Geophysical Research Abstracts
Vol. 12, EGU2010-6127, 2010
EGU General Assembly 2010

Ice Loss and Glacial Isostatic Adjustment Adjacent to the Drake Passage: 2003 - 2009 using GPS and GRACE

Erik Ivins (1), Michael Watkins (1), Dah-Ning Yuan (1), Reinhard Dietrich (2), Gino Casassa (3), and Axel Rülke (4)

(1) JPL/Caltech, Div. Earth and Space Science MS300-233, Pasadena, CA, United States (erik.r.ivins@jpl.nasa.gov, 818 354 9476), (2) Institut für Planetare Geodäsie, Technische Universität Dresden, 01069 Dresden, Germany, (3) Centro de Estudios Cientificos, Arturo Prat 514, Valdivia, Chile, (4) Bundesamt für Kartographie und Geodäsie, Karl-Rothe-Straße 10-14 04105 Leipzig, Germany

Accelerating ice mass losses are well-documented in the Southern Patagonian Icefield (SPI) as well as in the northern Antarctic Peninsula (NAP). New GRACE data that allow continuity with past mass change measurements therefore bear heavily on answering this question. GRACE is an especially potent method because these data do not require independent measurements of both the surface mass balance components and glacial fluxes. Annual rates snow accumulation and glacier out-flux may both be increasing in the NAP, and there may be particularly large uncertainty in the rate at which precipitation varies. Here we report mass trends determined using a relatively new GRACE global-mascon treatment (GM) that provides enhanced spatial resolution. For both the glaciers of NAP and NPI+SPI we employ a cap sub-ensemble embedded within a global-mascon grid that models both terrestrial geodetic uplift data and GRACE determined mass changes. The use of GPS data allows 'in situ' correction for and glacial isostatic adjustment (GIA) 'errors' in determining present-day changes (PDC). Signals owing to *both* are contained in the crustal motion and space gravimetric data. We solve for 250 km and 200 km Gauss-smoothed and GIA-corrected water equivalent height (WHE) rate that minimizes chi-squared differences to both GPS and GRACE data in both NAP and NPI+SPI, respectively. Mantle viscosity was estimated in Antarctica for the first time. Bounds on the elastic lithosphere thicknesses for the two regions are similar: $20 < \quad h \quad < 45$ km, but distinctly different for mantle viscosity for south Patagonia ($4.0 \times 10^{18} < \eta < 8.0 \times 10^{18}$ Pa sec) versus the NAP ($9.5 \times 10^{18} < \eta < 5.5 \times 10^{19}$ Pa sec). Antarctic Peninsula ice mass loss is solved for: -41.5 Gt/yr in this process combined data-model optimization. Patagonian losses during the observing period Jan 2003 to March 2009 are -26 $\pm$ 6 Gt/yr and for the NAP: -41.5 $\pm$ 10 Gt/yr. We conclude that both the NAP and the NPI+SPI are now sustaining long-term inter-decadal ice loss and may be transitioning to a new warmer climate configuration.