

## ***Interactive comment on “Large-sample hydrology: a need to balance depth with breadth” by H. V. Gupta et al.***

**D. Wang (Referee)**

dingbao.wang@ucf.edu

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This opinion paper is well written and may have high impact in hydrologic research in the coming decades. I fully agree with the opinion of authors that depth and breadth needs to be balanced. Hopefully, my comments can stimulate further discussions which will be useful for revisions.

1. Section 5.1: As discussed in this section, there are barriers to the free exchange of hydrological data due to economic and legal issues with the public institutions who compiling and managing the data. Individual researchers and local agencies might be able to complement, besides federal institutions, the data sharing tasks. For example, a public website can be created and managed by IAHS or others so that individual

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researchers can upload and share their catchment data. The challenges for this include the required variables (such as precipitation, runoff etc.) and the time period of observations, the consistence of the data format, meta-data with the same format and others. If the data requirement is daily precipitation, runoff, temperature and potential evaporation like MOPEX catchments, a lot of catchments around the world meet this data requirement.

2. Section 5.2 Linking large sample studies with process hydrology & Section 5.6 Trading depth of analysis for sample size. These two sections are related and very important parts of this paper. These two sections may deserve more substantial discussions.

“balance depth with breadth” is one of important points advocated in this paper. Every catchment is unique like individual person; but catchments have some common characteristics like human beings. Individual detailed catchment analysis is helpful for us to understand the physical process of “tree”; large sample hydrology is helpful for us to see the “forest”. The understanding of common characteristics will benefit to improve our understanding on the behavior of local catchments; detailed study on experimental catchments can be used to understand the common characteristics in the processes-level.

Then, the challenging question is how to balance (or integrate) large sample study and specific catchment study to improve hydrologic understanding. What are the strength and weakness of “large-sample” approach and “a limited number of heavily instrumented catchments”, respectively? How to reconcile or integrate these two approaches to improve understanding of catchment behaviors? These two approaches can mutually benefit to each other.

In the study of individual catchment, observations at the finer spatial and temporal scales are available and more state and flux variables are observed such as soil moisture and groundwater table. While in the large sample study, there may be limited

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variables which are available in all the sample catchments. Once a hypothesis has been tested in a heavily instrumented catchment, the hypothesis can be generalized and tested in other catchments through large sample study. The challenge is that the required observations to test the hypothesis in these catchments are usually not available. Some thoughts and discussions along this line (how to integrate or reconcile the two approaches) may be highly appreciated by readers.

3. Section 5.5: Trading space for time. This definitely is one of the benefits from large sample hydrology. The underlying assumption for this method is that the catchment system including parameters will co-evolve with the changed climate in a certain path. Is there only one possible state for the catchment evolving to or are there multiple possible states? If it is the latter case, the uncertainty associated with the traded parameters may need to be quantified or other constraints besides climate need to be considered for projecting catchment changes. More references can be cited such as Sivapalan et al., (2011, Functional model of water balance variability at the catchment scale, 1: evidence of hydrologic similarity and space-time symmetry).

4. Nice reviews on the history of large sample hydrological studies. In recent years, some comparative hydrology studies based on MOPEX catchments may be included in the revision as pointed by other reviewers.

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