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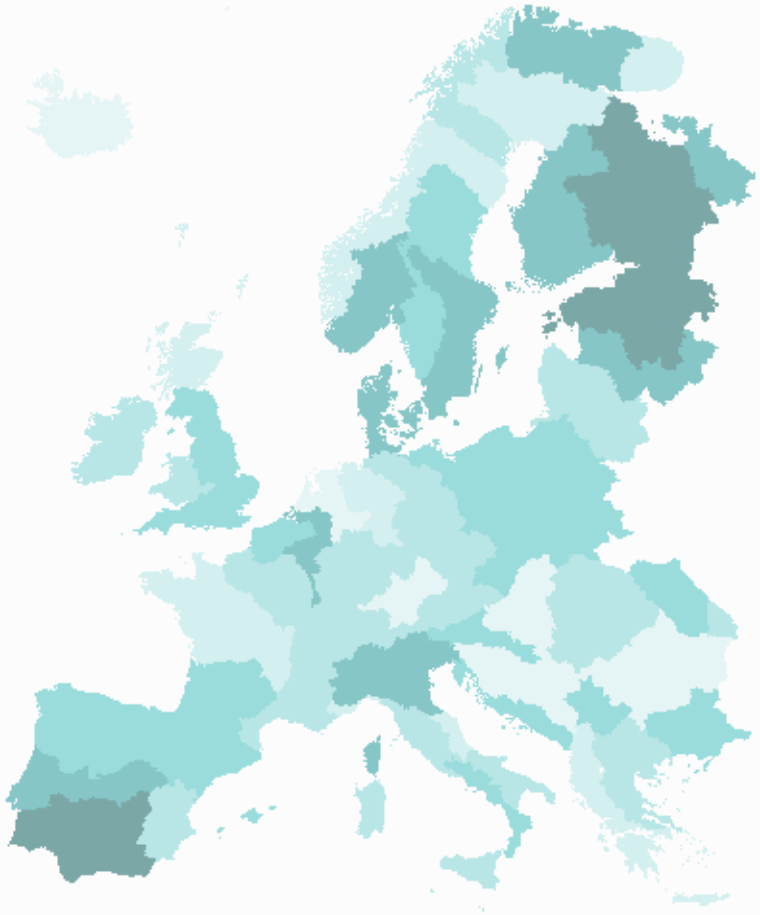
Learn from today to anticipate tomorrow



Skilful seasonal forecasts of streamflow over Europe?

Louise Arnal, H. Cloke, E. Stephens, F. Wetterhall, C. Prudhomme, J. Neumann, B. Krzeminski & F. Pappenberger

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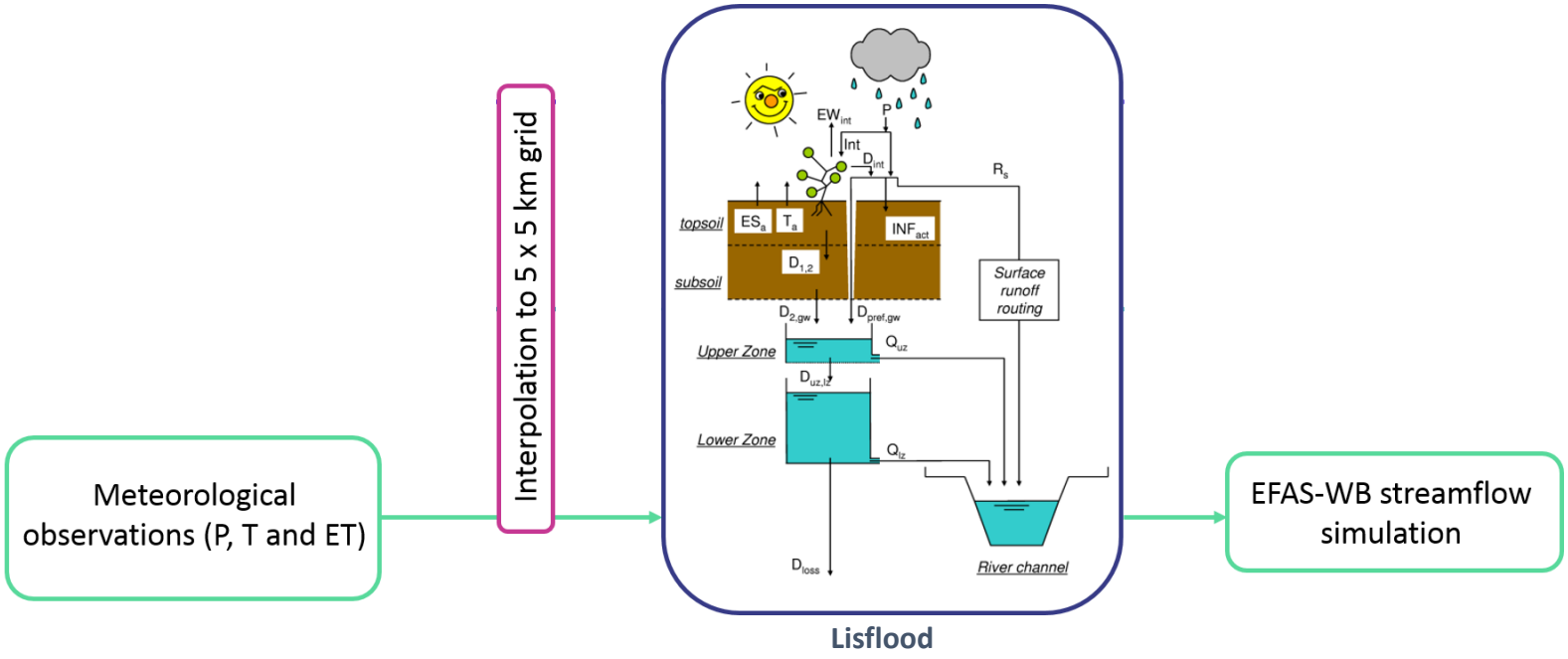
Context

