

Ecohydrologic Hypotheses Revisited: Synthesis with a Global Observation Network, *Fluxnet*

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We propose to use the La Thuile *Fluxnet* dataset to evaluate fundamental hypotheses in the field of ecohydrology. This outline briefly describes analyses planned to address two specific hypotheses.

The Budyko Curve: Eco-climatic variation of the surface water balance (Budyko 1974)

Do observed relations between actual evapotranspiration, potential evapotranspiration, and rainfall conform to the Budyko prediction, and to what might departures be attributed?

This analysis will investigate monthly to annual timescale dryness index (potential evapotranspiration / rainfall) and evaporative index (actual evapotranspiration / rainfall) for comparison to the Budyko Curve. Site-level attributes, such as seasonality of precipitation, vegetation cover, leaf area, and type, as well as soil type, will be explored for possible explanation of departures.

Controls on ET decay and the two-stage hypothesis

How eco-climatic conditions (vegetation and soil type, annual rainfall and seasonality, etc.) influence the temporal decay of *ET/PET* with moisture limitation is poorly understood and the Fluxnet synthesis dataset will likely provide valuable insights on the topic. We will evaluate a wide range of models proposed to describe this relation, one of which is the two-stage model (Shouse et al. 1982), where the first stage describes the period over which evaporation equals the potential rate, and the second stage is initiated when the evaporation becomes fully controlled by resistances that limit the rate of soil water movement to the surface (Brutsaert 1982, Parlange et al. 1992). Extension of the two-stage model from its bare soil origin to vegetated surfaces is non-trivial because transpiration relates to plant water extraction that adapts to water availability throughout a spatially distributed rooting volume, not just at the surface, and plants exert an added resistance from stomatal limitation (Jones 1983, Larcher 1995). We intend to analyze functional relationships between *ET*, *PET*, rainfall, soil moisture (where available), and a surface water balance index to study how well the two-stage approximation and other proposed forms describe *ET* decay with surface drying, as well as to study how parameters of fitted-functional forms vary with site characteristics. In addition, we intend to explore to what degree variation in vegetation cover and leaf area influence the structure of *ET* decay with drying.

This is a global synthesis, and we will, via email to the global fluxnet synthesis email list serve (assisted by ORNL), distribute this proposal, request the privilege of data use, and invite participation from site PIs from all sites that have at least one year of observations of evapotranspiration, shortwave radiation, and air temperature each less than ~40% gap filled during daylight hours. If at any time prior to publication, a data provider decides to disallow the use of his/her data, that restriction will be honored and the data will not be used in these analyses. Co-authorship rules will be as follows. All the data providers will be invited to give

intellectual input, meaning ideas for methodology, original analyses, insights for discussion, or original authorship of part of a paper. Before submission, data contributors will be informed of the lead investigator's intention regarding authorship on a manuscript and will be invited to comment and make a request for inclusion or exclusion from authorship on a particular manuscript. In the hopefully unlikely event of an apparent conflict regarding authorship we will request mediation or suggestion from the Scientific Moderation Committee. Finally, this approach may be improved upon and we welcome suggestions of how we might do so.

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