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Discussions

Interactive comment on "At which time scale does the complementary principle perform best on evaporation estimation?" *by* Liming Wang et al.

Liming Wang et al.

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Response to interactive comment on "At which time scale does the complementary principle perform best on evaporation estimation?" by Liming Wang et al.

Anonymous Referee #1

General response: Thank you for the timely review. We are very happy to hear the critical voice although we do not agree with many of them. We would like to discuss these contradictions with the reviewers. In the following we provided point-by-point responses as follows.

-The MS is carelessly written. It should be thoroughly rechecked for grammar, typos, language constructs.

Response: Thank you for the comments. We will go through and revise the manuscript thoroughly and hire some language experts to help polish the manuscript again.

-For example, the AA method is mentioned several times before it is explained.

Response: Thank you for pointing out this problem. we had provided the full name for it when the first time it is mentioned (Line 54-56, hereafter all lines numbers are based on the tracked version). Also, we moved the explanation from the methodology part to the introduction part.

-Also, the first asymmetric AA method was of Kahler and Brutsaert (2006), and not by Brutsaert and Parlange (1998).

Response: According to our reading, Brutsaert and Parlange (1998) provided the following equation in their paper: E=[(1+b) E0 - a Epa]/b where, E0 has the same meaning of Epo in our manuscript (i.e., potential evaporation), and a is a pan coefficient, b is an asymmetric parameter. Our statement "the CR was extended to a linear function with an asymmetric parameter (Brutsaert and Parlange, 1998)" refers to this equation.

Kahler and Brutsaert (2006) summarized the previous work of Brutsaert and Stricker (1979), Brutsaert and Parlange (1998), and Brutsaert (2005) and gave the equation:

(1+b) E0=Cp Epa+bE where, Cp is a constant parameter. We can see that this equation holds the same format with Brutsaert and Parlange (1998) after appropriate transformation (and replacing Cp with a). It may be the first time it was called "asymmetric AA". Thank you.

-Also, nobody reads the original work of Bouchet (1963), it seems, as it is in French. That may be the reason for frequent misquoting it. My understanding is that he never proposed a symmetrical CR. Even Brutsaert in his seminal book (1982) is controversial about this issue. The authors should clarify this issue though.

Response: Yes, the original work of Bouchet (1963) is French. In our institute of Tsinghua University, we have a PhD student coming from France, and he had translated this paper into English several years ago. We are pleased to provide the English version of Bouchet (1963) at the end of the response (Supplement) for the reference. After reading this paper, we suggest that the contribution of Bouchet (1963) should be respected.

Equation (5) and Figure 2 of Bouchet (1963) show a symmetrical complementary relationship: ETP+ETR=2 ETP0 where, ETR is the energy corresponding to the real evapotranspiration, ETP is corresponding to Epa, and ETP0 is corresponding to Epo.

In the book of Brutsaert (1982, p224-225), the above equation is cited as equation (10.35), and Brutsaert said that Bouchet (1963) arrived at the complementary relationship and admit Bouchet's approach contains worthwhile ideas and led to further developments. Brutsaert thought this method is not used widely because the assumption is strict and it did not provide exactly measures of Epa and Epo.

Thank you.

-I do not really see what we gain from this study. The high NSE value for the month comes about because its high variance between months and it is already being long enough to smooth things out.

Response: The aim of this study is to investigate at which time scale the complementary principle performs best on evaporation estimation. Based on this reviewer's comment, we understand that the reviewer gained that complementary functions perform best at the monthly scale. Actually, it's exactly what we want to convey to the audience. We did not find the evidence in previous studies or theoretical derivation which had already revealed this conclusion. Without these results, it is still uncertain how long is "enough to smooth things out". It could be 7 days, 30 days or 90 days. We agree with the reasons for the high NSE value at the monthly scale given by the reviewer, these reasons are also discussed in our manuscript (Line 236- 241). The "high variance" can be corresponding to our explanation about "variabilities of x and y" (Line 240), and the "smooth things out" can be corresponding to our explanation of RMSE. Thank you.

-I bet that between Mays, Junes, Julys, etc., the NSE value would not be better than for the seasons and years.

Response: We are not very clear about this comment. In the current version, the study periods are from April to September for the Northern Hemisphere and from October to March for the Southern Hemisphere. Did the reviewer mean that if the study periods are shortened (e.g, from May to July), the NSE values at the monthly scale will be worse than for the seasons and years? We have provided the results for May to July in Table R1. In this situation, the seasonal result is equal to the annual result and there is one seasonal result (May to July) each year. These results still support our conclusion. The NSE values at the monthly scale (NSEH = 0.38 and NSEB = 0.32) are higher than those at the seasonal/annual scale (NSEB = −0.07 and NSEB = −0.05). Thank you for providing an opportunity to test the uncertainty in the length of study periods.

Table R1. The evaluation merits (NSE, R2 and, RMSE in W m−2) of the two generalized complementary functions from May to July (The table is better viewed in the supplement) ãĂĂ Month Season/Year NSEH [0.38] [−0.07] NSEB [0.32] [−0.05] R2H [0.63] [0.56] R2B [0.63] [0.56] RMSEH [12.17] [8.86] RMSEB [21.51] [8.81]

-The low value for the annual time-scale is a bit worrisome as it means that these two chosen methods cannot replicate any long-term trends in ET rates to acceptable accuracy, which diminishes their potential values for long-term hydrological modeling.

Response: Yes, the complementary functions perform worse in estimating E at the annual scale. To the best of our knowledge, this point had not been thoroughly discussed previously. We did not recommend choosing the annual scale as the timestep to estimate E because of the low efficiency. However, we can still replicate the long-term trends in E rates by adopting the monthly timestep. Thank you.

The response file can be found in Supplement. But the revised manuscript was not submitted as supplement following the introduction of the journal.

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Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2020-379/hess-2020-379-AC1-supplement.pdf

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