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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Complementary Relationship for Estimating Evapotranspiration Using the Granger-Gray Model: Improvements and Comparison with a Remote Sensing Method" *by* Homin Kim and Jagath J. Kaluarachchi

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ET estimation methods can be divided into two categories: (1) ground-based ET that use standard meteorological data; and (2) ET models that based on remote sensing data that must be combined with retrieval algorithms to estimate ET in accordance with McMahon et al. (2016). From the study of Kim and Kaluarachchi (2017), the model without a 'f' function was validated by comparing with other complementary relationship models including CRAE, GG, AA, and Modified GG (Anayah and Kaluarachchi, 2014) with the 59 eddy-covariance sites measured ET. The mean RMSE of our model

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across the 59 sites was 14 mm month-1 compared to 21 mm month-1 of CRAE, 28 mm month-1 of AA, 27 mm month-1 of GG, and 17 mm month-1 of the Modified GG. We showed these comparison results presented in Figure 1 without GG and AA models because the validation of our model with original ET methods was the purpose of the previous study of Kim and Kaluarachchi (2017). For further information, the Modified GG model also was validated with CRAE, AA, and GG across 34 global sites. Since these findings are good within the first category (ground-based ET), the subject of this study was to validate our model with the widely used remote sensing method (SSEBop, Senay et al. 2013) that was developed by USGS. We agree with the evaporation fluxes and validation comments. For the evaporation comment, we collected the level 4 measured meteorological data and latent heat flux (LE) data at 76 AmeriFlux towers then we excluded those towers with actual vegetation type different from MODIS land cover type at any surrounding 3x3 km2 pixels. Then, we further excluded those towers with less than half a year of measurements during 2000-2007. Finally, 60 sites were involved in this study. We also know about the limitation of the NDVI. Several studies (Pettorelli et al. 2005, Yuan et al. 2010, Mu et al. 2011) recommended instead of NDVI for heterogeneous areas with LAI (Leaf Area Index) and SAVI (Soil-Adjusted Vegetation Index). However, these indices also have limitations that they require more data. For the most efficient process, we adopted the NDVI with theoretical backgrounds (Yang et al. 2006, Zhang et al. 2004). More research is needed to better understand the heterogeneous vegetation. Also, further validation is also needed to establish the robust equation as the comment. In this study, we attempted to demonstrate the limitation of complementary relationship which refers to a symmetric relationship and to introduce the enhance method with a correction function. Although the current study is based on 60 eddy covariance sites, the further study is regarding the other data sources including remote sensing data across the United States to follow the suggestion and could assess the potential applications of ET.

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