SPATIAL SCALE EFFECT IN AIRBORNE THERMAL HYPERSPECTRAL IMAGES

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1. Objectives

This paper attempt to describe the scale issue associated with temperature and emissivity separation algorithm. The TIR data were obtained at different spatial scales by Thermal Airborne Hyperspectral Imager (TASI) during the field campaign at Shijiazhuang city, Hebei province in 2010.

2. Methodology

To analyze the mechanism of scale effects, this paper selects ASTER's TES algorithm to retrieve temperature and emissivity (Yang H. 2011), and four scale transformation methods (center pixels method, simple average method, point spread function method (PSF), wavelet transform method (WTM)) to scaling.

There are two alternative ways to scaling. One is to scaling of thermal radiance and then to retrieve temperature and emissivity (P1). The other is to retrieve temperature and emissivity and then scaling of temperature and emissivity respectively (P2). To describe simply, several abbreviations are list as follows:

T_{P1}、 ε_{P1}： represent temperature and emissivity at pixel scale using P1 scheme.

T_{P2}、 ε_{P2}： represent temperature and emissivity at pixel scale using P2 scheme.

$\Delta T = T_{P1} - T_{P2}$， $\Delta\varepsilon = \varepsilon_{P1} - \varepsilon_{P2}$： the differences of temperature and emissivity

between $P1$ and $P2$, respectively.

3. Conclusions

Center pixels method is not fit for scale transformation; the spatial autocorrelation of images using PSF method is higher than that of images using simple average method and wavelet transform method; but the standard deviation of images using PSF method is lower than that of images using simple average method and wavelet transform method. Wavelet transformation method transforms the image from spatial domain to frequent domain, and causes to error because of processing the edge pixels for each moving windows.

The implementation efficiency of average method is best, next best is PSF method, and the wavelet transformation method is worse.

After analysis of the difference between T_{P1} and T_{P2}, the scale effect of

temperature for city is greater than that for country; With increase in scale transformation windows, the histogram of difference in temperature becomes more and more scattered, and the peak value becomes lower and lower.

There are significant relationship between T_{P1} and T_{P2}. After regression analysis and scale correction, the result shows that the regression equation on the base of statistical method can decrease the scale effect of temperature and emissivity.