Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10412, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10412
EGU General Assembly 2008

Oxygen, a tool for assessing ocean tracer transport models

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Various techniques are used by modellers in order to overcome difficulties in modelling biogeochemical cycles (BGC) over long time periods. Off-line modelling or asynchronous coupling are among the popular methods in BGC modelling. In some other cases the numerical scheme used for the transport of tracers may differ from that used for the active variables (T and S) in order to guarantee positivity or conservation, or to get rid of spurious variability. Though it is highly desirable that the chosen method be assessed as it might strongly affect the ocean ventilation scales as experienced by the tracers, it is not always straightforward to test for its consistency.

Salinity and ideal age tracers may provide some useful information but this information is not always sufficient. On the other hand oxygen is a good candidate for testing the consistency of the transport model as one may take advantage of the strong influence of temperature, and to a lesser extent of salinity, on its solubility. Further it provides informations on surface as well as deep ocean processes.

A solubility oxygen tracer, not affected by biological processes, is included in the transport model. This tracer obeys the same solubility equation as oxygen but its piston velocity is very large, such that surface waters in the model are at equilibrium with the atmosphere. By comparing the solubility oxygen distribution to the theoretical oxygen saturation obtained from the model temperature and salinity fields a clear diagnostic of the ability of the tracer model to correctly reproduce the ventilation scales of the OGCM may be drawn. This method is applied to transport model forced by the outputs of different OGCMs. Reasons for discrepancies are investigated and explicited.