

Interactive comment on “Climate warming has led to the degradation of permafrost stability in the past half century over the Qinghai-Tibet Plateau” by Youhua Ran et al.

Youhua Ran et al.

ranyh@lzb.ac.cn

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Responses to Anonymous Referee #2's Comments and Suggestions (The answers are shown in blue)

Interactive comment on “Climate warming has led to the degradation of permafrost stability in the past half century over the Qinghai-Tibet Plateau” by Youhua Ran et al. Anonymous Referee #3 Received and published: 9 October 2017

General comments: The authors of the manuscript “Climate warming has led to the degradation of permafrost stability in the past half century over the Qinghai-Tibet

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Plateau” present modelled permafrost conditions and evolution over the Qinghai-Tibet Plateau. The purpose of the work is to assess permafrost stability in the over the QTP and the presented results are interesting. The manuscript is in general well written, but I have some comments. Some of the assumptions in the paper are not very well discussed. In particular, I find that the authors do not discuss the use of MAAT and the chosen limit (-1 celcius) of permafrost. Do the presented results reflect the real thermal state of the QTP? Results and Discussion sections should be separated. Introduction: Though I find this manuscript highly interesting, the introduction would improve if the authors would motivate the study further in the introduction, e.g. include implications of the thermal stability degradation at QTP (Section 3.3.2). Thank you very much. We agree with your comments. Major revisions have been made according to your very helpful comments. The results and discussion sections have been separated. An additional discussion of the uncertainty of MAAT and the chosen limit (-1 Celsius) of permafrost has been added. We also improved the introduction section. We have included the revised version of the manuscript and a document showing the specific changes made in the manuscript.

Specific comments: 1. Page 1, Line 29: Replace "soil or rock that includes ice or organic material" by "ground". Thank you. According to the Permafrost Subcommittee, we replaced “soil or rock” with “earth materials”.

2. Page 2, Line 5- 7: I do not understand this sentence. Thank you. We have improved this sentence and made it clearer in the revised manuscript.

3. Page 3, Line 2-3: Rewrite sentence, e.g. "Despite current warming, large permafrost areas may persist" Thank you. This sentence has been modified and moved into the discussion section.

4. Page 4, Line 9: Avoid the word "Obviously". Why is the engineering perspective more useful? Thank you. The word "Obviously" has been removed. 5. Page 4, Line 18: Why is MAAT -1 celcius used as boundary between seasonally frozen ground and

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extremely unstable permafrost instead of MAAT -2 celcius? (Why is cave ice included?) Thank you. We have improved the description to make it clearer. The definition of the extremely unstable type in the thermal stability classification system proposed by Cheng (1984) refers to regions that include cave ice and frozen gravel below the lower limit of permafrost, which is a very scattered distribution. The MAAT of the extremely unstable type is >-2.0 Celsius. The upper limit temperature is not clear. In this paper, a MAAT of -1 Celsius is simply used as an upper limit temperature to distinguish extremely unstable permafrost from seasonally frozen ground.

6. Page 5, Line 23: (Eq 4). First part of equation is not printed Thank you. This may be a display issue. It appears normal for me. We also improved this description.

7. Page 8, Line 12: MAAT -0.58 celcius in 2000 indicates seasonally frozen ground (According to Page 4, Line 18). I understand that permafrost is likely to persist in the ground though MAAT exceeded the chosen limit (-1 celcius), but this should be more clearly stated to avoid misunderstandings. Thank you. This section is the MAAT change for the total QTP, i.e., the mean MAAT over QTP. We have improved the related description to avoid misunderstandings.

8. Page 9, Line 5: Why are glaciers included in the permafrost area? Are these glaciers cold based? Thank you. For permafrost area statistics, due to the limited knowledge of permafrost under glaciers (it is unknown if permafrost exists under glaciers), two cases (including and excluding glaciers) are generally used for the statistics of the areas.

9. Page 10, Line 3: Rewrite. The ground temperature is not independent of MAAT. Thank you. This is really an inappropriate word. We have modified this in the revised manuscript. We also added a sentence for clarification. The complex process and limited knowledge of permafrost-glacier interactions may enhance the uncertainty.

10. Page 10, Line 6: The snow cover is dependent on the climate zone (Not the sensitivity of the snow cover) Thank you very much. Here, we mainly discussed the sensitivity of the glaciers and snow. We have also improved this description.

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11. Page 11, Line 19: Why is the geothermal heat flux missing? Thank you. The MAAT model cannot reflect the change of geothermal flux from the crustal interior. Additionally, the geothermal flux data are generally limited or unavailable. We have clarified this in the revised manuscript.

Please also note the supplement to this comment:

<https://www.the-cryosphere-discuss.net/tc-2017-120/tc-2017-120-AC3-supplement.pdf>

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-120>, 2017.

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