

Constraints on Accumulation and Postglacial Rebound from GRACE and InSAR

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We use monthly measurements of time variable gravity from the GRACE satellite gravity mission to determine spatial variation in ice mass (IM) trend and seasonality for over a six year period starting in Apr 2002. We compare spatial pattern and amplitude of the IM changes from GRACE with the one from the mass budget methods combining InSAR and regional climate modeling output. The two estimates are completely independent and characterized by different error sources. While largest source of error for the GRACE IM estimates is the uncertainties in the glacial isostatic adjustment (GIA) signal. For the mass budget method a large source of uncertainty can be traced to the surface mass balance components from regional climate modeling output. The comparison allows improved constrains on GIA and surface mass balance model output. We find that a thinner ice sheet at the Last Glacial Maximum may be required in the East Antarctic Ice sheet as well as in the Ross Sea region. In the Bellingshausen Sea area comparisons indicate that both a larger signal from the long-term accumulation and a larger GIA signal are likely. The adjusted forward model explanation for the Bellingshausen Sea time-dependent gravity is attributed to a combination of lower viscosity structure and geologically more recent ice mass loss.