RGB product for convective clouds using COMS

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Introduction

- RGB Products using the geostationary meteorological satellite such as COMS, Himawari-8/9, GOSE-R and Geo-KOMPSAT 2A have an advantage for operational users because of their ability to compress multispectral information content without losing the information observed by the satellite.
- A new RGB product for detecting convective clouds is developed using the combinations of the brightness temperatures observed at COMS 6.75㎛, 10.8㎛ and 12.0㎛ channels. The threshold values of the new RGB product for convective clouds are determined through the ground radar observations in Korea and the RGB products operated in EUMETSAT.
- We provide a case study to show the capability of this RGB product, for example, detection of the center location of Typhoons.

Methods

- BT to Colors

 - The Convective clouds RGB product consists of the Brightness Temperature Difference (BTD) between IR12.0㎛ and IR10.8㎛ (on red), the BTD between WV6.7㎛ and IR 10.8㎛ (on green), and brightness temperature at IR10.8㎛ (on blue).

 - The threshold values of convective clouds RGB product are determined from Look-Up Table (LUT) of Convective Rainfall Rate (CRR) algorithm. KMA improved this LUT of CRR using rainfall datasets observed from the Korea radar network system and COMS/MI datasets (Fig. 1), which shows a better performance at 10㎜/hr or higher rain rate (Kim *et* al, 2012).

- Color interpretation

 - For cumulus cloud or mature convection, this RGB products show yellowish and greenish color (Fig. 2) because of the positive value of BTD between WV6.7㎛ and IR10.8㎛ (corresponding to green color) when the rain rate more than 20㎜/hr (NWC SAF, 2009).

- Applications to Typhoon analysis

 - the center locations of Typhoons using RGB convective cloud product were compared with best-track data from JMA(Japan Meteorological Administration), Joint Typhoon warning Center (JTWC), Regional Specialized Meteorological Center (RSMC) Tokyo and Cooperative Institute for Meteorological Satellite Studies (CIMSS).

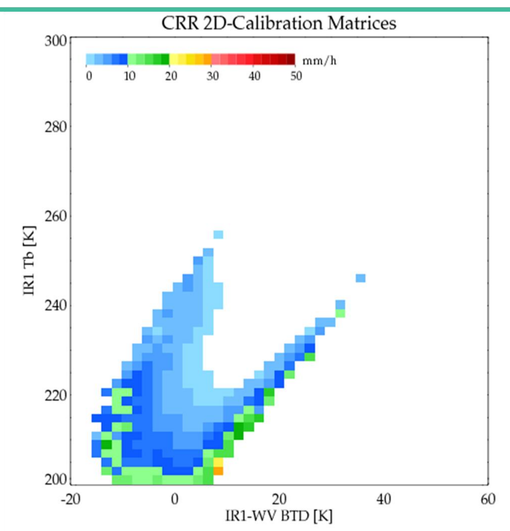

Fig. 1. CRR 2D-Calibration Matrices

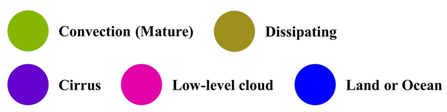

Fig. 2 Color Interpretation

Result

- Fig. 3-a shows the IR image of Typhoon Danas from COMS observation. It is hard to determine the center locations of Typhoon. Meanwhile, the RGB convective cloud product shows the characteristics of center locations of typhoons in Fig 3-b.
- Figs. 4-a, 5-a, and 6-a exhibit the best-track data for typhoon Danas in 2013 and Neoguri and Halong in 2014 analyzed from JMA, JTWC, RSMC, and CIMMS with this RGB analysis, respectively. Figs. 4-b, 5-b, and 6-b shows the statistical results for distance differences of typhoon center locations between the JMA's best-track data and JTWC, RSMC, CIMSS, and RGB analysis for the three typhoons as stated above.
- Conclusively, the results present the effectiveness and accuracy of RGB analysis for deciding the typhoon center locations when it is operated for the forecasters, even they don't have enough experiences.

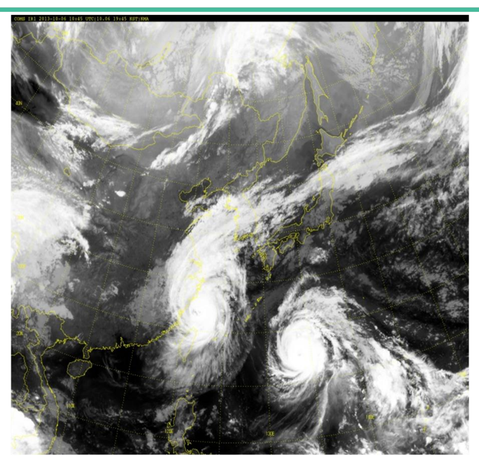

Fig. 3-a IR10.8㎛ Image of COMS/MI (2013.10.06.10:45UTC)

