Dear Sir or Madam:

Thank you very much for your helpful review. We have carefully studied the comments and suggestions and revised our paper accordingly. The following are our point-by-point responses to the general and specific comments. We hope that the revisions are acceptable and that our responses adequately address the comments. Thank you for your consideration.

Sincerely,

Zeng, Xin-Min and coauthors

Responses to comments from Referee #1

1. General comments

(1) This manuscript presents simulations of surface air temperature with a weather research and forecast model using different soil moisture conditions as input variables. The aim is to study how the soil moisture conditions ranging between ±50% of those obtained from satellite measurements. In addition, the authors study the effect of moisture on the processes effecting the weather simulations e.g. latent and sensible heat fluxes and their effects on atmospheric air circulation.

Response: We agree with you that this manuscript presents simulations of surface air temperature with a weather research and forecast model using different soil moisture conditions as input variables. In this paper, we address model simulations in the context of land-atmosphere interactions for a high-temperature event. In particular, we focus on the extent to which the change of initial soil moisture modifies surface air temperature, and on how physical processes affect the temperature simulation, as induced by the soil moisture change. Our aim is to quantify and explain the "sensitivity of high-temperature weather to initial soil moisture", as is consistent with the title of the paper.

(2) I evaluated the manuscript mainly from the point of view of presentation quality, because I am not able to evaluate the methods and models behind the simulations. I am not a meteorologist, thus I am not able to estimate the novelty aspect of the study and the validity of model simulations and assumptions behind. This would require substantial understanding on the structure, function and assumptions behind the meteorological model used in this study.

Response: We agree with you. Thank you for the review from the point of view of presentation quality.

(3) I would suggest letting a native English speaker to carry out language edition for the manuscript, because the text was at some points difficult to understand, even though the

grammar may be technically correct. Also, the authors should pay attention to the text flow in the manuscript. The text could be condensed in many parts. Below, I have pointed out some parts where the text has repetetition or where the sentences nd logic are difficult to follow.

Response: As suggested, a native English speaker (a Senior English Editor; hereafter EE) has carried out language (British English used in ACP) edition for the manuscript. We appreciate your constructive comments below and have made revisions accordingly.

2. Detailed comments

(1) Abstract 11666 L4 hot event -> hot weather event

Response: We have made the correction accordingly, and then the relevant sentence has been further modified by the EE for better phrasing in the revised form of the manuscript.

(2) The aims of the study are rather general and no hypotheses are presented. You should explain in the aims of the study more specifically the simulations you are going to carry out. For example, it is not mentioned until the results and discussion that you actually used the WRF model also to simulate soil water conditions in different soil layers.

Response: As addressed in Point (1) of the response to general comments, the aim of the study is to quantify and explain the sensitivity of high-temperature weather to initial soil moisture. In the revised form of the text, we have explained in the aims of the study more specifically the simulations we would carry out. Please find the statements in the introduction section: "The objective of this paper is to quantify and explain the sensitivity of high-temperature weather to initial soil moisture by answering the above questions. Hence, using different soil moisture initialisations in the Noah land surface scheme in the WRF model, we perform sensitivity experiments to simulate the temperature change and related quantities (e.g., sensible and latent heat fluxes, radiative fluxes, and geopotential heights) for the East China high-temperature event of late July 2003. "

As for the comment for the hypotheses of this paper, we think that this point is a question of style. As we know, a hypothesis is often in the form of an if/then statement in a scientific paper, and can be tested. All these features can be found in the introduction section. In the revision, we have added more concepts and addressed the relationship for the hypotheses, as also described above.

(3) In addition, there are results on geopotential heights, latent and sensible heat fluxes etc. in the results and discussion section. The concepts to be presented in the results and discussion section should already be presented in the introduction, aims and hypotheses of the study. Otherwise the structure of the text becomes difficult to follow and is inconsistent. Therefore I suggest that the concepts presented in the paragraphs of the results and discussion section should be presented also in the intro and aims of the study. Also, you should explain in the material and methods section what and how you

simulated. Otherwise the different paragraphs are not consistent with each other. In the current manuscript, there are lot of concepts and results in the results and discussion section which pop out from nowhere.

Response: Thank you for the review. We have made the revision according to the comments and suggestions. For instance, please find these sentence: (in the introduction section) "Fischer et al. (2007) indicated that during the heat wave, the soil moisture was extremely low, which substantially reduced latent cooling (latent heat flux) and greatly increased the surface temperature anomaly; their regional climate model sensitivity simulations showed that soil moisture played a key role in the partitioning of net radiation into latent and sensible heat fluxes and in the evolution of the heat wave. Positive feedback was identified between soil moisture, atmospheric circulation, and temperature based on the summer anomalies of geopotential heights and air temperature in the troposphere"; "we perform sensitivity experiments to simulate the temperature change and related quantities (e.g., sensible and latent heat fluxes, radiative fluxes, and geopotential heights) for the East China high-temperature event of late July 2003"; (in the Methods and data section) "Once the initial and boundary conditions are defined, according to the WRF formulations, both the land and atmospheric variables (e.g., atmospheric wind speeds, pressure, temperature, geopotential height, soil temperature and soil moisture), as well as the surface fluxes (e.g., radiative, sensible heat and latent heat fluxes), vary over time during the model integrations; these simulation results are used for the analysis."

