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A spectral global barotropic ocean model

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A global spectral barotropic model for simulating the depth-averaged flow of the World Ocean is introduced. The equations are based on vorticity and divergence and continents are considered as part of the fluid with infinitely large viscosity. The coding follows that of spectral atmospheric general circulation models using triangular truncation and semi-implicit time integration to provide a first step for seamless coupling to spectral atmospheric global circulation models and an efficient method for filtering of ocean wave dynamics.

Three experiments demonstrate the model performance: (i) Bounded by an idealized basin geometry and driven by a zonally uniform wind stress, the ocean circulation shows close similarity with Munk's analytical solution. (ii) The ocean wave-dynamics of equatorial waves, excited by a height perturbation at the equator, shows wave dispersion and reflection at eastern and western coastal boundaries. (iii) With a real land-sea mask the model is capable of reproducing the spin-up, location and magnitudes of depth-averaged barotropic ocean currents. We intend to use this spectral ocean model in combination with intermediate complexity spectral atmospheric models as an efficient tool for the conceptual modeling of long term climate variability. Furthermore, we are currently working on a multi-layer version which is capable to simulate baroclinic flows with and without filtering ocean wave dynamics.