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Remote sensing of global land evapotranspiration with energy balance method

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Remote sensing has provided us with an opportunity to observe Earth land surface. The spectral information from remote sensing can be used to provide information on land-air interaction. A completely satellite observationally-driven, spatially and temporally continuous ET product is urgently needed. However, there are some challenges when applying remote sensing variables to calculate global land-air heat and water exchange fluxes. A global turbulent exchange parameterization scheme was developed for global momentum and heat roughness length calculation with remote sensing information. The roughness length was used in an energy balance model, which uses land-air temperature gradient to estimate the turbulent sensible heat (H), and take the latent heat flux as a residual of the available energy (net radiation minus ground heat flux) and H. Unlike most ET thermal remote sensing models which are constrained to work under clear-sky conditions, two gap-filling methods have been used to avoid gaps in the daily ET data. A global daily evaporation product without spatial-temporal gaps for 2000-2017 is delivered by using an energy balance (EB) algorithms and MODIS satellite data. It provides us with the first ever moderate resolution estimates of ET without spatial-temporal gaps on a global scale. The model is driven by instantaneous remote sensing land surface temperature and daily meteorological data. The performance of evapotranspiration (ET) data has been evaluated in comparison to 230 flux sites measurements representative of a broad range of biomes and climates at the global scale. The gap-filling algorithm reproduces observed ET with reasonable accuracy. The daily ET product has a mean bias of 0.04 mm/day, with the RMSE value of 1.56 ($\pm$0.25) mm/day. In addition, this algorithm is generic enough that it can be applied to polar or geostationary satellite thermal sensors, e.g. Sentinel 3A&3B, and FengYun 3B&3C. The talk will also discuss the application of the ET data to water balance, water resource management in 'One Belt One Road' region. Some potential interesting research question for this region will be suggested and discussed.