3D Inertial Wave Attractors

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For a few decades now, numerous studies have been devoted to the intriguing properties of inertia-gravity wave reflection [5]. Since the angle of propagation of these waves is set by the ratio of their frequency to the buoyancy or rotation frequency, the reflection on a wall does not follow the usual Snell-Descartes law. In particular, in a confined trapezoidal geometry, when one of the walls is neither horizontal nor vertical, the wave beam experiences a focusing effect and eventually, whatever the initial source of the waves, ends on a definite trajectory called *attractor*.

Experimental and numerical studies have shown evidence of this structure for internal gravity waves [4] and for internal inertial waves [6] in 2D geometry . Due to the local energy focusing, non-linear triadic cascades occur in the branches of the attractor, leading to energy transfer between scales, which has been observed experimentally [2][3].

More recently, geometric and 3D aspects of internal wave attractors have been explored using numerical simulations with inertial waves. Direct numerical simulations pictured an axisymmetric inertial wave attractor, in a trapezoidal cylindrical domain, in which focusing and defocusing effects are caused by the reflection on the inclined wall, as well as by the radially expanding geometry itself. Wave instability occurs while forcing the attractor, leading to a destabilised flow and a symmetry breakdown. Using an experimental apparatus that has shown relevance for axisymmetric wave generation [1], we produce an inertial wave attractor in a cylindrical domain and we explore its properties.

Références

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