



CGMS-37, CMA-WP-10
Prepared by CMA
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Discussed in WG II

FY-3A OCEAN COLOUR PRODUCT AND ITS APPLICATION

Summary of the Working Paper

The paper describes the FY-3A/MERSI Ocean colour product and its preliminary validation. Some applications are briefly introduced.

FY-3A OCEAN COLOR PRODUCT AND ITS APPLICATION

1. FY-3A OCEAN COLOR PRODUCT

1.1 Product specification

The FY-3A/MERSI band specification related with ocean color is listed in Table 1.

From the FY-3A/MERSI ocean color products we can get the following parameters.

- Water-leaving reflectance ($\rho_w = L_u(0+)/L_d(0+)$) for band 8 to16 retrieved from atmospheric correction algorithm based on LUTs;
- Chlorophyll concentration (CHL1) and pigment concentration (PIG1) from global empirical models, and
- Chlorophyll concentration (CHL2), total suspended mater concentration (TSM), absorption coefficient of CDOM and NAP (YS443) from Chinese regional empirical models.

FY-3A ocean color product specification is shown in Table 2. The product file format is HDF5. Some examples of ocean color product are shown in Figure 1.

Table 1. Ocean color related band information

| Band | Central Wave (μm) | Band Width (μm) | Resolution (m) | NE Δ R | Dynamic Range |
|------|--------------------------------|------------------------------|----------------|---------------|---------------|
| 1 | 0.470 | 0.05 | 250 | 0.45 | 100% |
| 2 | 0.550 | 0.05 | 250 | 0.4 | 100% |
| 3 | 0.650 | 0.05 | 250 | 0.3 | 100% |
| 4 | 0.865 | 0.05 | 250 | 0.3* | 100% |
| 6 | 1.030 | 0.02 | 1000 | 0.10 | 90% |
| 7 | 1.640 | 0.05 | 1000 | 0.05 | 90% |
| 8 | 0.412 | 0.02 | 1000 | 0.1 | 80% |
| 9 | 0.443 | 0.02 | 1000 | 0.1 | 80% |
| 10 | 0.490 | 0.02 | 1000 | 0.05 | 80% |
| 11 | 0.520 | 0.02 | 1000 | 0.05 | 80% |
| 12 | 0.565 | 0.02 | 1000 | 0.05 | 80% |
| 13 | 0.650 | 0.02 | 1000 | 0.05 | 80% |
| 14 | 0.685 | 0.02 | 1000 | 0.05 | 80% |
| 15 | 0.765 | 0.02 | 1000 | 0.05 | 80% |
| 16 | 0.865 | 0.02 | 1000 | 0.05 | 80% |
| 20 | 2.130 | 0.05 | 1000 | 0.05 | 90% |

Table 2. FY-3A ocean color product specification

| Type | Projection | Coverage | Spatial Resolution |
|----------|-------------------------------|-----------------------------|--------------------|
| 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° |

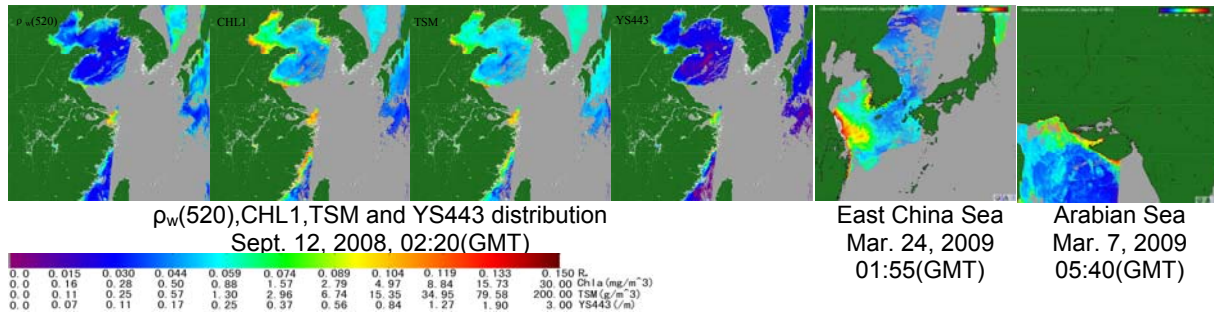


Figure 1. Examples of FY-3A ocean color product

1.2 Primary validation result

The FY-3A ocean color product was preliminarily validated by comparison with in situ data collected in Feb. 2009. But only two match-ups were available, whose time differences were less than 5 minutes. The RMS difference and percentage difference values were given in Table 3. The ρ_w at 443, 520 and 565 nm was systematically overestimated, while ρ_w at 490 nm was underestimated.

This result was obtained from cross-calibrated MERSI L1B data with MODIS. To improve the ocean color product quality, more calibration work should be carried out.

Table 3 FY-3A ocean color product primary validation result

| | $\rho_w(412)$ | $\rho_w(443)$ | $\rho_w(490)$ | $\rho_w(520)$ | $\rho_w(565)$ | Chl a | TSM |
|----------|---------------|---------------|---------------|---------------|---------------|-------|-------|
| RMSD | 0.005 | 0.004 | 0.004 | 0.003 | 0.003 | 0.023 | 0.095 |
| RMSPD(%) | 21.3 | 18.9 | 20.9 | 30.2 | 48.2 | 9.4 | 10.1 |

2. FY-3A OCEAN COLOR APPLICATION

2.1 Algae bloom monitoring

In late Spring and early summer in 2008, a severe *enteromorpha prolifera* bloom broke out in Yellow Sea that seriously threat the coastal area of Qingdao city that was going to hold some Olympic event. FY-3A/MERSI monitored the algae distribution, route, and provided information to direct the cleaning operation. Figure 2(a) showed one false color MERSI image (RGB with band 3/4/1) on June 28, 2008.

