Leibniz Centre for Agricultural Landscape Research (ZALF)

Irrigation Monitoring With Integrated Use Of Optical And Radar Time Series In Temperate Regions

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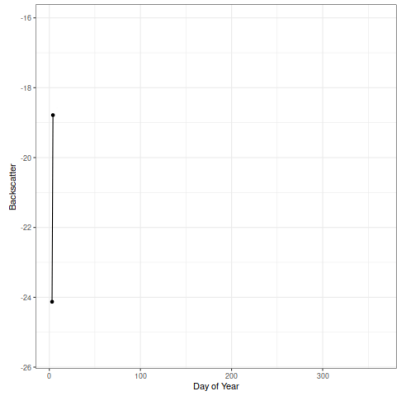
BACKGROUND

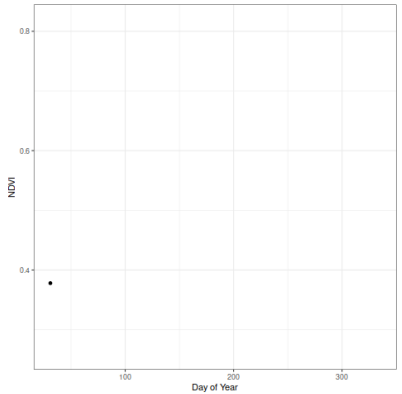
- Irrigation is the largest user of freshwater
- Increasing pressure on water and land resources due to the increasing global demand for food
- Need for reliable and timely information on irrigation

BACKGROUND

Remote sensing of mapping irrigation:

- Easier in semi-arid and arid areas
- Not apparent in humid climates





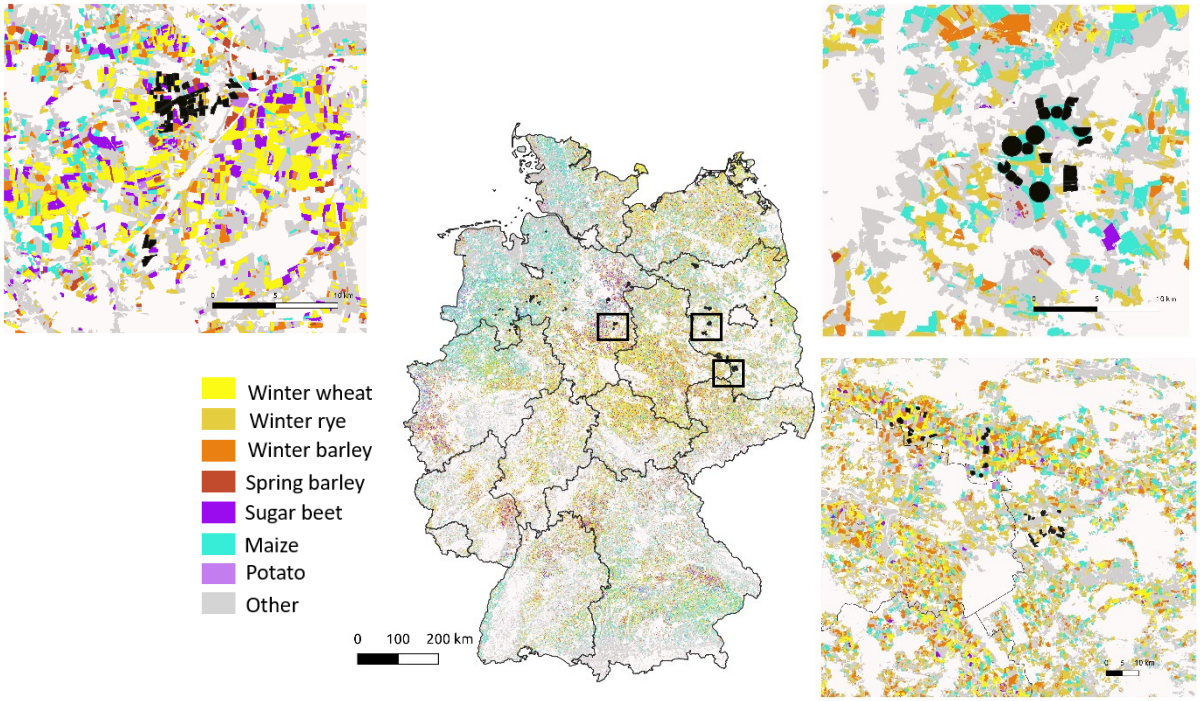
Objectives:

- The evaluation of the impact of various remote sensing based metrics and aggregation levels on the accuracy of irrigation mapping.
- The assessment of spatial patterns of mapping uncertainty and the performance of different algorithms for specific crops.

