

1 Motivation

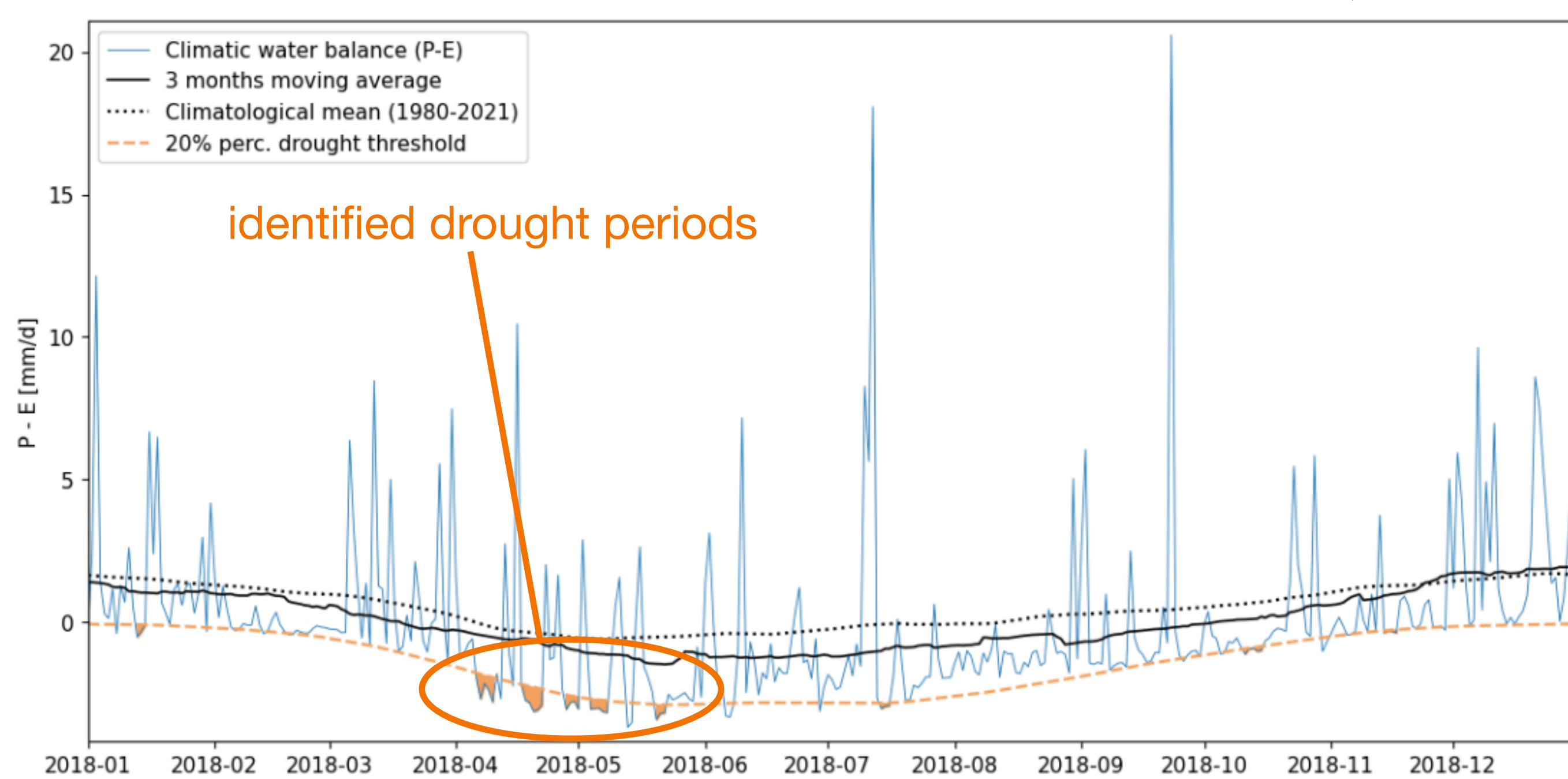
- Climate change likely to increase droughts and other meteorological extremes in frequency and intensity
- Exceptional drought 2018-2022, especially in the Brandenburg/Spree region
- Regional drought forecast is being developed
- Probability of future drought events will be assessed
- Results used to develop strategies for adapting regional water use

