Japan Coastal Ocean Predictability Experiment (JCOPE) -Hindcast/Forecast System-

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Key words: Ocean weather, Kuroshio, meso-scale eddy, OGCM, data assimilation

1. Introduction

An experimental forecast/hindcast system for Japan coastal ocean is developed to investigate predictability of the Kuroshio path variation. This system mainly simulates interactions between meso-scale eddies and the Kuroshio. Preliminary experiments showed that the system has the forecast skill for the kuroshio meandering within 70-80 days after the initialization using the satellite altimetry data (Miyazawa et al, 2002b). In order to verify the forecast skill in near real time, we update the initialization at interval of 10 days. The routine prediction of oceanic variation ('ocean weather forecast'), combining with in-situ verification of the results, is expected to significantly contribute to the improvement of atmosphere-ocean models that predict longer-term climate change.

2. Model

The present ocean model is based on one of world community models, which is called Princeton Ocean Model (POM). A high-resolution regional model with spatial grid of 1/12 degree and 35 sigma levels is embedded in a low-resolution basin-wide model with spatial grid of about 1/4 degree and 21 sigma levels. The former model domain covers the Northwest pacific (117E-180E, 12N-56N) and its lateral boundary condition is determined using the one-way nesting method (Guo et al., 2002) from the latter model. The low-resolution model underestimates the baroclinic component of the Kuroshio and overestimates its barotropic component. High resolution model corrects such underestimation and overestimation and thus reproduces a more realistic the density and current fields (Guo et al., 2002). Moreover, the present model reproduces the three Kuroshio paths south of Japan as well as the meso-scale eddies (Miyazawa et al., 2002a). The model is driven by wind stresses, and heat and salt fluxes. The wind stress and heat flux field is calculated from sea surface variables of the 6-hourly NCEP/NCAR reanalysis data using the bulk formula. The salinity at the surface is restored to the monthly mean climatology with a time scale of 30 days.

3. Data assimilation

The TOPEX/POSEIDON and ERS-2 altimetry data provided by CCAR is assimilated into the high-resolution model as follows. (i) creating of grid fields of sea surface height anomaly from the altimetry with 10 days interval using optimum interpolation, (ii) vertical projection from 2-D grid data using the correlation method and blending with model state for estimation of vertical profiles of sub-surface (150m-2000m) temperature/salinity, (iii) and nudging of temperature/salinity estimate for the model state to achieve smooth initialization.

4. Forecast

The model is forced by the constant wind stress and the heat and salt fluxes after the latest initialization. The short-term interactions between meso-scale eddies and the Kuroshio, which influence the short-term Kuroshio path variation, are almost governed by variations of the main thermocline lower 200m rather than the surface forcing at that time. In this system, a 2-months forecast is executed.

5. Evaluation

For verification of the model result, 10 days mean sea surface temperature is operationally created using the Multi Channel Sea Surface Temperature (MCSST) algorithm from the satellite brightness temperature provided by JPL/NASA. In addition, the results will be compared with the in-situ observation data provided by the field observation projects.

References

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The hindcast/forecast results are exhibited on the following web site.
http://www.jamstec.go.jp/frsgc/jcope/