Deutscher Wetterdienst
Wetter und Klima aus einer Hand


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Monika Skolimowska/ZB/dpa

Towards a sub-seasonal agricultural drought forecast

Motivation

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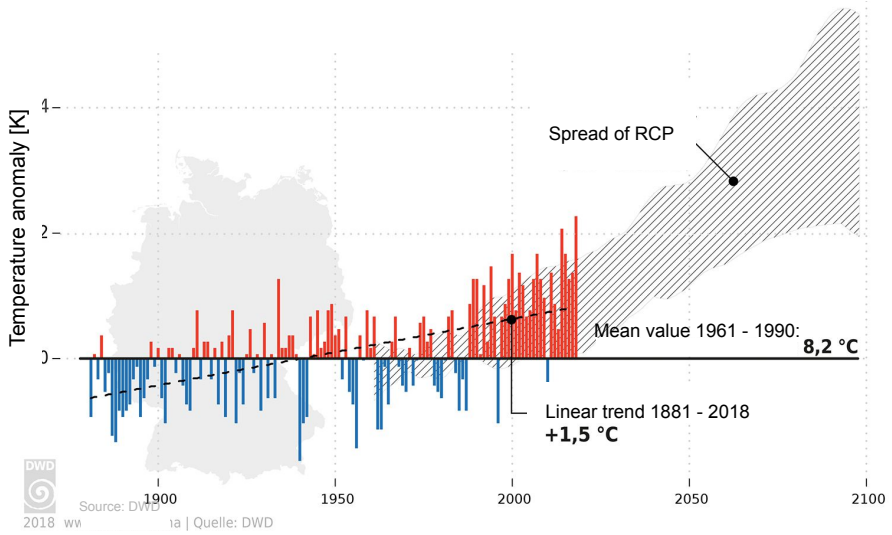
2018 was record breaking in Germany

- Warmest year since 1881 (Mean annual temperature: 10,5 °C, + 2,3)
- Highest sunshine duration since 1951 (2.015 sunshine hours)
- Fourth driest year since 1881 (Mean precipitation 586 l/m^2, - 26 %)

Mean annual temperature in Germany since 1881



Motivation

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Federal Ministry of Food and Agriculture:

“The drought 2018 was an event of national dimension” 22. August 2018

- Low yield for cereals (- 16 %, 3-year average)
- Different regional impact: Schleswig-Holstein (- 31 %), Brandenburg (-27 %), Sachsen-Anhalt (-26 %), Mecklenburg-Vorpommern (-25 %) and Niedersachsen (-26%)
- Provision of 340.000.000 € as disaster relief for affected farms

Problem definition

Is a drought predictable?

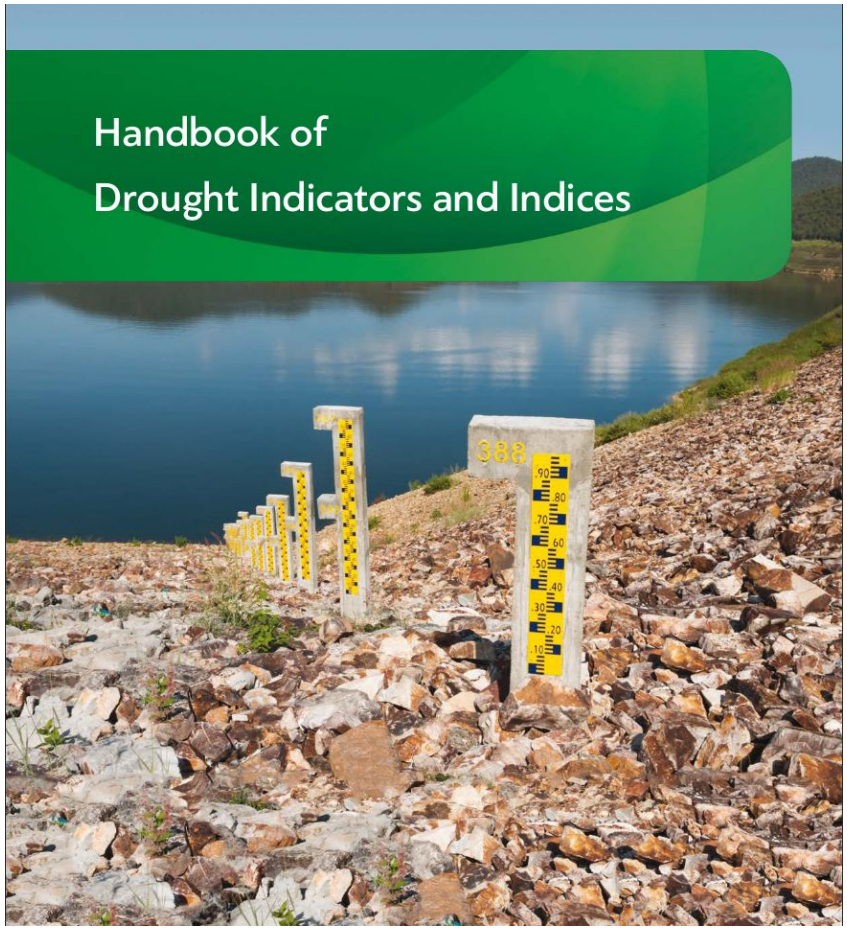
- Which **drought indicator** is appropriate?
- Which **forecast period** is required?
- How to implement the **drought product**?
- Would have been a **drought forecast for 2018** possible?

