

## ***Interactive comment on “Investigating effects of different evapotranspiration (ET) schemes on soil water dynamics and ET partitioning: a large lysimeter case of summer maize in a semi-arid environment northwest of China” by L. Yu et al.***

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We thank the anonymous referee for valuable comments that help us to improve the manuscript. We would like to provide point to point reply to all the comments and questions. (Q: Question, A: Answer)

Response to comment from the anonymous reviewer: The discussion paper presents a comparison of two different ET parameterization schemes for ET for land surface modelling. One scheme (ETind) is based on reference crop ET and LAI, while the

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other scheme (ETdir) uses canopy minimum resistance and actual soil resistance into the Penman-Monteith model. The analysis was done using the extended STEMMUS model and lysimeter data. ET parameterization in land surface modelling is an important topic that has been well addressed by the authors. The paper is well structured, but the English needs improvements, which I'll indicate in the detailed remarks.

Main remarks: Q: In figure 9, its caption and the text in section 3.4.3 ETind and ETdir results are confused. The same for figure 6 and 7. Please check this for all figures, captions and text. For example on page 22, line 24 it is written that ETind gives the highest cumulative ET, while in figure 9 it is ETdir. In figure 7 (a) shows ETind, while the caption mentions ETdir. A: Thank you for your comment. We checked the manuscript and made changes as follows: Page 9998, L23-24: We've replaced "The cumulative ET for lysimeter observed, ETind and ETdir simulated are 334.18, 369.37 and 354.89 mm, respectively" with "The cumulative ET for lysimeter observed, ETind and ETdir simulated were 334.18, 354.89 and 369.37 mm, respectively". Figure 3 caption: We've replaced "the solid black line is" with "the solid black line shows" and "the solid gray line is" with "the solid gray line shows". Figure 6 caption: We've replaced "a) estimated using ETdir scheme. b) estimated using ETind scheme" with "(a) estimated using ETind method. (b) estimated using ETdir method". Figure 7 caption: We've replaced "a) estimated using ETdir scheme. b) estimated using ETind scheme" with "(a) estimated using ETind method. (b) estimated using ETdir method". Page 9989, line 24: We've replaced "Fig. 2b" with "Fig. 2c". Page 9997, line 18: We've replaced "Fig. 6" with "Fig. 7". Page 10001, line 16: We've replaced "Fig. 2b and c" with "Fig. 2c and d".

Q: On page 18, lines 12-20 it is mentioned that both ET schemes underestimate the soil water content in the early growing season. Two reasons are given. Which reason is most important? A: Thank you for your question. From my point, I think the second reason maybe more important. The space heterogeneity of soil moisture has been reported in the field conditions due to various reasons. It is difficult for the single-point soil moisture observation to fully capture the average soil moisture dynamics, i.e. the

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model simulations.

Q: On page 19, line 15 it is stated that the two ET schemes show similar trends in soil water storage. Is it possible to plot the measured soil water content in Fig. 4? A: Thank you for your comment. In Fig.4, We plot the average soil water content together with the soil water storage in the root zone. Note that the average soil water content is calculated from the measured soil moisture at 20, 40, 60, 80 and 100cm, while the soil water storage is calculated using the model simulations of soil water content at more finer soil layers (0.25, 0.5, 1cm, ..., 100cm, ...). This mismatch in soil layers results in some differences between the dynamics of two curves.

Detailed comments: General remarks on English language: Q: - "at early the growing season" or "at later the growing season" should be replaced with "early in the growing season" or "late in the growing season" respectively, throughout the text. A: Thank you very much for your comment. We look through the text and would like to make changes as follows: Page 9992, L12: Replace "at the late growing season" with "late in the growing season" Page 9992, L18-19: Replace "at earlier growing season" and "at late growing season" with "in the early growing season" and "in the late growing season". Page 9994, L13, L15: Replace "at early the growing season" with "early in the growing season". Page 9994, L19-20: Replace "at later the growing season" with "late in the growing season" Page 9998, L5: Replace "at early the growing season" with "early in the growing season". Page 9998, L7-8: Replace "at late the growing season" with "late in the growing season" Page 10000, L13: Replace "at early the growing season" with "in the early growing season" Page 10000, L24-25: Replace "at the early growing season" with "early in the growing season". Page 10000, L25: Replace "at the middle season" with "in the middle season" Page 10001, L2: Replace "at early the growing season" with "early in the growing season". Page 10001, L3-4: Replace "at late the growing season" with "late in the growing season" Page 10001, L15: Replace "at the early growing season" with "early in the growing season". Page 10001, L18: Replace "at late the growing season" with "in the late growing season"

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Page 10001, L19: Replace "at the early growing season" with "in the early growing season". Page 10002, L27: Replace "at the late growing season" with "late in the growing season" Page 10003, L7: Replace "at late the growing season" with "late in the growing season" Page 10003, L8: Replace "at the early growing season" with "early in the growing season".

