



Ocean Hydrodynamics Numerical Model in Curvilinear Coordinates for Simulating Circulation of the Global Ocean and its Separate Basins.

Anatoly Gusev, Nikolay Diansky, and Vladimir Zalesny

Institute of Numerical Mathematics RAS, Moscow, Russian Federation (gusev@inm.ras.ru, +7 495 9381821)

The original program complex is proposed for the ocean circulation sigma-model, developed in the Institute of Numerical Mathematics (INM), Russian Academy of Sciences (RAS). The complex can be used in various curvilinear orthogonal coordinate systems. In addition to ocean circulation model, the complex contains a sea ice dynamics and thermodynamics model, as well as the original system of the atmospheric forcing implementation on the basis of both prescribed meteorological data and atmospheric model results. This complex can be used as the oceanic block of Earth climate model as well as for solving the scientific and practical problems concerning the World ocean and its separate oceans and seas. The developed program complex can be effectively used on parallel shared memory computational systems and on contemporary personal computers.

On the base of the complex proposed the ocean general circulation model (OGCM) was developed. The model is realized in the curvilinear orthogonal coordinate system obtained by the conformal transformation of the standard geographical grid that allowed us to locate the system singularities outside the integration domain. The horizontal resolution of the OGCM is 1 degree on longitude, 0.5 degree on latitude, and it has 40 non-uniform sigma-levels in depth. The model was integrated for 100 years starting from the Levitus January climatology using the realistic atmospheric annual cycle calculated on the base of CORE datasets. The experimental results showed us that the model adequately reproduces the basic characteristics of large-scale World Ocean dynamics, that is in good agreement with both observational data and results of the best climatic OGCMs. This OGCM is used as the oceanic component of the new version of climatic system model (CSM) developed in INM RAS. The latter is now ready for carrying out the new numerical experiments on climate and its change modelling according to IPCC (Intergovernmental Panel on Climate Change) scenarios in the scope of the CMIP-5 (Coupled Model Intercomparison Project).

On the base of the complex proposed the Pacific Ocean circulation eddy-resolving model was realized. The integration domain covers the Pacific from Equator to Bering Strait. The model horizontal resolution is 0.125 degree and it has 20 non-uniform sigma-levels in depth. The model adequately reproduces circulation large-scale structure and its variability: Kuroshio meandering, ocean synoptic eddies, frontal zones, etc. Kuroshio high variability is shown. The distribution of contaminant was simulated that is admittedly wasted near Petropavlovsk-Kamchatsky. The results demonstrate contaminant distribution structure and provide us understanding of hydrological fields formation processes in the North-West Pacific.