Operational applications of Argo Data in JMA
Report to the 8th Argo Steering Team Meeting
Global Environment and Marine Department, Japan Meteorological Agency

This report provides a description of the use of Argo in the Japan Meteorological Agency (JMA). JMA has been using real-time Argo data in two operational systems: one for operational oceanographic analysis and forecast, and the other for the monitoring and predicting of ENSO.

A. Operational oceanographic analysis and forecast system, operated at the Office of Marine Prediction, JMA

1. Description of how Argo data are used.
Real-time Argo data are used as one of the in situ data sources for operational numerical ocean analysis, assimilation and forecast systems, called COMPASS-K (Comprehensive Ocean Modeling, Prediction, Analysis and Synthesis System in the Kuroshio region; Kamachi et al., 2001) and MOVE/MRI.COM (MRI Multivariate Ocean Variational Estimation/MRI Community Ocean Model; Usui et al., 2006), which is the successor to COMPASS-K. Target of these systems is to represent meso-scale oceanographic conditions such as western boundary currents, eddies, and water mass distributions in the seas adjacent to Japan.

Specification of COMPASS-K (operated from January 2001 to present)

Spatial coverage:
North Pacific (119°E-109°W, 12.5°N-55.5°N)

Resolution:
horizontal: 0.25° x 0.25° (119°E-180°, 23°N-45°N)
The spacing gradually changes to 0.5° in latitude and 1.5° in longitude outside the above region.
vertical: 21 levels

Atmospheric forcing:
objective analysis produced by the operational NWP system of JMA

Ocean data:
subsurface temperature and salinity data
sea surface height data

Assimilation method:
4-D OI, nudging
Specification of MOVE/MRI.COM (will be operated in 2008)

*Spatial coverage:*
- North Pacific and western North Pacific models (one-way nesting)
  - North Pacific (100°E-75°W, 15°S-65°N)
  - western North Pacific (117°E-160°W, 15°N-65°N)

*Resolution:*
- horizontal: 0.5° x 0.5° (North Pacific)
  - 0.1° x 0.1° (western North Pacific)
- vertical: 54 levels

*Atmospheric forcing:*
- objective analysis produced by the operational NWP system of JMA

*Ocean data:*
- subsurface temperature and salinity data
- sea surface height data

*Assimilation method:*
- 3-D VAR analysis scheme with a vertical coupled T–S EOF modal decomposition of a background error covariance matrix, Incremental Analysis Update

2. *Source of data (GTS or GDAC) in the application*
We get all subsurface temperature and salinity data including Argo data through GTS.

3. *Timeliness of Argo data for the application*
Each Ocean analysis is carried out for 5 days ending few days before the operation. Most of the Argo data during the analysis period have arrived in time.

4. *Assessment of the quality of the data and the use of Argo real-time or delayed mode QC flags*
We apply our own QC before feeding the data to the model because of the following reasons:
  - the quality of GTS TS profile data, which consist of Argo, XBT, ship board CTD, drifters and moorings, is not uniform
  - Argo real-time QC is coarse.
We don’t use either of the real-time and delayed mode QC flags because GTS data
don’t carry QC flags.

5. Suitability of Argo data coverage for this application
Not very suitable but useful.

6. Impact of Argo data on forecasts
A forecast experiment is being carried out (not yet completed), in order to evaluate how the ocean initial conditions improved by Argo give impact on the forecast of the western boundary currents such as Kuroshio and Oyashio.

References

B. ENSO Monitoring and predicting system, operated at Climate Prediction Division, JMA
1. Description of how Argo data are used.
JMA has operated an Ocean Data Assimilation System (ODAS) for monitoring El Niño and providing oceanic initial condition to a Coupled ocean-atmosphere General Circulation Model (JMA-CGCM02) for the prediction of ENSO (JMA, 2007). The ODAS consists of an ocean general circulation model (OGCM) and a subsurface analysis scheme using 3-D VAR. The analyzed temperature and salinity data are continuously assimilated into the OGCM.

Specification of OGCM used in the El Niño forecast model
Spatial coverage:
Global except the Arctic Ocean
Resolution:
horizontal: 2.5 ° (longitude) x 2.0 ° (latitude) except near the equator (0.5 °) vertical : 20 levels
Atmospheric forcing:
objective analysis produced by the operational NWP system of JMA

*Ocean data*:  
- subsurface temperature and salinity data  
- sea surface height data  

*Assimilation method*:  
- 3-D VAR, Incremental Analysis Update

Ocean data used in ODAS are subsurface temperature and salinity data observed with Argo floats, XBT or XCTD in SOOP, Buoy (TAO/TRITON) and CTD by research vessel.

2. *Source of data (GTS or GDAC) in the application*

We get all subsurface temperature and salinity data including Argo data through GTS.

3. *Timeliness of Argo data for the application*

Each Ocean analysis is carried out for 5 days ending 2 days before the operation. Most of the Argo data during the analysis period have arrived in time.

4. *Assessment of the quality of the data and the use of Argo real-time or delayed mode QC flags*

We don’t use either of the real-time and delayed mode QC flags because GTS data don’t carry QC flags.

5. *Suitability of Argo data coverage for this application*

Upgrade of the ODAS is planned in early 2008. Since the new ODAS (Usui et al., 2006) will include the higher resolution ocean model (1° x 1°), more floats will be preferable, especially in the tropical Pacific and Indian Ocean.

6. *Impact of Argo data on forecasts or other measures of system/application skill*

Reanalysis using the new ODAS has been carried out with and without Argo data. The results will be presented at the AST-8 meeting.

*References*

Japan Meteorological Agency,, 2007: Outline of the operational numerical weather prediction at the Japan Meteorological Agency. *Appendix to WMO numerical*
weather prediction progress report (in press).