DeepHydro: Petrus 2.0

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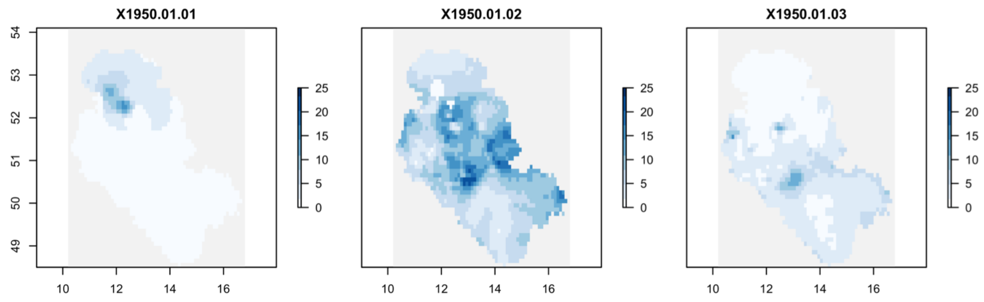
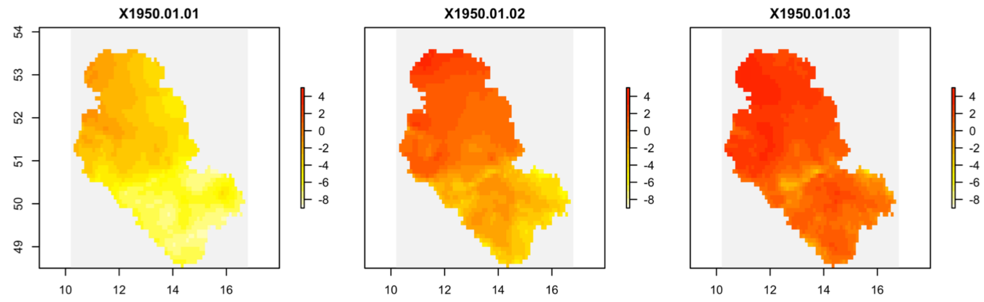
HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

