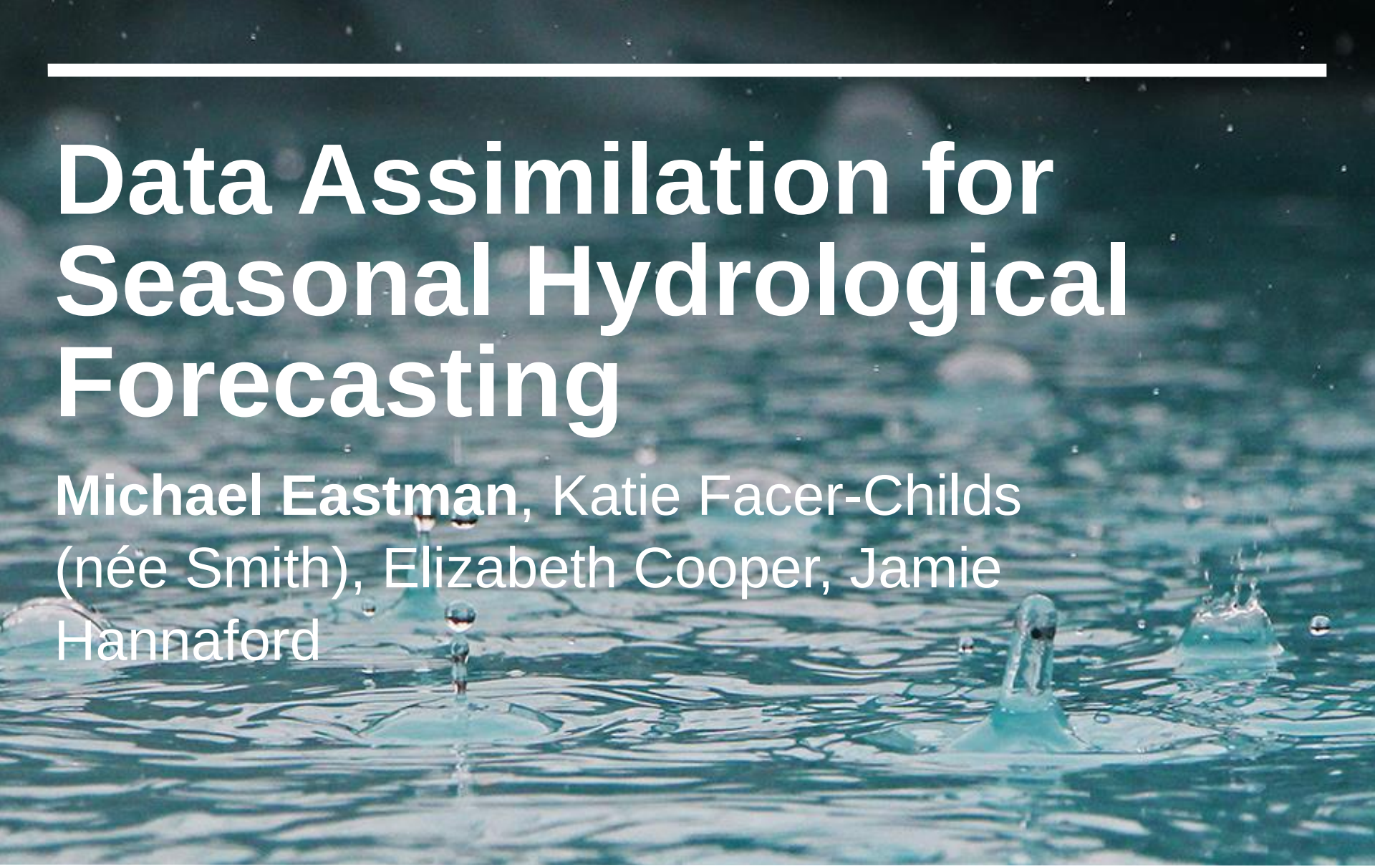

Data Assimilation for Seasonal Hydrological Forecasting

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Hydro-JULES

UK Centre for Ecology & Hydrology

BGS British Geological Survey

National Centre for Atmospheric Science
