The 20th International TOVS Study Conference
28 October ~ 3 November 2015

Improvements to Accuracy for COMS SST and SSI Products and Their Impact in KMA's NWP System

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❖ Introduction

- **Satellite-derived surface variables** such as Sea Surface Temperature, Snow Cover, Sea Ice, and Soil Moisture are very **important for better understanding of interaction** between the sea- and land-surface and the atmosphere (Reynolds et al., 2007).
- But there has been no snow observation information incorporated into the NWP model (Samantha et al., 2010). Recently, Satellite-derived SST and SSI are frequently used in NWP model to improve surface conditions.
- We present results of the quality improvement of COMS SST and SSI which is used in KMA NWP model. Also, we will present the impact of these products on KMA NWP model simulation.

❖ Improvement of COMS SST and SSI

▪ Sea Surface Temperature(SST)

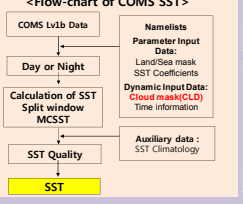
➢ To improve quality of COMS SST in the East Asia region, KMA/NMSC retrieved **new regression coefficient** for Multi-Channel Sea Surface Temperature (MCSST) using **quality controlled buoy data and robust cloud screening**.

✓ Method : MCSST
- MCSST=a1*IR1 + a2(IR1-IR2) + a3(IR1-IR2)(secθ-1) + a4

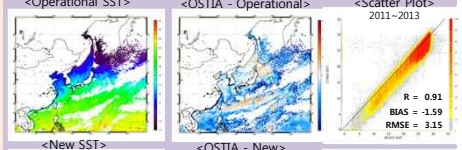
✓ New Regression Coefficients
- FD & ENH vs. BUOY
- 2011. 4. 1. ~ 2012. 3. 31.

✓ Cloud Screening

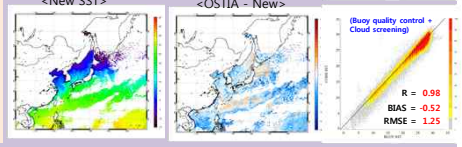
<Flow-chart of COMS SST>



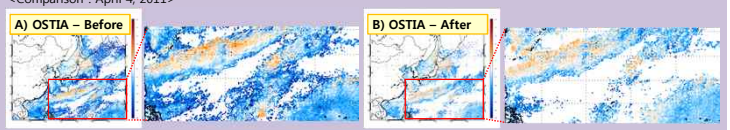
<Operational SST> <OSTIA - Operational> <Scatter Plot> 2011~2013



<New SST> <OSTIA - New>

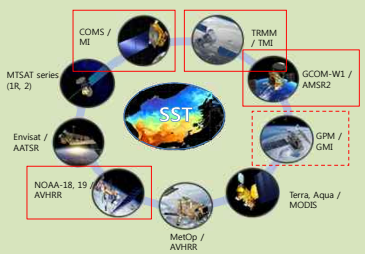


<Comparison : April 4, 2011>

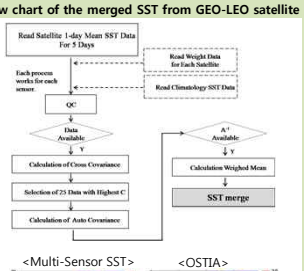


➢ **Improved Merging technique of multi-sensor SST**

< Multi-Sensor and Satellite >



< Flow chart of the merged SST from GEO-LEO satellite >

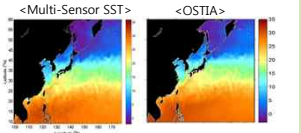


<The weight of the each satellite SST using Guan and Kawamura's formula (2004)>

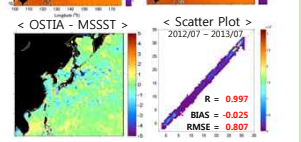
Satellite	Sensor	Periods	Temporal	Spatial	Weighting
COMS	MI	2012/07 – 2013/07 (13 months)	30min	4 km	0.1742
NOAA-18	AVHRR			1 km	0.1662
NOAA-19	AVHRR			1 km	0.1568
GCOM-W1	AMSR2			25 km	0.2731
TRMM	TMI			25 km	0.2297

✓ The optimal interpolation is applied to merge various SSTs after the bias correction of each SST was done.