3 Drought detection tool

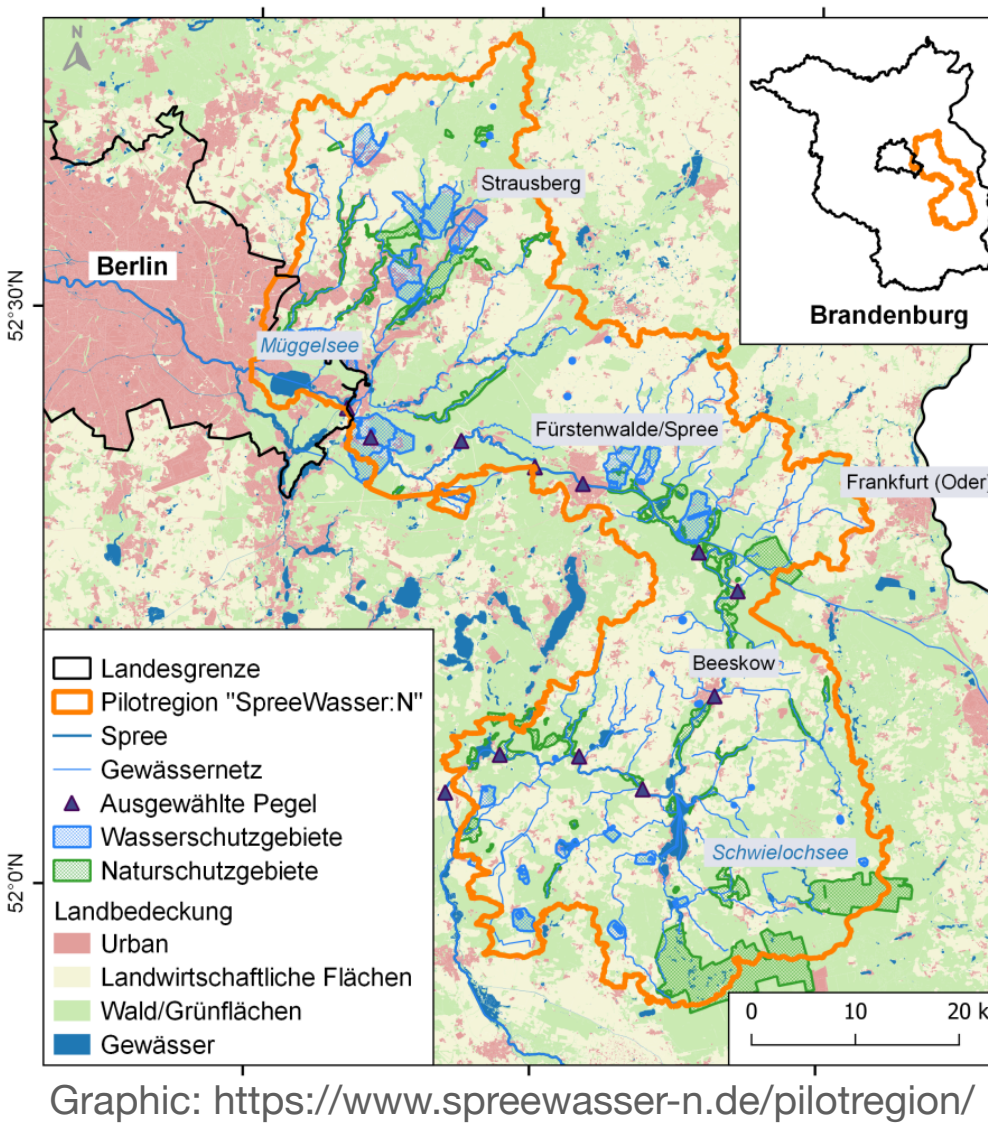
- in development -

- **Input:** Time series of climatic water balance
- Tool identifies drought periods based on drought threshold (a percentile of the smoothed daily climatological mean, in this example 20%), allowing a certain number of days where the threshold is not reached as gaps
- **Output**
 - Detected drought periods
 - Many parameters possible: beginning/end, duration, intensity, mean, minimum, precipitation sum, deviance from climatological mean, ...
- Parameters (drought threshold percentile, maximum number of gaps, examined season, ...) are set dependent on needs of the user, e.g. for a certain crop it would be beneficial to only examine its growing season and set the other parameters according to the water needs of the crop

...open to suggestions and ideas! (also for the visualization)

