Artificial neural network based atmospheric temperature determination from remotely sensed data

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Determination of atmospheric temperature (AT) from remotely sensed data is very important for the global or regional climatic modeling, computing of heat flux, environmental monitoring and hydrology. Because the retrieved AT that was obtained using the empirical or statistical models between the land surface temperature (LST) and the AT could not achieve a satisfied precision for applications in environmental modeling. This paper focuses on the derivation of the AT using artificial neural network (ANN) that would has an excellent approximation of any complicated non-linear relationships. Which is good for constructing the association between AT and LST. The MODIS data from satellite Aqua in local time of 13:58 on April 30, 2004 were downloaded from NASA website. Firstly, the LSTs were retrieved using an algorithm named iterative self-consistent split-window method after performing the radiation calibration, geo-rectification and segmentation of the MODIS data. Secondly, the collected 20 ground-measured ATs from Beijing Meteorological stations were separated into two groups. Each of which has 10 ATs. One group was used to training the relationship between LSTs and ATs, the other one was used to testing the established relationship. And finally, if the tested accuracy is within our proposed destination, then the whole image covering the Beijing governmental area were performed the determination of the AT using the derived and proved relationship between the AT and LST. And if the precision is not acceptable, the same training and testing procedures with different parameters would be continued until the precision is satisfied. Our results showed that the final absolute error between the derived ATs and the observed ATs is within 1 degree. Which is benefit for improving the precision in the global or regional climatic modeling, environmental monitoring and other modeling events using the parameter of AT.

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