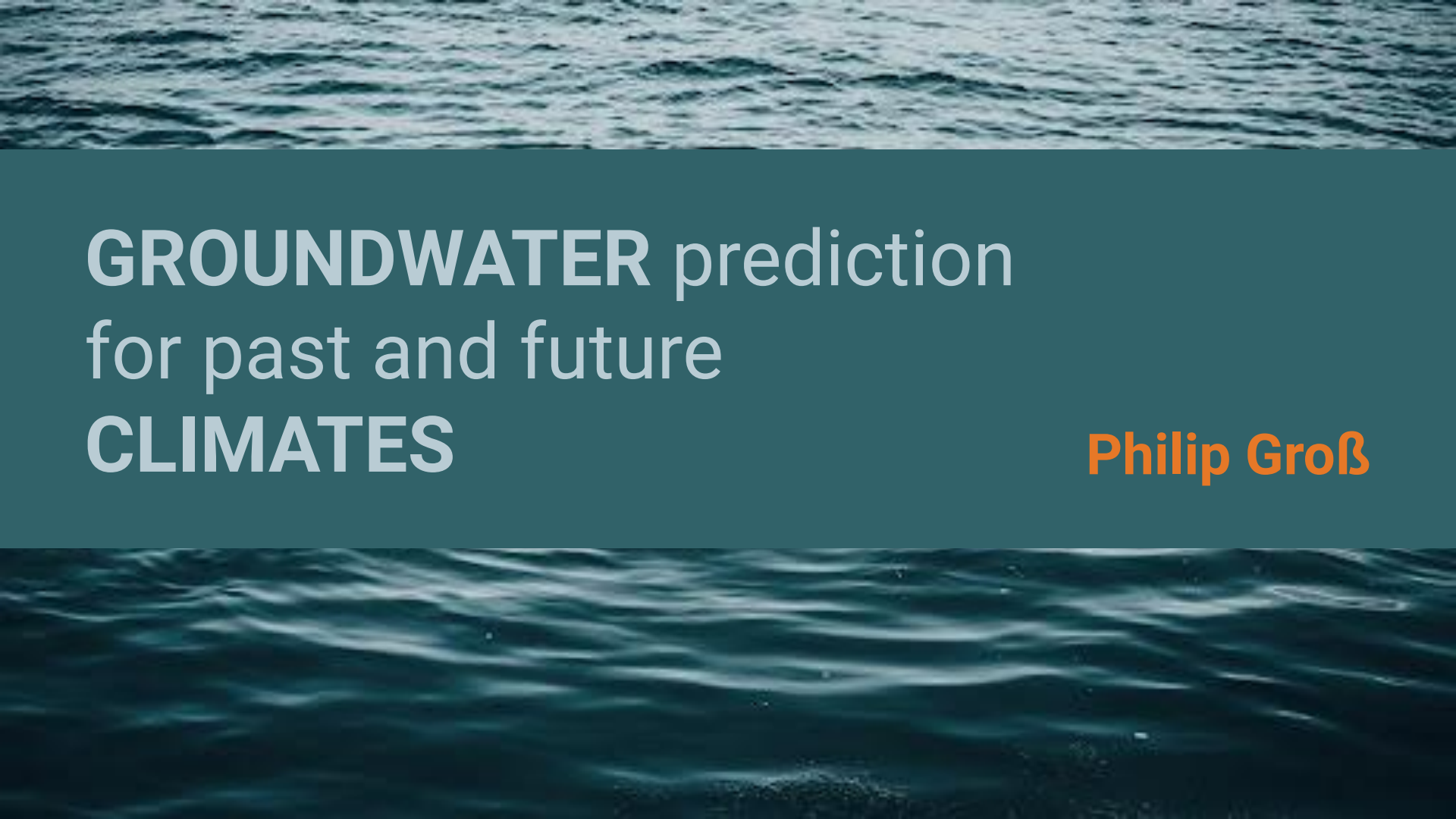


GROUNDWATER prediction for past and future **CLIMATES**

Philip Groß

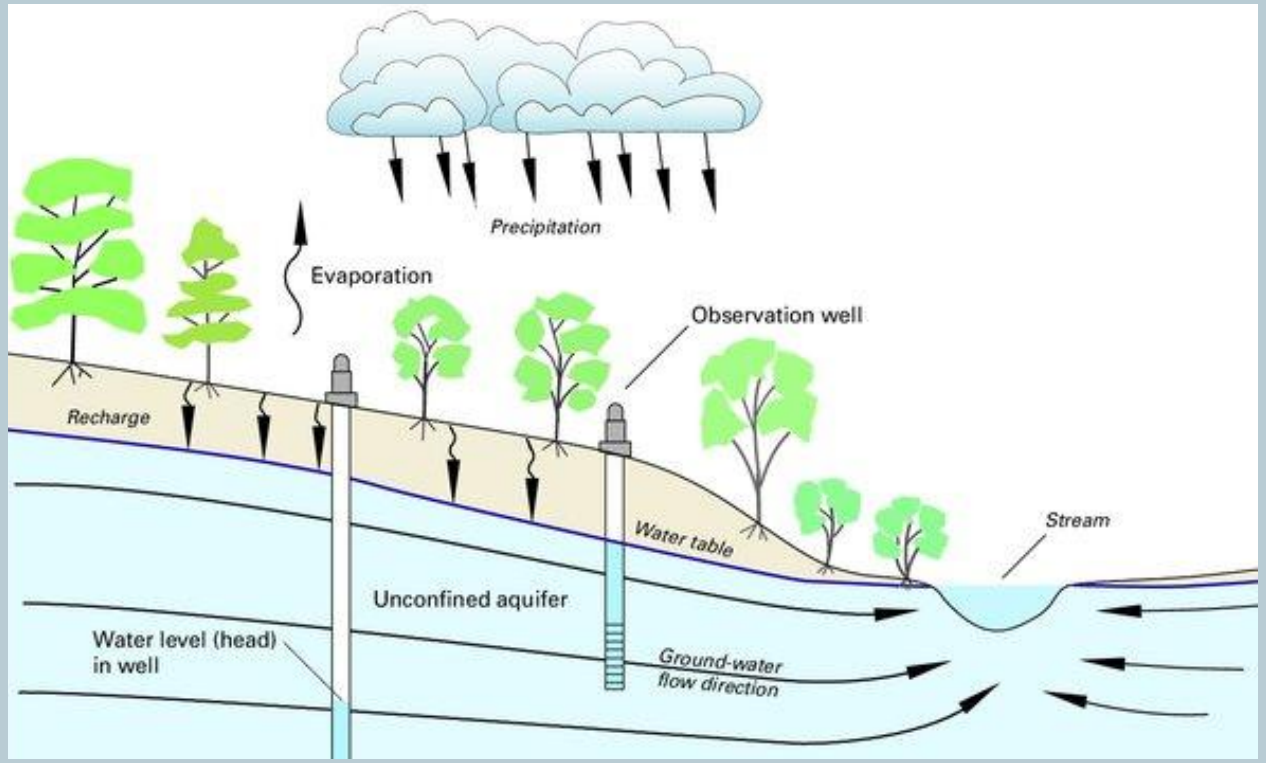
Groundwater - a key resource!

≈ 70%

of drinking water in Germany extracted from groundwater!

In some regions completely!

Groundwater - a key resource!



Groundwater level controlled by:

