Geophysical Research Abstracts
Vol. 12, EGU2010-4972, 2010
EGU General Assembly 2010
© Author(s) 2010

# Consistent patterns of Antarctic ice sheet interannual variations from ENVISAT radar altimetry and GRACE

Martin Horwath (1), Benoît Legrésy (1), Fabien Blarel (1), Frédérique Rémy (1), and Jean-Michel Lemoine (2)
(1) LEGOS (CNES/CNSR/IRD/UPS), Toulouse, France (martin.horwath@legos.obs-mip.fr), (2) CNES/GRGS Toulouse, France

By observing temporal volume and mass changes, respectively, satellite radar altimetry (RA) and satellite gravimetry are complementary tools for ice sheet mass balance studies.

We compare and jointly interpret results from ENVISAT RA and GRACE. The underlying RA products were generated with the Along-Track Satellite Radar Altimetry approach which exploits all observations along the repeat track and accounts for time-variable volume echo effects through analyzing the temporal variations of the radar echo shape. The used GRACE products are the CNES/GRGS 10-daily global gravity solutions obtained with a regularisation during processing and requiring no additional filtering. In order to render the spatial resolution of both datasets comparable we rigorously describe the spatial filtering of geophysical signals that is inherent to the GRACE processing. We then apply the same filtering to the maps of altimetric height changes.

After correction for glacial isostatic adjustment, the spatial patterns of linear trends shown by RA and GRACE over a common period agree well, not only for the extreme ice losses in the Amundsen Sea Sector of West Antarctica but also for an alternating sequence of gains and losses along the East Antarctic coast. Differences between ENVISAT ice sheet thickness changes and GRACE equivalent ice thickness changes are primarily due to the lack of RA coverage and secondarily due to changes in the firn density structure associated with surface mass balance fluctuations as well as due to errors in either observational data sets.

Moreover, the general patterns of year-to-year nonlinear variations on top of the trends agree between the two data sets. This agreement gives confidence in the interannual variations of both data sets. As a consequence, the high-resolution patterns provided by RA can be used to relate the interannual mass variations observed by GRACE to either flow variations or surface mass balance (SMB) variations and to validate atmospheric modeling results on SMB fluctuations. For example, we find that the dynamic ice mass loss in the Amundsen Sea Basin was temporarily mitigated by a snow accumulation excess in the second half of 2005 and that in most of East Antarctica, linear trends over 5 years are predominantly due to fluctuations in snow accumulation.