

# STUDY ON HETEROGENEITY OF REGIONAL EVAPOTRANSPIRATION RETRIEVED BY SATELLITE SENSORS

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## **Abstract:**

The calculation of evapotranspiration and its components transpiration are of crucial importance in dynamic crop-weather models, irrigation models and SVAT models. Compared with other methods (micrometeorological, climatological, or hydrological method), remote sensing-based land surface models have demonstrated ability to provide spatially distributed estimates of energy fluxes/evapotranspiration (ET) over large areas. However, the ability to capture the full range of variability in the fluxes is dependent on the resolution of the remote sensing data.

Over the last few decades, there has been a focus on better determining evapotranspiration and its spatial variability, but for many regions routine prediction is not generally available at a spatial resolution appropriate to the underlying surface heterogeneity. Over agricultural regions especially in China, this is particularly critical, since the spatial extent of typical field scales is not regularly resolved within the pixel resolution of satellite sensors. Clearly, for landscapes with significant variability in vegetation cover, type/architecture, and moisture, the spatial resolution of the remote sensing data is crucial for discriminating fluxes for the different land cover types and hence avoiding significant errors due to application of a land surface model to a mixed pixel containing large contrasts in surface temperature and vegetation cover. High resolution remotely sensed data is seemly to discriminate the differences over heterogeneous landscape, but we are inclined to use MODIS data (high temporal resolution, free of charge) to estimate regional ET. At such coarse spatial resolutions, the capability to monitor the impact of land cover change and disturbances on ET or to evaluate ET from different land covers is severely hampered. So, understanding the role of landscape heterogeneity and its influence on the scaling behavior of surface fluxes as observed by satellite sensors with different spatial resolutions is a critical research needed.

In this study, data from Landsat-ETM (60m), MODIS (1km) satellite platforms combined with meteorological data are employed to independently estimate evapotranspiration. The

results derived at these two resolutions were assessed against eddy covariance flux measurements. Comparisons of energy balance components (net radiation, soil heat flux, sensible and latent heat flux) with measured fluxes were made. The better agreement between the estimates at high resolution and the tower flux measurements indicates that the remote sensing model is appropriate for estimating regional evapotranspiration over heterogeneous surfaces. Histograms of the flux distributions and resulting statistics at the different pixel resolutions are compared and contrasted. Furthermore, a comprehensive scale intercomparison of remotely sensed predictions, which include intercomparisons of the evapotranspiration products from the two sensors. The results showed that the differences between the two RS data estimations are remarkable. In order to further investigate the scale effect of remotely sensed ET, the ETM+ maps were transformed from 60m resolution to 1000 resolution using a scaling-up technique and empirical method, the differences between ETM+-1km-simulated fluxes with MODIS data can be regarded as the “spatial scale error” of ET at lower resolution. Finally, The effect of pixel resolution on evaluating the performance of the land surface model and interpreting spatial variations of land surface fluxes over these heterogeneous areas is evaluated and Landsat-ETM (60m) classified data is used to improve the fluxes retrieved by MODIS data.

Heterogeneity effect on regional ET is a complicated issue. This knowledge is very useful for correction of scale error of ET estimation, and can also be used to study the spatio-temporal effect of remotely sensed ET, which is going to be carried out in the future.

**Key words:** Evapotranspiration(ET); Remote Sensing; Heterogeneity; Energy Balance method

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