Drought indicator

- Great variety of definitions
- Numerous studies are available

Requirements:

- Optimized for agricultural usage
- Sensitivity to water stress for plant
- Nationwide availability
- Sufficient predictability



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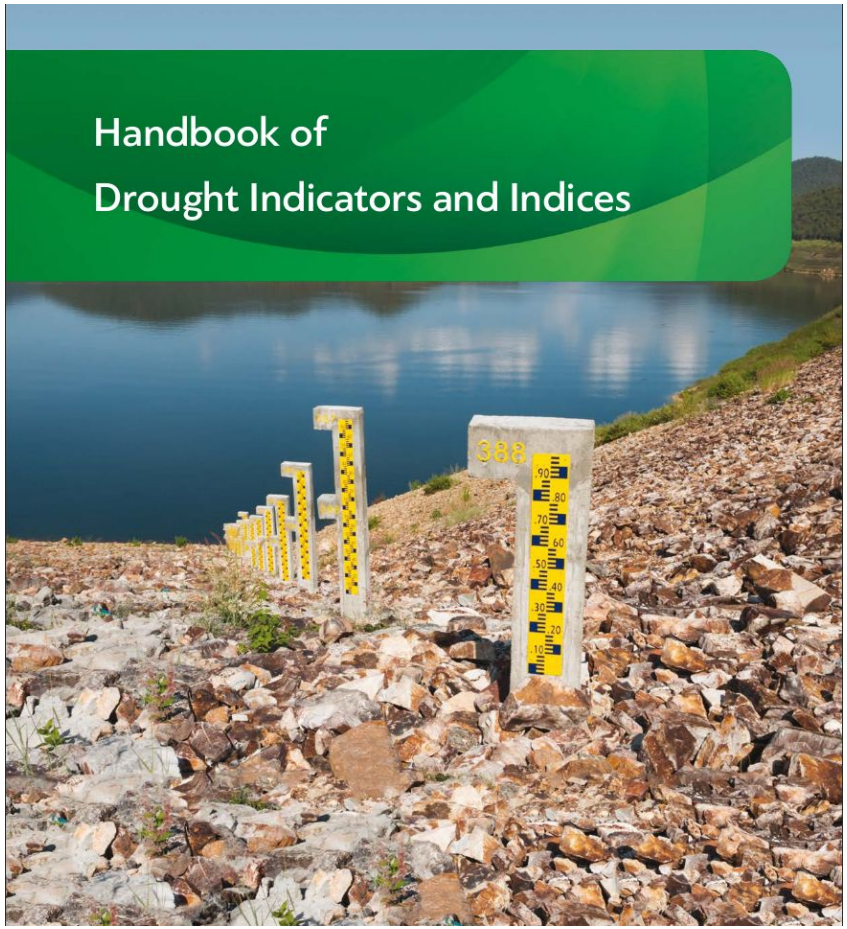
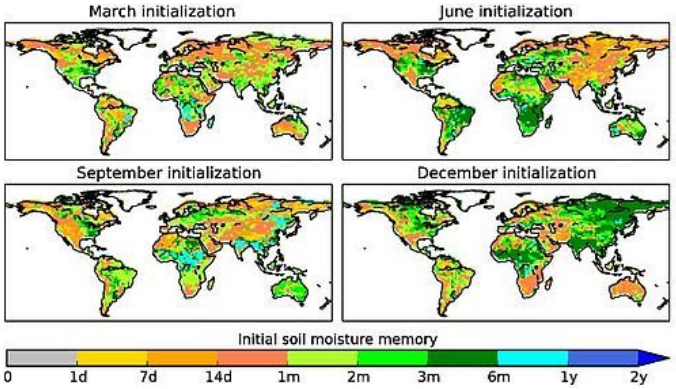
Soil moisture