+ precipitation

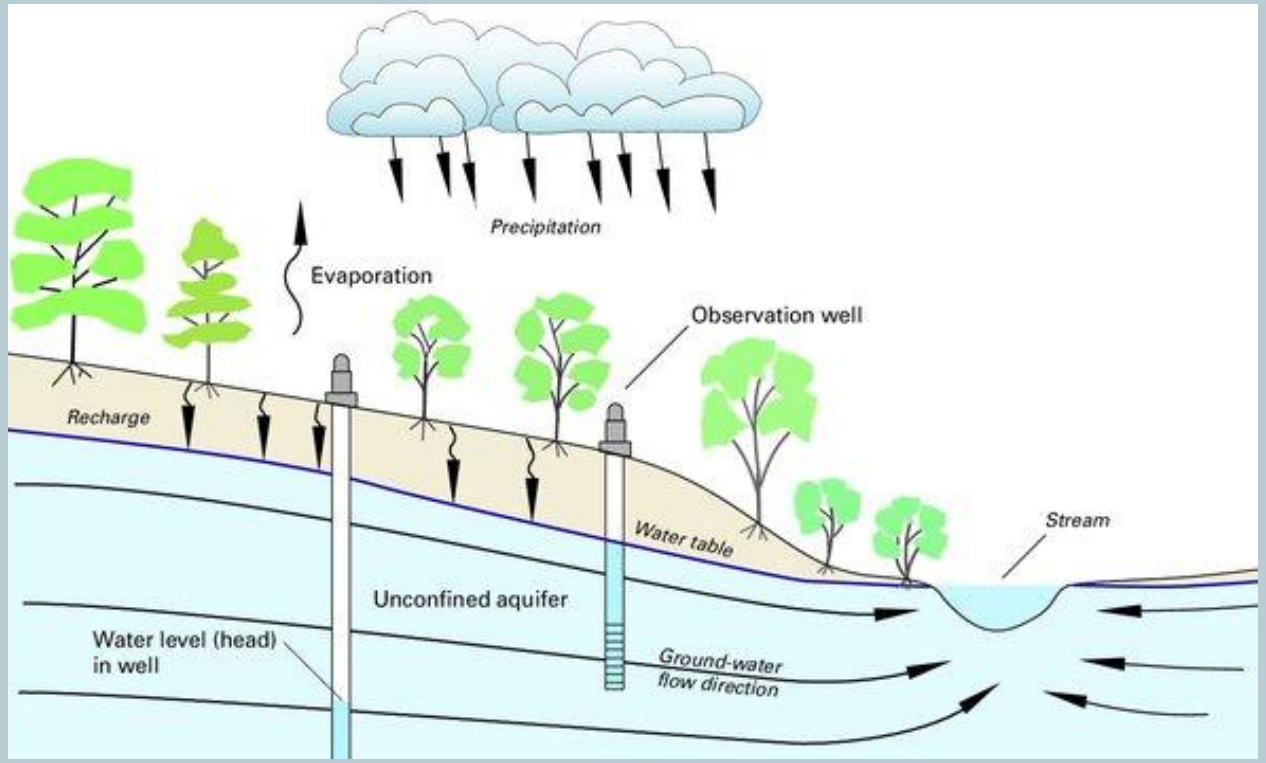
- surface runoff

- evaporation (soil)

- transpiration (plants)

- human extraction

Groundwater - a key resource!



Groundwater level controlled by:

+ precipitation

- surface runoff

- evaporation (soil)

- transpiration (plants)

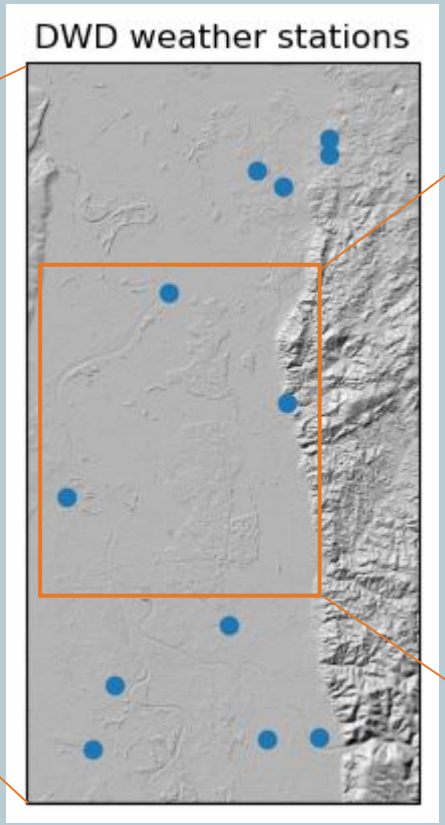
- human extraction

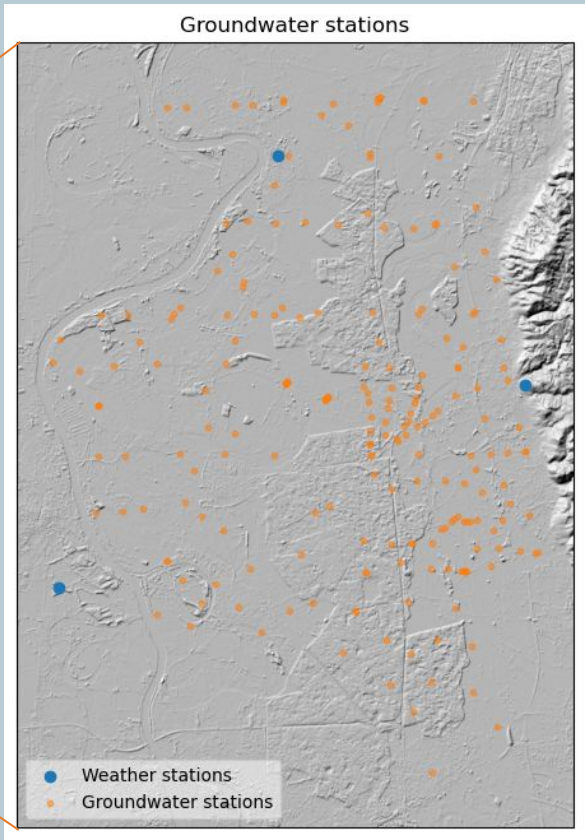
Effect of changing climate?

