Abstract View

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Vertical Diffusion Driven by Internal Waves in a Sill Fjord

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ABSTRACT

A new mechanism, the breaking of internal waves, is proposed to explain vertical mixing within the lower layers of sill fjords. The generation of the waves at the sill of a fjord is modelled assuming constant depth except at the narrow sill whose height is the thickness of the lower layer. A barotropic tide oscillating across the still creates internal waves which propagate both seaward and landward from the still. These waves break against the bottom, creating boundary turbulence which mixes water of different density in the lower layer. This is demonstrated experimentally. The mixture flows away from the boundaries into the interior of the fjord, causing an effective vertical mixing. The energy input into the internal waves and the damping of barotropic seiches are computed using linear theory. Possible instability, except at the bottom, is discounted by considering representative Richardson and Froude numbers. The theory is then qualitatively applied to the Oslofjord with particular attention given to the effects caused by changing the sill geometry. An estimate of the Richardson flux number from the Oslofjord data gives a value of 0.05.