Geophysical Research Abstracts
Vol. 20, EGU2018-8905, 2018
EGU General Assembly 2018


# On the observability of epeirogenic movement in current and future gravity missions

Siavash Ghelichkhan (1,2), Michael Murböck (4), Lorenzo Colli (3), Roland Pail (2), and Hans-Peter Bunge (1)

(1) Department of Earth and Environmental Sciences, Munich University, (2) Lehrstuhl für Astronomische und Physikalische Geodäsie, Technische Universität München, (3) Earth & Atmospheric Sciences, University of Housten, (4) Helmholtz-Zentrum Potsdam - Deutsches GeoForschungsZentrum GFZ

Next generation gravity missions are expected to improve the accuracy of temporal gravity models significantly. The periodic signals and trends retrieved by these missions are induced by mass redistribution in the Earth system, carrying essential information on dynamic processes in the atmosphere, cryosphere, continental hydrosphere, the oceans and the solid Earth. While temporal gravity signals induced by deep Earth's processes are commonly thought to lie below the observational threshold of satellite gravity missions, as one assumes them to be small in amplitude and restricted to the longest spatial and temporal scales, there exists evidence from the geologic record for rapid uplift and subsidence events at regional scales, especially along passive continental margins, related to flow in the underlying mantle. Here we explore novel mantle flow retrodictions for geodynamically plausible, compressible, high resolution Earth models with $\approx$ 670 million finite elements. These time-dependent Earth models link to geologic observables in the late Paleogene that can be tested independently, while at the same time indicating mantle flow induced geoid rates on the order of 5 $\mu$m/year, at spatial scales of 1000 km. We assess the signal retrievability of the modeled rates in closed-loop numerical simulations, with different satellite gravity retrieval mission assumptions, including GRACE, GRACE-FO and a next generation gravity mission. We find the modeled deep Earth signal to be on the edge of detectability, but coming into the range of detectability in future temporal gravity field solutions, suggesting the use of satellite gravity data to validate geodynamic Earth models. Importantly, the application of forward modeled dynamic mantle signals seems to be essential for improved de-aliasing and signal separation in future gravity missions.