

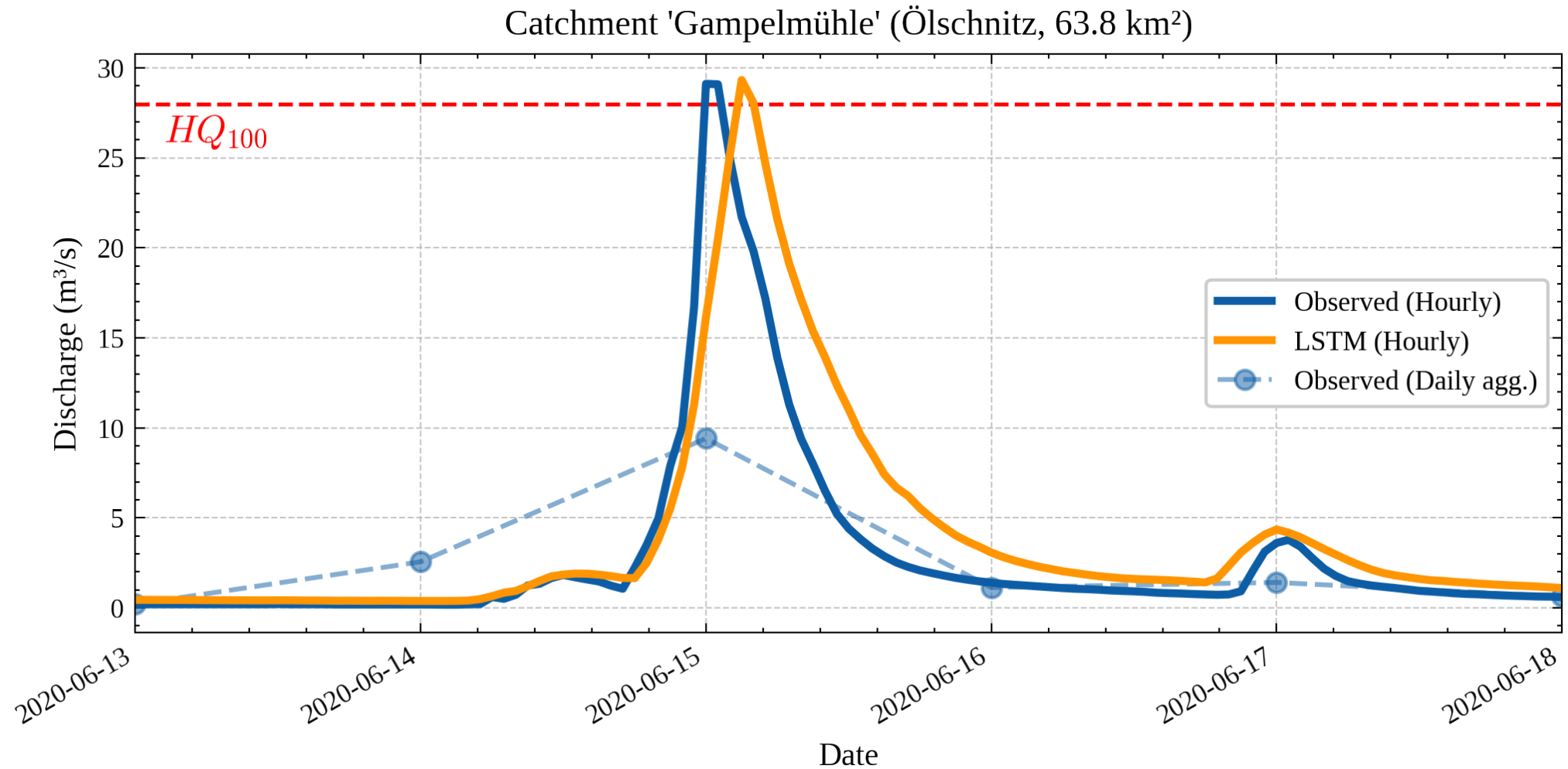
CAMELS-DE-1h: Advancing Large-Sample Hydrological Modeling by Shifting to the Hourly Scale

Alexander Dolich, Eduardo Acuña Espinoza, Uwe Ehret, Jan Bondy, and Ralf Lortz

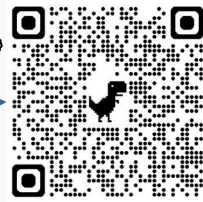
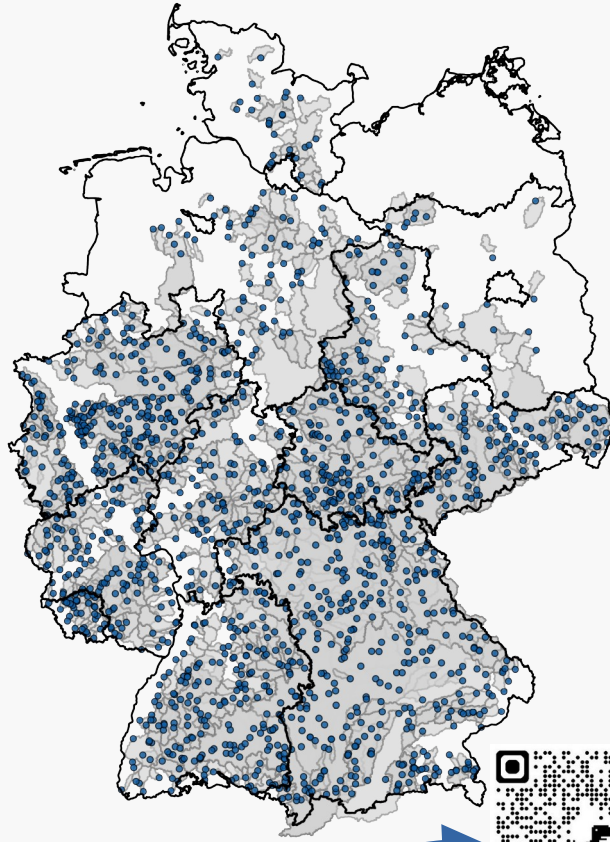
With funding from the:



The Necessity of Sub-Daily Resolution



CAMELS-DE-1h

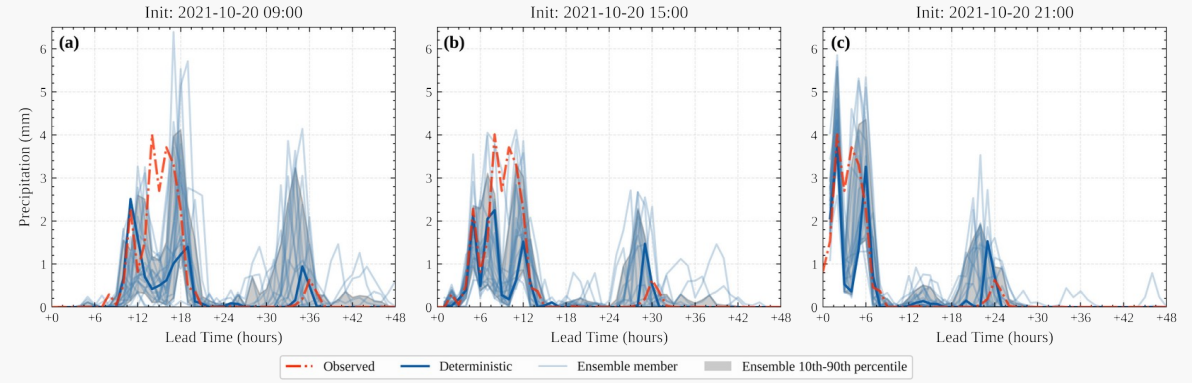


www.camels-de.org

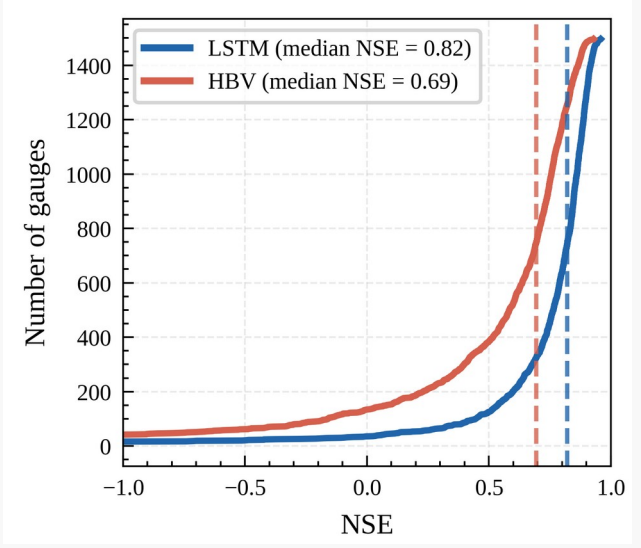
Dataset CAMELS-DE-1h: hourly hydro-meteorological time series, weather forecasts, and attributes for 1611 catchments in Germany **Released**

