

Proposal of a Working Group on Large sample hydrology (WG-LSH) for the IAHS Panta Rhei decade

Context

Since the 1970s, studies on large samples of watersheds have received a growing attention in hydrology and have reached a certain level of scientific maturity during the last decade. As stated by Gupta et al. (HESS 2014, in press), the benefits of large sample hydrology are multiple:

- **Improving understanding**, by facilitating more rigorous testing and comparison of competing model hypotheses and structures on common grounds;
- **Improving the robustness of generalizations**, by allowing statistical analyses of model performances and avoid giving too much weight to outliers;
- **Facilitating classification, regionalization and model transfer**, by gathering a wide diversity of hydrometeorological contexts, enabling testing classification and regionalisation strategies;
- **Supporting the estimation of uncertainties**, by establishing the predictive capabilities and performance of hydrological models on a variety of hydrometeorological contexts.

As shown by the success of the MOPEX dataset, such large watershed samples, if available for the community, would also help hydrologists from countries where data are scarce or not easily accessible to test their methodologies on widely used data sample.

However, gathering and manipulating large samples of watersheds faces practical difficulties and challenges:

- **Gathering, managing and sharing the samples of watersheds:** apart from a widely available and used datasets (e.g. the MOPEX dataset), most of the existing samples of watersheds remain difficult to share, e.g. due to data ownership issues;
- **Assessing data quality:** due to the large amount of data to analyse, the data quality assessment of large sample of watersheds is usually rather limited;
- **Reporting and sharing protocols for data and models:** since large sample hydrology is a developing scientific practice, common standards to report results and share testing protocols or model applications still have to be built.

Objectives of the Large Sample Hydrology Working Group

This initiative on Large Sample Hydrology intends to contribute to the Panta Rhei decade by improving the current practices around large samples of watersheds and by providing other IAHS working groups with unified data sets.

A preliminary phase of the work will be to define a scientific blueprint for this initiative, in link with the working groups that will be active during the Panta Rhei decade. A few key questions will be identified, and the construction of large watershed samples will be oriented towards these key objectives. An example of recently developed watershed

sample built for Panta Rhei objectives is the sample proposed to the participants of the HW15 workshop at the 2013 IAHS Assembly in Gothenburg to test models in changing conditions.

The WG-LSH will have three main objectives, which will structure its progress over the decade:

Objective #1: Gathering, organizing and making available a worldwide large sample of watersheds

- Define a data collection framework, with specifications on the expected watershed variables (type, time step, record length, etc.), metadata and properties (location, topography, soils, etc.) we would like to gather, given scientific objectives;
- Collect existing samples, starting from the review by Gupta et al. (2014, HESSD). The first step would be to contact authors and try to collect these existing datasets. The patronage of IAHS / WMO would help facilitating the ownership issues;
- Build new datasets with local contacts of countries that open their databases, to get a sample representative of the hydrometeorological conditions in the five continents;
- Define a strategy to share these datasets, given constraints of data providers and the interest of potential users. An agenda to advertise in conferences, organize workshops, make publications, invite researchers to webinars, organize summer schools for young researchers, etc., will be defined. A website will be developed and constantly updated to communicate on LSH, with links to existing databases, continuous scientific literature monitoring on LSH, blog to exchange ideas, etc.

Objective #2: Organizing a data base and assessing quality

- Develop adequate database structure, to facilitate its use by the hydrological community;
- Define common data formats to ease data use;
- Build database with online access, that could be hosted by IAHS or participating organizations, to ensure long-term access;
- Test or develop methods to assess data quality on large sample of data.

Objective #3: Improving current practices based on large sample of watersheds

- Develop guidelines and protocols to improve the use of large sample of watersheds and the communication of results or models;
- Contribute to various key scientific objectives, in link with other WG (improve understanding, robustness of generalization, regionalization studies, estimation of uncertainties, etc.).

WG leaders and contacts:

The structure, leaders and organisation of the WG-LSH still have to be found. A core group composed by Dr. Vazken Andréassian, Dr. Charles Perrin, Dr. Thibault Mathevet

and Pr. Hoshin Gupta has initiated this proposal. The first year will allow to set the organisation of this WG.

- Dr Vazken Andréassian Irstea, France

Dr Vazken Andréassian has a long-standing involvement in LSH and has published several key papers to promote the development of LSH (Andréassian et al., 2006; 2007; 2009). He also published a large number of studies based on large samples of watersheds in France, USA, Australia, etc.

- Pr Hoshin Gupta, University of Arizona, USA

Pr Hoshin Gupta has a large experience in hydrology and hydrological modelling, covering a wide range of issues. He published many articles on large datasets and he recently lead a review paper (Gupta et al., 2013) on LSH to encourage the development of this area.

Potential contributors to this WG:

A core group of potential contributors interested in LSH will be established. Ideally, it should gather people from the five continents and included researchers already involved in LSH. Among the potential contributors to the WG, we identified:

Europe:

- France: Irstea (V. Andréassian, C. Perrin), UPMC (N. Le Moine, L. Oudin), T. Mathevet ;
- Sweden: B. Arheimer ;
- Austria: G. Blöschl ;
- Germany: R. Kumar, A. Bardossy ;
- UK, Ireland, Norway, Switzerland

America:

- USA: H. Gupta, M. Clark, M. Smith, J. Schaake

Oceania:

- Australia : T. Pagano, J. Lerat, J. Vaze, F. Chiew
- New Zealand: H. McMillan

Africa:

- South Africa: D. Hugues

Europe, USA and Australia appear to be well identified. Many regions & countries of the world remain to be covered to improve the richness of such watershed sample.

Contact with other working groups and organizations:

The WG-LSH will collaborate with the other IAHS and Panta Rhei working groups that would be interested to use large data sets and share experience. For example, links will be established with the MOXXI WG that works on new observations and the WG on education in hydrological sciences to promote LSH. Links will also be established with IAHS commissions (e.g. ICSW, ICSH, etc.) to join efforts and promote the use of the large samples in the community.

The WG will also search for links with WMO, which was very active in the past decades to organize comparative experiments and promote the access to meteorological data, and UNESCO for educational purposes (for example with possible collaborations with IHE).

References

Andréassian, V., Hall, A., Chahinian, N., and Schaake, J.: Introduction and Synthesis: Why should hydrologists work on a large number of basin data sets?, in: IAHS Publication n°307, Large sample basin experiments for hydrological model parameterization: Results of the Model Parameter Experiment - MOPEX, Paris, 2006, 1-5,

Andréassian, V., Lerat, J., Loumagne, C., Mathevet, T., Michel, C., Oudin, L., and Perrin, C.: What is really undermining hydrologic science today?, *Hydrol. Processes*, 21, 2819-2822, DOI: 2810.1002/hyp.6854, 2007.

Andréassian, V., Perrin, C., Berthet, L., Le Moine, N., Lerat, J., Loumagne, C., Oudin, L., Mathevet, T., Ramos, M. H., and Valéry, A.: Crash tests for a standardized evaluation of hydrological models, *Hydrology and Earth System Sciences*, 1757-1764, 2009.

Gupta, H. V., Perrin, C., Kumar, R., Blöschl, G., Clark, M., Montanari, A., and Andréassian, V.: Large-sample hydrology: a need to balance depth with breadth, *Hydrol. Earth Syst. Sci. Discuss.*, 10, 9147-9189, doi:10.5194/hessd-10-9147-2013, 2013.