Intrinsic eddy variability in the ocean diagnosed from the Lorenz energy cycle

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Abstract

A robust feature of the Lorenz energy cycle in the ocean is that it differs from the atmosphere in two ways. First, generation of mean kinetic and potential energy is at first order balanced by dissipation instead of conversion to eddy terms. Second, and associated with the first point, generation of eddy energy occurs through variations in atmospheric forcing, especially winds, and baroclinic and barotropic mean to eddy energy conversion are much weaker. This is in line with wide-held belief in climate and atmospheric science that ocean variability is predominantly forced by the atmosphere. While this is true from a global average perspective, both generation of eddy kinetic energy by winds and conversion from eddy potential and mean kinetic energy to eddy kinetic energy have distinct spatial patterns. The latter two pathways (baroclinic and barotropic) may be identified with intrinsic variability versus forced variability through the wind generation term. Here, I will discuss the importance of each pathway on a local and regional scale, identifying areas where intrinsic variability is most important in terms of energy conversion and what we can learn from its spatial pattern. Estimates from a 1/4 and 1/12 degree NEMO model will be compared, addressing the role of resolution for the relative importance of intrinsic ocean variability.

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