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The Cryosphere Discussions

Interactive comment on "Thermal state of the active layer and permafrost along the Qinghai-Xizang (Tibet) railway from 2006 to 2010" *by* Q. Wu et al.

Q. Wu et al.

tzhang@nsidc.org

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Reply to reviewers' Interactive comment on "Thermal state of the active layer and permafrost along the Qinghai-Xizang (Tibet) railway from 2006 to 2010" by Q. Wu et al.

First of all, we appreciate the two reviewers for their constructive and insightful comments and suggestions for this manuscript. We consider all comments and suggestions seriously. All comments are very helpful for further revision of our manuscript. We have made all changes based on the reviewers' comments and suggestion as described below.

Anonymous Referee #1 General Comments: It is always good to get the publication of

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new data, but the analysis here is not particularly insightful. A much shorter note more thoroughly describing the sites and the main statistical description of the data would be better. These sites are 30 to 80 meters from the centerline of the development and that raises question as to if it is possible to consider these sites as "natural". There are a number of studies that document the impacts on vegetation and upper-soil characteristics out well over 100 m from development and these sites are clearly much closer than that. I would caution anyone from interpreting these results as being from a location that has not been impacted by this development.

Reply: Thank you for the reviewer's suggestions. Because Qinghai-Xizang Railway construction had better protection measures of environment, it is ensured that the environment and surface conditions around sites 30 to 80 meters away from railway have not been disturbed. The survey results in September, 2011 show that surface conditions around these sites maintain the original natural state. We add some site description on environment impact.

Because Qinghai-Xizang Railway started to be constructed since 2001, and environment and surface conditions outside of embankment had been protected during the period of construction, we believed that these sites have not been impacted by the railway construction and operation during the periods of the past 10 years. We conducted a comprehensive survey on surface conditions around these sites in September, 2011 and found that the surface conditions maintain the original state compared with those several hundred meters away from the railway. We believe the surface disturbance by the railway is minimum and negligible. Long-term monitoring and further studies are certainly needed.

Specific Comments: I am not sure what a "sand protection facility" is that is mentioned in the discussion, but it does not sound like a naturally occurring feature, and should therefore not be included in this paper.

Reply: Thank you very much. The site locates at the area of engineering activities. We

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deleted the related data analysis in our revised manuscript.

Why are only a few sites included in the Figures? If these are supposed to be representative of the 3 regions discussed on page 2468, there is no mention of it? Are they supposed to present a range of conditions? Some explanation for why these were chosen is needed.

Reply: In Figure 1, the left Figure just shows the locations of research regions in China, and point in the left Figure shows several locations along the Qinghai-Xizang Railway, no observation sites and representative areas of the 3 regions discussed on page 2468.

There is no distinction between "climate" and "weather". It is simply not possible to see the effects of climatic change in a 5-year record, as that is too short of a period and is weather. Climatic impacts are those seen over longer time periods.

Reply: I agree with you. Thank you.

We need to make it clear that we did not discuss the effect of climate change on permafrost here since five years is too short. This is what the reviewer's meaning. Make changes accordingly in the text.

The authors seem to suggest that there should be a clear relationship between air temperatures and soil temperatures, and yet there are many papers that discuss that this relationship is only simple at and in perhaps the upper cm or two of soil. Further down, it is increasingly complex and dependent upon many factors. At depth one sees a relationship with climate over time, but only with much lag and much damping.

Reply: I agree with your suggestion. Permafrost is the products of climate and soil and permafrost temperatures and ALT varies with air temperature, but impact on local factors. From our study, we demonstrate that changes in permafrost temperatures on the Qinghai-Tibet Plateau are mainly controlled by changes in air temperature. Compared with permafrost conditions in the Arctic where snow may also play a very important

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role, there is little or no snow cover during winter months on the plateau, that's why air temperature is much more important.

Technical Corrections: Try to use "mean" instead of "average" whenever possible as average can refer to the mean, mode, or median statistically.

Reply: Thank you very much, we revised.

pg 2467 - line 22 - "whether" should be "weather"

Reply: Thank you very much. We revised.

pg 2468 - line 5 - "descript" should be "describe"

Reply: Thank you very much. We revised.

pg 2468 - line 24&26 - not sure what is meant by "exceptionally", but perhaps they mean "except for a few"?

Reply: Thank you very much. You are correct. We revised.

pg 2468 - there is a long discussion here of essentially 3 regions within the study area (mts, high plains, basins, etc.). It would be very helpful to indicate where those regions are on Figure 1 for those who aren't familiar with the study area.

Reply: Thank you very much for your suggestion. But, it is difficult to present the areas of Mts, high plains and basin along Qinghai-Xizang Plateau due to the scale of Figure.

Figure 1 - in the captions it says "after" but should be "since"

Reply: Thank you. We revised.

pg 2469 - line 6 - "data-log" should be "data-logger"

Reply: Thank you. We revised.

pg 2469 - line 7 - should say that "Use of thermistor strings is widely accepted and they have been used in this region since the early 1980s" or similar as there are several

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sentences which overlap and are difficult to understand.