STUDY AREA

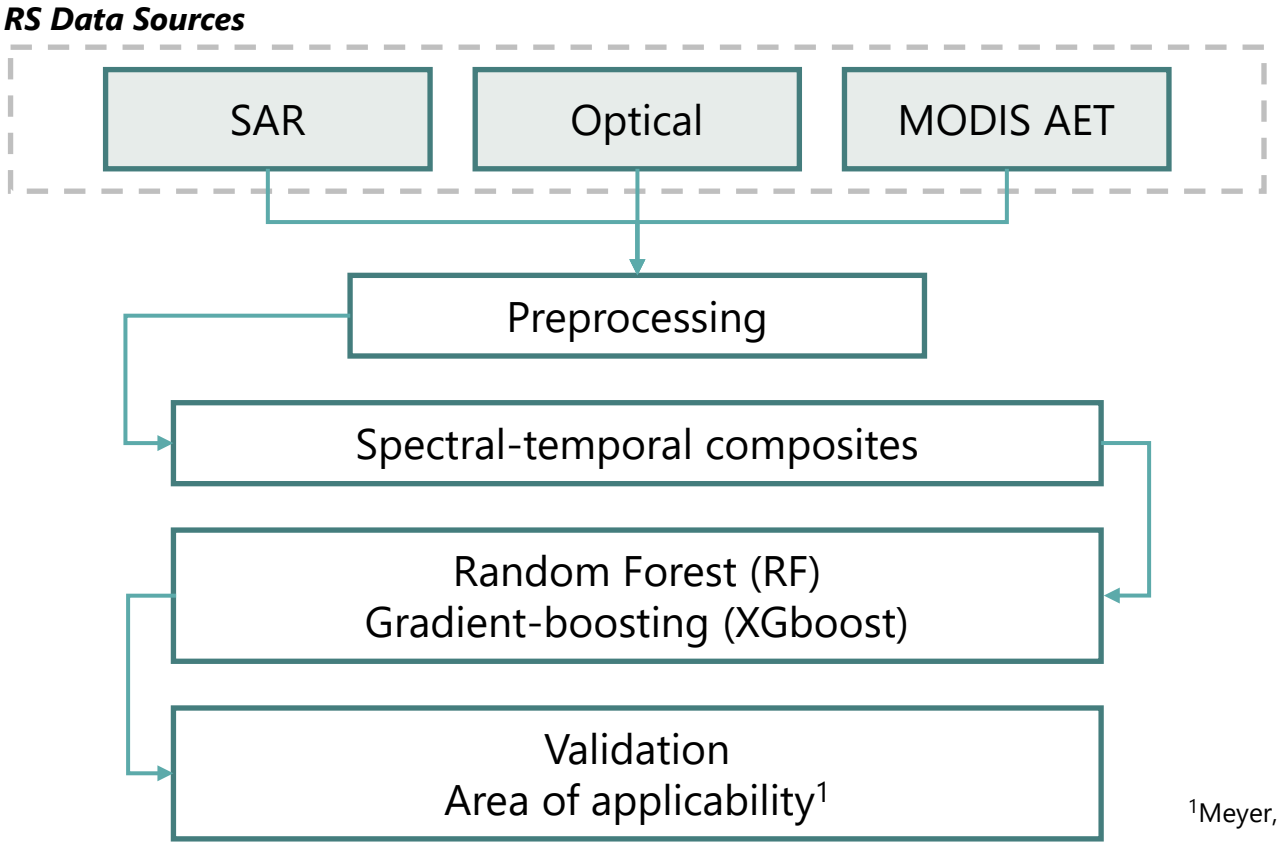
Location:
Brandenburg and Lower Saxony, Germany

