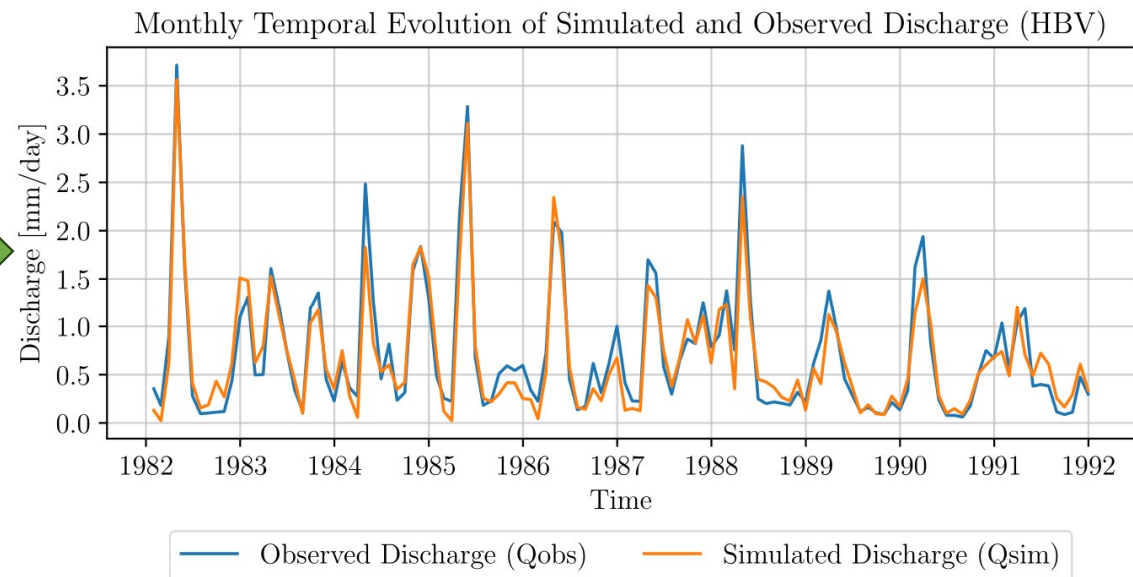
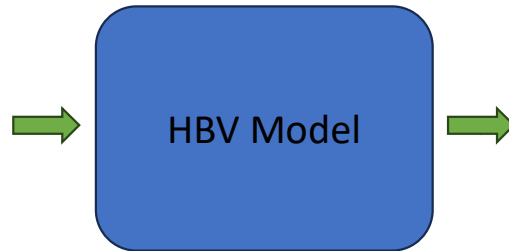


Hydrological time series analysis using LSTMs and Transformers?

