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Internal mixing modifies across shelf exchange: results from the Ocean Microstructure Glider

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A key mechanism for diapycnal mixing in our oceans is internal waves either via enhanced interfacial shear or wave breaking. Dramatic examples are observed at the continental shelf break where energy is extracted from the barotropic tide to produce localized mixing hotspots and radiate energy onto the shelf and into the open ocean. The effect on diapycnal mixing over the continental shelf is still poorly understood due to 1) the lack of sustained measurements of pycnocline turbulence 2) the sporadic nature of turbulence and 3) the spatial variability of interaction with on-shelf topography. Here we extend the capability of traditional measurements by using an ocean glider equipped with a turbulence package that provides 9 days of continuous measurements of upper water column turbulence and mixing. Data reveal highly energetic and turbulent internal waves propagating onto the shelf that raise diapycnal mixing several orders of magnitude above background levels. The observed rates of vertical mixing provide a potential mechanism for limiting the exchange of shelf and open ocean water; reducing across shelf gradients and promoting return flow of both water masses. We examine the importance of this mechanism on exchange flows and examine the dependence of shelf break exchange on diapycnal mixing on the shelf using the recently developed, high-resolution shelf-wide model NEMO-shelf.