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Estimation of regional evapotranspiration for clear sky days over the North China Plain

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The triangle method combined with thermal inertia for estimation of regional evapotranspiration based on Feng Yun-2C(FY-2C) satellite data and MODIS products over the North China Plain is presented. FY-2C, China's first operational geostationary meteorological satellite which features 5 spectral bands (1 VIS and 4 IR), can acquire one full disc image of China (60° N - 60° S ,45° E - 165° E) per hour every day. Two thermal red channels (IR1: 10.3-11.3 μm) and (IR2:11.5-12.5 μm) were used for surface temperature estimation using a split window algorithm originally proposed for the MSG-SEVIRI sensor assuming the channel response function range of the two split-window channels for MSG SEVIRI and FY-2C are similar and that the center of channels are the same. For application of the improved triangle method taking thermal inertia into account, the surface-air temperature gradient in the Ts-NDVI space, was replaced by the surface temperature temporal change estimated from the Land Surface Temperature at hours 8:00 and 12:00 in local time (Ts). Combined with the 16 days composite MODIS Vegetation Indices product (MOD 13) at spatial resolution of 5 km, evaporative fraction was estimated by interpolation in the Ts-NDVI triangular-shaped parameter space. Subsequently, regional actual evapotranspiration was estimated based on the derived evaporative fraction and available energy estimated from satellite data. In the piedmont plain with high NDVI and low Ts, evapotranspiration rate is high because of irrigation of winter wheat. In the coastal plain NDVI is low and also Ts is low as high evapotranspiration rates are sustained water supply from shallow water table. Ground-based measurements of evapotranspiration were retrieved from a lysimeter at the Luancheng eco-agricultural station of China Academy of Sciences. These data are representative for evapotranspiration in the piedmont plain and were used for validation of the actual evapotranspiration retrievals from the remote sensing data.