

Interactive comment on “Hydroclimatological influences at multi-spatial scales on recently increased droughts in China’s largest freshwater lake” by Y. Liu and G. Wu

Anonymous Referee #4

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In this manuscript, the authors report the characteristics of droughts in the Poyang Lake basin in China during the recent decade, and attempt to explain the hydroclimatic and anthropogenic causes of the droughts. They found that the droughts have exacerbated in duration, frequency, and magnitude. Based on analyses of historical hydrological and climatic data, the authors conclude that the worsening droughts in recent decade have resulted from decreased inflow (45%), increased outflow (24%), reduced precipitation (23%), and increased evapotranspiration (8%) in the lake basin. They further show that the decreased inflow owes 82% to precipitation decrease and 12% to evapotranspiration increase in the tributaries of the Poyang Lake. The authors

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also conclude that the Three Gorge Dam (TGD) impoundments may have played a limited role in increasing the drought magnitude. However, this conclusion is based on the prior findings and some rather simple comparisons between the TGD impoundment and concurrent drought events. While this manuscript provides the information of water budget in the Poyang Lake basin and use it to explain the worsening droughts, it contains several confusing areas that need to be clarified before it may be accepted for publication.

Specific comments and suggestions: 1) In this manuscript, the authors misunderstood the content of the word “multi-scale” and misused it in their explanation of the processes that they believe contributed to the droughts. “Multi-scale” means presence and interactions of physical processes of rather distinct spatial and temporal scales, such as multidecadal, interannual, seasonal or diurnal time scales, and global, continental, regional and local spatial scales. This study focuses on individual drought events in the lake basin and their water budgets. The components in the water budget have the same scale in both space and time, and no multi-scale processes or interactions are considered. Thus, using the word “multi-scale” in this manuscript is a misconception of the word and is misleading. I suggest the authors change the title of the manuscript and replace the word “multi-scales” in the manuscript by accurate word(s) relevant to the physical process.

2) The authors overlooked the accumulative effect of precipitation/water deficit prior to drought onset. Drought occurs after a prolonged period of water shortage in a region. Analysis of causes for drought should consider the water budget for the period before the drought actually occurs. Water budget during the drought would be useful for understanding the maintenance of the drought. In the Poyang Lake basin, it is drying from July with reduced precipitation and strong evaporation. If there is below-average precipitation in the months from April-June (the rainy season in the Poyang Lake basin) the deficit in water supply to the basin cannot be exacerbated after the rainy season ends and severe drought could occur. In some years, rainfall in July-August

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declined drastically, and severe droughts happened and persisted (August-September or October). In some other years, rainfall in July-August decreased slightly, so the drying further accumulated. A drought would occur in the fall (October-November). This drought could persist through the winter and into the following spring, resulting in severe spring drought in the lake basin because of continuing accumulative dryness during its winter dry season (Guo, et al. 2012). Because this accumulative effect of water deficit plays a significant role in the droughts in Poyang Lake basin it should be examined or discussed in this manuscript on the Poyang Lake droughts.

3) The TGD effect was discussed very briefly without much new result from the prior studies. Simple comparisons between the TGD impoundment and concurrent drought are inadequate to support their notion that the TGD is not responsible for increased drought events (change in frequency) in the lake basin in recent decade. It is important to note that while TGD impoundment has increased the drought magnitude, it also has raised the chances of drought occurrence/frequency.

4) On page2, lines14-16, the authors wrote "The increased outflow was principally controlled by the weakened blocking effects of the Yangtze River, which serves as a boundary condition of Poyang Lake." This statement is inconsistent with their result shown in Fig. 5. In Fig. 5, the outflow from the lake to the Yangtze River varied in-phase with the inflow from the five tributaries to the lake. These synchronous variations suggest that the outflow is primarily influenced by the inflow from the five tributaries, rather than by the blocking effect of the Yangtze River. Also, without any analysis of change in blocking effects of the Yangtze River, you should not use Yangtze River blocking to explain the water budget of the Poyang Lake.

5) In Fig. 1, the Xinjiang basin should be switched with the Raohe basin.

References: Guo, H., Hu, Q., Zhang, Q., Wang Y-J. 2012. Annual variation in climatic and hydrological processes and related flood and drought occurrences in the Poyang Lake basin. *Acta Geographica Sinica*: 699-709.

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