<Multi-Sensor SST> <OSTIA>



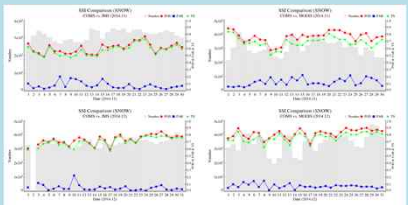
< OSTIA - MSSST > < Scatter Plot > 2012/07 – 2013/07



▪ Snow Cover and Sea Ice

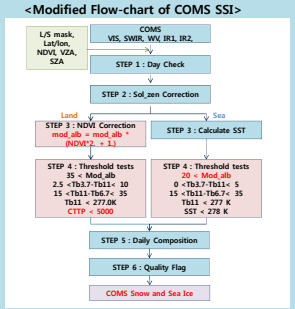
➢ Interactive Multisensor Snow and Ice Mapping System (IMS)'s snow cover has been used to modify background snow amount of the operational KMA NWP model. However, snow cover was **frequently overestimated with IMS data** in the East Asia. So, we **improved COMS snow detection algorithm and try to adjust the model background snow amount** by using COMS SSI.

✓ **Modification**
- Upper level cloud contamination with CTH
- Modify Albedo in the Forest area using NDVI
- Modify thresholds for Sea Ice
- Periods : 2013. 10. ~ 2014. 2.
  2014. 10. ~ 2015. 2.



Accuracy of COMS snow cover data show high quality statistics compared to IMS and MODIS snow data in winter.

<Modified Flow-chart of COMS SSI>

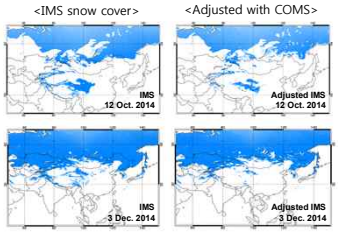


❖ Application of COMS Snow Cover

▪ Impacts of COMS snow cover in Global NWP model

➢ Periods : 12 Nov. 2014 ~ 20 Dec. 2014.
➢ Verifications : Observation, Analysis

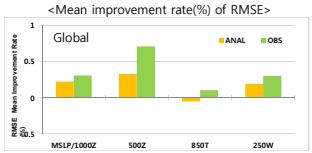
<IMS snow cover> <Adjusted with COMS>

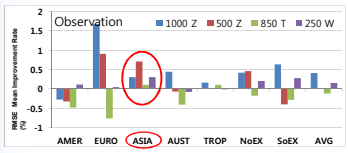


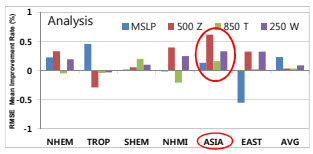
✓ Right figure shows original IMS snow cover and adjusted IMS snow cover using COMS snow for two different days.
✓ The effects of adjustment in snow build-up period appears more larger than winter season. Unfortunately, IMS grib2 data files do not exist in this period, the experiment is started from 12 November.

✓ The effects on the snow analysis appear **slightly positive impacts** in the snow build-up periods.
✓ Asia region affected by COMS snow data is improved for all verification results.
✓ Mean improvement rate(%) of RMSE according to the regions. Left panel is for observation verification and right panel is for analysis.(⬇)

<Mean improvement rate(%) of RMSE>







❖ Summary and Further Work

- We not only **improved the accuracy of COMS SST** through robust **quality control process of in-situ SST and cloud screening**, but also developed a **blending technique of multi-sensor SST** from COMS and LEO SST over the East Asia region. The accuracy of **new COMS SST and multi-sensor SST** was -**0.52 ºC, -0.025 ºC for bias ºC and 1.25 ºC, 0.807 ºC for RMSE** respectively.
- We **improved COMS snow detection algorithm** and try to **adjust the model background snow amount** by using COMS SSI.
- The **effects on the snow analysis appear slightly positive impacts** in the snow build-up period. Asia region affected by COMS snow data is improved for all verification results.
- We will try to improve accuracy of satellite-derived surface parameters such as Sea Surface Temperature, Snow Cover, and Soil Moisture to use as input on NWP.