Seasonal gravity change observed from a superconducting gravimeter at Ny-Alesund, Svalbard in Arctic

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Since September 1999, continuous gravity observation with a superconducting gravimeter (SG) is carrying out at Ny-Alesund, Svalbard as the most northern observation station of the GGP network (Global Geodynamics Project, Crossley et al., 1999).

We have analyzed the short and long periodic tidal components using the 4-year data obtained from the beginning of the obser-vation. The residual gravity signals, which were obtained by subtracting the gravity tides in-cluding the effects of annual and semiannual ocean tides and the polar motion effect, show a clear seasonal variation.

We have checked the stability in the scale factor of SG based on the temporal changes in the observed tidal signals, and the results indicate that the observed seasonal gravity change is not due to the instability of the SG itself. The observed seasonal signal is rather regular in time, i.e., during the past 4 years, the change starts on at around May-June in the sense of decreasing in gravity and it recovers at around July-August in the sense of increasing, although the amplitudes change year by year.

Beside the SG observation, at Ny-Alesund, since 1998, the absolute gravity measurements with FG5s were conducted 4 times by several European institutes in cooparated with us, and the results lead to a secular rate of -2.5+/-0.9 microGal/yr (decrease in gravity). Our examinations indicate that the present-day ice melting in Svalbard contributes to this gravity decreasing as well as the effect of post-glacial re-bound (Sato et al., 2003). Therefore, there is a possibility that the observed seasonal gravity variation may reflect a seasonal instability of the permafrost at Ny-Alesund and/or a seasonal mass change in the glaciers in Svalbard.