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# A simple analytical description of turbulent slope currents for use in large-scale models

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In the global overturning circulation in the oceans, highly localized downwellings at polar latitudes carry dense surface waters to abyssal depths. These sinking legs in the overturning circulation generally take the form of downslope currents of dense water sourced from a marginal sea.

We develop a simple analytical model to describe the mean path and the lateral spreading of a turbulent semi-geostrophic current on a topographic slope, with the aim of examining its role in the large-scale overturning circulation. For the small slopes typical of the oceans, we assume that the turbulence in the current is maintained by bottom friction and that the spreading is due to baroclinic instability. We also use the fact that, at small slopes, entrainment per unit depth of fall into such currents is almost independent of slope.

We solve for the velocities, dimensions and entrainment rates of bottom currents by coupling the flow with the large-scale overturning circulation. We compare the predictions with field data for the bottom currents from the Weddell Sea, one of the main formation sites for bottom water in the global oceans.