

StatEO

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Sentinel-2 Based Estimation of Crop Yields for Official Statistics in Germany

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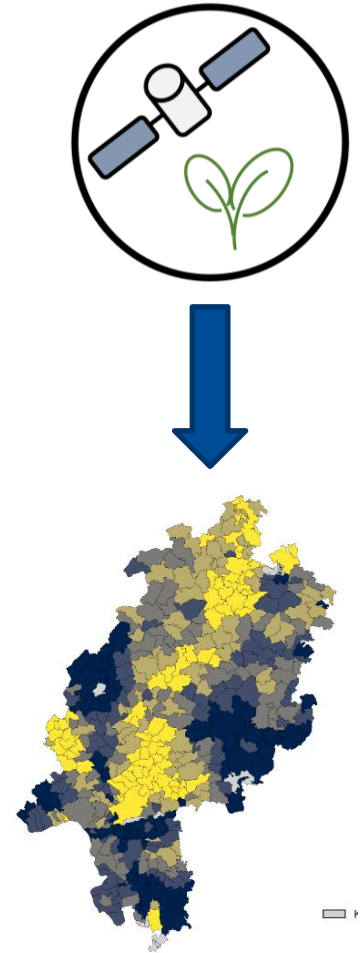
Goal: operational yield estimation at field level for Germany

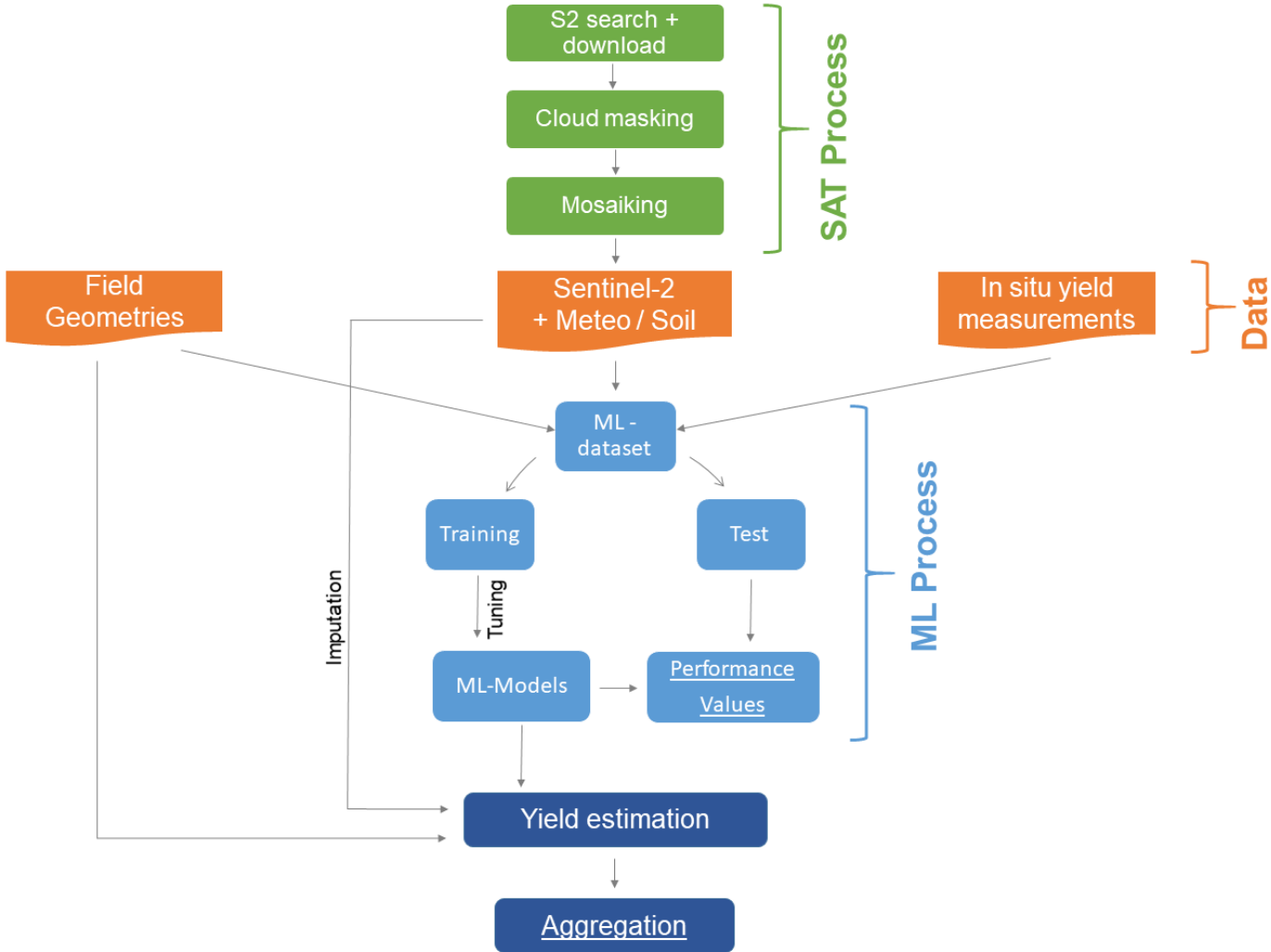
Motivation: overcome dependency on volunteers

