



Evaluation of daytime evaporative fraction from MODIS TOA radiances using FLUXNET observations

Jian Peng and Alexander Loew

Max Planck Institute for Meteorology, Bundesstr 53, 20146 Hamburg, Germany (jian.peng@mpimet.mpg.de)

The LST/NDVI (Land Surface Temperature/Vegetation Index) feature space has been widely used to estimate ET (Evapotranspiration) or EF (Evaporative Fraction, defined as the ratio of latent heat flux to surface available energy) in recent decades. Traditionally, it is essential to pre-process satellite TOA (top of atmosphere) radiances to obtain LST and NDVI before estimating EF. However, pre-processing TOA radiances is a cumbersome task including corrections for atmospheric, adjacency and directional effects. Based on the contextual relationship between LST and NDVI, some studies proposed the direct use of TOA radiances instead of satellite products to estimate EF, and found that use of TOA radiances is applicable in some regional studies. The purpose of the present study is to test the robustness of the TOA radiances based EF estimation scheme over different climatic and surface conditions. Flux measurements from 16 FLUXNET (a global network of eddy covariance towers) sites were used to validate the MODIS (Moderate Resolution Imaging Spectro radiometer) TOA radiances estimated daytime EF. It is found that the EF estimates perform well across a wide variety of climate and biome types – grasslands, crops, cropland/natural vegetation mosaic, closed shrublands, mixed forest, deciduous broadleaf forest, and savannas. The overall BIAS (mean bias error), MAD (mean absolute difference), RMSD (root mean square difference) and R (correlation coefficient) values for all the sites are 0.018, 0.147, 0.178 and 0.590, respectively, which are comparable with published results in the literature. We conclude that the direct use of measured TOA radiances to estimate daytime EF is feasible and applicable, and would facilitate the relevant applications where minimum pre-processing is important.