RESEARCH ON DARK DENSE VEGETATION ALGORITHM BASED ON ENVIRONMENTAL SATELLITE CCD DATA

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1. INTRODUCTION

Aerosol had a dramatic impact on human health and living environment. Using Terra and Aqua/ MODIS data, Dark Dense Vegetation (DDV) algorithm has showed excellent competence at the aerosol distribution and properties retrieval. Since global MODIS aerosol product (MOD04) is 10KM*10KM resolution so that many detailed information can't be obtained. At 11:25 on September 6, 2008, China launched "environment and disaster monitoring and forecasting small satellite constellation" satellite A, B into space. At 17 o'clock on the September 8, the two satellites successfully sent the first remote sensing image back. The environmental constellation includes two optical satellites and one SAR satellite (called HJ-A, B, C), compared to MODIS data, HJ-A, B with CCD camera can provide higher resolution remote sensing data (30M* 30M). This paper attempts to retrieve AOT from HJ-CCD camera using DDV algorithm.

2. METHOD

The DDV algorithm made assumption that surface reflectance in the red channel was a constant ratio of the blue channel, as showed in (1):

$$\rho^s_{red} = k\rho^s_{blue} \tag{1}$$

Where ρ^s_{red} 、 ρ^s_{blue} is the angular spectral surface reflectance in 0.66 μm and 0.47 μm channel, k is the radio which is set 2 in MODIS DDV algorithm. According to the character of HJ-CCD camera, we have carried out a series of experiment in Pearl River Delta and the radio value is given as 1.55 subsequently. The Normalized Difference Vegetation Index (NDVI), a function of the red and near-IR is used to find the Dark Dense Vegetation, as defined in (2):

$$NDVI = \frac{\rho_{nir} - \rho_{red}}{\rho_{nir} + \rho_{red}} \tag{2}$$

From the ground experiment we use ASD to obtain various targets NDVI such as grass, bosket, rice, cement, lake surface and so on. The value of vegetated area NDVI is set as 0.35.

3. DATA PROCESS

The aerosol retrieval process can be divided into these main parts:

1) LUT building: We set the parameters such as band response, geometric conditions, AOT based on HJ-CCD camera in 6S software to build a lookup table.
2) Cloud detection: Cloud mask is tested by 0.66 micro reflectance and 0.87/0.66 micron reflectance radio.
3) Dark dense target AOT retrieval: Equations (3) can be used to calculate dark dense target AOT.

$$\begin{cases} \rho_{blue}^{TOA}(\mu_s,\mu_v,\phi) = \rho_0(\mu_s,\mu_v,\phi) + \dfrac{T(\mu_s)T(\mu_v)\rho_{blue}^{s}}{[1-\rho_{blue}^{s}S]} \\ \rho_{red}^{TOA}(\mu_s,\mu_v,\phi) = \rho_0(\mu_s,\mu_v,\phi) + \dfrac{T(\mu_s)T(\mu_v)\rho_{red}^{s}}{[1-\rho_{red}^{s}S]} \\ \rho_{red}^{s} = k\rho_{blue}^{s} \end{cases} \quad (3)$$

4. VALIDATION AND ERROR ANALYSIS

We used Beijing, Xianghe and Hongkong station Aerosol RObotic NETwork(AERONET) data and NASA-MODIS aerosol product to validate the HJ-CCD AOT. The results showed that AOT retrieved by HJ-CCD is more close to AERONET data and its advantage and error is discussed later. Fig 1 showed Sep. 20, 2008 Beijing, Tianjin and Tangshan level map of AOT.

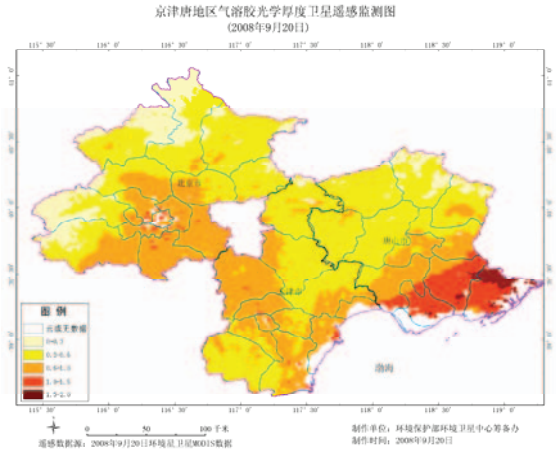

Fig 1 Sep. 20, 2008 Beijing, Tianjin and Tangshan level map of AOT

5. CONCLUSION

HJ satellite has been carrying out large-scale, all-weather, all-time dynamic monitoring for environmental pollution, ecological damage, disasters and emergency rescue. Its advantage will be showed along with the correlative algorithm in future.

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