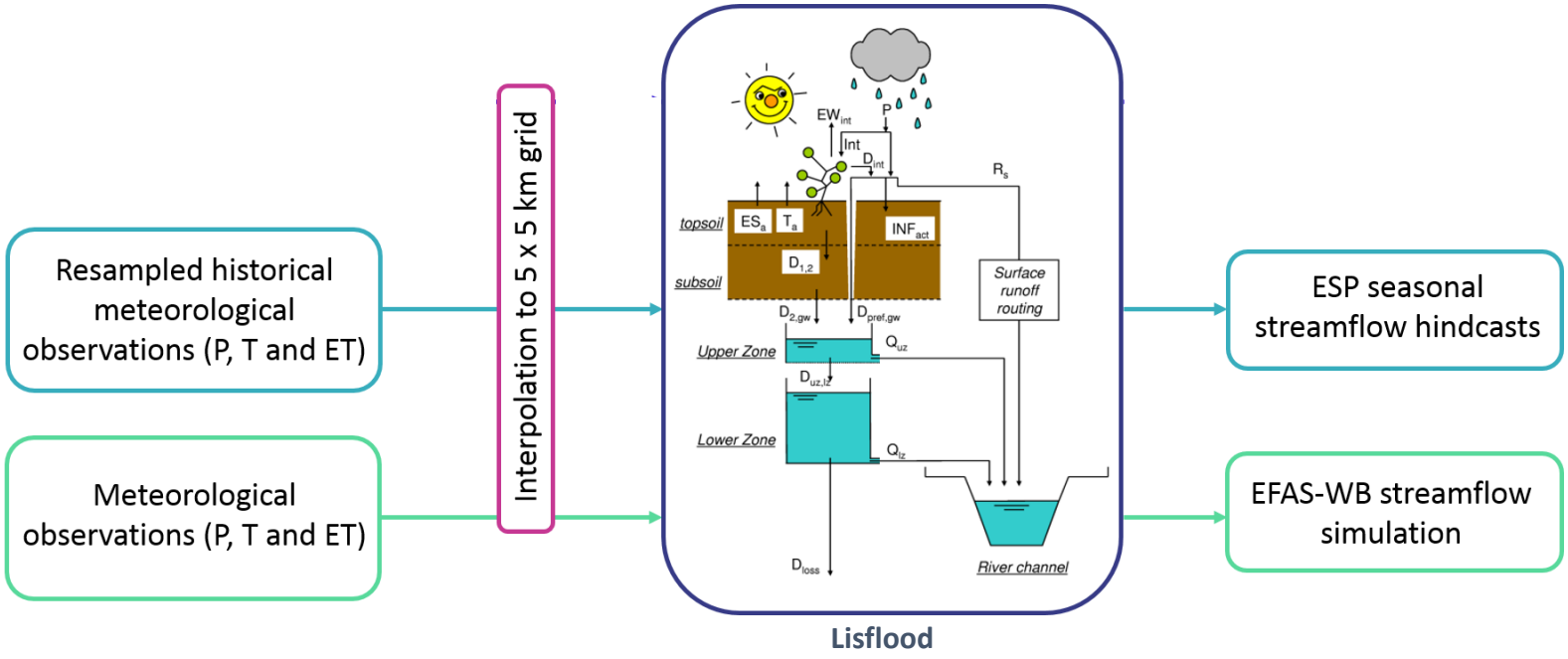
- European climate-model based seasonal streamflow forecasting studies are still scarce
- Yet ... the science has improved in the last decades:
  - Improved understanding of streamflow generating mechanisms
  - Earth System Models
  - Better seasonal climate forecasts
  - …
- And ... this information could be of great benefit to water-related applications!

