Hydrol. Earth Syst. Sci. Discuss., 11, C5829–C5831, 2014
www.hydrol-earth-syst-sci-discuss.net/11/C5829/2014/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Towards observation based gridded runoff estimates for Europe" *by* L. Gudmundsson and S. I. Seneviratne

B. Fekete (Referee)

bfekete@ccny.cuny.edu

Received and published: 26 December 2014

Gudmundsson and Seneviratne presented new time varying gridded runoff estimates for Europe primarily based on observed river discharge combined with atmospheric forcing and land surface characteristics in a stochastic framework. I was quite excited about the paper when I was invited to provide my comments, because I anticipated that the authors will take my earlier work (Fekete et al. 2002, that the authors cited) to a new level. I strongly believe that discharge records are poorly utilized in continental scale hydrology despite their high accuracy compared to other "measured" components of the hydrological cycle, therefore I was looking forward to see new advancement in their utilization. To be honest, this paper was different than I expected.

In principal, I probably disagree with the authors that a calibrated blackbox model (machine learning algorithms) is any closer to observations than physically based models. In that sense, I don't necessary see the difference between implementing machine learning algorithm using a series of input variables from physically based land surface models (LSMs). I personally have a preference using the later, partly because that is what I am more familiar with, but more importantly, physically based LSMs can give insight into how the water cycle works that a blackbox model can not. I admit that LSMs applied coarse resolution are possibly as much detached from physical reality than a blackbox model, but nevertheless they implement well understood physical processes.

I normally don't like to push my own work in reviewing, but I think the authors somewhat overlooked our paper (Fekete 2002) that could be seen as a predecessor to their work. Although our 2002 paper only provided monthly climatology of gridded runoff estimates, we produced 10 year time series (1986-1995) for the ISLSCP-II initiative (http://daac.ornl.gov/ISLSCP_II/guides/comp_runoff_monthly_xdeg.html). I have to admit that the ISLSCP-II time series has serious problems as the number of discharge gauges drop out over time, but both the provided climatology and the delineated subbasisn and inter-basin discharge could serve as a reference to the present study.

The fundamental difference between our work and this study is the use of large vs. small river basins. While large river basins are more prone to human alterations, but I would argue that having multiple discharge gauges along the rivers main-stems should be sufficient to isolate affected and "pristine" river reaches. A step forward would be the combination of the authors approach looking at small basins that are smaller than a grid box with large river basins. To some degree the authors accomplish this by considering major river basins across Europe, but I think, more fine grained subbasin partitioning should be feasible.

I would encourage the authors to implement their work on a finer resolution grid. Half a degree resolution is pretty much the norm for global scale studies therefore one would expect higher resolution analysis for a single continent.

Although, the paper did not quite meet my expectation in terms of delivering gridded runoff fields (where I have to admit that probably my expectations were biased), I found plenty of valuable research findings with respect of what variables are important for large scale hydrological modeling. This angle of the paper was more valuable to me than producing gridded runoff fields. I would argue that this sensitivity analysis is where the blackbox approach is more convincing. When sensitivity analyses are carried out with physically based models, one has to wonder if the derived results are indeed the characteristics of the physical world or the model.

Taking the machine learning model and testing different sets of model inputs in a stochastic framework appears to be a better approach in telling which data are important. Although these results might be still misleading since high noise in certain input data and the corresponding over fitting might be a problem with the input data itself rather than its significance in the simulated processes, but nevertheless it is informative with respect of where one should put more emphasis in large scale modeling.

Although, this paper is quite different from what I hoped for, but it has substantial valuable results that is worthy for publication. I encourage to authors to take a closer look at the time series implementation of the composite runoff fields that we produced for the ISLSCP-II Initiative, but if the authors chose to stick to the current content I will support their papers' publication in its present form.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 12883, 2014.