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Diapycnal fluxes and overturning from a tracer release experiment in a tidal canyon

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The overturning of the ocean has been classically described by sinking at high latitudes and upwelling of deep water in the ocean interior. However, measurements showing bottom enhanced mixing have suggested that the ocean interior experiences downwelling, and it has been recently proposed that the upwelling of deep water should arise over sloping boundaries. The Bottom Boundary Layer Turbulence and Abyssal Recipes project was set up to test this paradigm in the Rockall Trough, a natural laboratory of the deep ocean overturning. We conducted a tracer experiment that began by the injection of 15 kg of long lived inert SF5CF3 on the deep part of a tidal canyon in July 2021. The injection was performed in the bottom boundary layer, ~7 meters above the bottom, along streaks between 1800 m and 2000 m depth, tagging water at potential temperature of 3.6°C within a temperature window of 0.1°C. Within 24 hours we started the tracer survey along the full canyon length for two weeks (totalling 81 stations) and we report here on the integrated diapycnal fluxes (upwellings and downwellings) at key locations between 900 m and 2600 m depth, at different time steps from neap to spring tides. The tracer dispersion along the canyon unprecedently documents a rapid diapycnal upwelling of the tracer ranging from 50 to 300 meters per day driven by tidal mixing implying an overturning circulation. As the tracer evolved in the canyon under tidal sloshing, its leading edge was detected reaching 8.5°C at the canyon head as we entered spring tides. We will also report on the tracer chase outside of the canyon to explore the contribution of sloping boundary mixing to ventilation at the scale of the Rockall Trough.