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Hydrology and Earth System Sciences
Discussions

Interactive comment on "HESS Opinions: Repeatable research: what hydrologists can learn from the Duke cancer research scandal" *by* Michael N. Fienen and Mark Bakker

A Bellin (Referee)

alberto.bellin@unitn.it

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This opinion paper addresses a very important and sensitive aspect of documenting research results with an emphasis on hydrology. The authors move from a short description (too short indeed) of the Duke cancer research scandal, introduce the concept of reproducibility and repeatability and discuss how the latter applies to hydrological studies. After observing that in hydrology like in "omics" (the science involved in the Duke scandal) some type of modeling is applied to forecast the behavior of the analyzed system and that both use large datasets, which need to be processed, trimmed and validated before using them in modeling, the authors conclude on the need for the hydrological community to organize modeling works such as to guarantee full repro-

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ducibility of their simulations.

The opinion is well written and addresses an important issue, which is currently debated in the hydrological community. However, given the topic and the context I was expecting more comprehensive conclusions and suggestions on how to implement this concept in hydrological sciences. Adopting open source tools and collaborative coding environments is highly recommendable, but it is only an aspect of a more complex picture involving data sharing and methodological developments, including the correct quantification of uncertainty, which has not been considered in the opinion. In the presentation the authors mix technological choices (such as scripting instead of GUI) with the more general issue of reporting modeling efforts with a level of detail enough to allow the reader to repeat all the computations. I believe the second aspect is much more relevant than the first one and requires a reversing of the actual trend to publish in "letters" form. In addition, technology is today available for data and modeling sharing, to a higher level than we currently do. This of course requires a change of perspective, moving from a competitive type of environment to a more collaborative one, in which anyone can build more easily than today on the results of others. A technological solution helping in reporting, within a script, all the steps of the modeling effort is important but only an aspect of the entire picture. I suggest to separate these two points and comment more on the second aspect of the modeling effort. Furthermore, there are still cases in hydrology in which data are scarse, a situation that is in sharp contrast with the "omics", in which large datasets are available and some trimming is always necessary. In hydrology trimming is a luxury that in many cases we do not enjoy. In hydrology the concept of repeatability is broader than described by the authors, since it is recognized that different models, with the same dignity, may lead to different results (epistemic uncertainty) and the same model can produce different, yet likely, results depending on the chosen parameters (parametric uncertainty). This is common in all natural sciences, indeed. The strict definition of repeatability requires that the same model with the same set of parameters is run a second time by another independent group to check if the same results are obtained, but this does not guar-

antee about correctness of the interpretation and conclusions of the study. It is “just” a technical verification of the modeling exercise. How can be repeatability defined in a context in which we recognize that uncertainty plagues our modeling efforts? This is a question, which I think may deserve space in this opinion paper. However, giving the nature of the paper this is not a request to revise, in case of a different opinion by the authors. Overall, the manuscript is well written and it may be instrumental to stimulate discussions in the hydrological community on this relevant topic.

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