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# The vertical distribution of mixing in a dense overflow

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Turbulent mixing associated with an oceanic flow across a sill causes a streamwise reduction in the stratification of the overflowing water. This effect is immediately apparent in along-stream density sections where the vertical spacing of isopycnal surfaces increases downstream of the sill. Below a level where the isopycnals remain flat across the sill the density decreases downstream. The buoyancy gained by this deep layer must be lost from overlying water, implying (in case of a unidirectional overflow) the existence of an upper layer in which the density increases along the flow path.

An extensive hydrographic and velocity data set from an overflow in an abyssal canyon is analyzed. The data confirm the existence of both the deep layer, where the density decreases across the sill, and the shallower one, where the density increases. The volume flux across the sill determined by current-meter measurements shows good agreement with a hydraulic estimate. In order to determine whether the along-stream evolution of density is consistent with the effects of vertical mixing, a simplified version of the density equation is used in a non-linear inverse approach. The solution quickly converges to a mixing profile that is only weakly dependent on the a priori initialization (including zero mixing). The inversion-derived mixing profile is quantitatively consistent with estimates resulting from the application of different methods, including control-volume budgets and Thorpe scales, while providing better vertical resolution.

The new method presented here allows mixing parameterizations of dense overflows to be derived purely from hydrographic data, possibly (but not necessarily) augmented by velocity measurements. This is useful because hydrographic surveys are much easier to carry out than more direct mixing measurements, e.g. using microstructure profilers.