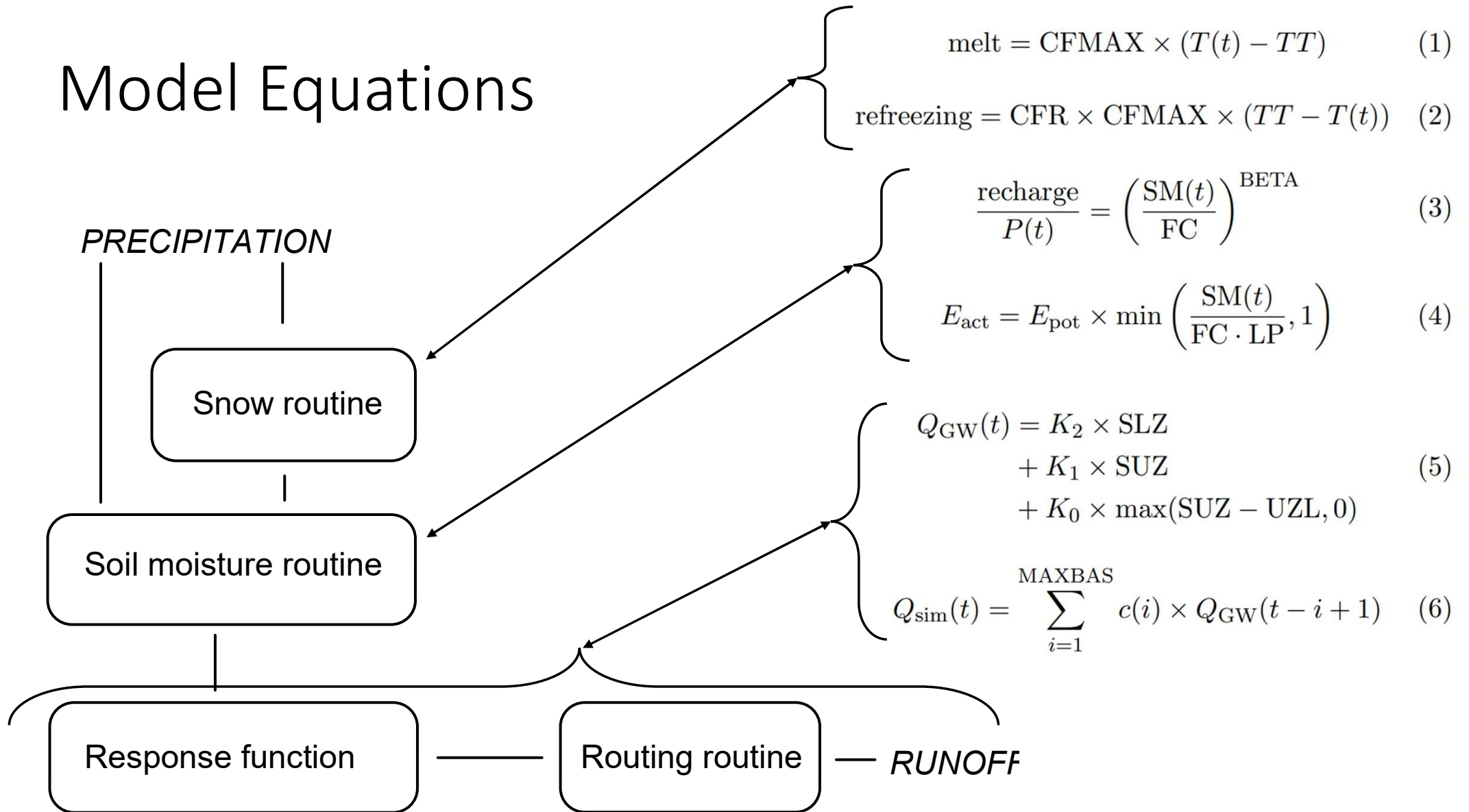
Jouval Somer and Philip Hoel

HBV hydrological model

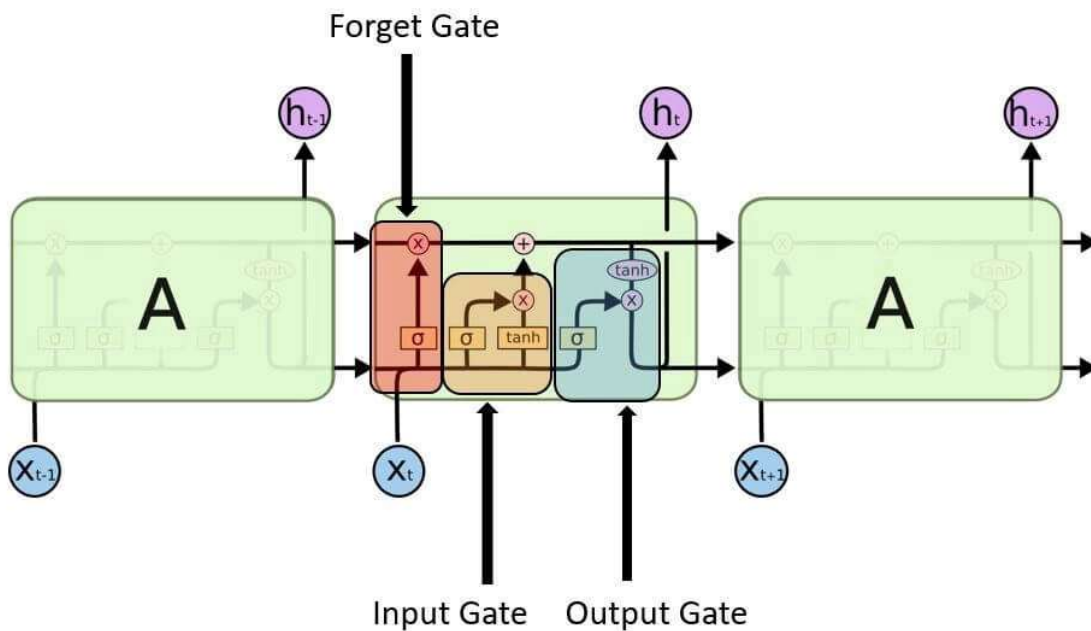
date	Prec.	Temp	Qobs
19810101	0	-0.7	1.36
19810102	0	-3.43	1.17
19810103	0.19	-8	1.21
19810104	0.07	-9.73	1.04
19810105	0	-14.77	0.95
19810106	0	-17.7	0.89
19810107	0	-12.53	0.83
19810108	1.23	-4.87	0.77
19810109	1.66	2.73	0.71
19810110	0	-2.83	0.66
19810111	0	-4.87	0.64
19810112	1.11	1.4	0.62
19810113	0	-4.47	0.58
19810114	11.29	-4.87	0.54
19810115	4.41	-1	0.52
19810116	1.36	-4.07	0.5
19810117	1.27	-5.87	0.46
19810118	0.15	-9.97	0.5
19810119	0	-12.27	0.58
19810120	0	-16.53	0.76
19810121	1.7	-7.23	0.56
19810122	1.25	0.23	0.38
19810123	0	-1.93	0.37
19810124	0	2.83	0.43
19810125	1.04	0	0.4
19810126	0	-4.67	0.35
19810127	0	-2.8	0.32
19810128	0	-1.9	0.3



