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# Geometrical effects in a double-gyre model of the Kuroshio Extension

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The classical double-gyre model of the wind-driven ocean circulation is usually applied to a rectangular box. The relevance of deriving, in such a simplified context, an internal low-frequency variability that shares significant aspects with the observed large-scale ocean fluctuations, fully justifies the simplicity of the adopted geometry. It is nonetheless important to carry out studies aimed at analyzing the sensitivity of the modeled variability to more realistic geometries. In an application of the double-gyre problem to the North Atlantic, Dijkstra and Molemaker (1999) have shown that the perturbed pitchfork bifurcation found in a rectangular basin remains robust if a more realistic geometry is considered. Thus, the question arises as to whether an analogous weak sensitivity to the basin geometry can be expected for the North Pacific internal low-frequency variability as well. A recent double-gyre reduced-gravity shallow water model of the Kuroshio Extension ("KE", Pierini 2006), in which the domain of integration is bounded to the west by a schematic coastline that mimics the real basin shape, exhibits a bimodal decadal variability in significant agreement with altimeter observations (Qiu and Chen 2005) for the period 1992-2004. In order to analyze the sensitivity of these model results to the basin geometry, numerical experiments have been performed by gradually passing from the schematic western coast to a straight meridional boundary. Unlike the North Atlantic case, the results show here an extreme sensitivity of the variability to the shape of the western coast. If, for example, a straight meridional western boundary south of Japan is adopted, then the resulting KE dynamics is totally unrealistic: in fact, the meandering pattern of the KE is preserved but the strong bimodal variability found with the more realistic coast completely disappears in this case (only extremely weak fluctuations are obtained). Moreover, the mean kinetic energy of the KE corresponds roughly to the maximum energy peaks found in the realistic case. Variations of the lateral eddy viscosity do not alter these drastic results, for which a preliminary explanation based on geophysical fluid dynamical principles is provided.