Geophysical Research Abstracts
Vol. 13, EGU2011-10047, 2011
EGU General Assembly 2011

Nonlinear interaction between ocean tides and the Larsen C Ice Shelf system

Matt King (1), G. Hilmar Gudmundsson (2), and Keith Makinson (2)

(1) Newcastle University, School of Civil Engineering and Geosciences, Newcastle upon Tyne, United Kingdom (m.a.king@ncl.ac.uk, +44 (0)191 222 6502), (2) 2. British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, United Kingdom

We report on GPS records of flow of the Larsen C Ice Shelf, spanning 2 months to 2 years. Variations in speed are evident at periods from a few hours to $\sim$182 days, including semi-diurnal, diurnal and $\sim$14.76 days. At fortnightly periods the ice shelf varies by $\pm$10% from its long-term speed but at diurnal timescales it is up to $\pm$100%. The fortnightly signal is near synchronous across the ice shelf pointing to a common source mechanism. The diurnal and higher frequency signal has similar structure across the ice shelf, but with some phase differences as well as amplification of parts of the signal toward the ice shelf front. We model the modulation of flow as a non-linear function of basal shear stress ($\tilde{\tau}_b$) including tidal perturbations in the ice shelf grounding zone. Close agreement with the observations is found with $\tilde{\tau}_b$=10 kPa and exponent m$\approx$3, suggesting the presence of a viscous and non-linear till in the grounding zone, at least for Mobiloil and Cabinet inlets, and thereby providing new boundary conditions for modeling the Larsen C Ice Shelf system. While the fortnightly signal and the structure of the diurnal and higher frequency signal is closely reproduced by the model, it does not explain the entire signal, notably the amplification of diurnal and higher frequency signal toward the ice shelf front or relatively small lateral ice shelf motion. We suggest that an elastic response to tidal tilting of the ice shelf may be responsible.