Geophysical Research Abstracts
Vol. 13, EGU2011-9294, 2011
EGU General Assembly 2011

Recent uplift of Greenland from ICESat observations and GIA modelling

Gabriella Ruggieri (1), Louise Sophie Sorensen (2), and Giorgio Spada (1)

(1) Dip.to di Scienze di Base e Fondamenti, Universit′a di Urbino "Carlo Bo", Urbino, Italy (gabriella.ruggieri@gmail.com), (2) Sorensen,DTU-Space, National Space Institute,Copenhagen(DK)

In the last years various remote sensing techniques have been employed to estimate the current mass balance of the Greenland ice sheet (GIS). In this work we use the GIS mass balance recently inverted from ICESat altimetry observations during the period 2003-2008 with the aim to investigate vertical movements and consequent sea-level variations at a regional scale. To investigate the elastic deformation of Greenland, we use two different methods. One takes into account the interaction between the regional deformation and the gravity changes, the other results from the direct effect of melting. A recent GPS network is used as basis for the analyses of vertical deformations. In particular, we use a set of data from five GPS sites located around the coastal sector of Greenland. The vertical movements predicted by an elastic response of the Earth as consequence of recent melting of GIS constitutes the major component of total deformation. Assuming negligible tectonic movements in Greenland, when this component is subtracted from the secular uplift rate, detected in the GPS measurements, the residual vertical displacement should be explained through the long-term effect of GIA (Glacial Isostatic Adjustment). The visco-elastic deformation due to the past global ice variability are investigate solving the Sea Level Equation for two different melting history. First, we use the global ice model ICE5G (VM2). Next, we employ different scenarios for the ice melting histories proposed in the literature, and we perform a sensitivity analysis in which various mantle viscosity profiles and lithospheric thicknesses are tested to establish upper and lower bounds on the GIA contribution. Combining the predictions obtained by elastic models with those obtained by visco-elastic models, we assess the total vertical deformation across Greenland and we produce scenarios for the future relative regional sea level variations. Finally we assess whether the uplift rates based on GPS measurements are consistent with the sum of the postglacial rebound and present elastic deformation. The misfit between observed GPS trend and total displacements can be partly attributed to a poor knowledge of the viscoelastic properties of the mantle and to uncertainties in the details of the past melting history of the GIS.