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Hydrology and Earth System Sciences Discussions

Interactive comment on "Hortonian overland flow closure relations in the Representative Elementary Watershed Framework evaluated with observations" *by* E. Vannametee et al.

Anonymous Referee #1

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General

The paper is a sequel of a previous publication of the authors on the REW concept (Advances in Water Resources 43 (2012) 52–66), whereby it is not clear in how far the present paper provides a significant contribution beyond what has been published in the AWR paper.

The principal observation on the work presented in this manuscript is that the authors do not seem to consider in what the REW concept actually consists, by calling a mass balance analysis for Geomorphologic Response Units based on empirical relationships a "Representative Elementary Watershed" application.

The REW approach consists of identifying "representative" units or control volumes, which are defined in such a way as to be recognizable at different spatial scales, and subsequently integrating the micro-scale conservation equations for mass, momentum and energy over the control volume.

In this process spatial gradients are converted into fluxes across the control volume boundaries. REW-scale mass fluxes, forces and energy fluxes are obtained, which need to be closed at the spatial scale of the volume. The control volumes can encompass either a single hill-slope, or be extended to include an entire watershed, the basic definitions however do not change.

To address a variety of spatial scales, which characterize the flow processes on the surface and subsurface, and make the definition time-scale consistent, the conservation equations are additionally averaged over a characteristic time interval, similarly to approaches used to describe turbulence in fluid mechanics.

In the REW process closure relationships are derived by combining mass/momentum and/or energy balance, i.e. first principles, with the aim to avoid postulating closure relationships "ad hoc". This approach however has not been pursued in the manuscript, where the authors postulate closure relationships for mass balance equation, without invoking conservation equations for momentum and/or energy. A macro-scale flux is closed with micro-scale parameterization, mixing up spatial scales in the process.

The criterion used by the authors to delineate REWs does not pay any attention to the fact that REWs are originally defined as spatially-independent scalable entities, and need therefore to be recognizable over a whole range of scales. As such a REW is fundamentally different from a "Geomorphologic Response Unit". The manuscript suggest that the authors have used "dominant geomorphologic features" as criterion to identify spatial entities, which is not what the REW approach represents. A spatial discretisation based on "geomorphologic features" does not necessarily lead to control volumes defined independently of spatial scale.

As a general observation, the Nash Sutcliffe efficiency values below 0.5 are quite low.

In summary it is not clear in how far the present work is in line with the original REW formulation and definitions. The mass balance is formulated as a problem at the scale of a control volume, fluxes on the other hand are closed from a point-scale optic. It is therefore suggested to rename the work an application and calibration of a Geomorphologic Response Unit application.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 1769, 2013.