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A laboratory study of gas giants' zonal jets: formation and long-term evolution[1] DAPHNE LEMASQUERIER, BENJAMIN FAVIER, MICHAEL LE BARS, Aix-Marseille Univ, CNRS, Centrale Marseille, I.R.P.H.E, UMR 7342, 49 rue F. Joliot Curie, 13013 Marseille — The stability, structure and dynamics of gas giants' zonal jet streams are still poorly understood, especially in terms of coupling with their deep molecular interior. Here, we use an experimental approach to address the questions of zonal jets formation and long-term evolution. A strong topographic β-effect is obtained inside a rotating water tank thanks to the paraboloidal shape of the fluid free surface due the centrifugally-induced pressure. The shape of the bottom of the tank is chosen so that this β-effect is spatially constant. A small-scale turbulent forcing is performed over 128 injection and suction points at the base of the tank allowing a control of its spatio-temporal distribution and intensity. Time-resolving PIV measurements are performed in a horizontal plane. We identify a subcritical bifurcation between two regimes where zonal jets with strong instantaneous signature are present. In the first regime, the jets are weak in amplitude, directly forced and steady. In the second one, we observe self-developed highly energetic jets, independent of the forcing scale. In that last case, the zonal flows kinetic energy spectra are consistent with theoretical predictions in the regime of so-called zonostrophic turbulence relevant to planetary applications.

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