Project goal

Predictive model for
groundwater levels
in past and future climates!

Study area between MA and DA





Model Pipeline

- Learning algorithm: HistGradientBoostingRegressor
- Train-test-split by stations including cross-validation

- Training parameters:
  - Initial groundwater station properties
  - Encoded station location data
  - Meteorological data over time
- Predicted label: Water depth below surface

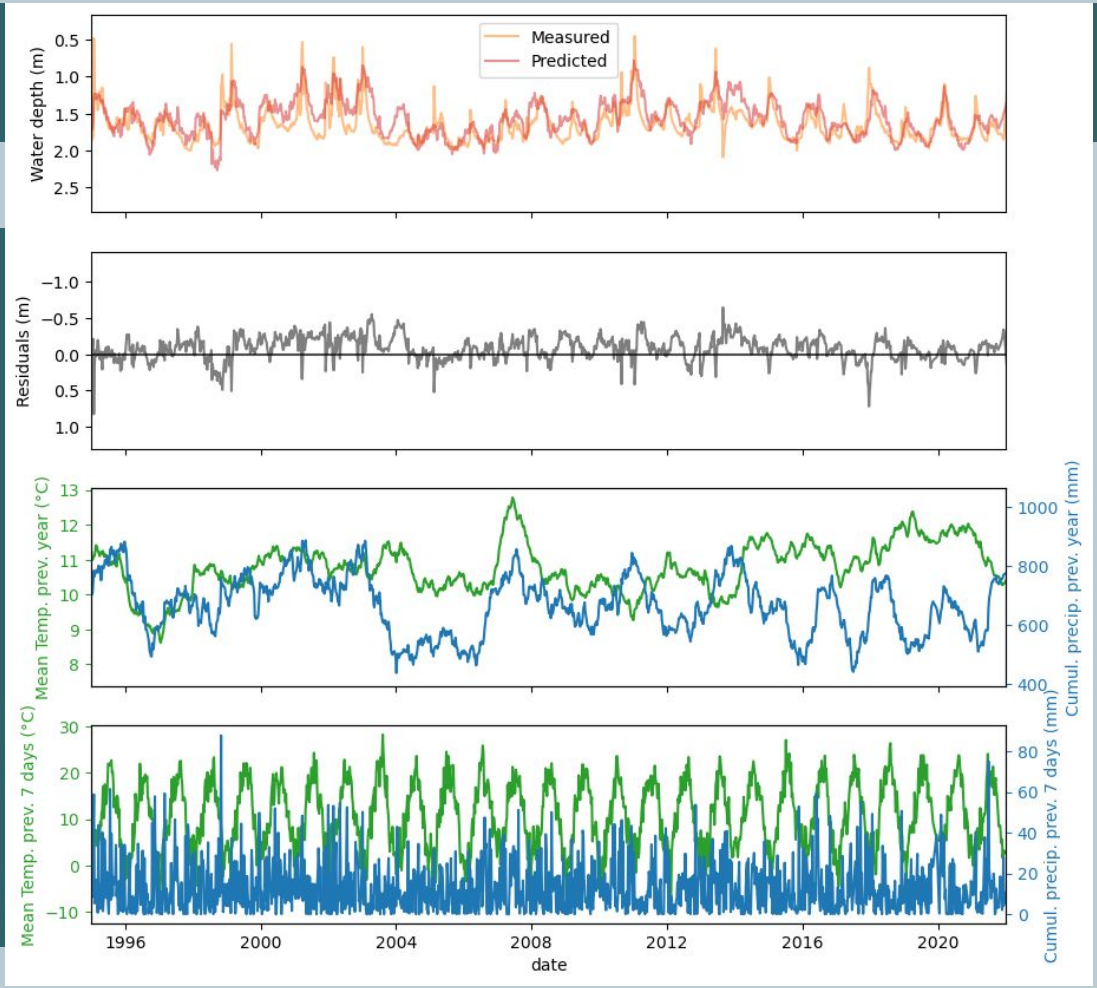
Final prediction with trained model on all stations using past and future weather!

