CGMS

CGMS-34, JMA-WP-09
Prepared by JMA
Agenda Item: II/6.3
Discussed in WG II

STATUS OF AEROSOL PRODUCTS AT MSC

This paper, prepared in relation to Action 33.06 from CGMS-XXXIII, reports on the status of MSC's aerosol products and future plan.

Aerosol products are generated from data of MTSAT-1R/JAMI and NOAA-18/AVHRR. In these products, two parameters on atmospheric aerosol are calculated, i.e. aerosol optical depth (AOD) at 500 nm and Ångström exponent. These parameters are retrieved in the vicinity of Japan over cloud-free sea. MSC has been developing aerosol products over land around Japan since April 2006, and continues improving these products to make them more suitable for climate applications.

This paper also reports on the status of MSC's dust monitoring product. This product contains information on dust retrieved from MTSAT-1R/JAMI infrared (11 micron and 12 micron) data.

STATUS OF AEROSOL PRODUCTS AT MSC

1 INTRODUCTION

This paper presents aerosol products, which have been generated at the Meteorological Satellite Center (MSC) since 2002. These products are generated from data of MTSAT-1R/JAMI and NOAA-18/AVHRR.

In addition, the MTSAT-1R dust monitoring product is presented in this paper, which has been generated at MSC since February 2006.

2 CURRENT STATUS OF AEROSOL PRODUCTS

Aerosol products were developed at MSC in cooperation with the Meteorological Research Institute (MRI) of JMA. In these products, two parameters on atmospheric aerosol are calculated, namely, aerosol optical depth (AOD) at 500 nm and Ångström exponent. The former is related to aerosol concentration, and the latter to its particle size distribution. AOD and Ångström exponent are retrieved from visible and near infrared data of NOAA-18/AVHRR. AOD at 0.3, 0.4 and 0.5 Ångström exponents is retrieved from visible data of MTSAT-1R/JAMI. The type of retrieved aerosol in these products is assumed to be dust particles. Although the aerosol products have been developed to detect and monitor dust distribution, they are used in JMA also for monitoring of other kinds of aerosol distribution including smoke from forest fires and volcanic ash. Moreover, these products are expected to be introduced into the aerosol transport model and the radiative transfer model of JMA.

These aerosol parameters are retrieved by referring to the Look Up Tables (LUTs) generated beforehand by radiative transfer calculations. The LUTs were developed at MRI [1]. AOD and Ångström exponent data are produced at every 20 km grid intervals in the vicinity of Japan over cloud-free sea. Table 1 shows the specifications of these products, and Figure 1 shows calculation examples.

Table 1 Specification of aerosol products

Output frequency	MTSAT-1R: 7 times a day (00-06UTC, hourly) NOAA-18: 1-3 times a day (depending on the satellite track)
Processing region	114E-150E, 17N-52N (in the vicinity of Japan)
Resolution	0.25 degree (longitude) × 0.20 degree (latitude)
Calculation condition (at every grid)	· Over the sea · Pixels without cloud · Solar zenith angle < 70 degrees · Satellite zenith angle < 70 degrees · Sun glint angle > 30 degrees