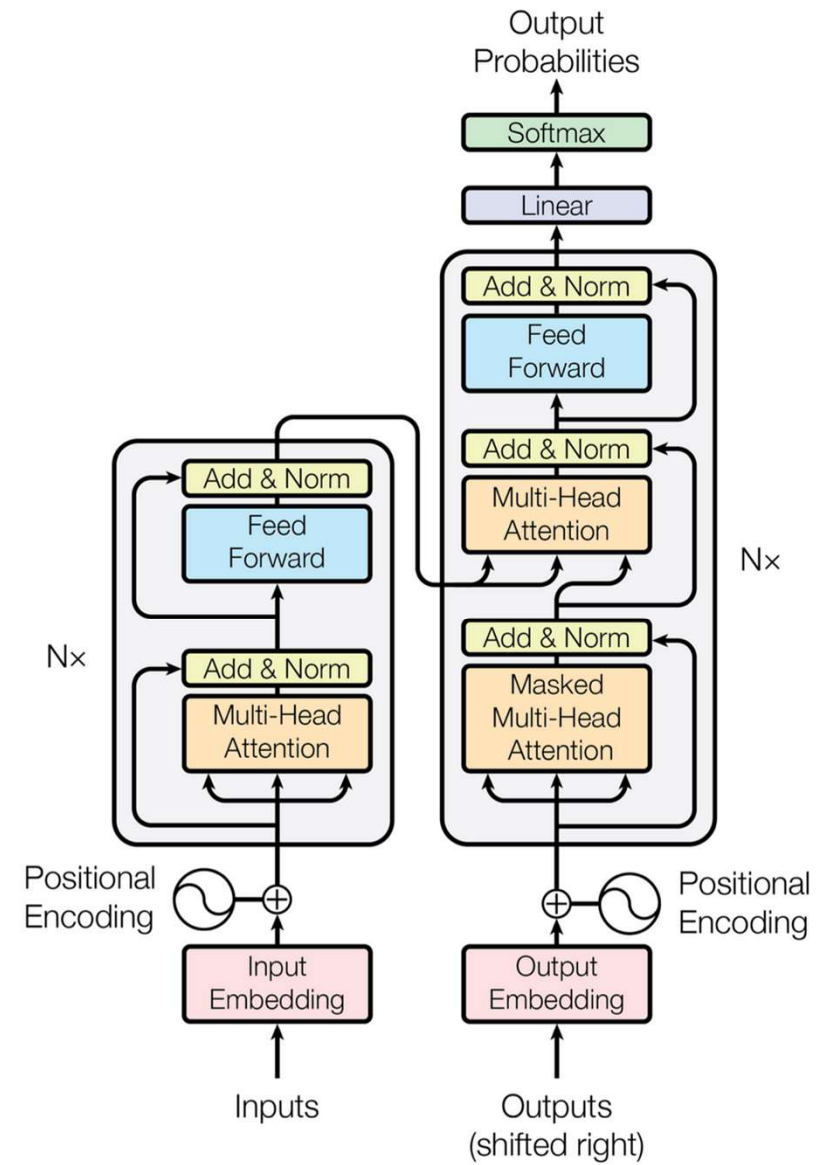
Model Equations



ML for time series analysis

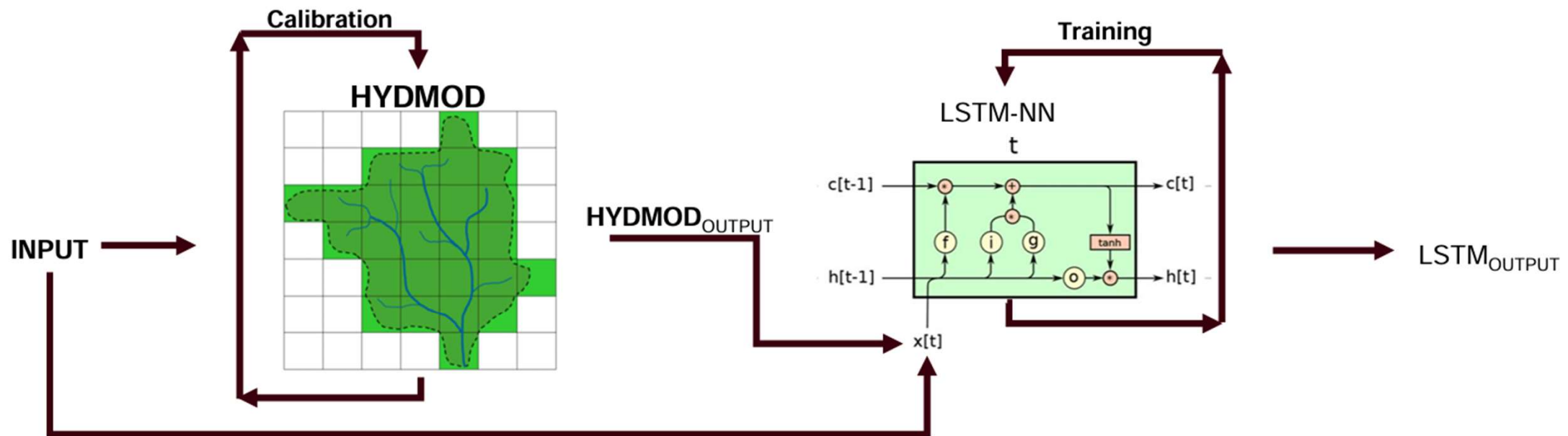


Long short-term memory (LSTM)



