

**Title:** HESS Opinions: The complementary merits of top-down and bottom-up modelling philosophies in hydrology

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**Journal:** Hydrology and Earth System Sciences

**Review:**

Hydrological models are used to predict floods, droughts, groundwater recharge and land-atmosphere exchange, and are of critical importance as tools to develop strategies for water resources planning and management. In these hydrological models, two modelling philosophies, namely bottom-up and top-down approaches are the basis in representing a hydrological system. In bottom-up approaches, very detailed representations of the hydrological system is considered. On the other hand, in top-down approaches, less detailed, often spatially lumped representations of the hydrological system is considered. As underscored in the current literature, it has been extensively argued in numerous journal papers about the pros and cons of top-down and bottom-up approaches.

In this manuscript, the authors scrutinize common modelling critiques on top-down approaches and discuss the extent to which they are justified.

Based on this review, the following comments are made:

- 1) The current version of the paper does not convince that the cited papers are sufficient and informative for the authors to draw conclusions or comments on the topic that is discussed in this paper. Moreover, from the reader's point of view, what has been discussed in this paper has already been echoed in the current literature.
- 2) It has been extensively argued in numerous journal papers about the pros and cons of top-down and bottom-up approach. Therefore, from the reader's point of view, for this commentary to have some merits, the authors need to go beyond what has been understood in the current literature. From the reader's point of view, it would be more useful, for example, if the authors bring the concept of middleware that lies in between the said approaches of modeling (i.e., top-down and bottom-up).
- 3) In the current version of the paper, the authors scrutinize common modelling critiques (C1-C3). Are these critiques developed by the authors? Are these critiques developed based on some published survey? What motivated the authors to consider these critiques as the "common" modelling critiques?
- 4) In the current version of the paper, the authors scrutinize common modelling critiques on top-down models (C1-C3) and discuss the extent to which they are justified. From the reader's point of view, the title of the paper does not fit the content of the paper.

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- 5) Referring to line number 22 on page number one, the authors state that the models frequently fail to reproduce the hydrological response in periods they have not been calibrated for, thereby providing unreliable predictions. From the reader's point of view, this statement needs to be cited.
- 6) In the current version of the paper, the authors discuss about the spatial complexity, process complexity, and spatial scale. However, referring to line number 22 on page number one, from the reader's point of view, it would be more useful if the authors discuss about the influences of temporal scale and its complexity on the said approaches of modeling (i.e., top-down and bottom-up). Is it scientifically justifiable that the processes that are modeled at a particular temporal scale do not change when the temporal scale changes? In the current literature and the modeling practices, the processes that are modeled are the same regardless of the temporal scale of the simulation.
- 7) Referring to line number ten on page number one, a better understanding bears the potential of identifying the complementary value of the two philosophies for improving "our" models. Are these models developed by the authors? Is this commentary about the models developed by the authors?
- 8) From the reader's point of view, some of the paragraphs are repetitive (e.g., the paragraphs about the activation and deactivation of processes).

**Signed**

**Editor-in-chief**

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