Review of *Hydrol. Earth Syst. Sci. Discuss*., 7, 6613–6646, 2010

Large-scale runoff generation – parsimonious parameterisation using high-resolution topography
by
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Overview
The paper essentially consists of two parts. The first is a procedure for estimating the infiltration capacity curve in the VIC land surface model based on a topographic index derived from high resolution topography – SRTM as processed by the HydroSHEDS project. The second is applying the estimated index, along with a VIC-type parameterization to estimate discharge from three basins as well as some (modest) investigation of equifinality.

Recognizing that the VIC infiltration capacity curve can be estimated from a topographic index, and that the VIC parameterization is essentially the same as TOPMODEL is well known in the literature. Besides the paper cited in the article addressing this (Sivapalan et al., 1995 *Hydrol. Proc*. 11, 1307-1330), there is Kavetski et al., 2003 (Semidistributed hydrological modeling: A "saturation path" perspective on TOPMODEL and VIC, *Wat. Resour. Res.* 39(9): Art. 1246 that addresses both the relationship between the models but more importantly the numerical issues that affect performance.

The paper has an extended discussion on how one could establish the maximum storage capacity within a macro-scale modeling grid or a basin, and this discussion is useful for researchers who are starting to use the HydroSHEDS data for paramerizing storage-type hydrologic models.. They draw on earlier work by Quinn et al (1995 (cited) on estimating the topographic index, and explored the effect of the tails of the topographic index distribution on model performance (Figure 5). The paper would be strengthened if the authors did additional work on the impact of the tails on the discharge predictions, thought how work from geomorphology may contribute to estimating what would be the catchment support area for continually flowing streams and how may this area vary with climate. My take-away message from the paper's Figure 2 is that after trimming the tails of the topographic index, the resulting distribution looks very similar to the VIC infiltration capacity curve.

Their model along with a VIC-based parameterization was applied to three basins, with the results essentially identical (Figures 7 and 8). One interesting issue is the calibrated VIC infiltration capacity curves and their topographic indices are quite different, looking at Figure 9. This suggests that they should address the question on the sensitivity of the predicted discharge to the variability in the shape of these curves. Looking at Figures 7-9, it seems that reasonable curves give essentially identical predictions. Perhaps the authors can comment on this?

Specific concerns.
The paper really needs to be edited for clarity and proper usage of English.

I question their interpretation of the parameter *m* in equation 3 as representing transmissivity. This is a hold-over from the TOPMODEL sub-surface flow development, but has no real place in their model development. In the end they use it as a (spatially constant) scaling parameter to relate storage deficits to the topographic index. Can they comment on the suitability of the assumption of holding *m* spatially constant?

They don't include or discuss infiltration, and assume that all precipitation that falls on non-saturated areas infiltrates. We know that for heavy rain rates often exceed the potential infiltration rate, leading to what is referred to as Hortonian overland flow. Can they comment on how this should be included in their topographically-based model?

Overall Assessment.

The major contribution of the paper is presenting an approach for using high resolution topography to estimate VIC infiltration capacity curves, and being able to map back to the catchment the locations of the deficits and saturated areas. This has assumptions not fully recognized, and is similar to the similarity assumptions in TOPMODEL.

Overall, the paper is a useful, but modest, contribution to the literature.