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The Cryosphere
Discussions

Interactive comment on "Analysis of ice phenology of lakes on the Tibetan Plateau from MODIS data" *by* J. Kropáček et al.

Anonymous Referee #2

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This paper presents a very interesting and novel evaluation of climate change on the Tibetan Plateau based on variations in lake ice. This work can largely be done based on remotely sensed data products, thereby overcoming the usual data sparsity issues in remote regions such as the Tibetan Plateau. Overall I think it is a great idea that has interesting potential.

There are currently a few issues, relating to the robustness of the results and the geographic grouping, as well as some oddities with the climate date.

General suggestions:

Regarding the data robustness, currently very few of the results are evaluated for statistical significance (with the exception of the correlations from Table 4 & 5). This makes

it very difficult to assess whether there are indeed any trends or changes evident at these lakes because, if a trend is not statistically significant, that means there is in fact no trend. Similarly, if differences in means are not significant (which could be assessed using t-tests), then there are no differences. Therefore, adding statistical significance tests to all of the presented results will be essential.

A related issue is regarding the use of 8-day composite MODIS data. Does this essentially add a +/- 8 day error bar on any results? So, for a hypothetical example of a change in freeze-up date of 8 days, does this mean it could either be 16 days, or 0 days?

In making comparisons across regions, another suggestion is to standardize the data by creating anomalies from the mean, and dividing by the standard deviation (create z-scores), and then averaging the z-scores. This could alleviate some of the small vs. large lake differences and would make for more meaningful comparisons.

Regarding the geographic grouping, I think subdividing the plateau according to geographic coordinates may be the least meaningful way to group these lakes, since they respond to so many different factors (size, salinity, elevation, wind, shape, etc.). Using geographic grouping coarsely accounts for latitude (south to north) and elevation (lower elevation east, higher elevation west). Why not group the lakes statistically using cluster analysis or even a simple approach such as ANOVA? An analysis like this might then also provide clues as to what the most important variables are in terms of affecting lake freezing/thawing? For example, would a cluster analysis sort all the lakes according to size, or geometry, or elevation, etc.? I think this would be a really interesting result and might improve the signal-to-noise issues (i.e. small trends and high variability) and ultimately produce more meaningful results.

Finally, regarding the climate analysis I find it odd that temperature data from 1950-2000 are used to evaluate lake freeze/thaw changes from 2001-2010. How was this done?

Specific suggestions:

The issue of wind speed may be very important for the Tibetan Plateau and it may be worthwhile to provide some estimates, either from the literature or from actual data, if/how/when/where wind speed varies across the plateau. Even though wind speed data do not exist specifically at each lake, gridded (such as reanalysis) data are readily available and could provide a rough look at general variability, seasonality, etc.

Is salinity in these Tibetan lakes high enough to affect the freezing process (in terms of affecting the density stratification of these cold lakes)?

It appears you employed a thawing index (cumulative temperature above 0°C) in section 4.5. Was the freezing index (below 0°C degree days) also considered? Freezing index should correlate strongly with freezing, and thawing index with melting.

page 1757, line 18: should that say "r = 0.52," not "r > 0.41" (based on Table 4)?

Interactive comment on The Cryosphere Discuss., 6, 1739, 2012.