Dominant crops :
Maize, potato, sugar beet, spring barley and winter wheat



Modified from Blickensdörfer et al., 2022

WORKFLOW



[1]Meyer, H., & Pebesma, E. 2021

DATA

Sentinel-2 spectral bands+

NDVI
TC indices (Brightness, Greenness, Wetness)
MNDWI
NDMI

Sentinel-1

VV
VH
VV/VH

MODIS

Actual evapotranspiration

Aggregation Minimum, maximum, Q50, Q25, Median,Q75, IQR,STD

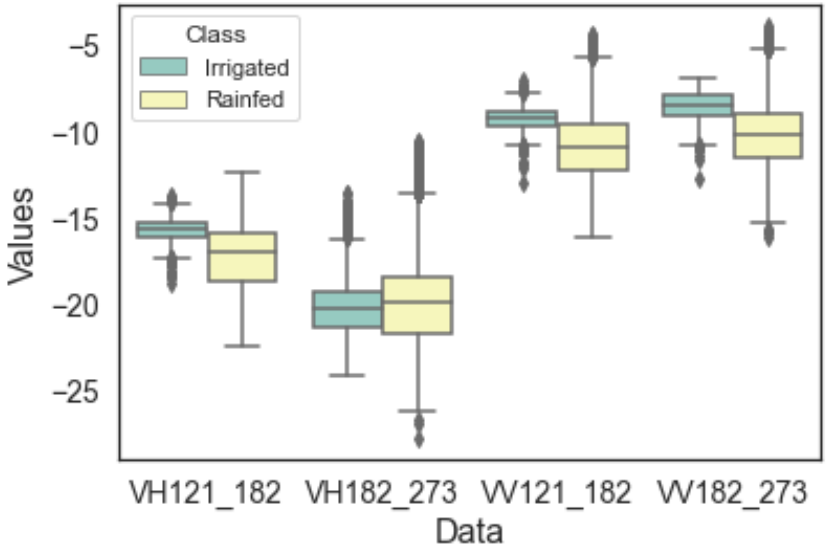
Three periods:

- April-October
- May-June
- July-September

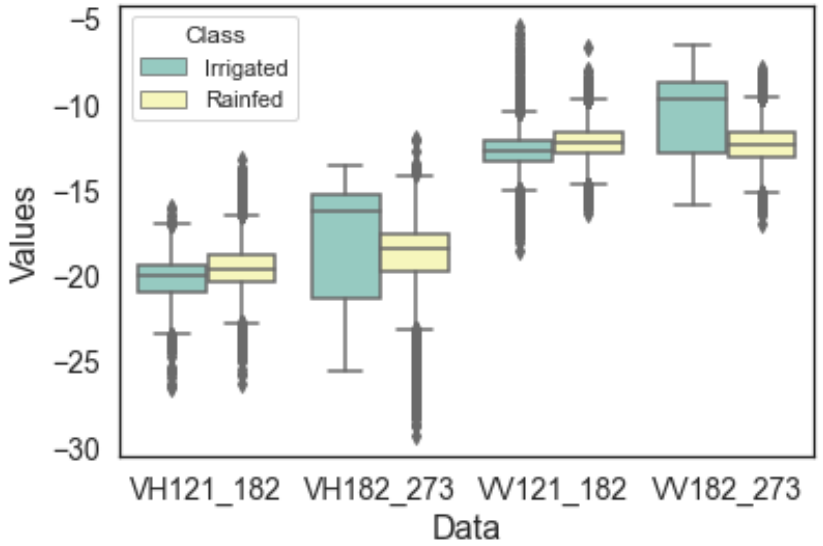
Four final classes:

- Spring cereals
- Winter cereals
- Maize
- Other (Potato, Sugarbeet)