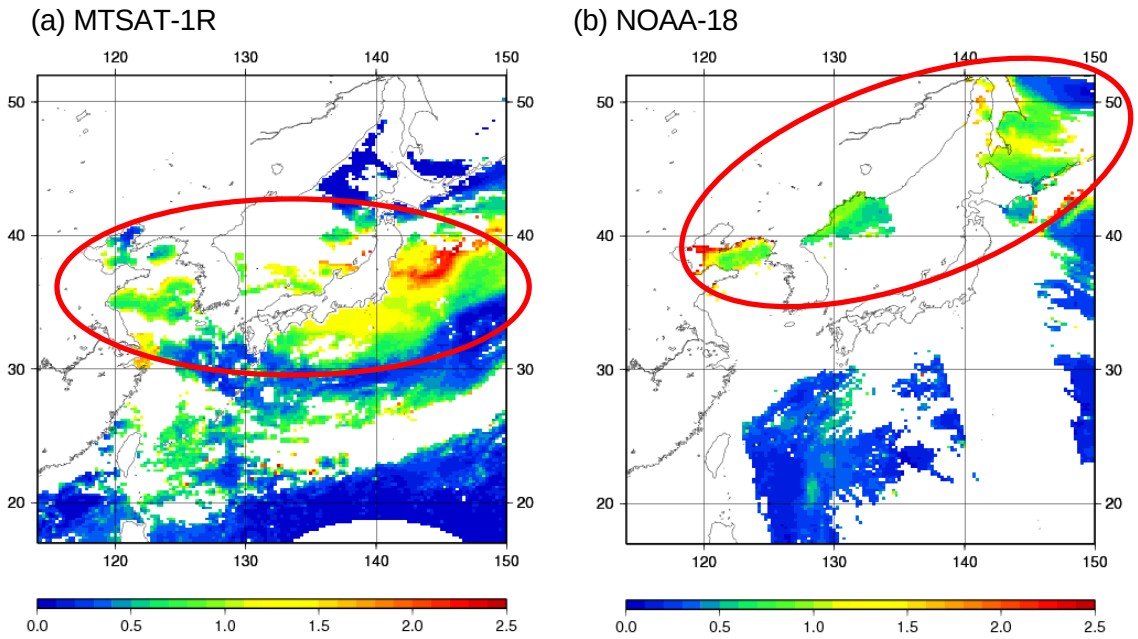

Figure 1 Calculation examples of aerosol products
(a) AOD distribution retrieved from MTSAT-1R/JAMI (03 UTC on 18 April 2006) Yellow Sand Dust in the vicinity of Japan was detected by the product.
(b) AOD distribution retrieved from NOAA-18/AVHRR (04 UTC on 17 May 2006) Smoke from forest fires in the Russian Far East spreading in the vicinity of Japan was detected by the product.

Figure 2 shows the comparisons of AOD between ground observations and the nearest grid values of satellite products. The sites of ground observation are shown in Figure 3. Figure 2 indicates that the satellite AOD products are well correlated to the ground observations.

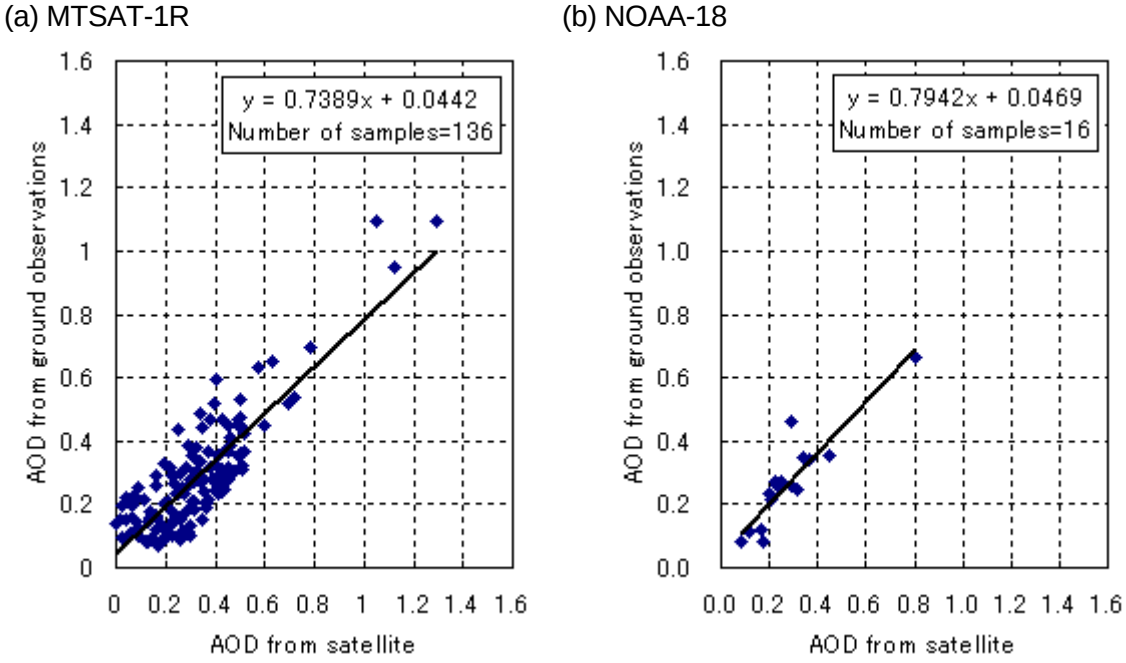

Figure 2 Comparisons of AOD data between Sunphotometer observations conducted in the sites shown in Figure 3 and (a) MTSAT-1R and (b) NOAA-18, from March to May 2006 (season of the Yellow Sand Dust).

