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Gravity tide and seasonal gravity variation at Ny-Ålesund, Svalbard in Arctic

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We have analyzed the 4-year gravity data (September 1999-August 2003) obtained from the superconducting gravimeter at Ny-Ålesund, Svalbard in Arctic. Our analysis results indicate that the observed short-period gravity tides show the seasonal variation, which is mainly due to the ocean tides variations, especially in the semidiurnal waves. The gravity residuals, which were obtained by correcting for the observed short- and long-period tides (up to the Sa wave in the periods) including the loading and attraction of ocean tide, the air pressure and the polar motion effects, show a clear seasonal variation. The vertical motion obtained from the continuous GPS measurements carried out near the gravity station also shows the seasonal variation that is consistent with the gravity data at least in their sign. We have estimated the gravity changes due to the effect of hydrology (i.e. the effect of snow and soil moisture) based on a hydrological model called the LaD model (The Land Dynamics model, Milly and Shmakin, 2002). While the hydrological model computation recovers general feature of the observed seasonal cycle of the gravity changes in both the amplitude and phase, we found that the model computation for the season of 2000-2001 gives too small as much as about three times in amplitude compared with the observed gravity amplitude. From the comparison between the LaD model value for the grid near Ny-Ålesund and the observed data used in Japan Meteorological Agency to constraint their model computation of hydrology, we may point out that the error in the LaD model is the dominant reason of the difference between the observation and the hy-

drological prediction in this period. Our study may give a good example for that the gravity observation on the ground can give a useful data to improve the accuracy of the hydrological modeling. By increasing the number of observation sites for the comparison, we may obtain a data that can be also used to validation and calibration of the satellite gravimetry.

Reference:

Milly, P. C. D. and A. B. Shmakin, 2002, Global Modeling of Land Water and Energy Balances. Part I: The Land Dynamics (LaD) Model.