Advantages:

objective, automated, comprehensive, municipal level

Status: operational test phase for main crops
(wheat, rye, barley, oat, triticale, rapeseed)

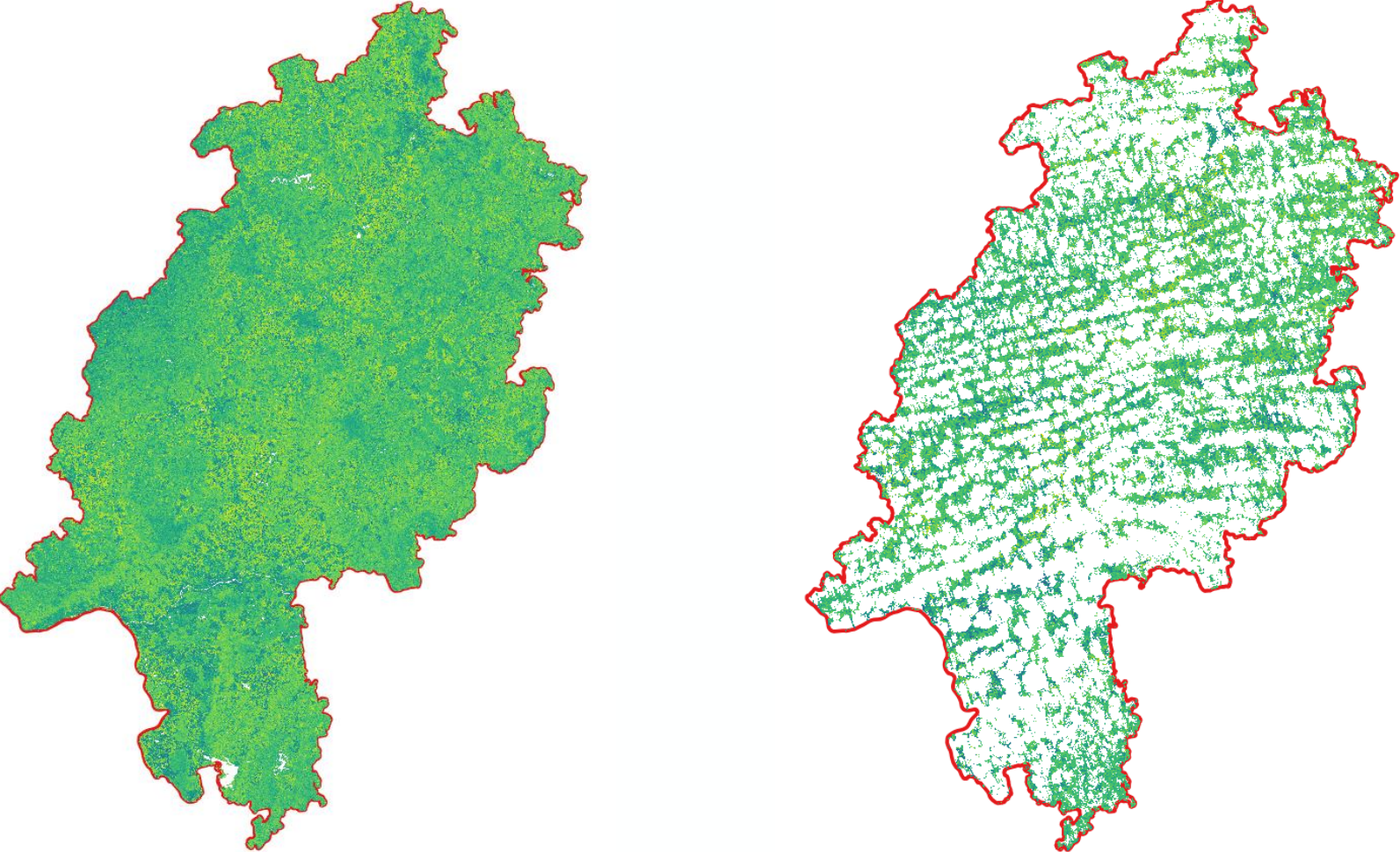




1. Search + Download of L2A files from CDSE via ODATA
 - Max cloud cover: 70%
 - Window: Apr 26 – Aug 01
2. Cloud masking with Scene Classification Band from Sen2Cor
3. Calculation of vegetation indices
 - **NDMI**: water content in vegetation
 - **REP**: chlorophyll content in vegetation
4. Aggregation and mosaicking to weekly mean files per state



