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Turning Ocean Mixing Upside Down RAFFAELE FERRARI, ALI MASHAYEK, JEAN-MICHAEL CAMPIN, MIT, TREVOR MCDOUGALL, University of South Wales, MAXIM NIKURASHIN, University of Tasmania — It is generally understood that small-scale mixing, such as is caused by breaking internal waves, drives upwelling of the densest ocean waters that sink to the ocean bottom at high latitudes. However the observational evidence that small-scale mixing is more vigorous close to the ocean bottom than above implies that small-scale mixing converts light waters into denser ones, thus driving a net sinking of abyssal water. It is shown that abyssal waters return to the surface along weakly stratified boundary layers, where the small-scale mixing of density decays to zero. The net ocean meridional overturning circulation is thus the small residual of a large sinking of waters, driven by small-scale mixing in the stratified interior, and an equally large upwelling, driven by the reduced small-scale mixing along the ocean boundaries. Thus whether abyssal waters upwell or sink in the net cannot be inferred simply from the vertical profile of mixing intensity, but depends also on the ocean hypsometry, i.e. the shape of the bottom topography. The implications of this result for our understanding of the abyssal ocean circulation will be presented with a combination of numerical models and observations.

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