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Analyses of the degree 2/order 1 conundrum in the GRACE derived time-dependent gravity field

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Although the ICE-5G(VM2) model of the global process of glacial isostatic adjustment provides a highly accurate fit to the dominant time dependent gravity signature over the North American continent, it does so only when the time derivatives of the degree 2 and order 1 Stokes coefficients are eliminated from both the theory and the “observations”. It has been suggested that this may be a consequence of the failure of the conventional theory to accurately predict the magnitude of the polar wander contribution to the observed field due to the neglect in this theory of the difference between the observed flattening of planetary shape and the flattening predicted by the linear visco-elastic field theory of Peltier (eg. 2004; *Ann. Rev. Earth and Planet. Sci.* 32, 111-149). Detailed analyses of the contribution of this effect to the values of the degree 2 and order 1 Stokes coefficients demonstrate that this suggested reconciliation between observations and theory is not viable. A corollary is that the values of these coefficients in the previously released RL04 data sets are suspect. Since it is well known that the accuracy of the GRACE fields at degree 2 and order 0 is insufficient to allow the system to confirm the value of this coefficient delivered by satellite laser ranging, it would not be surprising if similar difficulties were to attend the inference at the same degree but order 1.