Oceanic Rossby waves and mean-flow generation

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Oceanic eastward jets such as the Gulf Stream or Kuroshio extension are maintained by systematic up-gradient fluxes of momentum and potential vorticity. These fluxes are associated with meridional Rossby wave propagation away from transient features such as jet meanders or coherent vortices. I will present results obtained via idealised shallow-water dynamics that illuminate the dependence that such Rossby waves have on large-scale flow characteristics, with a particular focus on background flow. Importantly, the mean-flow generation (zonal momentum flux convergence) associated with outward Rossby wave propagation can be explained by considering the waves' properties and, in turn, the dependence that these properties have on large-scale flow features. For example, it is found that the mean-flow generation by locally excited Rossby waves (via a wavemaker) has a robust and significant dependence on the amplitude and direction of the underlying background flow. This dependence can be recast in terms of two essential factors: (1) wavemaker resonance with the Rossby wave spectrum and (2) rectification efficiency. This work has two major benefits. First, from a theoretical standpoint, it elucidates the role of Rossby waves in driving mean flows. Second, these results may be applied to the development of mesoscale eddy parameterisations which by construction is well-suited for modelling oceanic jets.

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