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Computing the volume response of the Antarctic Peninsula ice sheet to warming scenarios to 2200

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The contribution to sea level to 2200 from the grounded, mainland Antarctic Peninsula ice sheet (APIS) was calculated using an ice sheet model initialized with a new technique computing ice fluxes based on observed surface velocities, altimetry and surface mass balance, and computing volume response using a linearised method. Volume change estimates of the APIS resulting from surface mass balance anomalies calculated by the regional model $RACMO_2$, forced by A1B and E1 scenarios of the global models ECHAM5 and HadCM3, predicted net negative sea level contributions between –0.5 and –12 mm sea-level equivalent (SLE) by 2200. Increased glacier flow due to ice thickening returned $\sim$15% of the increased accumulation to the sea by 2100 and $\sim$30% by 2200. The likely change in volume of the APIS by 2200 in response to imposed 10 and 20 km retreats of the grounding-line at individual large outlet glaciers in Palmer Land, southern AP, ranged between 0.5 and 3.5 mm SLE per drainage basin. Ensemble calculations of APIS volume change resulting from imposed grounding-line retreat due to ice-shelf break up scenarios applied to all twenty of the largest drainage basins in Palmer Land (covering $\sim$40% of the total area of APIS) resulted in net sea level contributions of 7-16 mm SLE by 2100, and 10-25 mm SLE by 2200. Inclusion of basins in the northern peninsula and realistic simulation of grounding-line movement for AP outlet glaciers will improve future projections.