE mailing list.
- Preparation of the 17th ICAE General Assembly (ICAE2022). Applied and obtained financial

ICCL (<http://www.iccl-iamas.net/>) activities in 2021:

- Organization at EGU 2021 (19-30 April 2021) of the session: “The global monsoons in current, future and palaeoclimates and their role in extreme weather and climate events.”
- Organization at the 4th Congress of China Geodesy and Geophysics (CCGG) (17-18 July 2021) at Qingdao JS03: Atmosphere-Ocean-Cryosphere coupling and anthropogenic forcing/climate feedback.
- Organization of the biennial meeting (virtual) of the ICCL members (22 July 2021).
- Organization of two Special Issues: “Earth’s climate response to astronomical forcing” in Atmosphere, and “Global monsoonal systems during the last glacial-interglacial cycle” in Quaternary Science Reviews.
- Preparation of 10 symposium proposals for the 28th IUGG2023 in Berlin, Germany.

Awards 2021:

- Prof. Ayako Abe-Ouch was awarded the Milutin Milankovitch Medal at EGU 2021.
- Dr. Emilie Capron was awarded the AXA Award 2021 for Climate Science from the AXA Research Fund.

ICCP (<https://www.iamas.org/iccp/>) activities in 2021:

The major activity of 2021 was conducting the ICCP conference, held virtually from the Indian Institute of Tropical Meteorology (IITM) in Pune, India between 2 and 6 August 2021. Dr. Thara Prabhakaran served as the conference chair. The conference was hosted on a virtual platform with real world like interactions between the participants at the following link: https://gather.town/invite?token=MkhqX2lO2r1KffWc89S91B2ERv_njnVW. The conference hosted 639 authors contributing to the conference from 32 countries. There were over 200 oral presentations in the 40 sessions of the conference. Over 400 posters were presented in an interactive mode. There were three monsoon sessions and a dedicated poster session for the topic of monsoon clouds and precipitation. Details of the conference are available at https://www.tropmet.res.in/201-event_details

Each day of the conference started with a plenary lecture delivered by the following experts:

- Dr. Ravi Nanjundiah “IITM research and initiatives”;
- Prof. Andrea Flossmann “Memorial to the lost Legends in cloud physics”;
- Prof. William Cotton “A review of my career associated with aerosol impacts on deep convection”;
- Prof. Zamin A. Kanji “Has Diversity, Equity, and Inclusion influenced science and research in the cloud physics community?”; and
- Dr. Alexei Korolev on “Future of Lab Studies.”

Another unique aspect of ICCP 2021 was the conduct of events after the daily poster sessions that stimulated discussions on various topics. Panel discussions were conducted on the following specific topics:

- 1) Cloud physics observations,
- 2) Numerical model improvements,
- 3) Diversity and women in cloud physics,
- 4) Cloud physics in the future and
- 5) Needs of Laboratory studies.

All these discussions are available on YouTube.

The ICCP commission meeting took place through Zoom on 1 August 2021, with several members retiring and new members selected. The new officers of ICCP are

Prof. Greg McFarquhar (President),
Dr. Heike Wex (Vice-President), and
Dr. Martina Krämer (Secretary/Treasurer).

New members elected are the following: Ali Abshaev, Orit Altaratz, Eldo Avila, Henrique Barbosa, Jiwen Fan, Yi Huang, Zamin Kanji, Mahen Konwar, Luis Ladino, Yanluan Lin, Jason Milbrandt, David Noone, Akinola Oluseyi, Odran Sourdeval, and Peter Spichtinger.

Members who finished their terms on the commission are as follows: Paul Field, Charmaine Franklin, Ismail Gultepe, Ilan Koren, Ottmar Mohler, Victor Petrov, Thara Prabhakaran, Bob Rauber, Rob Wood, and Huiwen Xue.

Other important events from the ICCP conference include the awarding of Prof. Bill Cotton as an ICCP Honorary Member, and the announcement of the location of the next ICCP conference in Jeju, Korea, 14 to 19 July 2024 with Prof. Seong Soo Yum as the Chair of the Organizing Committee.

There were some meetings associated with the ICCP Conference. **The International cloud modelling workshop (26-30 July 2021)**, held virtually by IITM, was attended by over 120 participants from around the world. Pi-Chamber, CAIPEEX, Congestus and COPE cloud modelling cases were represented. Proceedings of the four cases are available <https://iccp2020.tropmet.res.in/Cloud-Modeling-Workshop-2020>. There was also a session on weather modification on the last day of the workshop and case studies from CAIPEEX seeding in embedded convection in the monsoon, and SNOWIE case and numerical simulation of seeding (DNS and bin microphysics) were discussed.

After the conference, the **ICCP short course on radar** was conducted on 7th Aug 2021 to introduce the principles of Doppler and polarimetric radar and its application to observing cloud microphysical processes. The instructors for this course were Prof. V. Chandrasekar, Colorado State University, USA, and Dr. Renzo Bechini, Radar Scientist, Regional Meteorological Service, Italy. The course was attended by nearly 160 participants from around the world. More information is available at https://iccp2020.tropmet.res.in/fnd/assets/Radar_course_flyer.pdf.

In the fall of 2021, IITM followed up with a virtual lecture series on cloud and precipitation physics that received considerable interest and lots of attendees. All lectures are available through the following link:

https://www.tropmet.res.in/static_pages.php?page_id=3056.

In the fall of 2021, a subgroup within ICCP led by Heike Wex with contributions from several others developed a “Statement on the Role of Clouds and Precipitation in Climate Change” appended below. This statement complements an earlier statement that ICCP released stating that ICCP does not support the implementation of climate engineering through artificial cloud modification to solve the global warming problem (found at <https://tinyurl.com/bkhd3z98>). The statement on the role of clouds and precipitation in climate change has now been approved by the ICCP Executive and will be added on the ICCP web page in the near future. It is also included at the end of this page.

The ICCP is happy to recognize that Luis Ladino recently received the very prestigious Marcos Moshinsky award for young scientists to support a project that he proposed. This award is usually given to someone working in a more classical branch of physics so it is of special significance that Luis received this recognition.

ICDM (<https://www.iamas.org/icdm/>)

In 2021, the leadership of ICDM initiated the process of new elections that will be conducted online in early 2022 so that the new members can contribute to the upcoming IUGG General Assembly in Berlin, Germany, in 2023.

ICDM developed ten symposia descriptions jointly with another IAMAS commission and three with another association (IAPSO) for the IUGG General Assembly in Berlin, Germany, in 2023.

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

Assembly symposia

ICMA proposed the “Middle Atmosphere Science Symposium” as an IAMAS event for the 2023 IUGG assembly in Berlin, Germany.

Business meetings / Internal affairs

ICMA held its business meeting (online) on 14 September 2021 with participation of the EC, members and ECS representative. The ICMA website has been restructured and is currently being moved to the new IAMAS website. ICMA nominated the successful candidate Dr. Marta Abalos (Spain) for the IAMAS ECS Medal Award 2021.

IO3C (<https://www.io3c.org/>)

The Quadrennial Ozone Symposium QOS2020 was held online on 3 - 9 October 2021. It had a total of 341 registered participants and up to 230 virtual participants at the oral sessions. Dobson and Farman's awards were presented to Dr. William Ball and the SBUV-MOD team (NASA). The meeting featured 7 keynote talks by Ulrike Langematz, Neil Harris, Sunyoung Park, Yuanhang Zhang, Amanda Maycock, Natalya Kramarova, and Jason West, and included 68 oral talks and 199 posters. See more information at <http://qos2021.yonsei.ac.kr/>

Following the QOS, a joint special issue between the journal Atmospheric Chemistry and Physics and Atmospheric Measurement Techniques opened on December 1st, 2021: “Atmospheric ozone and related species in the early 2020s: latest results and trends.” The special issue is open to all submissions within its scope until 31 December 2022. https://acp.copernicus.org/articles/special_issue1194.html
https://amt.copernicus.org/articles/special_issue10_1194.html

The IO3C held its Annual Meeting in November 2021 to discuss accomplishments, the WMO GAW plan for the Dobson and Brewer data reprocessing to update ozone cross-sections and include temperature corrections. A call for proposals to hold the next Quadrennial Ozone Symposium in 2024 was discussed.

Press Release: The International Ozone Commission, on the 34th anniversary of the Montreal Protocol, reports successes and remaining challenges for understanding ozone layer recovery <http://www.io3c.org/press-release-international-ozone-commission-34th-anniversary-montreal-protocol-reports-successes>

IO3C co-sponsored the ASOPOS 2.0 report on the Assessment of Standard Operating Procedures for Ozonesondes was recently published: https://www.gruan.org/gruan/editor/documents/meetings/icm-12/pres/pres_204_Smit_ASOPOS-20.pdf

The 11th Ozone Research Managers (ORM11) meeting was held in July 2021 and addressed the current needs for continuous monitoring of ozone and ODS. IO3C members participated in the discussion and contributed to the report. The ORM11 report provides recommendations on the regional tracking of ODS illegal production. Report of the eleventh meeting of the Ozone Research Managers of the Parties to the Vienna Convention (ORM11) can be found at: <https://ozone.unep.org/meetings/thirty-third-meeting-parties/presentations>

ICPAE (<https://www.iamas.org/icpae>)

- ICPAE launched a new website, hosted by IAMAS.
- ICPAE submitted a session proposal for IUGG2023, led by Ann C. Vandaele.
- An ICPAE proposal for a webinar plan in 2022 was selected to receive IAMAS support.
- Feng Tian and Ann C. Vandaele supported organizing the webinar team. The team members are Yeon Joo Lee, Daniel Yiu Wah Lo, Tao Cai, and Maarten Roos-Serote. The team prepared the webinar mailing list, webinar page & poster, and webinar channels in YouTube and Bilibili, and invites speakers. The first webinar was on 17 Januar 2022, and details can be found at <https://www.iamas.org/icpae/webinar/>.
- ICPAE supported the ECS webinar activity by inviting a speaker (Xi Zhang) among the ICPAE members (<https://www.iamas.org/ecs/2021/09/09/iamas-early-career-scientist-webinar-series-3-september-21st-2021/>). Yeon Joo Lee is representing ICPAE in the IAMAS ECS Committee.

ICPM (<https://www.iamas.org/icpm/>)

The International Commission on Polar Meteorology (ICPM) over the past year has worked on several activities coming out of the pandemic. The ICPM-endorsed 16th Workshop on Antarctic Meteorology and Climate was hosted online by the Byrd Polar Climate and Research Center at The Ohio State University <https://byrd.osu.edu/events/wamc>. The event hosted a record 140 attendees from 15 countries and is summarized in the associated journal of IAMAS, Advances in Atmospheric Sciences. Presentations can be found here: http://polarmet.osu.edu/WAMC_2021/program.php

An additional initiative that has been undertaken in the past year is the ICPM Webinar series. This effort brings polar atmospheric science to the community, especially to students and early career scientists. Presentations are made by both senior scientists and early career researchers. Topics have included the recent Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAIC) expedition and the Year of Polar Prediction – Southern Hemisphere (YOPP-SH). The presentations have been recorded and can be found here on the ICPM website: <https://www.iamas.org/icpm/resources/>

The first ever ICPM virtual business meeting was held in conjunction with the Virtual Atmosphere-Cryosphere-Ocean seminar series (VACO-21). This opens the door for future business meetings to be held on an annual basis.

ICPM continues its involvement with the IAMAS early career initiatives having a representative on the IAMAS Early Career Scientist committee (Lee Welhouse). The ICPM members have also elected two new roles to our committee to help us increase our engagement with our members: Jonathan Wille (ICPM ECR) and Amelie Kirchgaessner (social media/comms).

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

The International Radiation Commission quadrennial symposium (IRS) has now been twice delayed. IRS 2020 was originally scheduled for 6-10 July 2020 at the Thessaloniki Concert Hall Convention and Cultural Center, in Thessaloniki, Greece. Over 550 authors submitted over 600 abstracts. It was

rescheduled for 14–18 June 2021 due to the global pandemic, then again rescheduled for 4-8 July 2022 in Thessaloniki. Please see <https://www.irs2022.org/> for additional updates.

The IRC 2021 annual business meeting was held virtually on 10 September 2021. Eleven new commissioners who started their first terms in January were welcomed. The current IRC geographical representation is: Europe, 49%; North America, 31%; Asia, 18%; South America, 2%. Additional activities at the business meeting included reports from the 10 active IRC Working Groups. A new working group on Total and Spectral Solar Irradiance was proposed and unanimously approved by the commission. Finally, Prof. Ping Yang presented an In Memoriam for Kuo-Nan Liou (1943-2021). A tribute to Prof. Liou can be found at <https://www.iamas.org/irc/kuo-nan-liou-1943-2021/>.

FUTURE ACTIVITIES

Early Career Scientist (ECS) Committee

- Continue ECS webinar series
- Hold a one-week online event in summer (June or July) 2022, with scientific sessions, professional talks on manuscript writing, proposal writing, women scientists, etc.
- Continue connecting with YESS, W2W and other organizations by inviting them to our events and attending their events.
- Start regional working groups (we already started one in China) and regional activities

ICAE (<http://www.icae-iamas.org>)

- Prepare and convene the 17th ICAE General Assembly (ICAE2022).
- Issue two newsletters, one in spring and one in the fall.
- Maintain the website for ICAE.
- Update the ICAE colleague mailing list as needed.

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

- Organization at EGU 2022 (April 3-8, 2022) of two sessions: “Interglacial diversity” and “Monsoon systems in a changing climate: past, present and future.”
- Organization of a virtual international workshop on “Asian Monsoon variability and dynamics from astronomical time scale to decadal time scale” in June 2022.
- Nomination of new ICCL members.

ICCP (<https://www.iamas.org/iccp/>)

The ICCP is planning to sponsor several sessions at the 2023 IUGG/IAMAS meeting in Berlin, Germany. The proposed sessions are as follows:

- cloud and precipitation studies, including separate sessions on tropical and high latitude clouds;
- cloud-radiative interactions;
- weather and climate extremes: understanding, modelling, prediction and impacts;
- dynamics and microphysics of moist convection; cloud nucleation studies;
- weather modification and small-scale geoengineering: theory, practice and technology.

Several of these sessions are joint with other commissions. Before the IUGG/IAMAS meeting, Drs. Kraemer and Spichtinger are planning a workshop entitled “Discussions on clouds containing ice” to be held in Mainz, Germany.

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

The ICMA sponsored 1st VolMIP workshop has been postponed to 2022. Similarly, the 11th International Workshop on Long-Term Changes and Trends in the Atmosphere has been postponed to 30 May - 2 June 2022. ICMA is sponsoring the upcoming 44th COSPAR assembly in Athens, Greece, 16 - 24 July 2022.

