Estimates of Ocean Mixing Coefficients
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Summary
The global ERS3 P interface procedure (Stammer et al., 2002) is used to estimate horizontal and vertical ocean mixing coefficients (viscosity and diffusivity) that are consistent with WOCE data sets, the atmospheric forcing fields and the model physics. These estimates are obtained using various temporal and geographic tuning fields and are scaled along with other momentum and energy forcing as so to bring the model in consistency with global data sets over the period 1982 through 2000.
The estimated coefficients (viscosity and net vertical diffusivity) are not as expected, horizontal viscosity is reduced significantly along most of the lateral boundaries, while linear mixing is enhanced in western boundary currents. This is true even if the horizontal mixing occurs independently of the model drag and can be inferred from the mass of females of mixing at the depth.
We note that horizontal diffusivity is reduced throughout the water column across the entire temperature range where the relative importance of gravity wave mixing, especially near the surface. This suggests that enhanced horizontal mixing is the base of the upper gyre, mainly in the Northern Hemisphere. The diffusion is also reduced at the middepth in the Atlantic Ocean, an area with a strong enhancement of mesoscale activity.

Methodology
We use the ERS3 data assimilation procedure described by Stammer et al. (2002) on a spatial grid and over the period 1982 through 2000, but with the updated boundary conditions and lateral boundary conditions at lateral walls. Horizontal viscosity and diffusivity are used, with $\nu = 0.2 \times 10^3 m^2/s$ and $\kappa = 0.2 \times 10^3 m^2/s$ and $\nu = 0.2 \times 10^3 m^2/s$ for the lateral and vertical, respectively. The planetary boundary layer and vertical eddy diffusivity are replaced by the N2 vertical mixing coefficient.

In the following, we will show residing changes of the first guess background mixing coefficients, all normalized by their background values. We will also show percentage changes only. Values of -2 indicate that the model estimates a net mixing coefficient of zero. Values of 0 indicate a doubling of the background amplitude.

Viscosity

Diffusivity

Physical Interpretation

The Tropics:

The Atlantic Meridional Overturning Circulation:

An interesting pattern of positive and negative changes can be seen that often are associated with mixing only activity. In the southeast Indian Ocean, along the Gulf Stream and the North Atlantic, at 2000m depth, significant changes occur near only at topographic structures, such as the Sargasso Sea.

References