Soil moisture

- Persistent storage parameter
- Top soil from 0 - 60 cm
- Crop type specific for winter wheat
- In percentage of available water in profile (% PAW)
- Weekly aggregated values
- Small scale 1-D soil water model



Source:: Stacke and Hagemann, 2015

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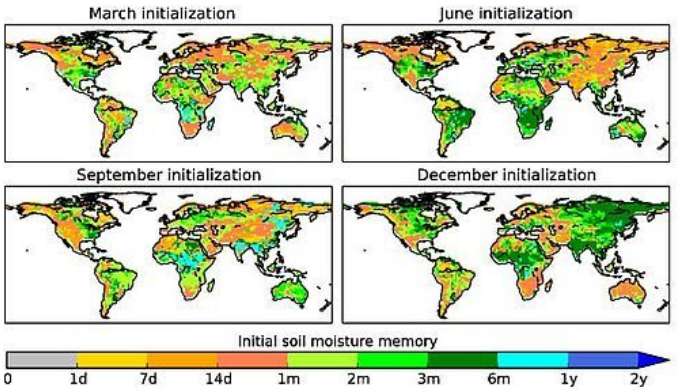

Source:: Stacke and Hagemann, 2015

Expectations:

- Low variability → longer lead time
- Relevant for agriculture
- Absolute values more functional in comparison to a relative index
- High availability due to modelling

Forecast period

- Critical soil moisture threshold: 30 % PAW
- Plant stage specific drought stress periods (grain filling...)
- Water deficit duration exceeding weeks
- Subseasonal time scale required

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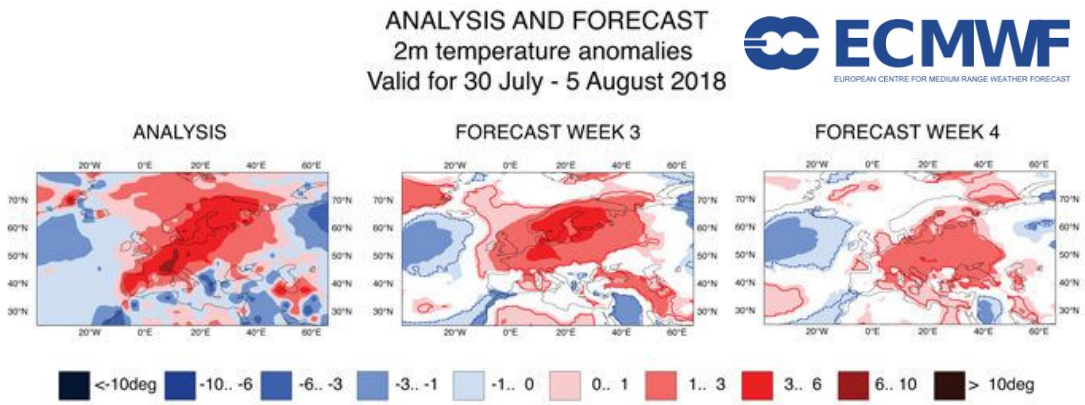
ENS Extended range forecast

- 46 days ahead
- 51 Ensemble Member
- 11 Hindcast Member
- 6-hourly temporal resolution



