

# Recent nitrate transport response to extreme weather conditions in the Bode lower-mountain range catchment, central Germany

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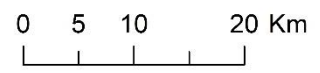
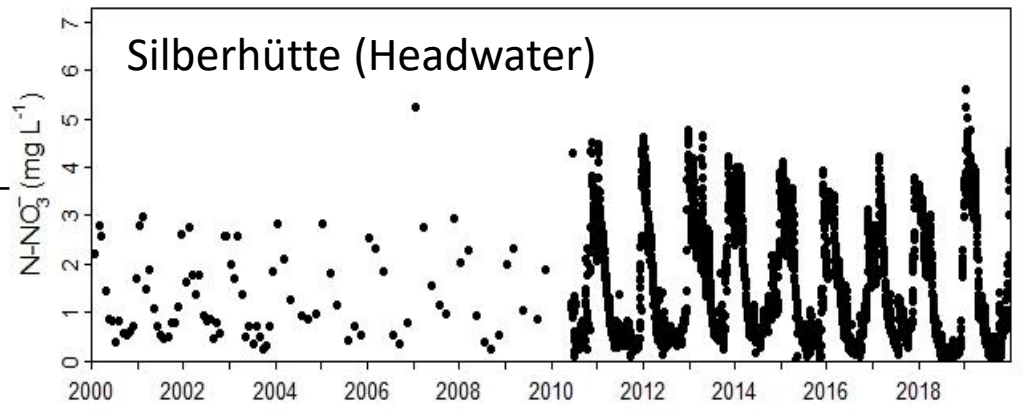
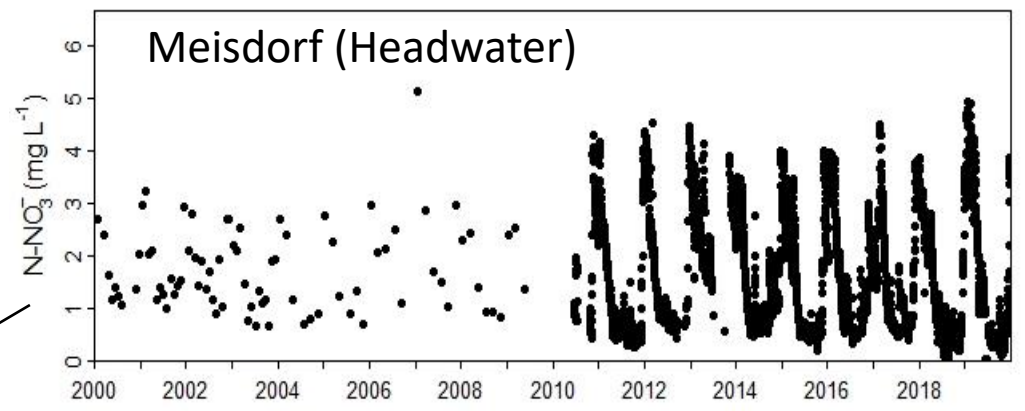
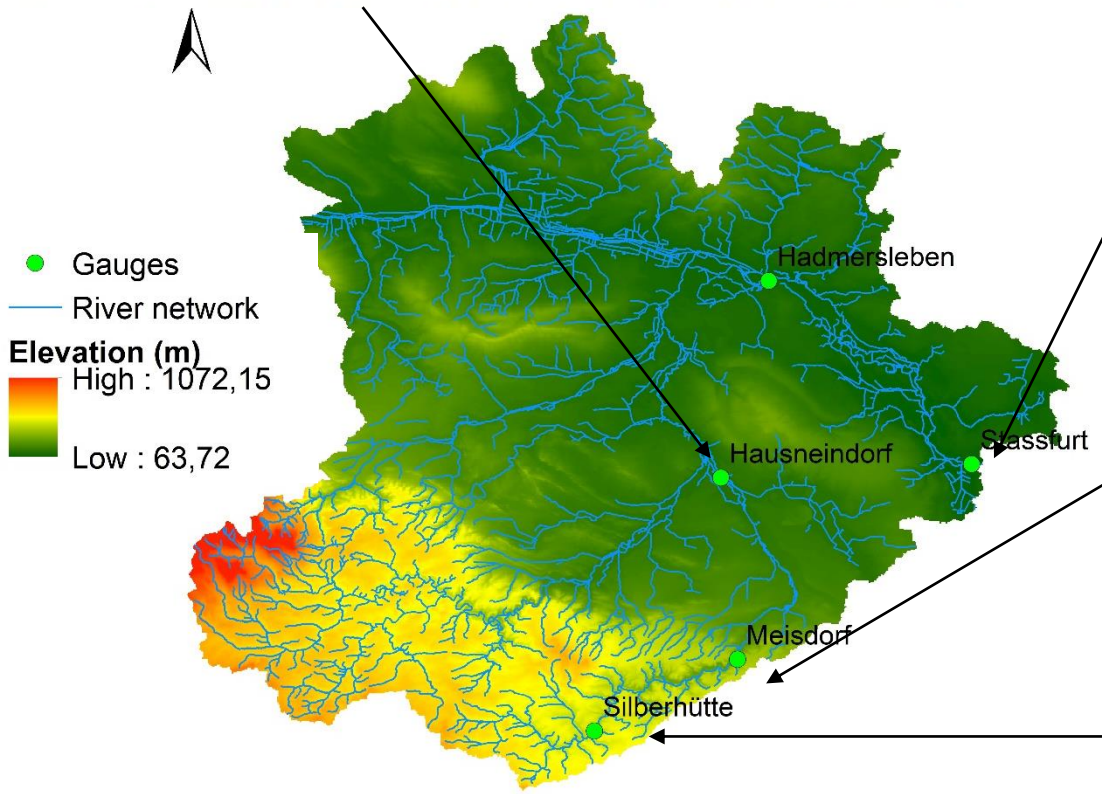