Cite as:
Dolich, Alexander; Acuna Espinoza, Eduardo; Ehret, Uwe; Kraft, Michael; Bondy, Jan; Meuer, Johannes; Loritz, Ralf (2026): CAMELS-DE-1h: hourly hydro-meteorological time series, weather forecasts, and attributes for 1611 catchments in Germany. GFZ Data Services. <https://doi.org/10.5880/idgeo.2026.045> [Copy citation to clipboard](#)

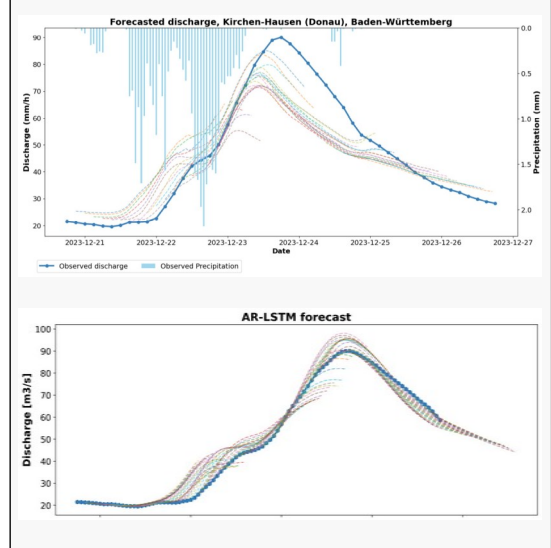
Weather Forecasts



LSTM & HBV Benchmarks

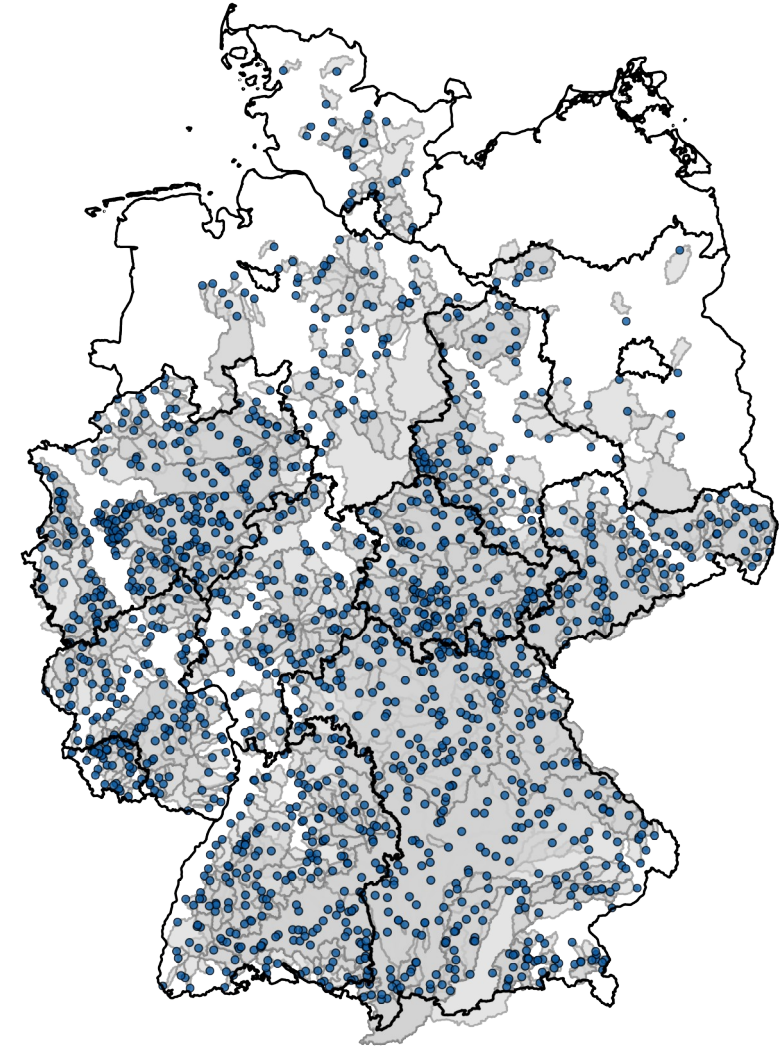


