The unexpected nature of the tidal currents observed off the Landes coast (44°N)

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The bottom tidal currents at 55m depth vanish in Autumn!

The decrease of bottom current is linked to the break down of the stratification

Main finding: At first order, coastal tidal currents in summer result of internal tide propagation. When the stratification breaks down in autumn, baroclinic (internal) tidal currents disappear and tidal currents are purely barotropic (and weak).

Internal tide generation: Why the baroclinic currents are so strong (vs. barotropic currents)?

A new hypothesis

The internal tide is generated by the interaction of the barotropic tidal current with the bathymetry. The body force expressed by the formulation of Baines (1982) shows that the double shelf breaks system ("Plateau des Landes" and Aquitanian shelf) defines region of potential generation of internal tides.

Internal tides (IT) in a continuously stratified ocean can be described by beams emanating from critical slope bathymetry. The IT energy follows characteristic pathways with a slope to the horizontal given by C (see formula on the figure). When the sea floor slope equals C, the internal tides generation becomes more efficient. In the region of the Landes, both slopes and critical height of the "Plateau des Landes" allows near resonant situation which could enhance baroclinic currents.

Perspective and future observations to be done...

These observations suffer the lack of hydrological (at least temperature) data in the water column. A more complete experiment dedicated to this region remain to be set up in the near future to validate (or not) this unusual internal tide generation process.

References:
