Geophysical Research Abstracts
Vol. 12, EGU2010-4974, 2010
EGU General Assembly 2010

UGWO - the Unstructured Grid World Ocean solver. The concept and 3D shallow water tests

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The goal of the present work is to develop the dynamical core of a "New Generation" global ocean model in the INM RAS, Moscow. This new model is the experimental one and probably will replace the INM RAS World Ocean block of the coupled climate model till 2020. We formulate the basic concepts and choose the methods suitable for the solution of this problem. We use unstructured triangular meshes, the main advantage of which is elimination of the pole problem. The primitive equations are formulated in local coordinates on each triangle, so that they have almost the same form as in the planar case, but there are no singularities inherent to global coordinate systems. The z^*-coordinate is used in the vertical in order to maintain the advantages of the z-system in the deep ocean and to represent upper boundary layer under variations of the ice cover and tides more accurately. We discretize the equations with the use of the finite-volume method, where the variables are placed according to a triangular analogue of the Arakawa's "C"-grid, which is similar to SUNTANS and ICON approaches. It gives some advantages in the approximation of the divergence and the gradient operators and the advection and diffusion terms. However, it requires using a Delaunay triangulation, which in fact can't be generated for an arbitrary domain. As the model will be run on massively parallel computers, we trend to use the explicit time schemes, this approach also solves the problem with the Coriolis term approximation on the "C" grid. The mesh is built with the ANI3D generator, developed in the INM RAS, Moscow, which is able to construct a quasi-uniform mesh on the sphere, placing the nodes on the equator, which is important to represent the equatorial waves. The model was tested for a standard simple test cases, such as the solution of the 3D shallow water equations, in order to represent gravitational and the Rossby-Haurwitz waves .