IO3C (www.io3c.org)

The joint special issue between the journal Atmospheric Chemistry and Physics and Atmospheric Measurement Techniques “Atmospheric ozone and related species in the early 2020s: latest results and trends.” is open to all submissions within its scope until 31 December 2022. https://acp.copernicus.org/articles/special_issue1194.html
https://amt.copernicus.org/articles/special_issue10_1194.html

ICPAE (<https://www.iamas.org/icpae>)

The first ICPAE webinar was on 17 January 2022, and details can be found at <https://www.iamas.org/icpae/webinar/>.

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

ICPM has concluded the planning for sessions at the 28th IUGG Assembly in Berlin, Germany, and will be hosting/co-hosting several sessions. The ICPM-endorsed 17th WAMC will be a hybrid meeting hosted by the University of Wisconsin-Madison, 4 and 5 August 2022 just before the Collective Madison Meeting which includes the 17th Conference on Polar Meteorology and Oceanography.

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

The IRS quadrennial symposium, see <https://www.irs2022.org/>, is presently scheduled for 4-8 July 2022 in Thessaloniki, Greece.

In October 2021, the IRC opened bidding for proposals for IRS2024. Proposals will be due by May 2022. A selection will be determined at the 2022 Business Meeting in Thessaloniki in July 2022. Interested bidders should refer to the Resources page on the IRC website, <https://www.iamas.org/irc/resources/>, for guidance on proposing. Bids from Asia and North America will be most welcome but all bids will be considered.

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: <https://iapso-ocean.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 <https://iapso-ocean.org/>.

ADMINISTRATION

The IAPSO Bureau was renewed in July 2019 during the IUGG General Assembly in Montreal. Two additional members were added in 2020 after online election and one of them was replaced in 2021 (By Law n. 9-d).

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)
	Rick Lumpkin (USA, until September 2021)
	Yukio Masumoto (Japan)

Jae-Hun Park (Republic of Korea)
Joellen Russell (USA, replace Rick Lumpkin from October 2021)
Alejandra Sanchez-Franks (UK)
Christa von Hillebrandt-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.

The Executive Committee met online on 26 May 2021 and any other business was conducted by email and Zoom where appropriate. Among these, various meetings were dedicated to the visibility of IAPSO and in particular to the development of a new website.

ACTIVITIES

Virtual Atmosphere-Cryosphere-Ocean seminar series (VACO-21), 19-23 July 2021

The principal activity during the year was the organization of VACO-21 replaced our postponed joint assembly with IAMAS and IACS in Busan (Rep. of Korea). Rather than having a general call for abstracts, VACO-21 consisted of a reduced number of invited speakers. The program was organized over 5 days from Monday, 19 July to Friday, 23 July 2021. Over the week, 187 individuals joined the audience. Recordings of the excellent presentations are available here: <https://www.youtube.com/channel/UCP3bCxu-NIglINmeoHgGxEQ/videos>. IAPSO contributed with the talks of 4 invited speakers.

2023 General Assembly

The next General Assembly of IUGG, involving all of IUGG's Associations, is scheduled for Berlin, Germany, 11-20 July 2023. Organizational work began in July 2021 regarding the establishment of the Science Program Committee (SPC) and preliminary discussions on the program.

IAPSO Best Practice Study Groups

A call for IAPSO Best Practice Study Groups in the period 2022-2023 has been opened on 6 September, 2021. IAPSO received five high calibre proposals and two of them were selected by the evaluation committee:

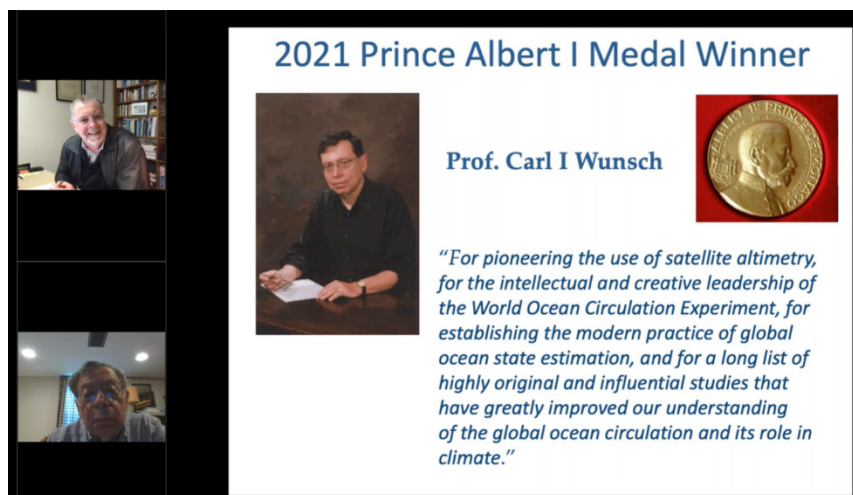
- Best Practice Study group for the systematic evaluation of mapping methods in reconstructing ocean heat content and thermosteric sea level
- Best Practice Study group on Tidal Analysis

IAPSO Medals

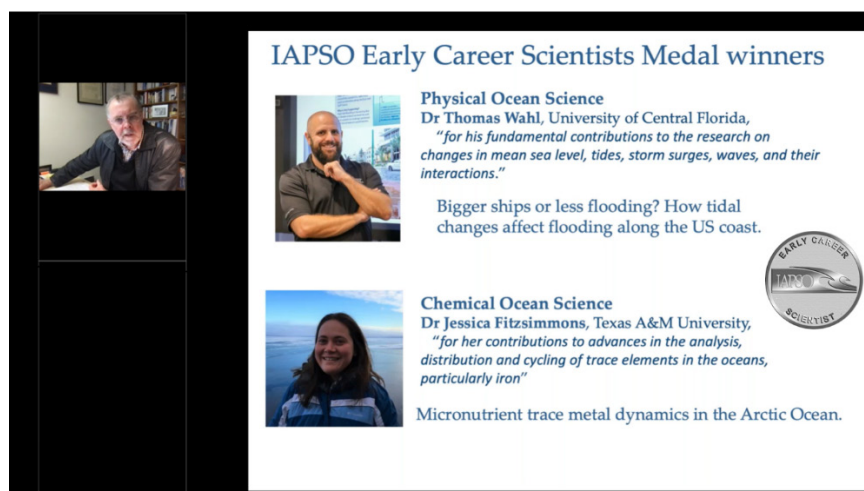
Despite the cancellation of the Joint Assembly in 2021, IAPSO has decided to continue the activity of awarding its medals. Calls for the Albert I medal and ECS medals for 2021 were issued in 2020 and the medals virtually delivered during online events. Presentations in person are scheduled to take place during the IUGG General Assembly, Berlin, Germany, July 2023.

- The Prince Albert I Medal 2021 was awarded to Prof. Carl Wunsch, Cecil and Ida Green Professor of Physical Oceanography, Emeritus, at the Massachusetts Institute of Technology, in recognition of his groundbreaking contributions to the development of modern physical oceanography. The Award Ceremony was held online on Monday, 19 July (http://iapso.iugg.org/images/stories/_imagesMedal/Albert_I_medal/IAPSO_Award_Ceremony_2021.mp4).
- The IAPSO Early Career Scientist Medal 2021 in physical ocean science was awarded to Dr. Thomas Wahl, University of Central Florida, USA, in recognition of his fundamental contributions to the research on changes in mean sea level, tides, storm surges, waves, and their interactions.
- The IAPSO Early Career Scientist Medal 2021 in chemical ocean science was awarded to Dr. Jessica Fitzsimmons, Texas A&M University, USA, in recognition of her contributions to advances in the analysis, distribution and cycling of trace elements in the oceans, particularly iron.

Dr. Wahl and Fitzsimmons presented their talks on Wednesday, 21 July during VACO-21 (<https://www.youtube.com/watch?v=NOI6VGp93HY>, <https://www.youtube.com/watch?v=ytrP3JAIFT0>).



IAPSO President Trevor McDougall presenting the Prince Albert I Medal to Prof. Carl Wunsch during the online Award Ceremony on Monday, 19 July 2021



IAPSO President Trevor McDougall presenting the Early Career Scientists Medal winners during the online Award Ceremony on Monday, 19 July 2021

SCOR Administration

IAPSO President Trevor McDougall attended the virtual SCOR Annual Meeting in October 2021. The many subsidiary body of SCOR were reviewed and memberships renewed. Many of these bodies coordinate physical, biogeochemical and fisheries research in the global ocean. Three new SCOR working groups were selected for funding, each receiving sufficient funds for three annual face-to-face meetings.

ACTIVITIES OF ASSOCIATION COMMISSIONS, WORKING GROUPS

Early Career Scientist Working Group

Throughout 2021, IAPSO ECS worked to strengthen diversity, equity and inclusion efforts during upcoming IUGG assemblies, as well as within the IAPSO ECS community. A new committee member, Mujeeb Abdulfatai, was recruited to strengthen the team for this effort. For the VACO21 week, the IAPSO ECS committee organised a virtual interactive career event, with two invited speakers sharing their experiences and providing advice on post-PhD career choices. The event was recorded and made available on the IAPSO ECS website (<http://www.iapsoecs.org>). The IAPSO ECS website continues to be a valuable resource for the network members, advertising events, jobs and other opportunities. The IAPSO ECS network now reaches over 230 members through the mailing list, and has over 400 followers on Twitter.

Joint Commission on Ice-Ocean Interactions (JCIOI, joint with IACS)

The IACS and IAPSO Joint Commission on Ice-Ocean Interactions (JCIOI) was formally established in January 2021, with the aim to facilitate community efforts to fill critical knowledge gaps in ice-ocean interactions. The primary focus of the joint commission will be on ice-ocean interactions in Antarctica and Greenland, including ice shelves, tidewater glaciers, icebergs, and melange dynamics. The Terms of Reference for JCIOI have been published, and will be made available via links on the parent organisation websites. JCIOI members are currently organising a workshop on ice-ocean interactions to be held in mid-late 2022.

Joint Committee on the Properties of Seawater (JCS)

JCS did not meet in person in 2021, but members continued work on tasks identified during the 2018 Workshops, as well as other items relevant to JCS. A virtual JCS meeting was held on 16 November 2021, comprised of three 2-hour sessions devoted to Salinity/Density, pH, and Relative Humidity, with an average of 10 participants in each session. Progress was reported and participants suggested that the virtual meeting format should be repeated at least once a year.

Permanent Service for Mean Sea Level (PSMSL)

In 2021 PSMSL updated 633 stations with 1095 years of data. Our annual mean sea level data set was an integral component of the relative sea level change rates used in the IPCC AR6 projections of sea level change. PSMSL staff developed a web portal to display different sea level projections across the Caribbean Sea (<https://psmsl.org/accord/projections.html>), which can be used to support decision making on how to improve resilience and adapt to future changes. As part of the EuroSea project, PSMSL created a portal (<https://psmsl.org/data/gnssir/>) to distribute sea level data from over 250 Global Navigation Satellite System (GNSS) receivers worldwide.

Tsunami Commission (Joint with IASPEI and IAVCEI)

In 2021, the Tsunami Commission organized the 30th International Symposium at Sendai in Japan using a hybrid meeting platform with in-person and online from 1 to 3 July. More than 150 scientists were participated in the meeting. Members of the Tsunami Commission also actively participated in the organization of numerous tsunami sessions at EGU and AGU. It should be noted that tsunami sessions at these meetings have recently attracted a large number of audiences because of recent destructive events and new findings.

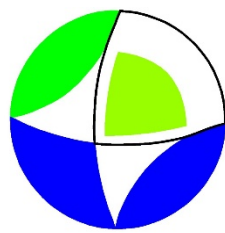
FUTURE ACTIVITIES

The following activities are scheduled for 2022 and beyond:

- 18-20 May 2022, The Second World Conference on Meteotsunamis, Menorca, Spain. All information, including submission of abstracts and registration, may be found at the conference web pages at <http://2cm-menorca.ime.cat/>.
- Participation in the 28th IUGG General Assembly, 11-20 July 2023, at the at the Messe Berlin – City Cube, Berlin, Germany.

Stefania Sparnocchia, IAPSO Secretary General
Trevor McDougall, IAPSO President

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



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 IASPEI efforts during 2021 were directed towards the 3rd Joint IAGA-IASPEI Scientific Assembly planned for Hyderabad, India, in 2021 and the (re)planning of the Assemblies of IASPEI's four Regional Commissions, planned for 2020 and rescheduled due to the COVID-19 pandemic.

ADMINISTRATION

EC & Bureau meetings

The IASPEI Bureau / Executive Committee (EC) had two joint meetings in 2021 both organized as video conferences. There were additional regular e-mail exchanges regarding all Association related questions (as e.g., financial support, requests, planning of future Assemblies or business to be solved immediately) with the members of the IASPEI Bureau and EC throughout the year.

Other matters

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

Statutes. The IASPEI statutes and by-laws were not changed in 2021. 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 download from the IASPEI website. Four Newsletter issues as well as three bulk-mails with information regarding the 3rd Joint IAGA-IASPEI Scientific Assembly were distributed in 2021.

ACTIVITIES

Scientific Assemblies, Workshops/Symposia etc.

The 3rd Joint Scientific Assembly of IAGA (International Association of Geomagnetism and Aeronomy) and IASPEI was planned as conference in Hyderabad, India. Due to the ongoing COVID-19 pandemic our Indian colleagues organized the Assembly as a fully virtual event from 21 to 27 August 2021 (<https://www.iaga-iaspei-india2021.in/>). Although new challenges had to be mastered with this new format, the meeting attracted 828 participants from 53 countries, over 500 from IAGA and nearly 300 from IASPEI, and included 212 students from 37 different countries. The program of the Scientific Assembly did not differ much from the originally planned one, and included 3 joint plenary talks, 8 joint sessions and 27 IAGA and 17 IASPEI symposia with altogether 778 abstracts for oral and poster presentations. It was preceded by the NGRI-CSIR Diamond Jubilee Symposium, which celebrated the 60th anniversary of the hosting institute with 8 invited lectures. During the Assembly, the IASPEI Commissions and IASPEI sponsored bodies also had their business meetings.



The opening ceremony of the IAGA-IASPEI Joint Assembly 2021 was attended in person by selected local participants and streamed online for all others

The 13th General Assembly of the Asian Seismological Commission (ASC) was originally planned to be held in Sharm el-Sheikh, Egypt, in June 2020. The Assembly was postponed and then held as part of the 3rd Joint IAGA-IASPEI Scientific Assembly in Hyderabad, India, in August 2021. The 14th General Assembly is now planned to be held in Egypt, in October 2022.

