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Mixing and Structure of Internal Hydraulic Jumps

Internal hydraulic jumps result in localized, intense mixing, affecting water properties and nutrient distributions. In some locations, the distribution of water properties can have severe negative effects on the local ecosystem; for example, in Hood Canal, low levels of dissolved oxygen result in periodic fish kills. To better understand how to mitigate these events, and how they might change in response to climate change, a better understanding of the behaviour of internal hydraulic jumps is required. Internal hydraulic jumps in the environment are complicated by many details, such as topographic variation, continuously varying velocity and density profiles, and Earth's rotation. This work describes the results of idealized simulations that show how the structure and mixing of internal hydraulic jumps varies with upstream shear in a straight channel, with channel width variations, and with rotation. Idealized simulations are employed to isolate individual effects. Large Eddy Simulations are conducted using the CFD code Gerris, allowing turbulence statistics to be calculated. The scalar variance production from the turbulent scalar variance equation is used to quantify and compare mixing between simulations.