Implementation

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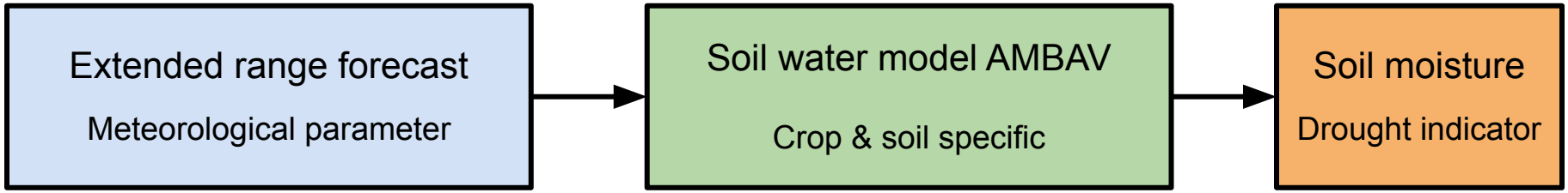
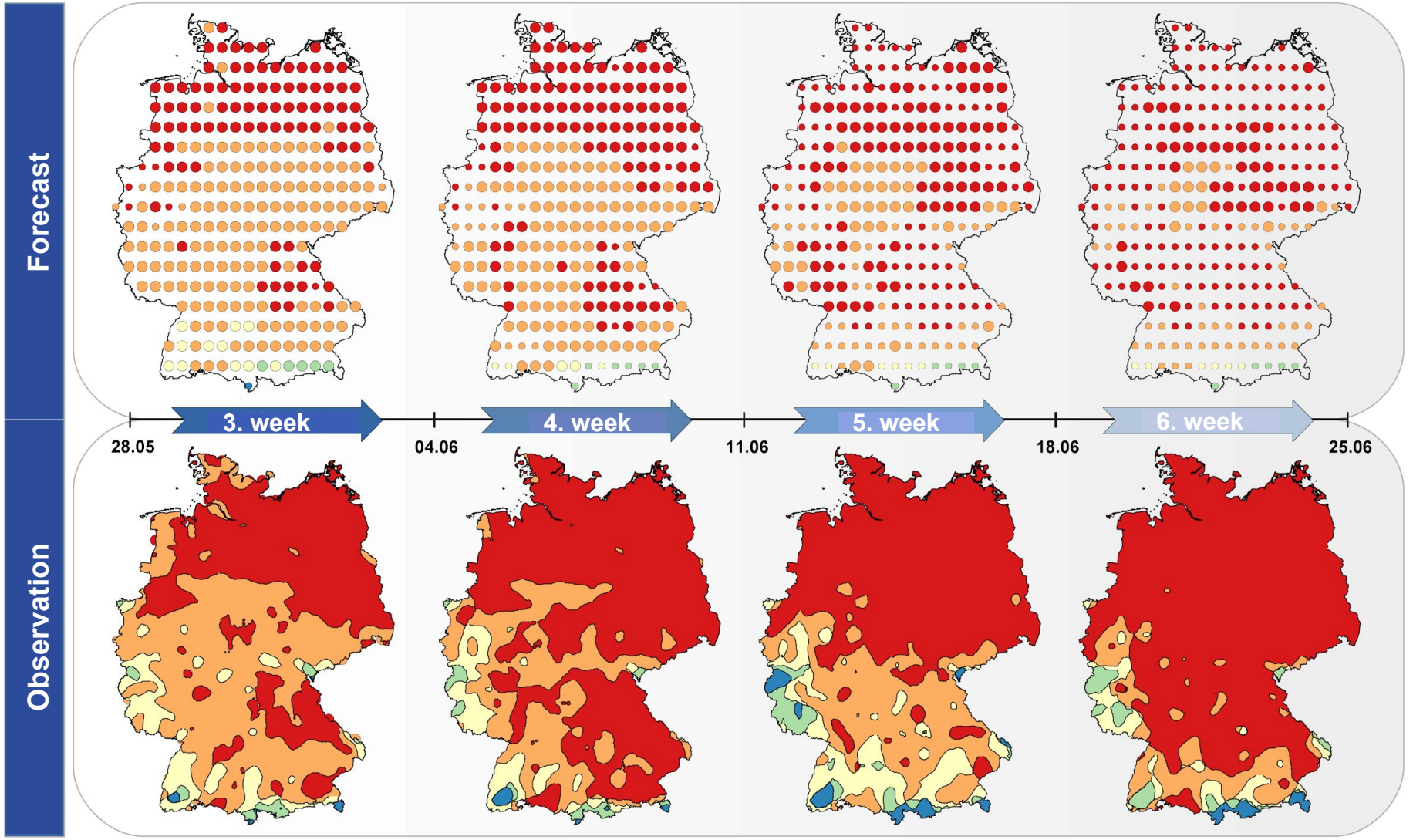
Model chain