NATURAL ENVIRONMENT RESEARCH COUNCIL

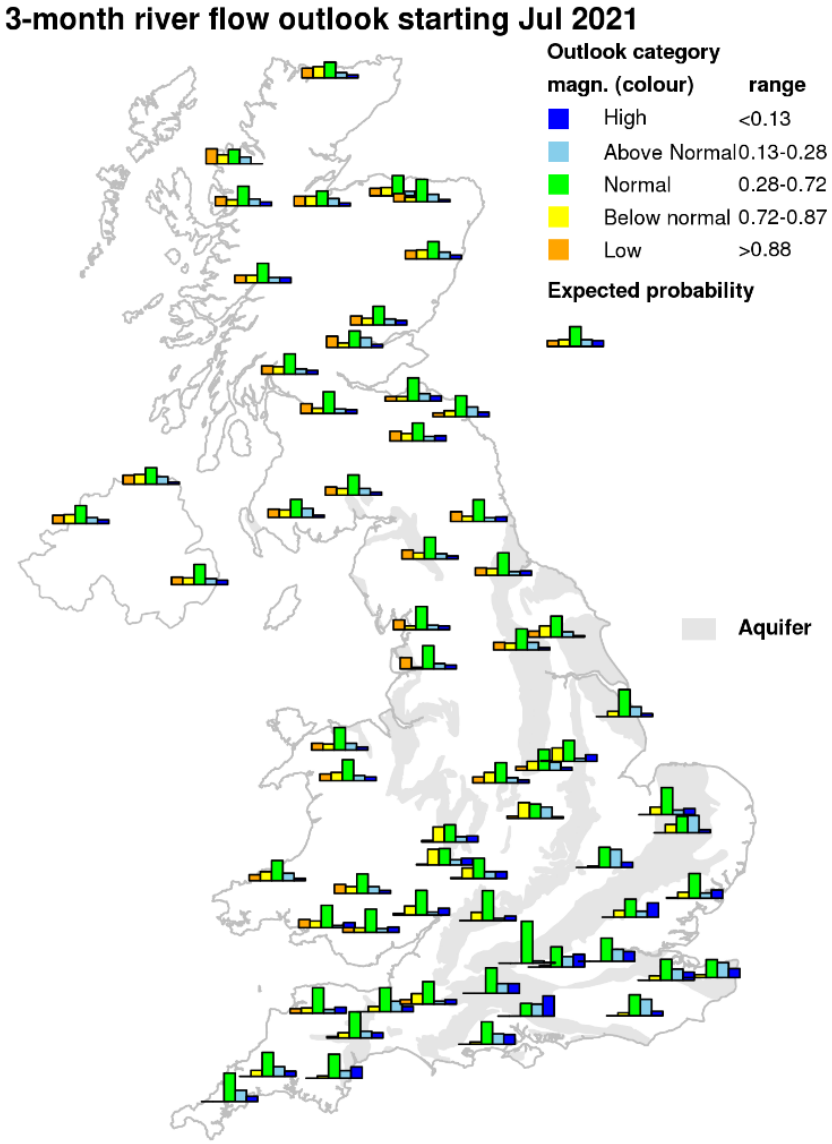
Hydrological Outlooks

1, 3, 6 month streamflow forecast

Hydrological Outlooks ESP method is a probabilistic forecast

53 Ensemble members

- 1964-2017 rainfall



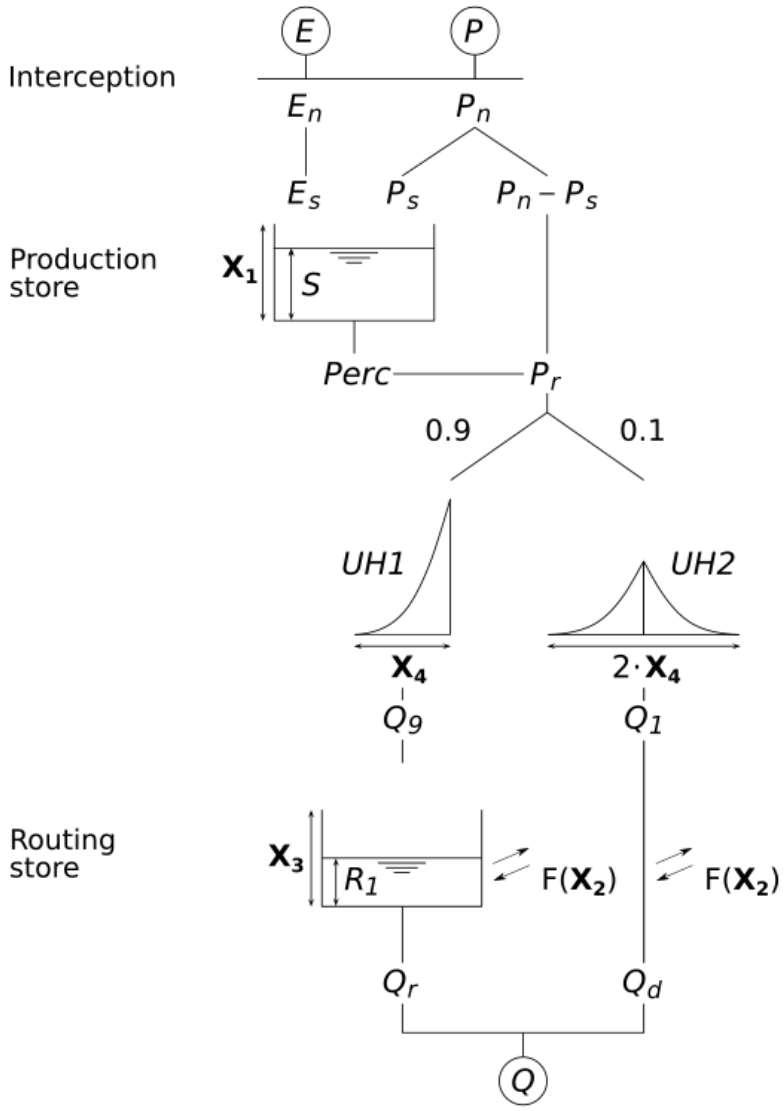
Inputs:

