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Hydrology and Earth System Sciences Discussions

Interactive comment on "Long-term meteorological and hydrological dryness and wetness conditions in the Zhujiang River Basin, South China" *by* T. Fischer et al.

Anonymous Referee #1

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The paper provides an analysis of hydrological drought and wetness in a sample river basin located in south China using observation data from 118 stations. In assessing drought and wet conditions in the area of interest, the authors applied the Standardized Precipitation Index (SPI) and the Standardized Discharge Index (SDI) on 24-month time scale. Principal Component Analysis (PCA) is then applied to the SPI-24 to identify sub-regions within the area having different drought/wetness variability, while spectral analysis is used to unveil the statistically significant periodicities in the time series of indices. The study, following the path of several recent papers on drought variability analysis and drought regionalization, is very interesting for its application to a region

of interest from a climatic point of view. Thus, the paper deserves publication but a careful revision of the text should be done, mainly devoted to clarify some conceptual and methodological aspects. Some suggestions are:

1) Along the text and also in the title, the authors refer both to meteorological and hydrological drought and wetness. However, the applications of indices involve only the long time scale of 24 months, typically used for monitoring hydrological aspects. Short time scales of a few months are instead necessary to investigate the meteorological conditions. Thus, I suggest explaining this aspect properly in the text clearly stating that only hydrological conditions are addressed. This implies also a change of the paper title that should concisely denote the content of the paper. Also, attention should be paid in using the word "flood", which denotes a meteorological phenomenon that is very different from "wetness", and is not addressed in the paper;

2) The abstract does not summarize clearly the study. The authors should refer to the time period considered and data used, as well as why the PCA is applied. The sentences "The principal component analysis reveals many spatial interdependencies in dryness and wetness conditions for the sub-basins and explains some spatio-temporal disparities. Moderate dryness conditions have a larger spatial impact than moderate wetness conditions in the sub-basins." are not clear. It is difficult for a reader, who is not familiar with PCA and SPI, to follow the text. Moreover, the spatial impact of moderate drought cannot be deduced from PCA, since the loadings identify regions of common climate variability that is represented by the associated PC scores; but PC scores does not provide information on the SPI classes;

3) The introduction should point out the aim of the paper and explain how the work is organized in order to highlight the relevance of the analysis also in relation to the previous studies on a similar topic (Bordi et al. 2003, 2004a, 2004b);

4) Section 2.3.1: Authors state that they use precipitation from 118 stations in the Xijiang River Basin. However, from Figure 1 it seems that most of that stations fall

outside the basin under study. Also, the title refers to the whole basin (Zhujiang Basin). This aspect should be clarified. The methodology used for the computation of the SPI at the six sub-basins in Figure 1 is not clearly described. The right way is to compute the precipitation time series averaged over the stations falling in each sub-basin to use as input for the SPI. If so, the PCA is applied only to the six SPI time series? At page 10531, lines 13–14, it is not correct to state that the SPI-24 is suitable for monitoring meteorological drought (see point 1) before). Also "long-term" is not appropriate here. Lastly, more details should be given about SDI; which function is used for fitting the distribution of discharge data accumulated on 24-month time scale? Is it the two-parameter Gamma as in the SPI computation?

5) Section 2.3.2: "We use the PCA to sum up the spatial patterns of co-variability of dryness and wetness according to the SPI-24 series at different stations", what does it mean? And the PCA is applied to all 118 stations? Then, please clearly state that the loading patterns, properly normalized, represent the correlation between the SPI time series at the stations and the associated PC scores time series. Is it so in your Figure 8?

6) Section 2.3.4: The description of the extrapolation of the SPI time series is confused, no optimization is applied;

7) Section 3.1: A comparison between annual precipitation in the whole Xijiang basin and the discharge at a single station might appear not correct to a reader; a plausible explanation should be provided. The end of the section is not clear;

8) Section 3.2: Does Figure 5 show the averaged SPI-24 over the whole basin? If yes, in this way you lose the SPI classes; the SPI for the whole basin should be computed using the averaged precipitation over the basin;

9) Section 3.3: Why the author use "moderate drought" for events characterized by SPI<–1? They are just dry events, all SPI dry classes are considered. The same holds for wet events. See also Table 1;

10) Section 3.4: The last sentence at page 10537 is unclear or wrong. Moreover, why the loading values at Figure 8a are so low? They vary between 0.36 and 0.44 denoting a low correlation between the SPI time series at the sub-basins and the associated PC-1 score in Figure 7. Is the loading properly normalized? Please check. Moreover, why do you not apply the PCA and Varimax rotation to the whole stations in order to identify possible sub-regions having different dryness/wetness variability? Or if the regionalization is not an objective of the study, why applying PCA? You have already considered different sub-basins and you know the time variability there (Figure 6);

11) Section 4: The authors should highlight the relevance of their results. The periodicities unveiled in the paper are close to the ones found in other remote regions; this aspect should be pointed out;

12) Figure 9 and 10: Please include in the figure captions the meaning of the horizontal dashed line. In Table 1 the mean magnitude of dry and wet events instead of magnitude should be more informative.

General comment: I think that the paper is not well written and this diminishes the work done. I encourage the authors to provide a careful revision of the text.

References:

Bordi I., K. Fraedrich, J. Jiang, A. Sutera, 2003: Dry and wet periods in Eastern China watersheds: patterns and predictability. Journal of Lake Sciences, 15, 56–67.

Bordi I., K. Fraederich, J.-M. Jiang, A Sutera, 2004a: Spatio-temporal variability of dry and wet periods in eastern China. Theor. Appl. Climatol., 79, 81–91.

Bordi I., K. Fraderich, F.-W Gerstengarbe, P. C. Werner, A. Sutera, 2004b: Potential predictability of dry and wet periods: Sicily and Elbe-Basin (Germany). Theor. Appl. Climatol., 77, 125–138.

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