Comparing single-scale, linear and multi-scale, nonlinear methods to explain flood probabilities across Europe

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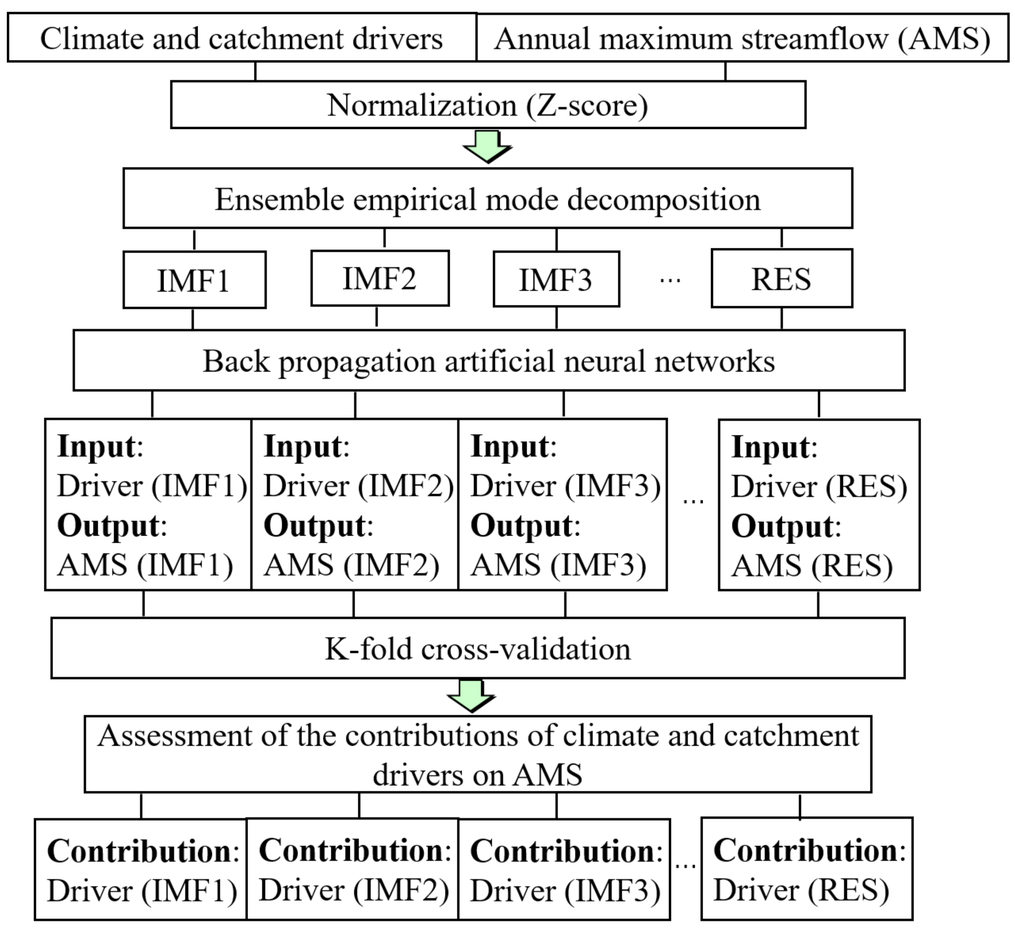
1 Introduction

Seasonal flood forecasting is usually performed in order to derive streamflow values for the season ahead. This is particularly interesting for water management. It is essential to understand the contributions of climate and catchment information on flood. However, the impacts of these information on flood at inter-annual and inter-decadal scales have rarely been assessed quantitatively.

This study develops a nonlinear hybrid model, which integrates ensemble empirical mode decomposition (EEMD), back propagation artificial neural networks (BPANN) to forecast extreme seasonal streamflow from around 650 stations in Europe by considering climate and catchment state before the target streamflow season. The performance of this model is compared with multiple linear regression (MLR).

2 Methodology



3 Data

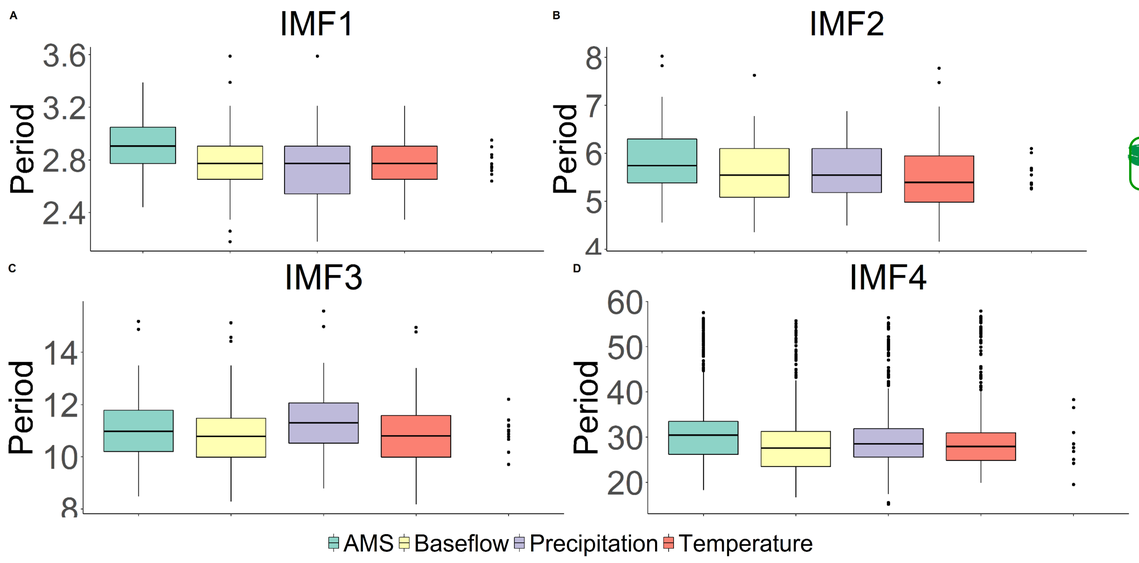
Flood data (1956-2016):

Monthly daily discharge time series are derived from the GRDC.

