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The application of MODIS data in regional evapotranspiration modeling and water deficit monitoring

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Water resource is considered to be a major limiting factor on wheat growth in northern China plain, where irrigation has been an indispensable method to insure a stable agricultural yield. How to quantify the crop water consumption and realize a high efficient irrigation pattern has important implication on the local water resource management. Remote sensing can provide an efficient guide for irrigated agriculture through modeling actual evapotranspiration (ET) and mapping water deficit in a repetitive way and a large scale. Three models including P-M equation, Surface Energy Balance System (SEBS) and Two-Source Energy Balance model (TSEB) were used to model the regional ET. The P-M equation has been constrained in its application of actual evaporation modeling for the difficulty in estimating the surface resistance estimation. In this paper, the surface resistance in P-M equation was estimated from MODIS leaf area index (LAI) and the results showed good consistence with the flux tower observations. Therefore, the P-M equation was used to give initial estimation of canopy transpiration in TSEB model. However, it was found that TSEB model results showed not much improvements over SEBS in this semi-humid zone when the crop suffered no obvious stress with small difference between the air and surface temperatures. This was because the TSEB model had to be resolved under some assumptions when the temperatures of the soil and vegetation components can not be acquired directly and therefore suffered greater uncertainty in the determination of resistances and also in the input parameters derived from remote sensing data, e.g. fraction coverage and LAI. The drought index based on the ratio of the actual to potential ET using the sin-

gle source model can give reasonable estimation of the crop water stress when the vegetation cover fraction was large. However, the two-source model showed advantages under partial vegetation cover because it could distinguish the crop transpiration from soil evaporation.