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Effect of Horizontal Component of the Coriolis Force on Propagation of Near-Inertial Waves in the Ocean

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Oceanic motions of scales small compared to the Earth's radius are commonly described as if the rotating Earth were locally flat with the horizontal component of the Coriolis force being neglected (the so-called traditional approximation). We show that taking into account the horizontal component of the Coriolis force changes dramatically dynamics of near-inertial waves. A new family of sub-inertial waves, which are absent under the traditional approximation, is found to play a crucial role: on the non-traditonal beta-plane inertial waves propagating poleward and reaching their inertial latitude are not reflected at this latitude, as is the case under the traditional approximation, but turn into subinertial waves which propagate further poleward trapped within near bottom and near surface wave-guides around the minima of the buoyancy frequency. Their horizontal and vertical scales rapidly decrease and tend to zero at a critical latitude. There is no reflection and, thus, inertial waves are absorbed contributing to deep ocean mixing.

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