Data

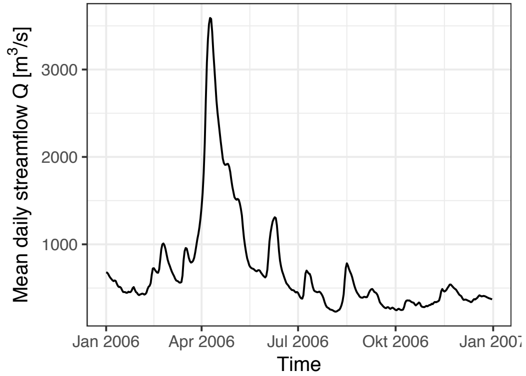
Precipitation



Air temperature



Input



Target

ConvLSTM

- Patterns
- Time-lags

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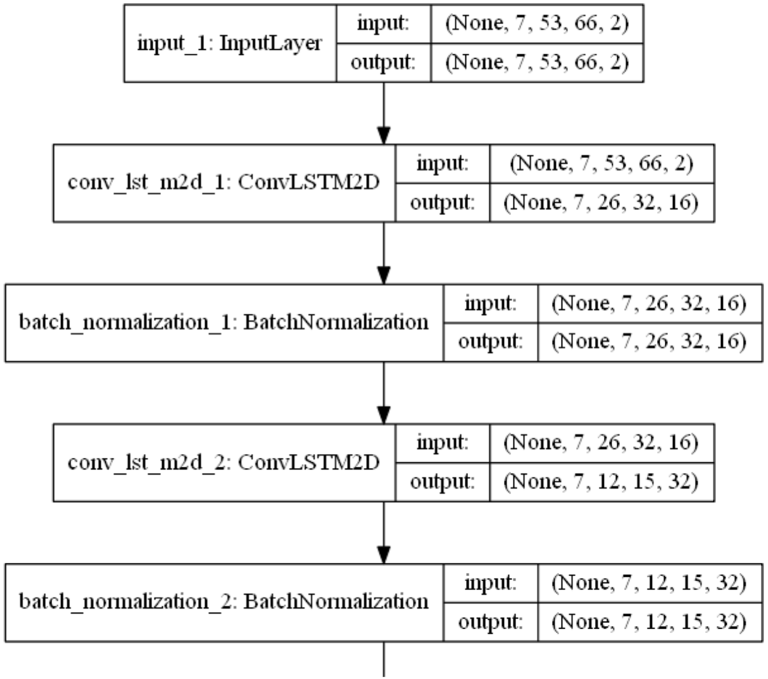
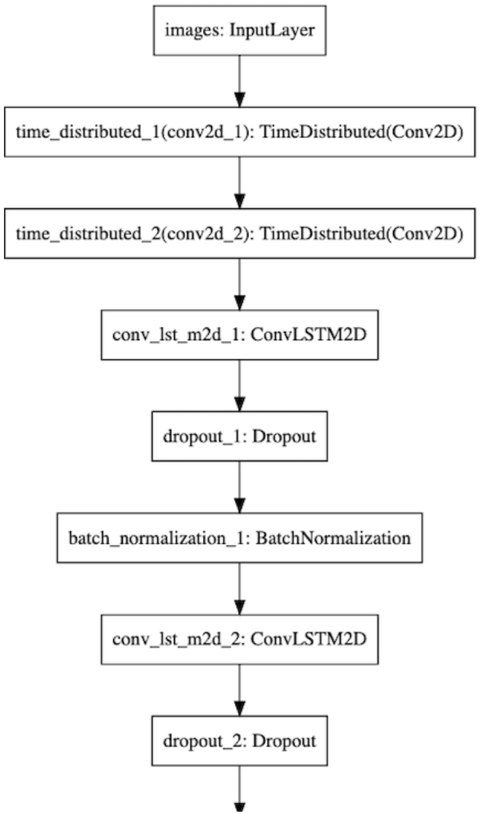
Old vs. new architecture

