

Reconstruction of MODIS land-surface temperature in a flat terrain and fragmented landscape

Abstract

Moderate Resolution Imaging Spectroradiometer (MODIS) land-surface temperature (LST) products provide important and reliable time-series data for the examination of global climate change, water cycling, and ecological evolution. In particular, in recently developed remote-sensing evapotranspiration models, such as the Surface Energy Balance Algorithm for Land and the Surface Energy Balance System, LST is a critical parameter that can directly influence the accuracy and integrity of final results. However, clouds and other atmospheric disturbances, which cover a large area throughout most of the year, are read as blank values by these programs, creating a problem. To solve this, a number of algorithms have been proposed to reconstruct LST data, but few can be used to evaluate flat and relatively fragmented landscape regions, such as the Yellow River Delta in China. Here, we conducted an analysis where we considered the LST of a flat area to be mainly influenced by land cover and other environmental elements (e.g. soil moisture). We used maps such as land cover, normalized difference vegetation index, and MODIS band 7 as additional data in the reconstruction model. All of the LST pixels we used were randomly divided into two parts: one part was used to train the model, and the other part was used to validate the calculated results. Three different methods have been developed to reconstruct LST data – linear regression, regression tree (RT) analysis, and artificial neural networks. In comparing these methods, we found that the RT method is able to estimate the LST of MODIS pixels with the greatest accuracy, and that it is both convenient and useful for reconstructing the LST map in flat and fragmented regions.