Geophysical Research Abstracts
Vol. 20, EGU2018-3772, 2018
EGU General Assembly 2018

Estimating the Aerodynamic Roughness Length over Farmland Using Proba-V 300m Products

Mingzhao Yu (1,2), Bingfang Wu (1,2), Qiang Xing (1), and Hongwei Zeng (1)

(1) Key Laboratory of Digital Earth Science, Institute of Remote Sensing and Digital Earth,Beijing, China (yumz@radi.ac.cn), (2) College of Resources and Environment, University of Chinese Academy of Sciences,Beijing, China (yumz@radi.ac.cn)

The aerodynamic roughness length z0m is a crucial parameter for reliably simulating the turbulent exchange between land surface and atmosphere. In most fluxes simulation models, z0m is usually considered as a simple parameter related to underlying surface types. Many researchers acquired z0m value from the look up table. While these look-up approaches ignore the inherent temporal and spatial variability of land cover, as well as the concomitant effects on heat transfer. For crops in particular, key variables affecting z0m over farmland are the mean canopy height, the canopy structure and the plant density, moreover, the annual variability of crop phenology and daily variability of crop development are major sources of uncertainty for z0m assessment, so it's important and effective to use multi-temporal remote sensing data to retrieve z0m for farmland.
Based on the normalized difference vegetation index (NDVI), a new vegetation index—the hotspot-darkspot vegetation index (HDVI)—is proposed to improve the quantitative estimation of the aerodynamic roughness length over farmland. To obtain this new index, the normalized-difference hotspot-darkspot index (NDHD) is introduced using a semi-empirical, kernel-driven, bidirectional reflectance model with multi-temporal Proba-V 300-m top-of-canopy (TOC) reflectance products. This paper aims to develop an innovative method for estimating z0m for different crop types using two field automatic weather station (AWS) data sets: one is located in Guantao County in Hai Basin, in which double-cropping systems and crop rotations with summer maize and winter wheat are implemented, and the other is in the Heihe River Basin with spring maize as the dominated crop. An iterative computation algorithm based on Monin-Obukhov similarity theory is employed to calculate the field z0m in time series. The NDHD from near-infrared (NIR) reflectance contains more meaningful bidirectional reflectance distribution function (BRDF) information than the red reflectance, and the linear relationship between HDVI and z0m can be determined in the crop growth period.
Results show that the relationship between HDVI and z0m is more pronounced than that between NDVI and z0m. These differences probably originate from the crop-ripening stage and harvest period, indicating that the significant impact of the crop residue on z0m can be captured by NDHD. The preliminary results of calibration and validation showed that the model could be used to estimate z0m over farmland. In addition, the estimated aerodynamic roughness is utilized to calculate evapotranspiration (ET) in the ETWatch system to evaluate the ET improvement with Eddy Correlation(EC) measured latent heat flux, which shows that the new estimated method for z0m can improve the accuracy of ET calculation over farmland effectively.