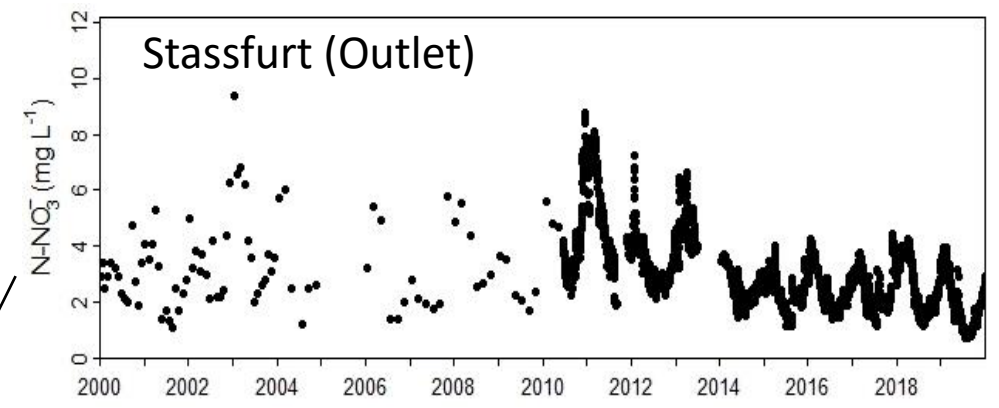
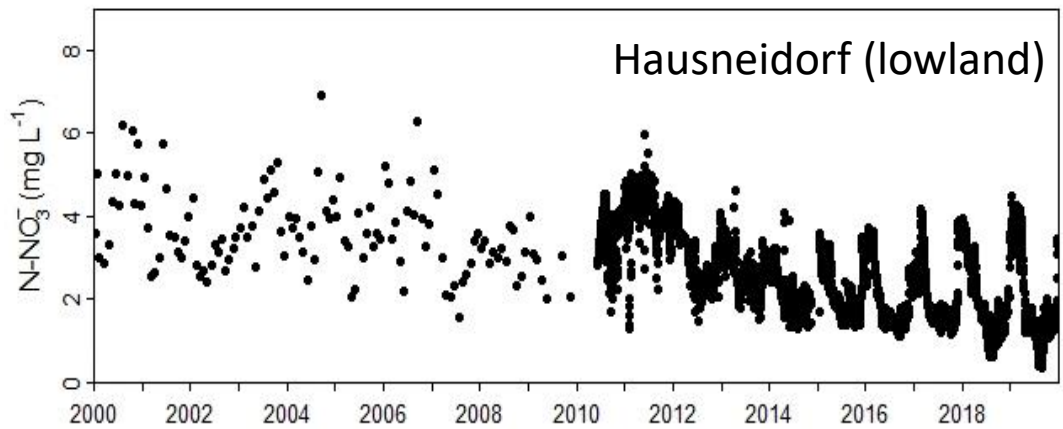
# Motivation: Effect of extreme weather conditions on water quality

There is mounting evidence that the extreme weather conditions, such as drought, could likely be more frequent than what was thought before, resulting in increased impacts on our ecosystems.