- Precipitation
- Evapotranspiration

Right side = Direct flow

Left side = Intercepted flow

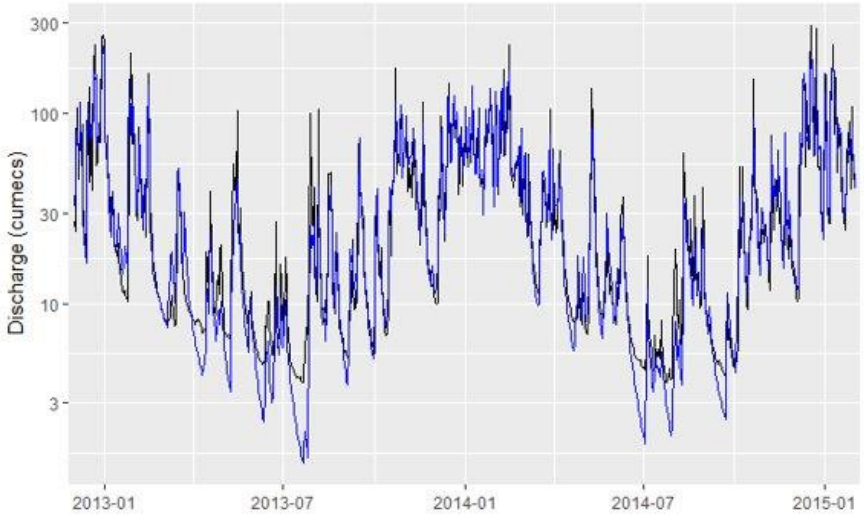
- 2 stores (Production and Routing)