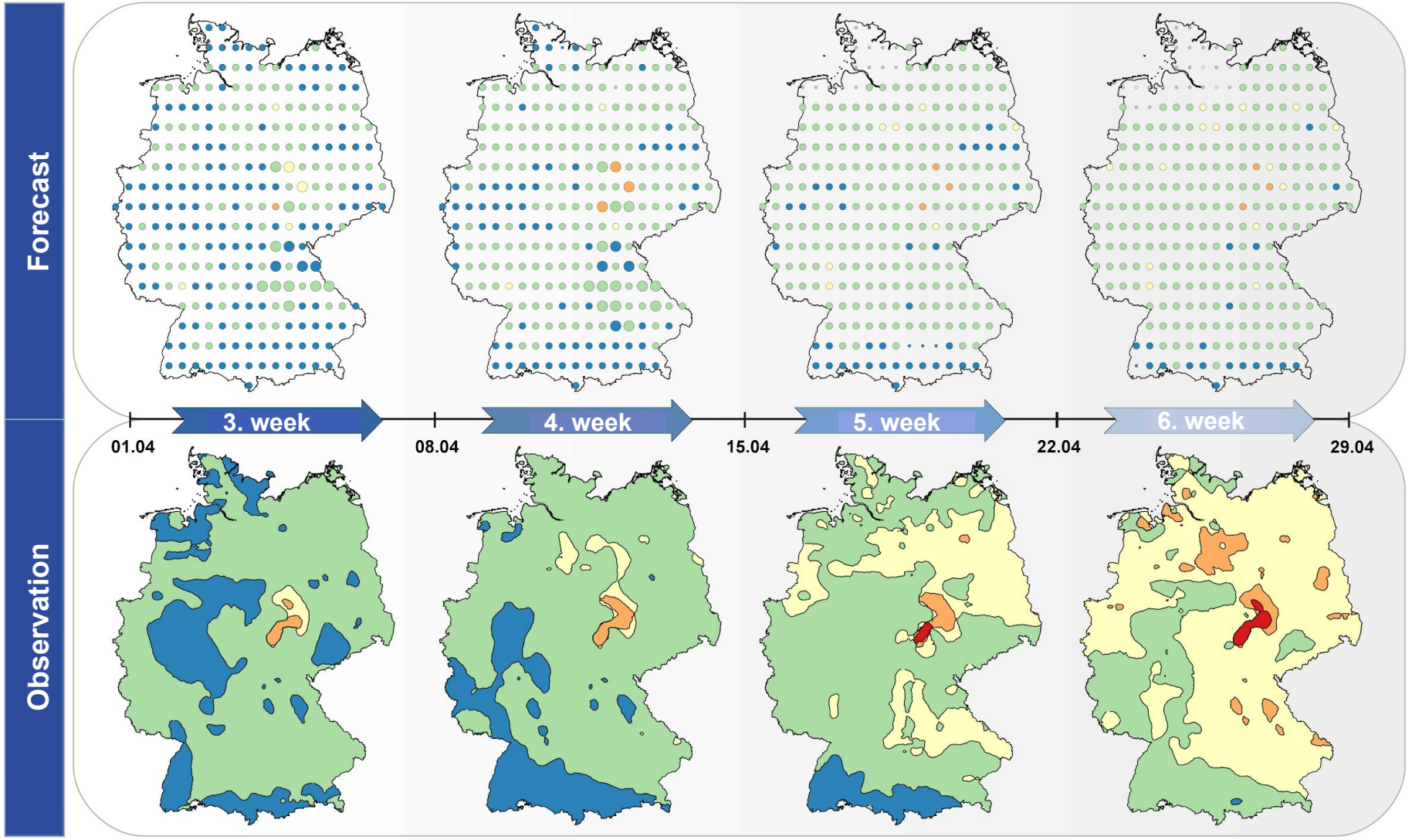


- Ensemble mean forecasts
- Weekly aggregated soil moisture
- Bias corrected mean values of model output
- Rank correlation as skill measure