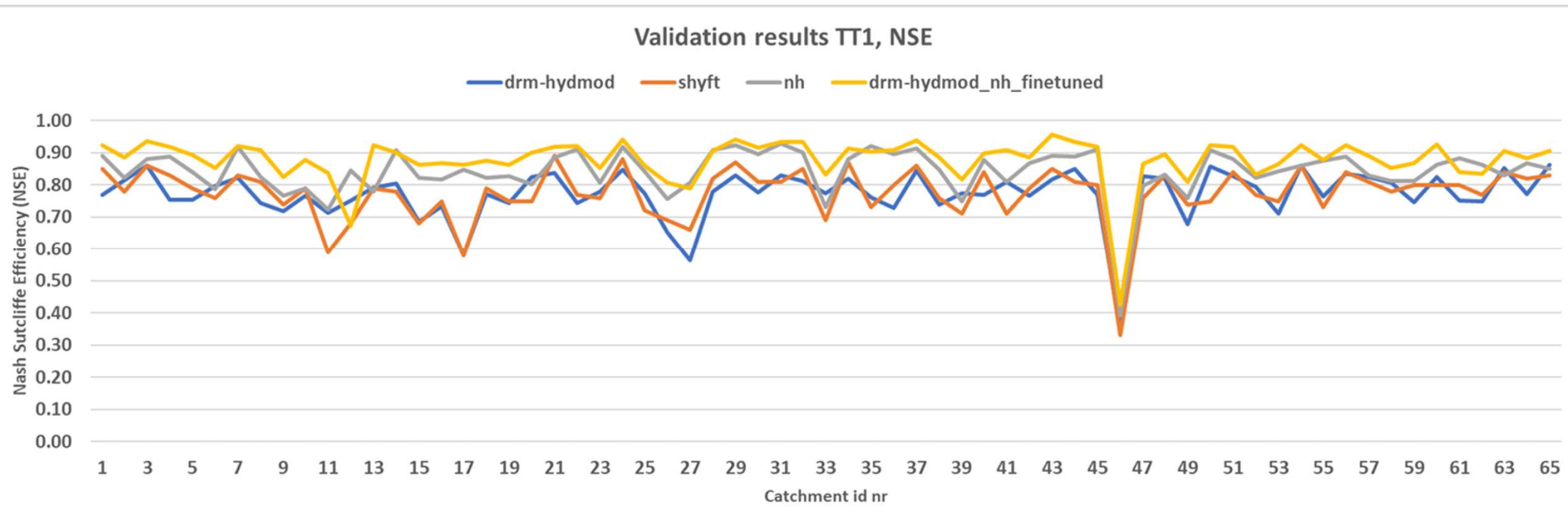
Transformer

Hybrid model between distributed hydrological regression model and LSTM Neural Network



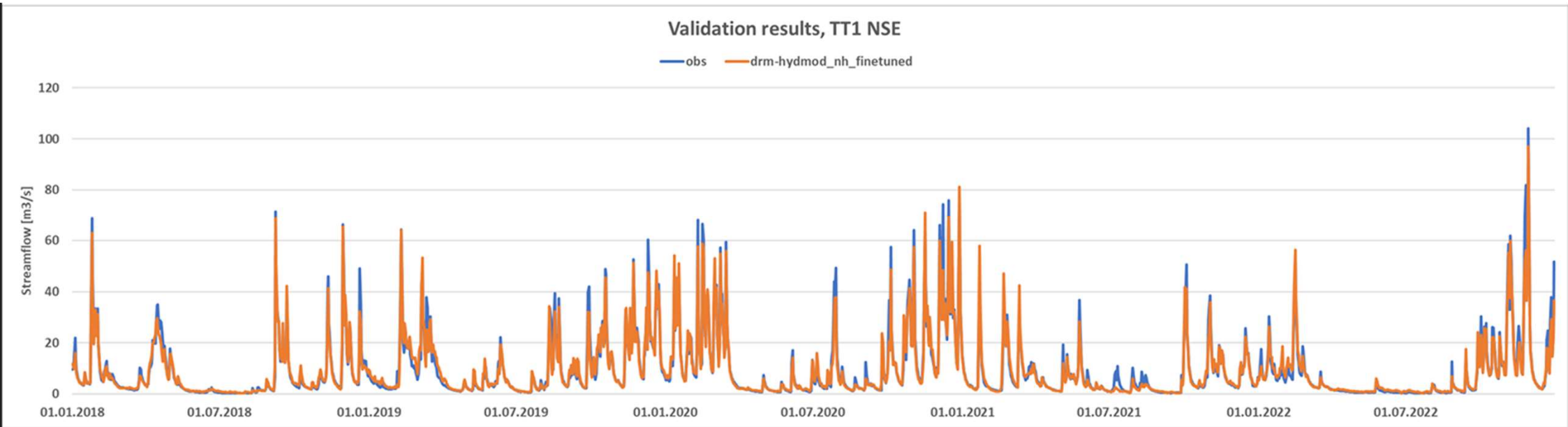
Åenergi - 7th Conference on Modelling Hydrology, Climate and Land Surface Processes. Lillehammer 19-21 Sep, 2023
The Distributed hydrological Regression Model (DRM)
Bernt Viggo Matheussen, Rajeev Shrestha, Bjarte Beil-Myhre

Results – Efficiency



Model	TT1_NSE_mean	TT2_NSE_mean	TT1_KGE_mean	TT2_KGE_mean	Average
DRM-HYDMOD	0.77	0.74	0.84	0.82	0.79
SHyFT	0.77	0.76	0.83	0.81	0.79
Neural Hydrology (NH)	0.84	0.82	0.86*	0.86*	0.84
DRM & Forcing + NH finetuned	0.88	0.85	0.91	0.91	0.89

Results – Hydrograph





Project overview

- “Recreate” the results from Åenergi
- Focus also on data handling, there is a lot of data available (feature detection and reduction)
- Use write code form scratch or PyTorch for parallelization using Quda