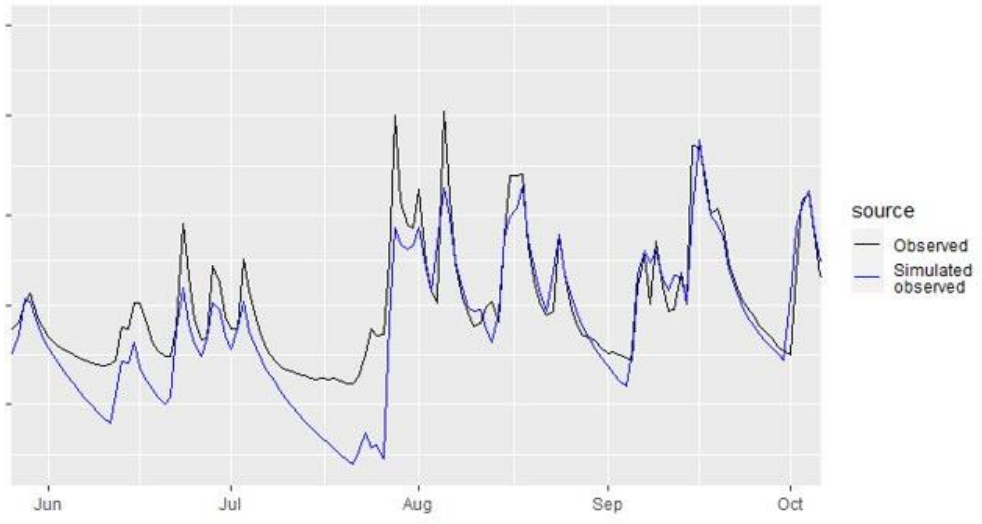


71001 – Ribble at Samlesbury

GR4J simulates discharge well when using observed rainfall data

Some challenges when taking a closer look





Skill - Spatial

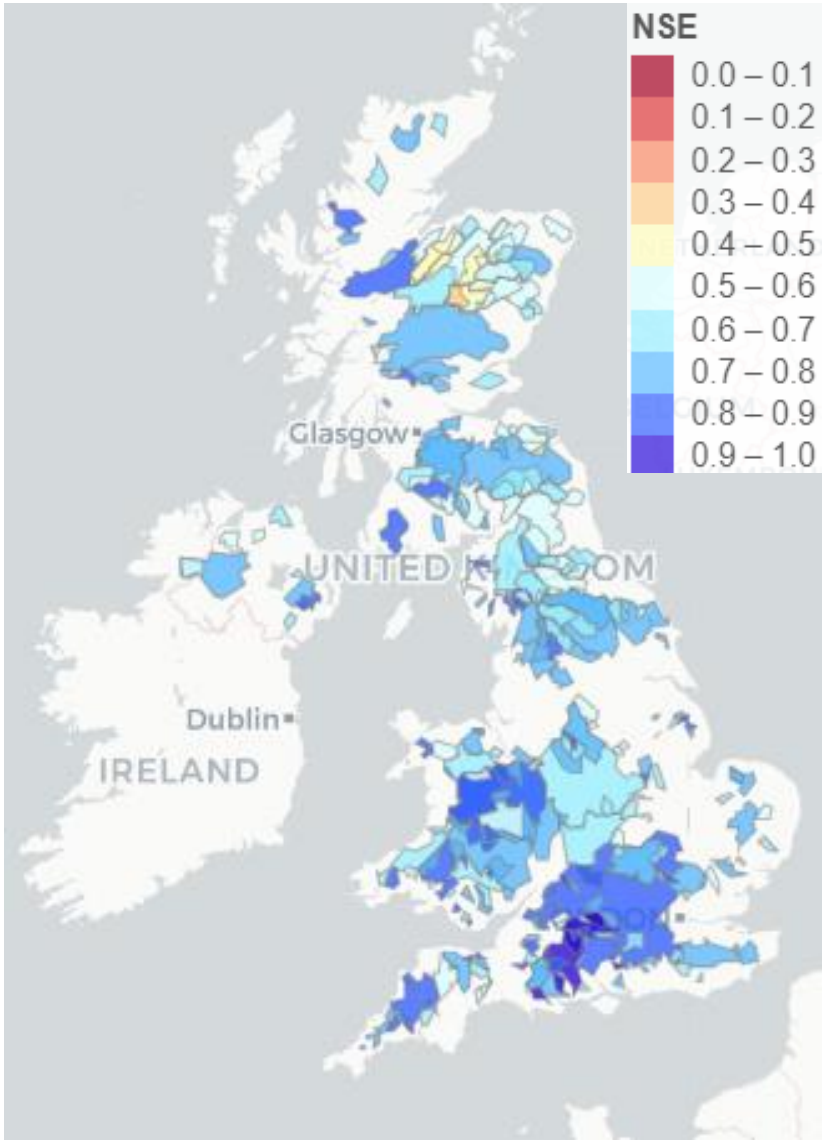
Nash Sutcliffe Efficiency