Figure 2(b) showed another true color MERSI image (RGB with band 3/2/1) during the dramatic phytoplankton bloom in the Barents Sea north of Russia on Sept. 6, 2009. The *coccolithophore* swirling in the waters west of Novaya Zemlya produced bright and turquoise patterns in the water.

In the end of 2008, a serious HAB attacked the Pacific coastal region of the Central America, especially around Costa Rica, Guatemala, El Salvador and Nicaragua. Figure 3 showed this red tide developing process using FY-3A Chl a product.

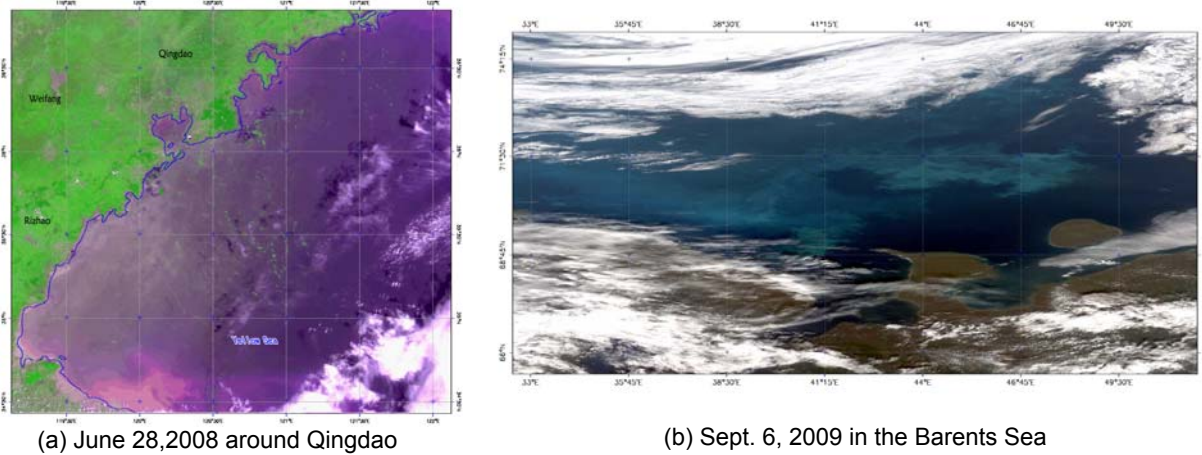


Figure 2. Algae bloom captured by FY-3A/MERSI

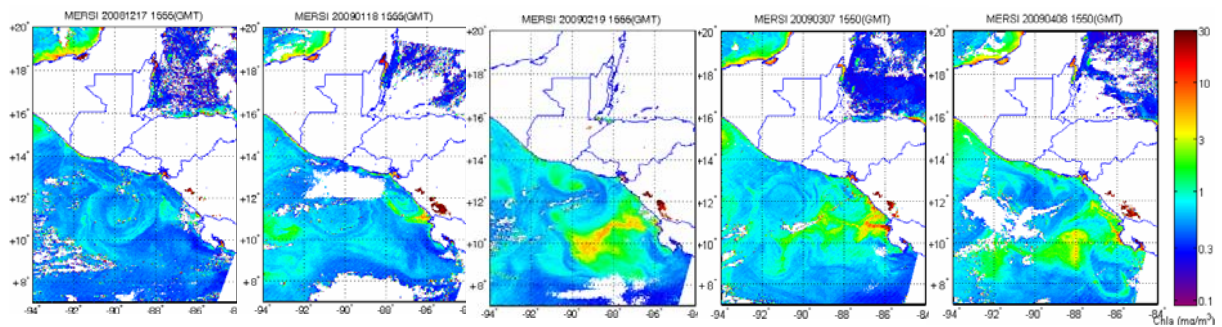


Figure 3. Red tide process in Central America

2.2 Suspended sediment variation

On the early morning of April 15, 2009, a large-scale stormy surge suddenly happened in Bohai Sea, distribution of marine sediment and suspended particle concentration dramatically changed, especially in the Bohai Bay and the Laizhou Bay. Figure 4. showed this process using the FY-3A TSM product.

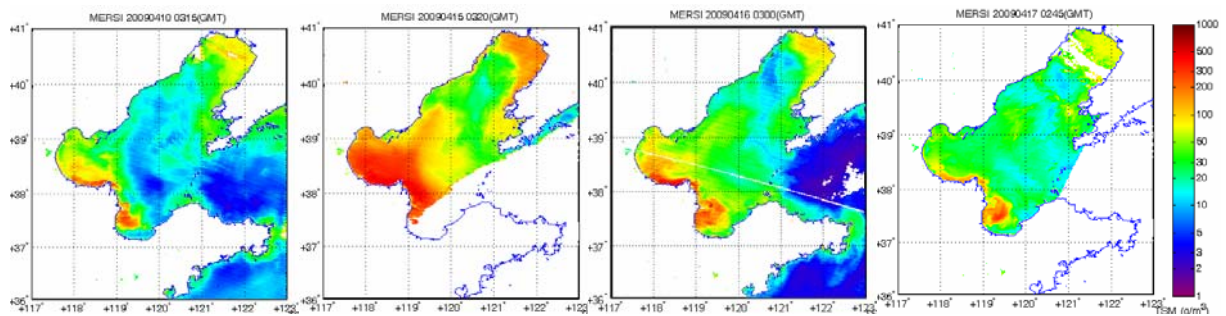


Figure 4. Suspended particle concentration variation caused by a storm surge in Bohai Sea