PROPOSAL FOR FLUXNET SYNTHESIS PUBLICATION

Initial coordinators:: Han Zheng[1], Gui-Rui Yu[1], Qiu-Feng Wang[1],

Collaborators needing access to data: Xian-Jin Zhu[1], Shi-Jie Han[2]

Affiliations: [1]Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, [2] Institute of Applied Ecology, Chinese Academy of Sciences

DATASET PROPOSED

LaThuile

TITLE OF PAPER AND OUTLINE

TITLE: Improving the performance of Budyko framework in predicting evapotranspiration of terrestrial ecosystems with FLUXNET data

Description

Evapotranspiration (ET) is a major component of both terrestrial water cycle and surface energy balance. Knowledge of the magnitudes and spatial variation of actual evapotranspiration (AET) is essential for not only determining the water requirements over natural vegetation and agricultural systems but also for the regional water management under climate change.

The Budyko framework elegantly reduced the complex spatial variation of AET and run-off to a general function of two variables: mean annual precipitation (MAP) and mean annual potential evapotranspiration (PET) and it has been proved to be a useful model for predicting catchment energy and water balances. Recently, by synthesizing the AET measurements across a global network of flux towers, Williams et al. (2012) has proved that the relationship between dryness index (PET/MAP) and evaporative index (AET/MAP) of global terrestrial ecosystems showed a broadly consistent with catchment-scale relations. And our results from flux sites of China also proved it. Thus, the Budyko framework, one of the most enduring theories for hydrological science, has its potential to estimate AET of terrestrial ecosystems in some settings.

The Budyko curve can be expressed as the functional form of Pike (1964) with Choudhury's (1999) adjustable parameter α , i.e.,

$$\frac{AET}{MAP} = \frac{1}{\left(1 + \left(\frac{MAP}{PET}\right)^{\alpha}\right)^{1/\alpha}} \qquad (1)$$

The adjustable parameter α can reflect the effects of surface characteristics, including topography, soil and vegetation characteristics, etc.

Results of Williams et al. (2012) showed that there were sizeable departures from the general predictions fitted by mean annual data of all sites when *α* was set as a constant. It means that, if we could find the variation patterns and influencing factors of *α*, we can explain the potential factors contributing to those departures. Also, if we could express *α* with an empirical or semi-empirical equation, Equation (1) would be more powerful in predicting AET of terrestrial ecosystems.

Therefore, on the basis of the FLUXNET dataset and Williams et al. (2012)'s work, we would like to analyze the variation patterns and influencing factors of Choudhury's (1999) adjustable parameter *α*, and then propose an approach to calculate it. Our research aims at improving the performance of Budyko framework in predicting AET of terrestrial ecosystems.

Main references:

Williams, C.A. et al., 2012. Climate and vegetation controls on the surface water balance: Synthesis of evapotranspiration measured across a global network of flux towers. Water Resour. Res., 48(6).

Pike, J., 1964. The estimation of annual run-off from meteorological data in a tropical climate. Journal of Hydrology, 2(2): 116-123.

Choudhury, B., 1999. Evaluation of an empirical equation for annual evaporation using field observations and results from a biophysical model. Journal of Hydrology, 216(1): 99-110.

PROPOSED SITES TO BE INVOLVED

All sites with enough and good quality data. Flux data, core variables and their quality control flags will be needed at 30 min scale.

PROPOSED RULES FOR CO-AUTHORSHIP

The rules as proposed in the disclaimer for the FLUXNET2007 synthesis will be applied.