

Interactive comment on “Climatic controls on watershed reference evapotranspiration vary dramatically during the past 50 years in southern China” by Mengsheng Qin et al.

Anonymous Referee #1

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This paper discusses the drivers of reference crop evapotranspiration (ET_o), as specifically defined in FAO56 (Allen et al., 1956), for the humid Qinhuai River basin in eastern China. The authors applied the Mann-Kendall test, the Theil-Sen estimator and a detrending approach to assess trends. Based on analyses of data from six meteorological stations extending for 1961 to 2012, the authors observed a decrease in ET_o over the period from 1961 to 1987 followed by an increase to the end of the period. They concluded that an increase in irrigation water demand for paddy rice crops is expected in the future.

General comments This paper is not a theoretical analysis but rather an application of standard procedures to a region in China where the specific procedures have not been

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applied. Given the nature of the contribution, the paper is excessively long. Nevertheless, I enjoyed reading the discussion in Section 4. The conclusions are supported by the analyses and the interpretation of results. I make the following recommendations.

1. Section 2.2 is well known material, and except for equation (1), the remaining material should be included as Supplementary Material.
2. I'm happy for Sections 2.3, 2.4 and 2.5 to be retained.
3. The results discussed in Section 3 need to be reduced to a small number of key observations. The current detail in Section 3 is unnecessary and very difficult to follow. All the information is shown clearly in the tables and figures which should be retained.

Specific comments

1. Ls48-50: Because the authors have adopted FAO56 reference crop equation (Allen et al. 1998) as the basis of their analysis, they need to be specific about the definition of a reference crop. A reference crop is defined as "A hypothetical reference crop with assumed crop height of 0.12 m, a fixed surface resistance of 70 s m⁻¹ and an albedo of 0.23" (Allen et al., 1998, page 23). Quoting a secondary reference like Liu et al. (2017) is inappropriate especially as the definition is not specifically correct.
2. L49: It is not necessary to have estimates of E_{T0} to determine actual ET. Actual ET is measured directly or through a water balance procedure where in some applications E_{T0} is an input.
3. Ls94-96: I think this statement is optimistic. Understanding climate controls on actual ET is much more important.
4. Ls100-104: I suggest you mention Theil-Sen estimator and the De-trending method here.
5. L108: It would be helpful to report all the percentage areas for paddy rice fields, dryland cropping, woodland and urban areas.
6. L112: Please indicate whether there were missing data and, if so, how were the time series infilled.
7. L115: I assume daily temperature was not measured but the result of averaging maximum and minimum temperatures. Please clarify in the paper.
8. L116: What is the relevance of the statement "Data from Jiangning station was available before 2007" when the authors say nothing about the data from the other five stations?
9. L150: This section requires a concluding observation stating which variables will be discussed in the following analysis especially as the authors do not consider sunshine hours yet include solar radiation which is not a vari-

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able measured at the meteorological stations. 10. L184: Before you begin discussing the results there needs to be a short explanation of the choice of climate variables you plan to discuss, noting that observed data are available for only four variables – wind speed, sunshine hours, relative humidity and temperature, yet you are including in your discussion solar radiation which is unknown but, I assume, is estimated by Equation (4). You do not tell the reader how R_a is estimated which is required to estimate R_s . 11. L191: The authors have not said why they are discussing R_s when it is not a measured variable. Why not discuss n (sunshine hours) for which data are available? 12. L195: I don't think the authors tell the reader that the E_{To} values used in the analysis are calculated values based on Equation (1). 13. L195: This section (3.1) would have been clearer to me if the mutation point (I think I'd rather use the terms 'change point' or 'turning point') was discussed initially and then follow with a discussion of trends. 14. Ls 364,365: Delete the sentence beginning "However". Because of the different periods examined, this sentence has little merit. 15. L418-421: This has not been discussed before. Delete. It is not a conclusion. 16. Table 1: Please replace all "-“ with the values of the trend. Although not statistically significant together they will provide a more complete picture of the trends. 17. Figure 2d: Please plot with same scale on both axes. 18. Add to Figure 2 caption before (a): 'Bars in the figures represent the average based on the six sites and the 52 years of data.' 19. Caption to Figure 5: Replace "1987" with '2012'. And delete from "and 1988-2012 ... (Tmin)"

