Resonant growth of inertial oscillations from lee waves

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Abstract

Lee waves are internal gravity waves produced by a wind blowing over a mountain. Lee wave motion has been the subject of numerous studies, since the linear theory of Lyra (1943) and Queney (1947) in the simplest two-dimensional case with uniform wind and stratified atmosphere. Nonlinear effects next appeared to have an essential impact on the atmosphere, as wave-induced momentum deposition can strongly affect the local winds and result in long-range transport (of ozone for instance) in the stratosphere. Lee wave motions are therefore an essential component of atmospheric flows.
Lee waves can also be generated in the Southern Ocean by the Antarctic Circumpolar Current, a strong, locally barotropic current that can reach the bottom topography. Nikurashin and Ferrari (2010) proposed from two-dimensional numerical simulations that lee wave-induced momentum deposition may lead to the growth of inertial oscillations through a nonlinear and fundamentally dissipative process. The interaction between the lee waves and the inertial oscillations may in turn promote wave breaking and intensify turbulent kinetic energy dissipation and mixing in the deep ocean.

In the present talk, we shall show that the emergence of inertial oscillations can result from an alternate, non dissipative, mechanism consisting in resonant interactions involving the lee waves. Two-dimensional numerical simulations will also be presented to assess the validity of this result.

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