Report of the meeting "2025 Glacial Isostatic Adjustment Workshop: Advancing Models and Observational Constraints"

The "2025 Glacial Isostatic Adjustment Workshop: Advancing Models and Observational Constraints" was held in Sidney, BC, Canada, June 2-6, 2025. The workshop was hosted by Natural Resources Canada and held jointly at the research facilities of the Institute of Ocean Sciences and the Pacific Geoscience Centre. The last such workshop on GIA was held in Ottawa, Canada, in 2019.

The meeting was organized as a hybrid event, with 93 in-person and 88 virtual registrations. Participants registered from 32 countries, and 68 % of them were early-career researchers. Furthermore, only 60 % of the registered participants identified as male. The participation of early career researchers benefited greatly from the support of IUGG, IACS, NSF (National Science Foundation) and SCAR-INSTANT (Scientific Committee on Antarctic Research - Instabilities and Thresholds in Antarctica).

The meeting consisted of oral and poster presentations on topics including Earth rheology, ice sheet evolution and dynamics, modern sea-level change, and geodetic observational techniques. Each day concluded with a discussion and summary session to highlight the important outcomes of the oral and poster presentations. The poster sessions had a length of 2.5 hours each day, which gave sufficient time for discussions. In addition to the poster and oral sessions, a one-day field trip to local sites offered participants a unique view of the area's geology and geomorphology, including neotectonic and glacial erosional and depositional features. The final day was dedicated to topical workshops to have in-depth discussions on issues of high interest to the GIA community.

One workshop focused on the uncertainties associated with GIA model outputs, an important issue, as these outputs are used in various applications (e.g., sea level estimates). Uncertainties were identified in the three main input components: ice models, Earth models, and the GIA codes themselves. Uncertainties in ice models (ice-sheet histories) arise from the large number of variables involved in model development. Additionally, not all ice models are coupled with a GIA code. Future development of ice-sheet histories requires more accurate climate forcing (from both the atmosphere and ocean), with adequate degrees of freedom to better capture variability. A further issue is that many GIA modelling studies do not take full advantage of the wide range of available ice-sheet histories. Similarly, Earth models also carry significant uncertainty, largely due to the variety of constraints used to define the viscosity structure and lithospheric thickness. Seismic tomography models are especially important in this context, and refined models, including uncertainty estimates, are needed to assess three-dimensional viscosity variations. The third component is the GIA codes. To date, only two benchmarking exercises have been conducted, and not all modelers were able to participate. Three additional benchmarks are currently planned to address existing gaps in GIA code validation. In addition, an ongoing comparison initiative (GRDMIP) is underway, aiming to evaluate the spread of GIA model outputs.

Another important aspect, that was discussed during the workshop, is the role of observations, which are critical for testing GIA models. At the same time, predictions from GIA models are necessary to remove the effects of GIA from observations used in other studies. In some cases, these two aspects interfere with each other, for example, when comparing horizontal velocity model predictions with geodetic observations. The latter requires the removal of tectonic plate motions from the observations, which is challenging when horizontal motions may be biased by GIA. As a result, tectonic plate rotations are not clearly defined and may depend on the chosen GIA model. One potential solution is to use a diverse set of observations to constrain GIA models. However, all observations also include signals from processes other than GIA. Users of GIA model predictions have requested that modelers publish all GIA

model outputs. Moreover, stronger collaboration between GIA modelers and observers is needed, including regular interactions to share the latest results and future developments. It was suggested that GIA Training Schools could help foster this connection.

Further emphasis will be placed on developing a database for GIA model outputs. A general issue in the GIA community is the limited sharing of existing model results. A database called *GIAmachine*, is currently under development. It will provide a graphical interface to display, download, and access various GIA model outputs. An important related point is the need to standardize variable names used for GIA model outputs. Efforts will be made to unify these names moving forward.

The general communication within the field was discussed and several potential improvements have been suggested (e.g., own mailing list for GIA, usage of a communication platform for daily usage). A new mailing list (gia@listserv.dfn.de) was created after the workshop. An additional point of discussion was the availability of GIA codes, especially open source-based codes. A developer of the open-source code CitcomSVE will provide a tutorial in the coming months to increase the usage of already existing codes.

Besides the mailing list, the *GIAmachine* database and GIA code tutorials, further clear goals have been developed for the coming months and years to be tackled by the entire GIA community. Several attendees suggested the compilation of review papers on various topics of GIA. A potential GIA book could compile such reviews providing a handbook for non-experts as well as being an introduction into the field and for future training schools.

Overall, the workshop was a great success with many discussions and new steps forward initiated. Funding from IUGG was used to support the travel of eight early career researchers (ECR) and cover the registration fee of six additional ECR. Additional funding was provided by IACS to organize an ECR dinner during the workshop, which was well attended.

2025 GIA Workshop participants gather at Mt. Tolmie during the Wednesday field trip (picture courtesy: Thomas James). More photos can be found here: https://polenet.org/2025-gia-workshop-photos/.