Internal wave in the ocean, local, global stability and transient growth

Gaétan Lerisson[1], Jean-Marc Chomaz[*†1], and Sabine Ortiz[1]

[1]Laboratoire d'Hydrodynamique (LadHyX) – Ecole Polytechnique – 91128 PALAISEAU CEDEX, France

Abstract

Internal gravity waves that exist in a continuously stratified fluid are particularly important in the ocean. They transport energy and are thought to generate turbulent mixing which contributes to the deep ocean circulation. Through fully non-linear and linear direct numerical simulations of the stability of a gravity wave beam, we show that the stability properties and transient growth intensity strongly depend on the mean flow intensity. Small scale instabilities dominate for small mean flow as for internal tide. For lee waves or more generally strong mean flows, large scales lead the instability but small scales dominate the short time growth. Computing the linear impulse response of a monochromatic internal wave we propose an interpretation based on an extension of absolute and convective theory to 2D periodic base flow and make the connection with the classical triadic instability theory of Phillips.

[*]Speaker
[†]Corresponding author: jmchomaz@gmail.com