Result for one station

Residuals
= measured - predicted

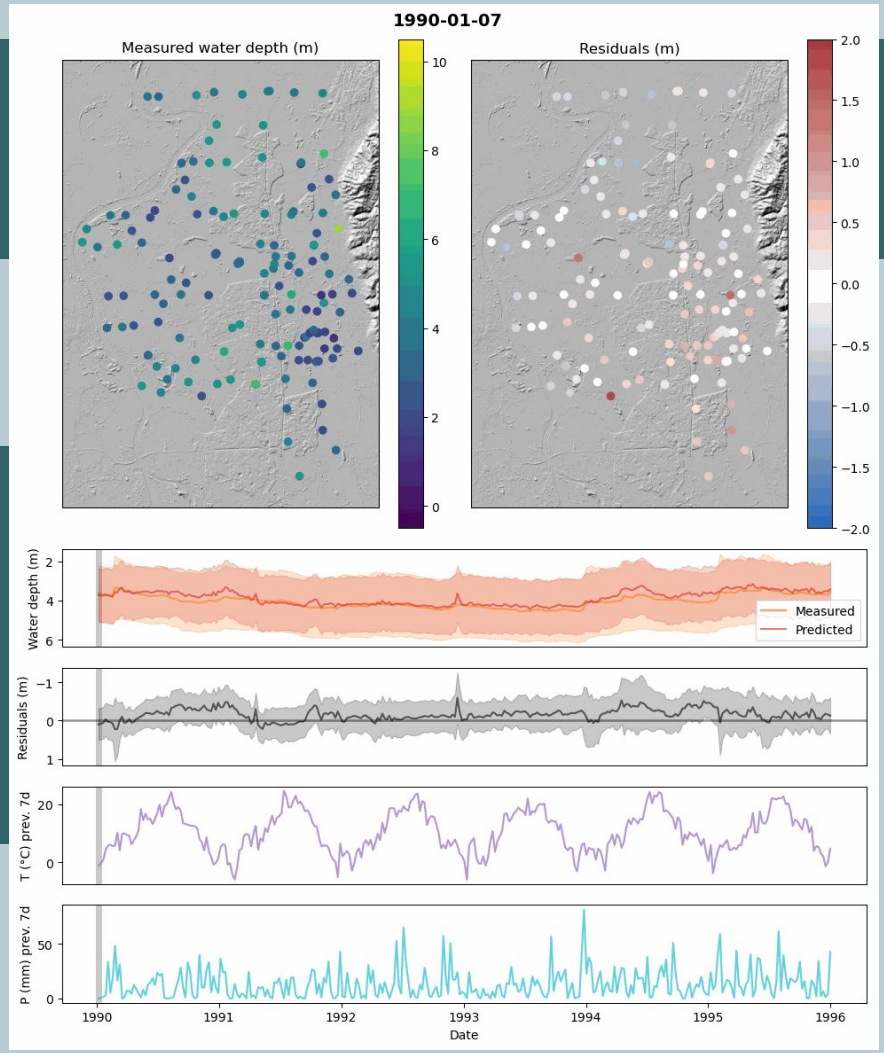
Temperature and precipitation
for previous year

Temperature and precipitation
for previous 7 days



Predicting past groundwater levels

- Model predictions are usually precise (low residuals for most stations)
- Some problems with extreme events
- few stations not working well