DATA

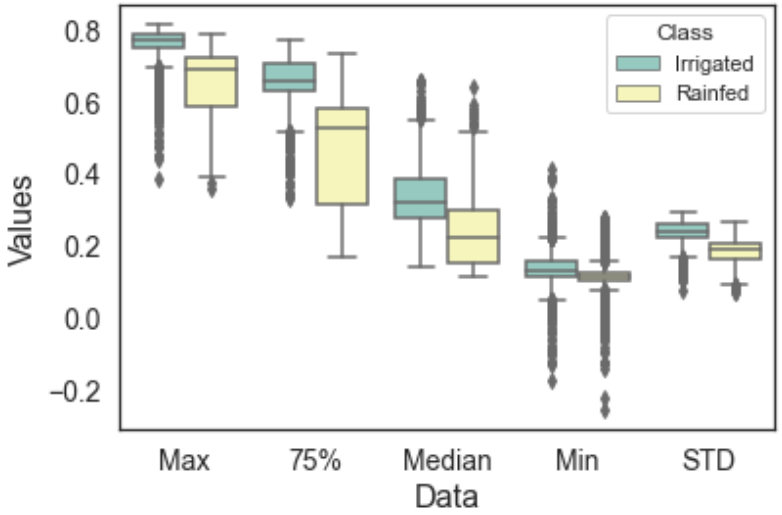


Sentinel-1 based metrics (Maize) 2016

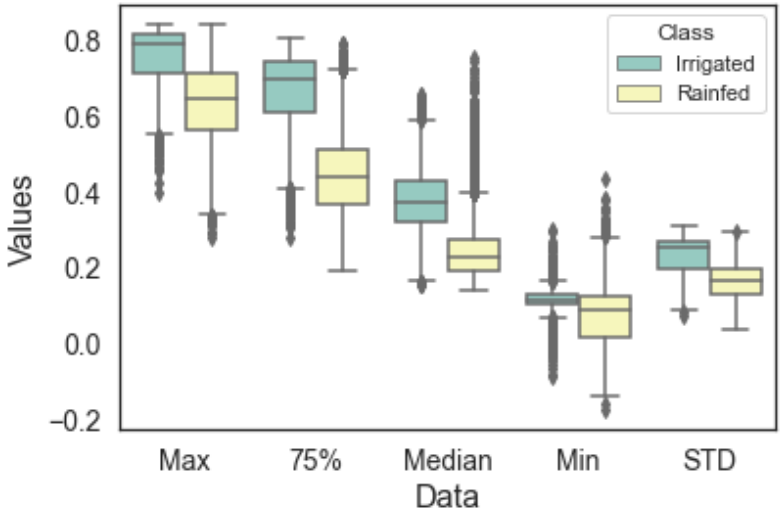


Sentinel-1 based metrics (Maize) 2018

DATA



Sentinel-2 based metrics (Maize) 2016
Index: NDVI

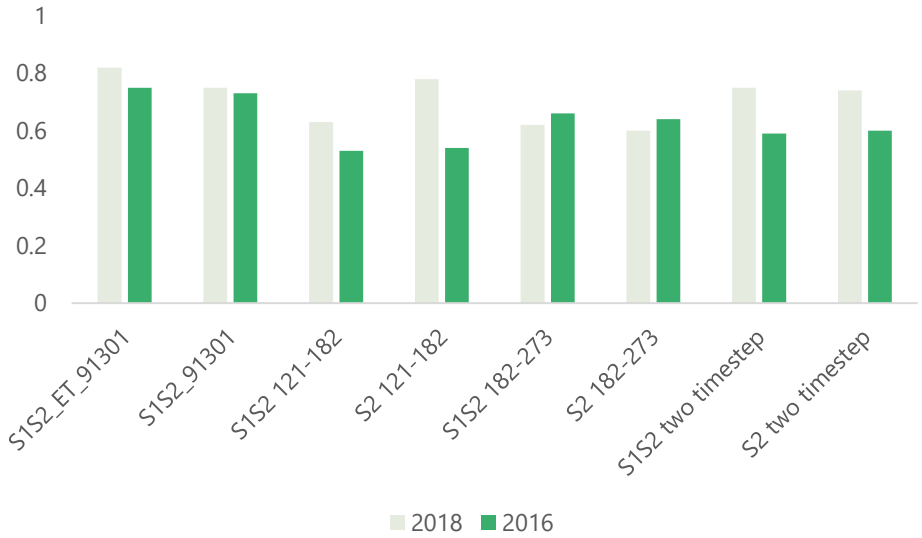


Sentinel-2 based metrics (Maize) 2018
Index: NDVI

RESULTS

XGboost outperformed RF

- DOY -121-182 May-June
- DOY -182-273 July-September
