

Generation of land surface temperature maps for entire China using MODIS data

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This paper analyzed the basic theory of thermal remote sensing and different LST algorithms. Based on some works of Qin et al. (2001), a split window algorithm was presented for MODIS data. This algorithm need two essential parameters, atmospheric transmittance and land surface emissivity. Visible and near infrared bands of MODIS data were used to calculate atmospheric water vapor. The relationship between atmospheric transmittance and atmospheric water vapor was got by means of MODTRAN radiative transfer model. Because MODIS scanning is 2330 km wide, the influence of large view angle cannot be neglected. We studied view angle correction method and analyzed the influence to atmosphere transmittance and LST result due to angle change. For the land surface emissivity, we first calculate NDVI, then make land cover classification using NDVI and estimate vegetation coverage fraction. So emissivity of every pixel can be estimated using component radiance of vegetation and natural surface.

The resolution of MODIS land surface temperature data is 1 kilometer which is relative coarse. While LST varieties greatly in temporal and spatial scales, and satellite overpass time is very short. Therefore, real time LST and atmospheric profile measurements are very difficult to be obtained. In this article, sensitivity analysis for the two parameters and real time high resolution remotely sensed data retrieving are used for the validation of MODIS LST result. Sensitivity analysis shows that medium parameters error of MODIS 31 and 32 bands will cause 0.6-0.8°C LST error. The algorithm is not sensitive to atmospheric transmittance and land surface emissivity. LST of Taihu lake and surrounding area were retrieving using ASTER data which is boarded on the same Terra platform with MODIS sensor. The result shows that the regression coefficient of LST retrieving using MODIS and ASTER data is 0.9666. The algorithm can obtain comparatively precise LST.

China has spacious land area and complex weather conditions as well as land cover types. Therefore, it is difficult to retrieve LST throughout our county and also hard to mosaic and compose different MODIS images. We obtain every pixel's atmospheric and land parameters to consider local atmospheric and land conditions. The method can reduce error caused by different land cover types and atmospheric profile. Because different solar elevation angle in different location can cause time effect, this article discusses the method of temporal correction and ten-day composition. We composite LST and also analyze the temporal and spatial characters from March to October throughout China in 2005.

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