The 38th General Assembly of the European Seismological Commission (ESC) was originally planned to be held on Corfu, Greece, in September 2020. The Assembly was postponed and was held as a fully virtual conference in September 2021.

The 3rd General Assembly of the African Seismological Commission (AfSC) was originally planned to be held in Kasane, Botswana, for June/July 2020. The Assembly was postponed several times and is now planned as a virtual conference for 2022.

The 4th General Assembly of the Latin American and Caribbean Seismological Commission (LACSC) was originally planned to be held in Quito, Ecuador, in August 2020. The Assembly had to be postponed and is now planned for November 2022.

Several IASPEI related or supported Workshops and Summer Schools planned for 2021 were cancelled or postponed to a later date.

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

In August 2021, the IASPEI Commission on Education and Outreach organized a pre-Assembly Summer School in the week before the Joint IAGA-IASPEI Scientific Assembly, in which 13 instructors gave lessons for 30 students.

The IASPEI Commission on Education and Outreach in collaboration with a) South Asia Alliance of Disaster Research Institutes (SAADRI), b) National Science and Technology Center for Disaster Reduction (NCDR), Rep. of China, c) Multidisciplinary Centre for Geoinformatics, Delhi Technological University (DTU) and d) National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Govt. of India organised a Three-day Online International Workshop on “Role of Early Warning System in Geo-Meteorological Hazards Risk Reduction”, which was held from 8 – 10 December 2021.

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 website of the GFZ Library (<http://bib.telegrafenberg.de/publizieren/vertrieb/nmsop/>).

Scientific Programs, Projects, Publications

In 2020, 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 2nd year during the IASPEI Assemblies. During the 3rd Joint IAGA-IASPEI Scientific Assembly, IASPEI honored Prof. Barbara Romanowicz (USA/France) with the **2021 IASPEI Medal**.

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 researcher, pre-tenure faculty member) from their commission at each even-year Assembly of that Regional Commission. The ESC decided during their General Assembly in September 2021, to give an IASPEI Early Career Scientist Award to Irina Dallo (Switzerland).

Obituaries

Obituaries for prominent scientists of the IASPEI community are regularly published in the IASPEI Newsletters and on the IASPEI webpage. In 2021, sadly, 10 obituaries had to be published.

FUTURE ACTIVITIES

2022 will be a busy year for IASPEI:

- In 2022, the IASPEI main activity will concentrate on the 28th IUGG General Assembly planned for 11 – 20 July 2023, in Berlin, Germany (<https://www.iugg2023berlin.org/>).
- All four Regional Commissions of IASPEI (AfSC, ASC, LACSC and ESC) are planning to hold their Assemblies in 2022:

AfSC plans its 3rd General Assembly as virtual conference in Botswana).

ESC plans its 38th General Assembly at a joint conference with the European Association of Earthquake Engineering (EAEE) as the 3rd European Conference on Earthquake Engineering and Seismology (3ECEES) in Bucharest, Romania, in September 2022.

The 4th General Assembly of LACSC is now planned for Quito, Ecuador, in October 2022.

ASC plans its 14th General Assembly in Egypt for October 2022.

The IASPEI Bureau / ExeCom decided during its joint meeting in September to organize the 2025 Scientific Assembly again as a Joint Assembly together with IAGA in Lisbon, Portugal.

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

INTRODUCTION

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, among which igneous geochemistry and petrology, geochronology, geophysics, remote sensing, modeling, the physics of magma genesis and ascent from the mantle to the surface, and volcano monitoring in worldwide Observatories.

Work is carried out in the following Commissions, Networks and Working Groups:

Purely IAVCEI Commissions

1. Chemistry of Volcanic Gases
2. Volcanic Lakes
3. Volcanic Clouds (ex-Remote Sensing)
4. Collapse Calderas
5. Explosive Volcanism
6. Monogenetic Volcanism
7. Submarine Volcanism
8. Volcanic and Igneous Plumbing Systems
9. Large Igneous Provinces
10. Volcano Geology
11. Volcanogenic Sediments
12. Tephrochronology
13. Tephra Hazard Modelling
14. Statistics in Volcanology
15. Volcanic Hazards and Risk
16. Cities and Volcanoes
17. International Volcanic Health Hazard Network (IVHHN)
18. Volcano Geoheritage and Protected Volcanic Landscapes

Networks

- a. Early-Career Researchers Network (ECR-Net)
- b. International Network for VOLcanology Collaboration (INVOLC)
- c. World Organization of Volcano Observatories (WOVO)

Joint Commissions

1. IAG/IAVCEI Commission on Volcano Geodesy
2. IASPEI/IAVCEI Commission on Volcano Seismology and Acoustics
3. IASPEI/IAVCEI/IAGA Commission Physics & Chemistry of Earth Materials
4. IAGA/IASPEI/IAVCEI Working Group on Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV)
5. IASPEI/IAVCEI International Heat Flow Commission
6. IAVCEI/IACS Commission on Volcano-Ice Interaction
7. IAPSO/IASPEI/IAVCEI Commission on Tsunamis

ADMINISTRATION

Its Executive Committee for the 2019-2023 term is composed of the following elected members:

President	Patrick Allard	France
Secretary General	Roberto Sulpizio	Italy
Vice-President	Masato Iguchi	Japan
Vice-President	Jan Lindsay	New Zealand
Immediate Past President	Donald Bruce Dingwell	Germany
Officers	Lizette Rodriguez	Puerto Rico
	Eisuke Fujita	Japan
	Fidel Costa Rodriguez	Singapore
	Jose' Viramonte	Argentina
	Julia Eychenne (ECR)	France

Like for other Associations, the Covid-19 pandemic has strongly impacted the meeting plans of IAVCEI during 2021, after the same in 2020. Our 11th Conference Cities on Volcanoes ought to be postponed twice – it will now be held in June 2022 - and our Scientific Assembly in New Zealand has been re-programmed to January 2023.

IAVCEI Executive Committee activities

- Online Exec. meeting every two-three months in 2021, depending on requirements. Updates on IAVCEI Finances, funding supports, strategies, and any other matter.
- Four issues of the newsletter "IAVCEI News" published in 2021, like every year, through mailing and the website.
- Overall survey of the activities of IAVCEI Commissions and Working Groups, in the perspective to reduce their numbers. This work was conducted by the two Vice-Presidents then approved by the EC. Guidelines for Commission activities, renewal or deactivation were updated. The updated list of Commissions and Working Groups is reported below.
- Activation of the new IAVCEI website (<https://www.iavceivolcano.org>), plus dedicated social media accounts (Twitter, Instagram and Facebook), since June 2021. Sub-domains were created for the Bulletin of Volcanology and for hosting the Commission's webpages (ongoing process).
- Creation and activation of an IAVCEI Communication Team led by our webmaster.
- Creation of an e-Volcano platform for specialists, teachers, students and the public (peer-reviewed video docs, with DOI, on all subjects and lessons in Volcanology).
- Online delivery of the IAVCEI Award for Volcano Surveillance and Crisis Management, attributed every 2 years.

- Signature of Memorandum of Understanding with different regional and international Associations (European Association of Geochemistry, Geochemical Society, International Association of Physics Students)

ACTIVITIES

Members

By the end of 2021 the IAVCEI had 2,142 members as a whole, among which about 800 with due-paid membership fee (1,042 in 2020). This annual fee, whose amount depends on the professional status of each member, is a main income source for IAVCEI's activities and supports to Commissions, travel grants, etc. Active members currently include 451 Regular members, 118 Life members, 231 Young researcher members and students, and 5 Benefactor members.

Special IAVCEI webinars

Activation of special IAVCEI webinars on ongoing or/and recent eruptions of major interest. Four such webinars were held in 2021 (Etna, Iceland, Soufriere in St. Vincent, and Nyiragongo eruptions). They attracted a wide audience and promoted effective membership renewal or even new membership.

Activation a new webinar series of our Early Researchers Career Network. First one was in December 2021.

World Organization of Volcano Observatories (WOVO)

Activation of a think-tank to mind about the renewing/restructuring of the WOVO. A dedicated Survey was sent to worldwide VOs in order to check their expectations and suggestions. Answers are being collected and will be soon analyzed. The WOVO status was changed from a Commission to a Network.

2021 Meetings, workshops and courses

Due to the current pandemics we had no meeting and workshops. We only supported summer schools:

- 14th International AIV summer school, 28 August to 4 September 2021, Lipari, Italy
- 9th Edition of postgraduate course in volcanology, 8 to 31 October 2021, Olot, Spain

FUTURE ACTIVITIES

Foreseen activities for 2022:

- 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
- Promotion of gender equity within IAVCEI instances

Patrick Allard, IAVCEI President
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

INTRODUCTION

The history and purpose of CCEC may be found on the CCEC website at: www.ccec-iugg.org

ADMINISTRATION

Membership

Officers and members of the Commission may be found in the IUGG Yearbook. The Chair is Jianping Li (China), the Vice-Chair is Keith Alverson (Canada/USA), the Secretary-Treasurer is Tonie van Dam (USA/Luxembourg), and the Immediate Past Chair is Tom Beer (Australia). Commission members include Harry Bryden (UK), Mark Clilverd (UK), Annette Eicker (Germany), Domenico Giardini (Switzerland), Andrew Mackintosh (Australia), Alberto Montanari (Italy), Joyce Penner (USA), Alan Robock (USA), Dan Rosbjerg (Denmark).

Business meetings

In 2021 we organized three business Zoom meetings as follows:

- On 24 February 2021. In attendance: Jiangping Li, Keith Alverson, Tom Beer, and Tonie van Dam. We discussed future actions for the CCEC, a product for the International Year of Basic Sciences for Sustainable Development, and CCEC's contribution at IUGG 2023 in Berlin, Germany.
- On 8 April 2021. In attendance: Jiangping Li, Keith Alverson, Tom Beer, and Tonie van Dam. The themes include a CCEC/authors meeting at IUGG 2023 in Berlin, a draft proposal to IUGG for some funding for our book project "Geosciences for Sustainable Development", connection with IOC of UNESCO on the international decade, and CCEC's Qingdao meeting in 2022.
- On 1 July 2021. In attendance: Keith Alverson, Annette Eicker, Alan Robock, Tom Beer, Jianping Li, Andrew Montanari, Domenico Giardini, Serhat Sensoy, Harry Bryden, and Tonie van Dam. The

themes include reports on Activities in 2020 and 2021, reports on CCEC finances, what IUGG can do for those outside of the IUGG community, and CCEC Membership.

ACTIVITIES

CCEC website maintenance

The CCEC website was updated to reflect the new Executive Committee.

Proposal for International Year of Basic Sciences for Sustainable Development (IYBSSD Proposal).

Evaluation of Applications to the IPCC Scholarship Programme Sixth Round of Awards (2021-2023).

Scientific Meeting Organization

- At EGU 2021 Assembly (19-30 April 2021), organized Session AS1.10: The global monsoons in current, future and palaeoclimates and their role in extreme weather and climate events (Convener, Jianping Li, and Co-conveners, Roberta D'Agostino, Kyung-Ja Ha, Pascal Terray, and Andrew Turner).
- Co-organized 4th CCGG (Chinese Congress of Geodesy and Geophysics) Conference from 17-18 July 2021 at Qingdao, China (Jianping Li as one of the lead organizers).

Keynote Speeches and Invited Talks

- Plenary Presentation: Tom Beer, Wildfires, Climate and Road Safety, 4th CCGG conference, 17-18 July 2021, Qingdao.
- Plenary Presentation: Tom Beer, Climate, Bushfires, Air Quality, Road Safety, 25th International Clean Air and Environment Conference (CASANZ2021), Virtual online conference, 18 May 2021.
- Keynote Presentation: Tom Beer, Climate, Bushfires, Road Safety, International Conference on Future Challenges and Sustainable Development Goals: Science to Policy Framework, New Delhi, India and online, 16 April 2021.

FUTURE ACTIVITIES

We plan to organize:

- The 3rd CCEC scientific workshop in 2022 in Qingdao if the COVID situation allows.
- Keith is appointed the Early Career Scientists Award Committee of the IUGG. He will represent IAMAS on the IUGG young scientist committee and do more work in late 2022 and 2023.
- Session AS1.18/CL5.3.9 at EGU 2022 Assembly (23–27 May 2022): Monsoon systems in a changing world: past, present and future.

Future Plans for 2023

- To lead a CCEC/authors meeting at the IUGG congress in Berlin in summer 2023.
- Contacted by the IUGG regarding the scientific committee.
- Union Sessions (e.g., Geosciences for Sustainable Development) at the 28th IUGG General Assembly.
- CCEC Business Meeting at the 28th IUGG General Assembly.

Jianping Li, CCEC Chair

Union Commission on Mathematical Geophysics (CMG)

CMG website: <http://www.iugg.org/about/commissions/cmg.php>

INTRODUCTION

During 2021 the commission has been awarded an IUGG grant for organizing an advanced geophysical workshop, submitted a book proposal to the Cambridge University Press – IUGG Special Publication Series, and kept organizing the 33rd biennial CMG meeting – IUGG Conference on Mathematical Geophysics.

ADMINISTRATION

Membership. The CMG membership remained the same in 2021. **Chair:** Alik Ismail-Zadeh (Germany); **Vice-Chairs:** Ute Herzfeld (USA) and Malcolm Sambridge (Australia); **Secretary:** Ilya Zaliapin (USA); **Past Chair:** Yehuda Ben-Zion (USA). **Executive Committee:** Roberto Carniel (Italy, IAVCEI), Enamundram Chandrasekhar (India), William Dewar (USA, IAGA), Alexander Fournier (France, IAGA), Salvatore Grimaldi (Italy, IAHS), Shin-Chan Han (Australia, IAG), Sang-Mook Lee (Korea, IUGG), Annick Pouquet (USA, IAMAS). **Advisory Committee:** Dick Peltier (Canada), Daniel Rothman (USA).