- DOY-91-301 April-October

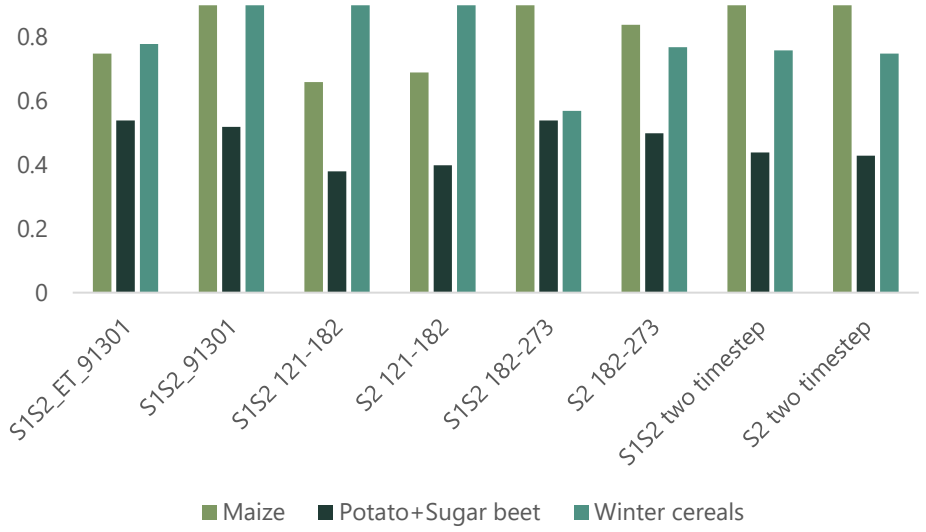


Overall accuracy when using all reference data

RESULTS

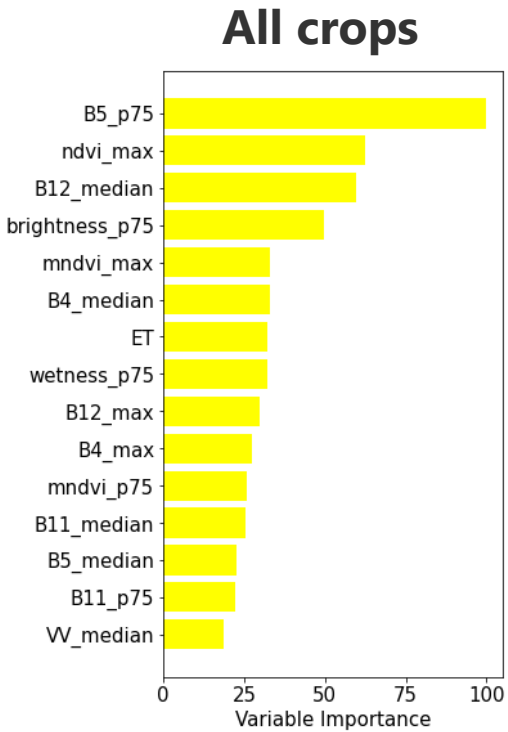
Crop specific differences:

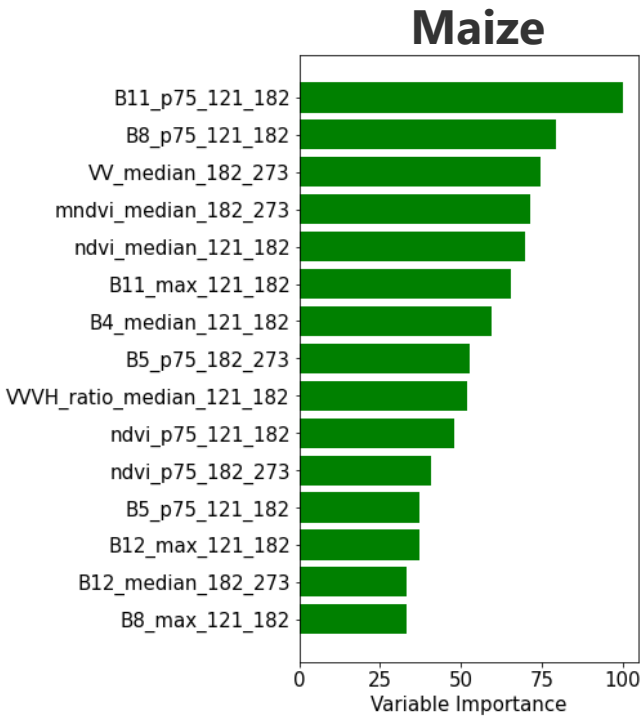
- Winter Cereals best identified with data from May-June
- Maize – two time-steps combined
- The lowest accuracies for the mixed classes (Potato and Sugar beet)



