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ITRF2008, Glacial Isostatic Adjustment and Recent Ice Melting

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We investigate what information station vertical velocities of the ITRF2008 (GPS stations) provide on global deformations of the Earth and by extension on Glacial Isostatic Adjustment (GIA) and Recent Ice Melting (RIM) processes. We infer degree-2 spherical harmonic coefficients of the Earth figure change and the J_2 gravity rate ($\dot{J}_2$), which we compare with different GIA models based on ICE5G/ICE4G ice history. Our best solution shows a $\dot{J}_2$ to be close to zero. Because ITRF2008 has been constructed using GPS data younger than 20 years, our results are consistent with recent studies that propose a large $\dot{J}_2$ change in the 1990s due to recent ice melting. It tends to favor models based on VM2 viscosity profile such as Peltier's or the GRACE Tellus GIA models (Peltier, 2004; Paulson et al., 2007). However, the spherical harmonic coefficients that are directly impacted by the GIA rotational feedback confirm with a good precision recent results from GRACE mission that initiated a debate on GIA rotational feedback. We find a coefficient consistent with most models but more than 7 times smaller than coefficients in Peltier's model. Two explanations are possible: (1) if the model of Peltier's IC5G/VM2 were to be correct, then the strong rotational feedback in the model must be counteracted by a strong rotational feedback in the opposite direction generated by current ice loss, (2) if the Tellus model were to be correct, therefore GIA and RIM separately induce negligible rotational feedbacks. Both answers are quite extreme and call for more investigation on GIA modeling and rotational feedback.