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Hydrology and Earth System Sciences Discussions

Interactive comment on "Hydrologic system complexity and nonlinear dynamic concepts for a catchment classification framework" *by* B. Sivakumar and V. P. Singh

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Guest Editor Comment – Attilio Castellarin (EC – C2495): The assessments reported in the reviews of two Referees, together with a short comment, basically share the same opinion on the manuscript. The manuscript discusses an actual and very interesting topic, which is definitely suitable for the Special Issue. Unfortunately, the study itself does not seem to be innovative enough relative to previous studies presented in the literature.

Also, a fundamental limitation of the study seems to be the lack an implementation

of the concepts and criteria described in the text that is general enough to make the proposed approach of practical use. The Reviewers provide detailed comments on the manuscript, which I sincerely believe can become useful should the authors consider at any time in the future to critically revise and resubmit their study.

Author Response: We thank Attilio Castellarin, the Guest Editor, for his recognition of the interesting nature of our work and its suitability for the Special Issue as well as his suggestions for further improvement of the manuscript. As we have discussed in detail in our "General Response to Guest Editor Comment (EC), Referees' Comments (RCs), and Short Comment (SC)," we have substantially revised our manuscript, including details of analysis of streamflow data from a large network of 117 gaging stations in the western United States. We have also incorporated all the relevant review comments (both technical and presentation), including removing certain sections/significant portions of the text, and it has resulted in a substantially different version of the manuscript.

As we have also clearly mentioned in our General Response, the full implementation of our proposal is a lengthy and enormously challenging task and needs to be carried out in multiple stages (each requiring careful interpretation). Consequently, the revised manuscript is limited to implementation of the essential first step in the classification framework: identification of complexity. This is done by employing a popular nonlinear dynamic method, the correlation dimension method, to the above 117 streamflow time series, and interpreting the dimensionality of the time series. The results (phase space diagrams and dimension results) allow grouping of the streamflows into four cateogires: Low-dimensional (L), Medium-dimensional (M), High-dimensional (H), and Unidentifiable (U).

We are in the process of employing some other nonlinear dynamic-based methods as well some linear ones to verify, and possibly confirm, the results from the correlation dimension method to gain even more confidence on the streamflow complexity and classification. Further verification also needs to be done through: (a) establishing relationships between the data patterns/complexity and the actual catchment/process

properties; and (b) studying the outputs simulated from existing hydrologic models and varying their complexities. The effectiveness of any such classification also needs to be tested on a wide variety of catchments and hydrologic data representing different climatic conditions, catchment characteristics, land use properties, and types of data, among others. Again, implementation of all these steps is a lengthy and enormously challenging task. We will report the details of our investigations and outcomes in our future publications. We hope the revised manuscript, presenting the analysis of a large number of streamflow time series (117) and also their preliminary classification based on dimensionality and complexity, is sufficient for a technical publication and also acceptable.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 4427, 2011.