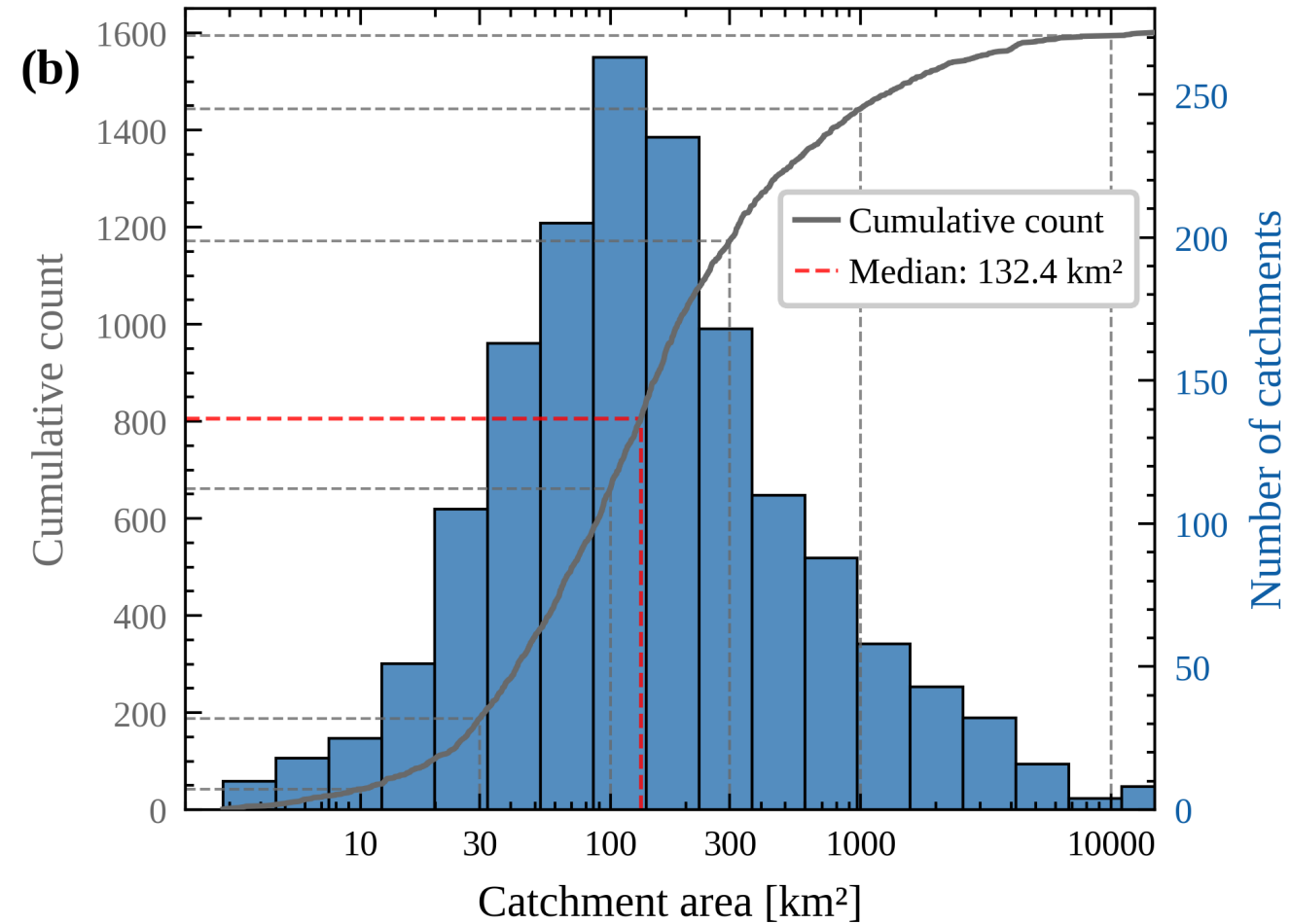
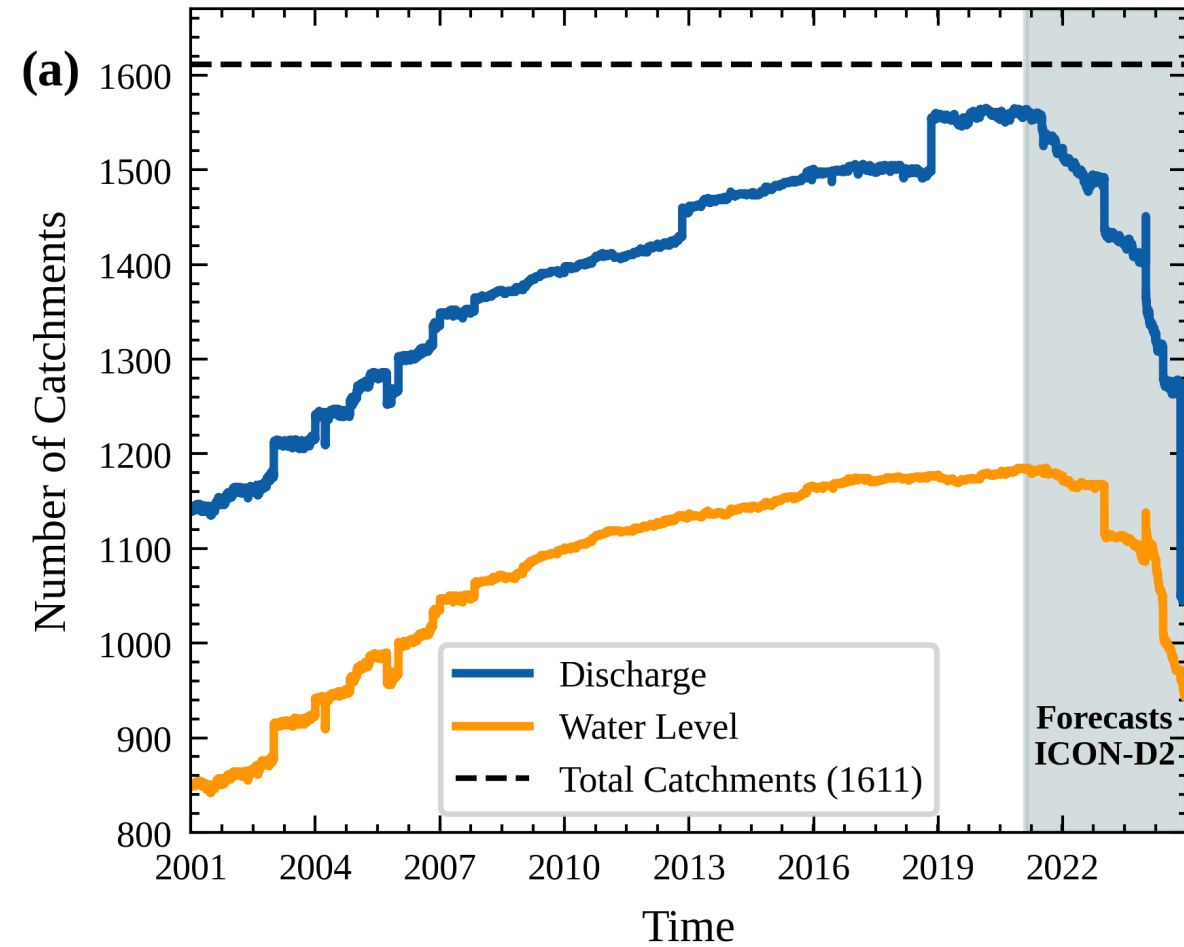
Forecast LSTM



CAMELS-DE-1h

- ❑ 1611 catchments
- ❑ Hourly hydro-meteorological time series (2001 – 2024)
- ❑ 48-hour weather forecasts (deterministic & ensemble, 2021 – 2024)
- ❑ Catchment attributes (topography, soil, land cover, ...)
- ❑ Benchmark Simulations (LSTM & HBV)

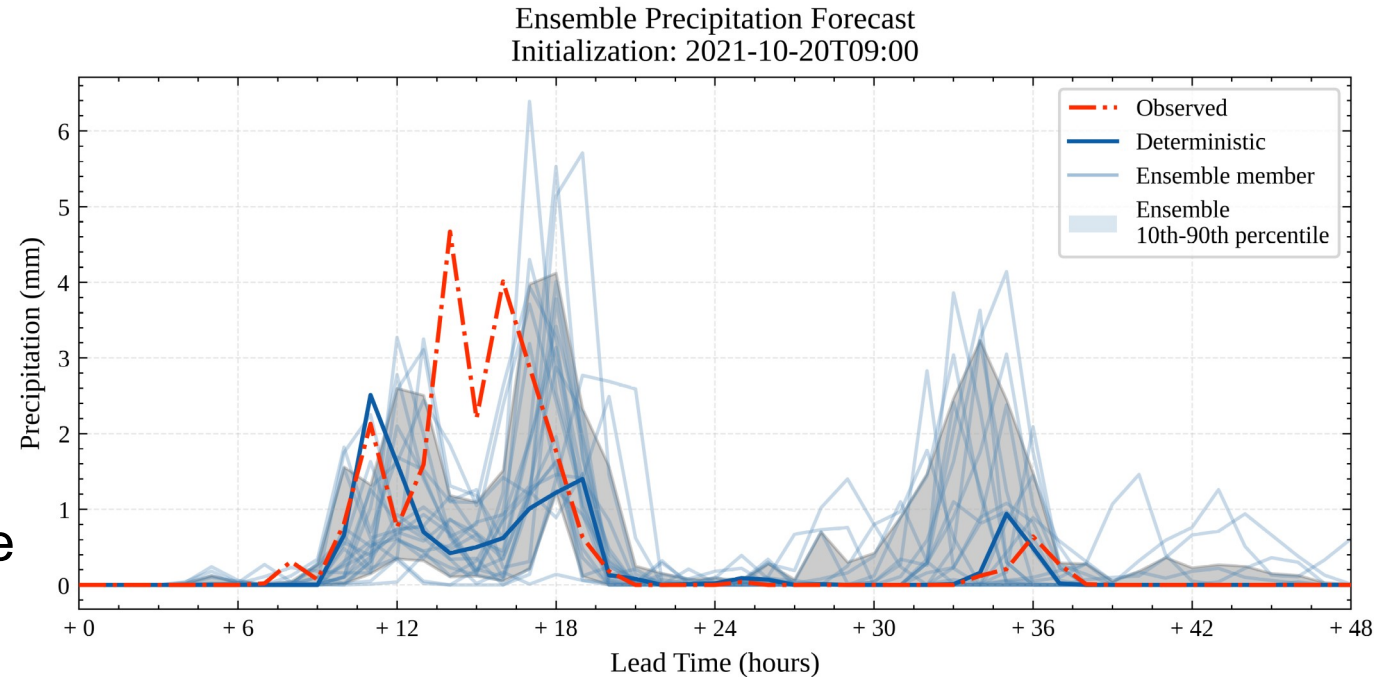




Weather Forecasts

□ ICON-D2 (DWD)

