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Recent Antarctic ice mass loss from InSAR and regional climate modeling

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Large uncertainties remain in the current and future contribution to sea level rise from Antarctica. Climate warming may increase snowfall in the interior but enhance glacier discharge at the coast where warmer air and ocean temperatures erode buttressing ice shelves and reduce backforce resistance to grounded-ice flow. Here, we use satellite interferometric synthetic-aperture radar observations from years 1992 to 2006 over 85 percent of the coastline to estimate the total mass flux into the ocean. We compare mass fluxes from large drainage basin units with interior snow accumulation calculated from a regional atmospheric climate model for years 1980 to 2004. In East Antarctica, small glacier losses along Wilkes Land and glacier gains at the mouths of the Filchner and Ross ice shelves combine for a near-zero -4+-61 Gt/yr mass balance. In West Antarctica and the Peninsula, widespread losses along the Bellingshausen and Amundsen seas and the northern tip of the Peninsula, respectively, combine for a loss that increased from 83+-59 Gt/yr in 1996, to 106+-60 Gt/yr in 2000 and 132+-60 Gt/yr in 2006, and 25+-45 Gt/yr to 28+-45 Gt/yr and 60+-46 Gt/yr. Observations of changes in surface elevation and glacier velocity show that losses are concentrated along narrow channels occupied by outlet glaciers and are caused by ongoing or past glacier acceleration. In the meantime, integrated snowfall over Antarctica did not change significantly. Changes in glacier flow therefore have a significant, if not dominant, impact on ice sheet mass balance; and glacier flow is strongly influenced by the temperature

of ocean waters near the grounding line.