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β-plumes created by overflows

S. Kida (1) , J. Price (2), and JY Yang (2)
(1) MIT/WHOI Joint Program in Oceanography (2) Woods Hole Oceanographic Institution

We have investigated the dynamics of overflow-upper layer interaction using a two layer isopycnal model configured to be an idealized Faroe Bank Channel overflow. The adiabatic interaction has been studied by shutting off diabatic mixing. Strong time variability due to a localized baroclinic instability was observed for realistic parameters. The instability made the overflow descend at a steeper angle than otherwise, and created an eddy potential vorticity (PV) flux in the upper layer. The time averaged circulation in the upper layer showed two β-plumes of opposite sign due to eddy PV flux divergence having two signs. With diabatic mixing (entrainment) included, the overflow descended at an even steeper angle due to entrainment stress. The upper layer now included a β-plume created by entrainment that strengthened the β-plume created by eddy PV flux. An overflow can thus create a large scale circulation of significant magnitude (on the order of few Sverdrups) in an active upper layer.