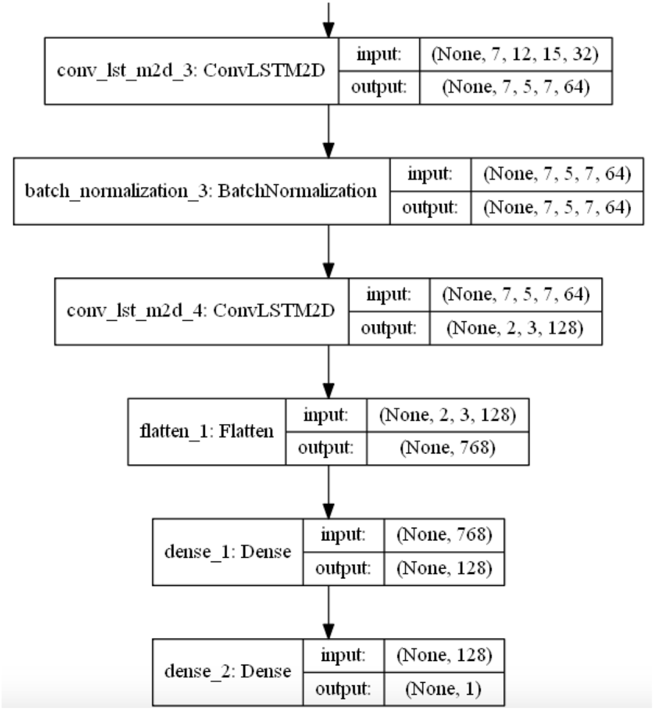


Old

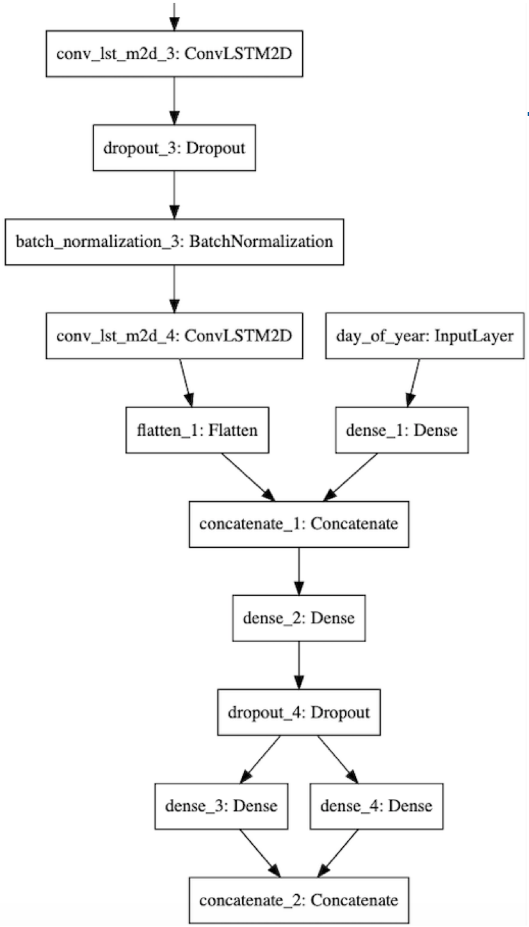


New

Old vs. new architecture

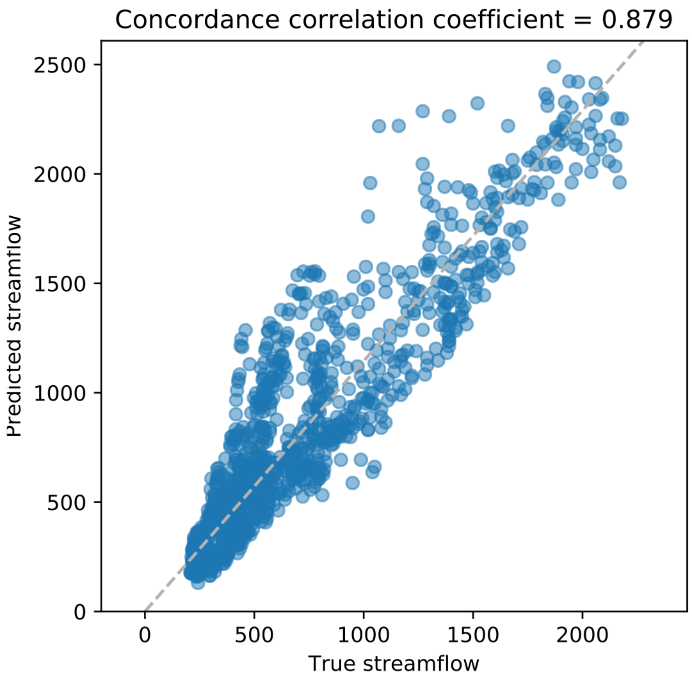


Old



New

ConvLSTM



Changes:

- (non-recurrent) 2D-convolutions in top layers
- Dropout
- Add day of the year
- Longer input sequence
- Add estimation of uncertainties (aleatoric+ epistemic)