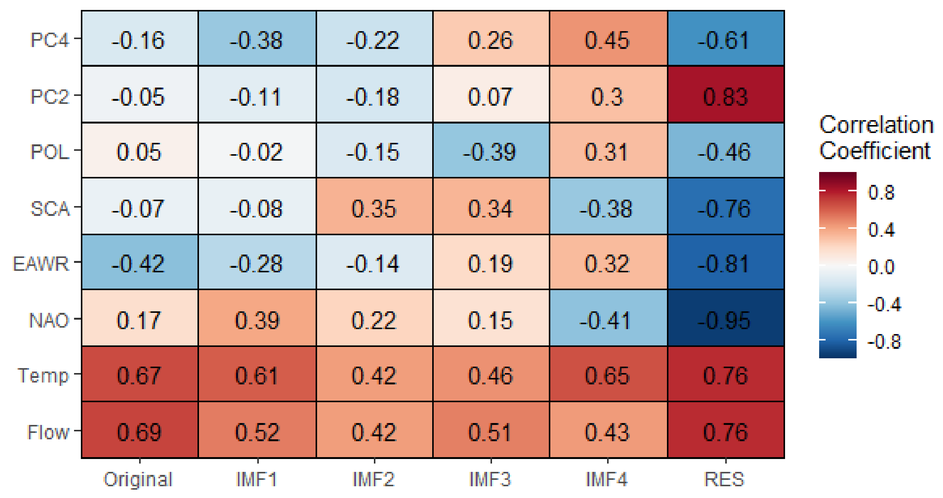
Catchment and climate drivers (1956-2016):

Precipitation, Temperature, Baseflow, NAO, EAWR, SCA, EA, POL, SIC, SST1-5

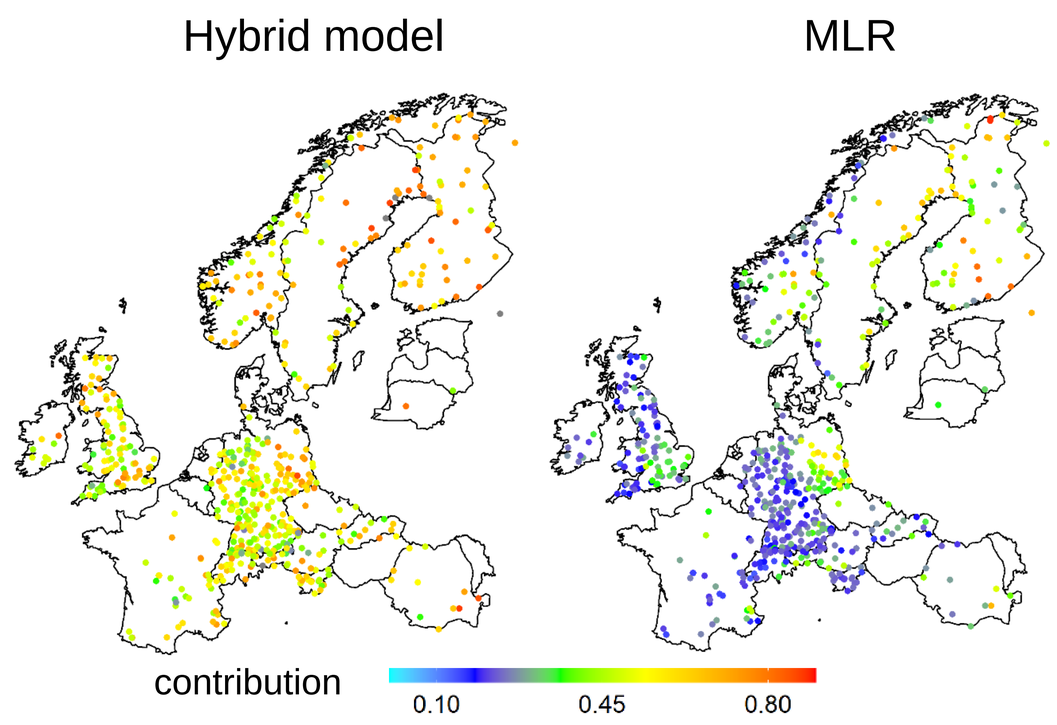
4 Results



Drivers and AMS can be separated into components that have comparable periods, which enables the assessment of the impacts of drivers on AMS at different time scales.



As the modes increase, the correlation and contribution between AMS and selected drivers basically increases. In addition, all drivers have higher contribution to AMS at RES scale. The counteracting associations may be masked when considering only the correlation coefficient of the observed data.



Multi-scale, nonlinear method (hybrid model) clearly better than single-scale, linear method (MLR).

5 Conclusion

The nonlinear hybrid model is superior than MLR model. We attribute this improvement to its ability to represent nonlinear relations and to simulate the driver-AMS relations separately for each time scale.

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