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Spatial and temporal variability of the Antarctic Slope Current in an eddying ocean-sea ice model

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The basal melt rate of Antarctica's ice shelves is largely controlled by heat delivered from the Southern Ocean to the Antarctic continental shelf. The Antarctic Slope Current (ASC) is an almost circumpolar feature that encircles Antarctica along the continental shelf break in an anti-clockwise direction. Because the circulation is to first order oriented along the topographic slope, it inhibits exchange of water masses between the Southern Ocean and the Antarctic continental shelf and thereby impacts cross-slope heat supply. Direct observations of the ASC system are sparse, but indicate a highly variable flow field both in time and space. Given the importance of the circulation near the shelf break for cross-shelf exchange of heat, it is timely to further improve our knowledge of the ASC system. This study makes use of the global ocean-sea ice model ACCESS-OM2-01 with a 1/10 degree horizontal resolution and describes the spatial and temporal variability of the velocity field. We categorise the modelled ASC into three different regimes, similar to previous works for the associated Antarctic Slope Front: (i) A surface-intensified current found predominantly in East Antarctica, (ii) a bottom-intensified current found downstream of the dense shelf water formation sites in the Ross, Weddell, and Prydz Bay Seas, and (iii) a reversed current found in West Antarctica where the eastward flowing Antarctic Circumpolar Current impinges onto the continental shelf break. We find that the temporal variability of the Antarctic Slope Current varies between the regimes. In the bottom-intensified regions, the variability is set by the timing of the dense shelf water overflows, whereas the surface-intensified flow responds to the sub-monthly variability in the wind field.