Data & methods



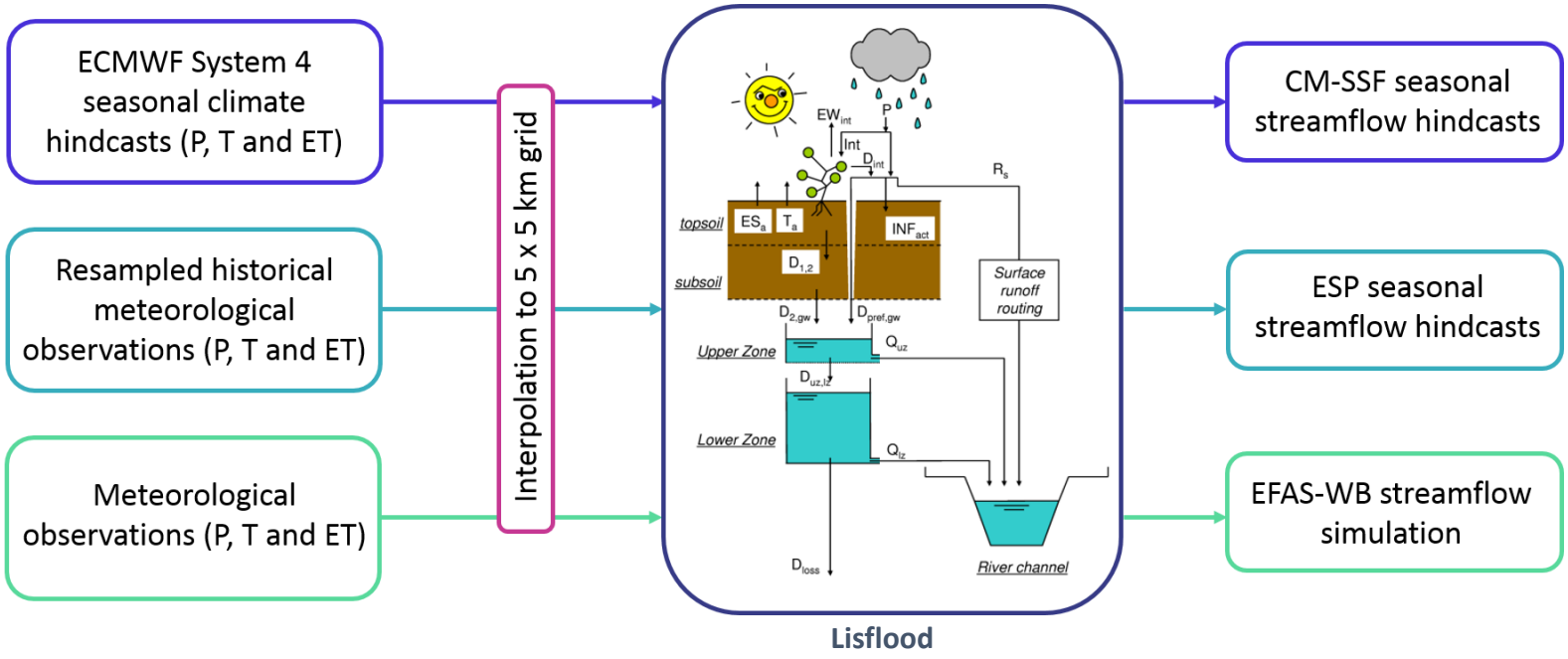
- **EFAS-WB:** proxy for observations

Data & methods



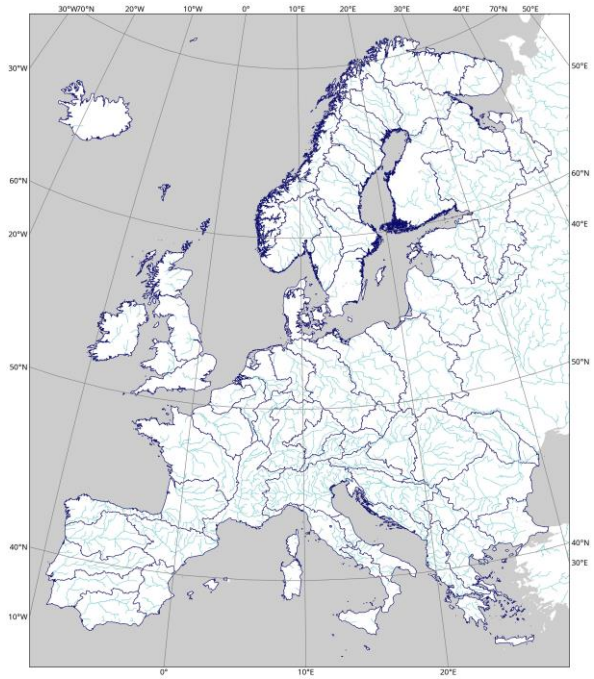
- **ESP:** Ensemble Streamflow Prediction
- **EFAS-WB:** proxy for observations

Data & methods



- **CM-SSF:** climate-model based seasonal streamflow forecast
- **ESP:** Ensemble Streamflow Prediction
- **EFAS-WB:** proxy for observations

Data & methods



- EFAS-WB & hindcasts from 1990-2017
- Hindcasts with 1-7 months lead time
- Monthly region streamflow averages
- Hindcasts evaluated against EFAS-WB for several attributes
- Skill: CM-SSF benchmarked against ESP

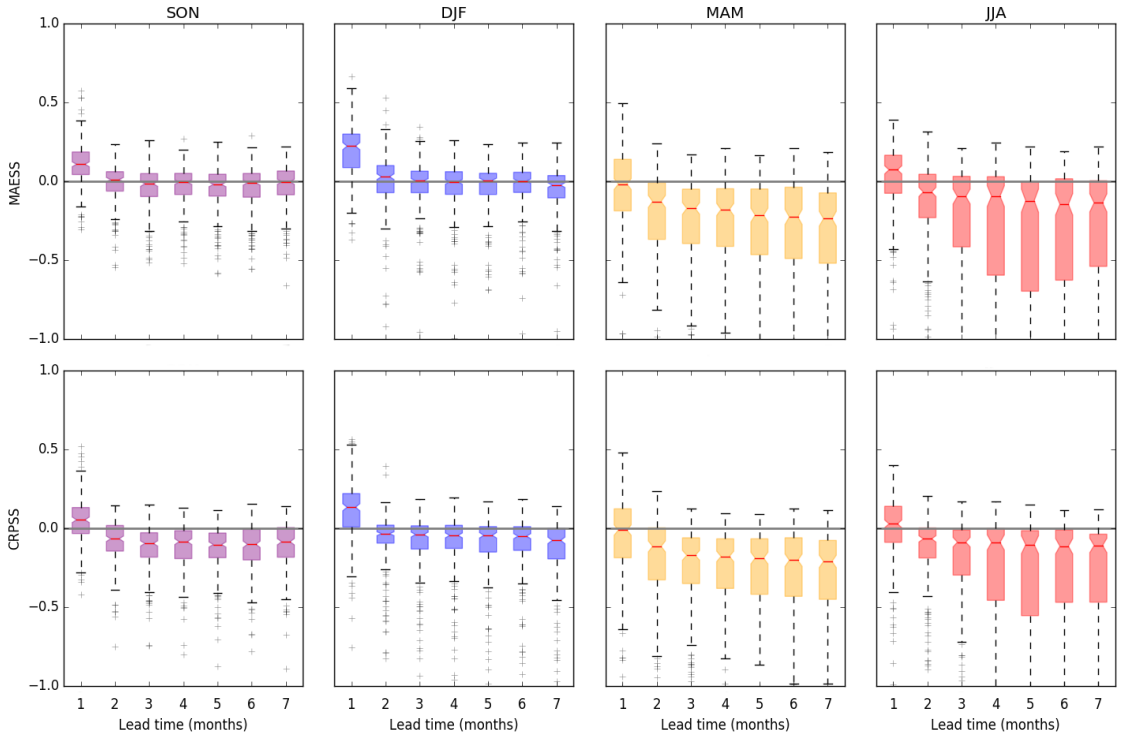
Does using seasonal climate forecast vs historical met. observations increase the seasonal streamflow forecast quality over Europe?

