MASS BALANCE OF ANTARCTICA AND PREDICTED GRAVITY AND GEOID CHANGE SIGNATURES WITH IMPLICATIONS FOR THE SECULAR ZONAL HARMONIC BUDGET

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Efforts to connect long wavelength temporal gravity observations and any secular (interdecadal) change in the total mass of the continental cryosphere have met with varying degrees of success over the past decade and a half. At least four elements have been encouraging in this regard: (1) the mass change may be connected to sealevel observations, for which the centennial-scale signal seems unambiguous (at $\dot{\xi}_{\rm Obs} \simeq$ 1.75 mm/yr; (2) gravity observations are more robust and now include more that 20 years of satellite laser ranging data (SLR) that determine a set of 6, or more, secular zonal coefficient rates; (3) improved a priori models of post-glacial rebound are now accompanied by crustal motion geodetic observations which add constraint to the gravity change signature; and, (4) the recent successful launch of ICE Sat and GRACE - meaning that simultaneous determination of height and gravity change data will, in the next 5 years, reduce the ambiguities of previous very long wavelength gravity solutions. The importance of the first of these four elements appears less impressive than previously thought due to the recognition that thermal expansion in the oceans has spatial and temporal complexity of large amplitude (possibly at the level of $\dot{\xi}_{\Delta \rm T} = 1$ mm/yr). However, altimetrically-based and flux model-based constraints on ice sheet change during the past 15 years [e.g., *Rignot and Thomas, 2002, Science, 297, 1502-1506*] now provide a more refined starting model for the present-day ice sheet contribution to the observed Stokes coefficient secular variations ($\dot{J}_n$) and polar wander ($\dot{\rm m}$). Given the tighter constraints on Greenland and Antarctic contribution to

observed $\dot{J}_n$, $\dot{\mathbf{m}}$ and to non-steric sealevel rise ($\dot{\xi}_{\rm IS} \simeq 0.33 \pm 0.15$ mm/yr), we discuss model implications for postglacial rebound errors and an improved treatment of large-scale continental hydrological systems.