CGMS

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Prepared by CMA
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Discussed in WG II

# FY-3A AEROSOL AND ITS APPLICATION

Summary of the Working Paper

Aerosol retrieval is one of the applications of MERSI sensor flying on FY-3A satellite. The method of so called the Dense Dark Vegetation depending on observations of band-1(0.47micron), band-3(0.65micron) and band-7(2.13micron) of MERSI is used as the operational algorithm to obtain the aerosol optical thickness（AOT）. Currently at NSMC/CMA, the operational MERSI aerosol product provides AOT at 470, 550 and 650nm and Ångström coefficient. Validation for MERIS products was made by comparison with the MODIS aerosol and found that the AOT/MERSI was little lower than AOT/MODIS, the two products have highly linear relativity with each other. When AOT/MERSI was compared with AOT/ CMA-CARSNET in situ, RMS of AOT at 550nm was 0.24 depending on 61 samples. AOT/MERSI aerosol product is now used for monitoring the air quality.

# FY-3A AEROSOL PRODUCT OVER LAND AND ITS APPLICATION

## 1 Introduction

MERSI (MEdium Resolution Spectral Imager) was one of the 11 instruments on FY-3A which was launched in May 2008. MERSI has 20 bands covering VNIR/SWIR/TIR spectral region, capable of making global observations of the Earth's system. Aerosol retrieval is one of application of this sensor.

## 2. Land aerosol product and validation

### 2.1 Product specification

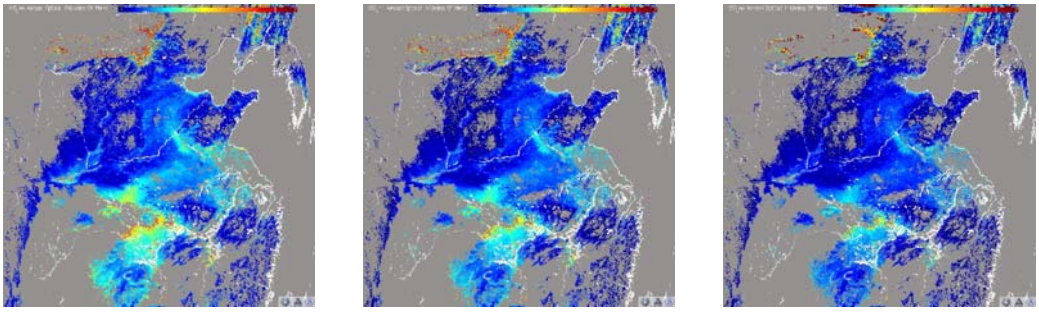
The band of FY-3A/MERSI used for land aerosol optical thickness retrieval is listed in Table 1. Land aerosol optical thickness retrieved by Dense Dark Vegetation method is based on band1, 3 and 7of MERSI and LUTs calculated by 6S model. Aerosol optical thickness at 470, 550 and 650nm and Ångström coefficient are provided in aerosol product. FY-3A aerosol product specification is shown in Table 2. The product file format is HDF5. Some examples of aerosol product are shown in Figure 1.

Table 1 Aerosol related band information

| Band | Central Wave (μm) | Band Width (μm) | Resolution (m) | NEΔR | Dynamic Range |
|---|---|---|---|---|---|
| 1 | 0.470 | 0.05 | 250 | 0.45 | 100% |
| 3 | 0.650 | 0.05 | 250 | 0.3 | 100% |
| 7 | 2.130 | 0.05 | 1000 | 0.05 | 90% |

Table 2 FY-3A Aerosol product specification

| Type | Projection | Coverage | Spatial Resolution |
|---|---|---|---|
| Orbit | None | Global, granule of 5minutes orbit | 1Km at Nadir |
| Day | Geographic Longitude/Latitude | Global, 10°×10° per breadth | 0.01°×0.01° |
| Ten days | Ditto | Global | 0.05°×0.05° |
| Month | Ditto | Global | 0.05°×0.05° |