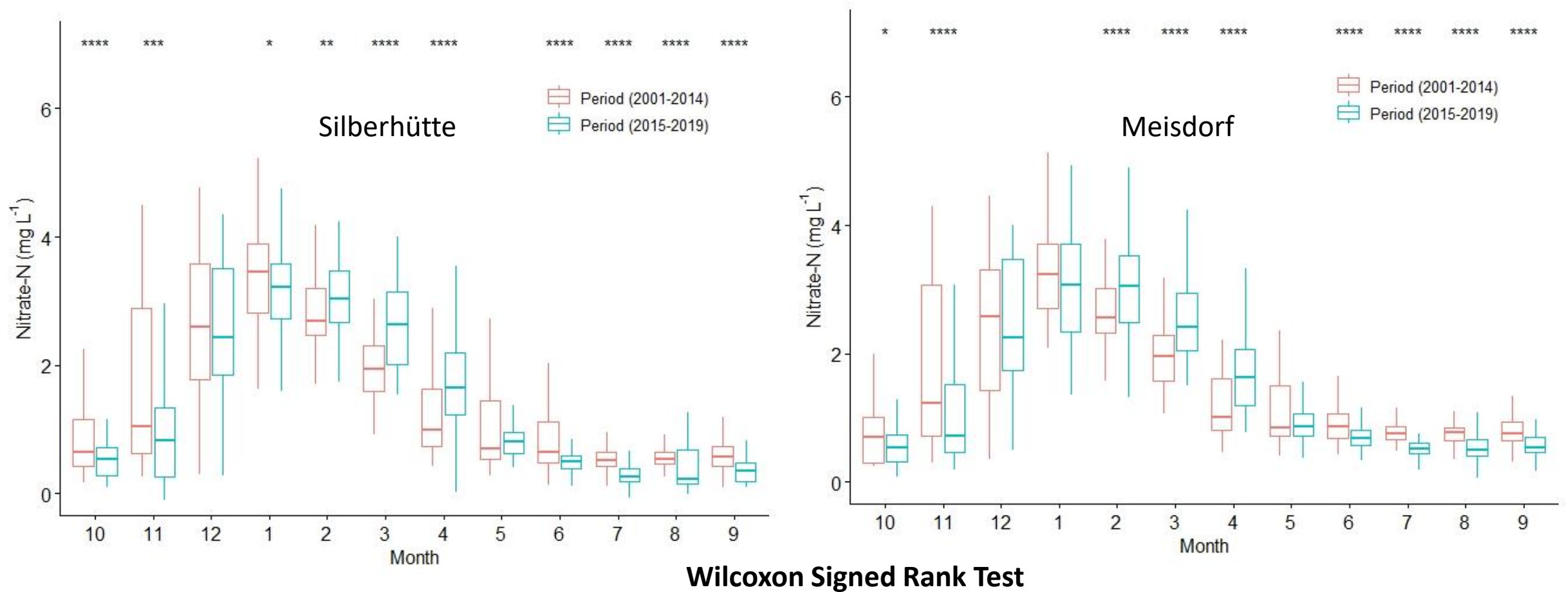
## Objective

This study aims to investigate the effect of the extreme drought events that occurred in the period 2015-2018 on the nitrate-N concentrations and loads in the Bode catchment (3300 km<sup>2</sup>) located in the transition areas of central uplands and northern lowlands of Germany.





