

Eulerian Derivation of Rotating Geophysical Equations

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In textbooks of geophysical fluid dynamics, the Coriolis force and the centrifugal force in a rotating fluid system are derived by making use of the fluid parcel concept. In contrast to this intuitive derivation to the apparent forces, more rigorous derivation would be useful not only for the pedagogical purpose, but also for the applications to other kinds of rotating geophysical systems rather than the fluid. The purpose of this paper is to show a general procedure to derive the transformed equations in the rotating frame of reference based on the local Galilean transformation and rotational coordinate transformation of field quantities. The generality and usefulness of this Eulerian approach is demonstrated in the derivation of apparent forces in rotating fluids as well as the transformed electromagnetic field equation in the rotating system.

References:

A. Kageyama and M. Hyodo, *Geochem. Geophys. Geosyst.*, in press; arXiv:physics/0509004