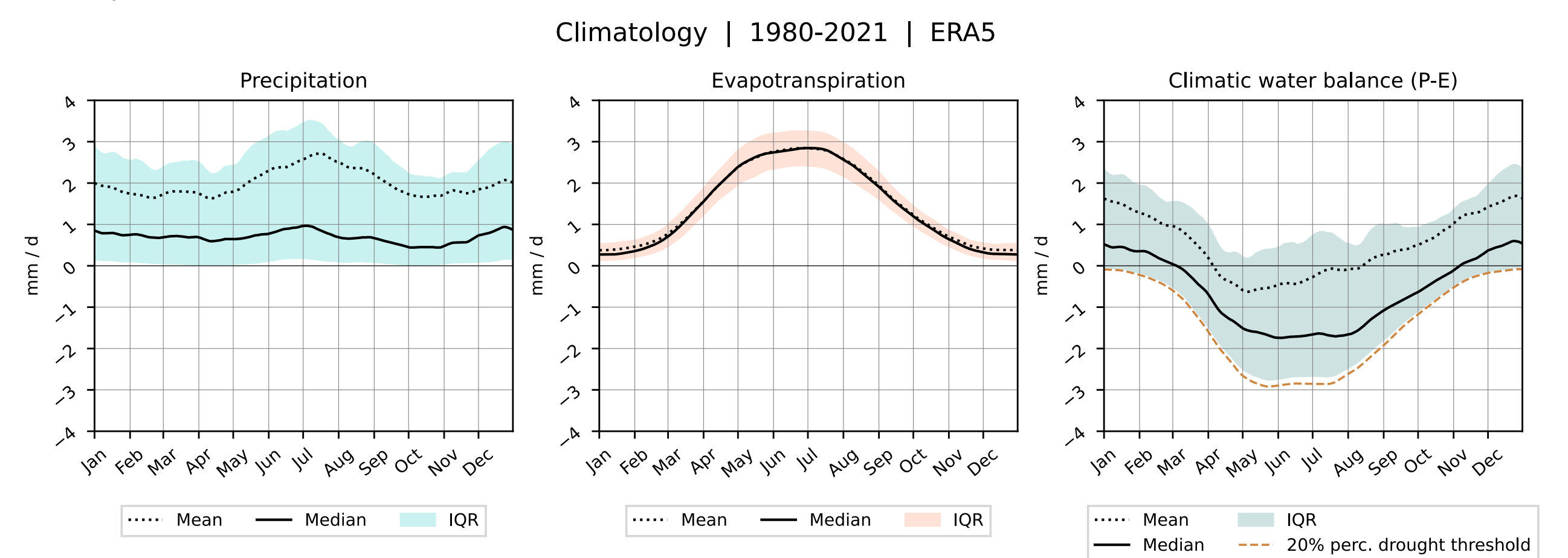


2 Drought (target) variable



- Time span: 1980 - 2021
- Spatial mean over study area of reanalysis ERA5 (ECMWF) data of daily
 - precipitation (P) and
 - evapotranspiration (E)
- Calculate "climatic water balance" (P-E) as drought measure (**target variable**)

