A first approach to Automatic Monitoring Procedure of Case II Water Quality From HJ-1 Satellite Images

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1. INTRODUCTION

To satisfy the ever increasing demands of water environmental monitoring by remote sensing data, China launched HJ-1 satellites on September 6, 2008. HJ-1 satellites include two optical satellites (HJ-1 A、B) and one radar satellite (HJ-1 C). Among these, the payloads of HJ-1 A include a multi-spectral camera and an ultra-spectral imager; the payloads of HJ-1 B include a multi-spectral camera and an infrared camera; and the payloads of HJ-1 C include a SAR. HJ-1 satellites have the advantages of middle-to-high spatial resolutions, high temporal and spectral resolutions, and wide field-of-view. Furthermore, HJ-1 satellites can integrate the advantages of observing methods of optic, infra-red, and microwave. All these advantages make HJ-1 satellites quite suitable for monitoring of environment, especially inland water quality. We developed a first approach to automatic monitoring procedure of case II water quality from HJ-1 satellite images.

2. DESIGN CONCEPTS

Monitoring case II water quality from remote sensing data need three types of data: HJ-1 satellite images, in-situ data and retrieve models. We use XML documents to organize these data, and design an automatic monitoring mode. In this mode, user can get water quality monitoring report from geometric corrected HJ-1 satellite images with “one-click”. That means, you do not have to concern the complex processing procedure, and what you need to do is select the study site. According to the study site, it will automatically get parameters from the indexed XML files and integrated database. The whole processing procedure does not need any user intervention, which greatly improve the processing efficiency.

3. METHODS

XML documents produced for automatic water quality monitoring include information such as: study site, sensor type, imaging time, data format, pre-processing steps, pre-processing file path, post-processing model.

The integrated flow of retrieve the constituents of case II water quality from HJ-1 satellite images are as flows: *Step1*: Select a study sites and import the geometric corrected HJ-1 satellite images; *Step2*: De-striping and performing radiometric correction of imported images: calculate raw image to radiance image with radiometric calibration coefficients; *Step3*: Building the mask of water areas using fixed threshold method; *Step4*: Atmospheric correction of Step2's results and get the reflectance images; *Setp5*: Water grass and Algae bloom identification using spectral index method; *Setp6*: Retrieve the water constituents such as phytoplankton pigment, suspended matter and color dissolved organic matter from reflectance images using inverse modeling technique under the SIOPs database support; *Setp7*: Compute statistics, density slice and color mapping towards the Step6's results; *Setp8*: Thematic mapping with background GIS data;

Atmospheric correction of remote sensing images using the Second Simulation of the Satellite Signal in the Solar Spectrum (6S) model: *Step1*: Prepare the relevant parameters of the HJ-1 satellite images, such as, imaging time, observation geometry, AOT (aerosol optical thickness); *Step2*: Calculate radiance at TOA (top-of-atmosphere) to surface reflectance using three output coefficients, *xa, xb, xc,* from 6S model; *Step3*: Calculate surface reflectance (*acr*) to water leaving reflectance (remote sensing reflectance) and water leaving radiance using the other output coefficients, E_{dir}, E_{dif}, from 6S model.

4. RESULTS

According to the monitoring methods, we retrieved water constituents of surface *chlorophyll a*, *total suspended matters*, *water transparency and trophic status index* in Tai'hu Lake, Chao'hu Lake and Dian'chi Lake in China. Simulated HJ-1 satellite images, MODIS images are used to test the operation of the approach. This automatic procedure greatly improves the HJ-1 satellite data processing efficiency in Case II water quality monitoring.

5. REFERENCES

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