Hindcast evaluation

Accuracy & overall performance

accuracy

overall performance



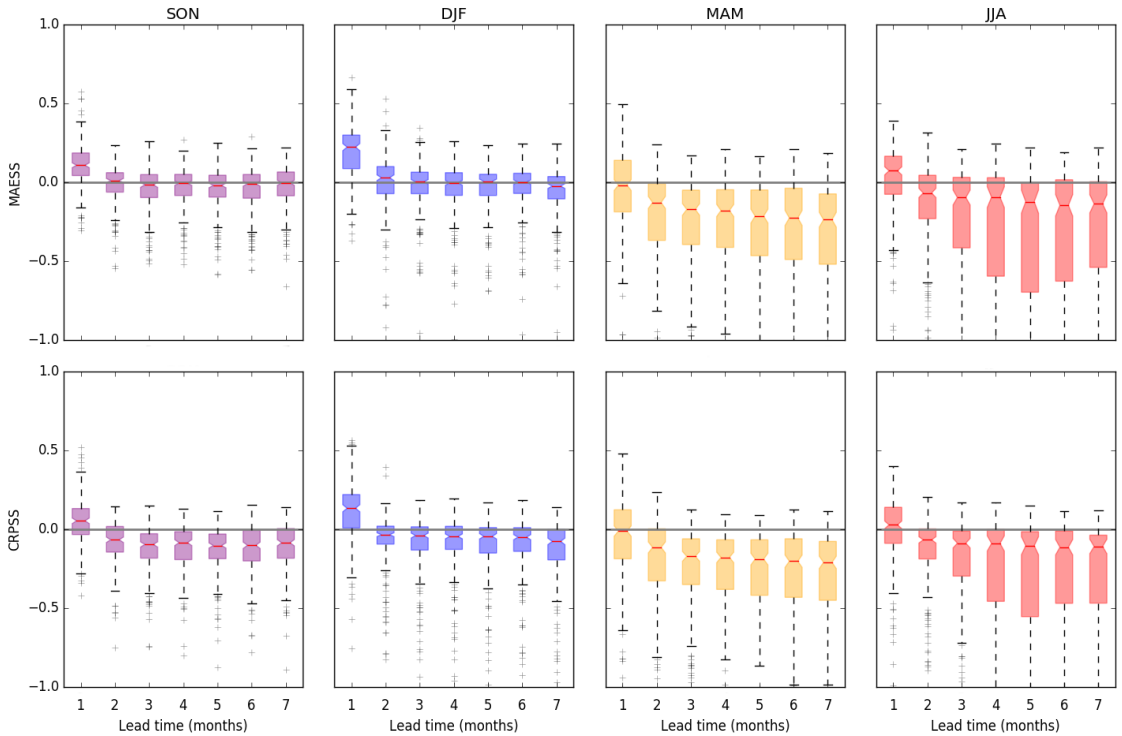
Hindcast evaluation

Accuracy & overall performance

- CM-SSF more skilful than ESP for 1st month lead time

accuracy

overall performance



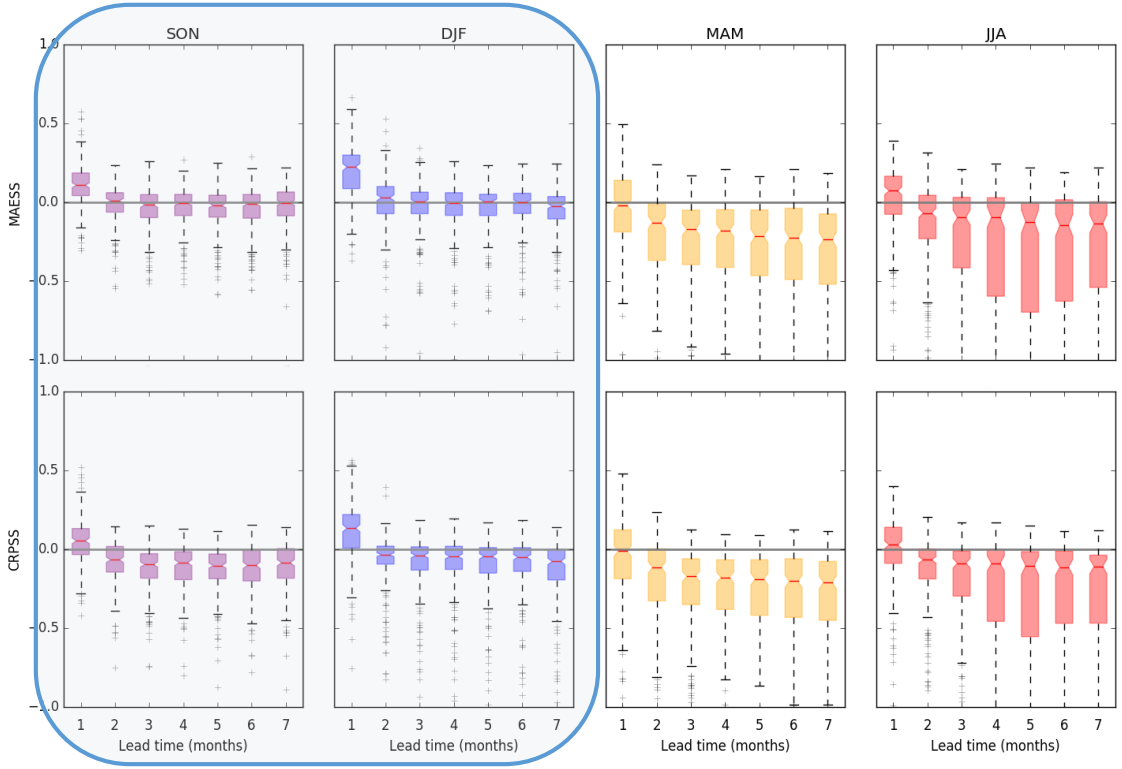
Hindcast evaluation

