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Rotational Feedback in Global Glacial Isostatic Adjustment

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Two anomalies in Earth's rotational state have previously been identified as being due to the ongoing global process of glacial isostatic adjustment, namely the so-called non-tidal acceleration of planetary rotation and the true polar wander that is presently occurring at a rate of approximately 1 degree per million years towards the Hudson Bay region of Canada. Although the connection of these anomalies to the GIA process has been uncontested for some time, it has recently been suggested that the latter may not be exclusively due to this ice-age related influence. This has been suggested to be associated with the influence of Earth's observed oblateness upon the speed of polar wander induced by glaciation and deglaciation. In the theory for the response of the rotating Earth to such surface forcing, the strength of this inhibiting influence upon polar wander speed is connected to the difference between the so-called fluid Love number and the infinite time asymptotic value of the tidal Love number of degree 2, as this is determined in the theory of Peltier (1982) and Wu and Peltier (1984). Although this difference appears to have a relatively minor influence upon the important contribution that rotational feedback makes to relative sea level history, it does influence the strength of the time dependence of the degree 2 and order 1 component of Earths gravitational field. I will discuss the implications of new results obtained with the revised form of the theory required to fully incorporate the influence of rotatational bulge derived inhibition of the TPW. The observation of this signal by the GRACE satellite may provide a means of directly assessing the fraction of the observed speed of TPW that we may be obliged to explain by appeal to other processes such as mantle convection. In exploiting the GRACE data set in this way, however, we will be obliged to simultaneously understand the secular variation in the strength of the pole tide that may be also be occurring in the current greenhouse warming climate.