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Spatially Downscaling Land Surface Temperature with a Non-Linear Model

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Abstract : Remote sensing-derived land surface temperature (LST) can provide an indication of the temporal and spatial patterns of surface evapotranspiration (ET). However, the spatial resolution achieved by existing commonly satellite products is ~1 km, which remains too coarse for ET estimations. This paper proposed a model that can disaggregate coarse resolution MODIS LST at 1 km scale to fine spatial resolutions at the scale of 250 m. Our approach attempted to weaken the impacts of soil moisture and growing statues on LST variations. The proposed model spatially disaggregates the coarse thermal data by using a non-linear model involving Bowen ratio, normalized difference vegetation index (NDVI) and photochemical reflectance index (PRI). This LST disaggregation model was tested on two heterogeneous landscapes in central Iowa, USA and Heihe River, China, during the growing seasons. Statistical results demonstrated that our model achieved better than the two classical methods (DisTrad and TsHARP). Furthermore, using the surface energy balance model, it was observed that the estimated ETs using the disaggregated LST from our model were more accurate than those using the disaggregated LST from DisTrad and TsHARP.

Keywords : Bowen ration, downscaling, evapotranspiration, land surface temperature
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