The Role of Jets in Mixing Across a Continental Shelf Break

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What controls mixing across a continental shelf break is considered using a high horizontal resolution quasigeostrophic model. The geometry is an idealized turbulent channel flow representing the circumpolar current and interacting with a sloping shelf topography. Results show that there are essentially three regimes controlling the mixing according to the width of the continental shelf break: (1) for very sharp shelves, mixing is continuous and no jet is observed on the shelf break, (2) for intermediate widths, a very strong and stable jet is observed on the shelf break, but becomes periodically unstable (leading to major mixing events), and (3) for wide shelves, a multiple jets regime is observed and mixing events are smaller but more frequent. An argument invoking baroclinic instability is used to explain these results. Experiments using a sinusoidal shelf break were also carried out. These show a behavior similar to that described above in the very long and very short shelf break wavelength limits. However, the jet formation can be totally suppressed when the wavelength of the shelf break corresponds to the typical size of an eddy.