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A mechanism for jet drift over topography. (English) Zbl 1404.86019

J. Fluid Mech. 845, 392-416 (2018).

Summary: The dynamics of multiple alternating oceanic jets has been studied in the presence of a simple bottom topography with constant slope in the zonal direction. A baroclinic quasi-geostrophic model forced with a horizontally uniform and vertically sheared background flow generates mesoscale eddies and jets that are tilted from the zonal direction and drift with constant speed. The governing dynamical equations are rewritten in a tilted frame of reference moving with the jets, and the cross-jet time-mean profiles of the linear and nonlinear stress terms are analysed. Here, the linear stress terms are present because of the zonally asymmetric topography. It is demonstrated that the linear dynamics controls the drift mechanism. Also, it is found that the drifting jets are directly forced by the imposed vertical shear, whereas the eddies oppose the jets, although this is limited to continuously forced dissipative systems. This role of the eddies is opposite to the one in the classical baroclinic model of stationary, zonally symmetric multiple jets. This is expected to be more generic in the ocean, which is zonally asymmetric nearly everywhere.

MSC:

86A05 Hydrology, hydrography, oceanography
86-08 Computational methods for problems pertaining to geophysics

Keywords:

baroclinic flows; quasi-geostrophic flows; topographic effects

Full Text: DOI

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