ACTIVITIES

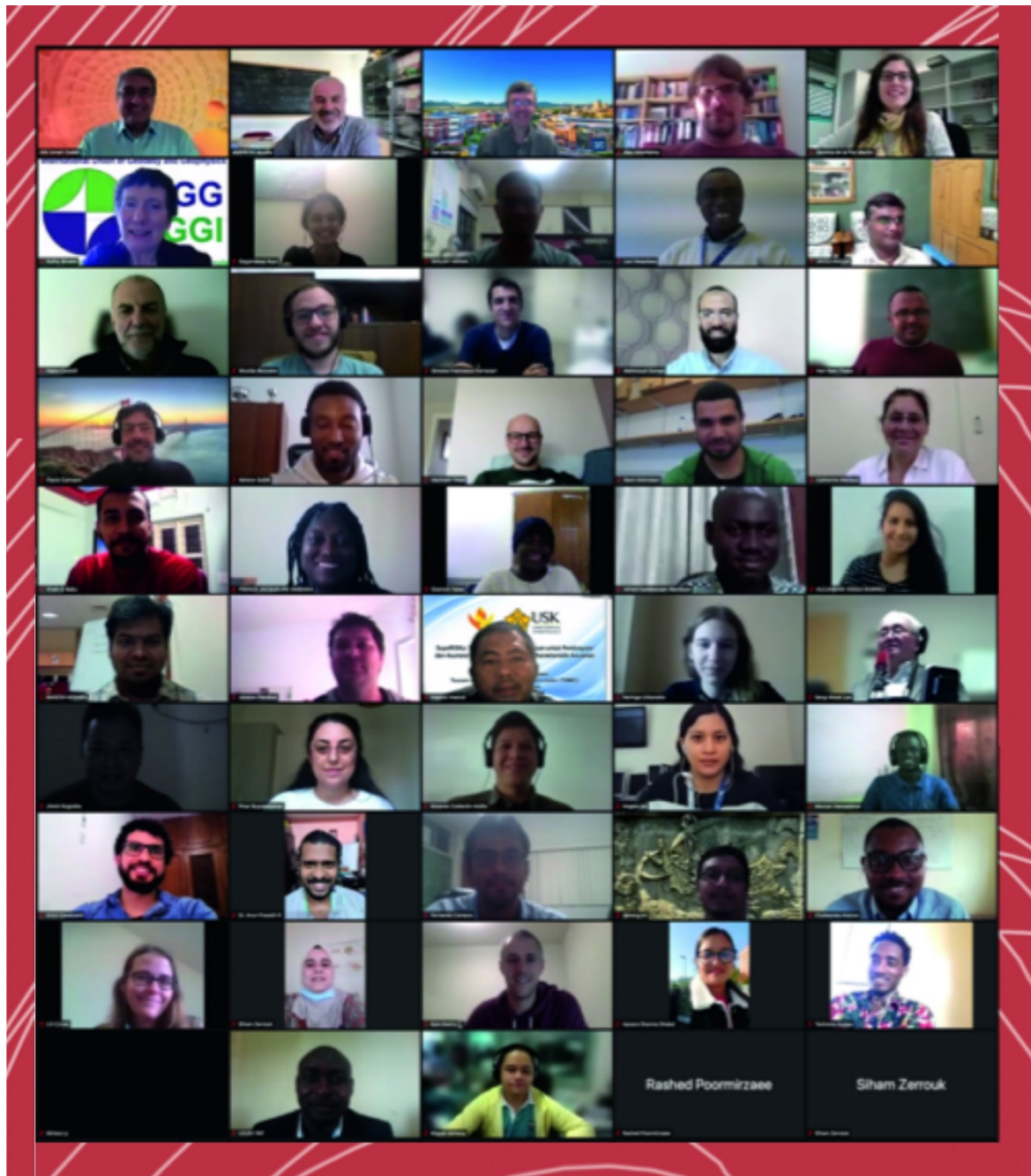
Joint ICTP-IUGG workshop on Data Assimilation and Inverse Problems in Geophysical Sciences, 18 to 29 October 2021

CMG in cooperation with the Earth System Science Section of the Abdus Salam International Centre for Theoretical Physics (ICTP, Trieste, Italy) and the East African Institute for Fundamental Research (EAIFR, Kigali, Rwanda) organized the Joint ICTP-IUGG Workshop “*Data Assimilation and Inverse Problems in Geophysical Sciences*” hosted by ICTP in Trieste, Italy, virtually from 18 to 29 October 2021. Workshop participants received welcome addresses from Kathryn Whaler, IUGG President, and Atish Dabholkar, ICTP Director and Assistant Director General of UNESCO. World leading scientists from Australia, Canada, Germany, Italy, Republic of Korea, Russia, Spain, Switzerland, and USA lectured at the workshop and discussed with participants the topics in relation to specific geophysical disciplines. 96 of 117 applications received were selected, and the applicants were invited to attend the workshop. Among them, 32% are female participants; 79% (12%) are participants from developing (least developed) countries, namely, from Africa and Middle East 33%, Asia 35%, Latin America 19%, and Oceania 3%. Maibys Sierra Lorenzi (Cuba; female), Maria Alejandra Vesga Ramirez (Argentina; female), and Hari Ram Thapa (Nepal, male) received the best workshop paper awards. The Workshop was supported in part by IUGG via grant to CMG and ICTP. More information on the Workshop (scientific program, list of participants, lecture notes and videos) can be found at: <http://indico.ictp.it/event/9609> (see photo next page).

Book “Applications of Data Assimilation and Inverse Problems in the Earth Sciences”

The Cambridge University Press Syndicate agreed to publish the above edited monograph as a part of the IUGG Special Publication Series. Editors: Alik Ismail-Zadeh (Germany/Russia), Dylan Jones (Canada), Fabio Castelli (Italy), and Sabrina Sanchez (France, early career scientist). Editorial Advisory Board consists of the Members of the CMG Executive Committee. We have received 19 chapters and 2 more

are still pending. The book's manuscript is expected to be ready for submission to the Cambridge University Press by May 2022.



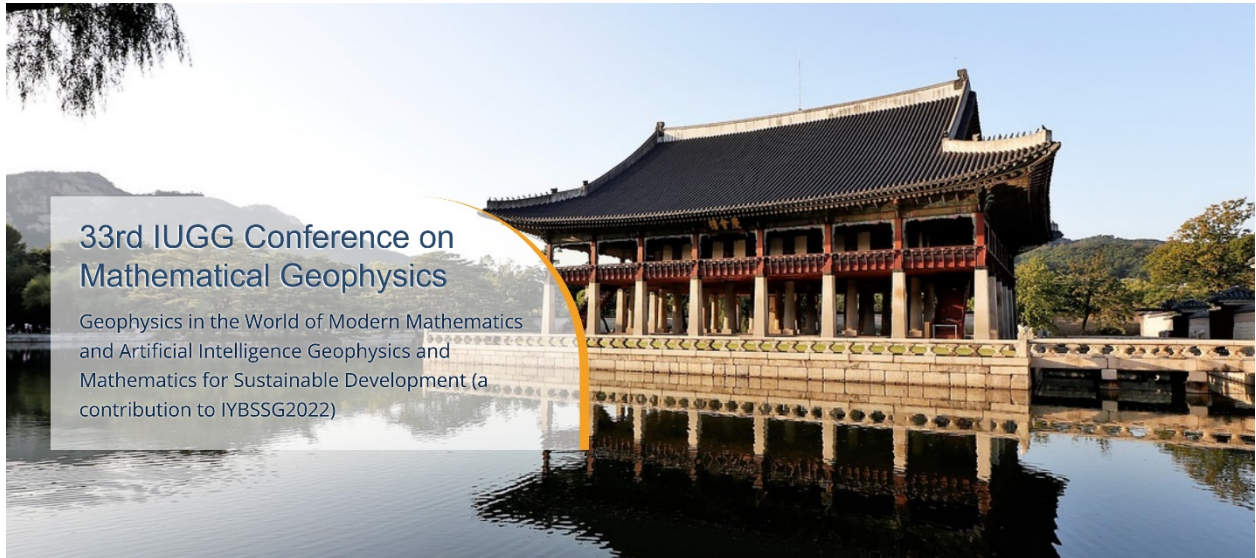
Joint ICTP-IUGG workshop on Data Assimilation and Inverse Problems in Geophysical Sciences, 18-29 October 2021, Trieste, Italy. Group photo. Source: ICTP

The Vladimir Keilis-Borok Medal

The Vladimir Keilis-Borok Medal of the IUGG Commission on Mathematical Geophysics (CMG) has been established by the IUGG Bureau in 2021 to recognize middle career scientists who made important contributions to the field of mathematical geophysics. The aim of the Medal is to honor the legacy of Keilis-Borok – a visionary science leader and organizer, prolific seismologist and mathematical geophysicist, the CMG founder, and former IUGG President – in promoting transformative scientific advancement and selfless leadership. A call for nominations for the Medal (with initial deadline of 1 December 2021) has been extended until 31 January 2022. Five nominations have been received. The

medal is expected to be awarded during the CMG2022 meeting. More information on the Medal can be found at: <http://www.iugg.org/about/commissions/cmg/iuggvkbmedal.pdf>.

Conference on Mathematical Geophysics (CMG 2022)



The committee continued preparation of the CMG conference CMG2022 to be held online (with local participants attending onsite). In December 2021, CMG Chair, CMG Secretary, and Chair of the CMG2022 Local Organizing Committee discussed the essential topics related to the CMG2022. More information on the conference is available at <http://www.cmg2022.org/>.

Union Symposium at the IUGG General Assembly 2023

The IUGG General Assembly (IUGG2023) will be held in Berlin from 11 to 20 July 2023. The IUGG2023 Scientific Program Committee (SPC) requested CMG to organize a Union Symposium. In consultations with the CMG Executive Committee, the following symposium was proposed: “**Geophysics and Mathematics for Implementing Sustainable Development Goals**”. On 16 December, the IUGG2023 SPC accepted our proposal and allocated 2 sessions (90 min each) to the symposium. The Commission negotiates with the IUGG Commission on Climatic and Environmental Changes about a potential joint symposium.

CMG website

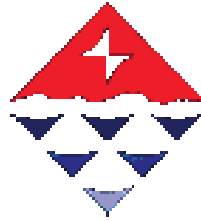
The Commission revised and updated its website, including a new logo:
<http://www.iugg.org/about/commissions/cmg.php>

FUTURE ACTIVITIES

- The commission plans to continue working on the CUP book.
- The commission is working on organizing the 33rd CMG conference in the Rep. of Korea (online with local onsite participation) during July 2022.
- The commission is working on inviting speakers to the 2023 IUGG Union Symposium.

Ilya Zaliapin, CMG Secretary

Union Commission on Geophysical Risk and Sustainability (GRC)



GRC website: TBD

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.

GRC Terms of Reference:

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

ADMINISTRATION

Executive Committee 2019-2023:

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

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) gmcbbean@uwo.ca
- Stephen McNutt (IAVCEI, USA) smcnutt@usf.edu
- Ramesh Singh (IASPEI, USA) rsingh@chapman.edu

ACTIVITIES

The past two years have challenged the future of robust international scientific activity and presented existential challenges to our scientific organizations. While threats of the COVID 19 pandemic were slowly receding in late 2021, a new challenge emerged via the brutality of atrocities unleashed upon the Ukrainian people. The [International Science Council](#) and the [International Association of Geodesy](#) have spoken to the impact of these actions upon our scientific colleagues. The COVID pandemic and these more recent international tensions present barriers to robust scientific cooperation between and within the scientific, governmental and commercial communities. Nations have closed their borders and scientists are forced to work from home while attending international symposia via virtual meetings at all hours of the day and night. The lack of person to person interaction has dulled the vitality of human spirit that energizes our scientific organizations. These same challenges will no doubt affect the 2023 IUGG General Meeting in Berlin, Germany, given the political, economic, and health related barriers to international travel and interaction. The natural, economic and political disasters of the past two years have directly impacted the GRC which ironically is devoted to the reduction of disaster risk to our societies. The GRC must address these challenges both to enhance the vitality of the GRC and to restore and strengthen the vitality of global scientific exchange.

GTEWS: The COVID 19 pandemic forced the postponement of the GRC sponsored Meeting of Principals reported in our 2020 annual report. The Principals meeting was to develop an organizational structure for the implementation of GNSS tsunami early warning system recommended by Resolution #4 of the IUGG 2015 General Assembly and the follow-on GTEWS 2017 workshop. The Principals meeting was partially supported by the IUGG grants program 2020-2023. The meeting was postponed due to COVID pandemic restrictions on travel and the IUGG funding was not requested. Planning continued between the GRC, Group on Earth Observation, the International Association of Geodesy, the Association of Pacific Rim Universities, and International Consortium on Landslides.

Landslides: The IUGG became a signatory of the Kyoto Landslide Commitment 2020 (KLC2020). President Kathy Whaler signed for the IUGG as a supporting organization of the Kyoto Landslide Commitment 2020 (KLC2020) on 8 October 2020. President Whaler provided opening introductions to the [KLC2020](#) during the launching ceremonies on 5 November 2020. The ceremony was scheduled to open the World Landslide Forum 5 (WLF-5) however the COVID-19 pandemic forced its postponement to 2-6 November 2021. The GRC agreed to represent the IUGG within the KLC2020. John LaBrecque, Chair of the GRC, has agreed to serve as co-chair of The Global Promotion Committee of the International Programme on Landslides and Kyoto Landslide Commitment.

Unfortunately, the 2021 WLF-5 meeting was also impacted by the pandemic and the meeting was held as a hybrid meeting. IUGG President Whaler provided welcoming comments and John LaBrecque, Chair of the GRC, participated in a high-level panel discussion entitled **Review of KLC2020 and The Way Forward**, GRC vice-chair Vyacheslav Gusiakov presented a keynote address during the [World Landslide Forum-5 \(WLF-5\)](#). Dr. Gusiakov's presentation on the [11 December 2018 landslide and 90-m icy tsunami in the Bureya water reservoir](#) was delivered on [World Tsunami Awareness Day](#) (5 November 2021) and is published in the ICL proceedings of the WLF-5.



Photograph of the 25 million cubic meter 11 December 2018 landslide and 90-m icy tsunami in the Bureya water reservoir of eastern Siberia as submitted to the World Landslide Forum-5 by GRC vice-chair Vyacheslav Gusiakov. (Gusiakov V., Makhinov A. (2021) 11 December 2018 Landslide and 90-m Icy Tsunami in the Bureya Water Reservoir. In: Sassa K., Mikoš M., Sassa S., Bobrowsky P.T., Takara K., Dang K. (eds) Understanding and Reducing Landslide Disaster Risk. WLF 2020. ICL Contribution to Landslide Disaster Risk Reduction. Springer, Cham. https://doi.org/10.1007/978-3-030-60196-6_25)

FUTURE ACTIVITIES

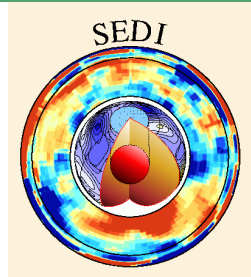
The GRC has resubmitted its proposal for a Meeting of Principals to organize the implementation of the IUGG Resolution #4 and the 2017 workshop recommendations. The proposal is submitted to the IUGG Grants program for the GTEWS implementation meeting to be held in late 2022 or early 2023 in anticipation of reduced pandemic risk. This resubmitted proposal is supported by the IAG, IAGA, IASPEI, IAPSO, as well as numerous international organizations including the GEO, ICL, and the APRU. Given the likely difficulties with international travel for many participants, we intend to hold one or more smaller symposia to discuss regional GTEWS programs for the Southwest Pacific Islands, Australia and New Zealand, as well as South America and the Caribbean.