(4) The lines 6-10 on P 11671 do not provide much information on the actual substance/aims of the study. I would rather delete those and instead present the above mentioned concepts and research aims in the introduction chapter.

Response: The revision has been made accordingly.

(5) P11669 L6 Explain acronym WRF when first used. P11670 L5 observations ->Observations P11670 L8 skill -> performance or accuracy P11670 L11 skill -> performance or accuracy P11670 L20 arise several questions in the following->arise following questions P11670 L24 delete “in the comparison” P11670 L26 understanding of -> understanding on, help us improve -> help us to improve P11670 L27 Delete "through better soil moisture initialization in the models." It is redundant. P11671 L1-4 You should explain here in more detail what you are going to do. For example, it is not mentioned until the results and discussion that you actually used the WRF model also to simulate soil water conditions in different soil layers. In addition, there will be results on geopotential heights, latent and sensible heat fluxes etc. in the results and discussion section. The concepts to be presented in the results and discussion section should already be presented in the introduction, aims and hypotheses of the study.

Response: The manuscript has been modified accordingly. Please refer to the revised version for details (or cf. Point 3 in response to detailed comments). Notably, after we changed "help us improve" to "help us to improve", the EE then changed the phrasing back to " help us improve". Further, we asked more people, and the results is "both are correct".

(6) P11671 L4-6 This sentence should be in the methods section.

Response: The manuscript has been modified accordingly.

(7) P11671 L6-10 This sentence does not provide much information on the substance.

Response: The manuscript has been modified accordingly.

(8) P11671 L20 Explain acronym “gpm”.

Response: Done in the revision. The acronym “gpm” means geopotential meters for the height of a given pressure level; quantitatively, 1 gpm is very close to 1 m in the troposphere, as also described in the revised paper.

(9) P11672 L3 Explain acronym SAT when first time used in the main text.

Response: Done. The words “surface air temperature (SAT)” have been added in the main text of the revised version before “P11672 L3”.

(10) P11672 L7-10 Complicated sentence. Please re-word. Preferably, split into two separate sentences.

Response: Rewording has been made accordingly.

(11) P11672 L13 "Approximated" may not be a correct word in this case. It is rather "ex-tended to over 2 months".

Response: We have done accordingly. Then the EE modified the sentence as follows: " From the distribution of day-to-day SATs (not shown), the high-temperature climate in southern China, with 35°C or higher daily maximum SATs, lasted for over one month (over 2 months in some areas)."

(12)P11672 L20-22 I would rather formulate this as follows: I would rather say "...We investigated the sensitivity of the temperature predictions produced by the Advanced Research WRF model to initial soil moisture..."

Response: The EE has made the modification accordingly.

(13) P11674 L12 I do not understand the "amplitude" here.

Response: It has been explained in the revision (i.e., +25 and 50%).

(14)P11678 L23 – P11679 L5 This part I do not quite understand. Does the model also simulate soil moisture conditions? I assumed that the SMOIS values were given as input for the model. Based on this sentence it looks like the SMOIS is simulated by the model.

Response: Yes. We have added more information in the text (e.g., Point 3 in response to detailed comments).

(15) P11679 L 13-21 The results presented here seem to be somehow redundant, because the same information was basically given on the previous page. Here you only report the differences in temperature simulations whereas on the previous you give the absolute simulated values? The manuscript is now quite long, so I would perhaps present either the absolute simulated values or the differences.

Response: We agree with you that here we only report the differences in temperature simulations whereas on the previous page we give the absolute simulated values. We present these results due to the following reasons:

i) We aim to quantify the sensitivity of high-temperature weather to initial soil moisture. Both the absolute simulated values and the differences are quantified, which are difficult to separate. Of course, we do want the paper to be concise. However, if we omitted the absolute values portion, some crucial results could not be shown. For example, P11678 L1-3: "The central position, range and strength of high temperature simulated in the CTL run are basically consistent with those in the NCEP FNL analysis field". Without this result, all the other results would become incredulous and further discussion would be meaningless. The presentation of "the absolute values" [P11678 L9-12] directly leads to the conclusions of the SMOIS-induced effects. If we omitted the part of "the differences" (P11679 L 13-21), issues regarding the quantification would be unclear, e.g., to what extent does the change in the initial soil moisture affect the temperature simulations over different locations within the domain? The answer to this question directly leads to conclusions in the abstract, e.g., "Areas with above-35˚C SAT06 are most affected". In addition, the subsequent conclusions would seem unexpected, and incongruity would be introduced, e.g., we could not conclude that "the amplitude of temperature rising (decreasing) differs in different areas, which is closely related with the forcings of surface energy balance, such as sensible and latent heat fluxes, in the areas" (P11679 L 18-20); furthermore, in the next section that explains how the sensitivity is induced, "the differences" are still needed, e.g., "Comparing Fig. 7b–e with Fig. 3g–j..." (P11682 L23-27) and "it is found that ...(Fig. 3g–j)" (P11683 L9-12).