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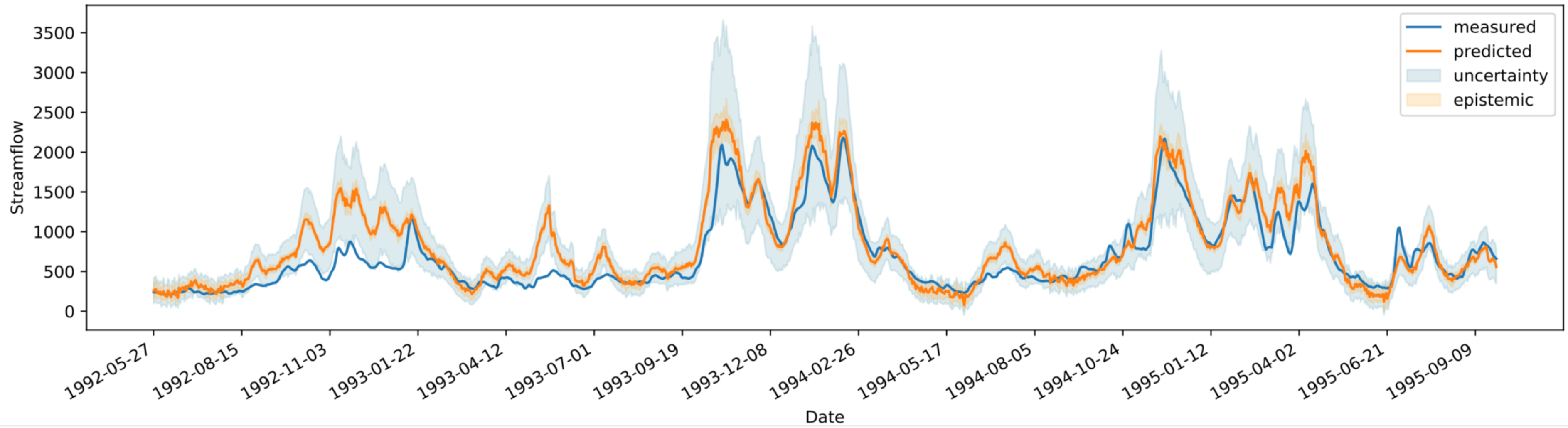
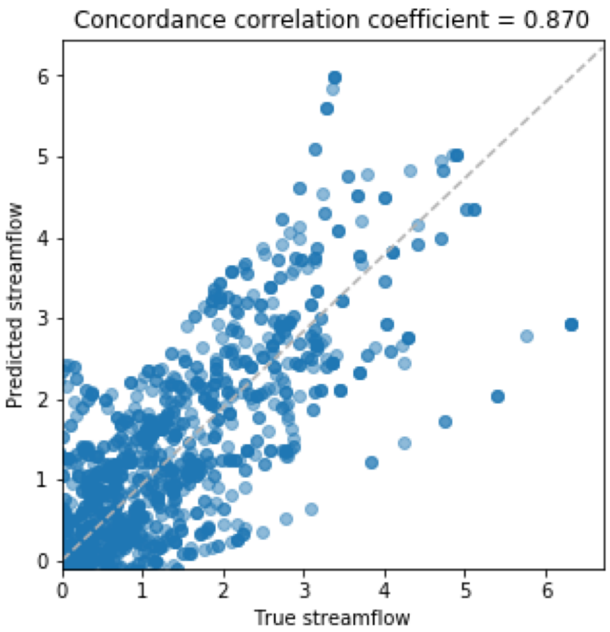
ConvLSTM


measured
predicted
uncertainty
epistemic
Streamflow
3500
3000
2500
2000
1500
1000
500
0
Date
1992-05-27
1992-08-15
1992-11-03
1993-01-22
1993-04-12
1993-07-01
1993-09-19
1993-12-08
1994-02-26
1994-05-17
1994-08-05
1994-10-24
1995-01-12
1995-04-02
1995-06-21
1995-09-09

1D-LSTM

(5000,)

