1/12° Global Ocean Modeling System by the Korea Institute of Ocean Science and Technology

The frequency and intensity of extreme ocean events, such as marine heatwaves and typhoons, have rapidly increased, causing significant damage to marine ecosystems and coastal communities. These extreme events pose a growing threat, emphasizing the urgent need for improved predictive tools and mitigation strategies. Additionally, marine pollution, driven by microplastics, marine debris, and radioactive materials, has gathered global attention due to its widespread and detrimental impact on marine life and human health. Understanding the distribution, movement, and concentration of these pollutants is crucial for developing effective solutions to protect the oceans. The high-resolution global ocean modeling system facilitates the prediction of the ocean states and provides essential ocean circulation information to track oceanic materials. The Korea Institute of Ocean Science and Technology, in collaboration with Pukyong National University, has developed a global ocean modeling system based on the MOM6 from the Geophysical Fluid Dynamics Laboratory. The model operates at a horizontal resolution of 1/12°×1/12° and employs a hybrid 60-layer vertical coordinate combining z-star and isopycnal coordinate systems to enhance simulation accuracy of both surface layers and vertical structures. To improve simulation fidelity, the model incorporates a vertical mixing scheme through ePBL parameterization and employs a 3rd order Piecewise Parabolic Method for horizontal tracer advection. Nonlinear eddy viscosity is computed using the biharmonic Smagorinsky scheme. Tidal momentum forcing for the main tidal constituents were estimated by pseudo-second order Runge-Kutta time stepping scheme and backward Euler scheme. A cost-effective data assimilation system, based on the Ensemble Optimal Interpolation, is implemented to assimilate ocean observations, including sea surface temperature, sea surface height, and in-situ temperature and salinity profiles. Our objective is to generate long-term ocean reanalysis data using the global ocean modeling system. Furthermore, we will aim to develop the 10-day ocean prediction system. The simulation characteristics of the global ocean modeling system will be presented in terms of the ocean temperature, salinity, and ocean circulation.

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