

## **Resolution 1: Improving Protection of Geodetic Observatories from Active Radio Services**

*The International Union of Geodesy and Geophysics,*

### **Considering**

- that the United Nations General Assembly Resolution 69/266 “A global geodetic reference frame for sustainable development” invites member states “to commit to improving and maintaining appropriate national geodetic infrastructure as an essential means to enhance the global geodetic reference frame”, and
- that the Global Geodetic Observing System (GGOS) of the International Association of Geodesy (IAG) is based on geodetic observatories employing radio telescopes for the method of Very Long Baseline Interferometry (VLBI) which is fundamental for the Global Geodetic Reference Frame (GGRF),

### **Acknowledging**

- that a multi-national best-effort endeavour to provide the needed products has been carried out by the International VLBI Service for Geodesy and Astrometry (IVS) since 1999, and
- that the IVS is developing a new observing system, the VLBI Global Observing System (VGOS), to improve and enhance the global network capabilities in order to meet the accuracy goals needed for geodesy in the context of sustainable development,

### **Noting**

- that the use of the electromagnetic spectrum is administered globally by the International Telecommunication Union (ITU), depending on inputs from national administrations,
- that the electromagnetic spectrum is a limited resource, and the increasing number of ground and space-based transmitters endanger the undisturbed VLBI observations of cosmic radio sources in the universe, and hence endanger the GGRF, and
- that there is no supra-national administration for the protection of global networks such as the global network of geodetic observatories,

### **Urges**

the affiliated scientific associations to advocate spectrum management issues at national, regional and international administration levels for the protection of their interests in the use of the electromagnetic spectrum.

### **Resolves**

- to support the introduction and conservation of local radio quiet zones or local coordination zones around the VLBI global network stations; and
- to bring this Resolution to the attention of the Director of the United Nations Statistical Commission (UNSC), to the Director of the United Nations Office for Outer Space Affairs (UNOOSA) and to the Secretary General of the ITU.

## **Resolution 2: Sustained Terrestrial Water Storage (TWS) Monitoring by Dedicated Gravity Satellite Constellations**

*The International Union of Geodesy and Geophysics,*

### **Considering**

- the interest of the IUGG scientific community to understand the processes of changes in global Terrestrial Water Storage (TWS), comprising all the water storage on the Earth's continental areas in frozen and liquid state, including ice caps, glaciers, snow cover, soil moisture, groundwater and the storage in surface water bodies and the interaction with ocean mass and sea level,
- that satellite gravimetry missions are a unique observing system to directly measure TWS on a regional to global scale,
- the ongoing efforts of national and international institutions and space agencies to extend the GRACE/GRACE-FO program of record that runs already for more than two decades and enhance it with improved satellite gravimetry products, and
- the significant efforts of the International Association of Geodesy (IAG) in developing and maintaining fundamental geodetic products, in particular snapshots of the Earth's time-variable gravity field providing TWS maps for scientific and societal benefits,

### **Acknowledging**

the adoption by the IUGG of Resolution 2 in Prague 2015 on Future Satellite Gravity and Magnetic Mission Constellations, and the adoption of TWS as a new Essential Climate Variable (ECV) in the implementation plan 2022 of the Global Climate Observing System (GCOS),

### **Noting**

- that satellite gravimetry missions such as GRACE and GRACE-FO successfully demonstrated the ability to globally observe the spatial and temporal variations of TWS from time-variable gravity on all continental areas,
- that improved temporal and spatial resolution and significantly increased accuracy are urgently needed by the user community and by operational services for, e.g., flood and drought monitoring and forecasting and water resources management, and
- that new technologies have been developed (such as laser ranging interferometry) or are currently being investigated (such as quantum gravimetry),

### **Urges**

national and international space agencies and decision makers to

- implement and maintain long-term sustained observing systems of the Earth's time-variable gravity field realized by dedicated gravity satellite constellations with improved measurement technology to enable new science and applications of enormous societal benefit; and
- evolve them into sustainable operational services in the longer term.

### **Resolution 3: Sharing Geophysical Data across Borders**

*The International Union of Geodesy and Geophysics,*

#### **Noting**

- that geopolitical conflicts create restrictions in sharing geophysical data across borders for scientific use, and
- that the above restrictions have negative impact on international scientific research, services and collaboration,

#### **Recognizing**

- that sharing geophysical data across borders is an international norm, and
- that sharing geophysical data can enhance their scientific returns and benefit the entire world, including nations that are involved in geopolitical conflicts,

#### **Urges**

- National Committees and relevant national bodies to take necessary actions in their respective countries to support sharing of geophysical data across borders; and
- the International Science Council (ISC) and other relevant international bodies to support national authorities, including those involved in geopolitical conflicts, in efforts to share geophysical data across borders.

