

Interactive comment on “Influence of solar activity on hydrological processes” by J. Pérez-Peraza et al.

Anonymous Referee #2

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In this paper, the authors analyzed the relationship between solar activity and the water volumes of two lakes: Lake Patzcuaro in Mexico and Lake Tchudskoye in Russia. The authors used several different statistical (mostly correlation and spectral analysis) techniques on various data sets of different time lengths. From the analysis, the authors concluded that “the source of the oscillation mechanism of the level of those lakes is the solar activity cycle through its influence on the magnetosphere and the terrestrial atmosphere.” The analysis is potentially interesting, for understanding the possible control of natural variability, including solar activity, on hydrological systems would help societies identify the relative roles of natural variations and human activities in driving change in various natural systems. However, the paper as presented has many problems in data presentation and selection, conclusions reached and interpretations. Below I only list a few examples of these problems. It seems to me that these problems are more fundamental than the validity of statistical analysis techniques, which I will

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not comment on.

1. The data sets used are not presented clearly. For example, there is no description of time series used for Patzcuaro on page 607-608 or elsewhere in the paper. What types of data used? What are the lengths of the records? There have been any significant impacts of human activities during the time period (e.g., irrigation, dam)? For Lake Tchudskoye, the time series description is confusing. For example, the authors indicate annual data from 1885-1987 (102 years) on page 615, but on page 619, they indicate that the data are actually available until January 1993, at least monthly data. Monthly data can be averaged to generate annual series, I believe. Also, many analyses were based on selective time intervals. For example, in Figs. 5-7, the authors focused on various time intervals of only about 10 years long. Also, Figure 8 only shows time periods from 1950-1986 for two lakes, which I believe was used to derive correlation figure in Fig. 9. As shown in Fig. 9, shifting two series for 11-15 years would generate a highest correlation of +0.7 or so. However, the records are only about 36 years long and if you look at the two curves, you can hardly see any correlation or similarity, which is fully understandable as two lakes are so far away under very different climate conditions. Even there is dominant solar forcing control on lake volumes, regional difference would induce different response at two lakes. Why did the authors choose that 36 years period for analysis? It would be nice if the authors would present all the time series, including lake levels and solar indexes, in time domain (rather than frequency domain as in spectra) before they present their spectral/correlation analysis results.

2. On page 615, the authors indicated “The analysis of the spectral characteristics was made with the series of the annual mean values of solar activity, water volume of Lake Tchudskoye from 1885-1987; the K p index from 1920-1984, atmospheric characteristics from 1934-1985 and the cosmic ray intensity from 1947-1987 (ionization chambers).” There are no explanations of various solar activity indexes and how were they measured or derived. See above comment about presenting time series data.

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3. As the longest record are only little over 100 years long , I cannot understand how the authors can reach any conclusion about 80-90 year cycle as discussed on page 618 and 621. Does this make any sense?

4. Because of these problems, the claim of solar-lake volume correlation is not fully supported by the evidence presented. Even though the documented apparent correlation was valid, the authors discuss no physical mechanisms that would cause such linkage. The statement that “through its (solar) influence on the magnetosphere and the terrestrial atmosphere” is too general to be useful. As so many inference (cause-effect) steps are involved in making connection between solar activity and lake volume, I doubt the weak signal from sun (solar energy outputs during 11-year sunspot cycles only vary ~0.1% around the so-called solar constant!) would be observable, considering all the noises involved. Immediate or proximal causes of lake level changes are change in water budget of the lake, due possibly to change in effective moisture, probably as a result of climate change (precipitation and evaporation), perhaps due to change in atmospheric circulation

In summary, the authors made attempts to study an interesting phenomenon about sun-climate/hydrology connection, which is indeed a long debated topic for the last century. However, the paper contains some major problems related to data presentation, conclusions and interpretation as indicated above. As a result, I don't think the authors have made a sound scientific case about the linkage of solar activity and hydrological change.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 605, 2005.

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