Estimation of Spatial and Temporal Changes in Land Surface Emissivity to Improve Modeling of Evapotranspiration

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Abstract:

Accurate modeling of evapotranspiration (ET) with remote sensing requires a good characterization of land surface types, and especially an understanding of the spatial and temporal scales of vegetative cover. Current models typically derive land cover information from observations in visible and near infrared bands as summarized by vegetation indices. These essential observations, however, rely upon the ability to discriminate between green plants and bare soils and poorly characterize senescent vegetation. From the ET estimation perspective this inability may result in poor estimation of evaporative flux due to at least three problems: inaccurate modeling of surface roughness, net longwave radiation and surface moisture content. In all instances the inaccuracy is partly due to modeling land cover with too much bare soil and too little non-transpiring vegetation. A proposed ET modeling scheme that reduces these problems utilizes an additional data stream: land surface emissivity. Utilizing multispectral thermal infrared observations from satellite sensors such as ASTER and MODIS, emissivities can be estimated and used to improve the retrieval of land surface temperature, longwave radiation, and surface cover type. The impact of emissivity data upon ET estimates could be substantial at a wide range of spatial and temporal scales, ranging from the detection of recent rainfall, seasonal crop senescence, to inter-annual changes in rangeland vegetation. Examples of these will be demonstrated using ASTER and MODIS-derived emissivities over two study sites in the USA: the semi-arid rangeland at Jornada, New Mexico and the semi-humid croplands in the Southern Great Plains of Oklahoma and Kansas.

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