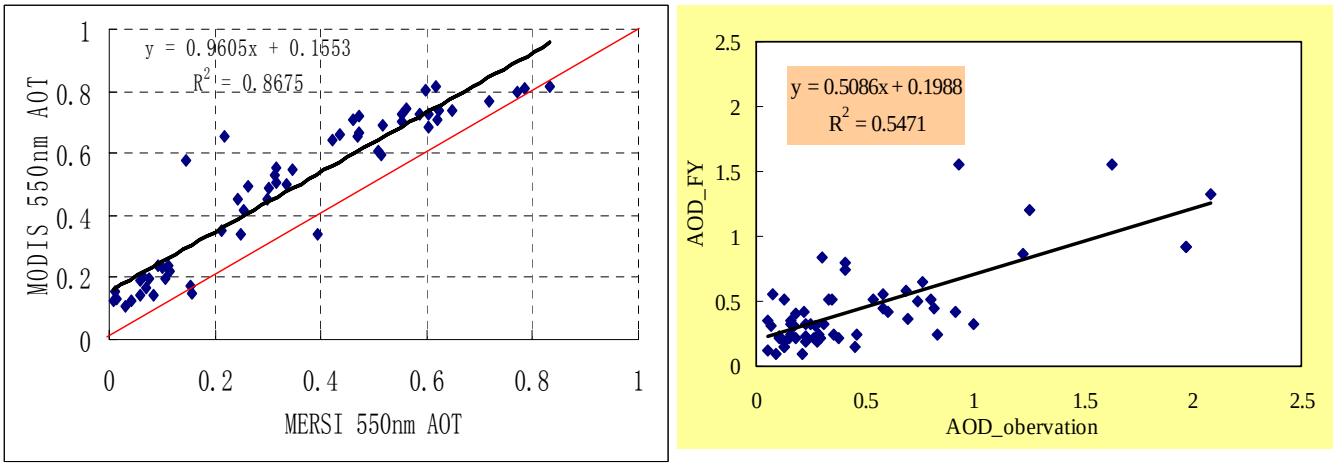
(a) 470nm AOT (b) 550nm AOT (c) 650nm AOT

Figure 1 FY-3A Land aerosol product examples in east of China (Granule of 5 minutes orbit ,no projection) 2008-12-15 02:55(UTM)

### 2.2 Primary validation result

The FY-3A aerosol product was validated by comparison with the MODIS product. AOT/MERSI was little lower than AOT/MODIS from NASA (mean difference of AOT at 550nm was -0.14173). AOT of the two satellites are highly linearly related (r=0.9314). Comparison with the AOT/ CMA-CARSNET in situ showed that RMS of AOT at 550nm was 0.24 depending on 61 samples, and the linearity relativity of the two produces was 0.7397.

These results were obtained from cross-calibrated MERSI L1B data with MODIS.




(a) (b)

Fig.2 Preliminarily validation of FY-3A aerosol product

(a) Comparing with AOT/ MODIS depending on MERSI and MODIS aerosol products in Dec. 15. 2008 between 02:30(UTM) and 03:00(UTM) (b) Comparing with AOT/ CMA-CARSNET in situ depending on MERSI and CARSNET aerosol products in March 1-

## 3 FY-3A AEROSOL APPLICATION

### 3.1 Air pollution operationally monitoring in citys

MERSI aerosol product is used to monitor city air quality. For example, In Figure 3, Beijing sees little air pollution based on 550nm AOT retrieval, on April.16, 2009.

### 3.2 Fire smoke monitoring

MERSI land aerosol was used to monitor the smoke move and thickness in forest fires. Figure 4 shows the fire points and the smoke in Canada and Greece. Figure 5 shows the fire point on Sept. 2, 2009 and burnt area to Sept. 8, 2009 in California of America. Figure 6 shows AOT distribution over a period of smoke in California by FY-3A land aerosol. Generally, values of aerosol optical thickness are higher than 2.0 near fire spots, the air is seriously polluted.

