

Ground and satellite gravimetry: a tool to study Earth's dynamics

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Abstract

This talk will give an overview of the topics in Earth Science which can be investigated with present-day measurements of time-varying gravity at the Earth's surface (absolute and superconducting gravimeters) or by satellite (GRACE). We will first present the characteristics of the ground instruments and their performances in various spectral bands. We will then compare these performances to what can be achieved by satellite observations. Recent results inferred from the observations and analysis of the time changes in the Earth's gravity field will be shown. Some results will mainly concern the higher frequency part (seismic and core modes including the Slichter translation of the solid inner core, hum) which can only be investigated with high quality continuous gravity observations at ground like the ones provided by the GGP (Global Geodynamics Project). GGP is an international network of superconducting gravimeters (roughly 25 meters worldwide) with broad scientific goals; the present status and possible evolution of the network will be discussed. Tidal (solid and ocean loading) results will be reviewed pointing out the importance of the calibration accuracy and stability. The role played by atmospheric loading will be addressed and we will show how different modeling schemes (local pressure, regional and global surface pressure field, 3D atmospheric load) are needed according to the subject. Non-tidal ocean loading also contributes to alter gravity and we report on recent progress made in this direction. One important topic today is the knowledge of the continental hydrological cycle and it appears that gravity measurements are nowadays an important tool to validate hydrology models at different length scales (from very local to continental). The talk will also show the constraints brought by gravity measurements in collocation with vertical displacement observations from geodetic techniques like VLBI, GPS, DORIS, SLR or LLR, in the field of tectonics or glaciology (post-glacial rebound and present-day ice melting). The final part of the talk will be devoted to the comparison of ground and space gravity data in so-called CAL/VAL (calibration/validation) experiments which are going on in different regions.