



Antarctic snow accumulation variability related to ENSO from GRACE

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Interannual variations in Antarctic snow accumulation are important for understanding the relation between the evolution of the Antarctic ice sheet and changes in the global climate system. In situ measurements from, e.g., stakes, near-surface ice cores or ground-penetrating radar are sparse and often merely locally representative. Observations from satellite laser and radar remote sensing are confined to detect surface properties such as height or roughness, requiring additional information about the interior of the snow pack to relate these measurements to ice mass. Here, we present interannual variations of the ice mass along the Antarctic Peninsula and in the Amundsen Sea Sector recovered for the years 2002 until 2008 from satellite gravimetry data of the Gravity Recovery and Climate Experiment (GRACE). For both regions, mass anomalies derived from the time series of GRACE gravity fields correlate well ($r \approx 0.8$) with accumulation variations estimated from freshwater fluxes from the European Centre for Medium Range Weather Forecasts. Moreover, the mass anomalies for Antarctic Peninsula and in the Amundsen Sea Sector are anti-correlated in time ($r \approx -0.5$) and contain El Niño Southern Oscillation signatures caused by the temporary existence of the Amundsen Sea low-pressure system governing West Antarctic atmospheric moisture transports. The GRACE-determined interannual ice-mass variations exhibit root-mean squared amplitudes of $\sim 15.5 \pm 5.0$ (AP) and 23.5 ± 10.5 Gt (AS), which are significant compared to the mean annual mass loss of -109.3 ± 6.9 Gt in the coastal West Antarctica.