The IGRC will host a half day symposium on Disaster Risk Reduction during the 2023 IUGG General Assembly Symposium. The symposium will focus upon geophysical risk, disaster risk reduction strategies, and sustainability with an emphasis on advanced acquisition and analysis topics including Artificial Intelligence and Machine Learning. We seek self-contained presentations that bring forward new scientific insights, technologies and partnerships that address the efficacy and sustainability of a specific approach to multi hazard early warning, recovery, and resiliency for geophysical hazards with special emphasis on emerging risk in today's complex world. We intend to coordinate the symposium content with ITU/WMO/UNEP Focus Group on Artificial Intelligence for Natural Disaster Management.

The GRC website has been removed from its previous location and the IUGG has offered to host the GRC website on www.IUGG.org. The IUGG secretariat will inform the GRC when it is prepared to accept the GRC web material. The previous GRC website had fallen into disrepair in previous years and had not been updated to include new activities and leadership. The Executive Committee has discussed a general outline for website content. Farshad Jalili Pirani (fjalilip@uwo.ca) of the Department of Civil and Environmental Engineering, Western University, Canada and an IUGG early career member) has volunteered to undertake this activity.

John LaBrecque, GRC Chair

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



SEDI website: 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 investigation of core magnetohydrodynamics at all time scales, both from a theoretical point of view and from an observational point of view, and of more general 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, core, mantle, crust and possibly surface fluid layers outer layers, with an aim to develop a global view of the Earth as a system of interacting regions, 5) the thermodynamics of the Earth and the investigation of its long-term thermal evolution.

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

IAGA-IASPEI 2021

At the IAGA/IASPEI meeting in 2021, held online in Hyderabad, India, SEDI inspired sessions were organized. One of those was chaired by Chris Davies, Swarandeeep Sahoo, Kimberly Moore and Christine Thomas and was focused on core studies J1: Earth and planetary core structure and evolution

from observations and modelling. The session went well with invited speakers were also from the SEDI members: R.v. Tent, J. O'Rourke and R. Yadav.

In the IASPEI part, the SEDI chair Christine Thomas together with Barbara Romanowicz, Stephane Rondenay and Sebastian Rost organized and chaired the session S13, Seismic structures in the mantle. Invited speakers were P. Kolinsky and L. Cobden.

In addition, plenary talks were given by SEDI chair Christine Thomas on seismic structures near the core-mantle boundary, connecting seismology on the mantle side with core studies, SEDI members Binod Sreenivasan on the role of the core-mantle interaction in the geodynamo and Trond Torsvik on India: A journey in time and space.

There were other sessions with themes of SEDI organized and chaired by members of the SEDI community: e.g., D2 Planetary magnetic fields and geomagnetic secular variation, or 1.4 Earth's magnetic field and secular variation on all temporal and spatial scales. All sessions went well and the digital format was ok for the conference. However, a meeting in person would still be preferred in the future, if it is safe to do so.

FUTURE ACTIVITIES

In **2022, the SEDI meeting** was supposed to be held in Tapei, Rep. of China, at the National Taiwan University at the Institute of Earth Sciences (Academia Sinica) after cancellation of the 2020 meeting in Taipei. The local organizing committee is comprised of Frederic Deschamps and Ban-Yuan Kuo (co-leads) along with Wen-Che Yu, Wen-Pin Hsieh and Kenny Vilella. However, due to the continuation of the Covid pandemic and the travel restrictions and quarantine requirements currently in place for Rep. of China, we are currently exploring possibilities to move the meeting from Taipei to Europe. A strong possibility is the ETH Zürich and we are in the process of finalizing the organization. The organizing committee will be the same as for Taipei and will in addition include Jerome Noir of the ETH, together with other ETH members. The speakers and chairs will be as organized by the Taipei group, with small changes.

Several online conferences have (in our opinion) shown that the talks/posters are often very nice, but the fostering of collaborations, the feedback, especially for posters or streamed talks, are much reduced compared with a conference "in person". Additionally, the time zones are problematic and while, when on a conference in another place, one can concentrate on the conference, a virtual conference does not allow this, since the teaching and admin duties at home continue. We therefore prefer physical meetings for the future. We feel 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.

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

Union Commission on Data and Information (UCDI)



UCDI website: www.iugg-ucdi.org

INTRODUCTION

The Union Commission on Data and Information (hereafter UCDI) was established in 2008 by IUGG. The UCDI was envisaged as a coordination entity for the cross-cutting data and information related activities of the eight Associations of IUGG and to engage with similar bodies in other Unions, Organisations and Societies. Accordingly, UCDI is expected to enable high level of cooperation within and between the scientific communities. This cooperation is needed to encourage the availability of modern data and information systems and services, which are globally distributed, provide universal open access, and ensure their sustainability. 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 Shenoj (India, IAPSO)
Vice-Chair: Anatoly Soloviev (Russia, IAGA)
Members: Sonia Maria Alves Costa (Brazil, IAG)
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: No formal business meeting could be held during 2021, due to the continuation of COVID-19 pandemic in USA, Europe and India that even affected some of the members.

ACTIVITIES

(i) UCDI Chair, Dr. Satheesh Shenoj delivered talks on (i) Importance of Data in assessing the impacts of climate change on Indian coasts at a special session on *Climate Resilience and Sustainability in Disaster Management* at 5th World Congress on Disaster Management on 24 November 2021 and a talk on (ii) Climate change and Indian coasts at COP26 Adaptation and Resilience Events Series, Final Event, organised by UKRI and other partner organisations from Asian countries on 15 Dec 2021.

(ii) UCDI Chair, Dr. Satheesh Shenoi participated in the 54th meeting of the Executive Council of IOC/UNESCO held on 14 June 2021 (online) as the Vice-chair of IOC representing the Group IV countries and as the liaison officer of IUGG to IOC/UNESCO and as part of Indian delegation.

(iii) UCDI Chair, Dr. Satheesh Shenoi participated in the 31st General Assembly of IOC/UNESCO held online during 15-25 June 2021 as the Vice-chair of IOC representing the Group IV countries and as the liaison officer of IUGG to IOC/UNESCO and as part of Indian delegation.



UCDI Chair, Dr. Satheesh Shenoi participating in the 31st General Assembly of IOC/UNESCO held online during 15-25 June 2021 as the Vice-chair of IOC representing the Group IV countries and as the liaison officer of IUGG to IOC/UNESCO and as part of Indian delegation

(iv) UCDI co-chair Dr. A. Soloviev co-convened a session “Geoscience data FAIR: life cycle inside repository, Licensing, data publication, and citation” and co-organized a session “Analogue Data for Future: Preservation and Present-Day Utilization of Instrumental Historical Data in the Geosciences” of the 2021 IAGA-IASPEI Joint Scientific Assembly. The session attracted more than 20 contributions.

(v) UCDI Vice-chair A. Soloviev delivered the following lectures at two important scientific events.

- “History of space weather studies and observations: Russian aspect” at 26th International Congress of History of Science and Technology held on online during 25-31 July 2021, <https://www.ichst2021.org/>.
- “Dynamics of the geomagnetic field in the Arctic region: sources, observations and models” at All-Russian school of young scientists "System analysis of the dynamics of natural processes in the Russian Arctic" held during 20-21 September 2021 at Arkhangelsk, Russia. <https://school2021.gcras.ru/>.



Prof. V. Pilipenko, Dr. R. Krasnoperov, Dr. A. Soloviev, Dr. A. Rybkina and Dr. P. Shebalin at the All-Russian school of young scientists "System analysis of the dynamics of natural processes in the Russian Arctic" conference held on 20-21 September 2021 at Arkhangelsk, Russia

(vi) Dr. A. Soloviev served as a Guest Editor of Special Issue on "Ground-Based Geomagnetic Observations: Techniques, Instruments and Scientific Outcomes" of Applied Sciences journal, https://www.mdpi.com/journal/applsci/special_issues/Ground_Geomagnetic_Observations in 2021.

(vii) During 2021, the UCDI Member Dr. Yasuhiro Murayama

- (a) Continued the contribution to G7 Open Science Working Group (G7OSWG) as its co-chair, which has been set up at the G7 Science Ministers' meeting 2016. The G7 science group aims at making a harmonized and high-level science policy by the governmental policy makers and international open science and/or research data experts of member country delegates, challenging to realize better science systems in G7 member countries and beyond. Also, he works as a co-chair of sub-working group of interoperability and sustainability of data infrastructure under G7OSWG.
- (b) Served as a moderator of panel on "Open Science: Issues and Challenges Accelerated by COVID-19" at the Annual Meeting of AAAS (American Association of Advancement of Science) on 11 February 2021.
- (c) Convened a session on "Promoting Research Data Sharing and Management in Japan - in context of Belmont Forum PARSEC project" and delivered a talk titled "Opening and overview of Belmont Forum 'CRA-SEI' and PARSEC", as part of the conference held at Japan Open Science Summit 2021 on 17 June 2021.
- (d) Dr. Yasuhiro Murayama was invited to the United Nation's 2nd Open Science Conference (<https://www.un.org/en/library/OS21>) organized by UN Dag Hammarskjöld Library and UN Division of SDGs, held virtually during 21-23 July 2021. He delivered a talk and joined the panel session "Policy Makers and Open Science" in the conference.
- (e) Dr. Murayama's article contributed to UN's 2nd Open Science Conference out-put document "Open Science for Climate Action" (https://www.un.org/sites/un2.un.org/files/open_science_for_climate_action_final.pdf).
- (f) Dr. Murayama organized a session on "Open-Science addressing Collaboration of CODATA and WDS Communities in Asia-Oceania Area" and delivered the opening speech.

FUTURE ACTIVITIES

- (i) Organize a special session on ocean data and management at International Indian Ocean Science Conference-2020 (IIOSC-2020) to be held virtually during 14-18 March 2022. This conference should have been held during 16-20 March 2020 in Goa, India, but did not materialise owing to Covid19 pandemic.
- (ii) Interactions with associations and other organizations with some of the Associations and IOC/UNESCO.
- (iii) Planning to hold an online seminar by inviting speakers in the 3rd or 4th quarter of 2022.

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) aims 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

On 18-21 November 2021, Shuanggen Jin was co-organizing and attended the International Symposium on Peaceful Use of Space Technology, Beijing, China, with giving a keynote.



Photo of Prof. Shuanggen Jin's keynote at 4th International Symposium on the Peaceful Use of Space Technology Health (IPSACE 2021), 18-21 November 2021, Beijing, China

On 17-19 October 2021, Shuanggen Jin was invited to attend the China Engineering Forum on Deep-Space Exploration Science and Technology in Shenzhen, China, and gave an invited talk.



Photo of Academician Chi Wang's and Prof. Shuanggen Jin's talks at China Engineering Forum on Deep-Space Exploration Science and Technology, Shenzhen, China

FUTURE ACTIVITIES

- 2nd IUGG Symposium on Planetary Science (IUGG-PS 2022): New Observations and Advances in Solar System, 20-23 July 2022, Changchun, China.
- Session: Science and Exploration of Mars and Venus at AOGS 19th Annual Meeting, 1-5 August 2022, Hawaii, USA.

Conveners:

Dr. Varun Sheel (Physical Research Laboratory, India)

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

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

Shuanggen Jin, UCPS Chair

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



EMSEV website: 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](http://www.iugg.org)). The three International IUGG Associations of Geomagnetism ([IAGA](http://www.iaga.org)), Volcanology and Chemistry of the Earth's Interior ([IAVCEI](http://www.iavcei.org)), and Seismology and Physics of the Earth's Interior ([IASPEI](http://www.iaspei.org)) 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 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 earthquake and volcanic hazards.

ADMINISTRATION

In 2018, the structure of the EMSEV changed significantly. The current EMSEV structure is now as follows: 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 (Rep. of China) 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 (Rep. of China).

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 in EMSEV research and participates in its activities. Exchange of information is facilitated through EMSEV meetings, which are organized every two years, IUGG General Assemblies (including IAGA, IASPEI, and IAVCEI meetings), and the 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. Three collaborations, two in Seismology and one in Geochemistry, are already active.

Business meetings will continue to be regularly organized at the EMSEV meetings and International General Assemblies. Minutes of the meetings will be distributed through the EMSEV mailing list as usual. Information, activities, and annual and business meetings reports are kept on the EMSEV website which is mainly managed by T. Nagao (webmaster@emsev-iugg.org). Messages and information on activities are also distributed by T. Nagao through the EMSEV mailing list. In FY2021, we sometimes used video conferences instead of on-site meetings. EMSEV organized the official 2021 virtual business meeting on 26 August 2021, to discuss the current status and future activities.

ACTIVITIES

In 2021, even under the COVID-19 period, 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.

Meetings

Important sessions were organized at the international conferences sponsored or organized by EMSEV Bureau members which were attended by international participants:

2021 EGU (19-30 April 2021, Virtual)

One EMSEV related session was organized.

NH4.2 EDI Short-term Earthquakes Forecast (StEF) and multi-parametric time-Dependent Assessment of Seismic Hazard (t-DASH).

Convener: V. Tramutoli (EMSEV vice-chair), Co-conveners: P. F. Biagi (EMSEV country liaison), N. Genzano, I. A. Moldovan, D. Stanica (EMSEV country liaison).

EMSEV awarded two researchers for the best young scientist presentation at EGU 2021.

Workshop on Bringing Land, Ocean, Atmosphere and Ionosphere Data to the Community for Hazards Alerts (24-28 May 2021)

Ramesh Singh (EMSEV bureau) enthusiastically organized this meeting with the help of Chapman University, AGU, and NSF. There were 650 participants who attended this workshop.

2021 JpGU (30 May – 6 June 2021, Virtual)

In JpGU2021, M-IS08 Interdisciplinary studies on pre-earthquake processes was organized.

Convener: K. Hattori (EMSEV bureau), Co-conveners: J. Y. Liu (EMSEV secretary, IAGA liaison), D. Ouzounov (EMSEV bureau), Q. Huang (EMSEV bureau, IASPEI liaison).

Joint with: AGU, EGU, AOGS. In the M-IS08 session, 15 oral presentations (including 6 invited talks) and 7 poster presentations were conducted.

2021 Biskek meeting (28 June – 2 July 2021, Virtual)

8th International Symposium on Problems of Geodynamics and Gepecology of Intracontinental Orogens. Organizer: Research Station of Russian Academy of Science.