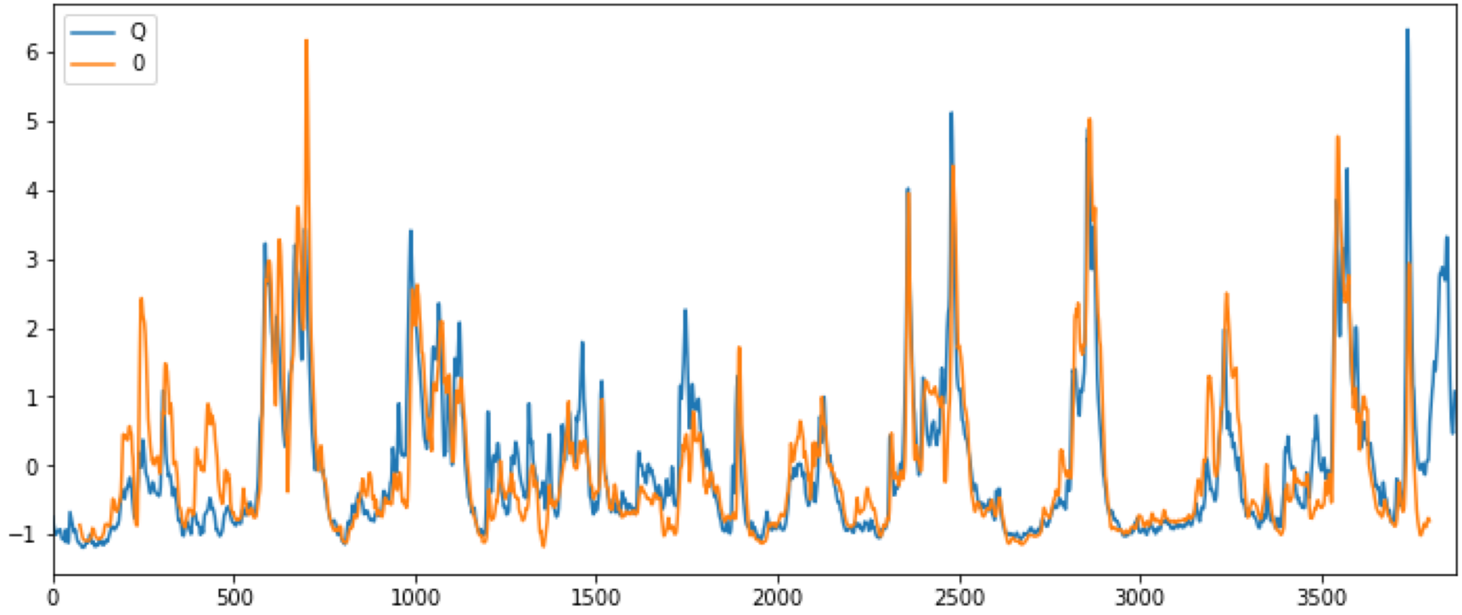


- Catchment Averages = Baseline
- Surprisingly high ccc
- Accurate modeling of timeseries

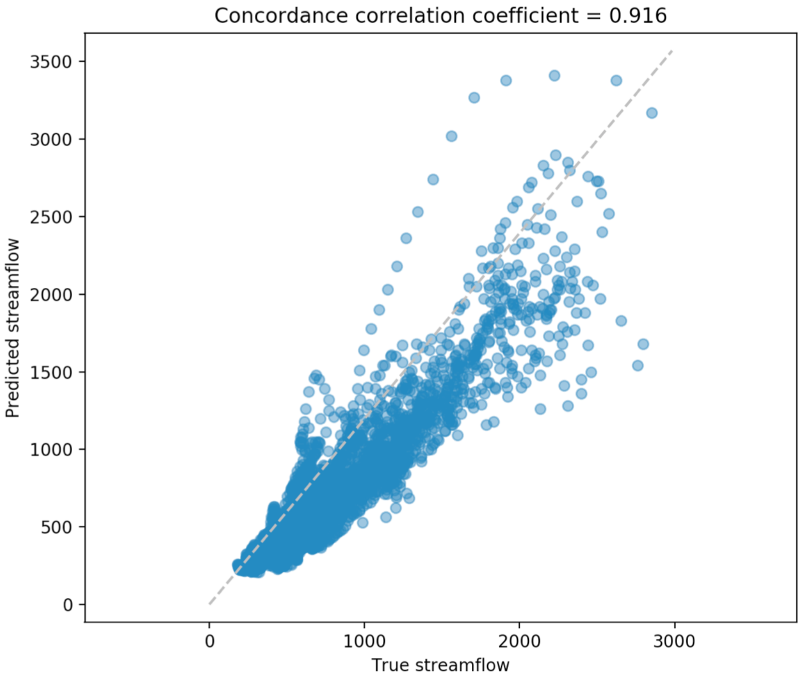
