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# A Southern Ocean variability study using the Argo-based Model for Investigation of the Global Ocean (AMIGO)

Konstantin Lebedev
Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia (KLebedev@ocean.ru)

The era of satellite observations of the ocean surface that started at the end of the 20th century and the development of the Argo project in the first years of the 21st century, designed to collect information of the upper 2000 m of the ocean using satellites, provides unique opportunities for continuous monitoring of the Global Ocean state. Starting from 2005, measurements with the Argo floats have been performed over the majority of the World Ocean. In November 2007, the Argo program reached coverage of 3000 simultaneously operating floats (one float in a three-degree square) planned during the development of the program. Currently, 4000 Argo floats autonomously profile the upper 2000-m water column of the ocean from Antarctica to Spitsbergen increasing World Ocean temperature and salinity databases by 12000 profiles per month. This makes it possible to solve problems on reconstructing and monitoring the ocean state on an almost real-time basis, study the ocean dynamics, obtain reasonable estimates of the climatic state of the ocean in the last decade and estimate existing intraclimatic trends.

We present the newly developed Argo-Based Model for Investigation of the Global Ocean (AMIGO), which consists of a block for variational interpolation of the profiles of drifting Argo floats to a regular grid and a block for model hydrodynamic adjustment of variationally interpolated fields. Such a method makes it possible to obtain a full set of oceanographic characteristics - temperature, salinity, density, and current velocity - using irregularly located Argo measurements (the principle of the variational interpolation technique entails minimization of the misfit between the interpolated fields defined on the regular grid and irregularly distributed data; hence the optimal solution passes as close to the data as possible). The simulations were performed for the entire globe limited in the north by 85.5° N using 1° grid spacing in both longitude and latitude. At the depths exceeding 2000 m, in which Argo data are lacking, the temperature and salinity data were taken from the WOA-09 database. The constant temperature and salinity values from the Argo data for the corresponding month (year, season) derived using the variational technique described above were specified as the boundary conditions at the ocean surface. The constant wind stress in the corresponding month (year, season) was specified from the ECMWF ERA-Interim reanalysis data.

The mass, salt, and heat transports over several regions of the Antarctic Circumpolar Current (ACC) and at its northern boundary (35° S) were calculated, seasonal and intra-decadal variation of the transports was studied. The calculations cover the 12-year period from 2005 to 2016.

The AMIGO database enjoys free public access on the Internet at: http://argo.ocean.ru/. The results are represented as monthly, seasonal, and annual data and climatological mean fields. The spatial resolution of the data is one degree in latitude and longitude, and the temporal resolution is one month. The work was supported by the Russian Science Foundation (project 16-17-10149).