T. Nagao (EMSEV chair) made a plenary talk. Three EMSEV bureau members joined as the organizing committee.

2021 AOGS (1-6 August 2021, Virtual)

ST2- Ionospheric Lithosphere and Space Weather

Convener: J. Y. Liu (EMSEV secretary, IAGA liaison), Co-conveners: K. Hattori (EMSEV bureau), D. Ouzounov (EMSEV bureau), Xuhui Shen (EMSEV country liaison)

2021 IAGA-IASPEI (21-27 August 2021, Virtual)

J3 Lithosphere-Atmosphere-Ionosphere Coupling: Seismo Ionospheric and Electromagnetic anomalies

Conveners: M. S. Bagiya, E. Astafyeva (EMSEV member), Y. Hobara (EMSEV member)

In the J3 session, 17 presentations were made.

S12 CoEGP Interdisciplinary observations of Pre-Earthquake processes: A new approach towards Earthquake prediction studies

Conveners: D. Ouzounov (EMSEV bureau), S. Pulinets (EMSEV bureau), K. Hattori (EMSEV bureau), P. Taylor (EMSEV member).

The 2021 IAGA/IASPEI S12 CoEGP session was dedicated to the multidisciplinary observations related to earthquakes, and the presented papers helped understand the physical processes preceding earthquakes. During the session, eleven articles were presented: three by Indian and eight by international scientists.

EMSEV awarded three researchers for the best young scientist presentation at IAGA-IASPEI 2021.

2021 CSES (22-25 October 2021, China, Virtual)

During the conference, 38 presentations were made.

Four EMSEV bureau members contributed to the workshop (D. Ouzounov, S. Pulinets, K. Hattori, T. Nagao).

2021 AGU Fall meeting (13-17 December, USA)

NH35D: Integrated studies of geospheres coupling associated with pre-earthquake processes, geohazards, and space weather revealed with multi-sensor observation.

Conveners: D. Ouzounov (EMSEV bureau), J. Y. Liu (EMSEV secretary, IAGA liaison), P. Taylor (EMSEV member), L. Conti (EMSEV member)

We discussed the latest results from cross-disciplinary observations from space and ground measurements associated with earthquakes. It was recognized that satellite technologies provide new opportunities never achieved before to study the geohazards from space.

Research Activities

EMSEV activity on volcanoes (Taal, Philippines)

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.

After the long quiescence, Taal erupted in January 2020, a large eruption (VEI 4) releasing ash clouds and lava occurred. This eruption totally destroyed EMSEV's geomagnetic and geoelectric monitoring station including the geochemistry and underground temperature measurement system on Volcano Island.

Fortunately, with the support of EMSEV for nearly 20 years, now, volcano-electromagnetism specialists have also grown in PHIVOLCS.

Now they are taking the lead in planning to rebuild the electromagnetic observation network on the volcanic island again using PHIVOLCS funds. EMSEV has provided advice on this reconstruction plan from the beginning and will continue to cooperate closely in the future.

EMSEV activity on volcanoes (Mt. Fuji, Japan)

The Mt. Fuji monitoring project started in 2020. In the initial plan of FY2021, a magnetometer was planned to be installed on the summit of Mt. Fuji, but the environment of the COVID-19 did not improve, and the summit base was particularly airtight because it needed to withstand harsh weather conditions. As a result, work on the mountaintop was severely restricted.

Therefore, we made an environmental survey around the Tarobo geomagnetic observation station which was installed in 2020. Furthermore, we constructed a portal site for displaying geomagnetic data, and a geomagnetic data analysis system incorporating principal component analysis (PCA) and independent component analysis (ICA).

At this moment, we have the following portal site: https://www.fujimonitor.org/total_magnetic_list

Currently, the portal site is written in Japanese only, but we have a plan to prepare an English version in the future

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.

During the IUGG GA 2019 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 catalogue. At this moment, EMSEV still keeps two spontaneous potential measurement stations in Kyrgyzstan.

Chinese Seismo-Electric Satellite mission and EMSEV

Following the promising results obtained during the French DEMETER mission, the Chinese Earthquake Administration has started 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 is an EMSEV Country liaison member.

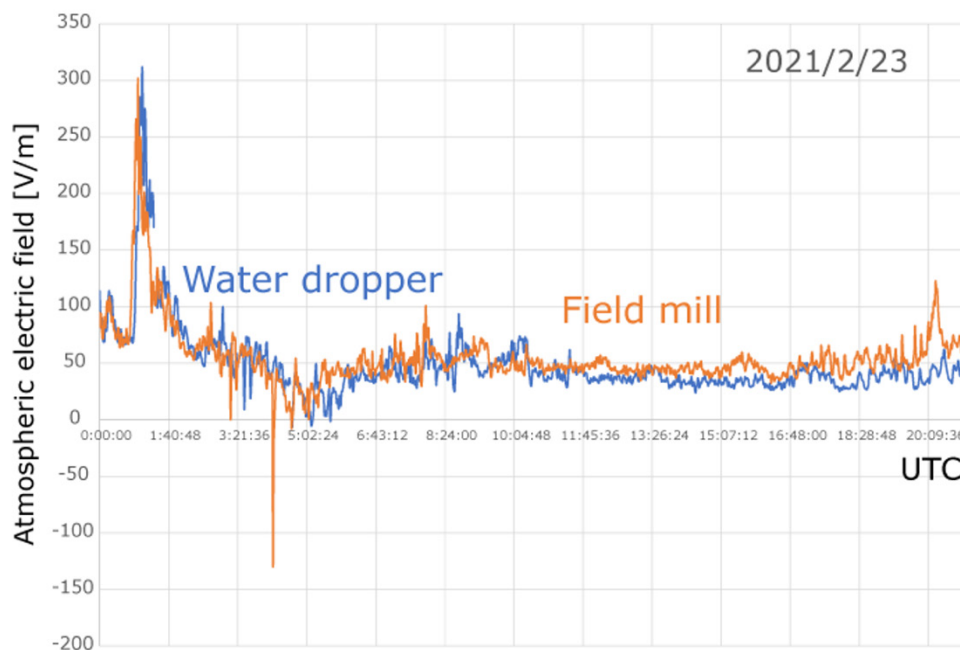
A Memorandum of Agreement between the Institute of Crustal Dynamics (CEA) and EMSEV was signed during the International Conference for the Decade Memory of the Wenchuan Earthquake held in Chengdu in May 2018 (<http://www.4thicce.com/>).

Continuation of Atmospheric field measurement in Kakioka, Japan

Atmospheric electric field measurements started in 1929 at the Kakioka Geomagnetic Observatory of the Japan Meteorological Agency. However, these measurements were terminated in February 2021 due to various reasons.

This is an extremely disappointing event for the field of geomagnetism; therefore, we have searched if any universities can conduct the observation. EMSEV also would like to support the continuation of this observation. After the surveillance, the University of Shizuoka can be continuing the observation.

At the Kakioka Geomagnetic Observatory, the atmospheric electric field was observed with a classical water-dropper instrument, which was invented by Lord Kelvin. Therefore, this observation method has a long history. However, at present, it is common to measure the atmospheric electric field with a device called a field mill, and Shizuoka Prefectural University also uses this device. For the continuity of observation, we made a parallel observation with two types of devices, and the data was confirmed. As a result of parallel observations, the two showed good agreement and succeeded in continuing the atmospheric electric field measurement in Kakioka.



Comparison between water-dropper device and field mill device on 23 February 2021. Two records are well coincided

IAVCEI eVolcano project

Late in 2021, IAVCEI launched a preliminary eVolcano website with the objective to gather key presentations (videos, PowerPoint documents, etc.) in volcano research. These presentations would be available on the Internet to young researchers, scientists, and the public.

EMVEV answered favorably and proposed to organize some topics on “Electromagnetic Effects related to Volcanic Structure and Activity”. J. Zlotnicki, M.J.S. Johnston, T. Hashimoto, N. Pergola, and Y. Sasai worked on this IAVCEI proposal. Five sub-domains were proposed: Physical Mechanisms at play during EM volcano effects, laboratory experiments: Constraints on physical mechanisms, modeling of EM Effects, EM imaging and monitoring, and cases study. An additional item on the Contribution of EM studies to volcanic eruptions forecast would have been possibly added.

In 2021, two presentations were nicely achieved. T. Hashimoto developed a presentation on “Magnetic monitoring” and N. Pergola covered the theme “Satellite imaging and monitoring of active volcanoes”. Another one could follow depending on the progress of the eVolcano website.

FUTURE ACTIVITIES

In 2020, EMSEV biennial meeting was postponed for two years due to COVID-19. We organize EMSEV 2022 from 22 to 26 August in the Rep. of China. This is the largest event during 2022.

<https://irsl.ss.ncu.edu.tw/emsev2022>

Furthermore, EMSEV plans to deeply work in two directions. The first one is to continue 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. The second direction is to strengthen EMSEV activities through international cooperation. This will be achieved by the pursuit of cooperation with the Philippines, Bishkek-Research station, Russian Academy of Sciences (EMSEV), and the development of EMSEV's involvement in the Chinese satellite mission (CSES mission) and so on.

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://ilp.nju.edu.cn>

INTRODUCTION

The International Lithosphere Program (ILP) is a joint project of IUGG and IUGS and receives additional funding from member countries (cf. financial report). ILP seeks to elucidate the nature, dynamics, origin and evolution of the lithosphere through international, multidisciplinary geoscience research projects in Task Forces (TF) and Regional Coordinating Committees (CC).

The major ILP themes are: 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, SINOPROBE, TOPO-EUROPE, etc.).

ADMINISTRATION

ILP operates on the base of terms of reference and has an international Bureau. The Bureau meets 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. ILP is supported by a science advisory board and its honorary members. The ILP Secretariat is complementarily located at Nanjing University, China. The 2021 ILP Bureau membership is as follows:

President:	H. Thybo	Turkey/Denmark
Secretary General	M. Liu	USA
Executive Secretary	Q. Wang	China
Representative of IUGG	H. Gupta	India
Representative of IUGS	K. Asch	Germany
Chair Committee National Representatives:	A. Tibaldi	Italy

The Advisory Board to ILP includes the following members: Ö. Adiyaman Lopes (UNESCO, France), S. Dong (China), C. Ebinger (USA), D. Mueller (Australia), H. Sato (Japan).

The Bureau is further supported by:

Past President	S. Cloetingh	Netherlands
Honorary President	A. Green	Switzerland
ILP Fellow	J.F.W. Negendank	Germany

ACTIVITIES

ILP had its 40 years anniversary in 2020. A series of events were planned for 2020 in this connection, including anniversary symposia at IGC in Delhi, India and EGU in Vienna, Austria. However, only the EGU event could be carried out as a virtual symposium, which was very well attended. ILP convened in 2021 another well attended hybrid (in-person/virtual attendance) anniversary symposium at the AGU meeting in New Orleans. A book is being planned with articles on the history and science of Task Forces/Coordinating Committees of ILP. It is planned as a Special Publication of Geological Society London.

The ILP Evgueni Burov Medal was presented during a virtual business meeting to Prof. Thorsten Becker, University of Austin, Texas, USA, for his ground-breaking contributions to studies of geodynamics, his noteworthy scientific leadership, and his selfless service to the Earth science community.

ILP was strongly represented at the recent virtual DEEP-21 meeting, organized in Beijing and Nanjing, China. Several task Forces/Coordinating Committees organised sessions, the ILP President gave a keynote lecture, and a key symposium was organised for the new Regional Coordinating Committee CC4: Global Geosciences Transects.

The ILP Task Forces and Coordinating Committees have been highly visible at large international virtual and hybrid meetings, including EGU and AGU. Several TFs organized sessions at EGU and AGU, which were held as virtual and hybrid sessions. ILP held a 40-years anniversary symposium at the AGU. All planned TF/CC workshops in 2021 were postponed due to the current pandemic situation, although some were held virtually.

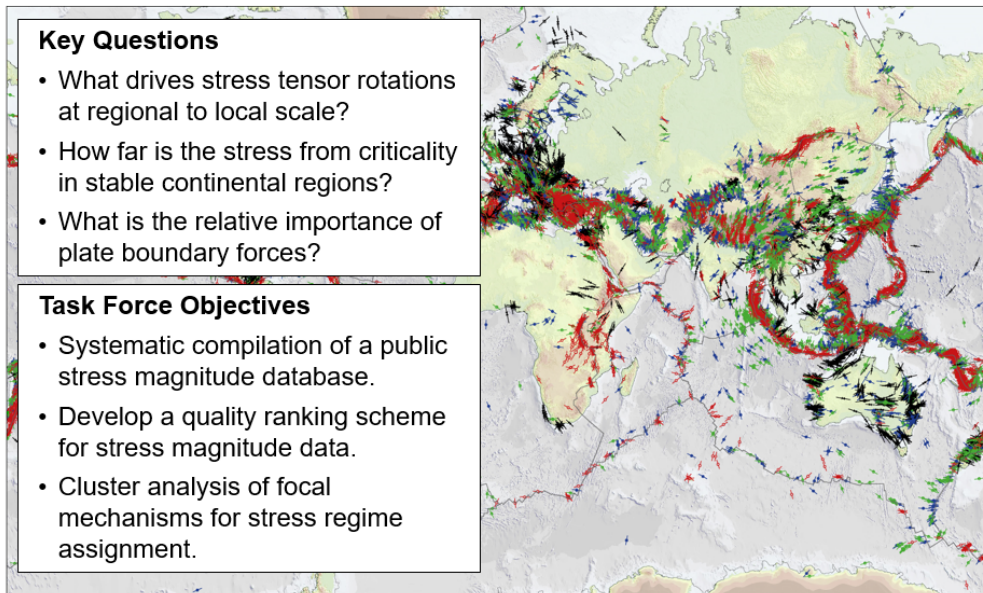
A bureau meeting was held virtually on 3 May. A new Task Force was approved: 2021-TF8 - Lithospheric Heat Flow – Global Data Assessment Project. This project will coordinate quality assessment of the global heat flow database; it is also supported by International Heat Flow Commission (IHFC).

ILP is a Founding Member of IUGS's Deep-Time Digital Earth (DDE) programme. The Secretary General of ILP is a member of the Council and the President of ILP is a member of the Scientific Advisory Board of DDE.