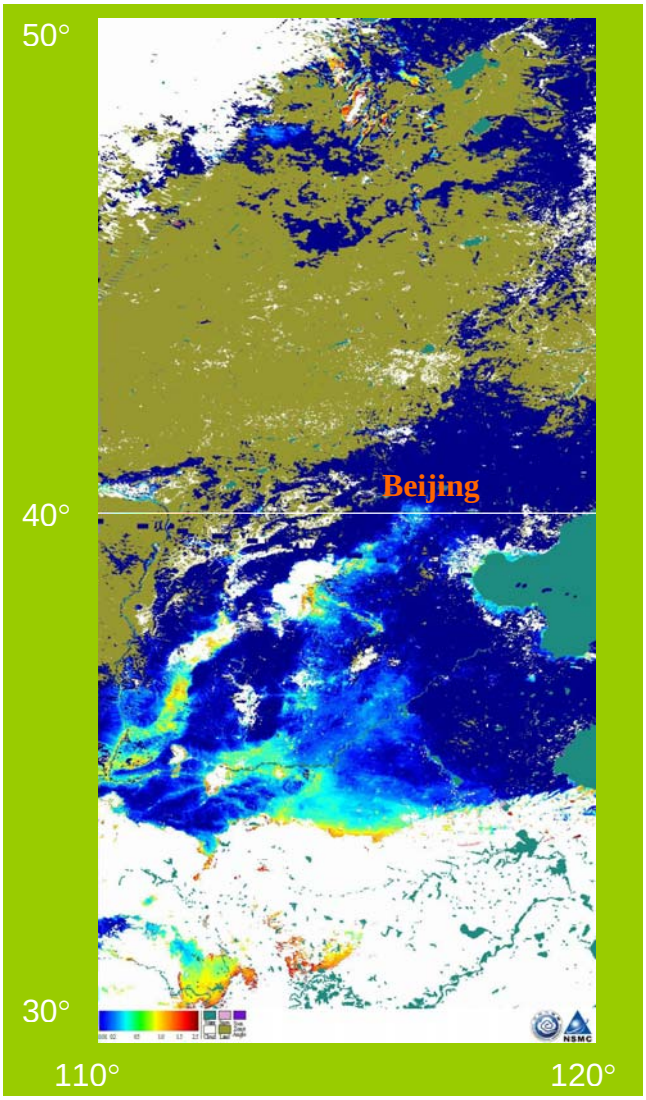
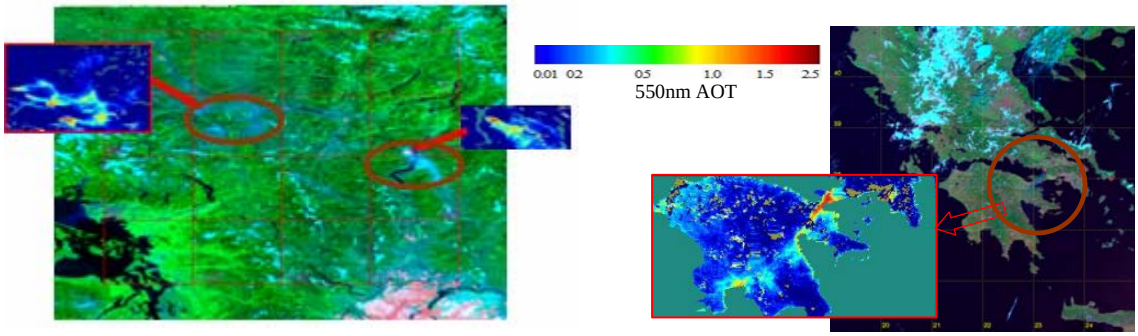
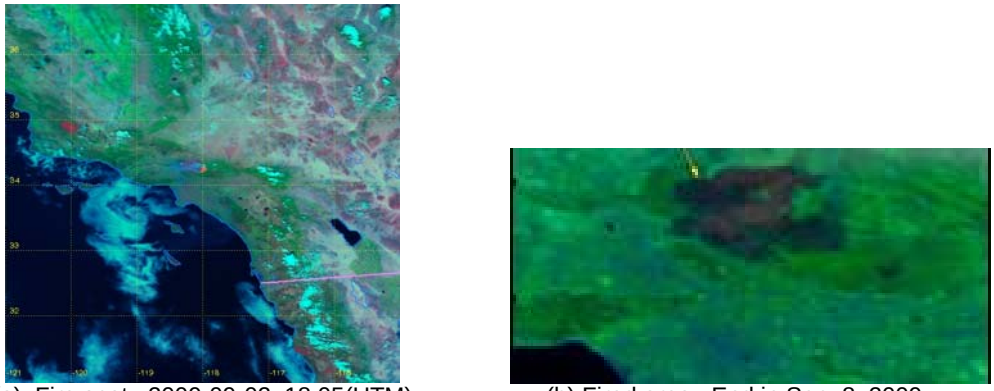



