

Reply to: CC1: 'Comment on egusphere-2024-4119', Benedikt Heudorfer

Great work. It adds to the increasing body of literature of spatially distributed ML models in hydrology. You might be interested in recent research by Martin Gauch as well.

Thank you very much for your feedback! We will certainly have a look into that.

Alyway, regarding the manuscript I have one minor comment and one non-binding suggestion.

First, in line 162 you state that you "derive static topography features from the digital elevation model". It does not get entirely clear what kind of static features you use. I "classic" entity-aware LSTM setup, usually some derived values are used. I interpret it that you simply use the DEM grid-specific elevation as such? Please specify what exactly you do here.

Thank you for pointing that out. Yes, we use the DEM grid-specific elevation as such. However, within the model, we perform a small computation: In each 7x7 receptive field of the CNN, we subtract the elevation of the center cell from all other cells, which turns the elevation into local differences of elevation. We describe this in the model section (lines 242-244). This is all we wanted to hint at with "derive static topography features". We will simply remove it from there.

Second, benchmarking against a process-based model is fine, but process-based and conceptual hydrological models have long been outmatched by DL models in performance, including by multiple studies you cite, and can not be called benchmark anymore. I don't question the obvious good performance of your model (figure 5), but to really showcase what it can do, it should be additionally compared to a regular entity-aware LSTM. Implementing this in a similar, multi-horizon setup should be straight-forward. This suggestion is non-binding, but would greatly improve the significance of this work.

Thank you for the suggestion. The focus of our study is to show that a distributed neural network is in general able to learn catchment outlines from observations and propagate water accordingly. Good performance was not our main goal. Due to time restrictions, we therefore did not prioritize the implementation of a lumped model, which represents a very different modeling approach. However, we are looking into options.