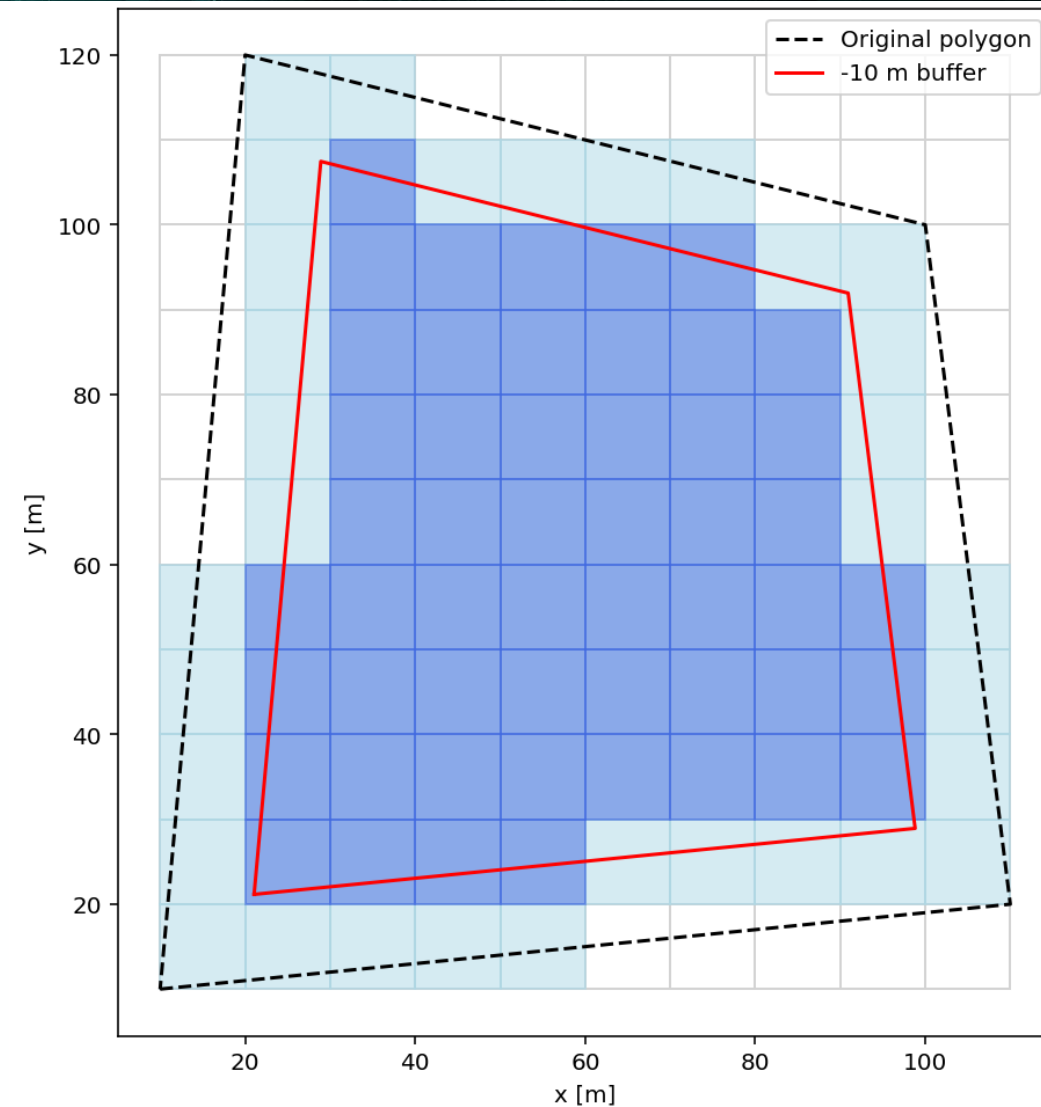
Sentinel-2 Processing: Result



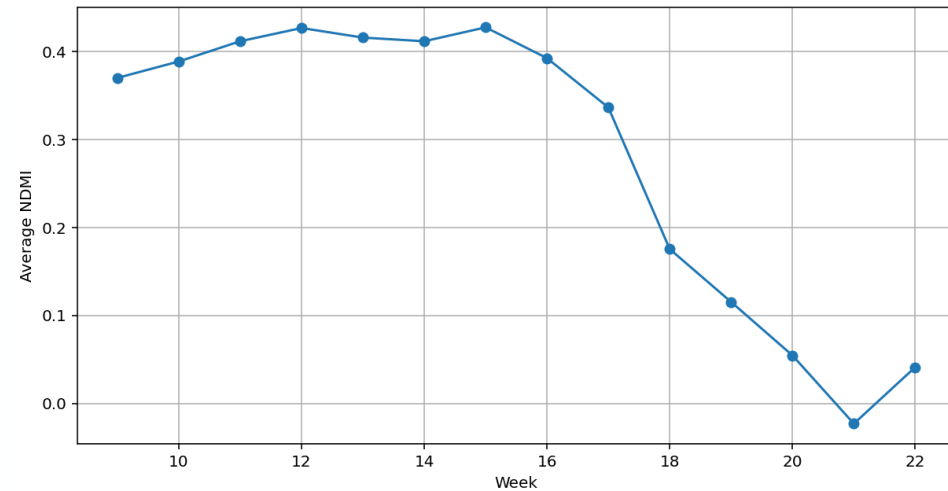
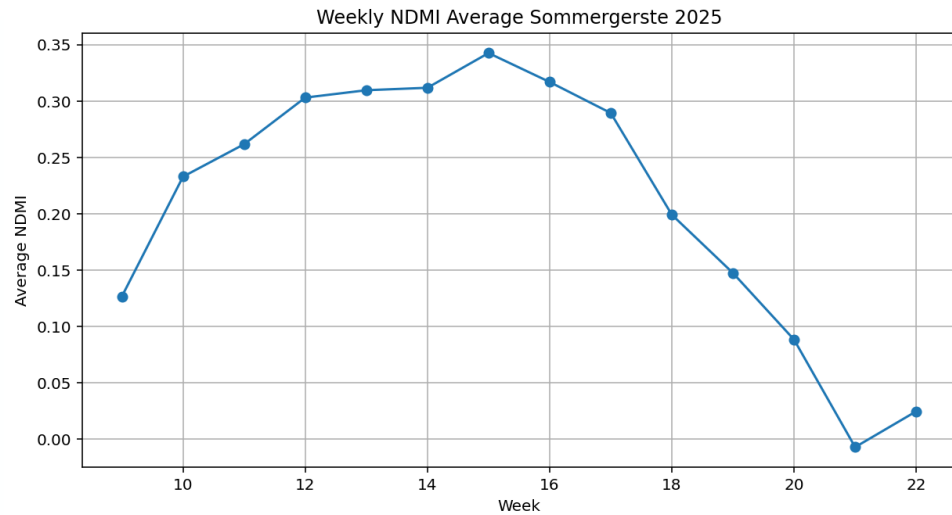