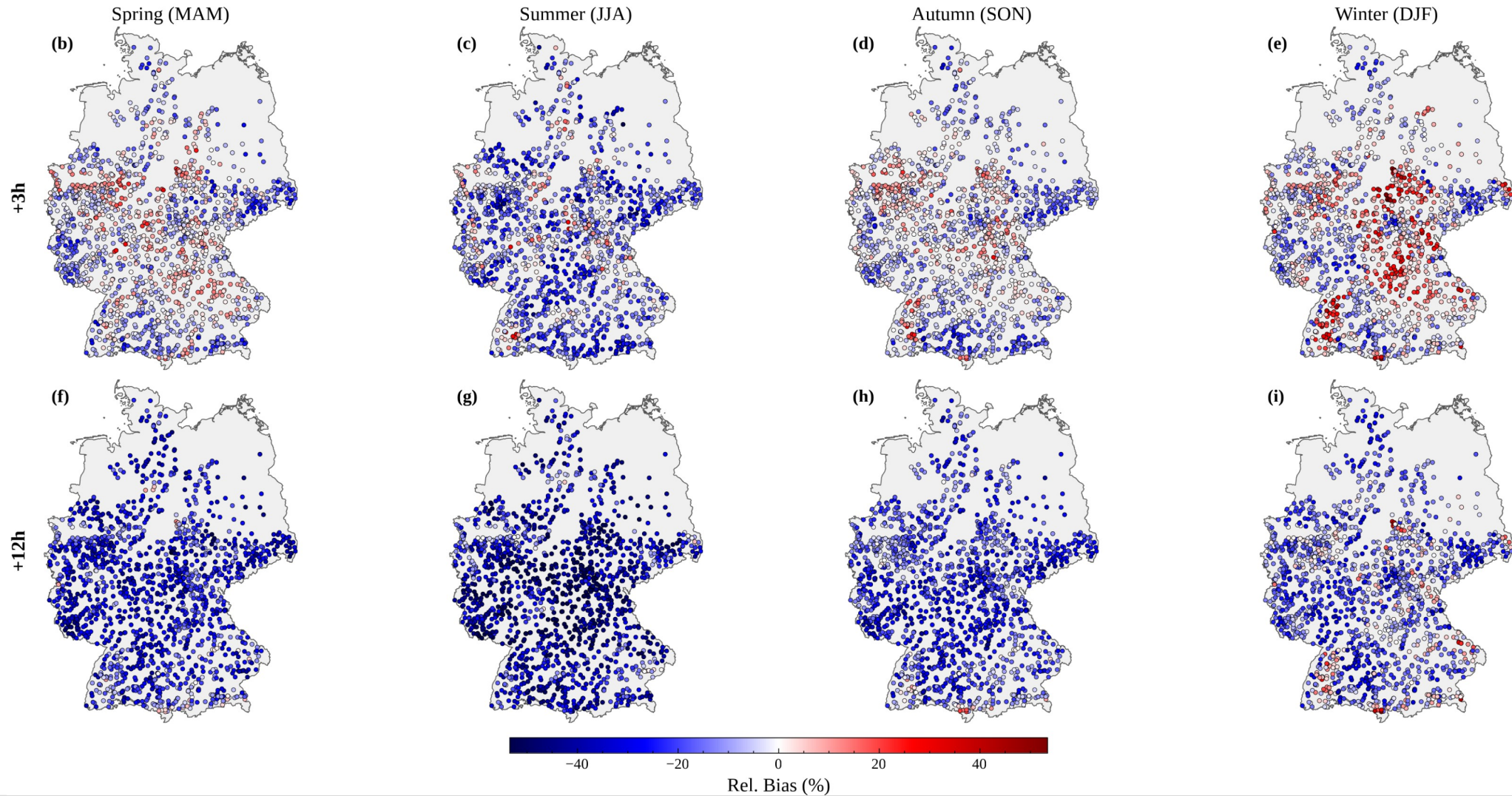
- Operational in Germany since 2021
- Used by authorities for flood forecasting (48 hours lead time, initialized every 3 hours)
- Deterministic & 20 member ensemble
- Readily processed for all 1611 catchments



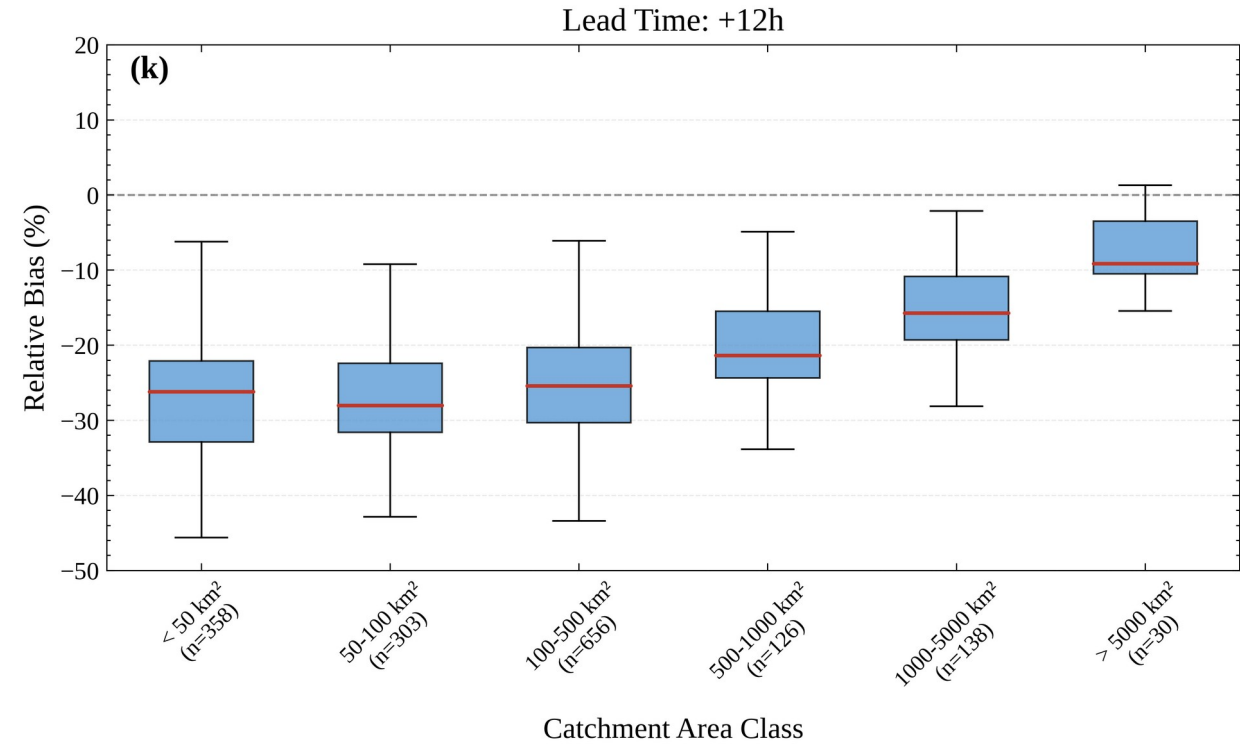
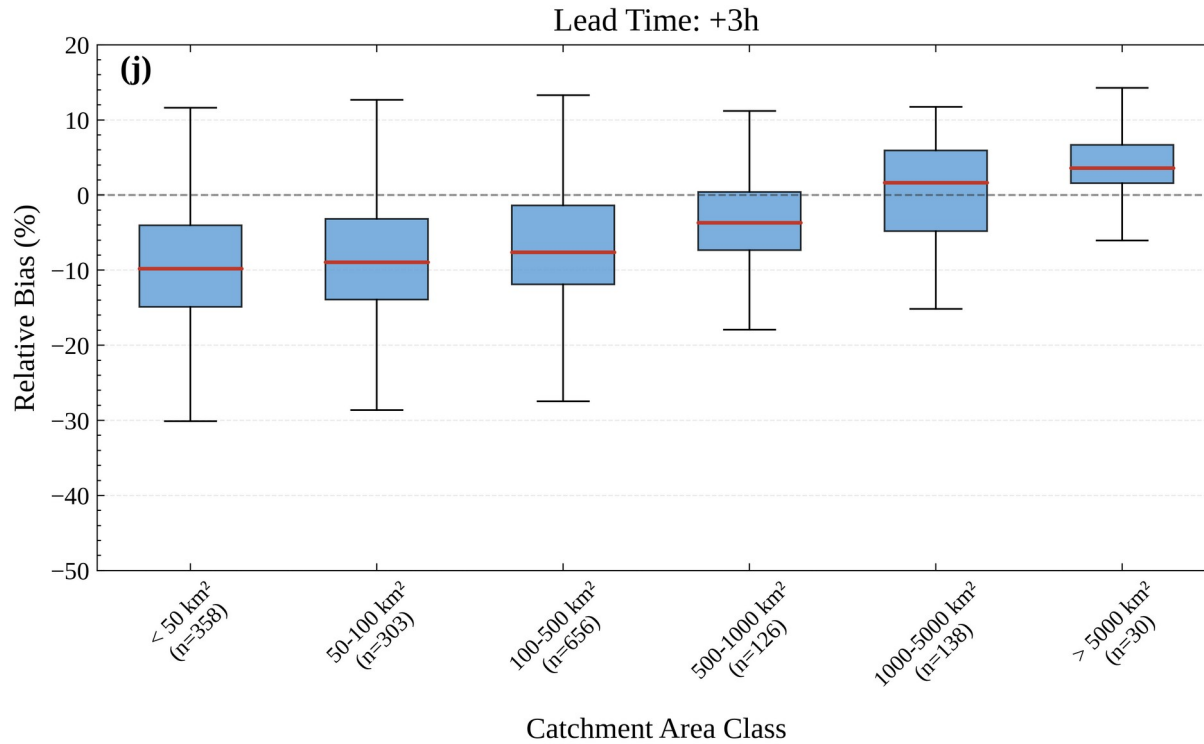
□ Evaluate models under operational conditions