Technical corrections L25: simply → simplifies L44: I suggest the authors do not use emotive terms like "dramatic". They are unnecessary. L52: Add 'a' between "provided" and "summary" L57: Suggest rephrase to '... and effective use of water resources in irrigation...' L65: has increased → increasing L79: Suggest rephrase to 'Our literature review suggests ...' L81: Suggest rephrase to 'and (iii) changes to E_{To} were affected not only by air temperature but ...' L97: Suggest rephrase to 'Based on previous studies of E_{To} in humid regions, ...' Ls118-119: Suggest rephrase to 'Accordingly, data for six periods were analysed: the four seasons, the annual period and the rice growing period.' L127: "Vapor pressure deficit" → 'vapor pressure deficit (VPD)' Ls173-174:

Suggest rephrase to ‘This method comprises three steps: (i) removing for each variable the trend to render the variable stationary, ...’ L176: Suggest rephrase to ‘... in ETo can be quantified by evaluating...’ L179: Characterize → is L179: “n” Would it not be better to use another letter here as ‘n’ is defined earlier as the number of sunshine hours? L181: More appropriately “R = 0” should be replaced by ‘R ≈ 0’ L182: lead → leads L188: “Table 2” should be ‘Table 1’ L191: Suggest replace “which was similar to” with ‘noted also by’ L202: Slops → Slopes L214: Suggest rephrase to ‘Variations in RH ...’ L215: State which decades L223,224: I don’t understand the sentence beginning “ETo of...”. Please rephrase. L226: Would it be correct to say ‘In each of the four seasons, the mean values ...’ Ls234-235: This maybe better expressed as ‘The daily detrended values were aggregated to yield detrended seasonal and annual detrended values.’ L235: Delete full stop after “Figure” and delete “obvious”. This adjective is not necessary. L236: Suggest rephrase to ‘...detrended variables at the annual time step’ L238: drtended → detrended L243: Suggest rephrase to ‘It is noted that ...’. L251: Replace “between annual original ETo and recalculated” with ‘between the original annual ETo and the recalculated annual ETo...’ L254: Delete “phenomenon”. L257: Delete “Obviously,”. L260: Replace “on the” with ‘at the’. L265: Delete “only” and replace “and then” with ‘which were’ L272: On → At L277: Replace “In” with ‘ During the’ L287: Add ‘in the growing’. L294: phenomenon → feature L295: Delete “the” L301: Rephrase ‘We found significant decreases in RH...’. L304: evapotranspiration → evaporation (One cannot have ET from an ocean as there is no vegetation.) L304: Rephrase “limited the evapotranspiration” with ‘reduce relatively the evaporation’. L304,305: Rephrase “from oceans eventually” with ‘from the oceans’. L306: was corresponding → corresponded L308: increase → increases L309: replace “cement surface” with ‘hard surfaces’ L310: city → cities. L314: Delete “tendency”. L315: Replace “It is unclear about the causes of AH variation” with ‘The causes of the AH variation are unclear’. L318: Replace “globally (Matsoukas et al., 2011). Matsoukas et al. (2011) suggested that the global” with ‘globally by Matsoukas et al. (2011). They suggest that global ...’ L320: Replace “of” with ‘in’. L321: I assume Platte River Basin is in USA. Please say so. L322:

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Add 'strongly' after "correlated" and delete "to a great extent". Also add a reference supporting the Platte River increased VPD. L323: Add after "was" 'found to be ' L323: on → in L323,324: Replace "1988-2012 and attributed to these reasons" with '1988-2012. The is attributed to two reasons:' L325: Delete "in QRB". L326: Add after "that" 'there was an' and replace "were found in vast majority" with 'during most'. L333: Add 'and to' before "vast" L338: Add 'the' before "annual" L339: Replace "at" with 'for the' L353: Replace "Different from these literatures" with 'In contrast' L354: Rephrase as follows 'driven not only by air' L354: Add 'by ' before "other" L355: Replace "periods. During 1961–1987," with 'periods, 1961-1987 and 1988-2012. During the first period, decreased. . . ' L359: After "same" add 'result' L363: Replace "with the" with 'for a' L367: Replace "another word" with 'other words' L368: was → is L371: Replace "S" with 's' L375: Delete "water shed" L377: Delete "during the recent 30 years" L381: Delete "new" L391: L391,392: Replace "to water vapour and" with 'and hence' L392: Delete "has" L394: increase → rise L395: delete "then" L396: influence → influences

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