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Wind-mixing by storms modifies baroclinic energy flux on the Celtic Sea shelf

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The internal tide generated at the continental shelf break transfers energy from the barotropic tide to vertical mixing in shelf seas. In this study, temperature and current measurements from an array of moorings across the Celtic Sea shelf-break, a well-known hot-spot for tidal energy conversion, show the impact of passing summer storms on the baroclinic wave field. Internal waves can propagate over a seabed with a gentle slope, but are reflected when they encounter sufficiently steep bottom topography, with the critical topographic slope above which reflection occurs being determined by the water column stratification.

In July 2012, wind-driven vertical mixing during two storms lowered stratification in the upper 50 meters of the water column, and baroclinic energy in the semidiurnal band appeared at the moorings 1-4 days after. The timing of the maximum in the baroclinic energy flux is consistent with the propagation of the semidiurnal internal tide from generation sites at the shelf break to the moorings 40 km away. The $\sim$3 day duration of the peak in M2 baroclinic energy fluxes at the moorings corresponds to the restratification time scale following the first storm. These results indicate that wind-mixing can change a topographic slope from super-critical to subcritical; variations in stratification with timescales of a few days may contribute to the unpredictability of the internal tide in shelf seas.