## **Resolution 4: Weather and Climate Engineering Based on the Addition of Aerosol Particles**

*The International Union of Geodesy and Geophysics,*

### **Considering**

that anthropogenic greenhouse gas (GHG) emissions are increasing, leading to multi-decadal increases in global average temperature and other weather and climate impacts,

### **Recognizing**

- that progress has been made in the understanding of the role of aerosol particles (AP) in Earth's weather and climate,
- that approaches to counteract the climate change of anthropogenic origin involving the interaction of AP with the atmosphere have been proposed, and
- that these concepts have become part of the discussion of weather and climate intervention (WCI) or geoengineering, the deliberate intervention in the regional and large-scale planetary environment of a nature and scale intended to counteract anthropogenic climate change and its impacts,

### **Acknowledging**

- that scientific research on detailed AP-based WCI techniques is relatively new and the current level of scientific knowledge about their feasibility and effects is poorly understood,
- that AP-based WCI can potentially damage biodiversity, ecosystems, agricultural production, water security, ecological services for society and sustainable development inside as well as outside target regions, and
- that given the current state of understanding, AP-based WCI cannot be considered a complement to or replacement for other mitigation approaches,

### **Noting**

that in addition to fundamental science questions, any attempt at AP-based WCI gives rise to societal, ethical, legal and governmental issues,

### **Recommends**

further research on the fundamental science and possible efficacy of AP-based WCI schemes, conducted in an open and independent manner that engages public participation, is used to assess properly the potential risks of regional and global climate change both with and without AP-based WCI.

### **Urges**

- the research community and policymakers to consider and address the societal, ethical, legal and governmental implications of AP-based WCI and fully engage all stakeholders in the decision-making process; and
- the development of effective and inclusive national and global governance frameworks that can address and manage all these considerations, prior to any WCI activity.

**Resolves**

that currently AP-based WCI cannot be considered an acceptable complement to

- the rapid implementation of required large reductions in GHG and short-lived climate pollutants; and
- greatly enhanced resilience to mitigate the increasingly serious problem of global warming.

## **Resolution 5: Preservation and Dissemination of and Enhanced Access to Analogue Records**

*The International Union of Geodesy and Geophysics,*

### **Considering**

the need for historical data preservation and open access in Earth sciences, and the risk of loss of large volumes of such data despite ongoing efforts devoted to their preservation,

### **Noting**

- that the digital management of analogue data (seismograms, magnetograms, marigrams, meteorograms, etc.) will undoubtedly improve their future preservation and add a wealth of information to our analysis,
- that the management of analogue data is a challenging task for many scientific communities, and that some crucial data have already been lost forever, and
- the impending retirement of the last generation of geoscientists familiar with the use of analogue data, along with the loss of knowledge on how these data were recorded, calibrated, and analysed,

### **Recognizing**

- the interdisciplinary consensus that all Earth science data, ranging from the deep Earth interior to the outer atmosphere, should be preserved, open, and freely accessible to the scientific community,
- the increasingly multidisciplinary nature of geoscience research,
- the rising value of long-term data series in geosciences for their long-term variability and short-term extremity,
- the increasing capabilities of modern computational infrastructure to facilitate storage, management, and access of data and information, and
- the growing recognition of the importance and benefits of the standardization of scientific data formats,

### **Encourages**

the scientific community and their scientific bodies worldwide

- to participate continuously in the improvement of analogue data recovery, preservation, digitization, and open distribution using established standards and digital repositories to bridge the existing digital divide between researchers who only use digital records and those who are familiar with analogue ones;
- to document properly and include the procedures originally used to generate these records in their associated metadata; and
- to develop improved tools for their use.

**Urges**

- the International Science Council, UNESCO, WMO, and other relevant international bodies to assist national authorities in this mission;
- the funding agencies to support the effort to rescue valuable analogue data; and
- the scientific community to contribute to the development of unified standards as well as the coordination of digital repositories and their compatibility among themselves and with the WDS guidelines/policies while following FAIR principles.

## **Resolution 6: Thanks**

*The International Union of Geodesy and Geophysics,*

### **Resolves**

To record gratefully its appreciation for the organization, arrangements, and hospitality at its 28<sup>th</sup> General Assembly.

On behalf of all participants the Council expresses its warm thanks to the Local Organizing Committee, the Scientific Program Committee, the main organizer and host German Research Centre for Geosciences (GFZ) and its co-organizers: the Helmholtz Association, Geo.X, the Federal Institute for Geosciences and Natural Resources (BGR), the Federal Agency for Cartography and Geodesy (BKG), the GEOMAR Helmholtz Centre for Ocean Research Kiel and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), the professional conference organizer company C-IN, and all others for making the 28<sup>th</sup> General Assembly an outstanding success in the beautiful city of Berlin.