□ Coupling of meteorological and hydrological forecast uncertainty

Weather Forecasts (deterministic)

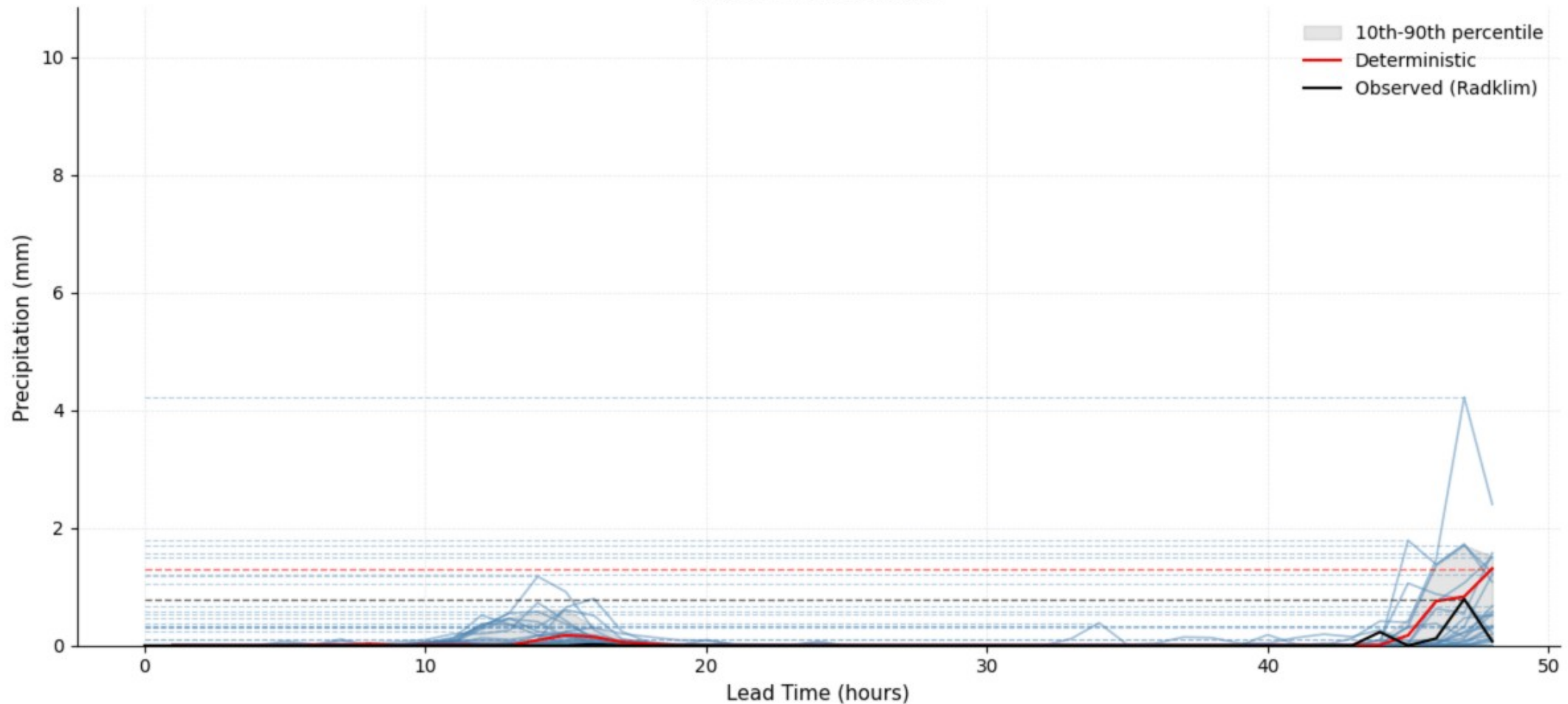


Weather Forecasts (deterministic)