- Higher = Better

Skill across UK

Skill varies spatially

- Very high in South and West
- Some challenges in North



Skill - Temporal

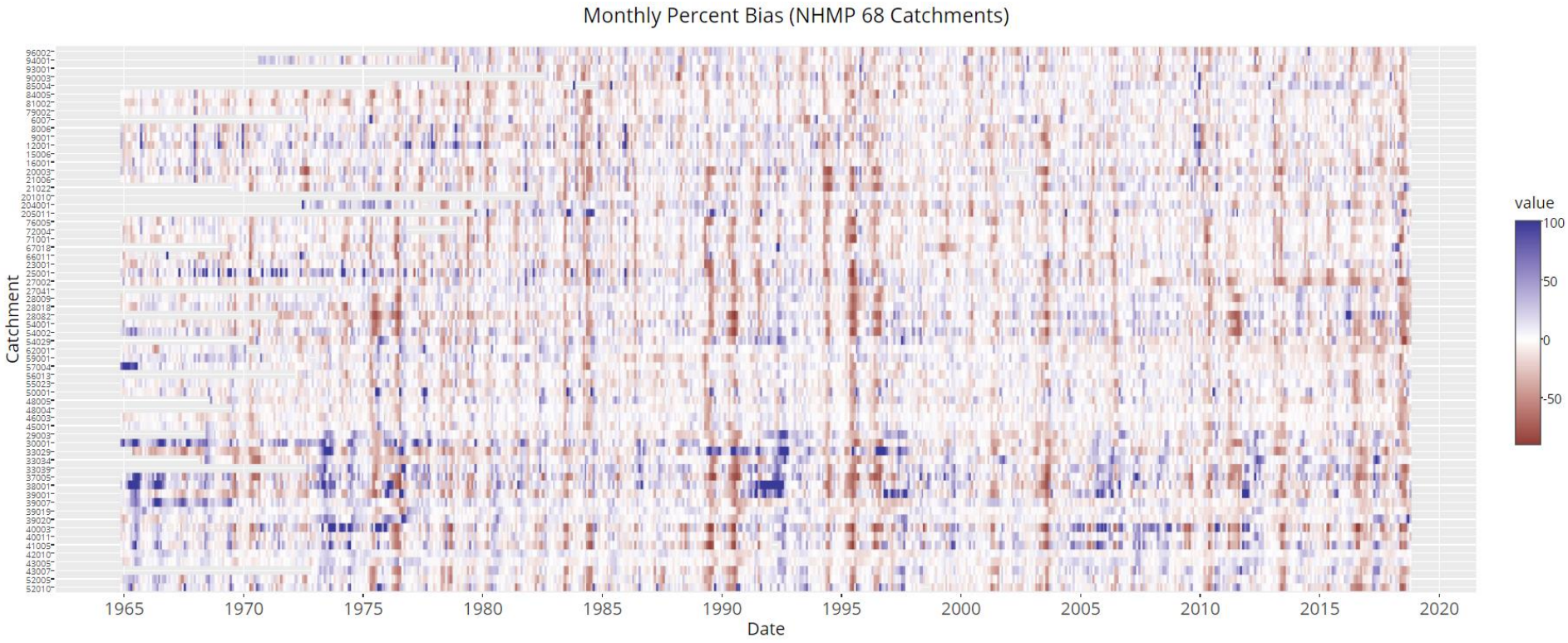
Skill also varies temporally

However, vertical bands are present

Does the model struggle at extremes?

