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Meridional Asymmetries in Forced Beta-Plane Turbulence

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ABSTRACT

Forced geostrophic turbulence on the surface of a rotating sphere (so called β-plane turbulence) is simulated trough the use of the *β-SQG*$^{+1}$ numerical model. Domain occupied by the fluid has a channel geometry with 512 by 256 grid points, periodic boundary conditions in x-direction and rigid boundaries in y-direction. Random forcing is applied at high wave-numbers in the spectral space. To better understand eddies dynamics we simulate both regimes, with and without stochastic forcing, starting from identical initial conditions. Direct numerical simulations exhibit different dynamical properties in different regimes. In the freely evolving case, a wave term that competes with inertia on large-scales (added as a result of the β-effect) produces high meridional asymmetries in the eddies spatial and time scales. This asymmetry is added to the standard for the β-plane turbulence zonal asymmetry. In the forced regime there is not only anisotropy in the eddies deformation radius, but also in their orientation. The preferred direction for the warm anomalies elongation is north-western, while for the cold anomalies is north-eastern. These results may explain the observed meridional meandering of the mid-latitude zonal jets.

KEYWORDS

Beta-Plane Turbulence, Stochastic Forcing, Meridional Asymmetries

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References

[1] M. Juckes, "Quasi-geostriphic Dynamics of the Tropo- Pause," Journal of the Atmospheric Sciences, Vol. 51, No. 19, 1994, pp. 2756-2768. doi:10.1175/1520-0469(1994)051<2756:QDOTT>2.0.CO;2

[2] I. M. Held, R. T. Pierrehumbert, S. T. Garner and K. L. Swanson, "Surface Quasi-Geostrophic Dynamics," Journal of Fluid Mechanics, Vol. 282, 1995, pp. 1-20. doi:10.1017/S0022112095000012

[3] G. J. Hakim, C. Snyder and D. J. Muraki, "A New Surface Model for Cyclone-Anticyclone Asymmetry," Journal of the Atmospheric Sciences, Vol. 59, No. 16, 2002, pp. 2404-2420.

[4] P. B. Rhines, "Waves and Turbulence on a β-Plane," Journal of Fluid Mechanics, Vol. 69, No. 3, 1975, pp. 417-443. doi:10.1017/S0022112075001504

[5] I. N. Panayotova, "A New Surface Model for -Plane Turbulence," Journal of the Atmospheric