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Nonlinear effects associated with harmonic forcing of the flow in a rotating sphere ALBAN SAURET, DAVID CÉBRON, IRPHE, France, CYPRIEN MORIZE, IRPHE, France & FAST, France, MICHAEL LE BARS, STÉPHANE LE DIZÈS, IRPHE, France — Significant axisymmetric stationary flows can be generated by the action of an harmonic forcing on a rotating fluid in a sphere. Such a mechanism could be of fundamental importance in natural systems, for instance in planetary cores subject to libration, precession or tides. Using a weakly non-linear analysis, we first show that the mechanism of zonal flow generation is fully generic: the main contribution in the bulk always comes from the non-linear self-interaction of the viscous boundary layer flow induced by a multipolar forcing. The analytical study predicts that the zonal flow amplitude scales as the square value of the considered forcing and is independent of the Ekman number. These results are confirmed by systematic PIV measurements in a rotating sphere and by asixymmetric simulations for the case of libration.

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