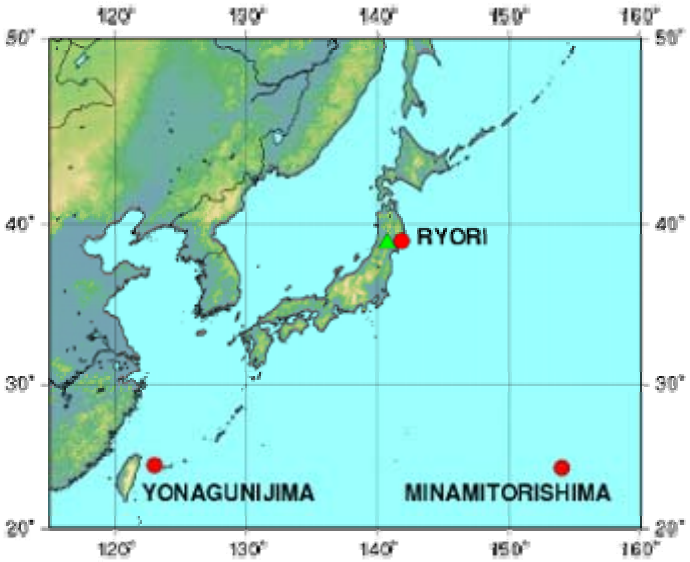

Figure 3 Sunphotometer observation sites of JMA (WMO Global Atmospheric Watch (GAW) stations)

3 CURRENT STATUS OF DUST MONITORING PRODUCT

Dust monitoring product was developed at MSC in cooperation with the Atmospheric Environment Division of JMA and MRI. This product contains information on dust detection retrieved from MTSAT-1R/JAMI infrared (11 micron and 12 micron) data. JMA uses this product to early grasp and monitor spread of dust events, and to issue dust information. Table 2 and Figure 4 show the specification of this product and a calculation example, respectively.

The algorithm of the dust detection is based on the split windows technique. The algorithm consists of the following two processes.

1) Index, which relatively represents the concentration of dust, is calculated at each grid by the equation,

$$(\text{Index}) = 100 \times \text{LOG}\,(BT_{12}/BT_{11}) + C,$$

where BT_{11} and BT_{12} denote brightness temperatures at 11 micron and 12 micron, respectively, and C denotes a constant value.

2) Several checks are made for dust detection with the index at every grid.

- The index is compared with the indices of previous 7 days at the same observing time. If the index is much larger than the previous indices, the dust is judged to be detected at the grid.
- The index is compared with the index one hour before to check the temporal variation.
- The index is compared with its surrounding indices to reject gross error.

Table 2 Specification of dust monitoring product

Output frequency	24 times a day (hourly)
Processing region	110E-150E, 20N-50N (in the vicinity of Japan)
Resolution	0.50 degree (longitude) × 0.50 degree (latitude)
Calculation condition (at every grid)	Pixels without cloud

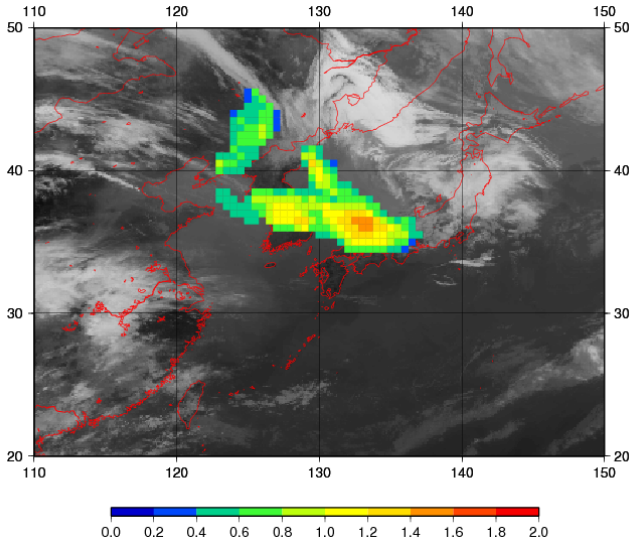

Figure 4 Calculation example of dust monitoring product (03 UTC on 8 April 2006, composite infrared image)

4 FUTURE PLANS

MSC has a plan to start generating aerosol optical depth (AOD) over land in and around Japan in 2007 using NOAA-18 HRPT data. This product is expected to be more worthy for climate monitoring and aerosol (radiative transfer or transport) model development.

MSC has continued improving the aerosol products by introducing another type of retrieved aerosol and expanding the processing region suitable for climate applications.

5 REFERENCE

[1] Masuda, K., Mano, Y., Ishimoto, H., Tokuno, M., Yoshizaki, Y., Okawara, N., 2002: Assessment of the nonsphericity of mineral dust from geostationary satellite measurements, *Remote Sensing of Environment*, 82, 238-247.