Spatial patterns in mass balance in the Siple Coast and Amundsen Sea Basin, West Antarctica

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Local rates of changes in ice sheet thickness were calculated at numerous sites in West Antarctica using the submergence velocity technique. This method entails measuring the vertical velocity of the ice sheet using repeat GPS surveys of markers and measuring local long-term rates of snow accumulation using firn core stratigraphy. The difference between these two quantities represents a thickness change with time. Measurements were conducted at sites located ~100-200 km apart along US ITASE traverse routes, and at several isolated locations. All but one of the sites are distributed in the Siple Coast and the Amundsen Sea Basin along contours of constant elevation, along flow lines, across ice divides, and close to regions of enhanced flow. Calculated rates of change are variable from site to site. Most of the large rates of change in ice thickness (~10 cm/yr or larger) are occurring in or close to regions of rapid flow. Other changes are observed at these same sites, including shear margin migration and ice stream deceleration. Near-steady-state conditions were calculated at most sites in the slow moving ice sheet interior and near the main West Antarctic ice divide. These results are consistent with regional estimates of ice sheet change at similar locations in West Antarctica, derived from remote sensing measurements.