Accuracy & overall performance

- >1st month lead time …

accuracy

overall performance



… CM-SSF ~as skilful as ESP

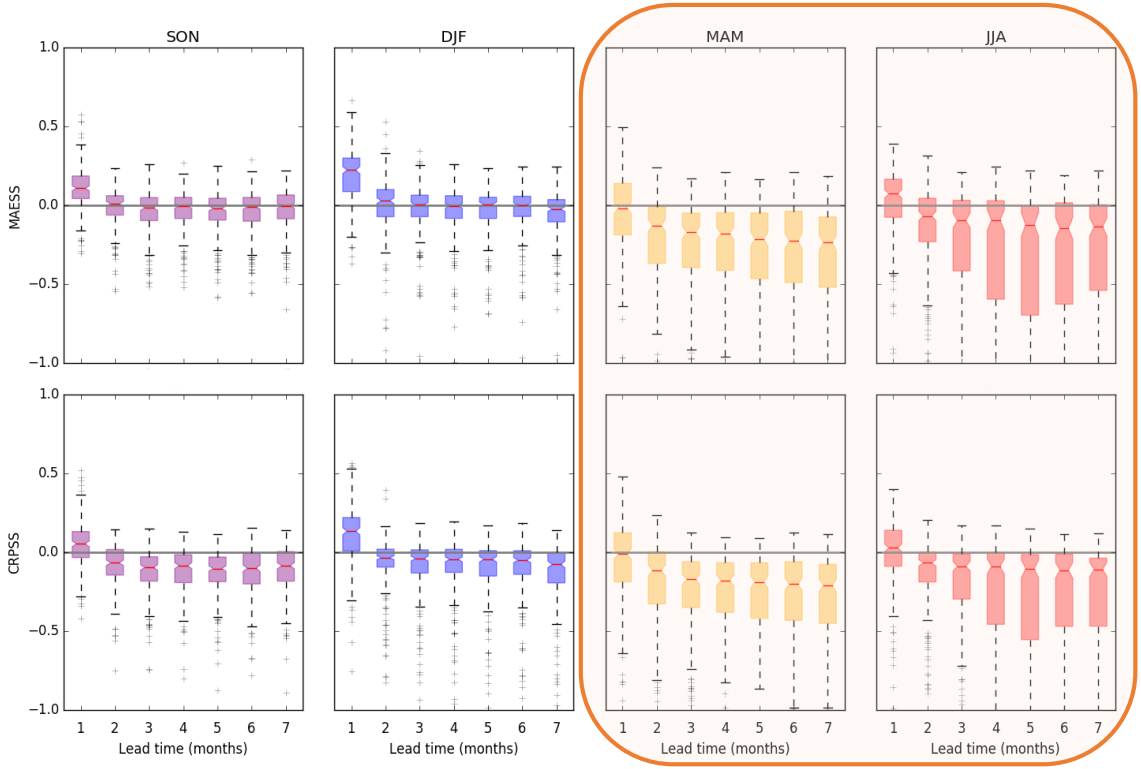
Hindcast evaluation

Accuracy & overall performance

- >1st month lead time …

accuracy

overall performance



… CM-SSF less skilful than ESP

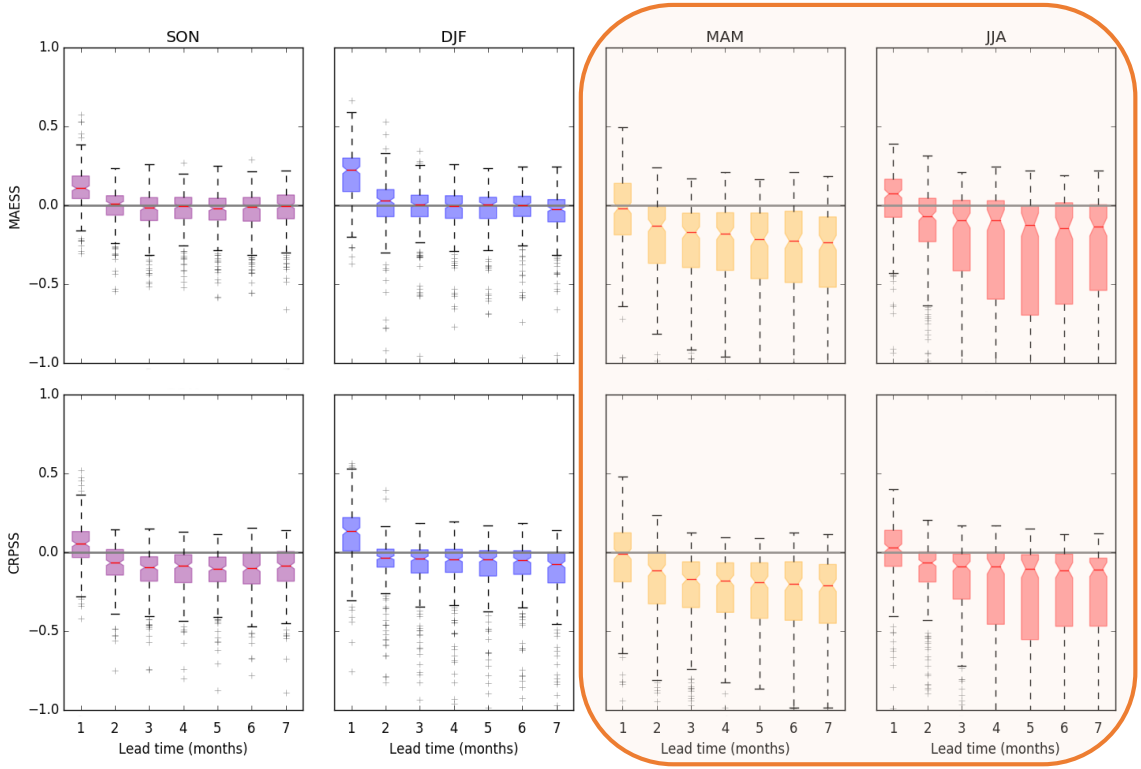
