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Baroclinic Instability over a Slope. Part I: Linear Theory

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ABSTRACT

We consider the instability properties of a circular current in the upper layer of a two-layer quasi-geostrophic ocean over a unidirectional slope. This particular flow-topography geometry is intended as a crude model of geophysical gyres where the variation of the Coriolis force is negligible. Such currents occur in the Arctic and in Gulf Stream rings. The slope destabilizes the flow; the critical Froude number is lowered as the slope increases. Baroclinic instabilities tend to generate time-independent or mean currents in the upper and lower layers which, because of the slope, are markedly asymmetric across the gyre.

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