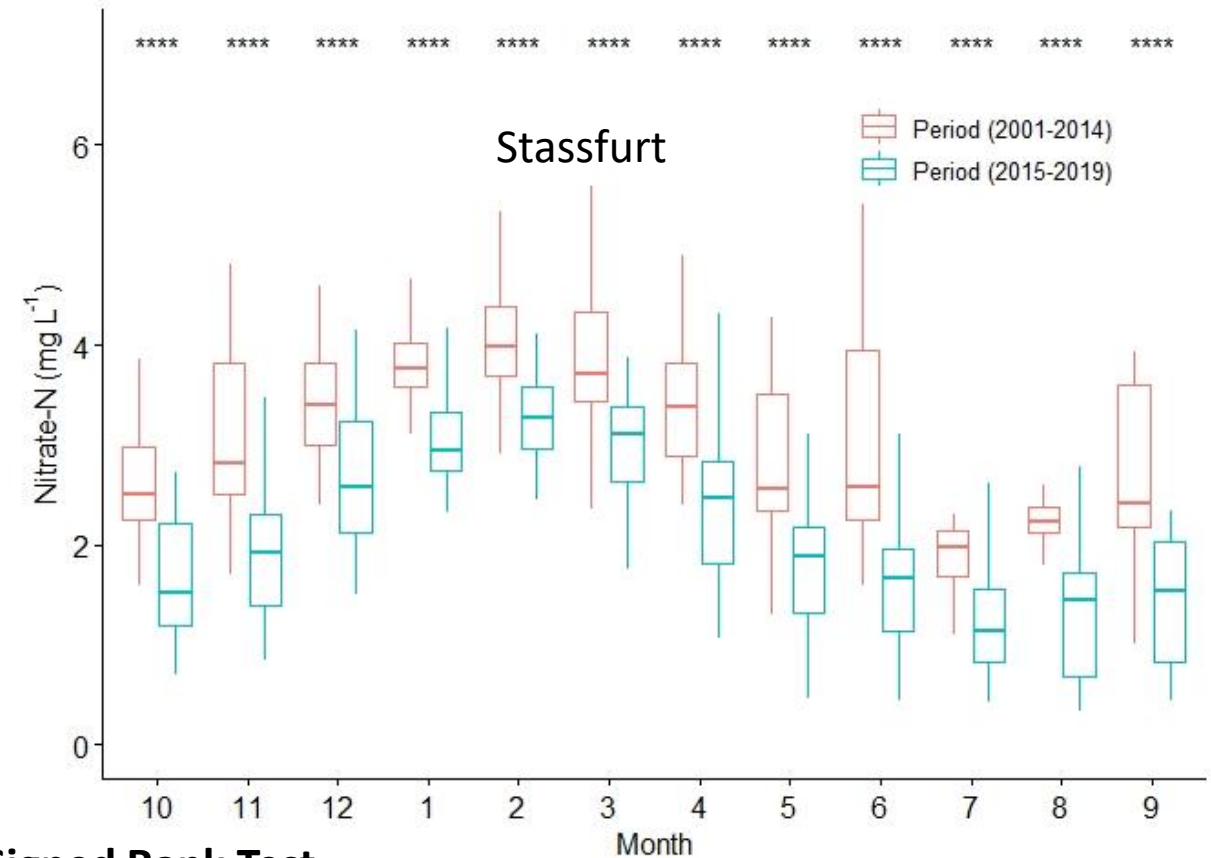
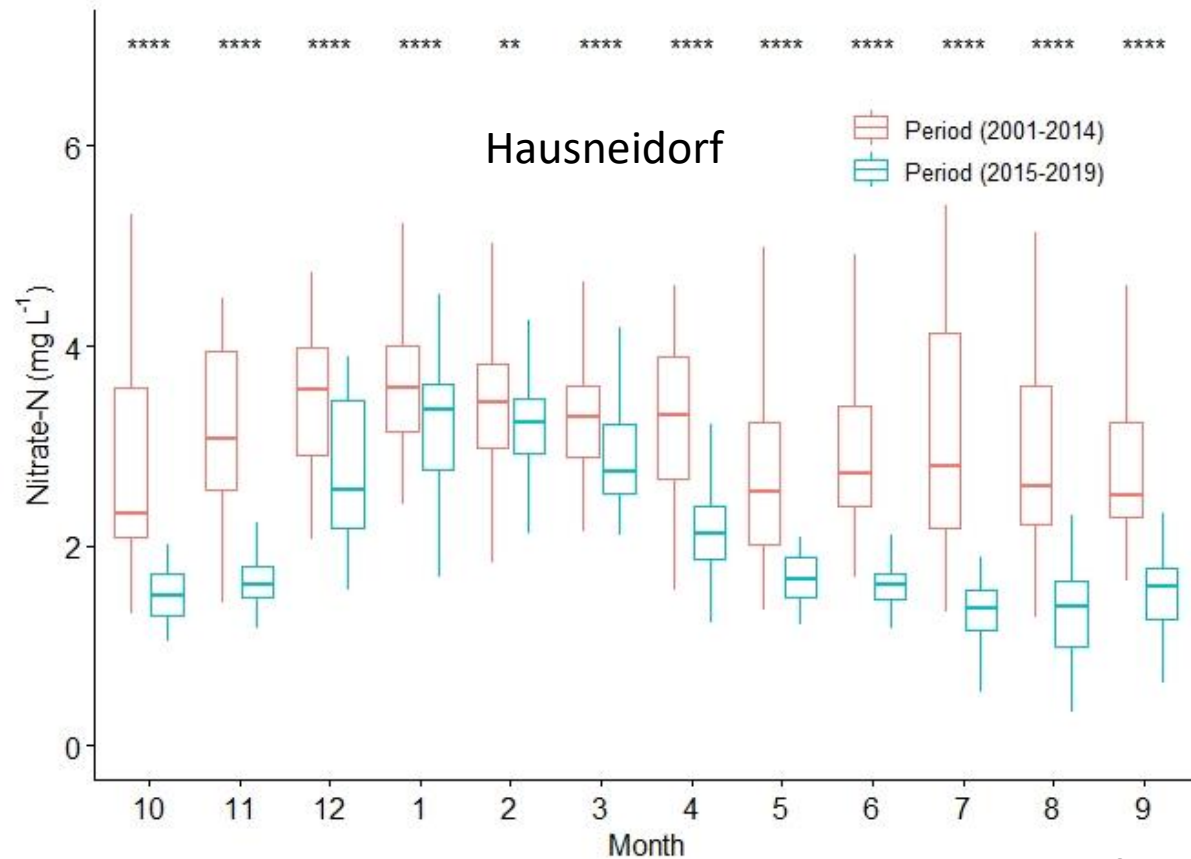
Comparison between the monthly averaged concentrations of the periods 2001-20014 (considered as baseline conditions) and 2015-2018 (considered as weather effect period) in the two headwater sub-catchments



