Hydrol. Earth Syst. Sci. Discuss., 11, C6870–C6872, 2015
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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Complex networks, streamflow, and hydrometric monitoring system design" *by* M. Halverson and S. Fleming

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Received and published: 22 May 2015

We thank the second referee for his positive assessment of the paper, recommending it for publication pending minor revisions, as did the first referee. We have also addressed referee 2's specific suggestions for improvements to the paper, resulting in a number of notable changes.

In particular, like referee 1, referee 2 indicated that some improvements to the literature review were warranted (although in this case the emphasis was on background information regarding hydrometric monitoring system design). As was the case for referee 1, we have fully incorporated the additional features recommended by referee 2. That is, general discussions of the both the technical and pragmatic considerations associ-

ated with hydrometric monitoring system design are given at some length in Section 1.3, and then revisited in Sections 5 and 6. As noted above, the introductory section of the paper has been reorganized; one result of this is that background information around hydrometric monitoring system design is now more clearly provided in Section 1.3. Further, the three literature citations suggested by the referee are all included in the revised manuscript.

The reviewer is correct in noting that we did not restrict our attention to streamflow gauges which sample an entire watershed in the sense of being located at the mouth of a given river. Doing so would of course be extremely limiting in practice. Our study analyzes an existing hydrometric database; as for any such streamflow network, some of the flow gauges are located at the downstream edge of a given catchment, and some are not. The author is also correct in that hydrologic information sampled by a downstream gauge reflects upstream hydrometeorological dynamics. Those upstream dynamics, and their diversity across gauges, are what make hydrometric monitoring system design challenging – and the results of hydrometric network analyses interesting and valuable. Relationships between identified network theoretic properties and basin-scale hydrometeorological controls, including but not limited to upstream catchment elevation and area, are discussed at length at various points in the article, but particularly in Section 4.2. We thank the author for his comments on this topic.

To answer the referee's final question, we believe the main contribution of our complex network analysis is to provide fresh insights into the fundamental nature of spatiotemporal hydrological relationships, and in particular, into hydrometric monitoring system design. The referee draws attention to clustering and information theoretic (Shannon entropy-based) methods as points of comparison for the network theoretic method, which is of course valid. However, there are in fact many methods and considerations available or relevant for analyzing existing environmental databases and designing environmental monitoring systems, as discussed at some length in Section 1.3 of the manuscript and revisited in Sections 5 and 6 (note again that the introductory section

has been reorganized, and discussions and background around hydrometric monitoring system design are now clearly provided in Section 1.3). It is far beyond the scope of the present manuscript to provide a comparative assessment of these methods and considerations, and further, there are inherent limitations to such comparisons given that many key controls on practical hydrometric monitoring system design are essentially logistical, as explained in the manuscript. That said, we thank the referee for his comments in this regard, and in the revised manuscript we have made an effort to clarify the possible contributions of this new approach; further, some thoughts are concisely but explicitly provided on comparing the results to those from various other techniques. These improvements to the manuscript occur in Sections 1.3, 5, and (in particular) 6.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 13663, 2014.