Predicting future groundwater levels

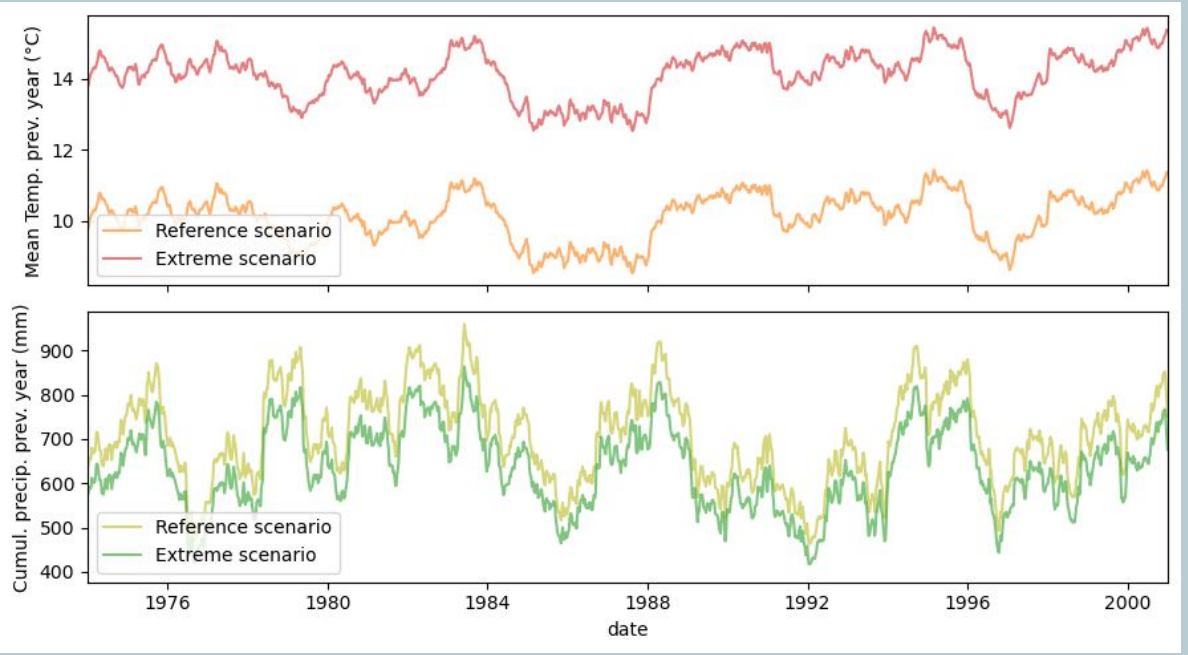
Use future climate projections to create “synthetic” future weather!

