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Hydrology and Earth System Sciences
Discussions

Interactive comment on "HydroSCAPE: a multi-scale framework for streamflow routing in large-scale hydrological models" *by* S. Piccolroaz et al.

Anonymous Referee #1

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This paper proposes some improvements to the WFIUH approach. The first argument of the paper is the emergence of socio-hydrology, which is not in scope of the paper. Then, justification of the paper is based on a literature review of Earth System Models and Large Scale Hydrological Models, which leads to the choice of the WFIUH approach for its parsimony, conceptualization, scalability... But finally the literature background of the geomorphology-based approaches, including the WFIUH, is not comprehensive and well displayed forefront, so that several claims of the "innovative", "perfect scaling" etc. proposal are not demonstrated.

The main underlying issue is the dealing with the emergence of dominant hydrological

processes and the relevance / improvement of the WFIUH in this regards when applied to mesoscale basins (as exemplified with upper Tiber basin in Italy): between hillslope / channel / drainage network; between grids and basin sizes / scales; between dispersion, space variability and simplifying assumptions (average velocity or not, rainfall spatial variability assessment and accounting. ...) – which could be made more explicit.

Literature about hillslope/channels (individuals and networks) articulation is acknowledged here and there, but the one about accounting for spatial variability in geomorphology-based IUH is not acknowledged. Papers do address this issue with different rainfall data input (radar, interpolation...), convolution enrichments, notions of effective networks, sub-basins nestings ... The approach presented here should be framed in the whole landscape of the corresponding literature.

Further, even if the griding and nodes rationale presented here allows in theory to account for spatial variability of runoff, it is not clear how calculations are operationalized. Hillslope runoff relies on classical models such as the SCS one, but how is this run at the hillslope level before downstream aggregation? How are soils and land covers described and conceptualized at the elementary level of this rationale? Runoff is in fact closer to net rainfall than to gross rainfall. This "hillslope production function" is very contingent across hillslopes and along time non linearities and is a major epistemological obstacle in the geomorphology-based literature which this paper somehow overlooks.

Spatial explicitation / Interpolation of rainfall (ideally net rainfall before the convolution with the transfer function) is also a major issue which is here solved by kriging with external drift from the network of available raingauges (changing from one event to the other). The influence of this interpolation approach on the rainfall-runoff modelling is not neglectable compared to the geomorphometric side. Is kriging relevant at the used modelling time step? Is'nt the geostatistical structure changing for changing rainfall fields under convective, advective and orographic influences? Further the griding scheme could be more linked/discussed in conjunction with the raingauge geometry

and resolution.

A full WFIUH approach is developed for nodes corresponding to macro grid cells, and then “rigidly translated” to downstream nodes. The relevance and interest of this nesting approach with a jump in simplifying assumptions are not discussed whereas it is at the origin of the high calculation cost (and so parallelization challenge) and whereas the classical WFIUH is parsimonious in calculation as based on a simple convolution.

The proposed approach is exemplified with two historical events of the upper Tiber basin. Results obtained do not allow to conclude 1) if the proposal performs better than “classical WFIUH”, including options which already account for spatially-variable rainfall; and 2) about relative errors, uncertainties and improvements of the rainfall space-time variability accounting, the hillslope production and transfer modelling, and the “innovative” network transfer modelling.

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