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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Upscaling instantaneous to daily evapotranspiration using modelled daily shortwave radiation for remote sensing applications: an Artificial Neural Network approach" *by* L. Wandera et al.

Anonymous Referee #3

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This paper assesses the performance in retrieving daily solar incoming radiation from instantaneous estimates using an ANN algorithm and ancillary earth-sun geometrical parameters, and subsequently the performance of upscaling instantaneous evapotranspiration estimates to daily totals using daily solar radiation derived from the ANN as an upscaling support variable. The latter is also compared to two classically used methods (using respectively the TOA solar radiation as a support variable and the evaporative fraction selfpreservation).

Main concern:

I don't see the point of upscaling ETi to ETd for days where instantaneous observations in the optical domain are not available from satellite platforms: instantaneous ETi estimates are usually produced with instantaneous data in the optical domain, typically Thermal Infra Red data, and are therefore not computed for low transmissivities, airborne platforms excepted. Days with low instantaneous (10AM, 1:30PM) transmissivities should be left out of the study i.e. the study should restrict to clear sky conditions from either MODIS cloud mask or, better, geostationary information (the CERES algorithm mentioned here).

I therefore doubt that there is any use of the method for "Remote sensing applications" as mentionned in the title, except for UAV applications. Actually, it is interesting to note that even for clearsky conditions the ANN method shows worse performances than the classical method based on the sole earth-sun geometrical parameters.

Estimating ETR between 2 successive clearsky days is an interpolation problem (which could be also treated using ANN) which needs to be tackled also.

Main comments:

- I also share the main concern with referee 1 about Energy Balance Closure: lack of EBC should not be overlooked and is simple to correct for FLUXNET sites; it could explain the poor performance of the Evaporative Fraction method. Disregarding EBC is a major methodological flaw of the paper.

- As criticized also by referee 1, crops and semi-arid or even dry subhumid sites are underrepresented in the FLUXNET database, this should be more carefully commented. It adds up to my concern above about the practical application of the method: TIR-based daily ETR computation algorithms are particularly needed for water use monitoring in water depleted environments, much less for natural vegetation in temperate climates.

- Are the validation and the training datasets from different years ? It seems to me that

this is a requirement to use the method for future applications.

- What is the true added value of the ANN for future operational applications of the upscaling algorithm, say for an operational satellite product ? This aspect, although the original motivation of the paper, is somewhat overlooked in the discussion section. From Table 2, it appears that the TOA solar radiation-based method shows the best performances.

- For cloudy conditions the ETR upscaling method using instantaneous solar radiation as part of the training (even from another site) performs slightly better than that based on the sole TOA solar radiation : is it mostly due to the fact that the ANN adds information on actual incoming radiation obtained at a "nearby" FLUXNET location ?

Minor comments:

In introduction one should add a review of which upscaling support variables can be derived from remote sensing data directly, which can be obtained indirectly from either RS data or any other distributed routinely produced data and those not obtainable from remote sensing or other distributed operational datasets.

How do you manage nighttime conditions ?

Move P5L1-4 to the end of this section and precise the variables fed by ANN upfront there.

P8 L11-15: It is not clear, why is there a testing dataset and a separate validation dataset within the training dataset ?

P9L5: Why use transmissivity rather than the ration between actual and theoretical clearsky radiations to separate the various cloudiness bins ? (in order at least to separate winter conditions with lower clear sky transmissivity from summer conditions)

P14L10: “would likely”: this can be checked, is it the case ?

P13L12: “reasonable” > “reasonably”

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