Real-time data assimilation products with Jason-1 data in JMA

Tsurane KURAGANO, Satoshi SUGIMOTO, Kumi YOSHITA

Climate and Marine Department, Japan Meteorological Agency

1. Introduction

Using the altimeter data, we are operating an ocean data assimilation system for the North Pacific since 2001. Only delay-mode information of monthly mean ocean condition has been produced from the model outputs. Real-time information, however, is required by ship navigator, fishery, coastal guard and wrecking crew in Japan Coastal Guard. We decided to operate the system in the real-time basis in response to the requirement. The real-time operation is examined at the present, it will start in next March, and new products will be appeared on the JMA home page, radio facsimile and Japan-GODAE product server. Here, we introduce the JMA assimilation system, our method of real-time operation, and some prototypes of real-time products.

2. Ocean Data Assimilation System at JMA

The model is an eddy permitting MRI-OGCM. The grid size is 1/4° near Japan and 21 vertical levels with a real bottom topography (Figure 1). Subsurface temperature and salinity fields are calculated by combining Jason-1 SSH data, satellite SST, subsurface ship and ARGO float data with a four dimensional optimum interpolation (4D-OI) method (Figure 2). The analyzed fields are relaxed to the model retrospectively. The surface wind from an operational atmospheric model in JMA is adopted for the forcing.

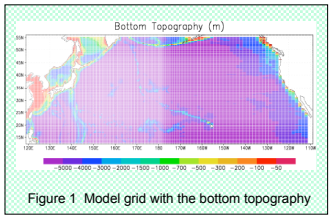

Figure 1 Model grid with the bottom topography

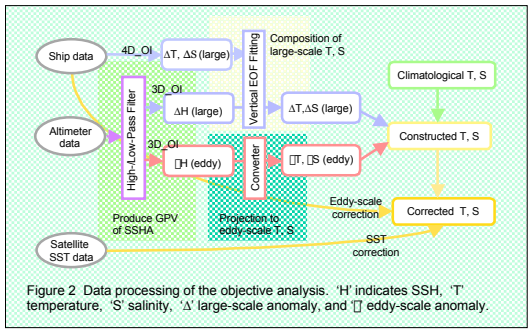

Figure 2 Data processing of the objective analysis. 'H' indicates SSH, 'T' temperature, 'S' salinity, 'Δ' large-scale anomaly, and '□' eddy-scale anomaly.

3. Real-Time Operation of Assimilation System

In situ data:

Temperature and Salinity data from ship, buoy and Argo float are obtained through the Global Telecommunication System (GTS), Internet and facsimile every day on near real-time basis.

Jason-1 data:

The altimeter data are also obtained on near-real-time basis, 4 days after its measurements, by the grace of rapid operation in CNES and JPL.

Objective analysis:

JMA adopts the nudging method, in which the model temperature and salinity are constrained to the objectively analyzed, gridded temperature and salinity. The sea surface height (SSH) obtained from Jason-1, in situ temperature and salinity and sea surface temperature (SST) from satellites are adopted in the objective analysis. The gridded data of a date five-day before are produced.

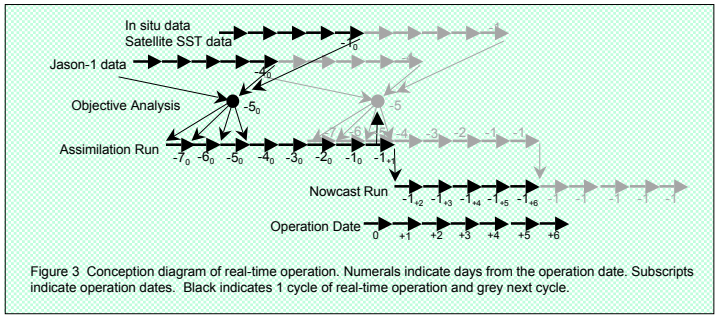

Figure 3 Conception diagram of real-time operation. Numerals indicate days from the operation date. Subscripts indicate operation dates. Black indicates 1 cycle of real-time operation and grey next cycle.

Assimilation run:

The assimilation run is performed with the constraint for 3 days, from 7- to 5-day before, and without constraint for 4 days, from 4- to 1-day before. The assimilation run is performed for another date on the next day, and results are adopted as the first guess of the next objective analysis.

