1. Abstract
The Svalbard archipelago, Norway, is affected by the post-glacial rebound (PGR) subsequent to the last deglaciation. Moreover, the glacial landscape harbours present-day ice melting (PDM). These two effects make Svalbard a very interesting area to study in order to better understand the consequences of ice melting at different times scales. We analyse nine years of gravity data obtained with a superconducting gravimeter (SG) and five absolute gravimetric (AG) measurements performed by the CRM at the University of Strasbourg. The absolute gravimetric measurements were performed four times: in 2002, 2003, 2004 and 2006. The accuracy of this new generation of AG gravimeters is a few micro-Gal, and the coordination errors are of the order of 0.1 µGal. GRACE data were used to compute the total gravity signal seen by GRACE in the region.

2. AG Data
5 campaigns of AG measurements between 1996 and 2007 at Ny-Ålesund (Fig. 3) with AG gravimeters belonging to 3 institutes. Geophysical corrections applied to the raw data:
- transfer to ground using vertical gravity gradient (-0.354 Gal/km)
- polar motion
- corrected data + season tide leading effect.
- atmospheric gravity changes (-0.42 Gal/mm)

3. SG Data
9 years (1 Jan 2000 - 31 Dec 2008) of SG data at Ny-Ålesund:
- near geophysical corrections as applied to the AG data,
- slope-repolynomial filtering with a 45 h window,
- correction for offsets,
- correction for the linear drift of the SG (1.00 Gal/yr) by adjusting SG and AG data.

4. Modeling of PDM & PGR effects
PDM
The Gravity function of the deformation is computed with Earth model PDEM (Dziewonski & Anderson 1981) using a spherical harmonics formalism (Farrell, 1975). The total effects induced by ice melting are obtained by combining the Gravity function with the load. We use two models of ice coverage:
- eGVM model (Hayashi et al., 2001)
- a model adapted from the Digital Chart of the World (DCW)

PGR
We use the values that Sato et al. (2006) computed for a viscoelastic Earth model in response to the ice model ICE-3G (Tushingham & Peltier, 1991): 1.88 mm/yr and -0.31 µGal/yr respectively for the uplift and gravity rates.

5. Synthesis

6. GRACE data
We estimate the linear trend of the gravity rate from 2003 until 2007 for 4 solutions of GRACE data computed up to harmonic degree 50 (Fig. 7). We use a Gaussian filter of radius 400 km for the CSR and GFZ solutions. In Greenland, Svalbard, and North America, the 3 solutions show similar patterns. However, the GRGS solutions show regional patches (Iceland, Svalbard, Novaya Zemlya). Over Svalbard, the GRGS solutions give a decreasing rate between -1 and -1.5 µGal/yr whereas the CSR and GFZ solutions give rates lower than or equal to -0.5 µGal/yr.

7. Conclusions
- Strong influence of topography and ice-melting location (equilibrium line of glaciers) on gravity rates, improvement of accuracy needed to better predict PDEM contribution.
- Good agreement between the predicted observation rates (GRV, CSL, AG) and the model-based on the SG with a 1 cm/yr PDM rate and the PGR deformation induced by ICE-3G model.
- Complementary observations like sea level changes from altimetry are needed to better predict the total gravity signal seen by GRACE in the region and to discriminate among the different GRACE solutions.
- If the PGR contribution is large, the PGR cannot be neglected in modelling the present-day vertical velocity, the ground and the satellite-derived gravity rates.

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