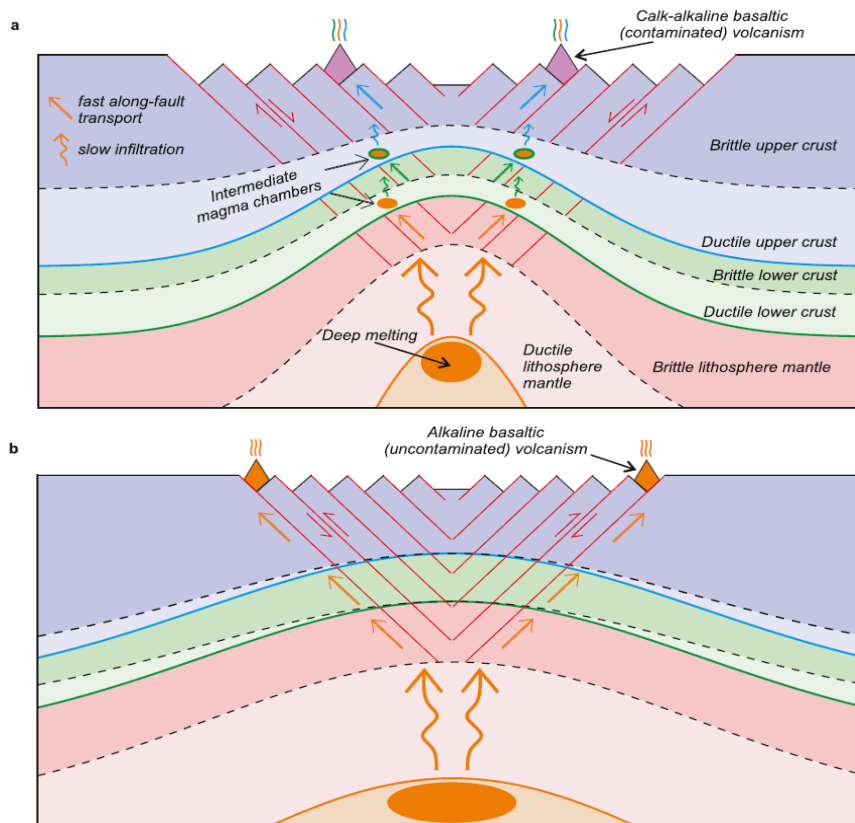
A few highlights from 2021 for the current projects:

TF1 on the lithosphere and mineral resources has published a volume on "Tectonics of Asia", which is a key geodynamic province hosting large mineral resources. TF2 developed studies at volcanic areas in different continents, and merged field geological and geophysical data with numerical modelling, published in a volume with 68 peer reviewed papers. TF3 has developed a quality and ranking scheme for database entries which allows inclusion of stress magnitude and pore pressure data. TF4 has initiated a data compilation to be able to assess the importance of stresses deep in the lithosphere. TF5 has acquired a large wealth of new data from the oceans. TF6 managed to hold an on-site international meeting with excursion; a volume is being edited. TF7 has developed a programme for studying the interrelation between lithosphere evolution and the origin of life. TF8 has initiated a quality check of entries in the database of the International Heat Flow Commission (IHFC). CC1 has developed models for the relation between plume-lithosphere interactions and dynamics of continental rifting to subduction initiation. CC2 expands its network in the Himalayan region and made new assessments of the large earthquakes in the region. CC3 has developed new models for the sources of large amplitude and large-scale topographic changes in Anatolia. CC4 has expanded its global network to initiate its large scale geotransects. CC5 has extended its membership through e.g. virtual splinter meetings and has made progress on the development of best practise in remote field instrumentation with application to Antarctica.

Clearly, the special situation created by the present Covid-19 pandemic has affected the activities strongly, but the TF/CCs have managed to stay active by inventive activities. An extract and the full annual reports from the TF/CCs annual reports are available on request.



2021-TF3: Global Lithospheric Stress - The World Stress Map in 3D. Key scientific questions for the new Task Force. Shown with the current density of stress measurements in the lithosphere as background



2021-CC1 TOPO-EUROPE, T. Ehlers (Germany) and S. Cloething (Netherlands). New model of development of the interrelation between the rheological structure of the lithosphere and the evolution of magmatism, illustrated with the Pannonian Basin as example (after Koptev et al., 2021)

FUTURE ACTIVITIES

- Updating the science plan in collaboration with TF/CCs and scientific advisors
- Provide active support to new Task Forces and Coordinating Committees
- Several sessions with TF and CC contributions at EGU and AGU
- Several workshops to be held by the TFs and CCs, depending on pandemic situation
- Hybrid ILP Business and Bureau meetings at EGU Vienna, 2022
- Award the E. Burov medal and Flinn-Hart award with virtual lectures at the business meeting
- Strengthen links with other IUGG and IUGS programs
- Seeking new support from national science foundations and industry
- Expand the national membership, e.g., with dedicated approach to African countries

Budget request for 2022

To assure continuity and enable us to support the selected Task Forces and Coordinating Committees, we request an IUGG subvention of 15,000.00 USD as in previous years.

Hans Thybo, ILP President
Mian Liu, ILP Secretary General
Qin WANG, ILP Executive Secretary

IUGG FINANCIAL REPORT

INTRODUCTION

In short, this report describes the status of the IUGG finances for the year 2021, the second year of the IUGG quadrennium 2020-2023. The report will be presented at the next Bureau Meeting. The [budget](#) for 2020-2023 was approved at the Council Meeting in Montreal, in July 2019.

The basic currency of IUGG is US dollars (USD). The price of 1 unit in 2021 was USD 2,080. For comparison, the budget value for 2021 is USD 2,100. The price is calculated using the September value of the US inflator index the year before. The 2021 index is up 5,4 % compared to the 2020 value.

As of 1 January 2022, IUGG has 73 members with 58 paying members representing 277 units. One country – Israel – moved one category up to cat 2. Otherwise no change in the membership situation. On page 105 one can find more details about memberships.

The membership dues paid by members are the economical basis for the activities of IUGG. The situation right now is 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.

A very warm thank you to the IUGG members for the continued support of IUGG, also in the situation where a pandemic is surging. The pandemic has affected the finances of IUGG considerably. Grants in support of scientific projects plus travelling expenses are almost non-existing.

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 is more representative for the financial status of the union than the individual accountings year by year. The IUGG accounts are audited by a chartered auditor

At the IUGG General Assembly in Montreal 2019 (IUGG2019) a new Treasurer was elected, Dr. Niels Andersen. This report is prepared by Dr. Aksel Walløe Hansen, Treasurer 1999-2019, as a special consultant.

Dr. Dmitry Krupsky has maintained the IUGG [website](#). There was no Assistant Treasurer in 2021.

Overview of the report:

Summary of the IUGG accounts in USD for 2021	page 100
General remarks and notes to the IUGG summary	page 101
Overview of IUGG grants and allocations	page 104
Membership information and statistics	page 105

SUMMARY OF THE IUGG ACCOUNTS IN US DOLLARS FOR 2021



SUMMARY OF IUGG ACCOUNTS 2021

US dollars	Accounts	Budget
RECEIPTS		
1. Membership Subscription	591.318,72	546.000,00
2. Assembly Surcharge	0,00	0,00
3. Royalties	152,18	200,00
4. Miscellaneous		
a. Interest	0,00	100,00
b. Gain on exchange	645,58	
c. Other	34.032,51	ILP-money
d. Associations, 2019 surcharge	0,00	
5. Total Receipts	626.148,99	546.300,00
6. Cash in hand	700,00	0,00
7. Bank balance on 1/1 2021	836.434,73	659.800,00
Check Sum	1.463.283,72	1.206.100,00
EXPENDITURES		
11. Administration		
11.1 Personnel	21.343,94	15.000,00 Dmitry, Simon, Aksel
11.2 Equipment	0,00	1.000,00
11.3 Supplies	0,00	4.000,00
11.4 Communications	0,00	4.000,00
11.5 Travelling	4.850,54	90.000,00
11.6 Miscellaneous	376,88	5.000,00 CUP
11.7 special	34.032,51	0,00 ILP money
12. New initiatives		
12.1 Education and outreach	14.179,22	30.000,00 ICTP postponed, Alk €7500-HYBSSD
12.2 Science	0,00	40.000,00
13. General Assemblies		
13.1 Organizational expenses	0,00	0,00
13.2 Travel grants	0,00	0,00
14. Symposia	0,00	25.000,00
15. Annual allocations		
15.1 Annual allocations	207.837,99	267.800,00 All assoc. - IAMAS: 2020 + net balance 20
16. Dues and Grants		
16.1 ISC	29.241,08	32.000,00
17. Union activities		
17.1 GRC, SEDI, CMG, UCIDI, UCPS, CCEC	0,00	24.000,00
17.2 Inter-Union Science (ILP)	15.000,00	15.000,00
18. Fees		
18.1 Professional services	0,00	5.000,00
18.2 Bank fees	1.925,77	3.000,00
19. Contingencies	0,00	2.500,00
20. Loss on exchange		
21. Total Expenditures	328.787,94	563.300,00
22. Balance on 31/12 2021	1.134.495,78	642.800,00
Check sum	1.463.283,72	1.206.100,00
Check sum balance	0,00	

	USD/DKK	
	Exchange rates	
December 31, 2021	Line 8	6,059 JAN 1, 2021 = DEC 31, 2020
Niels Andersen/Aksel Walløe Hansen	Line 24	6,552 DEC 31, 2021
	Other:	6,252 2021 average
	USD/EUR	
	Line 8	0,815 JAN 1, 2021 = DEC 31, 2020
	Line 24	0,881 DEC 31, 2021
	Other:	0,841 2021 average

GENERAL REMARKS AND NOTES TO THE IUGG SUMMARY

General Remarks

The financial status of IUGG in 2021 is strongly affected by the COVID-19 pandemic – as was 2020. Numerous travel and meeting activities have been cancelled or postponed. This is reflected in the bottom line of IUGG's accounts.

The annual balance of the IUGG economy is now of the same size or bigger than 2 year's normal turnover. In 2021, IUGG ended up with a surplus close to USD 300K. The reason for this is the abovementioned reduced travelling and meeting activity.

When the world returns to a more normal way of life it is expected that the not spent funds will be activated. The summary for the full 4 yr period (2020-2023) is therefore expected to show the long-term economy of IUGG than the special years 2020-2021.

The basic currency of IUGG is USD. Therefore, 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 USD.

IUGG is also hosting the funds of the IUGG/IUGS inter union activity International Lithosphere Program (ILP), and the Union Commission on Climatic and Environmental Change (CCEC). The corresponding accounts are not included in this report. These two balances as of 31 December 2021, are:

CCEC: USD 17,063,89. There was no activity in 2021.

ILP: EUR 151,096.72.

Notes

Income

Line 1, Membership Subscription

The amount shown in the summary is a mix of late payments for 2018-2020, regular payments for 2021 and one early payment for 2022. On 1 January 2022 the total payment received in 2021 for the year 2021 was equivalent to 226 units. Additional 3 units were already paid in 2020. Therefore, a total of 229 units was paid by 37 members at the end of the year 2021. The budget anticipated a payment equivalent to 260 units out of a total of 276 units. 48 units (from 21 members) are still in arrears.

Line 3, Royalties

IUGG has signed a publishing contract with Cambridge University Press giving rise to a small royalty fee.

Line 4.a, Interest

In 2021 Danske Bank didn't pay interest of money in the IUGG accounts. A negative interest was paid for funds in EUR and DKK

Line 4.b, Gain on exchange

This line together with the corresponding line 20 (loss on exchange) is used to balance the accounts for a particular year. In reality the loss/gain is not realized in the given year. Due to fluctuations in currencies loss/gain will change from year to year. In the long run the gain/loss will tend to cancel each other.

The main currency of IUGG is USD. Therefore, we “lose on exchange” when we keep money in EUR and DKK when the USD goes up. And vice versa when the USD goes down.

It should also be noticed that an averaged exchange rate is used for all account movements during the year.

Line 4.c, Other

This line was introduced for the 2020 accounting to accommodate the transfer of ILP money from Potsdam, Germany. IUGG will host this money for the time being. The transfers of ILP funds and payments of contribution from countries are done to both the EUR and the USD accounts. Line 4.c is balanced by line 11.7 representing the transfer of all received ILP funds to the special ILP account, see also page 100.

Line 4.d, associations surcharge

This line is only active after a general assembly year, it used to account for the surcharge from the general assembly usually paid to the union and not to the associations directly.

Expenditures

In the expenditure part of the accounting (lines 11 – 20) we notice lines where accounting and budget differs noticeably. We relate this to effects of the COVID-19 pandemic as explained earlier.

Line 11.1, Personnel

In 2021, IUGG was paying remunerations to three persons: Dmitry Krupsky, IUGG webmaster, Simon Jacobsen, student assistant, and Aksel Walløe Hansen, special consultant. The total is higher than the budget value.

Line 11.2 – 11.4, Equipment, Supplies, Cammunication

No expenditures in 2021

Line 11.5, travel expenses

Here, the expenditure is much smaller than the budget figure, due to the cancellation of the meeting in person of Bureau/Executive Committee.

This line includes all travel expenses, both those of the Bureau and Executive Committee and liaison officers. In 2021, the Bureau/Executive Committee did not meet for its meeting in Berlin. Instead, a teleconference took place.

The actual expenditure is associated with the IUGG cooperation with ICTP. There is no representative travelling by liaison officers. The total number of liaison officers travelling on behalf of IUGG may be higher, as the IUGG liaison officers find other sources of funding. IUGG appreciates this very much.

Line 11.6, miscellaneous

IUGG has taken out a special insurance against attacks by hackers.

Line 11.7, sepcial

This line will cover tarsnfers of money paid into the IUGG accounts on behalf of ILP, equivalent to line 4.c.

Line 12, New Initiatives

The line represents IUGG support of two types of initiatives: cofunding of the International Centre for Theoretical Physics (ICTP) IUGG related activities and a grant programme in support of smaller science projects. Except for one workshop the ICTP 2021 activities were postponed to 2022. One special grant was paid to IYBBS.

Line 14, Symposia

No activity in 2021, due to the pandemic.

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 2020-2023 and the allocations in 2021 are shown in the following table:

	%	2021 amounts in USD
IACS	10.50	25,475
IAG	12.56	30,473
IAGA	15.10	36,635
IAHS	12.55	30,449
IAMAS	15.06	36,538
IAPSO	10.79	26,179
IASPEI	12.94	31,395
IAVCEI	10.50	25,475
		242,619

By definition, IACS will get the same contribution as that of IAVCEI. After 2023, IACS will no longer be coupled to IAVCEI. The allocations to IACS will then follow the normal procedure laid out in the IUGG Guidelines.

The amount shown in line 15.1 of the 2021 account summary, page 104, differs from the sum given in this table due to a delayed transfer to one association.

Line 16.1, ISC

The IUGG annual dues to the International Science Council were paid as regularly.