Reference scenario:
1971-2000

Extreme scenario: 2071-2100

- Temp. increase by 4°C
- Precip. decrease by 10%

other scenarios are possible…

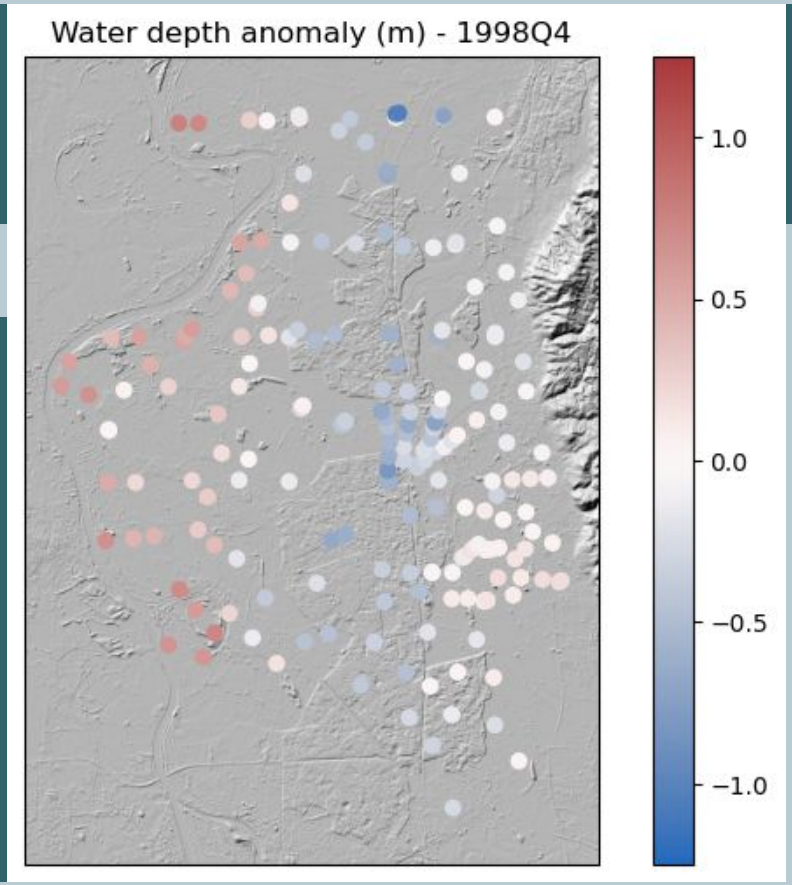


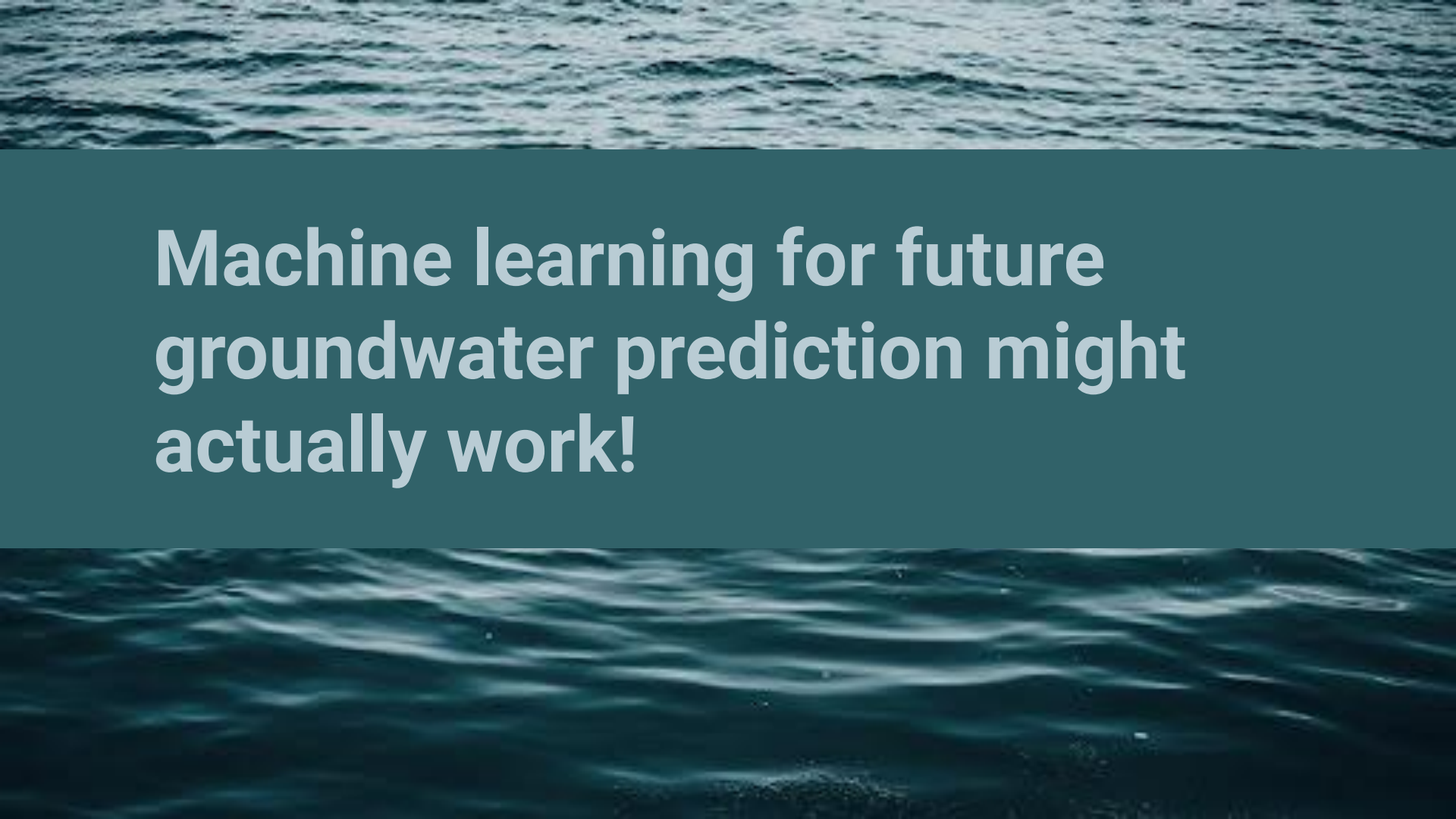
Predicting future groundwater levels

Anomaly = future prediction - reference
positive: deeper future groundwater levels
negative: shallower future groundwater levels

Model predicts complex change patterns in groundwater levels…

… but better future weather models are needed!




Machine learning for future groundwater prediction might actually work!

Appendix

Predicting future groundwater levels