

# ***Interactive comment on “Attribution of growing season evapotranspiration variability considering snowmelt and vegetation changes in the arid alpine basins” by Tingting Ning et al.***

## **Anonymous Referee #2**

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Title: Attribution of growing season evapotranspiration variability considering snowmelt and vegetation changes in the arid alpine basins

Authors: Ning et al

This manuscript aimed to extend previous framework of temporal variance decomposition in snow-dependent basins by incorporating the effects of snowmelt and vegetation changes. The topic is interesting and the manuscript is well structured. However, I have serious concerns with the methods and results (especially the robustness of the estimates of water cycle components) in the manuscript.

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## Comments

1. In this study, the total water storage is estimated using the GLDAS soil moisture and plant canopy surface water. Is this estimation reliable? More details about the methods (or additional comparison) may be needed to show the robustness of the total water storage estimation.
2. The degree-day model is used to estimate the equivalent of snowmelt runoff. In this model, the degree-day factors (DDF) in the study basins are fixed (if my understanding is correct here) and vary from 1.7-4.0 mm/day $\hat{A}$ °C. Is there any uncertainty/validation of these factors? How the variation of the DDF could possibly affect the results of snowmelt runoff?
3. The total water storage and snowmelt runoff estimates are then used to calculate ET. Is the obtained ET reliable in terms of the above two comments?
4. I do not understand the results in Fig. 3. For example, we can see there are black dots in panel (b) ( $P_e=R-dS$ ) with VERY low  $ET/P_e$  values (close to zero). If I understand this correctly, when replace  $P_e$  with  $R+Q_m-dS$  in panel (d), the  $ET/P_e$  should decrease as the  $Q_m$  is positive (Table 1). It means that these low  $ET/P_e$  values in panel (b) should be more close to zero (close to x-axis) in panel (d). However, I did not see any black dots close to x-axis. WHERE are they? The results in Fig. 3 are confusing and do not make sense.
5. Do the  $Q_s$  in the equations and the  $Q_m$  in the figures have the same physical meaning? If so, please keep the symbols consistent in the manuscript.
6. In this manuscript, the term “temporal variance” is used in growing season by simply extending previous studies (e.g., Liu et al 2019). Is the definition of “temporal variance” in the growing season in this study the same as that in previous work? I cannot understand how it works in math. . .

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