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Geoscientific Model Development Discussions

Interactive comment on "A subbasin-based framework to represent land surface processes in an Earth System Model" *by* H.-Y. Li et al.

Anonymous Referee #2

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General comments

Although the overall subject area of this paper (better representation of spatial heterogenity and hydrology in large-scale models) is of interest, I found little interesting information in the manuscript and recommend that it be rejected.

Overall it is well-written, although some of the figures could be improved through the use of alternative colour schemes. My main criticism though is that the paper does not describe any substantial advances in the field.

The paper describes a comparison between two versions of the CLM land surface model, the first using a traditional 'rectangular' grid and gridboxes, the second being a newly-developed approach in which the basic units are catchments (rather than rect-

angular grid boxes). These versions are called CLM and SCLM respectively. The perceived benefits of the SCLM approach include that it better represents the natural catchment-based structure of a landscape and is more similar to the catchment-based approach used in the hydrological modelling community. The study considers the Columbia River in the U.S.A. and compares results for CLM using 0.125° gridboxes with those from SCLM using catchments of approx 0.125° size. GIS methods are used to prepare appropriate input data for SCLM by calculating catchment-average values. The main result is a modest change between CLM and SCLM in the simulated streamflow.

The authors have clearly done a substantial amount of work in setting up the simulations and in creating the input data, and the system they describe has the potential to yeld some interesting results. However, on the basis of this paper I would say that they do not yet have those results.

By choosing to use 0.125° catchments for SCLM (on the basis that this is the fairest first comparison) the authors have almost inevitably found little difference between the models (as noted by Reviewer 1). It is quite possible that larger and more beneficial changes can be found if SCLM uses smaller units, but this was not tested here. Similarly, calibration for SCLM (which currently uses parameter values obtained for CLM) will most likely improve results. The authors also suggest (Summary, p2714 line 22) that SCLM is less sensitive to changes in resolution, which is another promising result but not from the current study. I see lots of promise, but not enough in this paper.

Specific comments There is fairly extensive discussion of how the input data were prepared (e.g. using GIS) but these do not appear to be novel (essentially using weighting by area).

The "important hydrologic parameters" f_{max} and C_s are not properly introduced - the reader should be given some idea of what they are and how they work.

Several of the figures (at least 2, 3, 4, 6) contain fairly little information - essentially they

show that differences between approaches are small, which arguably might be better just stated in the text.

The colour scheme of Fig,4 (essentially blue everywhere) is not helpful.

To me one of the features of Fig.5 is that the SCLM-calculated streamflow is often worse (compared to observations) than the CLM streamflow (e.g. low bias in June is often worse), which should at least be acknowledged in the text. I accept that this is a preliminary examination and SCLM might in time produce better results.

Various conclusions (e.g. that using high-resolution DEMs to calculate topographic indices does not guarantee improvements in simulated hydrology - in the Summary) are not all surprising to those in the field and do not serve to increase confidence in the paper.

The paper spends quite a while looking at different precipitation regimes and looking into the details of the hydrological simulations and forcing data, but my impression is that they are looking at small details (which might have to be done, but not reported at such length when the overall changes and conclusions are so slight) in the absence of major results.

Technical corrections I can suggest various minor corrections if this paper goes forward in its current form, although that currently seems unlikely (to me).

Interactive comment on Geosci. Model Dev. Discuss., 6, 2699, 2013.