

## ***Interactive comment on “HESS Opinions “Crash tests for a standardized evaluation of hydrological models”” by V. Andréassian et al.***

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Dear Prof. Clarke,

Thank you for your encouraging comments.

The analogy you propose with plant breeding is indeed excellent, because it mimics quite to perfection the common approach used by most hydrologists in the model development process: most of the models were developed indeed in 'greenhouse conditions' (on a single experimental catchment). Thus it is logical to think that they should have then be tested in field conditions (in a randomized setting, during several years), first with farmers known to follow 'best practices' (with catchments known for the quality of

C1746

their data set), and then with farmers chosen at random (with 'real-world' catchments). Unfortunately, this has rarely been done!

Another extremely pedagogical side of the analogy your propose lies in the combined impact of climatic variability and pests. Hydrologists too-often argue that their models should be tested on 'carefully selected catchment sets'. This is in our opinion wrong: first because if models are to benefit society (like John Schaake mentioned in his review), they should be able to withstand the conditions of the real world; second, because in hydrology, deciding which data set is of "high quality" will require using a model (implicit or explicit), and this will bias the selection (i.e. make it circular). What we find extremely powerful in your analogy is the reference to pests: we all know as gardeners that there is no way to avoid them completely, that we have to make do with their existence, and even if it were technically possible to avoid them, the environmental cost of it would be extremely high (we might eventually avoid all pests in our garden at the cost of poisoning completely the fruits and vegetables we grow: clearly, this would be a nonsense). Similarly, working with "cleansed" hydrological datasets is a nonsense!

Of course, hydrology and agronomy also have differences. There are in hydrology alternatives to the greenhouse step for model selection. The power of modern computers allows modern hydrologists to test directly all model variants in 'field conditions', at a very small cost, and we believe that it permits to focus on 'selecting' the most robust models.

A question of major importance that remains open (with either the agronomical or the crash-test analogy) is that of the selection of the test catchments. In a large dataset, what should be the relative weight of large vs small, dry vs humid, temperate vs tropical catchments? It will probably be extremely difficult to reach any consensus on this, mostly because many hydrologists believe that models need to be 'climate-specific'. As far as we are concerned, we have neither ready-made opinion nor theoretical position on this issue. We can just state that in our past tests, we have never been able to

C1747

show any significant impact of climate conditions on the RELATIVE ranking of the best models that we were testing. But in a first step, the best solution would probably consist in defining a small number of climate groups, and to have a different "crash-test" experiment (or as you put it, a field-condition experiment) for each of the groups. We may eventually find that it did not change much the ranks of model structures/model versions, but this remains to be tested.

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