The Cryosphere
Discussions

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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 #2

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General Comments:

The submitted potential publication by Ran et al. to The Cryophere titled "Climate warming has led to the degradation of permafrost stability in the past half century over the Qinghai-Tibet Plateau" examines modelled Mean Annual Air Temperature (MAAT) over a period of several decades to assess changes to permafrost stability as categorized by an existing classification scheme by Cheng (1984). Overall the feel that considerable effort, research and writing has gone into the preparation of this manuscript. The authors use a combination of climate data recorded at 152 sites and remote sensed data with six independent variables to spatially infill using a Geographically Weighted

Regression (GWR) model. This paper is promising and I believe can be suitable for publication in TC following some moderate revisions and additional analysis. Although the paper is generally well written I find certain sections to be not needed while a much clearer and better stated methods section is needed. Additionally, the Results and Discussion sections should be separated and more distinct. I am somewhat critical of some of the assumptions the authors have made in the methodology of this research and also feel the rational has been poorly explained. The authors must also more clearly understand the potential problems of only using MAAT as a predictor of permafrost. Although I am not opposed to using MAAT in any way, more discussion of specific problems and errors this can cause should be examined. I am happy to review this paper again in the future and will work with the editor and authors regarding this manuscript. I have several specific comments about various elements of the paper which I will go into specific detail below.

Global edits in the paper:

1) The use of the word altitude is improper throughout the paper. Altitude implies flying height above in earth's surface. I can see nowhere in the paper where this term should be used and the word elevation which refers to height above sea level should be used. The distinction becomes very important in the age of UAVs and MUST be changed in the paper and figures.

2) A space should be left between all numbers and units in the paper and figures. Example for temperature 0 °C should be used and not 0°C.

Specific Comments:

1) Abstract: here the authors use the correct term of "elevation" and generally the abstract describes the paper and research well.

2) Introduction: I feel the introduction is very long. I would recommend finding a way to shorten this section by about 15 %. Additionally, I think the authors should also add

subsections to the introduction including one for background and one for the goals of the paper. I found while reviewing the paper and reading the introduction it was very difficult to tell if the authors were describing their research or past contributions by other authors.

3) Page 1 – line 29, change "soil or rock" to "earth materials".

4) Page 2 – line 10, I noticed the term "significant" is used to describe permafrost degradation. Has statistical significance been measured in this occurrence? If not this should be changed to "substantial".

5) Page 2 – line 19, here the term "permafrost table" should be replace with "active layer" from what I read. Either way I find this statement hard to read and should be changed.

6) Page 2 – line 26, The term "relationship" is used and should be changed to "relation".

7) Page 2 – line 34, here the reference of Cheng and Jin (2013) is used however, I think more references are needed here.

8) Introduction: the last four lines of the introduction (page 3 – lines 1-4) are not needed and should be removed.

9) I find the methods section hard to follow. The first part of the methods section actually presents some background which is useful but perhaps this should be in the introduction.

10) More justification as to how the classification for permafrost stability from MAAT needs to be introduced as well as a better justification (e.g. -1 °C for extremely unstable permafrost, Why?)

11) Where other variables tried when the model was created (e.g. Solar radiation?).

12) I found it very difficult to relate the modeled results of the GWR with the air temperatures from previous decades. The authors make some big assumptions regarding

the patterns of vegetation, snow cover and other metrics being consistent over the past 50 years. The feel the authors need to support the assumption much better with references and additional text. Additionally, although I understand why MAAT was calculated for the different decades the authors need to do a much better job explaining how this is done any how the land surface variables from 2006-10 play into calculations of MAAT from the past. I had to read this section several times and feel the explanation can be simplified. Additionally, I feel the authors should conduct some additional analysis where the parameters used in the GWR are varied to test the spatial impact and robustness in the model which can be done to further support the assumptions used in the model over the 50-year period.

13) Page 5, line 19: what program is the GWR conducted in? Please include.

14) Page 7, line 13: here it mentions the 152 climate stations from 1960-2010, what is the sapling rate of data collection? Did data gaps exist? If so how were the gaps filled?

15) The results and discussion sections should be clearly separated.

16) Page 8, line 18-20: here the reference by Pepin et al. (2015) in Nature Climate change should be included.

17) Page 10, line 3: the authors say that ground temperature is independent of MAAT. I feel independent is too strong a word. The two are not the same but they are not truly independent.

18) Table 1: are there areas where MAAT is above 0 °C? How are they classified here this should be included.

19) Table 5: why is the R2 so low for extremely stable permafrost compared to the others? This should be discussed more.

20) Figure 5: I find this figure hard to read and feel it could be omitted.

21) Figure 6: the figure caption should be more clearly written.

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