Line 17, Union activities

Again, due to COVID-19 the activities were cancelled or postponed. One installment was done to ILP.

Line 18.1, Professional fees

This line represents the cost of the audit of the IUGG2019 accounting. Due to COVID-19 this audit is postponed to 2022.

Line 20, Loss on exchange

See line 4.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 103)
- ii) New initiatives, line 12
- iii) Smaller scientific meetings/workshops, line 14
- iv) Union activities, line 17
- v) Travel grants in connection with General Assemblies, line 13.2

Here follow the main figures for the amounts allocated for the year 2021, in USD:

i) Line 15.1 (Associations)		
7 Associations		207,837
ii) Line 12 (New initiatives)		
12.1 1 grant to ICTP activities (€7,5K), 1 grant paid to IYBBS (\$5K)		<u>14,179</u>
Total		14,179
iii) Line 14 (Symposia grants)		
No grants paid in 2021	<u>0</u>	
Total		0
iv) Line 17 (Union activities)		
17.2 ILP	<u>15,000</u>	
Total		15,000
v) Line 13		
13.2 Travel grants, General Assemblies		<u>0</u>
Grand total		237,016

MEMBERSHIP INFORMATION AND STATISTICS

On 1 January 2022, IUGG has 73 members, 58 paying members and 15 associate members. The 58 paying members represent 277 units. Israel moved from cat 1 to cat 2.

On 16 May 2022, 13 paying members representing 19 units are in observer status.

In category 1, 8 members, 8 units

Iran (11. year as observer) special situation
 Azerbaijan (7. year as observer)
 Indonesia (7. year as observer)
 Vietnam (6. year as observer)
 Jordan (5. year as observer)
 Mozambique (3. year as observer)
 Bulgaria (1. year as observer)
 Romania (1. year as observer)

In category 2, 4 members, 8 units

Nigeria (8. year as observer)
 Saudi Arabia (6. year as observer)
 Pakistan (4. year as observer)
 Egypt (3. year as observer)

In category 3, 1 member, 3 units

Brazil (3. 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	17	2	34
1	17	1	17
A	15	0	0
In total	73		277

ADDITIONAL UNION MATTERS

Awards and Honors

American Geophysical Union (AGU)

The AGU awarded the following scientists who have been active in IUGG at the 2021 AGU Fall Meeting: **Atalay Ayele** (Ethiopia), President of the IASPEI African Seismological Commission (AfSC, 2015-2018), was awarded the International Award.

Jacob Bortnik (USA), Co-Chair of the IAGA/URSI Working Group VLF/ELF Remote Sensing of the Ionosphere and Magnetosphere (VERSIM, (2016-2019), was awarded the Joanne Simpson Medal for Mid-Career Scientists.

Athena Coustenis (France), IAMAS President (2011-2015), was named the Eugene Shoemaker Lecturer.

Barbara Maher (UK), Chair of the IAGA Working Group I-4: Rock Magnetism (2003-2007), was named the Edward Bullard Lecturer.

Jonathan J. Makela (USA), Co-Chair of the IAGA Working Group II-E (2014-2015), was named the William B. Hanson Lecturer.

Joyce Penner (USA), IAMAS President (2019-2023), was named the Jacob Bjerknes Lecturer.

John W. Pomeroy (Canada), President of the IAHS International Commission on Snow & Ice Hydrology (ICSIH, 2006-2013), was named the Walter Langbein Lecturer.

Alan Robock (USA), Member of the Union Commission on Climatic and Environmental Change (CCEC, since 2020), was named the Stephen Schneider Lecturer.

Jiri Simunek (USA), Secretary of the IAHS International Commission on Atmosphere-Soil-Vegetation Relations (ICASVR, 2003), was awarded the Hydrologic Sciences Award.

American Meteorological Society (AMS)

The AMS awarded the following scientists who have been active in IUGG at the 2021 AMS Annual Meeting:

Joyce E. Penner (USA), IAMAS President (2019-2023), received the Syukuro Manabe Climate Research Award.

Soroosh Sorooshian (USA), IUGG Fellow (2019), received the Hydrologic Science Medal.

Asia Oceania Geosciences Society (AOGS)

The AOGS awarded the following scientists who have been active in IUGG at the 2021 AOGS Annual Meeting:

Iver Cairns (Australia), IAGA National Correspondent for Australia (2006-2015), was elected AOGS Honorary Member.

Kuo-Fong Ma (China, Rep. of), Executive Secretary of the IUGG National Committee for China, Academy of Sciences in Taipei (since 2016), was conferred the 2021 Axford Medal.

European Geosciences Union (EGU)

The EGU awarded the following scientists who have been active in IUGG at the 2021 EGU General Assembly:

Ayako Abe-Ouch (Japan), Member of IAMAS ICCL, was awarded the Milutin Milankovitch Medal.

Berit Arheimer (Sweden), President-Elect IAHS, was awarded the Henry Darcy Medal.

Giuliano Di Baldassarre (Sweden), Chair of the IAHS Panta Rhei Working Group (2018-2019), was awarded the Plinius Medal.

Fausto Guzzetti (Italy), President of the IUGG National Committee for Italy, was awarded the Sergey Soloviev Medal.

Christopher Jekeli (USA), President, IAG Commission 2: Gravity Field (2004-2007), was awarded the Vening Meinesz Medal.

Malcolm Sambridge (Australia), IASPEI Representative, Union Commission on Mathematical Geophysics (CMG), was awarded the Beno Gutenberg Medal.

The Nobel Prize in Physics 2021

On 5 October 2021, the Royal Swedish Academy of Sciences awarded the [Nobel Prize in Physics 2021](#) “for groundbreaking contributions to our understanding of complex physical systems” with one half jointly to **Syukuro Manabe** (Princeton University, USA) and **Klaus Hasselmann** (Max Planck Institute for Meteorology, Germany) “for the physical modelling of Earth’s climate, quantifying variability and reliably predicting global warming”, and the other half to **Giorgio Parisi** (Sapienza University of Rome, Italy) “for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales”. Klaus Hasselmann, Syukuro Manabe, and Giorgio Parisi are part of the IUGG family.

Royal Astronomical Society (RAS)

The RAS awarded the following scientists who have been active in IUGG at the 2021 RAS Ordinary Meeting:

Tamaz Chelidze (Georgia), President of the IUGG National Committee for Georgia, of the Nodia Institute of Geophysics, Tbilisi State University was awarded RAS Honorary Fellowship.

Thorne Lay (USA), IASPEI President and Member of the IUGG Executive Committee (2015-2019), of the University of California Santa Cruz was awarded the Gold Medal, the Society’s highest honour.

The Royal Society

Anny Cazenave (Switzerland), elected IUGG Fellow (2019), was elected a Foreign Member of the Royal Society.

Donald B. Dingwell (Germany), IAVCEI President (2015-2019), was elected a Fellow of the Royal Society.

International Association of Cryospheric Sciences (IACS)

David G. Bigelow (Canada) and **Giulia Mazzotti** (Switzerland) received the IACS Early Career Scientist Award 2021.

International Association of Geodesy (IAG)

Susanne Glaser (Germany) and **Khosro Ghobadi-Far** (USA) were awarded the IAG Young Authors Award 2019 and 2020.

International Association of Geomagnetism and Aeronomy (IAGA)

Man Hua (China) received the IAGA Early Career Award 2021.

Jay Johnson (USA) was awarded the Shen Kuo medal 2021.

Natalia Sergeyeva (Russia) was awarded the IAGA Long Service medal 2021.

International Association of Hydrological Sciences (IAHS)

Taikan Oki (Japan; Dooge medal) and **Harry F. Lins** (USA; Volker medal) were awarded the 2021 International Hydrology Prize.

Svenja Fischer (Germany) and **Philipp Bühler** (Germany) were awarded the 2021 Tison Award.

The 2021 SYSTA awardees which were invited to attend the 4th International Conference of the Great Rivers of Africa, 16-20 November 2021, Cotonou, Benin were: **Kossitse Venyo Akpataku** (Togo), **Meriem Ameer** (Tunisia), **Rajae El Aoula** (Morocco), **Cheikh Faye** (Senegal), **Abderraouf Hzami** (Tunisia), **Bérenger Koffi** (Côte d'Ivoire), **Kan Martin Kouassi** (Côte d'Ivoire), **Djan'na Koubodana** (Rwanda/Benin), **Batablinlè Lamboni** (Togo), **N'diaye Edwige Hermann Meledje** (Côte d'Ivoire), **Rodric Merime Nonki** (Cameroon), **Frédéric Saha** (Cameroon), and **Pierre Jerome Zohou** (Benin).

International Association of Meteorology and Atmospheric Sciences (IAMAS)

Marta Abalos (Spain) was awarded the 2021 IAMAS Early Career Medal.

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

Carl Wunsch (USA) was awarded the 2021 Prince Albert I Medal.

Thomas Wahl (USA) and **Jessica Fitzsimmons** (USA) were awarded the 2021 Early Career Scientist (ECS) Medals for Physical and Chemical ocean science.

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

Barbara Romanowicz (USA/France), IASPEI Bureau Member (2000-2003), was awarded the 2021 IASPEI Medal.

Irina Dallo (Switzerland) received the 2021 IASPEI Early Career Scientist Award.

Others

Donald Dingwell (Germany), IAVCEI President (2015-2019), was awarded the Order of Newfoundland and Labrador (Canada), the province's highest honour.

Regine Hock (Norway/USA) was awarded the 2021 Richardson medal by the International Glaciological Society (IGS).

Shuanggen Jin, UCPS Chair (2019-2023), was selected as World Class Professor of the Ministry of Education and Cultures, Indonesia, and elected as a Member of the Academy of the United Nations Sciences and Technology Organization (UNSTO).

Pierre Hubert (1943-2020)

Pierre Hubert (1943-2020) passed away on 31 December 2020. He became an engineer with a degree from Ecole Centrale in Paris in 1967, and received his PhD in 1971 and Doctorat ès Sciences (Habilitation) in 1986 in hydrology, from Université Pierre et Marie Curie in Paris. He worked from 1971 to 2007 for Ecole des Mines de Paris, and has always been at the heart of the Paris multi-institutional master and doctoral curricula on hydrology.

Pierre developed research activity on hydrology in the widest sense, from theoretical to science-management aspects, with a strong engagement in exploring multi-disciplinary approaches, and with an intense international focus which allowed him to tackle the diversity of challenges across hydroclimatic, socio-hydrological and geopolitical contexts; and back to have a panoramic view and contribution.

Pierre was at the scientific forefront on several topics, including isotopic hydro(geo)logy, modelling, scaling (fractal and multifractal), geo-statistics, change detection, as applied to various hydrometeorological variables and settings. The Hubert segmentation method is now a key one in the toolbox of any hydroclimatologist addressing the question of change. His methodological developments improved the design of monitoring networks, increased the understanding of processes and patterns, and then facilitated the modelling and the optimised management of resources and hazards.

Pierre developed bilateral and multilateral cooperation between France, Québec, Tunisia, Algeria, Western Africa, Romania, Russia etc. – always supporting individuals, groups and networks to accompany dynamics towards governance and scientific gap filling. He did so with a deep trust in the humanistic values of Science and Education being universal and independent from politics, and in the epistemological values of Hydrological Sciences benefitting from studying the hydrological diversity across the world.

Pierre was rapidly identified as a multifaceted expert, as well as a very pleasant character, in the French, francophone, and international institutions and communities. He benefited from his multiple engagements to encourage the emergence, funding and articulation of cooperation mechanisms. He has been active in the French SHF – Société Hydrotechnique de France and its Milon Prize. He has been a long-term contributor to the UNESCO International Hydrological Programme and the WMO Commission for Hydrology through the representation of France and then of IAHS and IUGG.

Pierre was a key player in the organisation (front of stage and backstage) of conferences and publications, on both sides of science content and of accessibility/open access, seen as platforms for science sharing, consolidation and dissemination. Beyond editorial and peer-reviewing tasks, he has been particularly active in the francophone side of the at-the-time bilingual Hydrological Sciences Journal of IAHS, and of the multilingual UNESCO-WMO International Glossary of Hydrology that he expanded in linguistic coverage and online accessibility, <http://hydrologie.org/glu/aglo.htm>. Early on



Pierre Hubert (photo credit Gaël Hubert)

he took the opportunities offered by the Internet to facilitate the open archiving of publications and the networking of scientists, in particular with the setting and mastering of the francophone portal <http://hydrologie.org>.

Pierre early engaged in IAHS, recognising in the Association a unique worldwide network whose vocation was close to his values, and where he could scale up his own efforts for articulating hydrological sciences and players. He served as President of the French IAHS then IUGG sections from 1990 to 2000. After successive roles in the IAHS commissions and publication mechanisms, he was Secretary General of IAHS from 2000-2011, thanks to a nomination when the position became vacant and then to two re-elections. He was particularly involved and efficient in facilitating the functioning of the Association, the emergence of digitisation, the digital rescue and open archiving of the IAHS publication series, the shaping of the agenda-setting PUB – Prediction in Ungauged Basin decade, the partnership with UN Agencies (in particular UNESCO IHP and WMO CHy). He also accompanied the emergence of IACS, and facilitated the interfacing with sister associations and contributions to transversal initiatives of IUGG. From 2011 to 2019, he followed up as a Bureau Member of IUGG, not only representing hydrological sciences, but also contributing to the strategy of the Union, from the Earth System Science approaches to the celebration of the 100yr Anniversary.

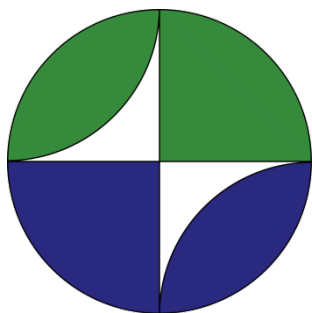
Pierre Hubert received the IAHS-UNESCO-WMO International Hydrology Prize / Volker Medal in 2015 as a recognition of his scientific excellence coupled with a profile of engagement for the community. He was made Knight of the Légion d'honneur in France. The many messages shared over the last weeks across various networks acknowledge this double reputation, and further list many anecdotes and testimonials of how Pierre was always mixing the scientific and the human adventures.

Christophe Cudennec, IAHS Secretary General

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
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



INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS
UNION GEODESIQUE ET GEOPHYSIQUE INTERNATIONALE

IUGG Secretariat

**Helmholtz Centre Potsdam
GFZ German Research Centre for Geosciences
Telegrafenberg A17, 14473 Potsdam, GERMANY**

How to cite:

IUGG AR21 (2022). Annual Report 2021, International Union of Geodesy and Geophysics, Potsdam. 112 p. Available at: <http://www.iugg.org/publications/reports/report2021.pdf>