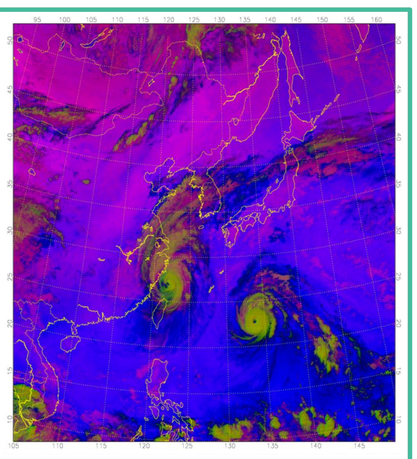

Fig. 3-b RGB convective cloud Image (2013.10.06.10:45UTC)

Case of Typhoon Danas (2013.10.06.00:00 ~ 2013.10.09.00:00 UTC)

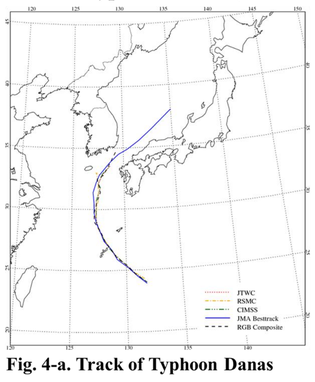

Fig. 4-a. Track of Typhoon Danas

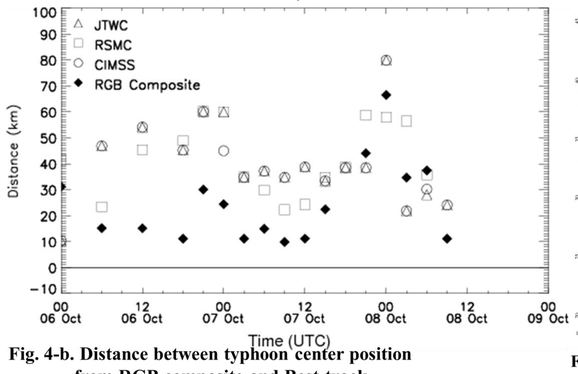

Fig. 4-b. Distance between typhoon center position from RGB composite and Best-track

Case of Typhoon Neoguri (2014.07.07.00:00 ~ 2014.07.11.00:00 UTC)

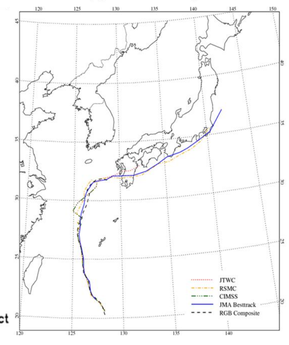

Fig. 5-a. Track of Typhoon Neoguri

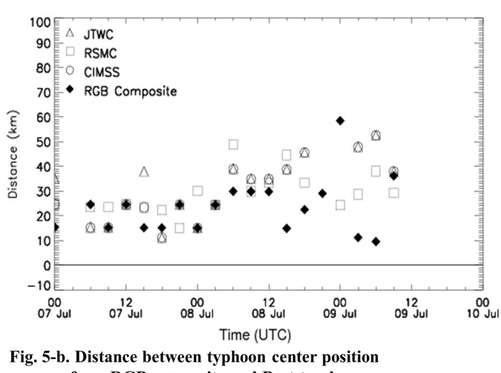

Fig. 5-b. Distance between typhoon center position from RGB composite and Best-track

Case of Typhoon Halong (2014.08.05.00:00 ~ 2014.08.10.00:00 UTC)

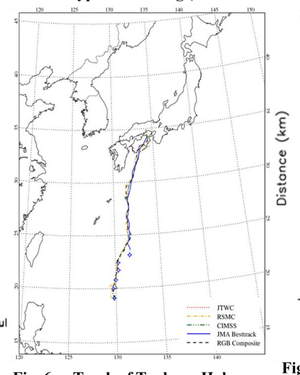

Fig. 6-a. Track of Typhoon Halong

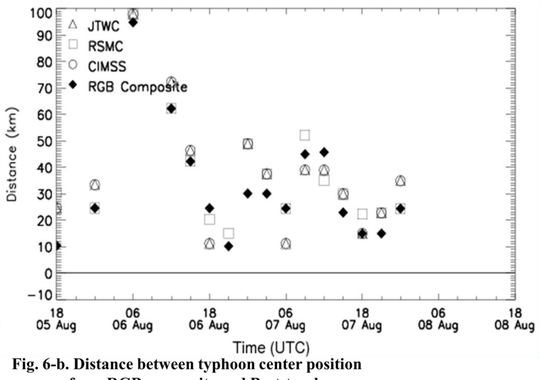

Fig. 6-b. Distance between typhoon center position from RGB composite and Best-track

Summary

- We developed a new and unique RGB product for monitoring the convective clouds using geostationary satellite observations.
- This RGB product has an advantage for typhoon analysis with high accuracy.
- In particular, KMA uses operationally this RGB product for monitoring convective clouds, heavy rainfall, and typhoon analysis.
- For the future work, we will develop more RGB products using various combination of 16 channels of GK-2A satellite for the forecasters and many other users

Reference

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