→ We do not exploit all of the spatial information

2D-LSTM

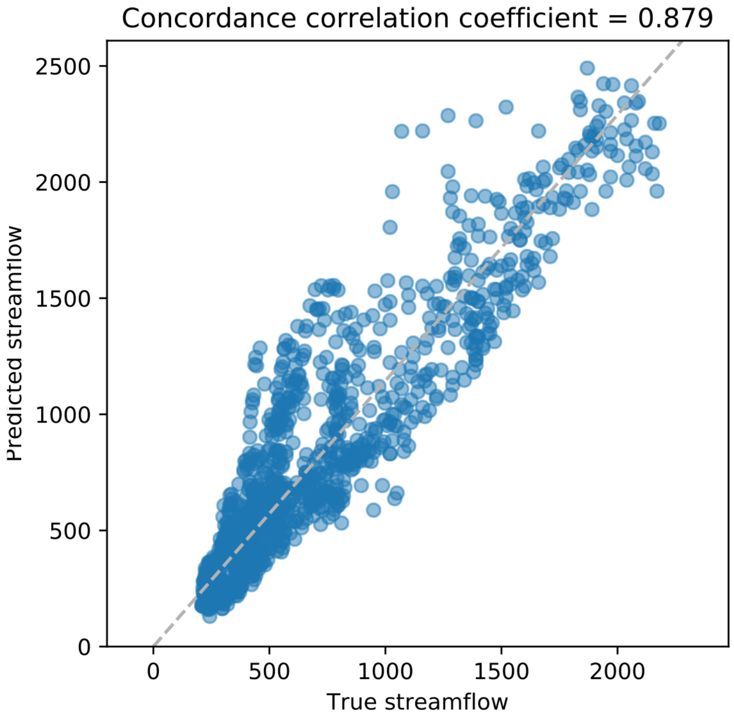
[118]: <matplotlib.axes._subplots.AxesSubplot at 0x2000c9ef85f8>