Reply: Thank you very much. We revised:

Use of thermistor strings is widely accepted since 1982 (Cheng, 1980) and they have been used in this regions since 1990's.

pg 2469 - line 12-16 - "unobvious" should be "unclear" or perhaps "no trend"

Reply: we revised: The variation of permafrost temperature at 6m depth at WD3 and WD4 is no trend (Table 3).

pg 2472 - line 14-18, Figure 2 - histograms are not very useful. Why aren't they graphed as 5 lines on plot depth on side (though with 0 at the top) and then time on the bottom as is done in Figure 3a? And why aren't Figure 2 b and 3b that way also?

Reply: Thank you very much. We revised the Figure 2a by lines, as same as figure 3a.

Anonymous Referee #2 The main contribution of the manuscript is in providing new permafrost temperature and ALT data from the Qinghai-Xizang (Tibet) Plateau. However, to be truly valuable, the data included in the paper should be accompanied by more detailed site descriptions. Such critical information as climate, vegetation, soils and proximity to human disturbance/structures are missing. For example the "Site Description" section just review the basic ground thermal regime information, which is somewhat redundant since the results-related sections, graphs, and tables essentially do the same. In addition, the geographic locations mentioned in the text (e.g. mountain ranges, basins) are not labeled in figure 1. Authors claim that sites are located in undisturbed, "natural" conditions. However, the discussion attributes the most significant ALT changes (site WL3) to "sand protection facility." This raises the concern about anthropogenic influences at this and other sites. In general, since the basic climate information and site descriptions are missing it is impossible to interpret the results.

Reply: Thank you for the reviewer's suggestions. Because Qinghai-Xizang Railway construction had better protection measures of environment, it is ensured that the

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environment and surface conditions around sites 30 to 80 meters away from railway have not been disturbed. The survey results in September, 2011 show that surface conditions around these sites maintain the original natural state. We add some site description on environment impact.

Because Qinghai-Xizang Railway started to be constructed since 2001, and environment and surface conditions outside of embankment had been protected during the period of construction, we believed that these sites have not been impacted by the railway construction and operation during the periods of the past 10 years. We conducted a comprehensive survey on surface conditions around these sites in September, 2011 and found that the surface conditions maintain the original state compared with those several hundred meters away from the railway. We believe the surface disturbance by the railway is minimum and negligible. Long-term monitoring and further studies are certainly needed.

Below I provide several specific comments: 1) Section 2.1 should include detailed information on climate, surface characteristics, and disturbance/proximity to structures for sites used in analysis. Some of this information can/should be included in table 1.

Reply: Thank you very much. We add the details information of climate, and disturbance for sites in Table 1.

2) Section 2.2: It is unclear how many thermistors are on each string. Information on thermistor spacing should also be included. This info is critical for assessing the accuracy of ALT estimation by interpolation.

Reply: Thank you very much. We describe in details thermistor spacing.

All measurements were made by a string of thermistors with intervals of 5, 20, 40, 80, 120, 160 and 200 cm from surface to 2 m deep and with intervals of 0.5 m from 2 m to 10 m deep and with intervals of 1m from 10 m to 20 m deep, including 33 thermistors.

3) Section 2.3: Interpolation technique used to estimate ALT should be briefly de-

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Reply: Thank you very much. We added:

ALT is estimated as the maximum thaw depth in the late autumn through linear interpolation of soil temperature profiles between two neighboring points above and below the 0°C isotherm at all sites.

4) Section 3 and 4: Without climate (e.g. air temp, precipitations) and site description (e.g. vegetation, terrain, exposition) the values presented in the paper are just numbers. Impossible to interpret.

Reply: We have added details information in Table 1. And air temperatures along the Qinghai-Xizang Railway, Ecosystem, and disturbance extent of the railway construction are added in Table 1. Soil types and vegetation cover for observed sites are revised.

5) Figures 2 and 3 and Tables 2-4: Should include climate (at least air temperature) data.

Reply: There are a few climatic data along the Qinghai-Xizang Railway, and we include air temperature in some locations, such as Chumaer high plains, Beilu River, Tuotuo River, Kaixinling in Table 1.

In Figure 2 and 3 and Table 2-4, it is difficult to include air temperature data because there are no air temperatures for respective sites. Because air temperature includes in Table 1, it seems to be repeated for including air temperature in Table 2-4.

6) Section 5: Discussion is rather meaningless without supporting information on climatic and edaphic characteristics for sites. What are “sand protection facilities?” Site WL3 should probably be excluded from analysis.

Reply: We have added data and information on climatic and edaphic characteristics for sites. And we deleted the WL3 site in the manuscript. And air temperatures along the Qinghai-Xizang Railway, Ecosystem, and disturbance extent of the railway construction

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are added in Table 1. Soil types and vegetation cover for observed sites are revised.

Interactive comment on The Cryosphere Discuss., 5, 2465, 2011.