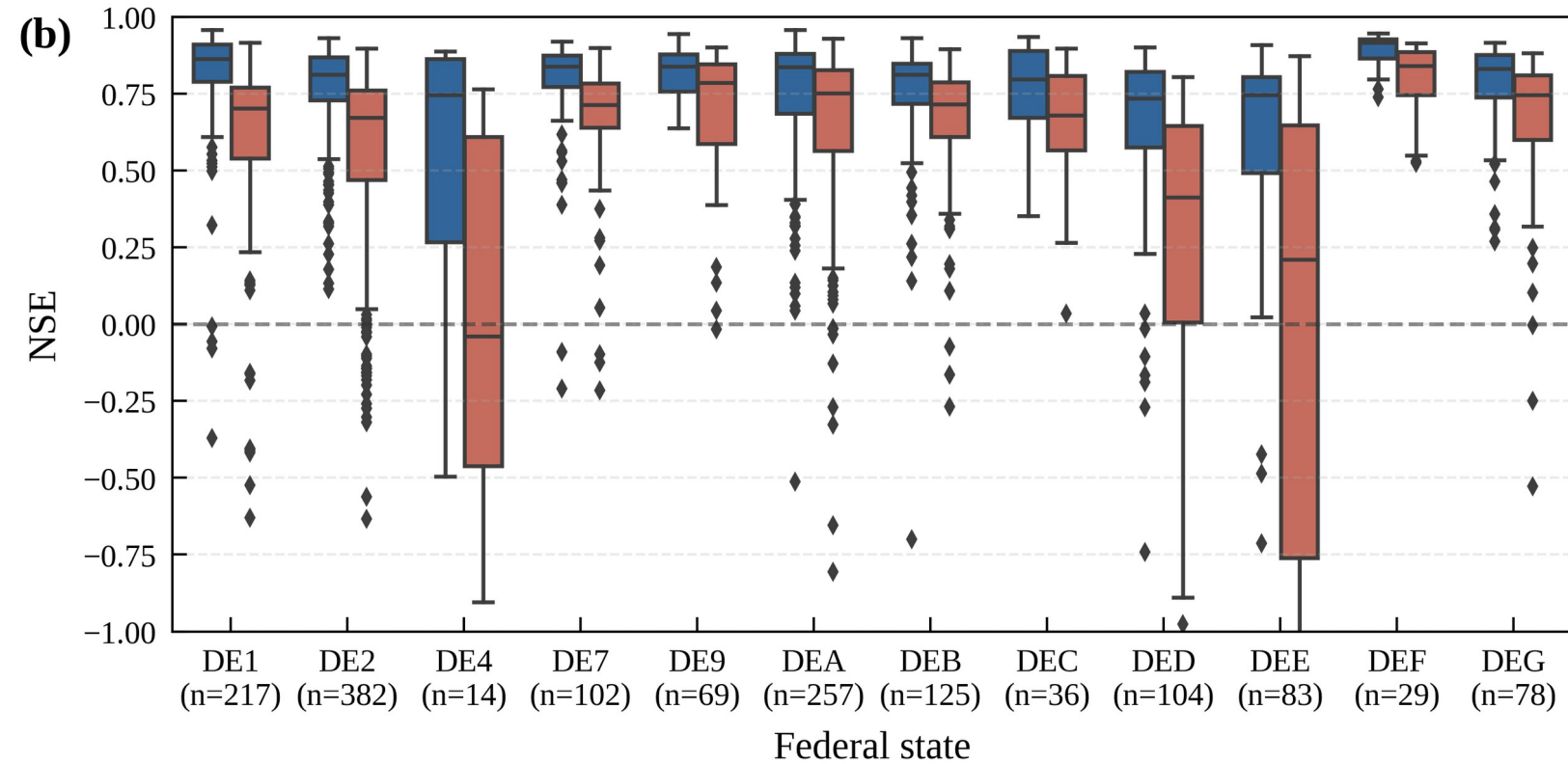
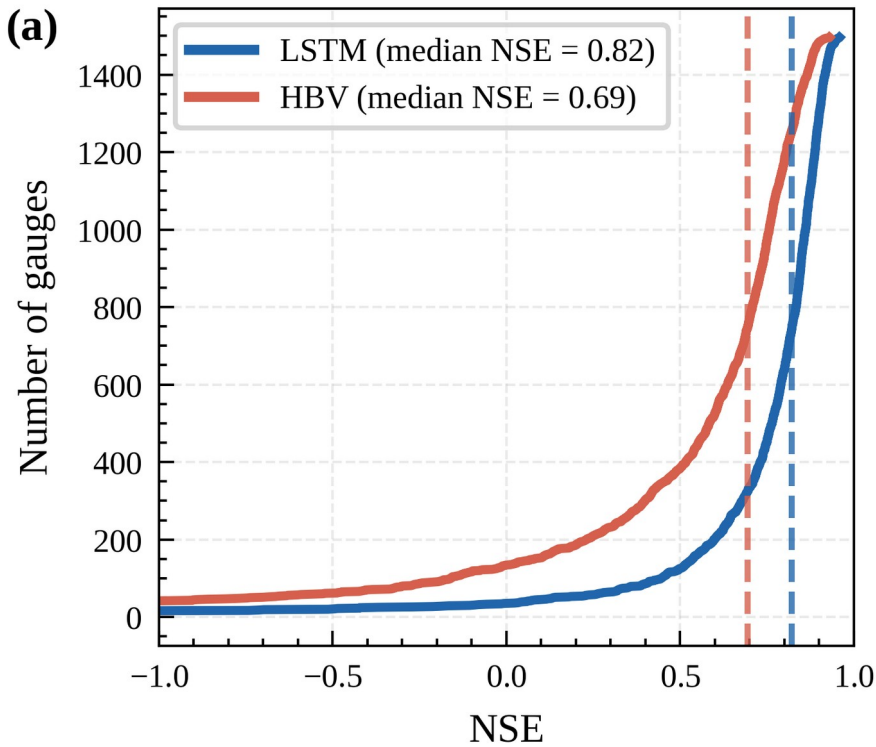


Weather Forecasts (ensemble)

Ensemble vs Observation (Frame 1/18)
Init: 2023-02-22T18:00

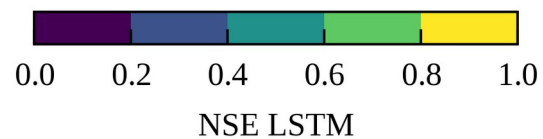
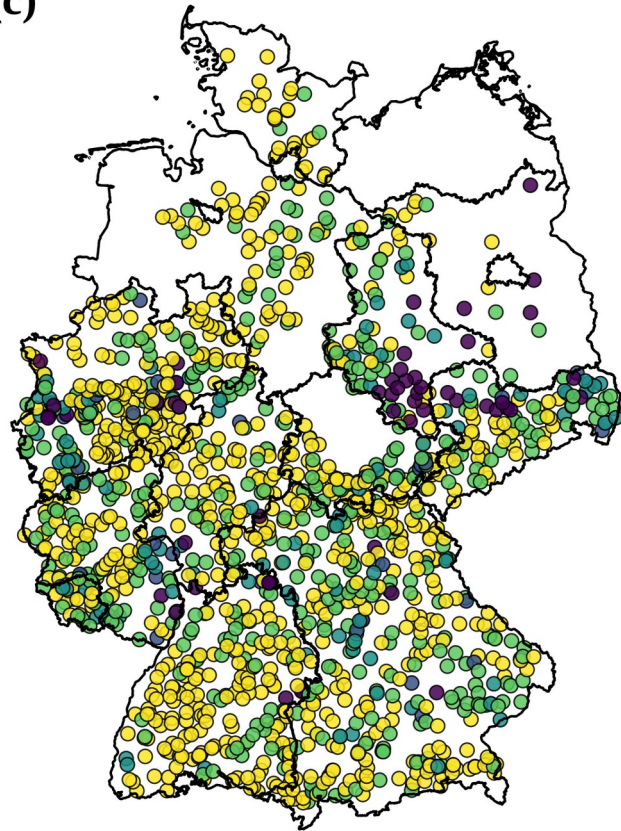


LSTM & HBV Benchmarks

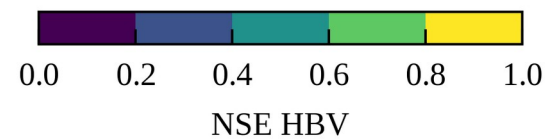
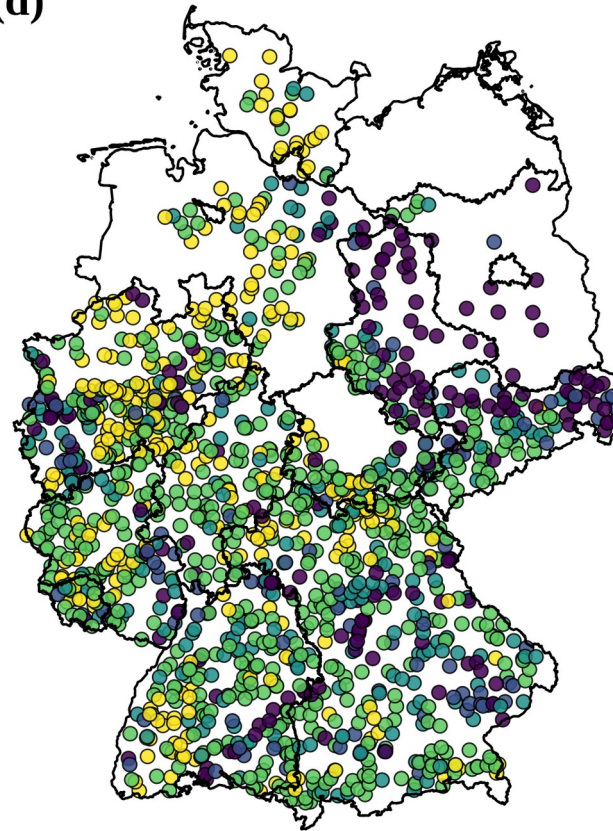


