Geophysical Research Abstracts
Vol. 12, EGU2010-10393, 2010
EGU General Assembly 2010


# Mitigation of along-track artifacts in unconstrained mass transport models based on GRACE satellite data

Pavel Ditmar, Hassan Hashemi Farahani, and João Encarnação

Delft University of Technology, Delft Institute of Earth Observation and Space Systems (DEOS), Delft, Netherlands (p.g.ditmar@tudelft.nl, +31 15 2782348)

The satellite gravity mission GRACE (Gravity Recovery And Climate Experiment), which was launched in 2002, offers a unique opportunity to monitor tiny variations of the Earth's gravity and associated mass transport from space. In particular, the redistribution of water in the Earth's system can be traced in this way, which is critical for monitoring key climate indicators such as ice-sheet mass balance, terrestrial water-storage change, sea-level rise, and ocean circulation. Unfortunately, mass transport models based on GRACE data suffer from along-track artifacts. In order to suppress these artifacts, various filtering algorithms are applied to unconstrained GRACE-based models at the post-processing stage. However, any filtering not only suppresses noise but also distorts signals. Therefore, it is important to study the precise origin of the along-track artifacts in an attempt to mitigate them already at the level of unconstrained solutions.

We identify two major causes of along-track artifacts: (1) the presence of low-frequency noise in GRACE data and (2) the observation principle of the GRACE satellite mission, which results in a poor sensitivity of the collected inter-satellite ranging data to the East-West gradient of the gravity field. According to our studies, an increased level of noise at low frequencies can be mostly explained by inaccuracies in the estimated orbits of GRACE satellites. To suppress this type of noise, we propose: (i) to use more advanced orbit determination procedures that allow deficiencies of available force models to be mitigated; (ii) to apply proper data weighting in the frequency domain, so that that the influence of frequencies with a large noise level is downweighted. As far as East-West gradients are concerned, we find it important to use the statistically optimal combination of GRACE inter-satellite ranging data with other observations (particularly, absolute positions of GRACE and CHAMP satellites). The added value of each of the above-mentioned measures is quantified.