Geosci. Model Dev. Discuss., 7, C908–C912, 2014
www.geosci-model-dev-discuss.net/7/C908/2014/

Geoscientific Model Development Discussions
Open Access

Interactive comment on "SEHR-ECHO v1.0: a Spatially-Explicit Hydrologic Response model for ecohydrologic applications" *by* B. Schaefli et al.

B. Schaefli et al.

bettina.schaefli@epfl.ch

Received and published: 12 June 2014

We would like to thank H. McMillan for her detailed review of our paper. We agree that the model is a fairly standard precipitation-runoff model even if we would like to point out that many similar models do not explicitly account for the spatial origin of flow at similar scales (10-100km2).

Before answering all comments in detail, we would like to emphasize why we have termed our model *spatially-explicit* (see also reviewer comment hereafter): The terms *distributed* or *semi-distributed* generally imply that the model parameters are fully distributed in space (each spatial unit has its own parameter set), whereas *semi-lumped*

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

is commonly used to describe models that compute the state variables separately for each spatial unit but with the same parameter set for all units. We believe that the term spatially-explicit is more generic since it implies that the state variables and the model output are computed separately for different spatial units without specifying a priori whether the parameters are distributed or not (in the presented model, some parameters are, others not). This more general term is also more intuitive to understand for other geoscientists (we believe that the distinction between semi-distributed and semi-lumped is very specific to rainfall-runoff modeling).

Response to detailed comments:

Title: the case for eco-hydrologic applications is not made clear in the paper.

The presented model computes spatially-explicit water fluxes at the ecosystem level and can thus be used as a modeling tool for ecohydrologic applications requiring distributed discharge information. We will make this clear in the revised paper.

P1868, L3: It is not clear how this term "spatially explicit hydrological response model" is different from the standard term "distributed model"

We will clarify this point (see above comment).

P1869,L 14: Are wind, radiation etc also used in the energy balance?

We will rephrase to avoid giving the impression that we solve the full energy balance.

P1870, L 6: Does "important vegetation cover" mean trees?

We should have been more specific; we are indeed talking about catchments with a significant amount of vegetation that is not covered by the snowpack (namely shrub and trees).

P1870: What happens to the non-evaporated water Ic? It may be better to reformulate this store as dIc/dt as with the other stores

We do not model interception – re-evaporation as a storage – emptying process but as an instantaneous process, assuming that it takes place at time scales smaller than the simulation time step (i.e. subhourly). Only the evaporated water is subtracted from the incoming precipitation, which corresponds to a return of non-evaporated water as throughfall. We will make this clear in the revised version.

P1875: How do you account for the fact that water flows more quickly at higher stage (i.e. the kinematic assumption)?

We assume constant flow velocity (in space and in time), which we consider a sufficiently good assumption for the range of flow conditions that might be encountered in similar catchments. This will need to be relaxed for larger systems. We will add a comment on this.

P1876, L 17: Is explicit time stepping good enough for the fast component?

Explicit time stepping is used for the fast subsurface flow component, which is slow compared to the surface runoff component and still has a residence time of several days. Explicit time stepping is thus good enough here.

P 1879, L 24: What are the units or values of rD?

The formulation was erroneous, it should read as: "and rD is the surface runoff coefficient of the dominant land use class" (rD is thus unit-free).

P1881, L 22: Please state how many individual parameters were you estimating, given that many were jointly estimated using scalings between subcatchments.

We estimate 12 parameters, 7 for the water input-runoff transform and 5 for the glacier- and snowmelt simulation. This will be specified in the paper and in Table 2.

P1882, L1: The splitting between different speed processes was partly imposed by setting minimum residence times.

Thanks for pointing this out, we will update our current statement to "The splitting be-

GMDD

7, C908–C912, 2014

Interactive Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

tween the three hillslope scale runoff generation processes corresponds to the expected pattern: Fig. 5 illustrates that the slow subsurface component contributes essentially to base flow and that the direct surface runoff is activated only occasionally. It is noteworthy, however, that this pattern results partially from the imposed subsurface residence time scaling."

P 1884, L 27: The "unique transferability across timescales" was not shown – I expect other models can also achieve this

We will tone down the statement. Based on our experience, many similar models require re-calibration if applied at a different time step, especially those that do not resolve the spatial origin of flow at the subcatchment scale.

P1885, L5: "the presented model can easily be extended to transport processes" – this is rather a bold statement, especially since the area-based scaling may no longer be valid when considering the transport of water/contaminant particles (e.g. Hrachowitz et al. 2009)

We will rephrase; our intention was to state that the general modeling framework (albeit not the exact parameterization) can be extended to transport processes and we will include a reference to a recently submitted paper that simulates water temperature based on a similar modeling framework for water input – runoff transform.

Other detailed comments:

We will make the following suggested corrections:

- P1867,L18: the Clark et al model has a separate parameterisation of subcatchment travel time before water reaches the defined channels; it is not considered negligible.
- Figure 1: It could also be useful to add the flux/state symbols.
- P 1874, L19: Should be "slow" in the subscript

Interactive comment on Geosci. Model Dev. Discuss., 7, 1865, 2014.

GMDD

7, C908–C912, 2014

Interactive Comment