Fig. 3 550nm AOT of MERSI/FY-3A for north China, Aprial16, 2009




(a) Canada 2009-08-02 09:25(UTM) (b) Greece 2009-08-24 09:05(UTM)

Figure 4. Fire smoke in Canada and Greece



(a) Fire spot 2009-09-02 18:05(UTM) (b) Fired area End in Sep. 8, 2009

Figure 5. Fire spot and burnt area in California

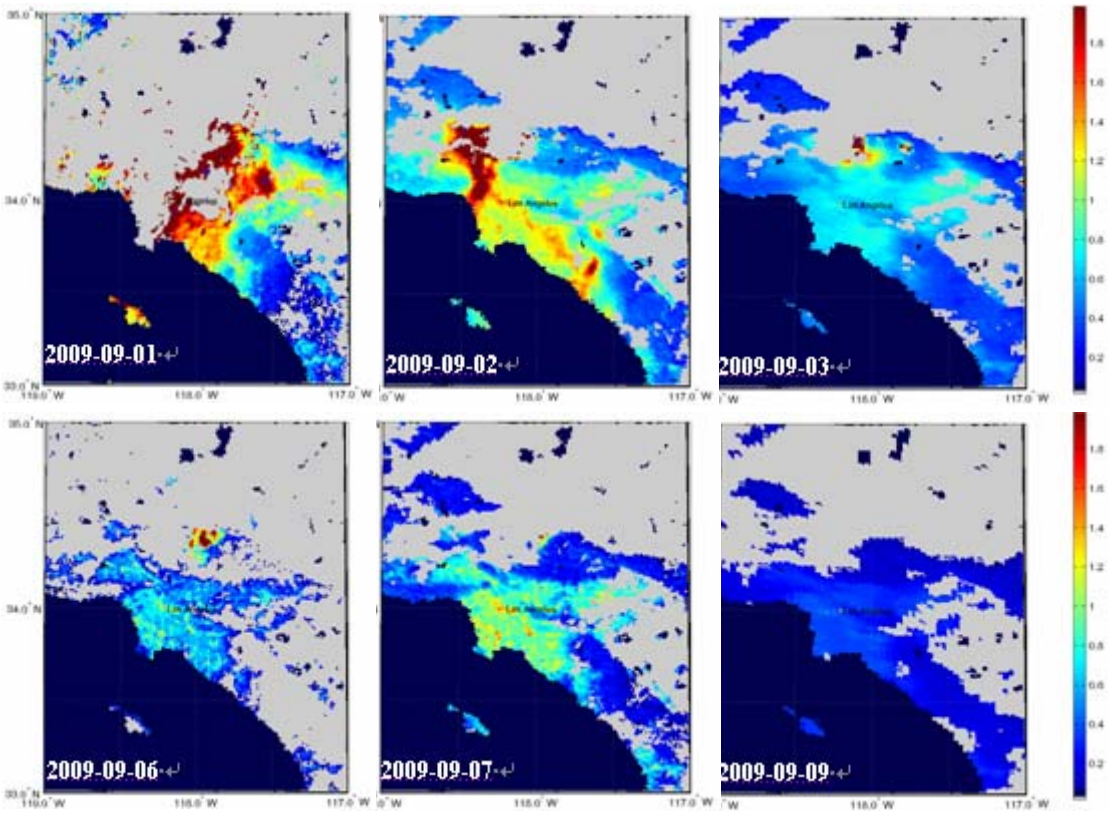



Figure 6 550nm Aerosol optical thickness distribution in the area of forest fire, California