Impact of ARGO Data on the East Sea Circulation Modeling

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Contents

- Introduction: study area & objectives
- Experiment method
- Results: Temperature, Salinity and Current
- Summary
Study Area

East Sea

• Marginal sea of the western Pacific Ocean
• Semi-closed sea and consists of three large basins (UB, YB, JB)
  - maximum depth: 4000m
• Connected to open sea through four shallow (~200m) straits.
  - Warm Current into the sea via Korea strait (2-3sv)
• Below about 500m, a cold and nearly homogeneous water mass exists.
• Similar water characteristics and current system with open ocean
  → “Miniature of Ocean”
Observation

In-situ observation number increased !!!

Argo data was gradually increase from 2001 and temporal distribution became more dense!!
ARGO Float Deployment

Deployment Location and Number since 1998 (Tot. 143)
Objectives and Method

**Objectives:**

- To investigate how the ARGO profile data affect the current pattern, temperature and salinity distribution of the East Sea

**Method**

- Ocean Model: GFDL MOM ver.3.1 (Modular Ocean Model Ver. 3.1)
- Resolution: 0.1°×0.1°; 42 vertical levels
- DA: 3D VAR (Weaver Courtier(2001) for the background error covariance)
  - Temp. (+ Argo): monthly
  - SST (AMSR-E): daily
  - SSHA (AVISO DT-MSLA: TOPEX/Poseidon, Jason-I, ERS-1/20): weekly
- Experiments: (2006-2009)
  1) **All_DA** : All-data Assimilation case
  2) **No_Argo** : Assimilation without Argo Data
  3) **No_DA**  : No-data Assimilation
## Model Validation

- Surface current obtained from the AOML SVP drifter (total 18)

<table>
<thead>
<tr>
<th></th>
<th>Mean Vel. (cm/s)</th>
<th>Mean BIAS (cm/s)</th>
<th>RMSE (cm/s)</th>
<th>KE (Kinetic Energy)</th>
<th>EKE (Eddy Kinetic Energy)</th>
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<tbody>
<tr>
<td></td>
<td>U</td>
<td>V</td>
<td>U</td>
<td>V</td>
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<tr>
<td>Obs</td>
<td>3.977</td>
<td>1.689</td>
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<td>9.334</td>
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<td>1.969</td>
<td>-0.045</td>
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<td>1.302</td>
<td>0.289</td>
<td>-0.387</td>
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<td>No_DA</td>
<td>3.882</td>
<td>2.469</td>
<td>-0.094</td>
<td>0.780</td>
<td>16.117</td>
</tr>
</tbody>
</table>
DA Effect on Winter: Surface

No_DA

Temperature & Current (2.64 m)
Feb 2009

All_DA

Temperature & Current (2.64 m)
Feb 2009
DA Effect on Summer: Surface

No_DA

Temperature & Current (2.64m)
Aug 2009

All_DA

Temperature & Current (2.64m)
Aug 2009

°C
Diff. (All_DA–NoArgo): Winter

Surface

Temperature & Current (2.64m)
Feb 2009

100 m

Temperature & Current (102.53m)
Feb 2009

300 m

Temperature & Current (300m)
Feb 2009

°C
Diff. (All_DA-NoArgo): Summer

Surface

Temperature & Current (2.64m)  Aug 2009

100 m

Temperature & Current (102.53m)  Aug 2009

300 m

Temperature & Current (300m)  Aug 2009

°C

nimr

KMA Korea Meteorological Administrator
Vertical Structure: East-West

All_DA

No_Argo

Difference

37 N:
Temp.

Sal.

V comp.
Vertical Structure: Float track

Drifter 85149

All_DA

No_Argo

All_DA - No_Argo

Drifter 75420
The impact of ARGO float data on the East Sea circulation modeling study was carried out using the 3-dimensional variation data assimilation method with the Modular Ocean Model (MOM ver. 3.1).

The data assimilation effect in the East Sea was showed. Based on comparison between the drifter track-based current and model results, the more data were assimilated, the closer the true value is calculated. The data assimilation effect was also different season by season.

The ARGO data showed much contribution in the sub-surface layer between 100 m layer and 300 m layer, which could be a cause of baroclinic effect - the most effective area of ARGO data:
- central area (37-40°N, 130-135°E) and
- coast area of Korea and west coast of Japan.

⇒ So what we could say, is the ARGO data contributed much more than we expected, even in the marginal sea.
Thank you!