Where \*:  $p \leq 0.05$ , \*\*:  $p \leq 0.01$ , \*\*\*:  $p \leq 0.001$ , \*\*\*\*:  $p \leq 0.0001$



# Comparison between the monthly averaged concentrations of the periods 2001-20014 (considered as baseline conditions) and 2015-2018 (considered as weather effect period) in lowlands sub-catchments



**Wilcoxon Signed Rank Test**

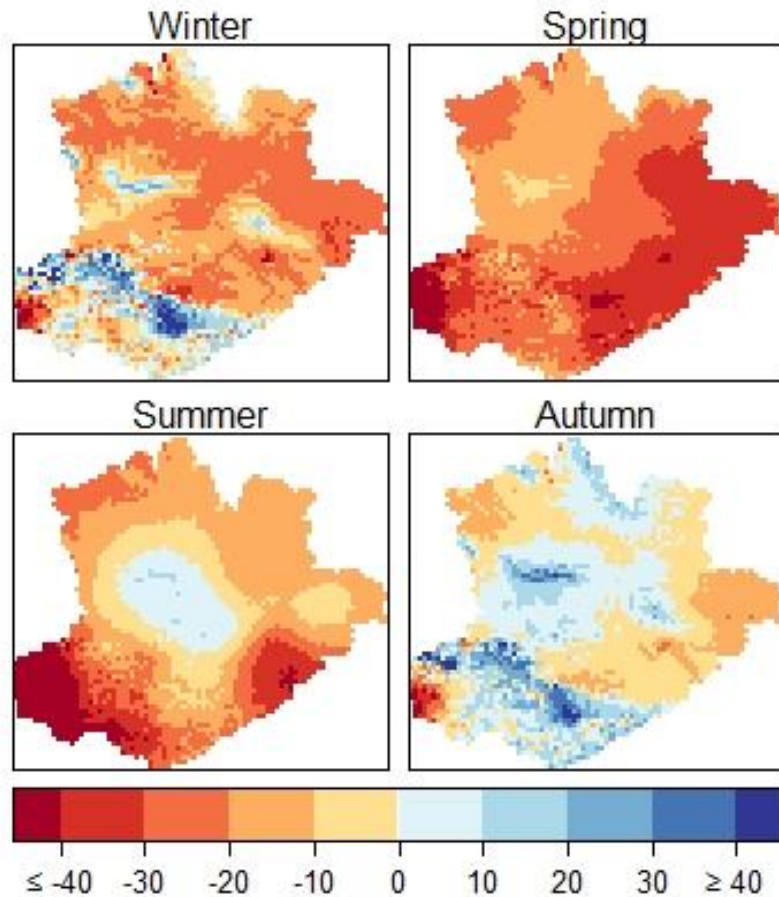
Where \*:  $p \leq 0.05$ , \*\*:  $p \leq 0.01$ , \*\*\*:  $p \leq 0.001$ , \*\*\*\*:  $p \leq 0.0001$



