Prepared by KMA
Agenda Item: II/3
Discussed in WGII

Report on Operational Analysis of Tropical Cyclone

This paper reports the Operational Analysis of Tropical Cyclone in KMA

Operational Analysis of Tropical Cyclone in KMA

Korea Meteorological Administration (KMA) has developed a web-based satellite image analysis system with higher availability and accessibility for operational analysis of tropical cyclone.

1. Background

The image data from geostationary and polar-orbit satellites are very useful to analyze the centers and intensities of typhoons. Out of the many satellite observations, the MTSAT-1R HiRID data are mainly used for operational typhoon analysis in KMA. The typhoon analysis with satellite data is based on Advanced Objective Dvorak Technique (AODT), developed by the SSEC/UW-Madison(Space Science and Engineering Center/University of Wisconsin-Madison)

2. Introduction to AODT

Subjective Dvorak Technique (SDT) relies on subjective interpretation of cloud pattern surrounding the tropical cyclone center on the satellite image. While SDT indicates good performance in most operational cases, it sometimes results in discrepancies of results between analysts. To minimize the subjectivity in standard Dvorak methodology, Velden et al. (1998) of SSEC/UW-Madison has developed the AODT, which has a computer-based objective algorithm on the infrared information.

Test of the AODT in operational basis got promising results in KMA. However, since AODT was developed mainly focused on the hurricanes, occurring in the Atlantic, it would not be fully applicable to typhoons occurring in the Pacific.

3. Validation of AODT

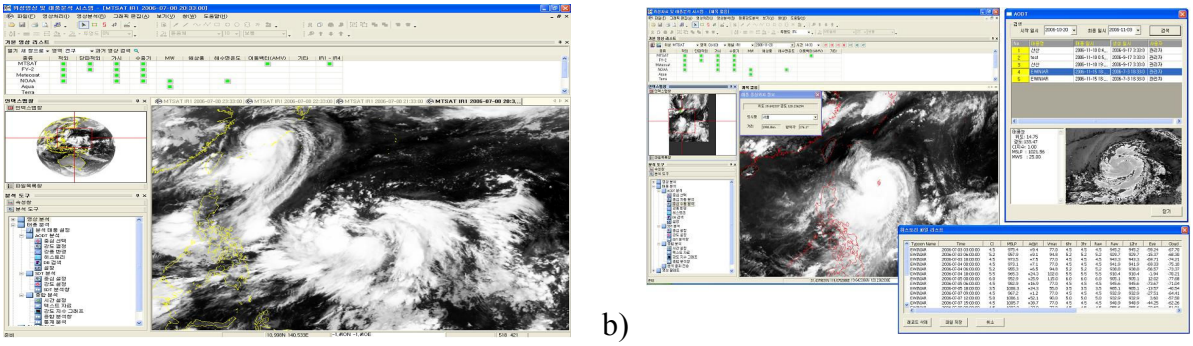
KMA analyzed Current Intensity (CI) number using SDT for typhoons in 2004 and compared it with AODT results for the same events. The correlation coefficient between CI numbers of SDT and AODT is 0.85, which is relatively high. The regression coefficient is 0.7861 and bias, 1.1361 with significant confidence level of 0.95. Although the correlation coefficient is high, the systematic bias more than 1 means that AODT results should be corrected. The difference between both indices shows dependence on the CI numbers.

To investigate the non-linearity, Hsieh (2004)'s nonlinear multi-variable time series analysis is applied based on Neural Network (NN). As expected, the significant non-linearity is shown on the analysis results and there is the distinct difference in CI numbers over small CI of AODT. Those results represent that systematic bias is relatively large in the initial and extinct stage of typhoon. Therefore, the cause of those systematic biases needs to be analyzed to estimate more accurate typhoon CI number over the northwestern Pacific.

4. Operational use of AODT

KMA has developed a web-based satellite image analysis system with higher availability and accessibility, which includes AODT algorithm ver. 6.3. The web-based system allows easily access to satellite DBMS in real time and displays lots of images from MTSAT-1R, NOAA, QuikSCAT, AMSR-E. In addition, image overlay, graphic editing, and simple statistical functions of this system provide useful tools to make comparison with other sources of typhoon information from RSMC-Tokyo, SAREP and JTWC.

a) b)



c) d)

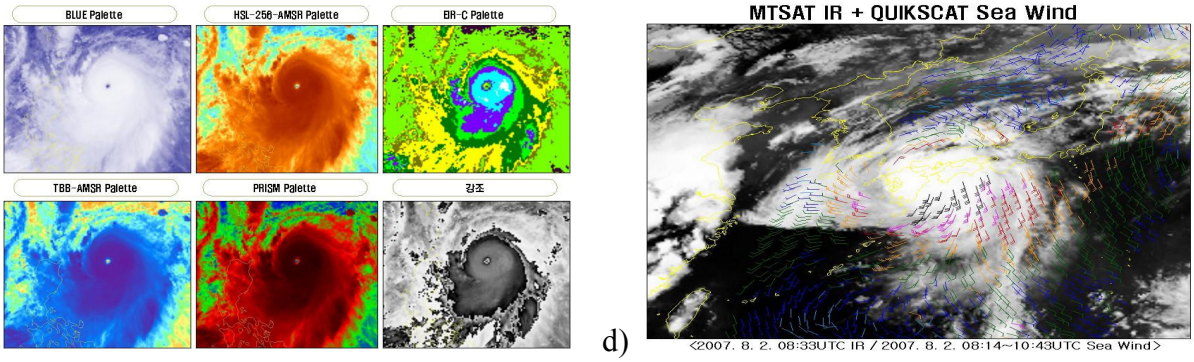


Figure 1. a) Main menu of the web-based satellite image analysis system, b) Typhoon center analysis tool , c) Various samples of displayed typhoon images, and d) Cloud motion wind vectors on a typhoon image