Hindcast evaluation

Accuracy & overall performance

Larger variability in spring & summer than in autumn & winter

accuracy

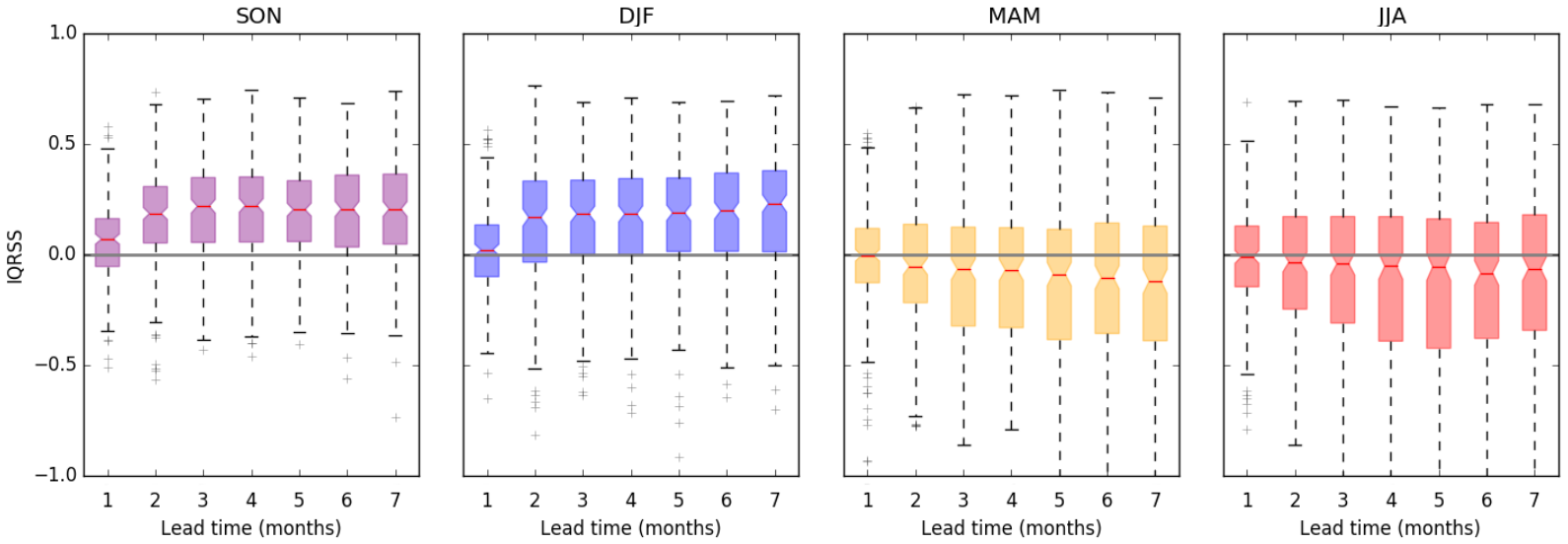
overall performance



Hindcast evaluation

Sharpness

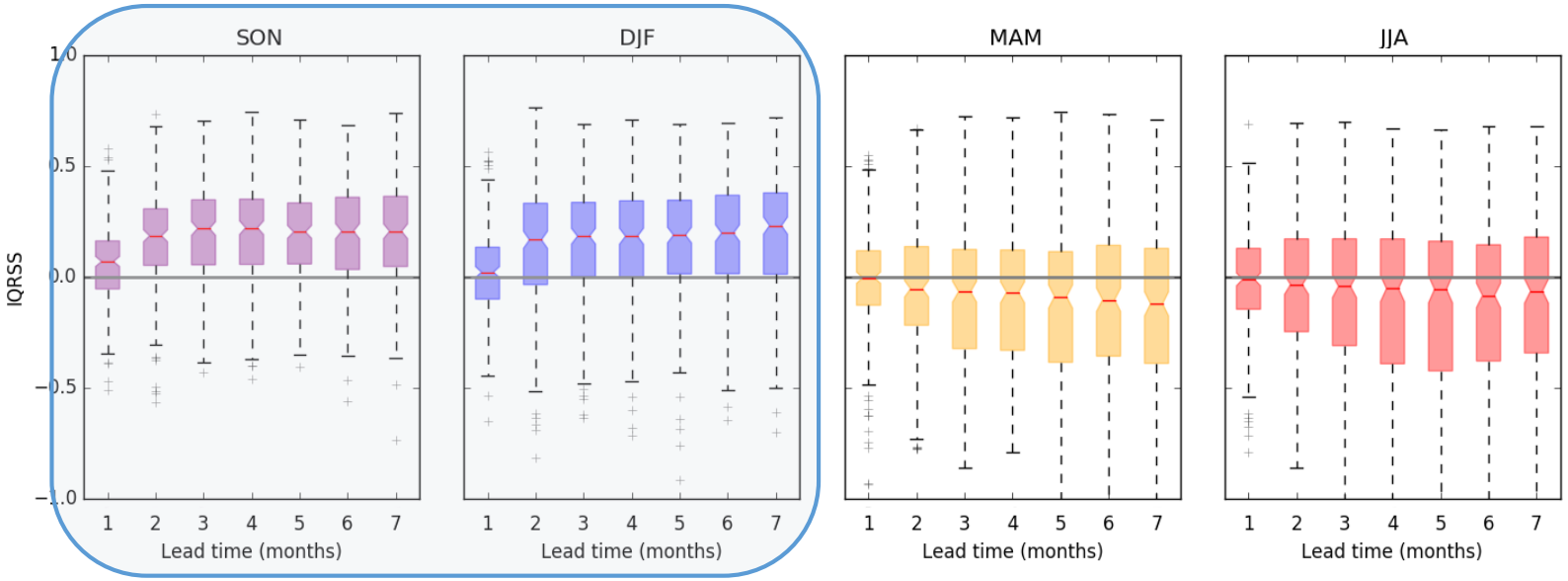
- CM-SSF as sharp as ESP for 1st month lead time