LSTM & HBV Benchmarks

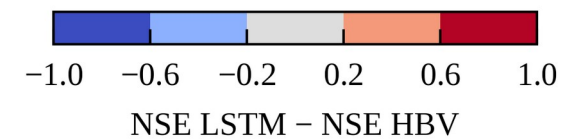
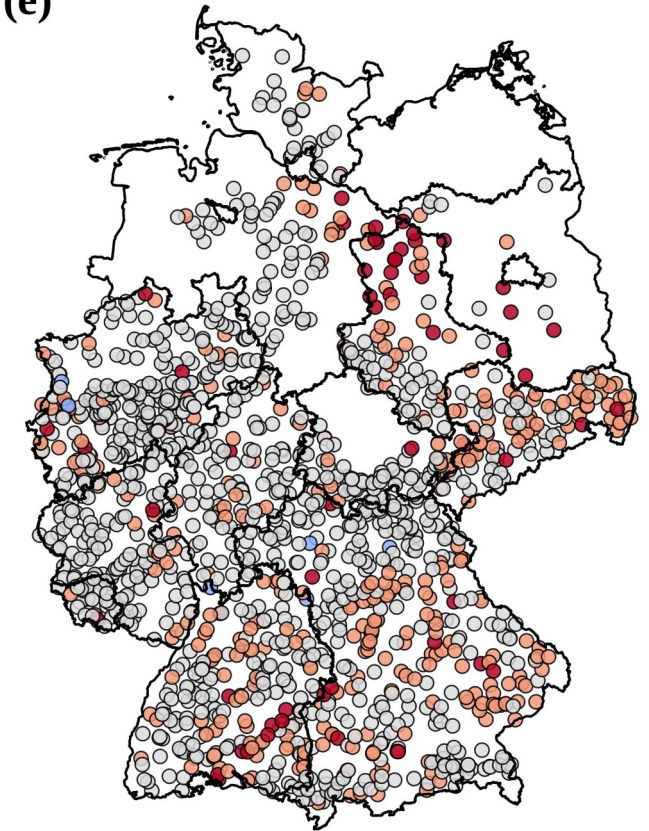
(c)



(d)



(e)

