IAHS2017-382
IAHS Scientific Assembly 2017

Should we reconsider the conceptual structure of hydrological models?

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Despite relevant progresses in monitoring means and computing resources during the past 20 years, performances of hydrological models are not much improved. In fact, relevant research efforts have been made to improve theoretical schemes and to propose innovative sub-disciplines in hydrology, but still modeling results are affected by significant uncertainty which severely undermines the reliability of design variables.

By looking at the history of science, one notes that relevant progresses frequently emerged from a complete change of perspective, rather than improved theory. Therefore, it is compelling to inquiry whether a paradigm change is also needed in hydrology, and how it should be stimulated. Should we reconsider the conceptual structure of hydrological models, rather than trying to improve theoretical schemes? Are the so-called physically based models supported by realistic interpretations?

The present contribution makes an attempt to challenge the basic concepts of hydrological models, by introducing random physically-based schemes where the traditional deterministic description fails to provide a reliable representation. An example will be discussed which refers to rainfall-runoff modeling for which the control volume for the water balance equation, that is impossible to describe deterministically, is expressed in stochastic terms.