Hydrol. Earth Syst. Sci. Discuss., 10, C3894–C3897, 2013
www.hydrol-earth-syst-sci-discuss.net/10/C3894/2013/

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Advancing catchment hydrology to deal with predictions under change" *by* U. Ehret et al.

Anonymous Referee #2

Received and published: 9 August 2013

This reviewer is basically sympathetic to the criticisms from the 18 July review. It is hard to know what to make of this kind of article; it is too broad in scope to achieve focused conclusions or a review of literature. Most (all?) of the points made are rehashed from a chain of literature stemming from the 1990's thinking on climate change and nonstationarity, and approaches to the science of complex systems, in a geoscience and catchment context. We have been here before. A common problem shared by the subsections of 4 is a lack of detail, precision, and a thorough literature review, but this is possibly unavoidable in this kind of paper. Therefore, I will take this paper for what it claims to be: an overview of a special issue. It should be published, and without dramatic rewriting in most sections. It contains many good references and facts, and is a nice discussion of the issues involved in modern catchment hydrology. This paper

should not try to be more than what it is, and should be more specific on one concept, and more general on another.

The strength of the paper is in the general discussions in sections 1 through 3.

The abstract lists a number of "perspectives" that are important and then that comparative hydrology and AIC have important benefits for catchment hydrology. I must have missed the discussion on comparative hydrology; there is a 1989 reference and I see a few references to the idea in section 4. But, the perspectives are generally well-taken.

In my view there are two significant problems with the paper: Stationarity and AIC.

The first was accurately critiqued in the 18 July review. Stationarity is the launching point motivating this paper, but the authors don't make the case that this concept really lies at the center of modern catchment hydrology. I don't think that it does. To me, stationarity has never been a concept in Earth Science, but is rather a fairly narrow statistical-methodological assumption needed by Engineers to judge risk in their design work in the absence of accurate numerical horsepower, physical parameterization, and especially input data for a watershed model. I have no reason to believe the authors are talking about anything more than the need for models that are updated with the most recent and accurate parameters and inputs. Can't we have a more detailed and precise discussion about whether those Engineering roots are still holding back Hydrologic theory, or at least about what exactly needs to be improved about our modeling to make it useful in an environment where the underlying physical parameterizations and input data might not be reliable due to change? Later in the paper I read parenthetically that stationarity has something to do with assumptions that separate timescales of processes. Maybe that thinking could be placed up front to clarify what you mean by stationarity and what non-stationarity means, specifically, for catchments and modeling. Be more specific please and tie this idea to all of the "perspectives" and how they address stationarity- or, alternatively, find another way to motivate catchment hydrology under change!

HESSD

10, C3894–C3897, 2013

The large section at the end on Algorithmic Information Content, by contrast, is non-sequiter because it is too narrow and specific, both in the sense that it goes into far more detail and is far narrower than the other "perspective" sections, and in the sense that it is myopic regarding the decades-long literature of Bayesian, Jayesian, and Shannon-Entropic/Information-Theory concepts and applications in modeling, geoscience, and hydrology. The reference list and conceptual description reduces this rich history to the last three years of work (mainly by Gupta et al.) interpreting models and hydrology as algorithms using AIC. I know that there are papers being published on this topic right now, and I sincerely hope those papers reflect a much broader understanding of how AIC fits into the big picture. AIC is one narrow interpretation of information theory and probability, which are in turn concepts that are part of a large family of statistical methods old and new that can be used to analyze systems. In order to be helpful and specific, let me ask for a revision that contains a more general but still brief discussion of information, statistics, and probability as frameworks for understanding complex systems and for helping with modeling, and in particular for recent applications that use geoscience and climate data, or catchment data. Here are some google searches on what I mean, below. The authors are certainly aware of this background, but it would be much better, in my opinion, to place AIC in this broader context so that an uninformed reader can learn. I am not convinced that AIC is unique among statistics and probability for its value to catchment hydrology. Statistics and probability, including information theory, and AIC as an example, can be used skillfully to help us test hypotheses and distinguish between models. Be more general please. This section needs attention before publication.

"generalized information theory for engineering modeling and simulation"

"climate model information theory fidelity"

"information theory ecohydrology"

"information theory geoscience"

HESSD

10, C3894–C3897, 2013

"information theory modeling"

"information theory data analysis"

"traditional statistics vs bayes theorem"

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 8581, 2013.