Page 9996, L25: Replace "at early the growing stage" with "during the early growth stage" Page 9997, L4: Replace "at mid-season stage" with "during the mid-season stage" Page 9997, L22: Replace "at initial growing season" with "during the initial crop development stage". Page 9997, L22: Replace "at mid-season growth season" with "during the mid-season stage" Page 9998, L15: Replace "at the initial and mid-late growing season" with "during the initial and mid-late crop development stage" Page 9978, L21-22: Replace "at the late growing season" and "at the early growing season" with "late in the growing season" and "early in the growing season".

Q: - Tenses are incorrect. Check for each section which tense is appropriate. A: Thank you very much for your comment. Page 9979, L17-18: Replace "The performance of different ET equations varied with. . ." with "The performance of different ET equations varies with. . ." Page 9979, L19: Replace "Ershadi et al. (2015) highlighted. . ." with "Ershadi et al. (2015) highlights. ..". Page 9979, L21: Replace "Further evaluation confirmed that different ET schemes can significantly. . ." with "Further evaluation confirms that different ET schemes can significantly. . ." Page 9980, L1: Replace "However, most of these results evaluated. . ." with "However, most of these results evaluate. ..". Page 9980, L5: Replace "The other fact is that the uncertainties of crop growth parameters were not fully tested. . ." with "The other fact is that the uncertainties of crop growth parameters are not fully tested. ..". Page 9980, L9: Replace "the crop growth parameters had a. . ." with "the crop growth parameters have a. ..". Page 9980, L19: Replace "The results were discussed in Sect. 3. The summary and conclusion were. . ." with "The results are discussed in Sect. 3. The summary and conclusion are. ..". Page 9985, L9: Replace "It is assumed that. . ." with "It was assumed that. ..". Page 9985, L20:

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Replace "Two different parameterizations of ET components were adopted in land surface models." with "Two different parameterizations of ET components are adopted in land surface models.". Page 9985, L23: Replace "which was noted as..." with "which is noted as...". Page 9990, L17: Replace "soil water flow are fully coupled and equations are..." with "soil water flow were fully coupled and equations were...". Page 9990, L25: Replace "the simulation results vary with..." with "the simulation results varied with...". Page 9998, L24: Replace "ETdir simulated are..." with "ETdir simulated were...". Page 9999, L3: Replace "...difference was mainly..." with "...difference is mainly...". Page 10002, L13: Replace "...water, vapor and heat in the soil can affect..." with "...water, vapor and heat in the soil could affect...". Page 10002, L26: Replace "This study suggests..." with "This study suggested...". Page 10003, L5: Replace "When LAI is smaller..." with "When LAI was smaller...".

Specific comments: Q: Page 2, line 5: replace "effective" with "effectiveness" A: Page 9978, L5: this comment is similar to the comments from Dr. M. Coenders-Gerrits and we reply it as follows: We've replaced "... and climate, the accurate understanding of which is crucial to determine the effective irrigation." with "... and climate. The accurate understanding is crucial to determine effective irrigation schemes."

Q: Page 2, line 11: should start with "is the one-step ..." A: Page 9978, L11: We've added "the" before "one-step ...".

Q: Page 2, line 12: add "the" before "Penman-Monteith" A: Page 9978, L5: We've added "the" before "Penman-Monteith".

Q: Page 2, line 17: replace "irrigations" with "irrigation" A: Page 9978, L17: We've replaced "irrigations" with "irrigation".

Q: Page 3, line 29: add "the" before "PM" A: Page 9979, L29: We've added "the" before "PM".

Q: Page 4, line 2: add "an" before "individual variable" A: Page 9980, L2: We've added

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"an" before "individual variable".

Q: Page 4, line 13: "two fold" is one word "twofold" A: Page 9980, L13: We've replaced "two fold" with "twofold". Page 9994, L22: "two-fold" will be replaced with "twofold"

Q: Page 4, line 19: here present tense should be used (see General remarks on English language) A: Page 9980, L19: We've replaced past tense with present tense as "The results are discussed in section 3. The summary and conclusion are drawn in section 4."

Q: Page 5, line 22: "gravity oven method" should be "gravimetric method" A: Page 9981, L22: We've replaced "gravity oven method" with "gravimetric method".

Q: Page 8, line 15: "can be written as Thomas and Samsom (1995)" should be "can be written as eq. 7 (Thomas and Samsom, 1995)" A: Page 9984, L15: We've replaced "can be written as Thomas and Samsom (1995)" with "can be written as Eq. 7 (Thomas and Samsom, 1995)".

Q: Page 14, line 25: replace "fluctuate" with "fluctuating" A: Page 9990, L25: We've replaced "fluctuate" with "fluctuating".

Q: Page 16, line 7-8: rephrase "... made the relative values ... entered stage ii...". It is not clear. A: Page 9992, L7-8: Original sentence: "However, the 20% decreased LAI (Fig. 2b, dash grey line) made the relative values of LA<sub>eff</sub> entered stage ii, i.e. constantly equal stage, later at the leaf growing stage while earlier at the leaf senescent stage than the 20% increased LAI (Fig. 2b, solid grey line)." Corrected sentence: "However, the 20% decreased LAI scenario (Fig. 2b, dash grey line) entered stage ii, i.e. constantly equal stage, later at the leaf growing stage while earlier at the leaf senescent stage than the 20% increased LAI scenario (Fig. 2b, solid grey line)."

