Use of ACSPO VIIRS L3U SST in MGDSST (delayed analysis)

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Introduction

• **MGDSST** (Merged satellite and in-situ data Global Daily Sea Surface Temperature)
  - Global, 0.25 x 0.25 grid resolution, daily GPV
  - Biases of satellites’ data are corrected using in situ SSTs
  - Scale decomposed space-time optimal interpolation

**Prompt analysis**: conducted within JMA’s NWP System
  - Input: AVHRR (NOAA-18, 19, MetOp-A) [GAC and LAC around Japan], AMSR2, WindSat, In-situ

**Delayed analysis**: conducted five-months later in principle
  - Input: AVHRR (NOAA-18, 19, MetOp-A) [GAC], AMSR2, In-situ

**Reanalysis**: reprocessed for 1982-2006 with Pathfinder SST v5.0/5.1 and other data

*We conducted an impact test for delayed analysis.*
ACSP PO VIIRS L3U SST

- JMA has routinely acquired ACSPO VIIRS L3U SST (ver.2.40) from NOAA Server.
- The coverage of VIIRS SSTs are superior to that of AVHRR.

Daytime and nighttime data are combined on a 0.25° grid
• Impact of assimilation of VIIRS SSTs for the delayed-mode MGDSST analysis was tested against a control run (i.e. routine analysis) for the period from 02 Feb. 2016 to 30 Jun. 2016.

• The configuration of test run was the same as the control, except that VIIRS SSTs are used in place of NOAA18/AVHRR data. The SSES bias was removed from the VIIRS L3U SSTs.

• The observational error of VIIRS SSTs in optimal interpolation was set equal to 0.57 times of that of NOAA18/AVHRR SSTs by calculating the ratio of the both RMSEs against buoy SSTs.
Method of validation

- Validation was conducted against (1) in-situ observation and (2) daily VIIRS SSTs.

(1) Comparison against In-situ observation
   Moored/drifting buoy and Argo data were used. Those were not independent to analysis because they were also used for bias correction of satellites’ data.

(2) Comparison against daily VIIRS SSTs
   To confirm VIIRS SST were ingested into analysis, we also compare with daily VIIRS SSTs.

- Both data were daily-averaged and converted into 0.25 deg. X 0.25 deg. grids for comparison.
Results (1): Validation by in-situ data

- RMSE for Test run is improved by 0.016 K in global region.
- Improvement of RMSE is relatively large in the southern mid- and high- latitude.
- Bias for Test run is generally comparable with that of Control.

<table>
<thead>
<tr>
<th>Area</th>
<th>BIAS (K)</th>
<th>RSME(K)</th>
<th>Number of Observations</th>
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<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Test</td>
<td>Control</td>
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<tr>
<td>60N-90N</td>
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<td>0.575</td>
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<tr>
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<td>60S-30S</td>
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<tr>
<td>90S-60S</td>
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<td>-0.020</td>
<td>0.254</td>
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</tbody>
</table>
RMSE map against In-situ data

RMSE for Test (+ VIIRS) 【K】

RMSE for Control 【K】

[Above figures] RMSE for 10x10 degree grids

RMSE difference between Control and Test

[Left figure]
Warm color indicates RMSE(Test) is smaller than RMSE(Control).

- RMSE for Test is generally improved in almost all areas.
- Improvement is relatively large in the mid- and high-latitude.
Bias map against In-situ data

Bias for Test (+ VIIRS) 【K】

Bias for Control 【K】

[Above figures] Bias for 10x10 degree grids

Difference in absolute value of bias (abs (bias)) between Control and Test

[Left figure]
Warm color indicates abs (bias) (Test) is smaller than abs (bias) (Control).

- Both Test and Control have a positive bias in almost all areas.
- Abs (bias) for Test is comparable with that of Control.
Results (2) : Validation by daily VIIRS SSTs
RMSD map against daily VIIRS SSTs

RMSD for Test (+ VIIRS) 【K】

RMSD for Control 【K】

RMSD difference between Control and Test

SST diff. rmsd(tn)−rmsd(exp)  2017/02/10−06/30

[Left figure]
Warm color indicates RMSD (Test) is smaller than RMSD (Control).

- RMSD for Test is smaller in the mid- and high-latitude and around sea ice area.
- RMSD for Test is degraded along west coast of the North America, in seas off Alaska and the Red sea.

=> It might be caused by some unknown issues with our analysis system.
Bias map against daily VIIRS SSTs

Bias for Test (+ VIIRS) [K]

Bias for Control [K]

Difference in absolute value of bias (abs(bias)) between Control and Test

[Left figure]
Warm color indicates abs(bias) (Test) is smaller than abs(bias) (Control).

Abs(bias) is generally improved, however, not so large except around the Antarctic.
Summary & Future Work

• Impact of assimilation of VIIRS SSTs for the delayed-mode MGDSST analysis was tested.
• From the validation results against in-situ data, RMSE for Test run was improved by 0.016 K in global region.
• The improvement is relatively large in the southern mid- and high- latitude. This might be caused by better coverage of VIIRS SSTs in these areas, and by better accuracy of VIIRS SSTs.
• We will make an impact test for prompt analysis of MGDSST and HIMSST in current year.