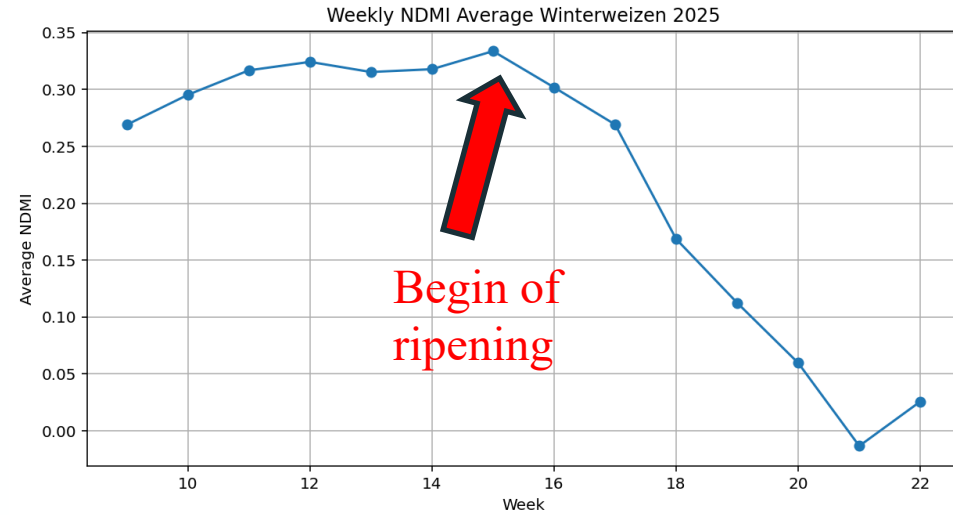
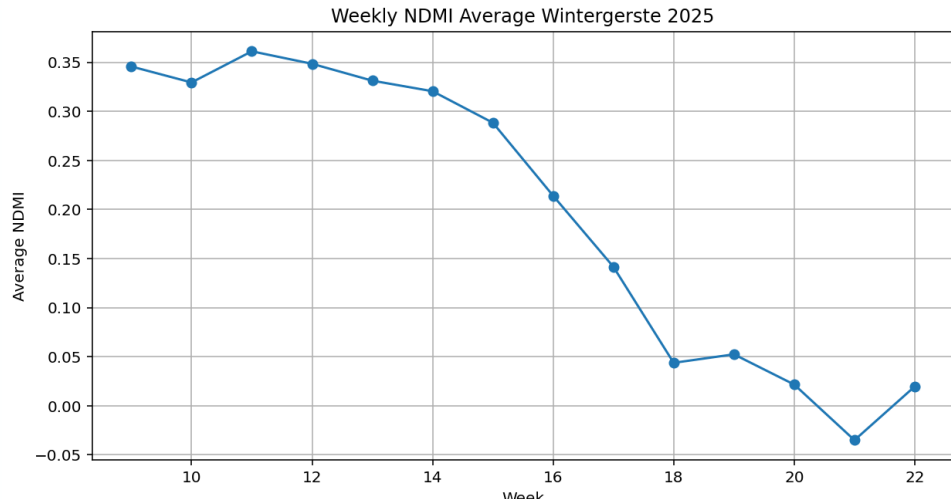
Extraction of Pixel Values

Extract and average all pixels which belong to a parcel geometry

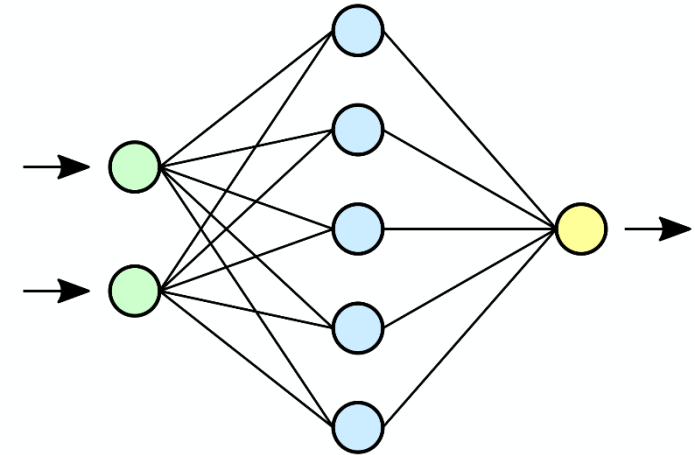
Negative buffer of -10m to exclude contaminated pixels from outside the parcel



