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Generation of a dense coastal current by an Antarctic polynya

A. V. Wilchinsky (1) and D. L. Feltham(1,2)

(1) Centre for Polar Observation and Modelling, Department of Earth Sciences, University College London (aw@cpom.ucl.ac.uk), (2) British Antarctic Survey

Descent and spreading of high salinity water generated by salt rejection during sea ice formation in an Antarctic coastal polynya is studied using a hydrostatic, primitive equation three-dimensional ocean model, POLCOMS.The shape of the polynya is assumed to be a rectangle 100 km long and 30 km wide, and the salinity flux into the polynya at its surface is constant. The model has been run at high horizontal spatial resolution (500 m) and numerical simulations reveal a buoyancy-driven coastal current. The coastal current is a robust feature and appears in a range of simulations designed to investigate the influence of a sloping bottom, variable bottom drag, variable vertical turbulent diffusivities, higher salinity flux, and an off-shore position of the polynya. It is shown that bottom drag is the main factor determining the current width.This coastal current has not been produced with other numerical models of polynyas, which may be because these models were run at coarser resolutions. The coastal current becomes unstable upstream of its front when the polynya is adjacent to the coast. When the polynya is situated off-shore an unstable current is produced from its outset due to the capture of cyclonic eddies.