But without a clear pattern

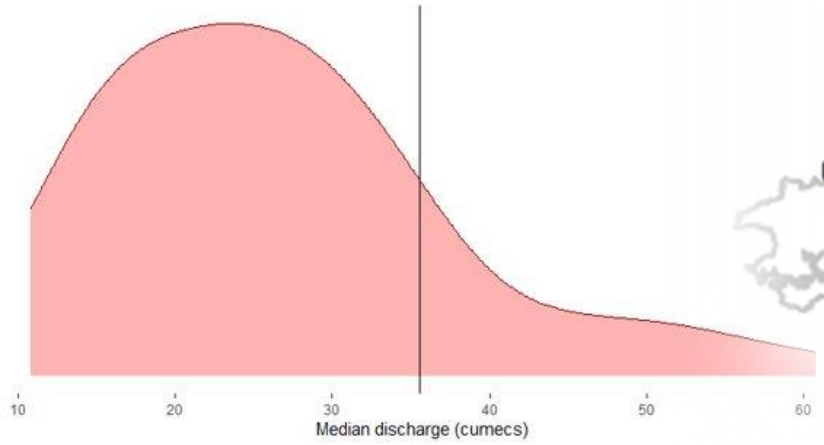
Many overlap notable hydrological events

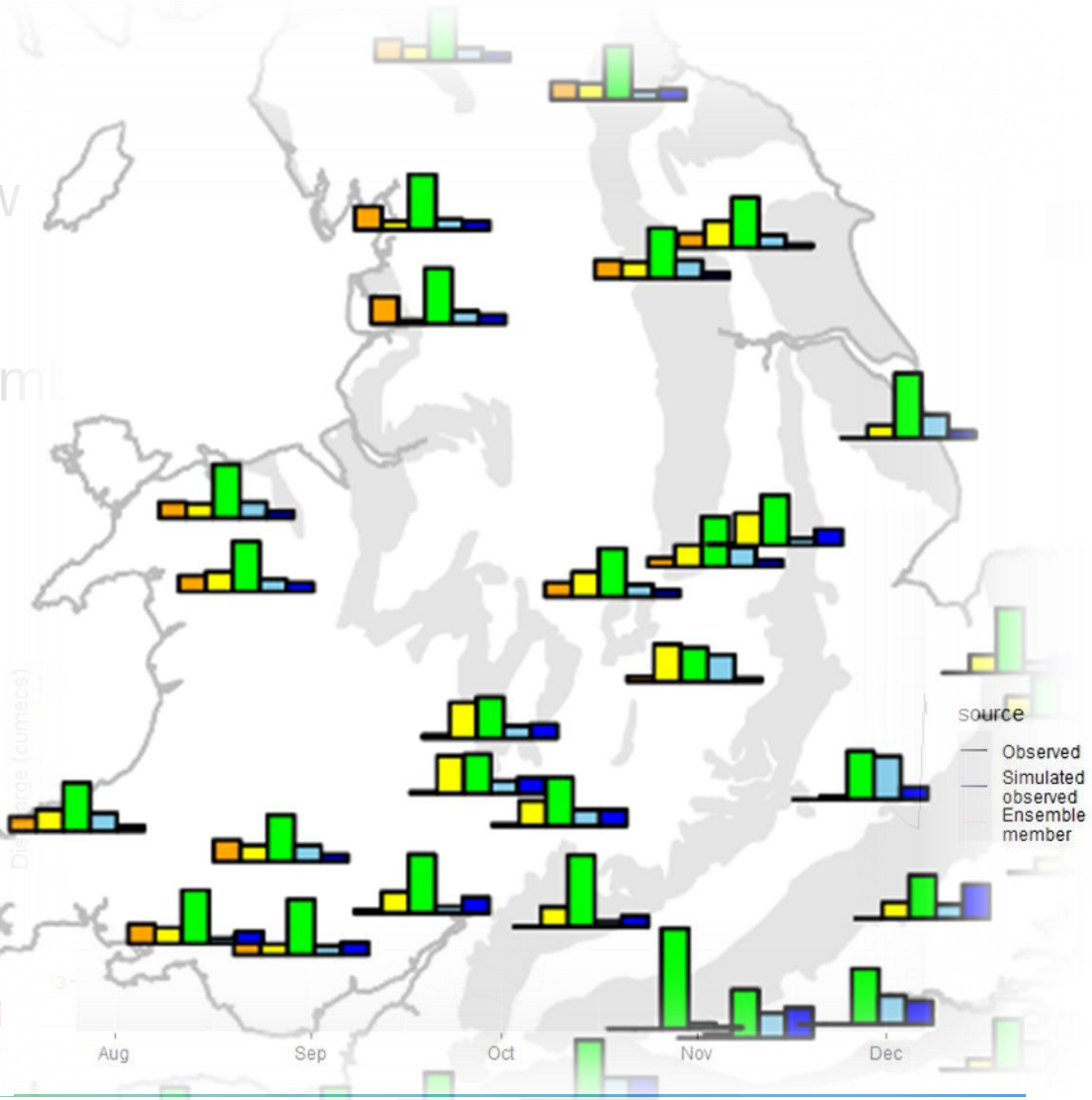


Skill - Ensemble

Ensemble members underestimate observed flow

Distribution of ensemble members is wide





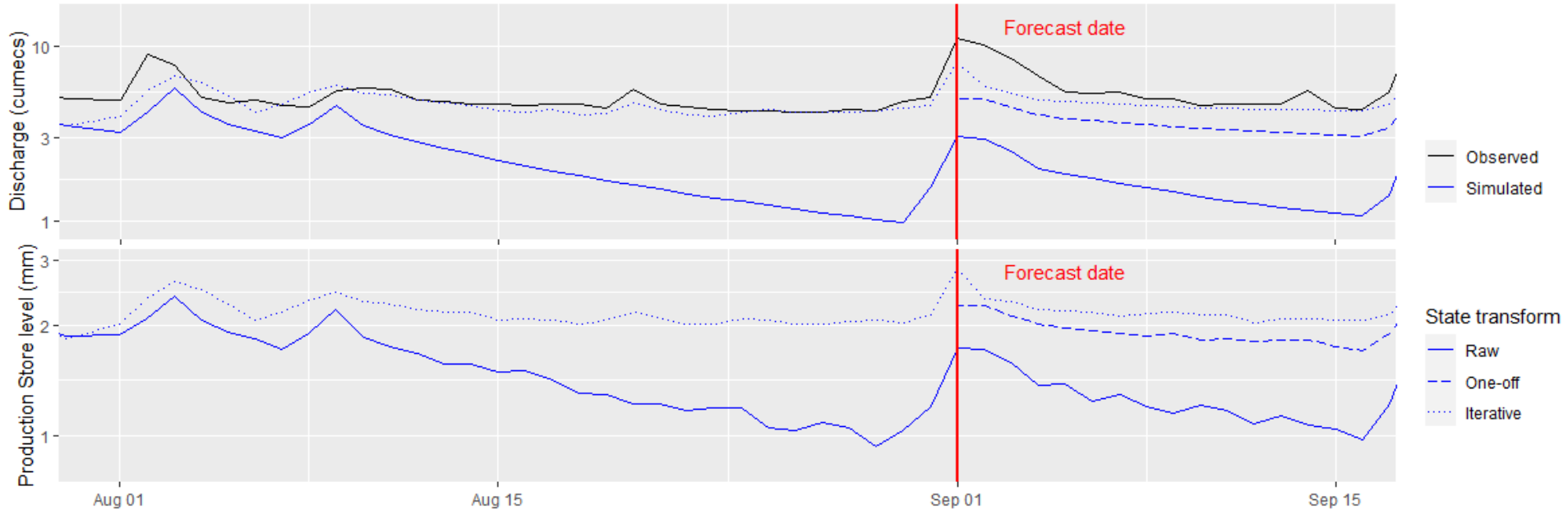
Options

- Bias correction
- Ensemble weighting
- Dynamic parameter estimation
- **Data assimilation**
- …