Q: Page 17, line 12: "the" should be removed before "20 cm" A: Page 9993, L12: We've removed "the" before "20cm".

Q: Page 19, line 18: "increasing while soil drying" should be "increasing while the soil

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was drying" A: Page 9995, L18: We've replaced "increasing while soil drying" with "increasing while the soil was drying".

Q: Page 19, line 20: "presented" should be "presents" A: Page 9995, L20: We've replaced "presented" with "presents".

Q: Page 20, line 9: "fully" should be "a thorough" A: Page 9996, L9: We've replaced "fully" with "a thorough".

Q: Page 21, line 16-17: rephrase "Lacking of ... net radiation". It is not well written.  
A: Page 9997, L16-17: Original sentence: "Lacking of considering the blocking effects of stochastic clouds on the net radiation, large overestimation of ET rates for both schemes would occur on some cloudy days (Fig. 6, DOY 196, 197, 221 and 241)." Corrected sentence: "Neglecting the effects of clouds on the net radiation, large overestimation of ET rates for both schemes would occur on some cloudy days (Fig. 7, DOY 196, 197, 221 and 241)."

Q: Page 21, line 19: "had a more fluctuation than" should be "had more variability"  
A: Page 9997, L19: We've replaced "had a more fluctuation than" with "had more variability".

Q: Page 22, line 26: remove "were" A: Page 9998, L26: We've removed "were".

Q: Page 24, line 13: rephrase "...more sensitive to LAI was presented at early the growing season". A: Page 10000, L13: Original sentence: "For the ETind scheme, more sensitive to LAI was presented at early the growing season," Corrected sentence: "For the ETind method, the influence of LAI was more important in the early growing season,"

Q: Page 24, lines 23 and 25: "was showed" is incorrect English A: Page 10000, L23 and L25: We've replaced "was showed" with "was shown". Page 10000, L10: We also replace "was showed" with "was shown".

Q: Page 24, line 24: replace "LAI dominated at" with "LAI dominated in" A: Page 10000, C6107

L24: We've replaced "LAI dominated at" with "LAI dominated in".

Q: Page 24, line 26: no capital for "Increasing" A: Page 10000, L26: We've replaced "Increasing" with "increasing".

Q: Page 25, line 14: replace "was" with "were" A: Page 10001, L14: We've replaced "was" with "were".

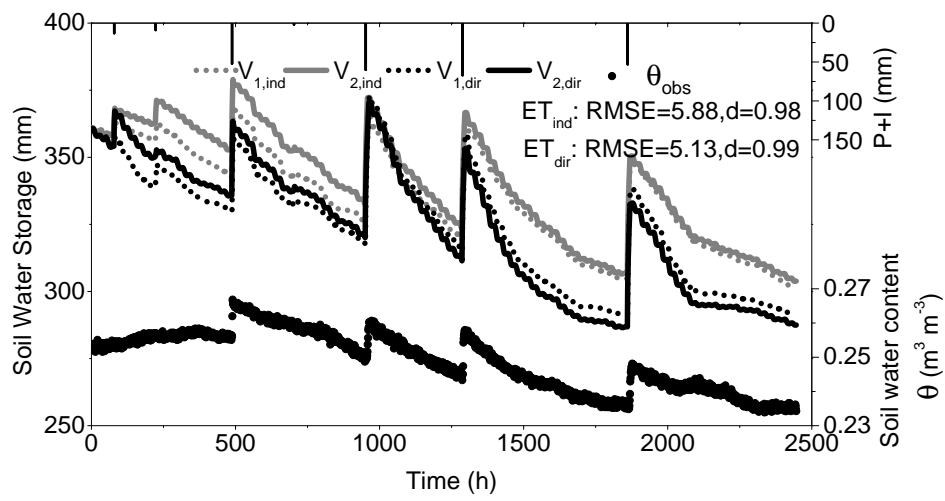
Q: Page 25, line 17-18: improve sentence A: Page 10001, L17-18: original sentence: "As shown in Fig. 2b and c, the effects of changing maximum rooting depth is increasing until reach its maximum value at late the growing season while the effects of changing root growth rate primarily dominates at the early growing season." Corrected sentence: "As shown in Fig. 2c and d, the effect of maximum rooting depth is increasing until reach its maximum value in the late growing season while the effect of root growth rate primarily dominates in the early growing season."

Q: Page 26, line 27: replace "at the late growing season" with "in the late growing season" A: Page 10002, L27: We've replaced "at the late growing season" with "in the late growing season"

Q: Figure 5: replace in the caption "the solid black line is" with "the solid black line shows" and "the solid gray line is" with "the solid gray line shows" A: Figure 5: We've replaced "the solid black line is" with "the solid black line shows" and "the solid gray line is" with "the solid gray line shows"

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**Fig. 1.** Figure 4 (along with soil water content)