Preliminary results with CFC-11 in a high resolution general circulation model

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Chlorofluorocarbons (CFCs) are known as an ideal tracer for evaluating the ability of ocean general circulation models (OGCMs) to simulate the uptake and redistribution of anthropogenic CO_2 in the oceans. CFCs are of purely anthropogenic origin and are therefore qualitatively similar to anthropogenic CO_2. Though many model studies of CFCs have been done with OGCMs, there are few such experiments that use a high resolution OGCM permitting or resolving mesoscale eddies and boundary currents. We are conducting a numerical experiment to simulate CFC-11 using the high resolution OGCM developed at JAMSTEC based on the Modular Ocean Model version 2 (MOM2) of GFDL. The model has 1/4 degree resolution in both latitude and longitude and 55 vertical levels. Hellerman and Rosenstein's [1982] monthly mean wind stress is used to force the model ocean. We apply heat and salt fluxes by restoring the model surface temperature and salinity to Levitus [1982] monthly data. After a time integration for 30 years, the CFC-11 simulation starts with atmospheric CFC-11 in 1950. Air-Sea exchange of CFC-11 is implemented by the same formulation used in the Ocean Carbon Model Intercomparison Project (OCMIP) phase 2. As the experiment is now going, the preliminary results for the 1970s are compared with those from a coarse resolution model. The results represent a realistic detailed distribution of CFC-11 corresponding to sharp density fronts associated with boundary currents, meanders and local upwelling. The results also show the importance of mixing by mesoscale eddies.