Data assimilation updates simulations using observations

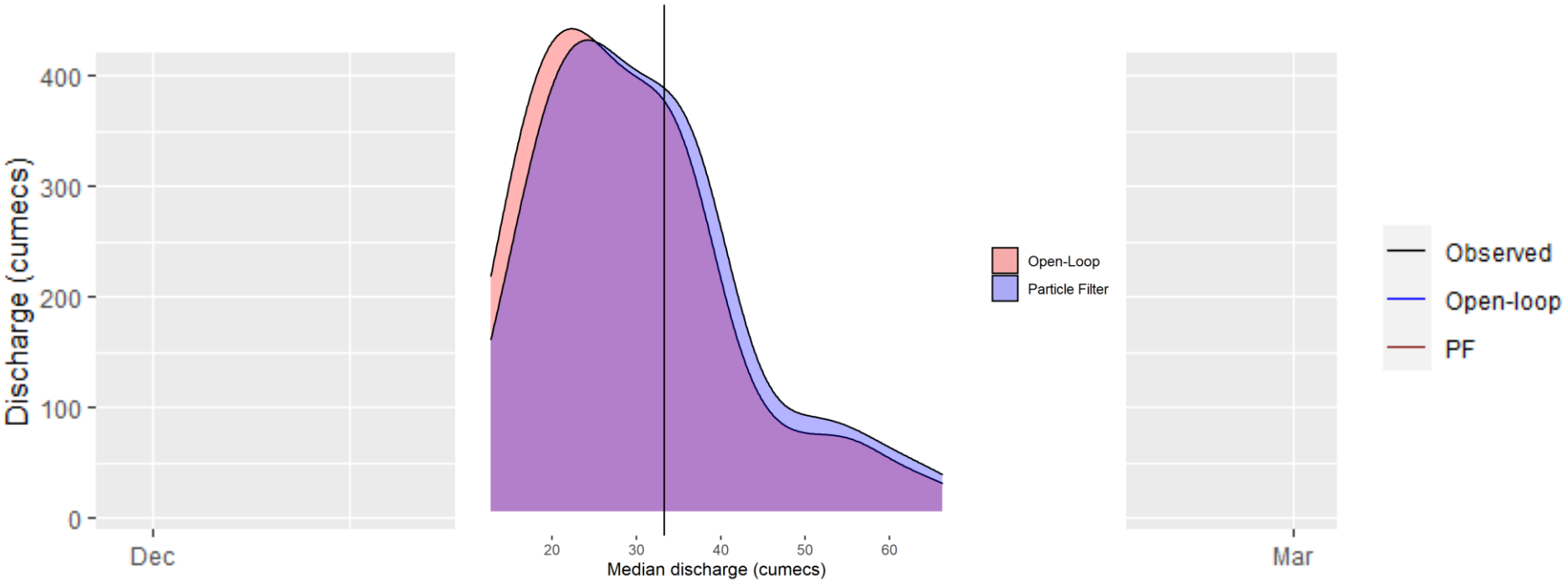
Why not just observations?

Why not just models?



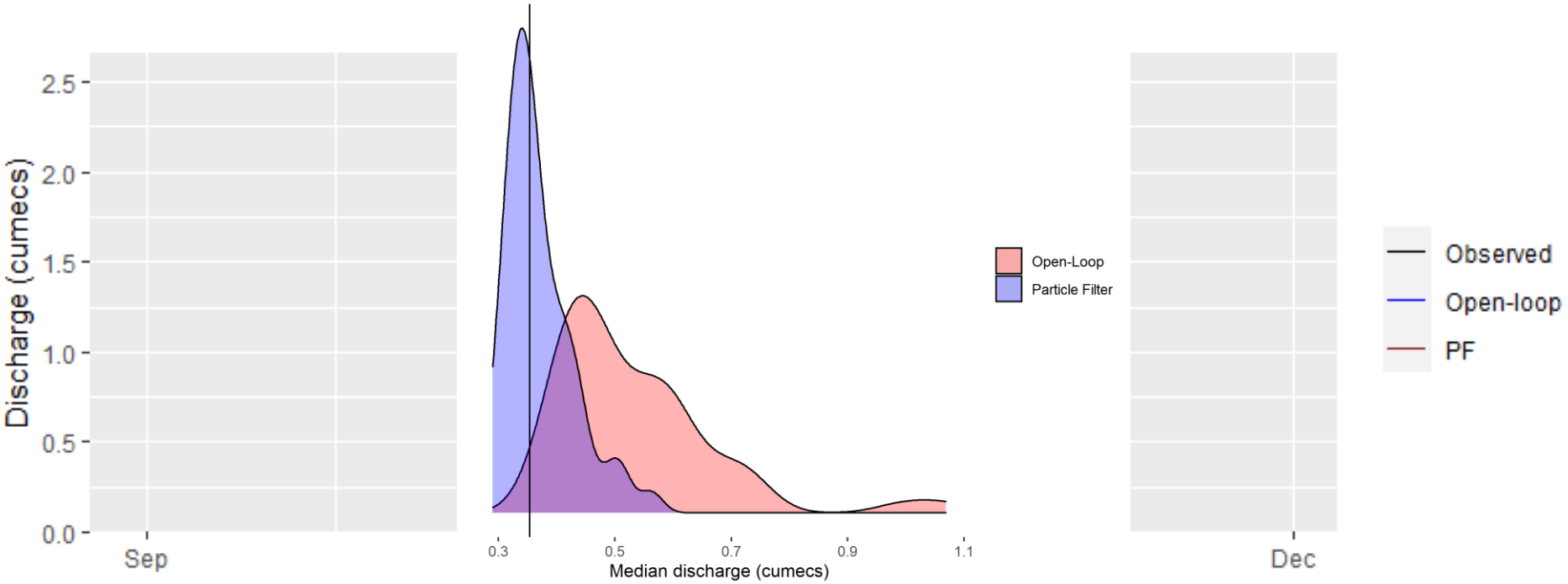
Data assimilation increases initial conditions towards the observation

