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Libration-driven flows in planetary cores and subsurface oceans

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Orbital dynamics that lead to forced longitudinal libration of celestial bodies also result in an elliptically deformed equatorial core-mantle boundary. In the present study, we investigate the effect of the topographic coupling on the flow in the liquid layers of a librating planet through a coupled numerical-experimental approach. We report the first evidence of libration-driven elliptical instability in a non-axisymmetric container. It is shown that intermittent turbulence, characteristic of such instabilities, is associated with an enhanced zonal flow. Outside of the resonant conditions, we observe a zonal flow that is well explained by Ekman boundary layer non-linear interactions and remains independent of the elliptical deformation of the container.