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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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The method we used in this study was not outdated. The starting point of this study was further refinement of the study of Anayah and Kaluarachchi (2014). Their ET method applied to estimate groundwater recharge in Ghana (Anayah et al., 2013) and assess the drought condition across the United States (Kim and Rhee, 2016). Meanwhile, we developed the GG-NDVI model to overcome the limitation of Anayah and Kaluarachchi (2014) and validation with other CR methods including CRAR, GG, and AA models was done in Kim and Kaluarachchi (2017). Additionally, the

Granger and Gray (1989) model is still ongoing research. For example, Zhu et al. (2016) evaluated the GG model using 12 eddy covariance flux stations in China. The purpose of this study was further validation with the widely used remote sensing method, SSEBop, developed by USGS (Senay et al., 2013). According to Senay et al. (2013), SSEBop was validated using 45 eddy covariance stations in the United States and Velpuri et al (2013) also used 60 eddy covariance stations in AmeriFlux for a comprehensive evaluation of MODIS global ET and SSEBop. Out validations were in line with these studies. We collected the level 4 measured meteorological data and latent heat flux (LE) data at 76 eddy covariance AmeriFlux stations then, we excluded those stations with actual vegetation type different from MODIS land cover type at any surrounding 500 m by 500 m pixels. Then, we further excluded those stations with less than half a year of measurements during 2000-2007. Finally, 60 sites were involved in this study without possible fluxes from heterogeneous vegetation. The manuscript is modified in Lines 3-7 at Page 8. Importantly, we did not disregard the recent study of Szilagyi et al. (2017) and Crago et al. (2016). Then, Crago et al. (2016) model was calibrated their parameters. They mentioned that the coefficients, a0, a1, a2, and a3, may be selected on physical grounds or through calibration and these values have been calibrated for their study and no additional requirement beyond those for any application of CR methods. Also, Szilagyi et al. (2017) noted that calibration of the parameters alpha and s0 were performed by a systematic trial and error approach and the objective function of calibration consisted of minimizing the RMSE between mean annual ET estimates and water balance derived ones. This process was similar to our model's. The Omega value in Eq. (7) was derived through a curve fitting procedure that minimizes RMSE between the measured and predicted evaporation ratio as mentioned in Line 16-17 at Page 6. Moreover, our model's parameters, alpha and beta in Eq. (18), do not need calibration anymore beyond this study such as Crago et al. (2017) mentioned. Also, k in Eq. (14) is constant and a recommended value of k is 1.2 for the United States. We excluded the additional sentence of Line 23-24 at Page 7 to avoid confusion and added studies of Szilagy et al. (2017) and Crago et al.

(2016) as references. Please see Lines 15 and 31-32 at Page 2. Unfortunately, we did not have much time to compare and review the study of Szilagy et al. (2017) because the current study was done before Szilagy et al. (2017) published. As the reviewer mentioned, it would be interesting to assess the scale issue and compare with the calibration-free version of CR. This is future research worthy of consideration.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2017-346/hess-2017-346-AC3-supplement.pdf

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