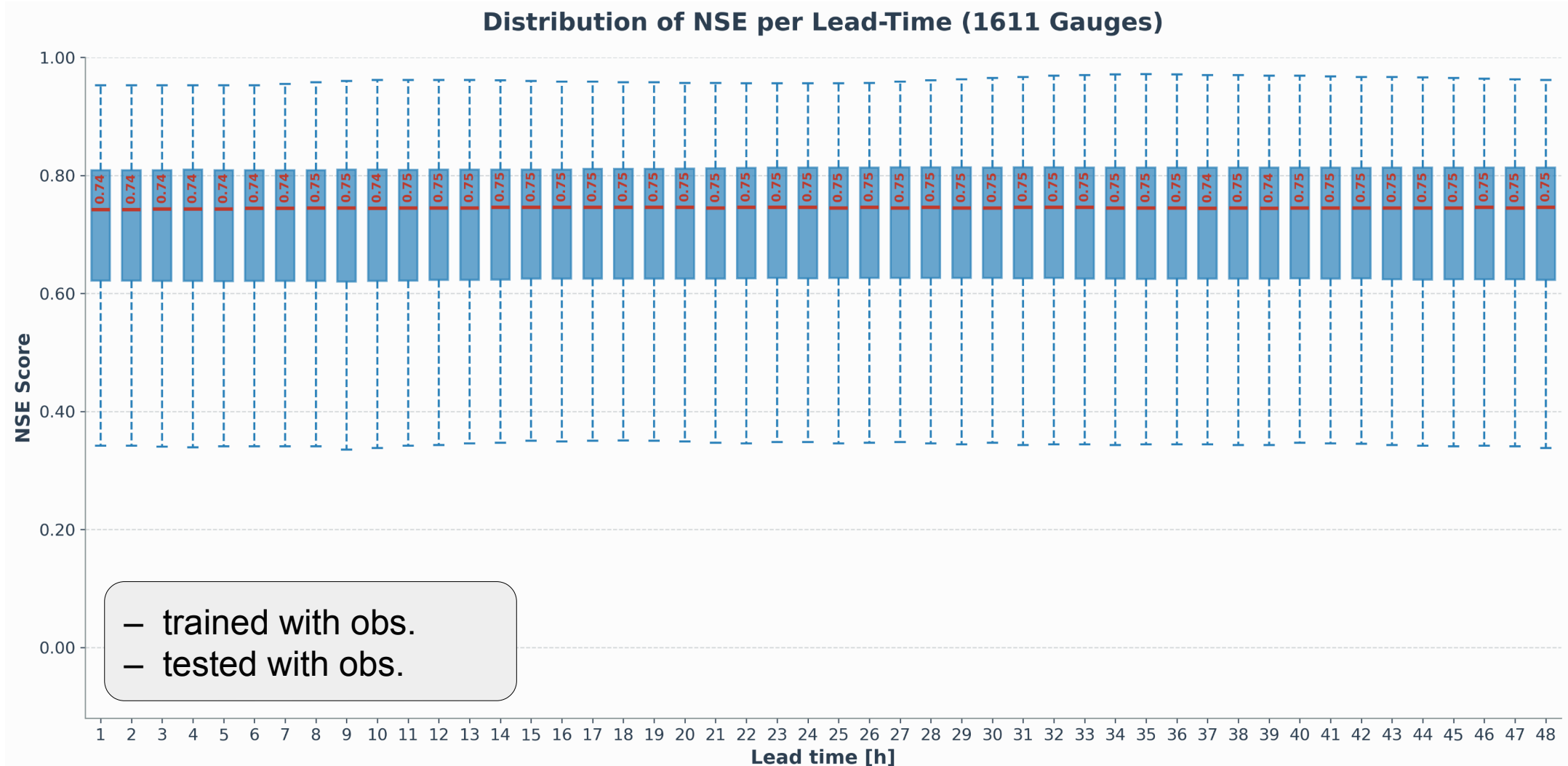


Daily to hourly data

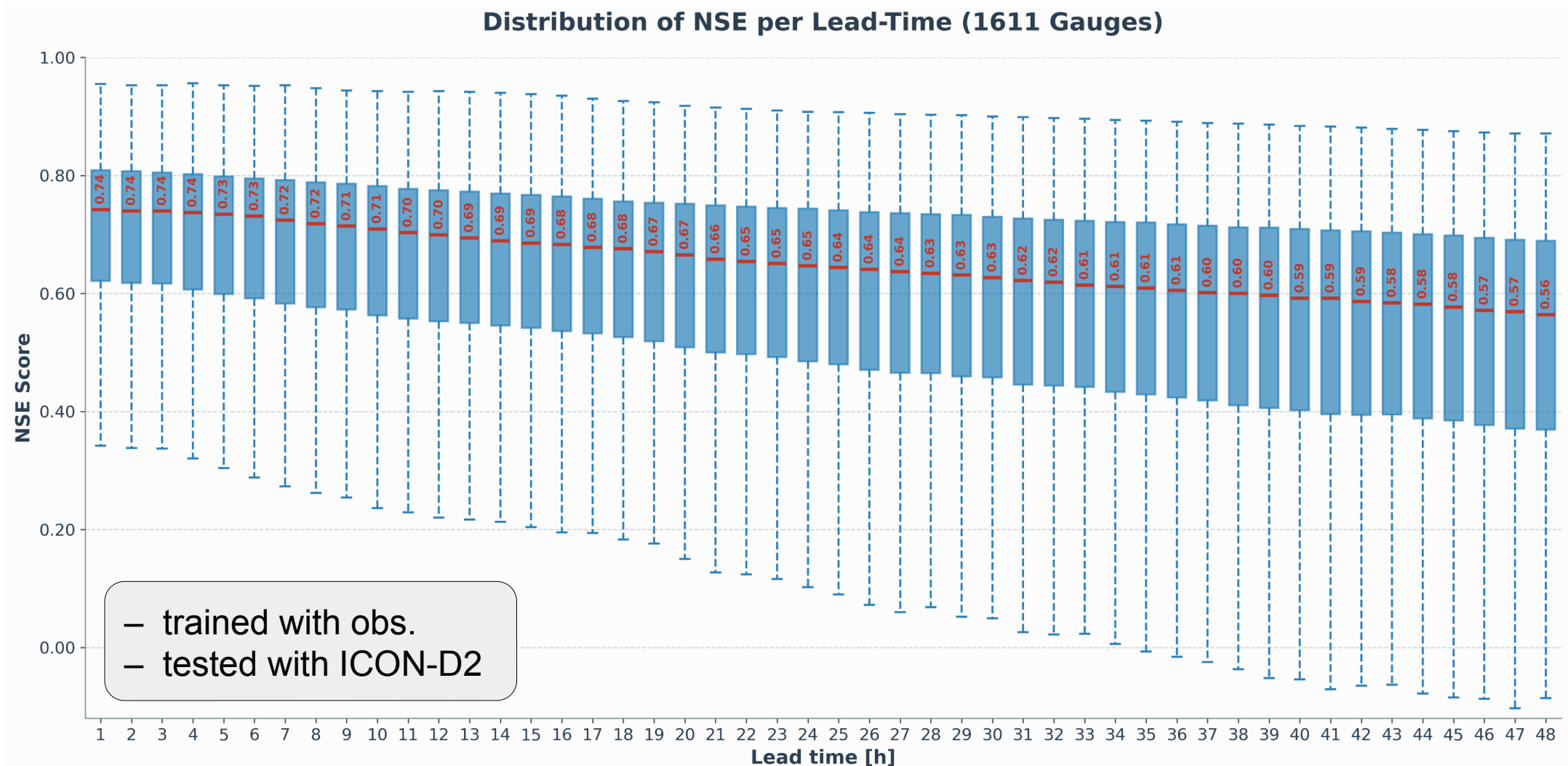
- ❑ Computational challenges (sequence length, number of samples)
- ❑ Re-evaluation of modeling challenges
 - Small, fast responding catchments
 - High flow performance
 - Model architecture, hyperparameters, training setup



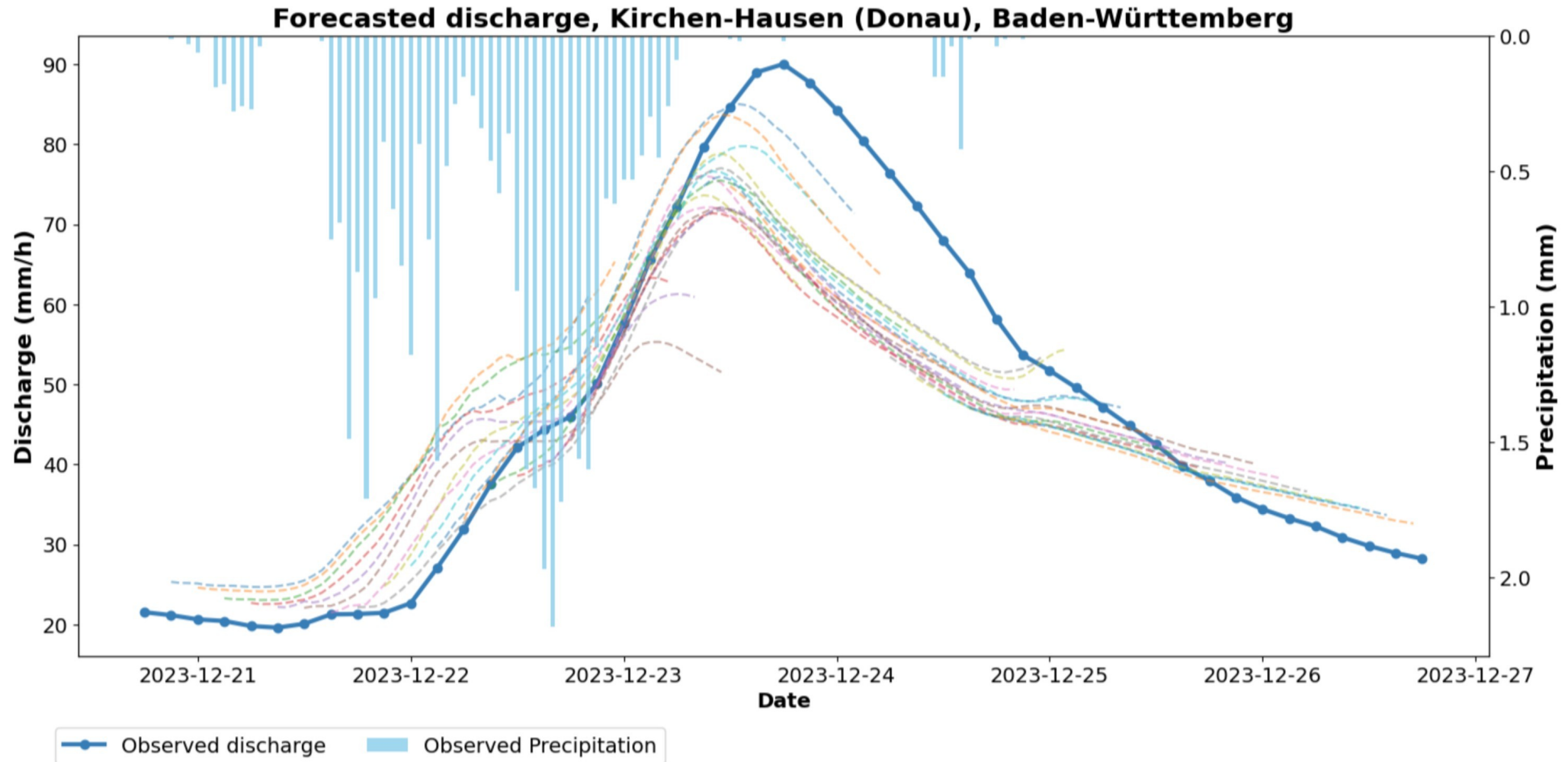
LSTM pseudo-forecasts



LSTM real forecasts



LSTM real forecasts



Forecast LSTM

Oral | Wednesday, 06 May, 11:20–11:30 (CEST) ■ Room B

Robust hourly flood forecasting using LSTM: Handling missing inputs and integrating discharge observations

Eduardo Acuna Espinoza ¹, Frederik Kratzert ², Martin Gauch ³, Manuel Álvarez Chaves ⁴, Ralf Loritz ¹, and Uwe Ehret ¹

¹Karlsruhe Institute of Technology, Institute of Water and Environment, Hydrology, Karlsruhe, Germany (eduardo.espinoza@kit.edu)

²Google Research, Vienna, Austria (kratzert@google.com)

³Google Research, Zurich, Switzerland (gauch@google.com)

⁴Stuttgart Center for Simulation Science, Statistical Model-Data Integration, University of Stuttgart, Germany (manuel.alvarez-chaves@simtech.uni-stuttgart.de)