Intermediate result: gapless time series



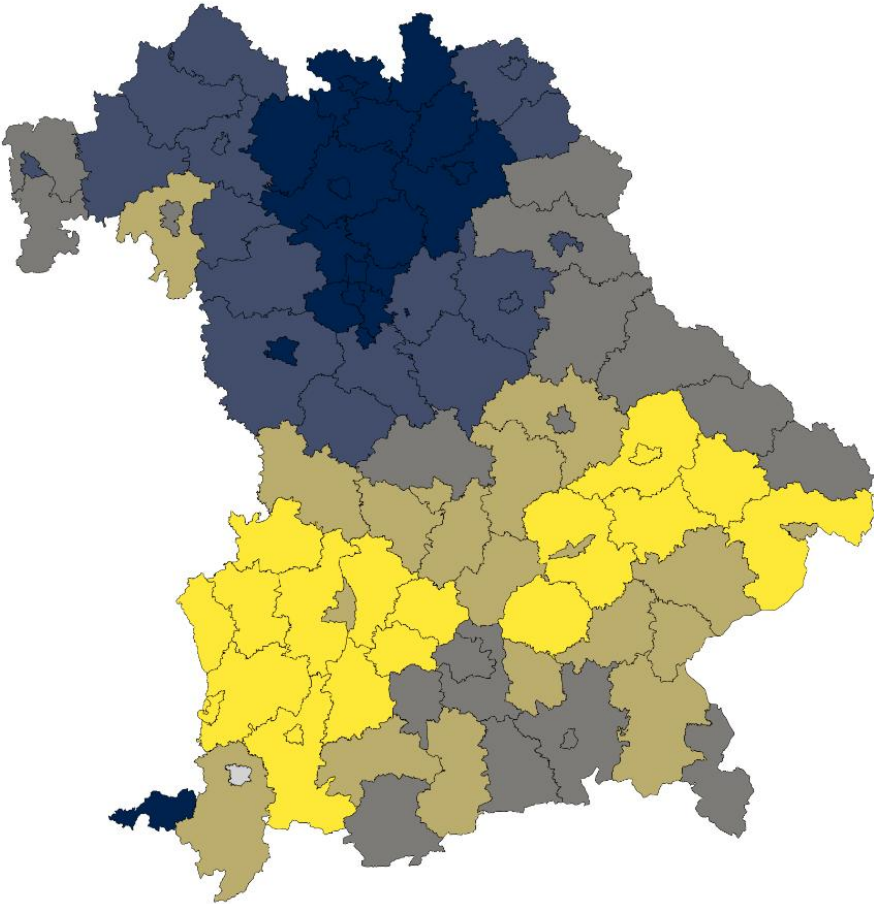
- One model per crop with data from all German states
- Ensemble of:
MLP Regression, LGBM, Support Vector Regression,
ExtraTrees, Elastic Net
- Repeated 5-fold CV for model performance