In addition, showing both the absolute simulated values and the differences is a conventional way of quantifying two-dimensional meteorological characteristics for comparison/sensitivity studies (e.g., Bonan et al., 2002; Fischer et al., 2007; Solman and Pessacg 2012; among many others), where the differences are often emphasised.

ii) Regarding the paper length, the mentioned part (P11679 L 13-21) has a relatively small contribution; we have also condensed the section "Summary and conclusions" (cf. Point 29). The revised paper (including the title, names of the authors, text, figure captions, tables, and references) is approximately 11,500 words. We believe that this paper is a normal length for weather/climate model simulations, e.g., there are approximately 11,600, 11,800, and 14,200 words in the papers by Bonan et al. (2002), Fischer et al. (2007), and Flagg and Taylor (2011), respectively.

The authors respectfully hope that the above responses are acceptable. Thank you for your consideration.

(16) P11682 L5-8 You should indicate in the material and methods and aims of the study that you also simulate the soil water content. This is not clearly stated in the text yet.

Response: Modification has been done accordingly. Please find relevant statements in the text, or refer to Point. 3 in the response to detailed comments.

(17)P11682 L22 General comment concerning paragraph 3.2.2. The text should be

streamlined and condensed. It contains repetitive information. Mane of the sentences are too complex and difficult to understand. I have pointed out the most difficult ones.

Response: Done accordingly. The text has been streamlined and condensed (reduced in length by roughly one third). Some revisions are also described below.

(18)P11683 L12-L17 Complicated and long sentence. Please reword.

Response: Rewording has been done.

(19) P11683 L17 SMIOS->SMOIS

Response: Thank you for catching the typo. The correction has been made.

(20) P11683 L23-L26 This sentence partly has the same information as the sentence on lines 12-16. There is some repetition in this section, and the text could be condensed to improve the readability.

Response: Modification has been done accordingly.

(21) P11684 L26-L29 The text here is partly repetition to the text on the previous pages. The whole section should be condensed to improve the readability and text flow.

Response: The words have been deleted (P11684 L26-L29). The revision has been made accordingly.

(22) P11685 L13-18 This sentence is too complicates, and nearly impossible to follow. Please reformulate. I am not very enthusiastic about presenting bi-directional results in the same sentence. The sentences where the words "increase (decrease)" are indicating two directions of the effects are rather confusing to follow. And they are throughout the manuscript which makes it difficult to read the text. I would suggest streamlining the text so that you express the bi-directional effects in separate sentences throughout the manuscript. Or replace them with " and vice versa" in the end of the sentence.

Response: Modification has been done accordingly. We have also replaced relevant expressions with "and vice versa" at the end of the sentences.

(23) P11686 L1-L4 This sentence is also too complex and nearly impossible to understand. I do not understand the logic in the sentences. Please split it into several sentences and streamline the structure of the sentences to improve the readability.

Response: We have made the revision accordingly.

(24) P11686 L8 suface->surface

Response: The typo has been corrected.

(25) P11686 L7-9 I do not understand what is the connection here to deforestation.

Response: This is because the deforestation of Amazon rain forest is one of the most important scientific issues concerning land-atmosphere interactions. The comparison between the soil moisture change and the deforestation shows the significance of the SMOIS-induced sensitivity. In the revised text, we have made a little modification for the

expression.

(26) P11686 L18 This doesn't say anything to a reader who does not have background in meteorology. Please explain what it means in practice.

Response: Modification has been done accordingly. The regional atmospheric circulations in the mid- and lower troposphere are characterized by the 500 and 850 hPa geopotential height fields, respectively.

(27) P11686 L20-25 I would suggest avoiding the use of these bi-directional expressions and replace them with "vice versa" in the end of the sentence.

Response: We have made the modifications accordingly.

(28) P11687 L8-15 Too long sentence. Needs to be cut into several shorter ones.

Response: It has been modified accordingly.

(29) P11691 L1 General comments concerning the summary and conclusions. It is way too long. It cannot be 3 1/2 pages long. It should be condensed and reduced in length by at least 50%. You do not need to present any more methods results in this chapter. Present only the big lines and conclusions. There is also no need to have citations and discussion to literature any more in this paragraph.

Response: Done according to the suggestions. Now the length of the section has been reduced from 1,158 to 549 words.

References:

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