Geophysical Research Abstracts, Vol. 9, 04885, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04885

Dynamically adaptive finite element analysis of open ocean deep convection; model validation and parameterisation.

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Deep convection is a highly localised event in both time and space, but has far reaching effects on large-scale circulation and global climate. An unstructured adaptive model has the potential to capture the small-scale structures and the large-scale processes simultaneously.

This is the first time fine-scale convection has been modelled on an fully unstructured adaptive finite element model. We will discuss the advantages and drawbacks of this approach, and present results comparing a fixed and dynamically adaptive mesh.

For comparison purposes we perform time series analyses of vertical heat fluxes and eddy kinetic energy. These data also give an insight into the effects of model resolution and adaptivity on the physical properties of the system.

The above results have been limited to small-scale simulations of a few tens of kilometres. At a larger-scale (such as that of a general circulation model) convection and vertical mixing may need to be parameterised.

In developing the Imperial College Ocean Model (ICOM) we have applied and tested two kinds of convective parameterisation. The results of the convective adjustment and Mellor Yamada turbulence models will be compared with the resolved simulation for accuracy and efficiency.

It will be argued that the dynamically adaptive mesh produces better accuracy for a given computational effort. For larger-scale simulations we also find that the com-

bination the Mellor Yamada turbulence model with mesh adaptivity is particularly powerful.