Hindcast evaluation

Sharpness

- >1st month lead time …

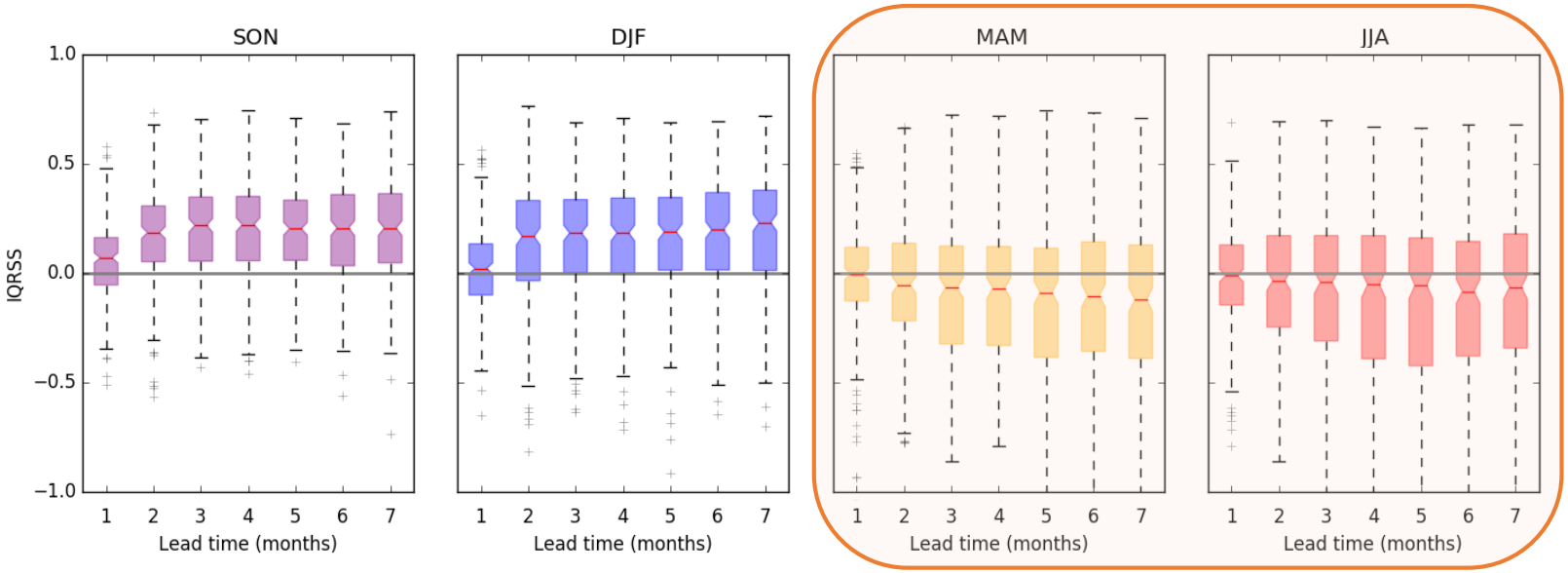


… CM-SSF sharper than ESP

Hindcast evaluation

Sharpness

- >1st month lead time …

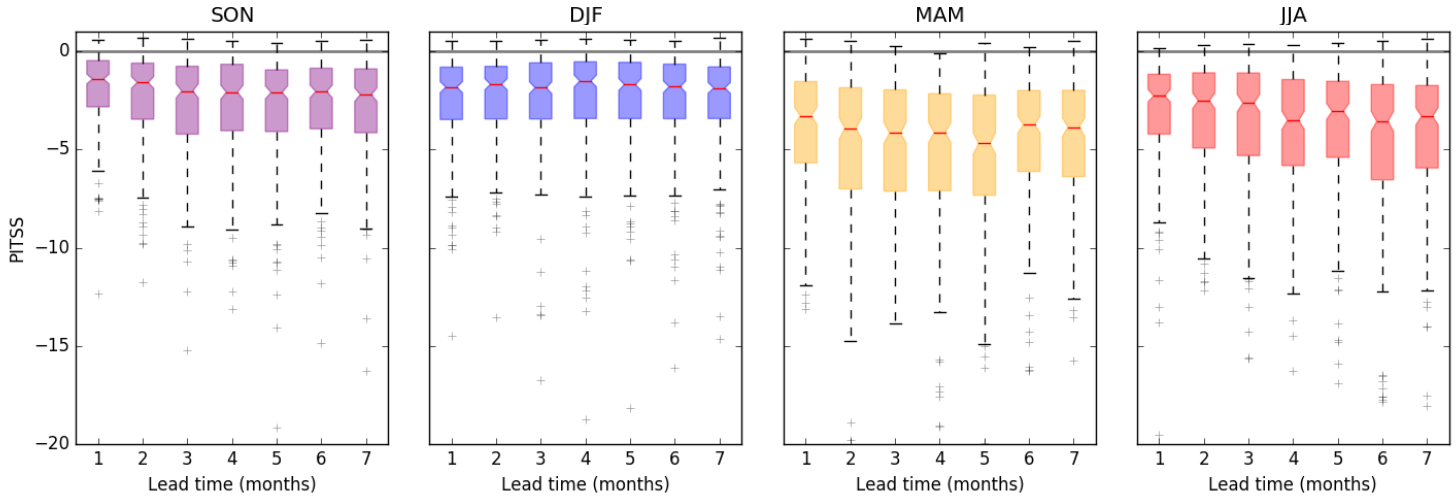


… CM-SSF less sharp than ESP

Hindcast evaluation

Reliability

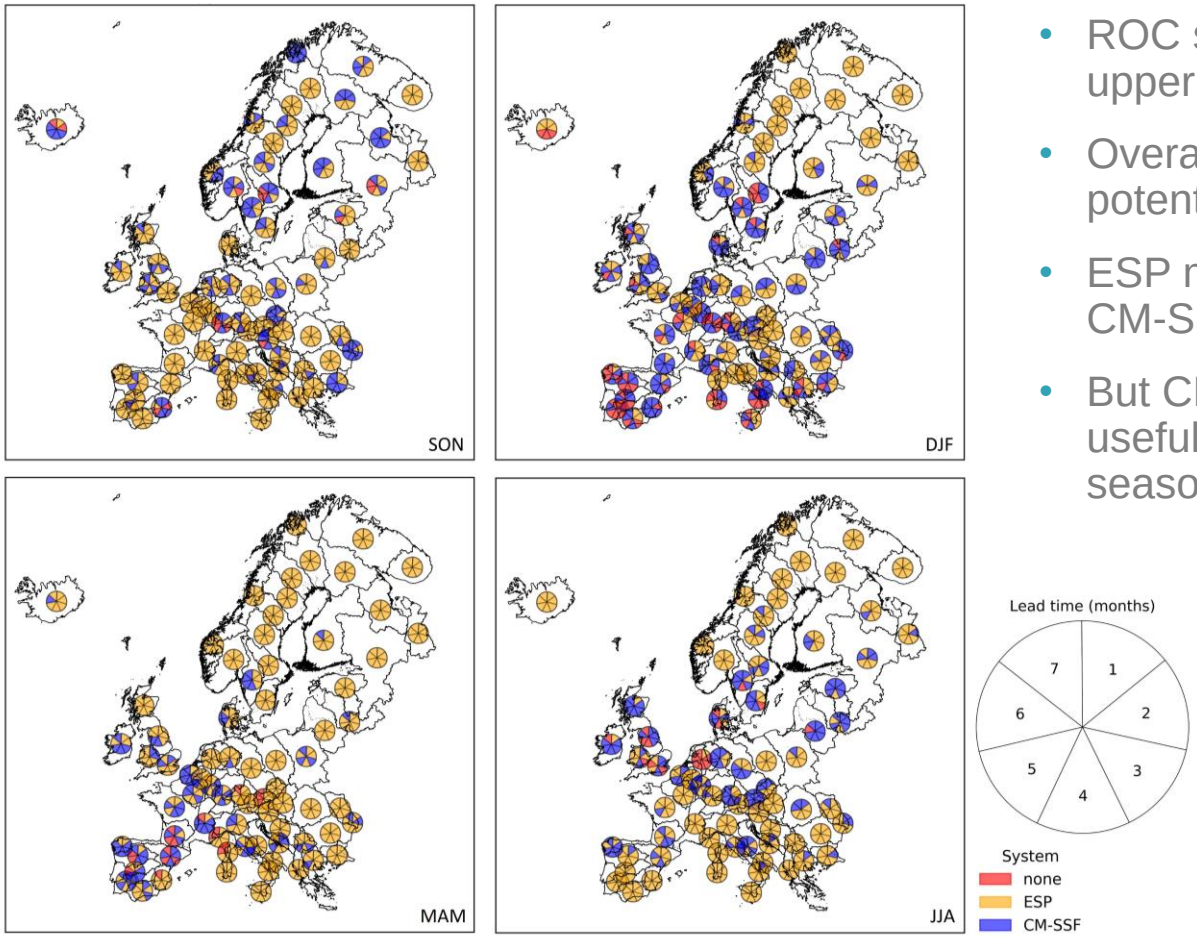
- CM-SSF less reliable than ESP for all lead times, because …



- … CM-SSF too narrow,
- under-predicts EFAS-WB in autumn & winter
- and over-predicts EFAS-WB in spring & summer

Hindcast evaluation

Potential usefulness for predicting anomalously high streamflows



- ROC score for the EFAS-WB upper tercile
- Overall, either of two forecasts potentially useful
- ESP more potentially useful than CM-SSF
- But CM-SSF most potentially useful in some regions and seasons

Take-home messages

Does using seasonal climate forecast vs historical met. observations increase the seasonal streamflow forecast quality over Europe?

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It depends …

Take-home messages

Does using seasonal climate forecast vs historical met. observations increase the seasonal streamflow forecast quality over Europe?

It depends …

- Yes, for 1st month lead time
- Beyond that for some regions & target months
- CM-SSF more potentially useful than ESP at predicting anomalously low & high streamflows in parts of Europe for certain seasons

Either ESP or CM-SSF potentially useful and could be used as monitoring and early-warning information for flood preparedness

Arnal, L., Cloke, H. L., Stephens, E., Wetterhall, F., Prudhomme, C., Neumann, J., Krzeminski, B., and Pappenberger, F.: Skilful seasonal forecasts of streamflow over Europe?, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-610, in review, 2017.

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Take-home messages

THANK YOU!

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It depends …

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- Beyond that for some regions & target months
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