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Study of long-term characteristics of the INM RAS – IO RAS World Ocean model.

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This work is a part of the program for developing a new modern eddy-resolving World Ocean model at the Institute of Numerical Mathematics (INM) and the Institute of Oceanology (IO) of the Russian Academy of Sciences (Ibrayev et al., 2012). The aims of the work are checking the model's characteristics, tuning of the model in conditions of the CORE-I experiment (Griffies et al., 2009), study of the solution's variability and sensitivity to variations of model parameters and external forcing. We show the results of a series of numerical experiments for up to 500 years during which the model ocean circulation reaches a quasi-equilibrium state.

The current model configuration uses a three-polar B-type grid, vertical z-coordinates, explicit difference schemes in time (except for vertical viscosity and diffusion) with decomposition of the solution into barotropic and baroclinic components, free ocean surface with explicit description of salt and water fluxes, Boussinesq and hydrostatics approximations. We utilize sea-ice thermodynamics and atmospheric boundary layer submodels. The code is MPI-parallelized according to the regular two-dimensional domain decomposition.

The key tuning parameters are horizontal and vertical resolution (1° – 0.25°, 20 – 70 levels), horizontal viscosity and diffusion coefficients, vertical diffusion description method (Munk-Anderson, Gent-McWilliams), equation of state approximation (3 – 25 terms), sea-ice submodel coefficients and short wave radiation penetration parameters. We study the model solution's sensitivity to wind field variations and to surface salinity relaxation to climatological CORE data. The main attention is paid to analysis of the solution in terms of deep circulation of heat and salinity and of vertical velocity field. Some integral and local characteristics are taken into account: cross-sections, global and horizontal means of temperature and salinity fields, kinetic energy, volume transport and separation points of boundary currents, meridional heat transport, etc. We also perform a detailed monitoring of the initial model spinup stage.

Griffies, S. et al., 2009. Coordinated ocean-ice reference experiments (COREs). Ocean Modelling, 26(1), 1-46.

Ibrayev, R.A. et al., 2012. Eddy-Resolving 1/10° Model of the World Ocean. Izvestiya, Atmospheric and Oceanic Physics, 48(1), 37–46.