Physical model: mHm



mHm



ConvLSTM

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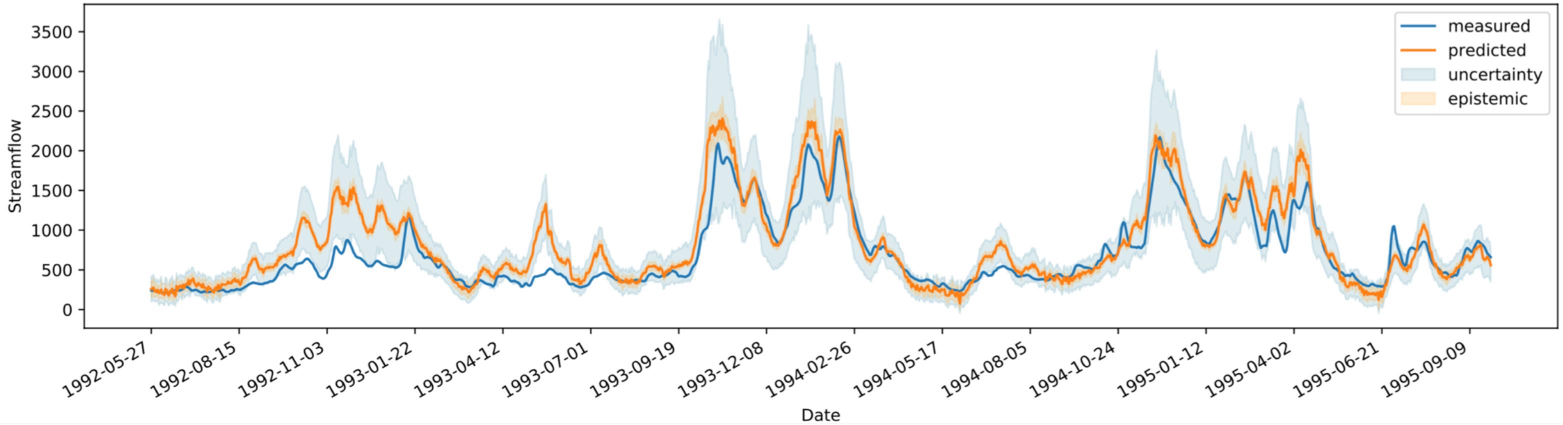
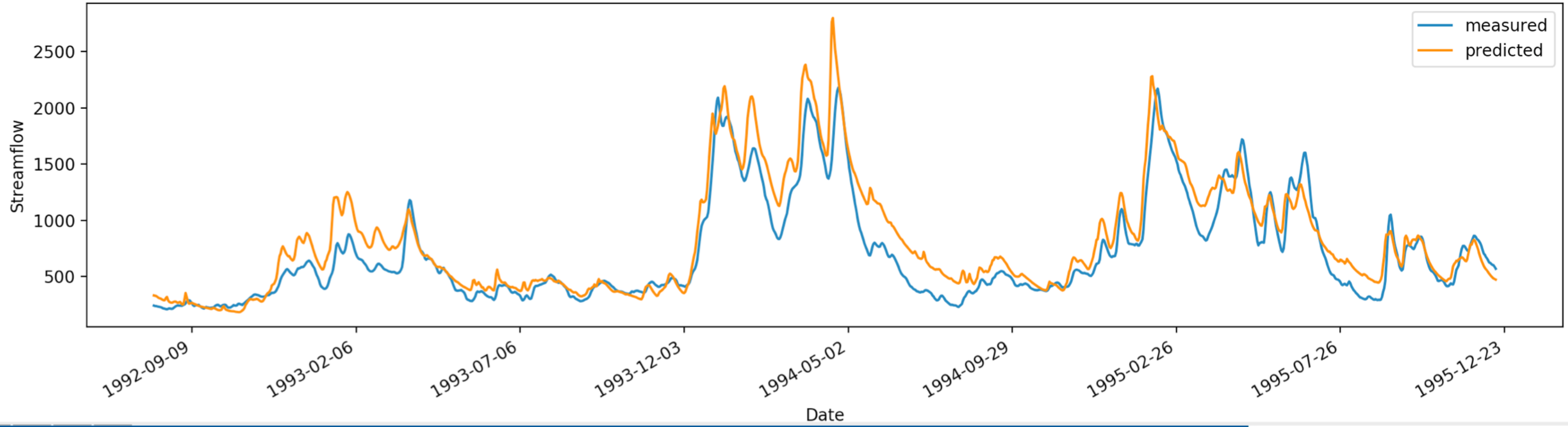
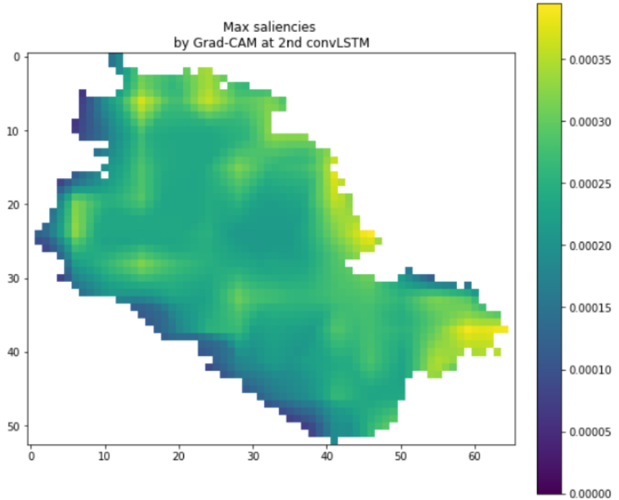
ConvLSTM vs. mHm

