Geophysical Research Abstracts, Vol. 8, 07286, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07286

An improved tracer advection scheme for OGCM's: Consequences for the simulated circulation

M. Hofmann (1) and M. A. Morales Maqueda (2)

(1) Potsdam Institute for Climate Impact Research (hofmann@pik-potsdam.de), (2) Proudman Oceanographic Laboratory (mamm@pol.ac.uk)

The reliability of Ocean General Circulation Models (OGCM's) strongly depends on the quality of the underlying tracer advection scheme. For the sake of simplicity and computing time, tracer advection schemes most commonly used in OGCM's are of low order and suffer from numerical diffusion and dispersion. As a consequence, the model physics is significantly distorted, and this has a strong impact on the simulated ocean circulation. The use of high-order advection schemes would considerably reduce such numerical errors but at a considerable expense of computing time. An alternative to high-order schemes is the use of algorithms that take into account the sub-grid distribution of tracers, such as the Second-Order Moments (SOM) scheme of Prather (1986). The implementation of SOM in the GFDL's Modular Ocean Model-3 (MOM-3) leads to a considerable reduction in the model's numerical diffusion compared to low order advection methods. The simulated large scale ocean circulation improves accordingly. SOM integrations produce upwelling of deep water masses mostly in the Southern ocean, whereas simulations using the FCT and QUICKER advection schemes tend to have strong upwelling at low latitudes. OGCM simulations with SOM admit hence circulation patterns that are closer to the so-called "reconfigured conveyor belt", where the bulk of the global ocean upwelling occurs in the Southern Ocean.