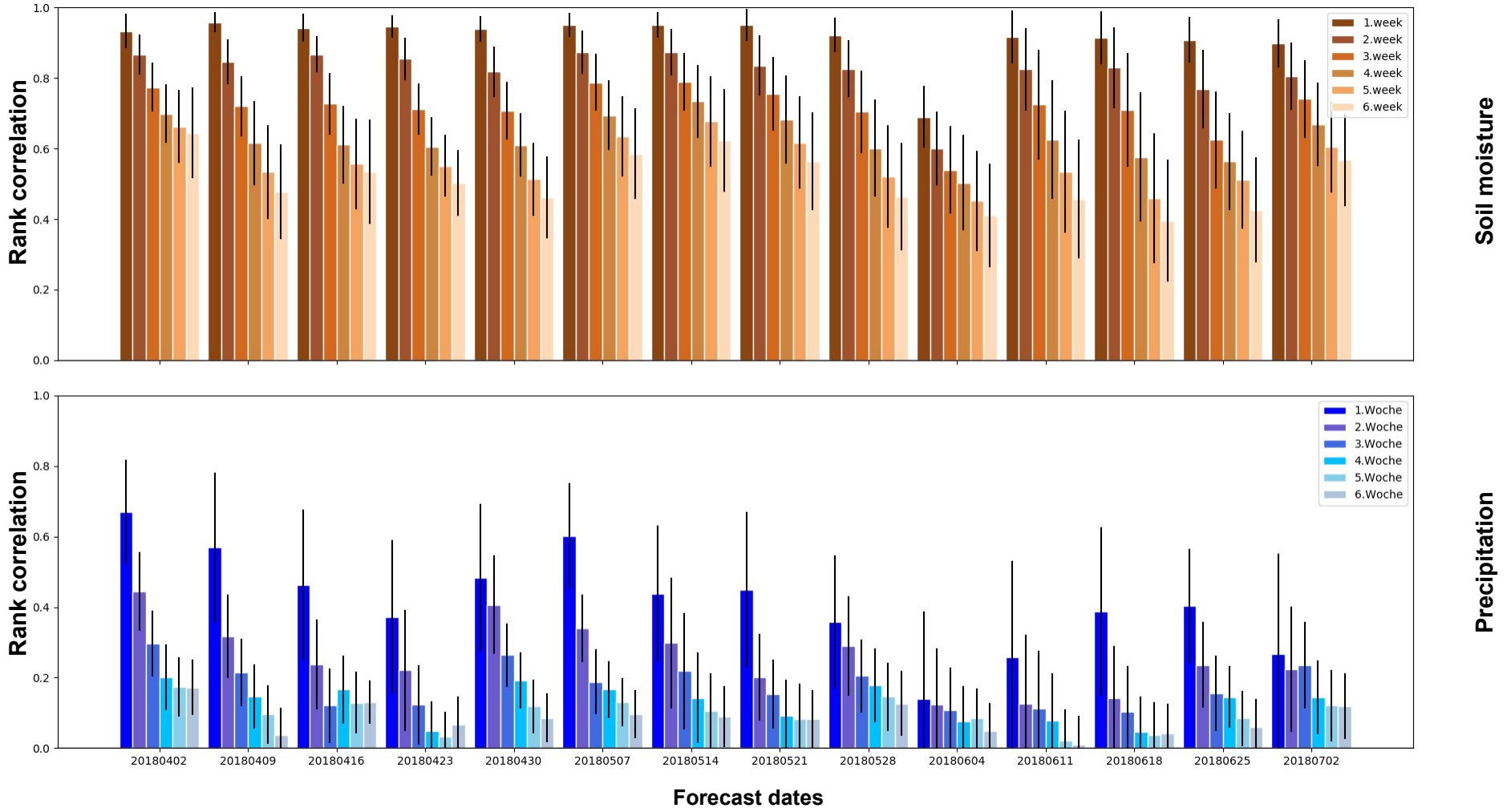
Subseasonal soil moisture forecast for winter wheat from 14.05.2018



Subseasonal soil moisture forecast for winter wheat from 18.03.2018



Test case: Drought 2018



Summary

- First test for drought in 2018 looks optimistic
- Intensity and regional distribution can be reproduced
- Soil moisture as drought indicator
- Adequate forecast skill up to week four
- Soil moisture improves the predictability in comparison to precipitation
- Only dry conditions were assessed (wetness not)
- Work in progress - More validation required
- Continuation of extended range forecasts with seasonal forecasts

Thank you