Nowcast run:

The results of the assimilation run are adopted as an initial condition of the nowcast run. The nowcast run is performed for 5 days without constraint, simulating the ocean condition of a date 1-day before every day.

4. Assimilation vs. Nowcast

The real-time products are produced from the non-constraint run for 5 to 9 days as shown above. So the model should have prediction ability for this time span. Figure 4 shows the comparison of ocean states calculated from the assimilation and nowcast runs. Some differences are recognized between them because of the model bias. Our model tends to produce higher temperature along the Kuroshio and northern shift of the Kuroshio Extension just east of Japan. We are tuning the model to represent the ocean condition more precisely.

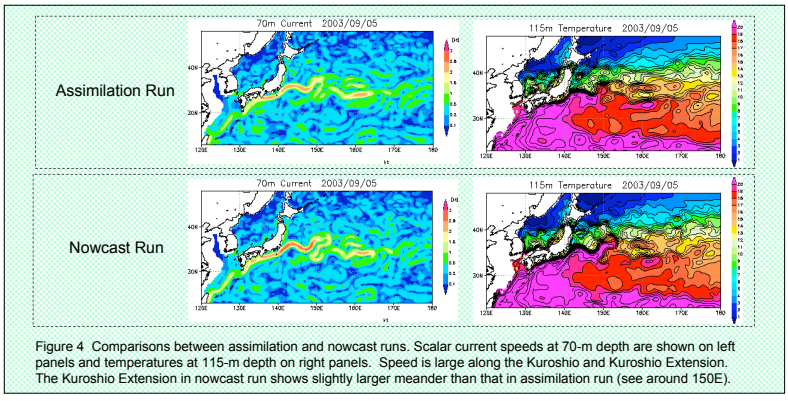

Figure 4 Comparisons between assimilation and nowcast runs. Scalar current speeds at 70-m depth are shown on left panels and temperatures at 115-m depth on right panels. Speed is large along the Kuroshio and Kuroshio Extension. The Kuroshio Extension in nowcast run shows slightly larger meander than that in assimilation run (see around 150E).

5. Products

The products will be available on the JMA website, and willl be transmitted through radio facsimile from March 2004 for various activities at sea (Figure 5).

The grid point values of temperature, salinity and current velocity of nowcast run will be also available in the **Japan-GODAE** website (http://godae.kishou.go.jp) from December 2003. The products of the previous date will be updated every day. You can access these data through the LIVE ACCESS SERVER (LAS). The LAS allows you to download and visualize data using a simple graphical user interface (Figure 6).

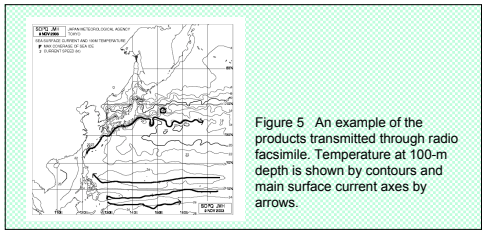

Figure 5 An example of the products transmitted through radio facsimile. Temperature at 100-m depth is shown by contours and main surface current axes by arrows.

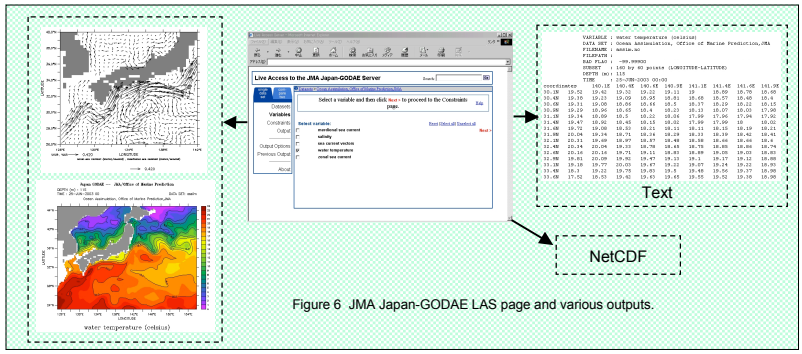

Figure 6 JMA Japan-GODAE LAS page and various outputs.