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Geoscientific Model Development Discussions

Interactive comment on "Fluxes from Soil Moisture Measurements (FluSM v1.0). A Data-driven Water Balance Framework for Permeable Pavements" *by* Axel Schaffitel et al.

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In preparing this manuscript, the authors aimed at providing approaches for analysing water fluxes in urban environments and, in particular, those urban environments where permeable pavements existed. For this purpose, a conceptual water balance model is proposed. The contribution to literature arises from the approach used to estimate the conceptual parameter values necessary for operation of the model.

While a continuous modelling system is employed for the water balance model, the time steps employed in the model were 10 minutes for the surface water balance and 1 hour for the remaining components. The response time for most urban surface water

systems is significantly shorter than 1 hour so the approach of using 10-minute computational times is an attempt to mitigate this problem. Unfortunately, in the opinion of this reviewer, a 10-minute computation step is still excessive. The result of the 10-minute computation step will be the absence of computation points on many events and, hence, a lack of data and information contained in the surface flow hydrograph.

For the surface water balance, the two large fluxes will be the precipitation and the evaporation. The surface runoff and infiltration constitute the balancing elements, as noted in the manuscript. Errors in the surface flow hydrographs will be balanced by equal but opposite errors in the infiltration component of the water balance.

The total flux through the surface runoff and infiltration is approximately 900mm. However, the distribution of this 900mm between surface runoff and infiltration is not provided; this data needs to be provided if the 10-minute computation step is to be validated. Furthermore, no surface runoff measurements are provided to validate the assumed values for parameters and the adopted calculation time steps.

The parameter Csurf is defined as the maximum surface storage capacity. As the normal definition of surface storage is the volume of water in temporary transit to the catchment outlet, it is suggested that the term Csurf actually refers to the initial loss storage, sometimes referred to as depression storage; until the depression storage is filled, surface runoff will not be generated which appears to be consistent with the authors' usage of Csurf. It would be interesting if the values obtained using the approach proposed by the authors were similar to the values obtained from the analysis of surface runoff hydrographs; see Boyd et al (1993) and Ball & Powell (1998) for examples of the determination of Csurf from analysis of runoff hydrographs.

While the division between infiltration and surface runoff defined by the authors is consistent with the approach discussed by Rankin & Ball (2010), it is possible for the infiltration capacity to vary with time and thus Icap will not be a constant as assumed by the authors. This variation can occur in both directions. During the storm event, the infiltration capacity will decrease to an asymptotic rate related to the hydraulic conductivity of the soil; this decrease arises from a decreasing differential between the saturated soil moisture and the antecedent soil moisture. During the dry inter-event periods, there is a recovery of infiltration capacity as the soil moisture decreases.

This variation in infiltration capacity becomes more important as the storm burst duration decreases; in other words, the more prevalent flash events become, the more important it is to assess variations in infiltration capacity. No information about the precipitation events is provided by the authors.

The apparent reliability, i.e. consistency in parameter estimation, of the approach proposed by the authors, maybe related also to the variation in precipitation mechanisms. If there is consistency in the precipitation mechanism and, as noted previously, potential errors are self-compensating, then it is likely that the resultant data clustering would force a convergence of empirical outcomes. Consideration of the rainfall mechanisms and attempting to include a variety of mechanisms would increase confidence in the authors' approach to parameter estimation.

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