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Instability of Gravity Driven Coastal Current in a Turntable Experiment

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The instability of a current driven by gravity and maintained along a vertical lateral wall by the Coriolis force is investigated in laboratory experiments, performed in the large Coriolis turntable (Grenoble). The flowing water floats over a homogeneous denser layer. It represents for instance the Algerian current, made of the light Atlantic water entering the Mediterranean Sea. This current is unstable, generating meanders and vortices. This is classically attributed to baroclinic instability, but in our case it is forbidden by the absence of potential vorticity gradient in the lower layer. However we find that the instability of the viscous boundary layer initiates the process: the wall vorticity concentrates into vortices, which then interact with the main current potential vorticity as propagating dipoles, mimicking the usual process of baroclinic instability. For oceanic modelling, a proper representation of the meander initiation therefore requires a good resolution of the viscous boundary layer.

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