

## ***Interactive comment on “Estimating actual, potential, reference crop and pan evaporation using standard meteorological data: a pragmatic synthesis” by T. A. McMahon et al.***

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First of all I would like to commend the authors on the breath of work they have taken up. I think their study will become an instant work of reference people will consult many-many times in the coming years.

I would like to point out one minor typo in their TableS13: The ET and precipitation values are for a year, not for a day, as the unit in the title of the Table suggests.

I would also like to submit a comment concerning the Budyko approach that relates the mean annual value of  $E/P$  to  $E_w/P$  ( $E$  is actual,  $E_w$  is a certain potential evaporation C4875

rate and  $P$  is precipitation), in a functional form.

Szilagyi and Jozsa (2009) realized that the sought for functional relationship can be expressed by the Complementary Relationship (CR) of Eq. (15) of McMahon et al.

$$E = 2E_w - E_{pot} \quad (1)$$

by dividing both sides by  $P$  and factoring the  $E_w/P$  term out to obtain

$$E/P = (2 - E_{pot}/E_w) E_w/P \quad (2)$$

In the CR  $E_w$  is the wet environment (potential) evaporation rate, while  $E_{pot}$  is the Penman potential evaporation rate. As Morton argues, the main difference between the two types of potential evaporation terms is due to their differing size: the former has a regional extent ( $E_w$ ) while the latter is the size of a pond ( $E_{pot}$ ).

So this way the CR tells us how the function in the Budyko equation can be obtained: i.e., by the ratio of two types of potential evaporation rates, both valid under energy-limited conditions, but one is affected by advection of energy due to its small size.

I think this is an important issue, most people are not aware of. Note that the  $E_{pot}/E_w$  ratio can incorporate the changes of environment, as Donohue et al. and Zhang and Chiew note, referenced in McMahon et al., about the Budyko approach.

So this way two different pieces of the evaporation puzzle are connected and it still takes time to figure out the ensuing implications.

Reference:

Szilagyi, J. and Jozsa, J. 2009. Complementary relationship of evaporation and the mean annual water-energy balance, *Water Resources Research* 45, W09201 doi:10.1029/2009WR008129.

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