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Inertial instability of oceanic submesoscale vortices: linear analysis, marginal stability criterion and laboratory experiments AYAH LAZAR, Geophysics and Planetary Sciences, Tel-Aviv University and Laboratoire de Meteorologie Dynamique, Ecole Polytechnique, ALEXANDRE STEGNER, Laboratoire de Meteorologie Dynamique, CNRS and Ecole Polytechnique, EYAL HEIFETZ, Geophysics and Planetary Sciences, Tel-Aviv University — Inertial instability is a possible mechanism for vertical mixing in the submesoscale ocean. The stability of axisymmetric oceanic-like vortices to inertial perturbations is investigated by linear stability analysis, taking into account the thickness and the stratification of the thermocline, as well as the vertical eddy viscosity. Numerical analysis reveals that the instability is insensitive to the vorticity profile if the intensity of the vortex is characterized by the vortex Rossby number (instead of the local normalized vorticity). This allows extending our analytical solutions for the Rankine vortex to a wide variety of oceanic cases, including results such as the analytic dispersion relation, and the marginal stability criterion. This suits oceanic conditions better than the widely used generalized Rayleigh criterion. Comparison with oceanographic data shows that our criterion permits cases that contradict the common oceanographic hypothesis for inertial instability. For instance, intense submesoscale anticyclones may be stable even with a core region of negative absolute vorticity. We corroborate our findings with large-scale laboratory experiments and find a signature of the instability on the mean-flow, which could be used in future oceanographic measurements.

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