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Geoid Stokes coefficient variations due to global glacial isostatic adjustment

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In a recent paper by Chambers et al (JGR, vol. 115, B11415, 2010)it has been suggested that the analysis of the influence of rotational feedback on the degree 2 and order 1 Stokes coefficients due to the process of glacial isostatic adjustment presented in Peltier and Luthcke (JGR, vol. 114, B11405) was incorrect.This is an important issue because the prediction of the time derivatives of these coefficients are being measured by the GRACE satellite and the values observed by GRACE differ significantly from those predicted by the ICE-5G (VM2) model of Peltier (Annu. Rev. Earth Planet. Sci., vol. 32, 111-149, 2004)which is the primary model of this process currently available. We isolate an egregious error in the Chambers et al paper which is derivative of their computation of the time derivatives of the Stokes coefficients using a formula for the relation between these coefficients and the "products of inertia" that is invalid for an Earth with oceans. Since the geoid is defined as the surface of constant gravitational potential which overlaps the surface of the sea in the absence of currents and tides, the formula they employ, from Chao and Gross (Geophys. J. R. astron. Soc. 91, 569-596, 1987) is not applicable to the analysis of this problem. When the complete gravitationally self consistent Sea Level Equation based theory of Peltier (eg. as recently reviewed in vol. 9 of the Treatise on Geophysics, Evolution of the Earth, pp. 243-293, 2007)is employed to compute the Stokes coefficients an analytical formula for these coefficients may be obtained which replaces the Chao and Gross formula for an Earth model with oceans. This makes clear the fact that the redistribution of water in the ocean basins that occurs in response to the changing rotation causes a highly significant amplification of the impact on the Stokes coefficients due to the GIA phenomenon and verifies the accuracy of the Peltier and Luthcke results. These authors have suggested the discrepancy between the modern GRACE observations of these coefficients and the GIA theory of ancient ice-age influence to be due to the influence of modern land ice melting due to the global warming phenomenon, an hypothesis that we continue to espouse.