LEGEND: Reports Answers

Report #1

Overall, the authors responded well to most of my comments and I think the paper can be published after some minor revisions (see below). Congratulations on a great paper!

Thank you for your comment and support throughout the whole revision process!

I have a few more comments that are related to comments I made in my previous review.

I am still not entirely convinced that “landscape features/properties/fingerprints” is the best choice of wording, e.g. in the abstract or line 117 or 244 (of the revised version). What the algorithm learns from the streamflow data that is not contained in the raw climate data is not necessarily (or at least not only) related to landscape features in the sense of soils, geology, etc. I would rather call it "hydrological features" or something similar, which are both a result of the interaction between the climate variables themselves and the landscape. This matches well the fact that they are strongly correlated with hydrological signatures like baseflow index or mean streamflow (the latter being mostly a signature of the climate).

Thank you for your comment. It is true that the learnt features are technically hydrological signatures (and are clearly correlated to them) because they are functions of the streamflow. Moreover, they must be minimally related to climate, through the conditional structure of the architecture. However, this holds true only assuming a perfect decoder, i.e. a decoder capable of utilising all the relevant information (relative to streamflow reconstruction) about the meteorological drivers. If such is the case, all the interactions between climate and landscape would be internally represented by the decoder, which would “know” how to merge the information coming from the encoder. The encoder would be then free to learn any additional information contained in the streamflow which is not contained in the drivers, and this information would be related to landscape properties not influenced by the climate. Of course, known landscape attributes are something different because they also contain climate information.

The conclusion that “our research reveals a significant reduction in the dimensionality of the streamflow time series” hinges on the choice of objective function (i.e. NSE). I mentioned in my previous review that NSE does not capture all that is hydrologically relevant (that’s the whole point of using diagnostic signatures in the first place). Thus, these two to three features might be enough to achieve a high

NSE, but it does not mean that it captured all information contained in the streamflow time series. I think that should be clarified in the conclusions.

Thank you for your comment. Of course, the learnt features itself and so the information that they can capture depend on the specific calibration function utilised. We will specify it in the conclusions. Any calibration function has certainly advantages and disadvantages, and none is perfect at all tasks. Moreover, the definition of what is hydrologically relevant is somewhat subjective. Nevertheless, in this work we have empirically shown that the performance of ENCA models is satisfactory in all the terms in which the NSE can be factored and are traditionally considered hydrologically relevant. However, we believe that a comparison between different calibration metrics is an interesting avenue of exploration, but it lies outside of the purposes of this work.

Some minor points:

In the abstract, it still says “collected by experts”, which I previously suggested to be changed.

Thank you for spotting this typo, we will modify it.

In Table 1 it should read topographic, not topologic. It would also be good to report all units.

Thank you again for spotting this other typo, we will correct it.

Report #2

From a reviewer perspective I am extremely happy with the result. From the start on the authors had a good core idea To summarize the paper a bit too much: The underlying information of landscape features for rainfall--runoff modeling lives on a small dimensional manifold. I really liked this idea from the start and I am glad the authors put so much work into the manuscript to polish it. In short: The paper started well, but throughout the peer review process the authors managed to improve every aspect of the manuscript and sharpen its focus!

Thank you for your comment and support throughout the whole revision process!