Session 5: Time variable gravity corrections

Tuesday, April 12th 11:00 - 13:00 CEST

Sessions Chairs: M. Van Camp (Belgium) and O. Francis (Luxemburg)

11:00 - 12:00	local	**Michel Van Camp, Olivier Francis, Hartmut Wziontek** *Introduction to the Earth Tides*
12:05 - 12:10	remote	**Jiangcun Zhou, Ernian Pan, Heping Sun, Jianqiao Xu** *A method to gravity correction induced by global temperature variations*
12:15 - 12:20	local	**Andreas Engfeldt** *How to deal with linear vertical motions for a modern national gravity network*
12:25 - 12:40	local	**Ludger Timmen** *Advanced model for the reduction of atmosphere in absolute gravimetry*
12:45 - 12:50	local	**Hartmut Wziontek, Thomas Klügel** *Applicatoin of the atmospheric attraction computation service Atmacs of BKG in absolute gravimetry?*

IGRF Workshop 2022
Leipzig, Germany, April 11-13 2022

Introduction to the Earth Tides

Michel Van Camp, Royal Observatory of Belgium, **Olivier Francis**, University of Luxembourg, **Hartmut Wziontek**, Federal Agency for Cartography and Geodesy, Leipzig

We explain the tidal phenomenon, which includes the development of the tidal potential, required to model the tidal effects. We briefly describe the main tidal waves, then present the best methods to correct gravity measurements for tidal effects, induced by both the solid Earth and the loading of the oceans. The methods rely on either solid Earth and ocean loading models, or on a tidal parameter set obtained from a tidal analysis of an at least one-month time series of continuous measurements of gravity.

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A method to gravity correction induced by global temperature variations

Jiangcun Zhou, State Key Laboratory of Geodesy and Earth's Dynamics, Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, Wuhan, China **Ernian Pan**, Disaster Prevention & Water Environment Research Center, National Yang Ming Chiao Tung University, Taiwan, **Heping Sun**, State Key Laboratory of Geodesy and Earth's Dynamics, Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, Wuhan, China, **Jianqiao Xu**, State Key Laboratory of Geodesy and Earth's Dynamics, Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, Wuhan

By coupling the heat conduction equation into the traditional elastic deformation theory for a layered spherical Earth, we have got the heat loading Love numbers, h, l and k, describing Earth's deformation induced by temperature variations on the Earth's surface. With these Love numbers, we can conduct the gravity correction by making use of the conventional Green's function method.

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How to deal with linear vertical motions for a modern national gravity network

Andreas Engfeldt, Lantmäteriet, Sweden

The post glacial rebound since the last glaciation strongly affects geodetic frames and networks in countries where it occurs. This includes the gravity reference frames and networks. Here, it will be described how the vertical motion of the post glacial rebound is handled in the Swedish modern gravity network RG 2000.

IUGG IAG International Association of Geodesy
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BGI BKG Bureau Gravimétrique International International Gravimetric Bureau

Advanced model for the reduction of atmosphere in absolute gravimetry

Ludger Timmen, Leibniz University Hannover

Variations in the local gravity acceleration and atmospheric pressure are known to be corrected with an admittance of about 3 nm/s² per hPa as a standard factor, which is in accordance with the IAG Resolution No. 9, 1983, and the IGRS 2020 conventions.

Investigating temporal gravity variations in geodynamics, the objective at the Institute of Geodesy in Hannover is to ensure a reduction uncertainty of 3 nm/s². Therefore, atmospheric gravity variations during absolute observations in the Fennoscandian land uplift area have been modelled using globally distributed ECMWF data. The attraction effect from the local zone (100 x 100 km²) around the gravity station was calculated with ECMWF 3D weather data describing different pressure levels up to a height of 50 km. To model the regional and global attraction, and all deformation components the Green's functions method and surface ECMWF 2D weather data were used. Compared with the classical approach, the absolute g-values of the 93 station determinations changed or improved by 8 nm/s² (rms difference) with a maximum change of 19 nm/s².

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Application of the atmospheric attraction computation service Atmacs of BKG in absolute gravimetry?

H. Wziontek, T. Klügel, Federal Agency for Cartography and Geodesy (BKG), Germany

Since 2009, the atmospheric attraction computation service Atmacs is operated by BKG, mainly to support stations with superconducting gravimeters. The computation is based on numerical weather models of DWD, the German Weather service. Atmacs is briefly introduced, also an optional feature to compute corrections upon requests. However, the compatibility with the IGRS defintion needs to be critically discussed, with respect to standard atmosphere and model changes.