Geophysical Research Abstracts
Vol. 20, EGU2018-7463, 2018
EGU General Assembly 2018

Estimation of the global ocean meridional eddy heat transport with the high-resolution INMIO model

Konstantin Ushakov (1,2), Rashit Ibrayev (2,1), and Maxim Kaurkin (1)

(1) Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia (ushakov@ocean.ru), (2) Institute of Numerical Mathematics, Russian Academy of Sciences, Moscow, Russia

Complexity of measurements makes mesoscale eddies one of the least observation-provided objects in the ocean. Meanwhile, mesoscale eddies make an essential contribution to heat and fresh water transport, including climate scales. Direct reconstructions of ocean eddy transports from contact and remote measurements are limited to resolution of several hundred kilometers. Therefore numerical modelling nowadays remains the only tool capable to reproduce the detailed global three-dimensional structure of mesoscale oceanic eddies and its impact on the heat and salt budget of the ocean.

We have obtained estimates of ocean eddy meridional heat transport (EMHT) by means of the global eddy-resolving configuration of the INMIO model (0.1° resolution) in conditions of the CORE-II atmospheric and radiative forcing for years 1978-1984. Software framework CMF2.0 that provides an environment for high-resolution calculations includes a fully parallel coupler and I/O procedures, as well as effective high-level means of interprocessor communication. The use of explicit numerical methods for the ocean dynamics equations allowed to achieve a high scalability level of the model program code with a simple two-dimensional decomposition of the computational domain. However, it has demanded a greater attention towards stability issues, particularly to self-consistency of numerical difference schemes and to the barotropic-baroclinic splitting technique. The current version of the 0.1° INMIO model is able to stably perform calculations with no laplacian viscous term and small heat and salt diffusivity.

The EMHT is estimated as the difference between the full meridional heat transport and the mean transport obtained from 3-month running means of temperature and velocity. The both latter quantities are calculated directly by the model advection schemes. We investigate zonal distributions of integral EMHT in the World Ocean and its basins. The EMHT constitutes an essential part of the total heat transport, particularly near the equator, in the Southern Ocean, in regions of western boundary currents and current confluences. In the Tropics, we find some qualitative differences between our results and other simulations and observational studies. In particular, it concerns the values of EMHT convergence in the Eastern Equatorial Pacific. Also we show that eddy heat transport may have a positive component along the horizontal temperature gradient direction which makes it ill-founded to parameterize EMHT by the traditional heat conductivity law with a positive diffusion coefficient.

The work was performed at INM RAS and IO RAS with the support of RSF (eddy-resolving model development, project 14-27-00126), RFBR (equatorial data analysis, project 16-05-01101) and Presidium of RAS (global EMHT analysis, program 49).