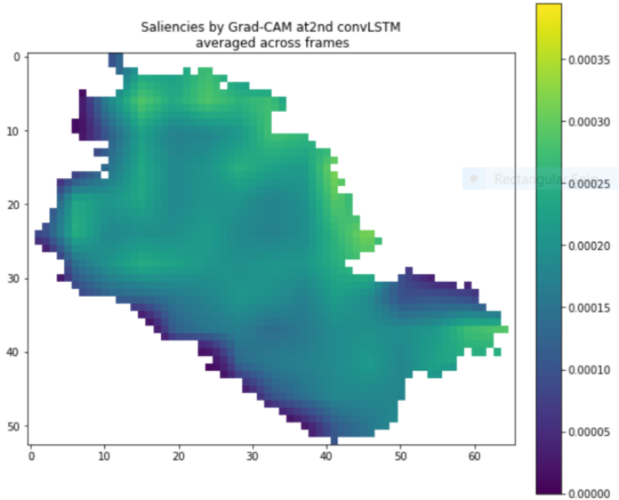




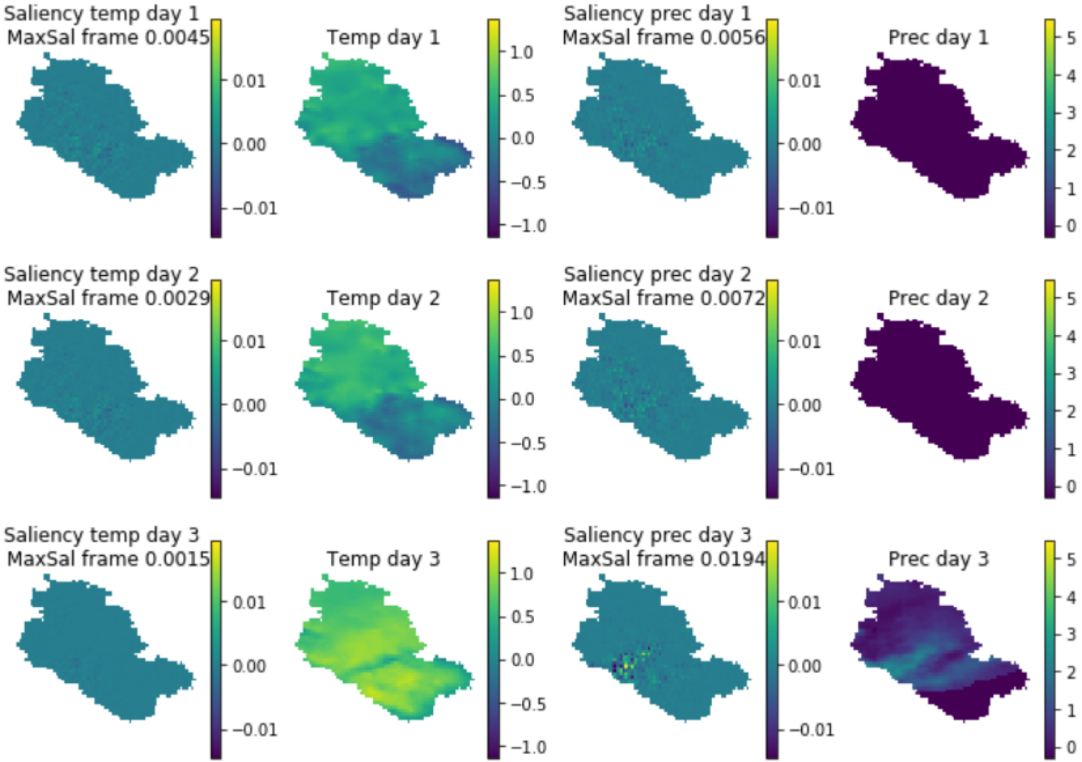
Saliency maps

- Grad-CAM and SHAP implemented
- Spatial and temporal importance
- Grad-CAM: Difficult to implement for LSTM
- SHAP: Model-agnostic





Saliency maps: SHAP



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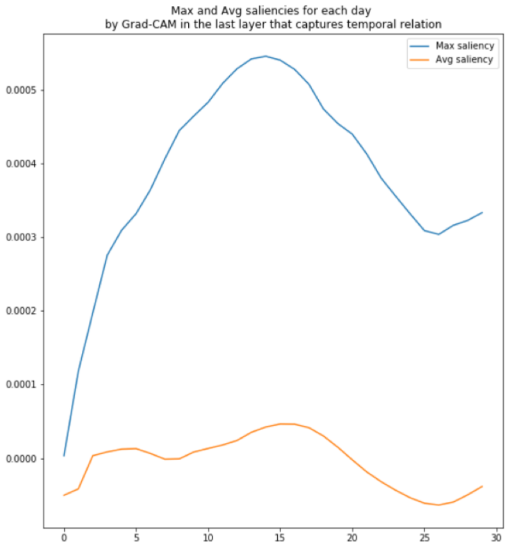

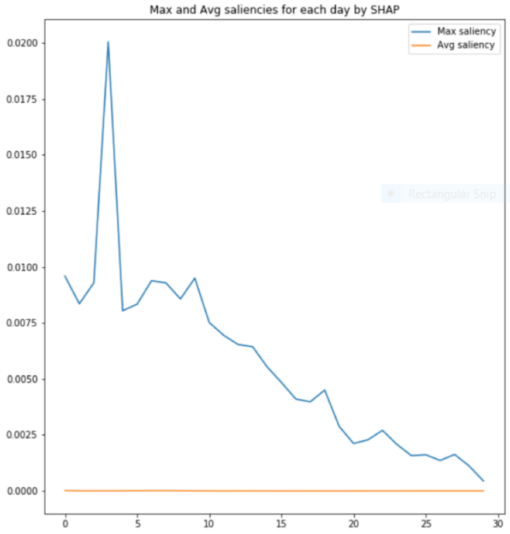

Summary

- Further tuning needed to exploit spatial information
- On par with physical model
- Saliency maps to be finished

Thanks for your attention!