Overall accuracy when using maize data

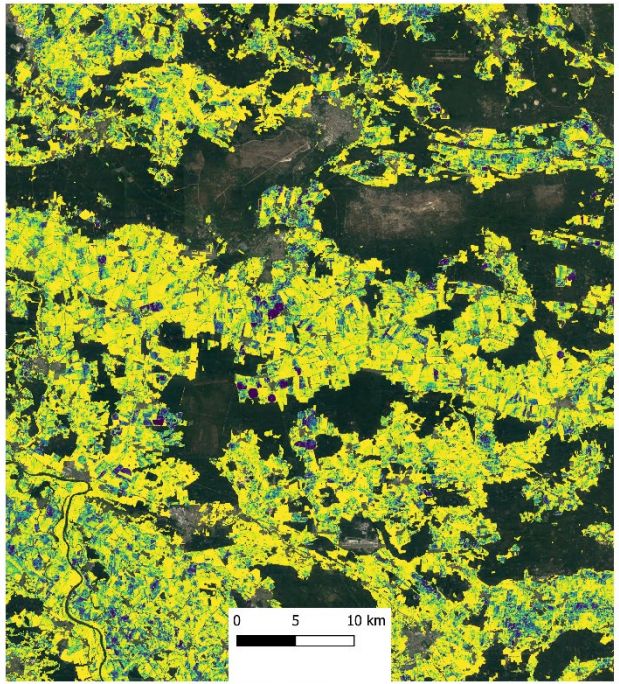
RESULTS



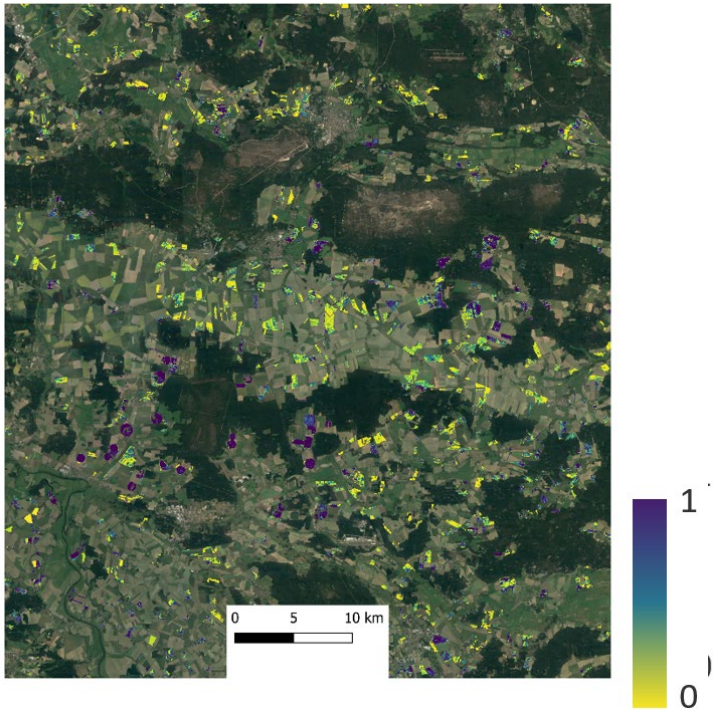


Variable importance (rescaled to 0-100)

RESULTS



Probability of irrigation



Probability of irrigation for Maize in 2018

Masked areas outside the Area of applicability

DISCUSSION

- Reasonable accuracy despite heterogeneous agricultural management practices.
- Varied accuracies for **different crops**, accuracy highly dependent on representativeness of the training data.
- Classification is easier during dry years.
- Integration of **optical** and **microwave** information improves the identification of irrigated fields.
- AOA is an important metric along with the validation measures.
- The generated irrigation masks for each crop will be further used to inform dynamic crop models.

Thank you for your attention.

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