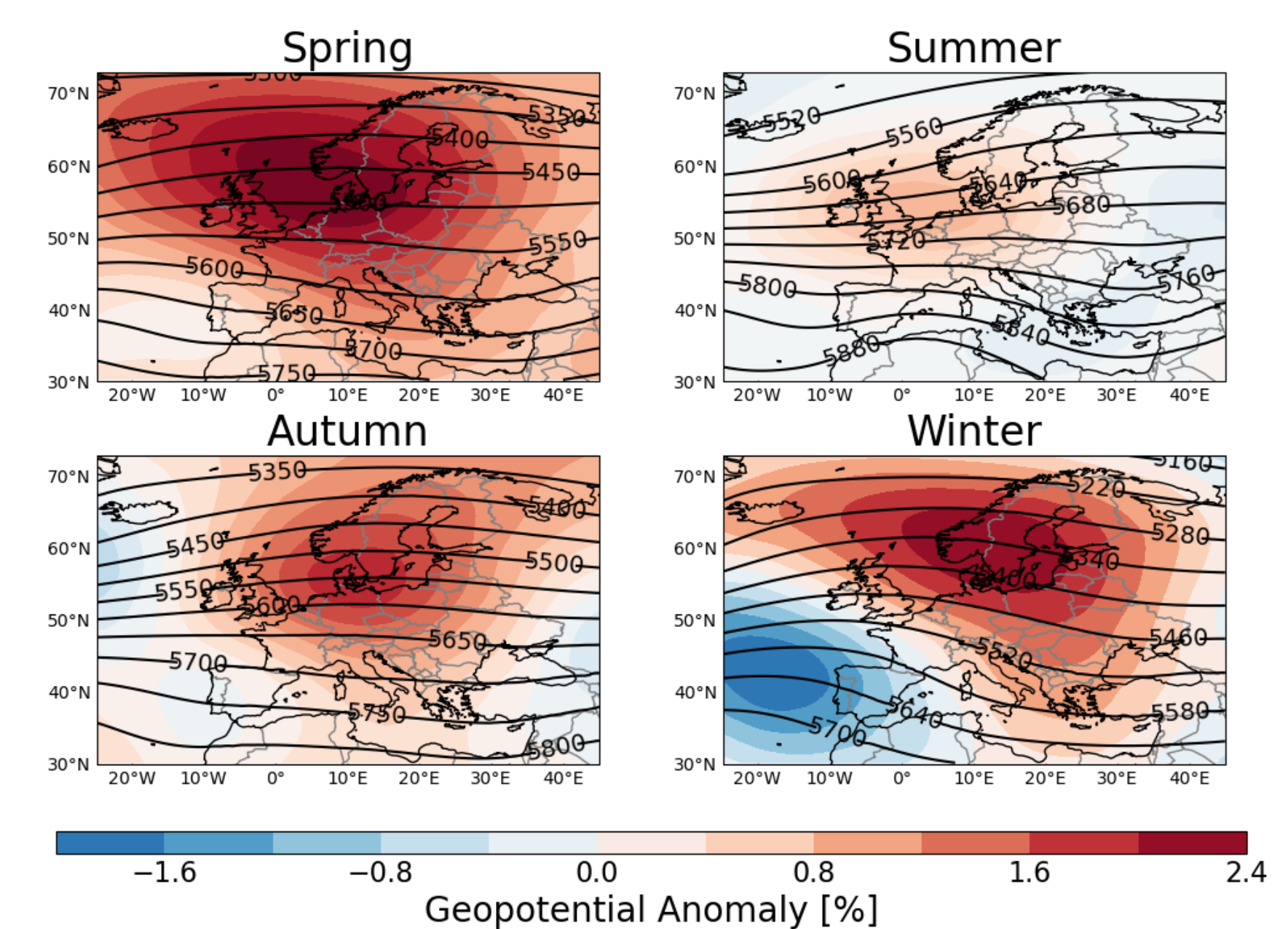
Study area



Annual variability of key drought variables

4 Large-scale weather context

- Investigation of large-scale weather patterns leading to local drought in the study region using the results of 3 (when 3 is finished)



Graphic: P. Schönau, Freie Universität Berlin

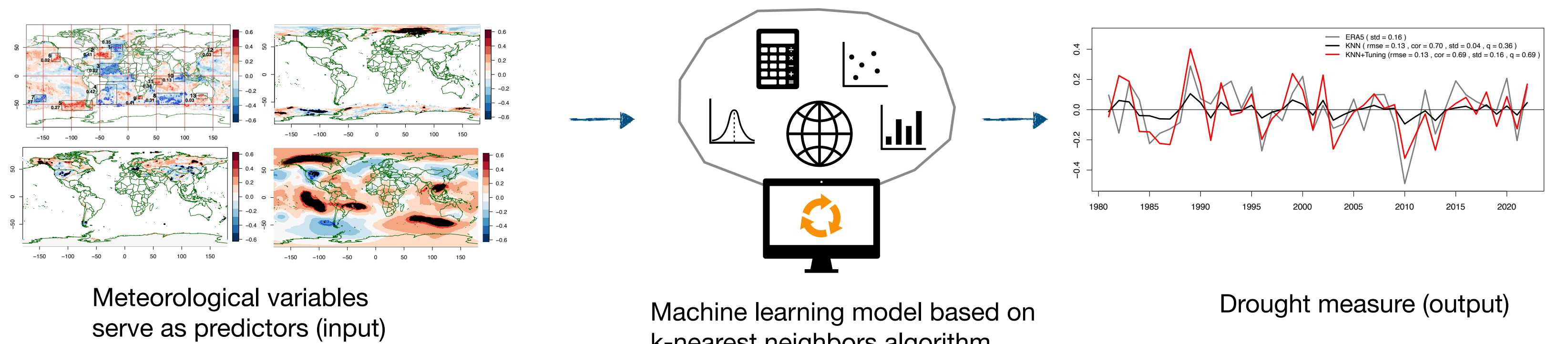
ERA5 500 hPa geopotential relative anomaly of driest (below 5th percentile of monthly precipitation anomalies) months in the study region and isohypses of all months, 1959-2020

5 Identification of drought predictors and drought forecast

- in development -

- ML model
 - automatically selects predictor variables and regions yielding the highest forecast skill - based on Wang-Bovik index as **error metric**
- **Input:** preliminary meteorological conditions and measures considering the evolution of meteorological variables (*persistence, succession, frequency, ...*) and the results from 4

- ☑ Identify meteorological predictors for drought
- ☑ Forecast drought index for different lead times



Graphics partially from: C. Hauke, 2021, "Prediction of the North Atlantic Oscillation Index for the winter months December-January-February via non-linear methods" Schematic of drought prediction with a machine learning model, shown here for winter NAO index prediction