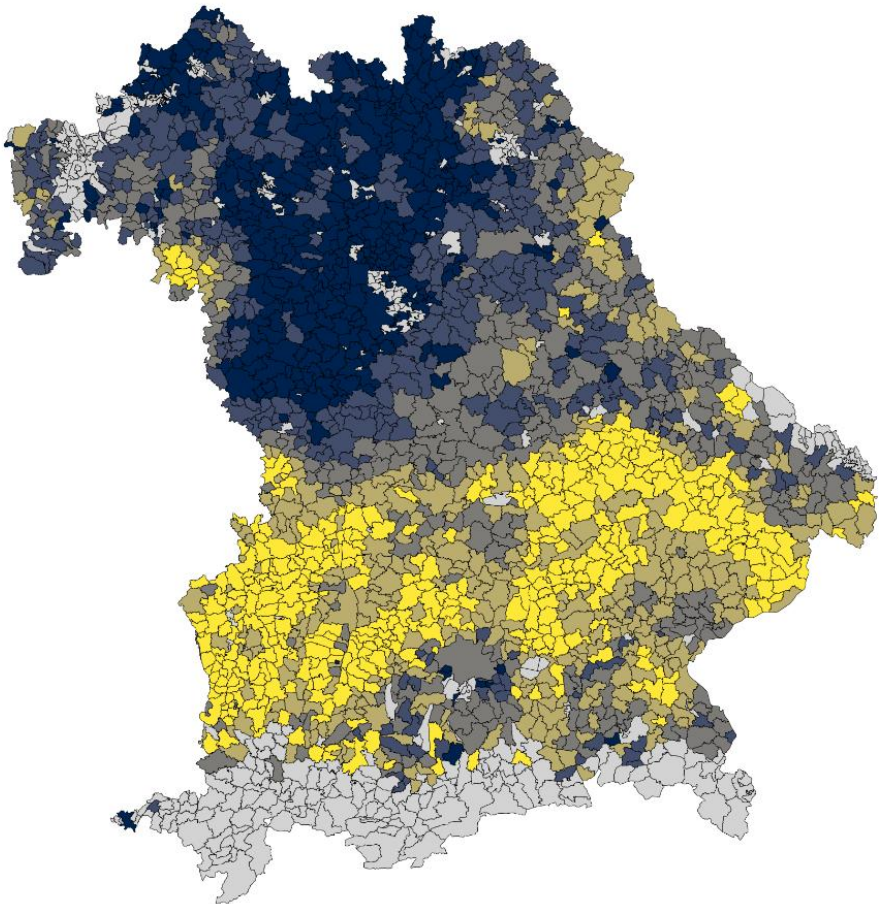
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Results: gapless yield statistics

