The performance of LSTM models from basin to continental scales

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Introduction
The Problem

With traditional hyd. Models, performance degrades significantly, when going from basin to regional scale.

See Kratzert et al. (2019) for more information regarding the models and underlying data.
The unreasonable effectiveness of data
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Can we use additional information from other basins to increase local model performance, using DL?
Experimental design
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- Using CAMELS data set and same periods as Kratzert et al. (2019)
- Hyperparameter tuning:
  - For each basin individually
  - One regional LSTM (one model for all basins; see ref. above)*
    - Hyperparameter tuning was done on a third unused data split of ~9 years.
- Single-basin model trained on meteorological inputs
- Regional model gets as additional input static catchment attributes (see ref. above)

*because of the current situation, we were not able to finish a large scale hyper parameter tuning for the regional model and took the same architecture as in the reference above
(preliminary) Results
Single basin LSTM vs. CONUS LSTM

per-basin optimized LSTMs vs a single LSTM for CONUS

empirical CDF

NSE

0.0 0.2 0.4 0.6 0.8 1.0

single CONUS LSTM
per-basin optimized LSTM
Conclusion

- Using LSTMs, models do not degrade performance when going from basin to regional scale but instead the performance increases.
- This indicates, that the LSTM can truly transfer learned process understanding across basins.

→ One step towards a good performing global hyd. model

- Open question: What are the limits? If we increase the number of basins or length of training period, when do we converge?