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Hydrology and Earth System Sciences
Discussions

Interactive comment on "HESS Opinions: Advocating process modeling and de-emphasizing parameter estimation" *by* A. Bahremand

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I would like to thank Dr. Holisaz for his useful comment. I received the comment shortly after the open discussion was closed on the 22ed, therefore, I hope I can still upload this reply. As Dr. Holisaz has mentioned that the uniqueness of place is analogous to the uniqueness of ecological phenomena. Complexity and uniqueness are said to be the reason for the lack of simple general hypothetico-deductive laws in ecology (Westra and Lemons, 1995). Perhaps one reason for moving from statistics to concepts is the uniqueness which prevents generalization and statistical extrapolation in ecology. However, in ecology also, the process based models, which are based on a theoretical understanding of relevant ecological process, are gaining more popularity as compared to statistical or rule-based models based on previously collected data (Cuddington et

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al. 2013). In the direction of the second comment, I would like to refer the reader to the statement of Hoshin Gupta in Page 12382 mentioning about the field “system hydrology” and its focus on the “learning problem”.

Related to the third comment, I would just add that, however, even to test our physics based models, we depend on observed data which are not free from error. Moreover, our interest for physics based modelling is because of our thirst for more understanding, so in my opinion the reason for the tendency toward physics-process-based modelling is not for “reducing the errors” but for the reasonability and understanding of the phenomena and processes. Otherwise some black box models might provide us better results!

Regarding the problem of scale and the problem caused by the scaled-depend parameters, I believe alternative ideas such as Representative Elementary Watershed concepts as a useful scale-independent framework for representation of hydrological processes (Regianni et al., 1998, 1999; Beven, 2006) and the thermodynamic reinterpretation of Zehe et al. (2014) are the right track. As Beven pointed out in the Holy Grail paper (Beven, 2006), the first and the second most important problem in the 21st Century both mentioned to be related to the scale, and “we should still contemplate the search [resolving the closure problem] as a matter of scientific honor” (Beven, 2006).

Dr. Holisaz has suggested about incorporation of the ideas of the paper in a policy-making context. What I would like to add here, that bringing more physics and more detailed attention to process modelling not only leads to better integration of surface and subsurface hydrology in models but also a further level of integration can be achieved by injecting such models into a management context to drive water resource management imperatives (Paniconi and Putti, 2015). I liked the last point of the comment criticizing that the modeling has sometimes been misused to justify decisions of policy makers, and by focusing on more physics and more process-details we move deeper to the world of discovery and understanding the nature.

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Again, I appreciate the different views of the comment.

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