



## IAIG Scientific Assembly 2025: Geodesy for a changing environment

### Symposium G04: Earth Rotation and Geodynamics

Conveners: Rebekka Steffen

#### G04-1: Geodetic Constraints and Modeling of Glacial Isostatic Adjustment and Cryospheric Deformation Across Time Scales

Conveners: Karen Simon, Matthias Willen, Carsten Ludwigsen, Lambert Caron, Ingo Sasgen

This session invites presentations that focus on geodetic constraints and models of glacial isostatic adjustment (GIA) and cryospheric loading deformation in currently and formerly glaciated regions. Traditionally, cryospheric deformation of the solid Earth has been divided into two categories: deformation caused by ice-loading changes several thousands of years ago ( $\sim$ GIA) and deformation due to present-day ice mass changes ( $\sim$ elastic). However, this division is insufficient to explain cryospheric deformation in certain regions. In recent years, increasing attention has been given to the viscoelastic deformation of the solid Earth in response to load changes over decades and centuries. A key challenge lies in addressing deformation across various time scales, ranging from several millennia to centuries and even months.

Submissions may discuss advancements in models representing the GIA process across both short and/or long-term time scales. This may include modelling of elastic and viscoelastic signals, studies of low viscosity regions experiencing ice mass change, and assessments of 3D mantle structure and/or transient rheologies. In addition, the session welcomes contributions on present geodetic observations that constrain recent changes to the cryosphere, particularly those contributing to a better understanding of GIA deformation. Submissions that explore the impacts of recent cryospheric changes on environmental indicators, including the influence of GIA and its uncertainties on quantifying present-day changes, are also encouraged, as are contributions focusing on longer-term aspects of GIA in previously glaciated regions.

#### G04-2: Tidal and non-tidal mass signatures in space and surface geodetic observations

Conveners: Severine Rosat, Carla Braitenberg, Xiaoming Cui, Henryk Dobslaw

Tidal and non-tidal phenomena influence terrestrial as well as satellite-borne acquisitions over a wide frequency band, ranging from seismic frequencies to long-period tides. The response of the solid Earth to tidal forces and to the dynamics of geophysical fluids depends on the Earth's rheology. On the one hand, precise observations of the Earth's variable gravity field and surface deformation due to tides and loading allows then to constrain Earth's rheological properties. On the other hand, it is essential

to consider these effects in the processing of space geodetic and terrestrial gravity observations and positioning in order to isolate other signals, like transients due to global change or water storage variations. We invite contributions related to the modelling and the analysis of solid Earth and ocean tides as well as studies on surface loading and the associated gravitational attraction effects due to oceanic and atmospheric tides, non-tidal geophysical fluid circulation (atmosphere, ocean, continental hydrology) on variations in the Earth's gravity field, its geocenter motion, and large-scale deformations.

### G04-3: Monitoring and Modelling of Earth Orientation Parameters Across Temporal Scales

Conveners: Henryk Dobslaw, Sigrid Böhm, Sadegh Modiri, Jolanta Nastula, Chengli Huang

Accurate knowledge about the orientation of the solid Earth with respect to inertial space is not only crucial for operational purposes related to satellite-based precise positioning and navigation on Earth, ground-based astronomy, and communication to deep-space probes but reveals also important insights about the dynamics of the geophysical fluid layers atmosphere, oceans, and terrestrial hydrosphere, which continuously exchange angular momentum with the solid Earth, where much of the geodetic infrastructure is attached to. Angular momentum exchange and mass redistributions in the Earth system cause slight variations in polar motion, UT1 and length-of-day, and precession/nutation, where near- and sub-diurnal atmospheric and oceanic tides are increasingly recognized as important contributors. This session welcomes contributions concerned with (i) theoretical and/or numerical modelling of the rotational response of a non-spherical Earth body to both internal and external forces; (ii) refined Earth Orientation Parameter (EOP) time-series based on consistent combinations of geodetic observations that vary in accuracy and precision throughout the decades; (iii) the interpretation of EOP in view of the delayed response of the Earth system to anthropogenic actions and global warming; and (iv) the reliable prediction and forecasting of EOP variations. We particularly invite studies utilizing advanced analysis techniques including machine learning to enhance both understanding and prediction of Earth orientation changes at time-scales from hours to several months into the future.

### G04-4: Open Session on Earth Rotation and Geodynamics

Conveners: Rebekka Steffen, José Manuel Ferrandiz, Anna Riddell, Chikondi Chisenga, Benjamin F. Chao

The Earth is a constantly changing planet, and geodetic data provides a powerful tool for its exploration. Both space-based and ground-based geodetic methods deliver highly accurate, precise, and reliable georeferenced data, which are crucial for studying various geophysical (geodynamic) processes. By examining spatial variations in the Earth's static and time-varying gravity field, along with global and local deformations (displacements) of the Earth's surface, researchers gain insights into the planet's internal structure and dynamic behaviour. Phenomena related to the Earth's rotation and orientation in space, including polar motion, Universal Time (UT1), Length of Day (LOD), precession/nutation, and pole tides, offer valuable information about the Earth's dynamics. Precise

measurements of these processes are essential for determining the transformation between terrestrial and celestial reference frames. This session invites presentations that study the entire range of physical processes associated with the movement and deformation of the Earth in response to both external and internal forces, but that do not fit into one of the other sessions of Symposium 3 (“Tidal and non-tidal mass signatures in space and surface geodetic observations”, “Monitoring and Modelling of Earth Orientation Parameters Across Temporal Scales”, and “Geodetic Constraints and Modeling of Glacial Isostatic Adjustment and Cryospheric Deformation Across Time Scales”) as well as the Highlight Session on “Geodesy for Geohazards”.