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Supplement of

Global 5 km resolution estimates of secondary evaporation including irrigation through satellite data assimilation

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Evaluation of energy balance components against FLUXNET site observations

We used a selection from the 'La Thuile' flux tower observation to evaluate model background estimates of energy balance components. The data selection and processing were described by Van Dijk et al. (2015).

Very few of the FLUXNET sites were in any way affected by irrigation or lateral water inflows, and therefore the comparison should be seen as an evaluation of the background model rather than the estimates of secondary evaporation. The latitude and longitude of flux tower locations was used to extract the corresponding 0.05° grid cell from the model forcing and simulated variables. The influence of sub-grid heterogeneity was not accounted for and would need to be considered on a case-by-case basis in interpretation.

The quality of energy balance estimates based on eddy covariance measurements is poor on days with rainfall and therefore only dry days were considered. Comparison in annual means showed good agreement between simulated and measured λE , with a median difference of 2 W m^{-2} or 5% of the flux ($N=169$; Figure S1a). There was a systematic difference between H estimates however, with a median difference of 16 W m^{-2} or 35% (Figure S1b). When expressed as evaporative fraction $EF=\lambda E/(\lambda E+H)$ there was no systematic bias between the model and observations, with a median difference of 0.04 or 9%, although a lesser fraction of variance was explained (Figure S1c). The difference in H estimates corresponds with a missing energy term in the eddy covariance observations (median 19 W m^{-2} or 22%; $N=109$) (Figure S1d). The main cause for the well-known energy balance closure problem under dry daytime conditions remains unresolved and hence it is unclear whether it is primarily λE or H (or, less likely, A) that are in error (see Van Dijk et al., 2015, for discussion).

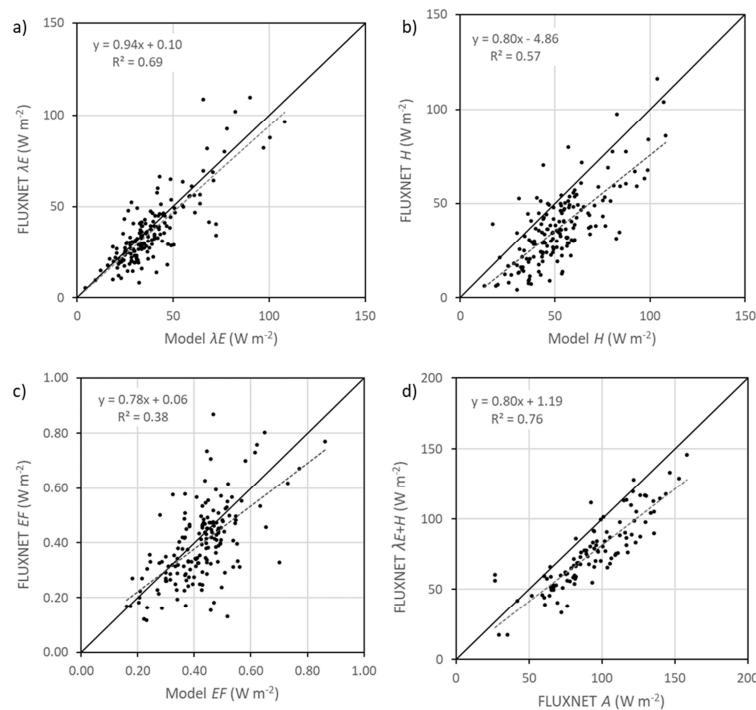


Figure S1. Comparison of model-estimated and measured energy balance components at FLUXNET sites, showing scatterplots of mean annual a) latent heat flux, λE ; b) sensible heat flux, H ; c) evaporative fraction EF ; and d) scatterplot the sum of latent and sensible heat flow vs. net available energy (A).