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Hydrology and Earth System Sciences Discussions

Interactive comment on "Paleoclimatological perspective on the hydrometeorology of the Mekong Basin" *by* T. A. Räsänen et al.

Anonymous Referee #3

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The paper derives a 700-year long time series of PDSI for the Mekong Basin from the Monsoon Asia Drought Atlas (Cook et al., 2010), and compares this time series with discharge data (station Stung Treng) for the 20th century. Based on the observed correlation between discharge and PDSI time series, it is assumed that the PDSI series is indicative of the hydrometeorological characteristics of the last 700 years. Its temporal behaviour is analysed and the reported increase in discharge variability for the last few decades (Delgado et al., 2010) is compared to the changes seen during the complete 700 years.

The paper attempts to link systematic measurements with paleohydrological data - an approach which is extremely interesting, for example, to understand natural climate

variability versus human-induced climate change. Hence, the overall aim of the paper is very valuable. The paper is well written and structured. However, I have major concerns and some specific comments:

(1) Scientific contribution: The paper uses existing / already published data and well-known statistical methods. Hence, its novelty should be sought in the insights it provides. It has essentially 2 messages: (A) The catchment-averaged PDSI, derived from the Monsoon Asia Drought Atlas, is correlated with discharge at station Stung Treng for the 20th century. (B) The increase in variability seen during the last decades has not been seen in the 700 years before. Message (A) is not new. For example, this has been published by Delgado et al. (2012). Message (B) is very interesting. However, this finding cannot be explained, and the reader is somehow left alone with this result. Hence, the scientific contribution of the paper is limited.

(2) Compared to its content/scientific contribution, the paper is very long. I feel it should be substantially shortened: - To make the point that discharge at station Stung Treng is related to the catchment-averaged PDSI, eight methods are used (P12735, L24-27.) Obviously, there are many methods to show that two time series are related. I recommend to reduce the number of methods by choosing the most adequate one(s). For example, what is the benefit of the spectral analysis when wavelet analyses have been performed? Do you really need two smoothing methods (LOESS, moving average)? Similary, to analyse the PDSI time series for 1300-2005, several methods are used. - There are many other locations where I feel that parts can be deleted, eg the introduction to the results section (P12740, L20-25) or the discussion about what cycles have been found by other studies (P12746, L23-28).

(3) Whereas the manuscript extensively uses different statistical methods and extensively describes the results, the interpretation of the findings is rather weak. There is almost no attempt to interpret the many cycles that are found in the analysis. It is well-known that hydrometeorological time series show cycles and fluctuations at different frequencies. It is also a widespread phenomenon that cycles come and go (eg Bur-

roughs, WJ, Weather cycles. Real or imaginery? Cambridge University Press, 2003) – so I would argue that the results (eg as shown in Fig. 4 and described on P12743) have to be expected. More interesting questions (How can these cycles be explained? What can we learn from these results? How do you interpret the striking increase of catchment-averaged PDSI variance in the post 1950 period? etc.), are not discussed in detail.

(4) The proposal that paleoclimatological data could provide valuable information about how future climate change may impact the region's hydroclimatology (P12733, L10-22) is extremely interesting, and I would like to learn more about how paleoclimatological insights could be used for this purpose. That topic could be elaborated later in the paper, e.g. in the section 'Future research directions' (beyond the few hints to published studies).

(5) I propose to delete Fig. 6 and the comparison of dry and wet epochs with other studies in Asia. I do not see the benefit of this comparison, given the difference in spatial scale, in definition of epochs, in regions. What can be learned from this comparison?

In summary: I think that, on the one hand, the interpretation needs to be strengthened substantially. On the other hand, the paper should concentrate on the key aspects. Redundant information and pure description of results should be shortened. It should be possible to show that there is a relation between discharge and PDSI with one or two methods (and not with eight).

Specific comments:

P12731, L9: Please elaborate on the statement ". . .general perception is that the flood variability has increased. . .dam construction". One sentence earlier, you say that severe droughts and floods have been observed recently. Please explain how severe droughts and floods are associated with increasing flood variability. Why should dam construction increase flood variability? I would expect a dampening effect.

P12731, L26: The 2 sentences ". . .Delgado et al. (2010) . . . 20th century..." are not very clear. The expression "they also found. . ." might imply that the increase in variability is another effect compared to the increase of likelihood of extreme floods. But the latter is a direct consequence of the increasing variability.

P12737, L21: The hydroclimatology of the Mekong basin is represented by cumulative flows of hydrological years. The Mekong River has a very pronounced hydrological regime, consisting of a dry and wet season. How can you differentiate between an average year with average flow in dry and wet season, and another year in which a high flow in the wet season is "canceled out" by a low flow in the dry season? Wouldn't it be helpful to derive two discharge time series, one as proxy for the dry season and the other for the flood season?

P12740, L12: What is the motivation to divide the long time period into sub-periods of 100 years? Why 100 years?

P12740, Section 3.26: I am not sure if I understand correctly what has been done here. How do you filter the PDSI time series (1 value per year) to obtain extreme values? Is the selection of extreme wet and extreme dry years related to the definition given in section 3.2.2?

P12741, L5ff: The correlation coefficients for the smoothed time series might lead to misinterpretation. Smoothing increases the correlation coefficient from 0.55 to 0.9. I propose to delete this information and Fig. 2B.

P12741, L20: Pdfs are calculated for 2 sub-periods. Why 2 sub-periods? Why the split in the year 1961?

P12742, L20: What do you mean by ". . .discharge led the PDSI in the 1920s. . ." ?

P12745, L9-10: What do you mean with this sentence (". . .indicate that the PDSI is a more efficient. . .")?

P12761, Fig.3: - Use same axis length for vertical axes, in order to better compare the

different wavelet results. - Again, I think there is no need to have 3 sub-figures, in order to show the relation between 2 time series. Please decide which method is the most adequate one, and delete the other redundant information.

P12762, Fig.4: On which basis has the period 1300-2005 been divided into 5 sub-periods?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 12729, 2012.