Skilful seasonal forecasts of streamflow over Europe?


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• 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
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- **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
Hindcast evaluation
Accuracy & overall performance

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

Accuracy & overall performance

• >1\textsuperscript{st} month lead time …

... CM-SSF \textasciitilde as skilful as ESP
Hindcast evaluation

Accuracy & overall performance

• >1st month lead time ...

... CM-SSF less skilful than ESP
Hindcast evaluation

Accuracy & overall performance

Larger variability in spring & summer than in autumn & winter
Hindcast evaluation

Sharpness

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

Sharpness

• $>1^{\text{st}}$ month lead time …

... CM-SSF sharper than ESP
Hindcast evaluation

Sharpness

• >1\textsuperscript{st} 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

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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

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