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Variational Model Reduction for Rotating Geophysical Flows with Full Coriolis Force

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Consider the motion of a rotating fluid governed by the Boussinesq equations with full Coriolis parameter. This is contrary to the so-called “traditional approximation” in which the horizontal part of the Coriolis parameter is zero. The model is obtained using variational principle which depends on Lagrangian dynamics. The full Coriolis force is used since the horizontal component of the angular velocity has a crucial role in that it introduces a dependence on the direction of the geostrophic flow in the horizontal geostrophical plane. We aim that singularity near the equatorial region can be solved with this assumption. This gives a consistent balance relation for any latitude on the Earth. We follow the similar strategy to that Oliver and Vasylyevych (2016) for the system to derive the Euler-Poincaré equations. Firstly, the system is transformed into desired scale giving the differences with the other scales. We derive the balance model Lagrangian as called L1 model, R. Salmon, using Hamiltonian principles. Near identity transformation is applied to simplify the Hamiltonian. Whole calculations are done considering the smallness assumption of the Rossby number. Balance relation is important to study on gravity waves which are used to describe the interaction between ocean and atmosphere. Long term, we aim that results help to understand the global energy cycle with the goal of validity and improving climate models.

Do you need an official invitation letter?

No

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