2. Outline of MOVE/MRI.COM-WNP system

Model

- Multivariate 3DVAR scheme with vertical coupled Temperature-Salinity (T-S) EOF modal decomposition
- lat-lon coordinates and 0.2°-2° vertical coordinates
- region: 115°E-155°W (nested to North Pacific Model)
- resolution: 1/10°(lon.) x 1/12°(lat.) within 15°-120°E, 1°-160°E (1/6°(lon.) east of 160°E and 1/6°(lat.) poleward of 50°N)
- 54 vertical levels from 0.5m at surface to 6000m near the bottom

Atmospheric forcing:
- [Analysis 3-hourly data from Japanese 55-year Reanalysis (JRA-55; Kobayashi et al., 2015)]
- [Forecast daily data from control run of One-month Ensemble Prediction System of JMA]

Data Assimilation scheme

- Operational ocean data assimilation/prediction system
- Data Assimilation scheme
- Data Assimilation

- Multivariate Ocean Variational Estimation system
- Meteorological Research Institute Community Ocean Model for the prediction system for the western North Pacific (MOVE/MRI.COM-WNP*) developed by the

- Satellite altimetry data: along-track sea level anomaly (SLA) data from AVISO+
- In situ observations of temperature and salinity profiles from ships, weather buoys and ARGO floats
- Analysis is conducted every 5 days
- Incremental Analysis Updates (IAU) technique is used to correct the model fields with the analysis result

Observation data for operational system

- In-situ observations of temperature and salinity profiles
- Satellite altimetry data: Jason-2 along-track sea level anomaly (SLA) data from AVISO+ after adding them to the mean sea surface dynamic height (SSDH) calculated from a preliminary analysis using temperature and salinity observations alone
- Sea surface temperature analysis

Analysis/Forecasting cycle (Operational system)

The execution date of delayed assimilation, defined as ‘Base Date’, is set every 5 days. The delayed assimilation is conducted on Base Date for the period from 54-day to 10-day before. Following the delayed assimilation, the 10-day near-real-time assimilation and 30-day prediction are conducted every day until the next Base Date.

Re-Assimilation (Non-operational 2018-2013)

- Atmospheric forcing : JMA-55
- Observation data:
  - In-situ temperature and salinity measurements (GTS, WOCE, GTSSP)
  - Satellite altimetry data: along-track sea level anomaly (SLA) data from AVISO+ [ERS-1/2, Topex/POSEIDON, Jason-1/2, ENVISAT, GF0, Cryosat-2, SARAL/Altika]

3. Products

- Analysis data on ocean currents and several layers of subsurface water temperatures from 1985 is available on the NEAR-GOOS Regional Real Time Database for research users (Fig. 3: http://dx.doi.org/jma.go.jp/mgd/goos/data/database.html)
- Region: the seas adjacent to Japan [115°N - 40°N, 115°E - 119°E, 0 - 1.3°]
- Format: text (for data), gif (for map)
- The analysis and predicted data [temperature, salinity, sea surface height and velocity] are also available for commercial users through the Japan Meteorological Business Support Center.

4. Performance of current forecasting

- Using MOVE/MRI.COM-WNP, JMA provides one month current/GST predictions over the seas around Japan. Especially, forecast of Kuroshio path is important for various marine industries and fisheries of South of Japan.
- Figure 5 shows a recent current prediction for Kuroshio area (initial date is 29 Jun. 2015). This system was able to successfully forecast that the perturbation south of Japan would develop and the Kuroshio would take a meander path late July.
- Latest current prediction maps can be found in JMA-website [in Japanese explanation: http://www.data.jma.go.jp/gmd/kaiyu/data/db/kaiyu/ocean/forecast/predict.html]

5. Impact of multi-satellite altimeter SLA assimilation

JMA has a plan to introduce multi-satellite altimeter SLA data to the operational MOVE/MRI.COM-WNP system, which is now using only Jason-2 SLA data. To evaluate the impact of multi-satellite altimeter assimilation, two Observation System Experiments (OSE) are performed for the delayed mode analysis as listed below. (The evaluation for operational analysis is a future task.)
- Assimilated data (delayed along-track SLA data from AVISO+
  - Exp:Alt1: Jason-2 alone, Exp:Alt2: Jason-2, Cryosat-2, SARAL/Altika and HY-2A
  (Both Exp. use in situ temperature and salinity data, and MGDSS)

Results

Figure 6 shows RMSE of model SSH variations against those of 1/4° x 1/4° gridded absolute dynamic topography from AVISO+ RMSE in Exp:Alt1 is better than that of Exp:Alt2 around Kuroshio extension (KE) and south of 30°N.
- Comparison with tide gauge data in Kuroshio area (Fig. 7) indicates good representation of SLA variations for both experiments, and slight improvement of correlation coefficient (0.77-0.84) for Exp:Alt4.
- Comparison with in-situ temperature data (not independent) for KE area (Fig. 8) indicates little impact to the accuracy of temperatures. However, independent in situ profiles should be necessary for the precise validation.

References