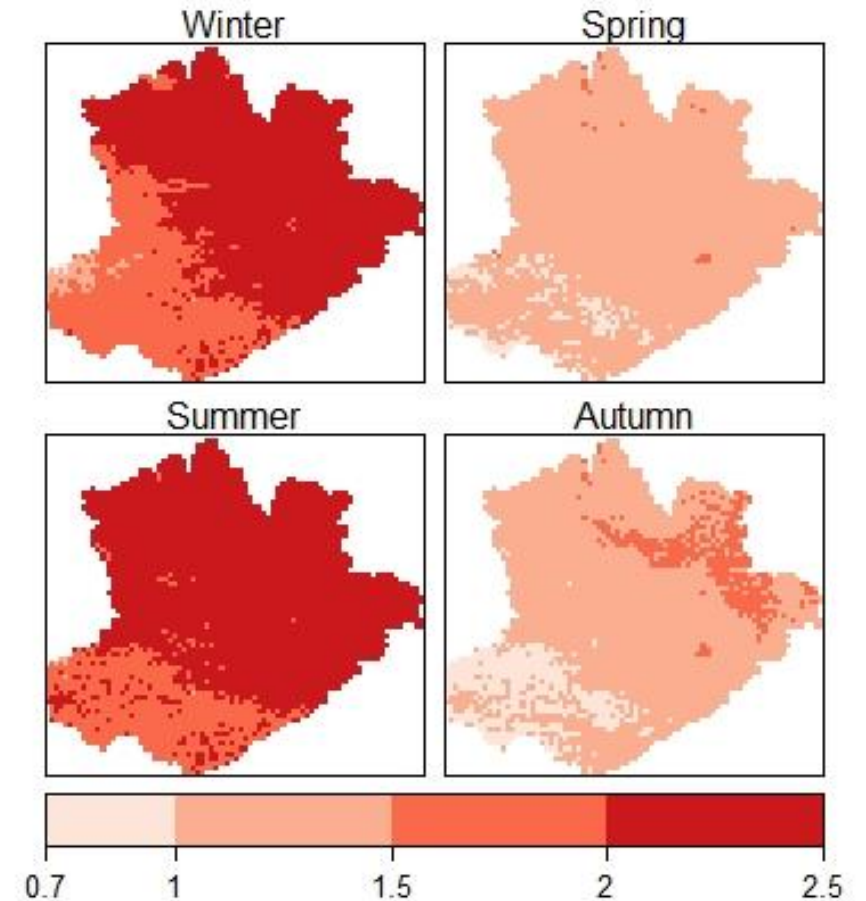


# Seasonal precipitation and temperature anomalies in the Bode catchment

The spatial distribution of seasonal precipitation anomaly [mm] during 2015-2019 relative to 1950-2014



The spatial distribution of seasonal mean temperature anomaly [°C] during 2015-2019 relative to 1950-2014



# Discussion

- In the period 2015-2018, mean annual precipitation decreased by about 10% and characterized by increased seasonal variabilities.
- The mean temperature in the period 2015-2018 increased by 1.46 °C compared to the period 1969-2014.
- No evident changes in nitrate-N concentrations and loads in the headwater areas (mainly forest) and in the groundwater-dominated gauging stations, reflecting no large impact of the droughts on these two archetypical sub-catchments.
- However, nitrate-N concentrations and loads declined significantly in the lowland, agriculture dominated areas of the Bode catchment, which it seems due to the reduction of nitrate-N contribution from the lower part of the catchment during the spring and summer periods.
- It seems that the drought-induced increased evapotranspiration and decreased precipitation resulted in the reduced runoff from lowland areas of the catchment, affecting the nitrate-N mixing of different N source areas within the catchment.
- Detailed investigation on runoff partitioning in both periods is required using process-based model.

