

Estimation and validation of land surface evaporation using remote sensing in North China

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There is a growing interest in quantifying regional scale actual evapotranspiration (ET) for water resource management. Using thermal and visible imagery from the MODerate-resolution Imaging Spectroradiometer (MODIS), in combination with meteorological data, a fully automated operational scheme can be used to estimate daily ET over 1-km grid covering North China. Surface Energy Balance System (SEBS) is adapted to partition the sensible heat from latent heat. Like other remote sensing approaches, it is constrained to work under clear-sky conditions when the surface temperature is assessible, leaving large gaps at both spatial and temporal. A reconstructed method for estimating ET during cloudy intervals is presented, defining a stress function related to the surface resistance from the fluxes output on clear days. On cloudy days, this stress function can be inverted to predict ET using Penman-Monteith approach.

Due to the inadequacy of the appropriate-scaled validation data, direct comparison between the model-estimated flux and the in-situ measurements can often be dominated by sub-pixel heterogeneity effects, making it difficult to assess the intrinsic model accuracy. In this paper, possible approaches to extending in-situ data to validating pixel-scaled flux estimation are adopted. SEBS is calibrated and validated using measurements from four flux sites in the semi-humid regions with different soil type, land cover and climate conditions in North China. The measured parameters include surface temperature, soil heat flux, crop height, net radiation, air temperature gradients, sensible heat flux, latent heat flux and evaporative fraction in two consecutive years. The gap-reconstructing method reproduces observed fluxes with reasonable accuracy, yielding similar to 15% errors in ET at daily timesteps and 5% at growing season timesteps.

Under temporal constrains from the ground data, the improved method could be used to study the impact of different agricultural water consuming patterns in North China. This work can also help to further understanding towards applicable models for the regional surface energy balance.

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