

Interactive comment on “Growth of a high-elevation large inland lake, associated with climate change and permafrost degradation in Tibet” by J. Liu et al.

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Received and published: 22 September 2009

General comments:

The authors report on the changes in Nam Co Lake, a large lake in Tibet. They combine analysis of the lake area from remotely sensed images with analysis of the primary hydrometeorological data from the area. They note that the lake has substantially expanded, particularly during the past decade, and use trend change analysis of the hydrometeorological data to infer the mechanisms that contributed to the lake changes.

The change of lake area and level of a major lake in this discontinuous permafrost environment is interesting and points to substantial changes in the water balance during the past decade. While the mapped limits of the lake change are quite straightforward, the presentation of data analysis is difficult to follow. The authors argue that the lake volume changes are generated, in part, by permafrost changes associated with warming in the area, but the active layer depth measurements shown indicate that the active layer has become progressively shallower since 1960. Hence, while there are substantial hydrometeorological changes that can explain the lake level changes, the inclusion of permafrost in the paper needs to be clarified, or reconsidered, in my view.

Overall, the data are presented quite well and generally clearly, but I would suggest that some of the data series should be shown to aid the reader (discharge, temperature, precipitation) discern the nature of the changes. Most of the presentation of data in the figures is of derived data sets. Additionally, some clarification in the text is necessary and the conclusions could be made more concise and clear.

Given interest in hydrological change, these results and analysis are of interest to the HESS readership and I recommend that the paper be published after moderate revisions.

Specific comments:

1. There are a number of important methodological details missing from the description of the trend analysis. Symbols like z , j and k are not defined. This section could be clarified to help the reader understand what the tests presented represent. One means of doing so would be to include the raw data in the figures where the results of these analyses are shown (Figs. 4 and 5) to help relate the results to the original data.
2. Changes in discharge that are described on p. 5453 lines 10-11 are difficult to see and relate to the other variables. I suggest you provide a figure with the series shown in it to make these changes in data clear to the reader.
3. Section 3.4 Permafrost Degradation is difficult to reconcile. The data in Figure 7

show that the frost table is thinning, suggesting reduced summer melt, yet the data is reported as warming (although mostly in winter). Unless I am missing something quite important, I can't see how the argument can be made that permafrost changes have any significant contribution to the changes in lake level.

4. In figure 2, the actual changes in lake area shown are quite subtle visually. I suggest perhaps trying to demonstrate the changes in lake level as well, or perhaps some small enlargements of areas where the changes are most apparent. I realize it is a very large lake, but there appear to be some areas where the shoreline has changed considerably.

Specific comments;

1. p 5447 line 2: is it 4.000 or 4,000 km²? If the former, that is too many significant digits.

2. p 5448 lines 5-14. What do BG and PD stand for? Please elaborate and add these to the caption of Figure 1 as well.

3. p 5452 line 18. The reference to global warming is overstated unless a citation is provided to support this.

4. p 5455 line 7. The comparison with the Lena River is not necessarily valid, as the Lena is a situation where frost depth/active layer thickness is increasing (compared to figure 7)

5. p 5455, line 26-29. I don't think this last sentence is relevant.

6. In the conclusions, remove the sub-heading and reorganize for clarity. The first few paragraphs seem repetitive.

7. Table 1 needs to be reformatted for clarity. I suggest making the primary column the year, with a second column for the lake area. The altitude and drainage area are not needed in this table (they are in the text).

8. Table 2 is also difficult to read. Some reworking might help. Units are needed for the

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variables

9. Add PD and BG written out in the caption of Figure 1

10. Figures 4 and 5: How are the confidence limits calculated? It is not clear to me. Also, it would help if the crossing-points are identified and the original data is shown in the same panel.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 5445, 2009.