However, the effect is short lived

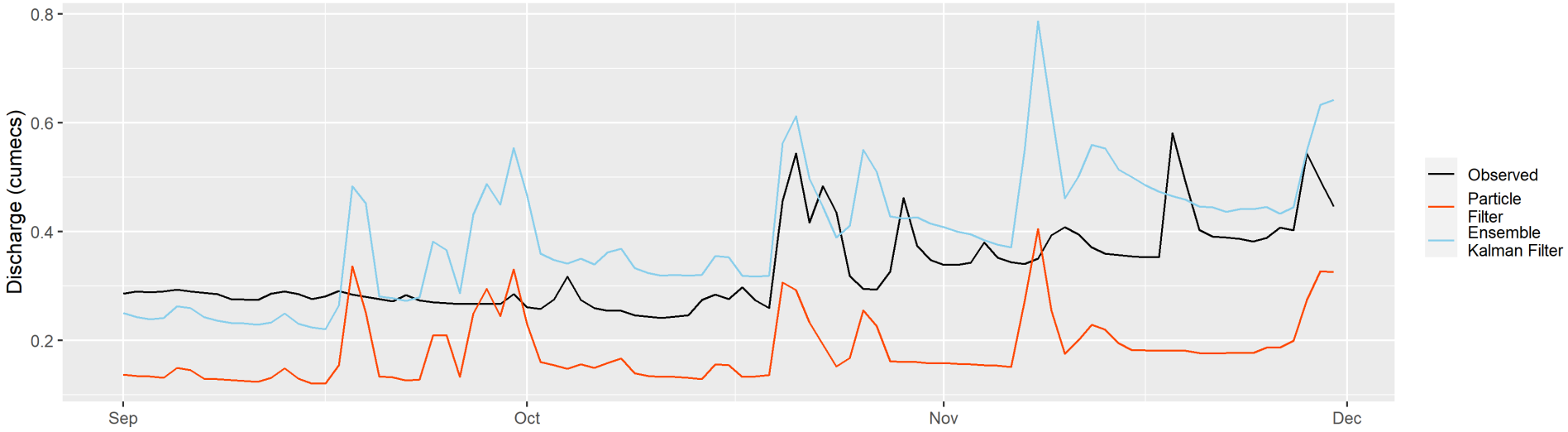


However, this is not always the case

Reduction in state variables leads to rainfall not causing sudden increase in flows



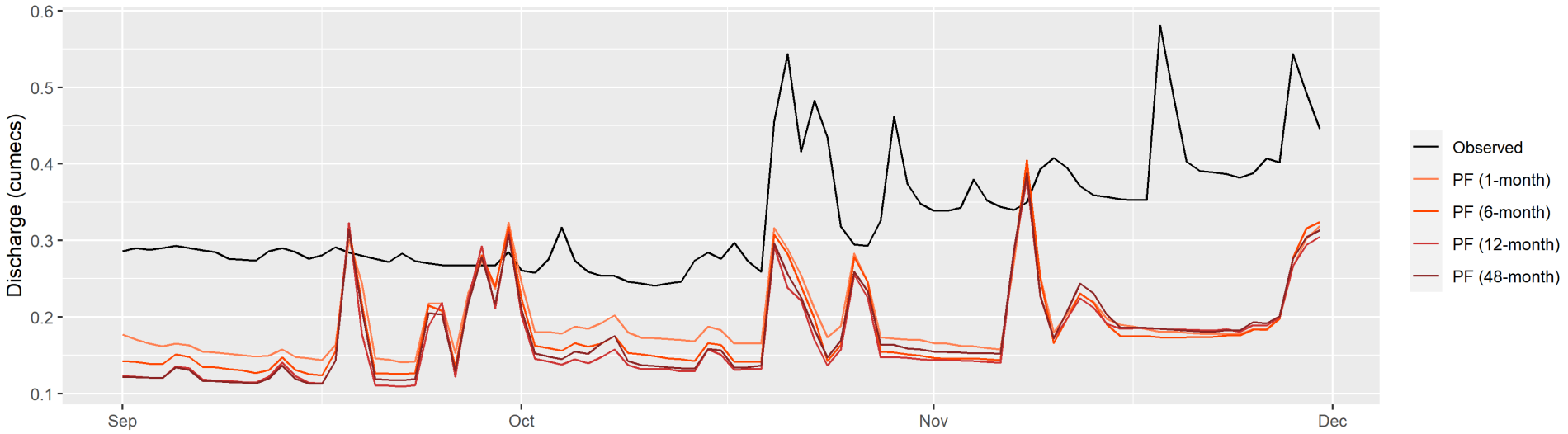
However, this is not the end of the story!



Effects vary with the algorithm used

However, this is not the end of the story!

Data assimilation is also sensitive to the warmup period of the model



Next steps

Investigate other sensitivities

- Seasonality
- Extremes
- Spatial variation
- Algorithms

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