District Level

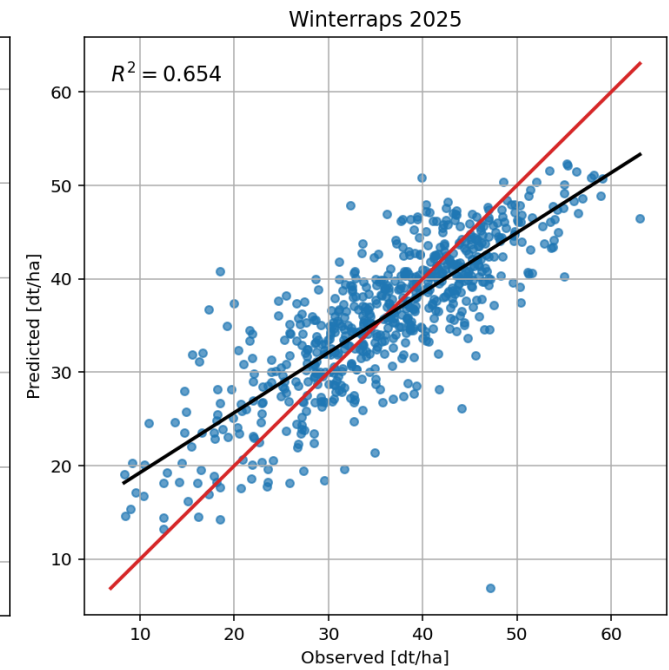
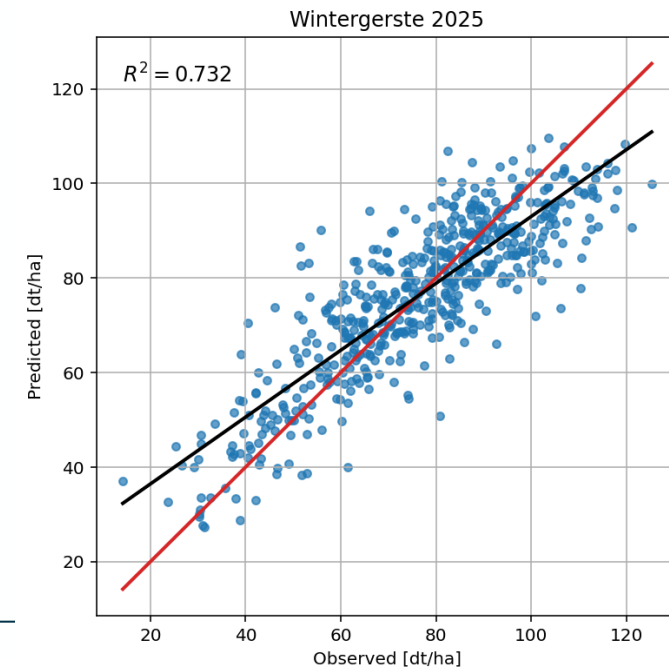
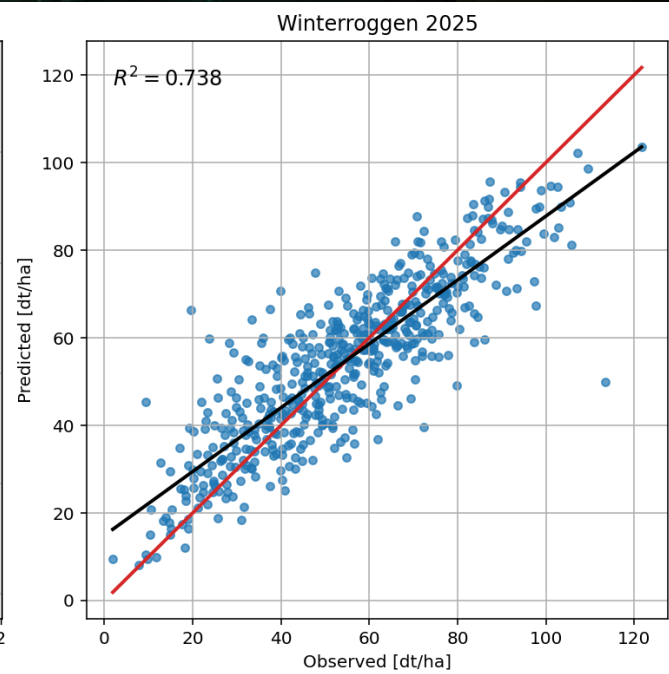
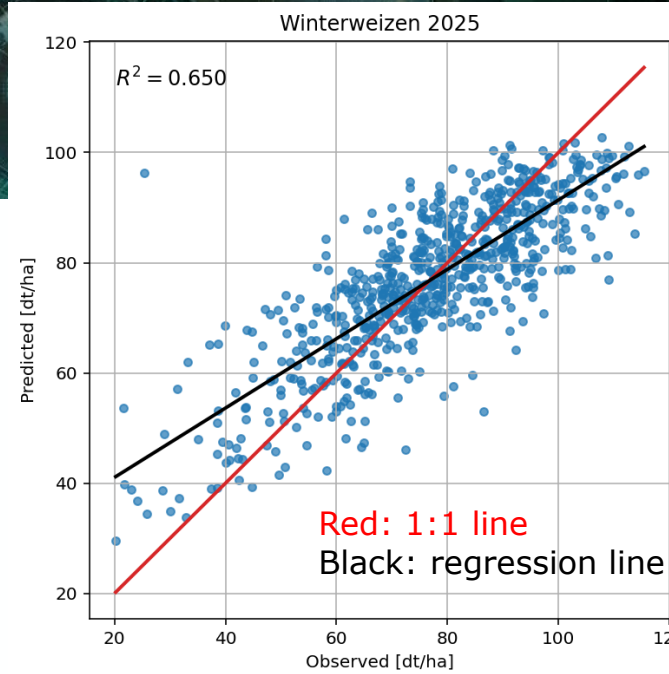


Municipal Level



Results 2025 – Scatterplots

- Improvement over baseline model is 32% to 47%, depending on the crop
- Regression towards the mean



- Evaluation at district level
- Missing information (soil, management, etc.)
- Grown vs harvested yield:
→ silage, african swine fever
- Rare events not represented in training data: hail, floods

- Implementation into official statistical production
- Transfer to the Netherlands
- Yield forecast
- Include S1

Helpful for our project:

- ARD Sentinel-1 Normalised Radar Backscatter Product
- Increased temporal resolution through three Sentinel-2 satellites



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