Hydrol. Earth Syst. Sci. Discuss., 9, C4882–C4886, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C4882/2012/
© Author(s) 2012. This work is distributed under
the Creative Commons Attribute 3.0 License.

Hydrology and
Earth System
Sciences
Discussions

Interactive comment on “Parameterizing sub-surface drainage with geology to improve modeling streamflow responses to climate in data limited environments” *by* C. L. Tague et al.

C. L. Tague et al.

jsc.eco@gmail.com

Received and published: 18 October 2012

First, we thank Charlie for his very insightful and thoughtful review of the paper. We agree in general that our emphasized goal of the paper as testing a strategy for disaggregation may be an overstatement. We do think that the paper has relevance for how watersheds are discretized, which can be considered a type of “disaggregation”, but we agree that this is not the conventional sense of the term. We have revised the introduction and discussion sections to clarify that the goal of this paper is to test a geologic end-member based scheme for transferring parameters – we also note that a

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

secondary goal is to test whether there are actually "geologic" end members – which has implications for parameter transfer schemes – and may contribute to thinking about strategies for disaggregation. We have also removed the "reductionist" rhetoric and agree that it was misleading.

We also add an additional table to our results to demonstrate the transferability of parameters to different watersheds within the WC classification. This includes a range of scales from 1st order to 3rd order. Results support the transfer of parameters across these scales; we include this to strengthen our argument that our results point towards the potential to assign parameters from geologic end-members across a range of scales. (New table attached for reviewer.)

We have also added more detail on the RHESSys hydrologic model and drainage parameters.

Charlie also points to some apparent inconsistencies in calibrated drainage parameters and physical interpretation. Some of this confusion arises from the interpretation of m – the parameter that controls the decay of saturated conductivity with depth. In RHESSys, decay is actually proportional to the inverse of this parameter; therefore, we have included this information to avoid this confusion. We have also added a discussion of HC and WC differences in calibrated m parameters.

"Improved performance for WC watersheds occurred with lower values of m relative to HC watersheds. Lower values of m denote a steeper decline in hydraulic conductivity with depth, and are consistent with shallower hydrologically active soils. This result is consistent with the more well-developed clay and bedrock confining layers associated with the older WC geology."

Charlie also made a good point that our results suggest a simple slow and fast drainage model, and suggested we discuss this. We include the following:

"We note that RHESSys is a spatially distributed hydrologic model of intermediate complexity. Simpler hydrologic models (such IHACRES) that use a lumped representation of fast and slow drainage systems may also be able to capture geologically based hydrologic differences between HC and WC systems. However, we note that these are steep mountain watersheds, and thus discretization of the landscape to account for spatial patterns of snow accumulation and melt would be more challenging to capture with these lumped models. In addition accounting for within watershed spatial redistribution of moisture may also impact evapotranspiration estimates by supporting higher ET in near stream areas or topographic hollows. RHESSys also account for coupled feedbacks between ecosystem carbon cycling and growth and hydrology. This paper highlights that a relative simple hydrologic parameterization scheme can be effective for this type of intermediate complexity hydrologic model"

Technical comments:

As suggested by this review and others we reduced the discussion of W2.

In response to concerns about use of correlation coefficient, we have drawn the one-to-one line on the graphs in Figure 6. We have also moved the observed box on Figure 7a to the far left as suggested to clarify that the modeled impact of warming should be compared with modeled baseline conditions rather than observed. We also include some additional discussion of sources of model error, in particular error in climate inputs, in the text as follows:

"There are, however, notable differences in inter-annual mean and variation between observed and modeled estimates. One potential source of these errors would be errors in estimation of meteorologic inputs. Interpolation of both temperature and precipitation in mountain environments is a well-documented source of error in hydrologic models (Liston and Elder, 2006). Here we use a relatively simple approach where point meteorologic measurements of temperature are scaled using a constant environmental lapse rate of temperature with elevation, and precipitation is scaled based on long-term mean patterns derived from PRISM (Daly, 1994). Recent studies have shown that air temperature lapse rates with elevation are considerably more complex in this region, reflecting temperature inversions and cold air pooling (Lundquist and Cayan, 2007, Daly et al., 2007). Similarly, there are likely to be substantial errors in interpolating precipitation data for specific storm events. Our use of daily streamflow over several decades for model calibration and evaluation emphasizes long-term seasonal patterns of high and low flows and recession behavior – which are more likely to be sensitive to average climate and geology and are the focus of this paper. We therefore emphasize drainage parameter calibration and transferability, given expected uncertainties in meteorologic forcing. What is particularly encouraging is that even with these limitations the SF watershed shows no degradation in performance relative to calibrated watersheds (based on predictions of spring fraction of flow). Future work will focus on disentangling the relative roles played by errors in meteorologic forcing and drainage properties."

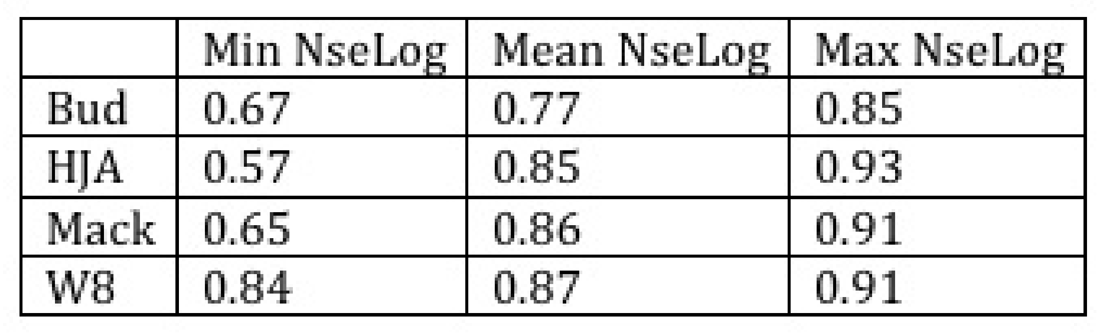
Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 8665, 2012.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



	Min NseLog	Mean NseLog	Max NseLog
Bud	0.67	0.77	0.85
HJA	0.57	0.85	0.93
Mack	0.65	0.86	0.91
W8	0.84	0.87	0.91

Fig. 1.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper