

Hy-PiPE

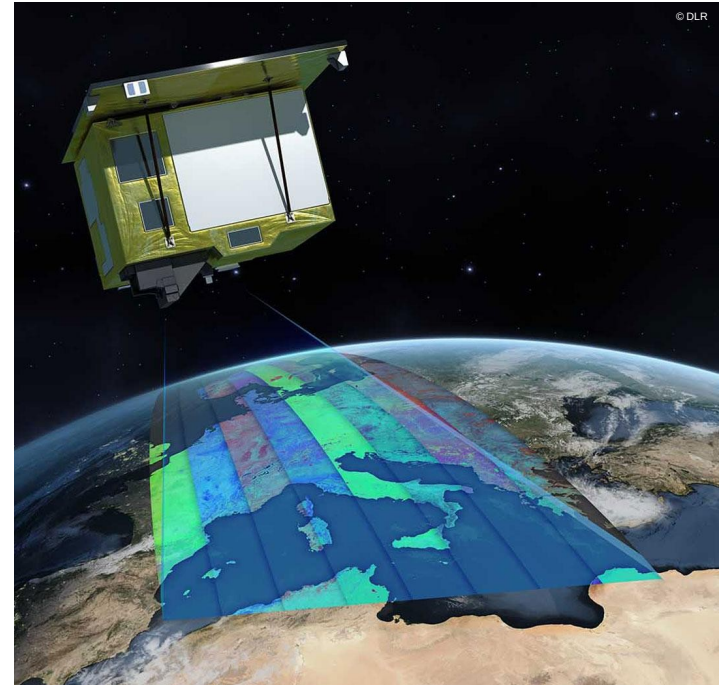
Pixel-based PROSAIL parameterization for large-scale hyperspectral crop trait retrieval and yield estimation

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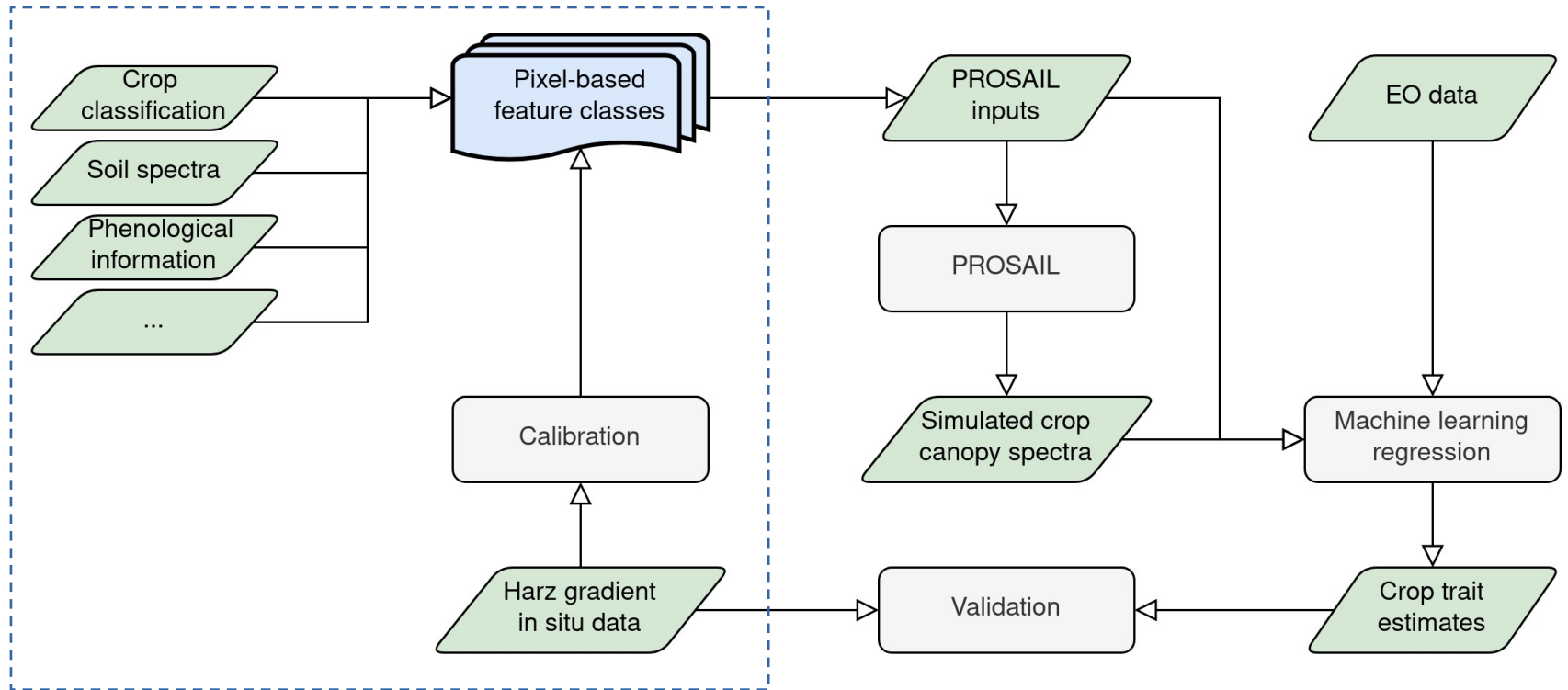


Motivation

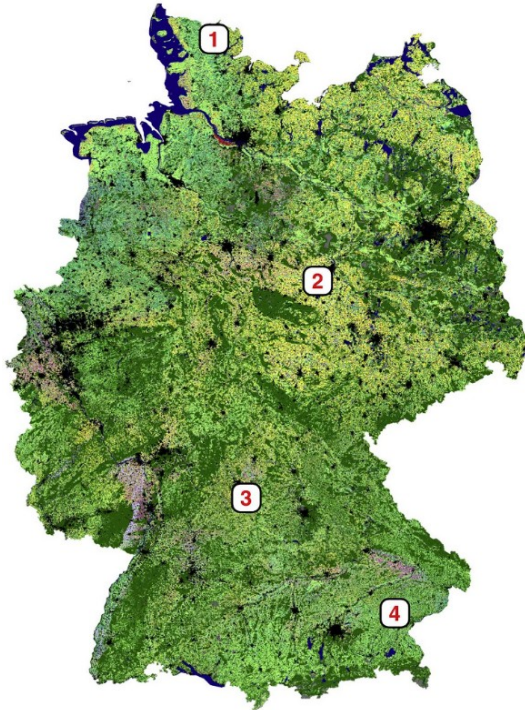
- Modern agriculture is facing more and more demands
- State-of-the-art EO missions as EnMAP provide unprecedented tools for agricultural decision-making
- PROSAIL inversion enables large-scale crop trait retrieval, but requires sophisticated parameterization to reduce errors



Methodological Overview



Establishment of pixel-based feature classes – ApiC crop classification



APiC (Preidl et al. 2020)

- Ongoing classification of 19 land cover types throughout Germany with ~ 88% overall classification accuracy
- 20 m spatial resolution



Remote Sensing of Environment

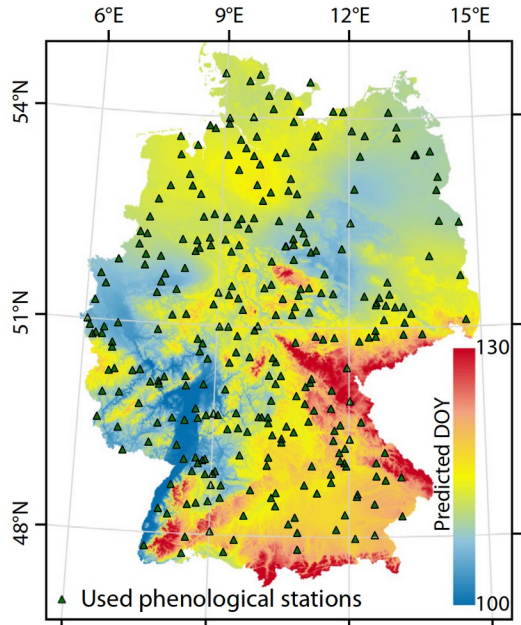
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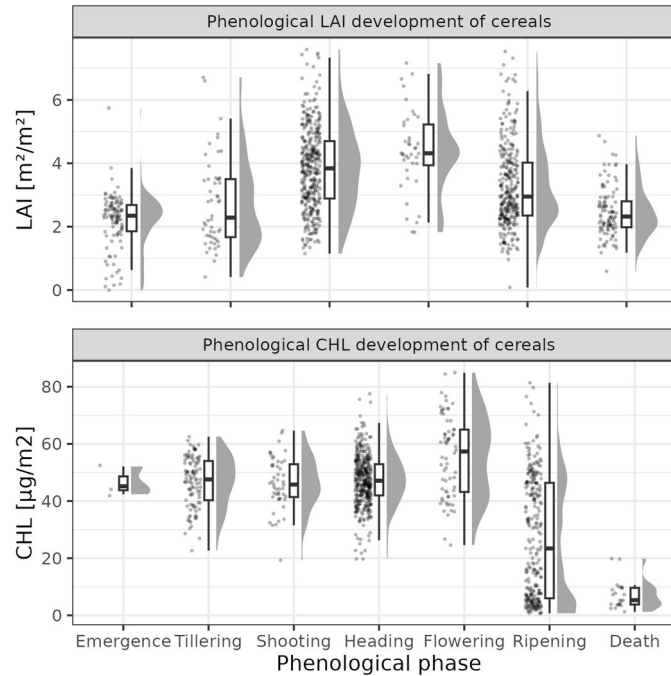
Introducing APiC for regionalised land cover mapping on the national scale using Sentinel-2A imagery

[Sebastian Preidl](#)   [Maximilian Lange](#), [Daniel Doktor](#)

Establishment of pixel-based feature classes – Phenological development



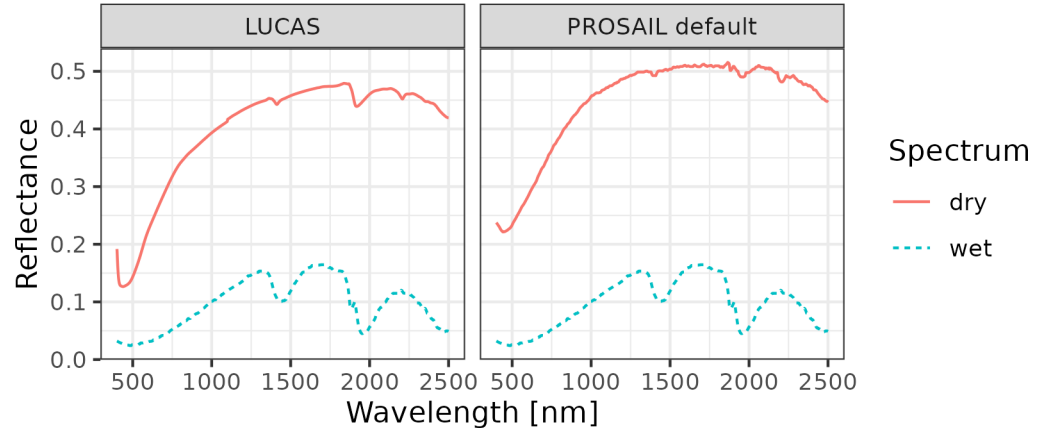
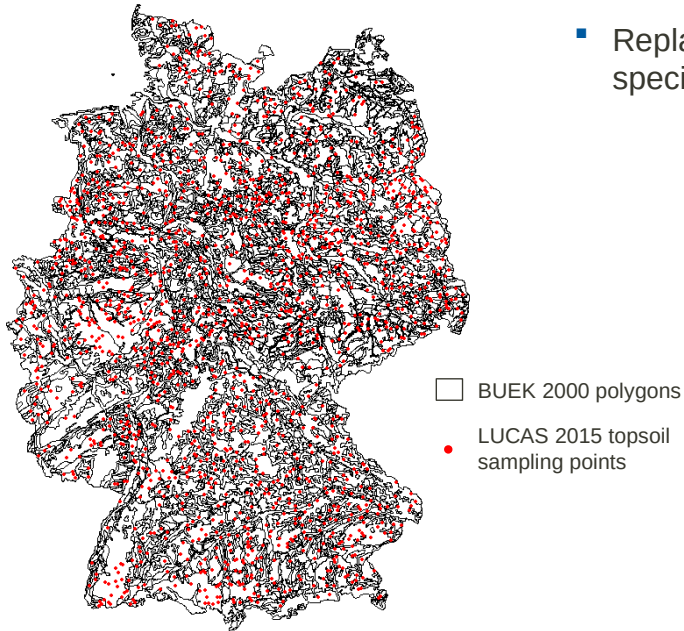
PHASE (Gerstmann et al. 2016)



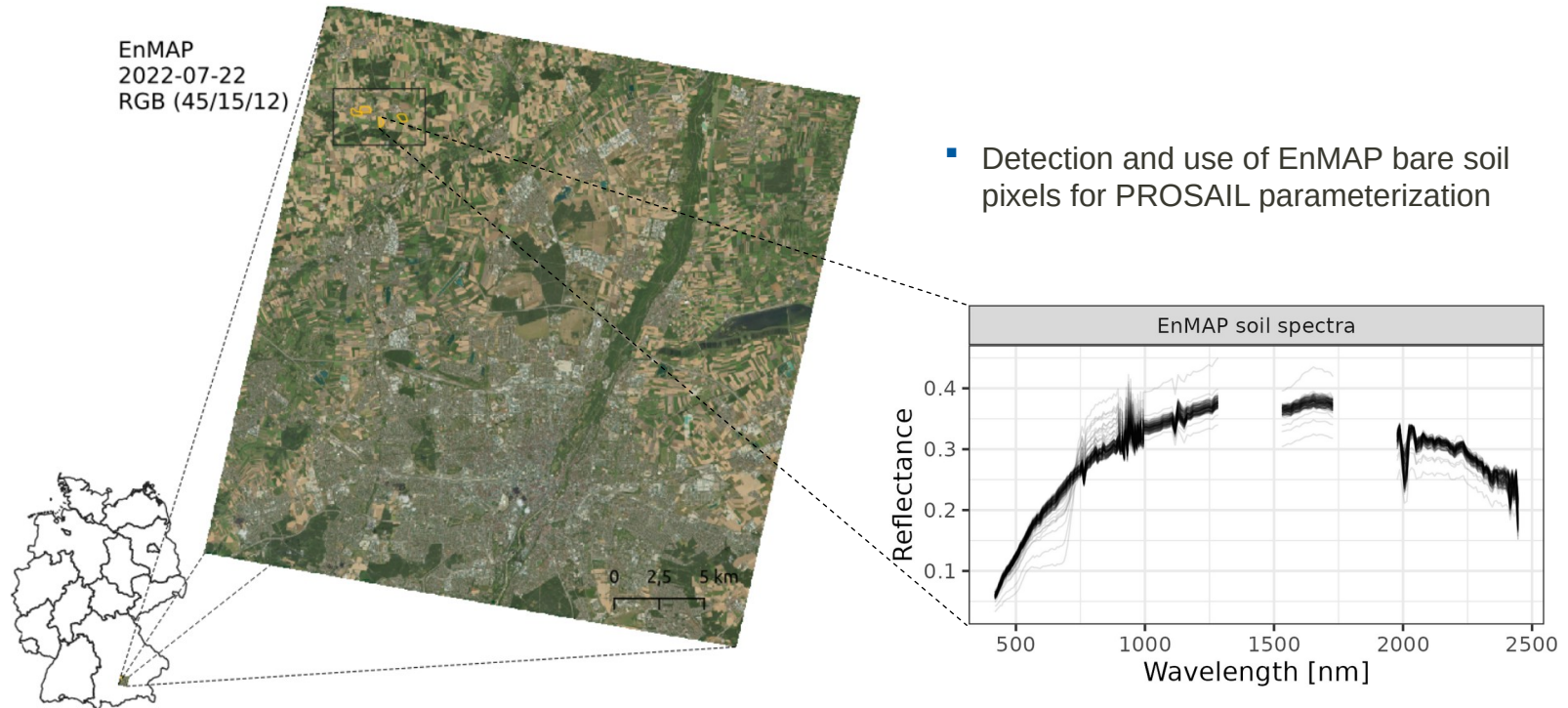
- Coupling of crop-specific interpolated phenological entry dates with in situ measurements and literature values

Establishment of pixel-based feature classes – Use of hyperspectral soil information

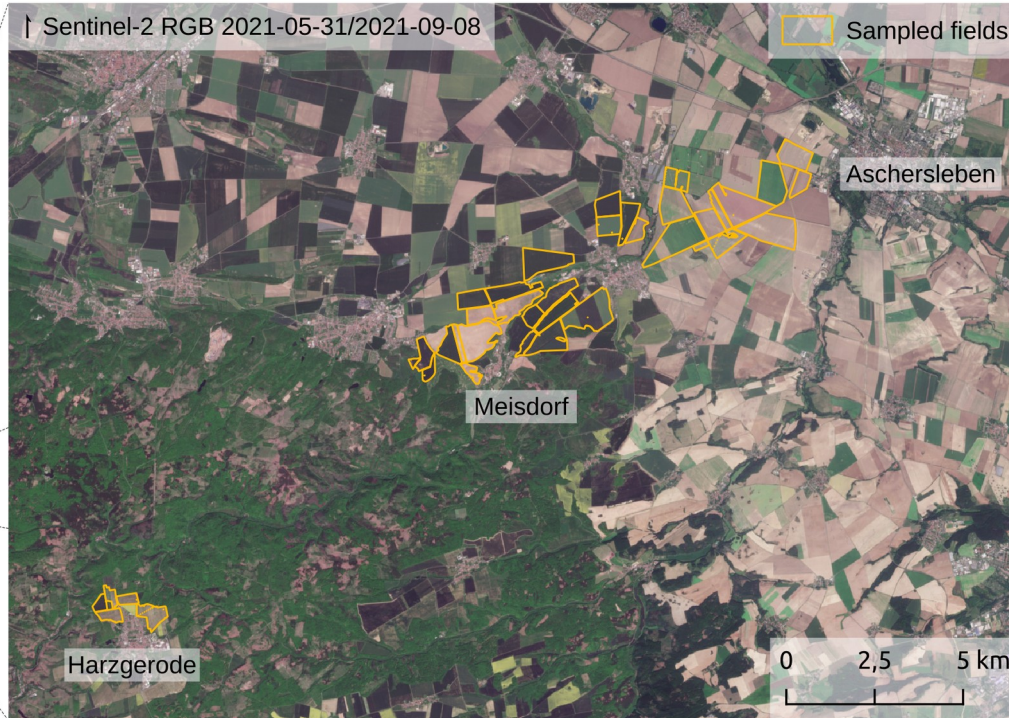
- Investigation of spectral similarity of soil type associations by soil survey map
- Replacement of PROSAIL default soil spectra with site-specific LUCAS spectra



Establishment of pixel-based feature classes – Use of hyperspectral soil information



Harz gradient campaign for model calibration and validation

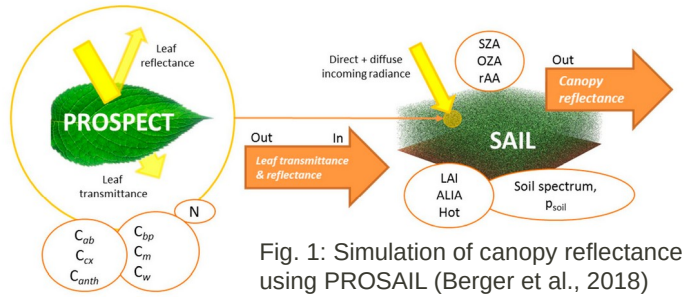


- Continuous (bi-) weekly non-destructive sampling since March 2023 of ~ 40 fields in Harz foreland
- Crop type
- Phenology (BBCH)
- Plant height
- SPAD
- Leaf area index (LAI)

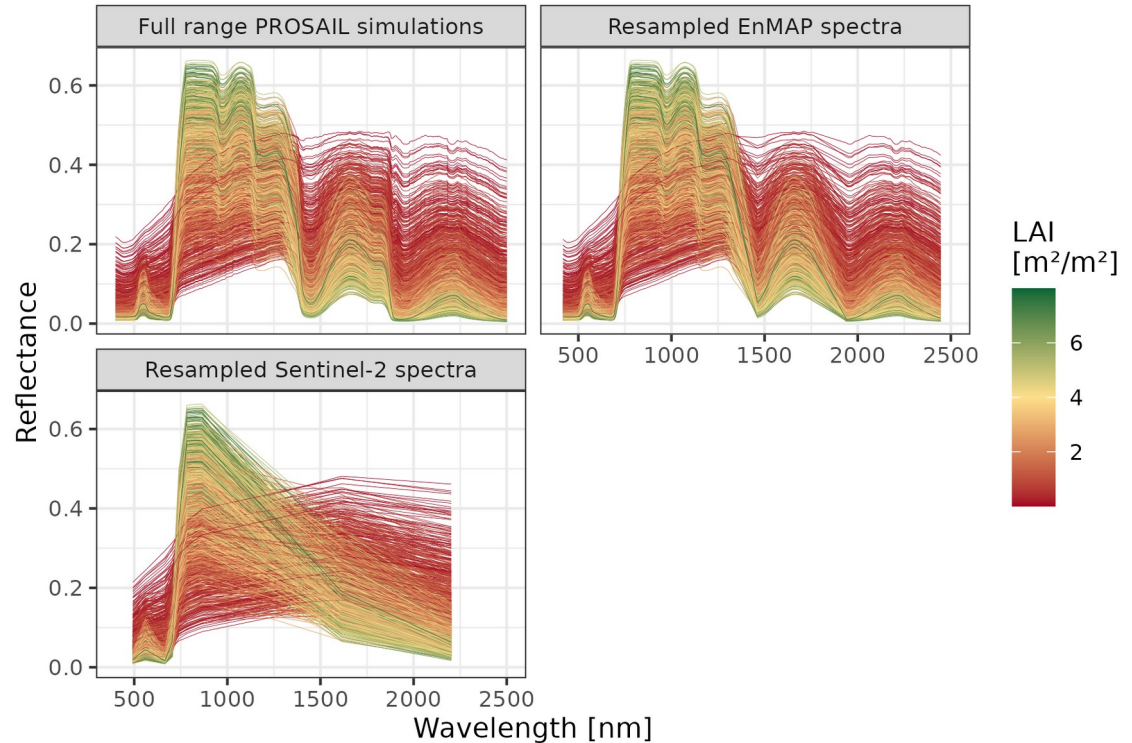
Harz gradient campaign for model calibration and validation



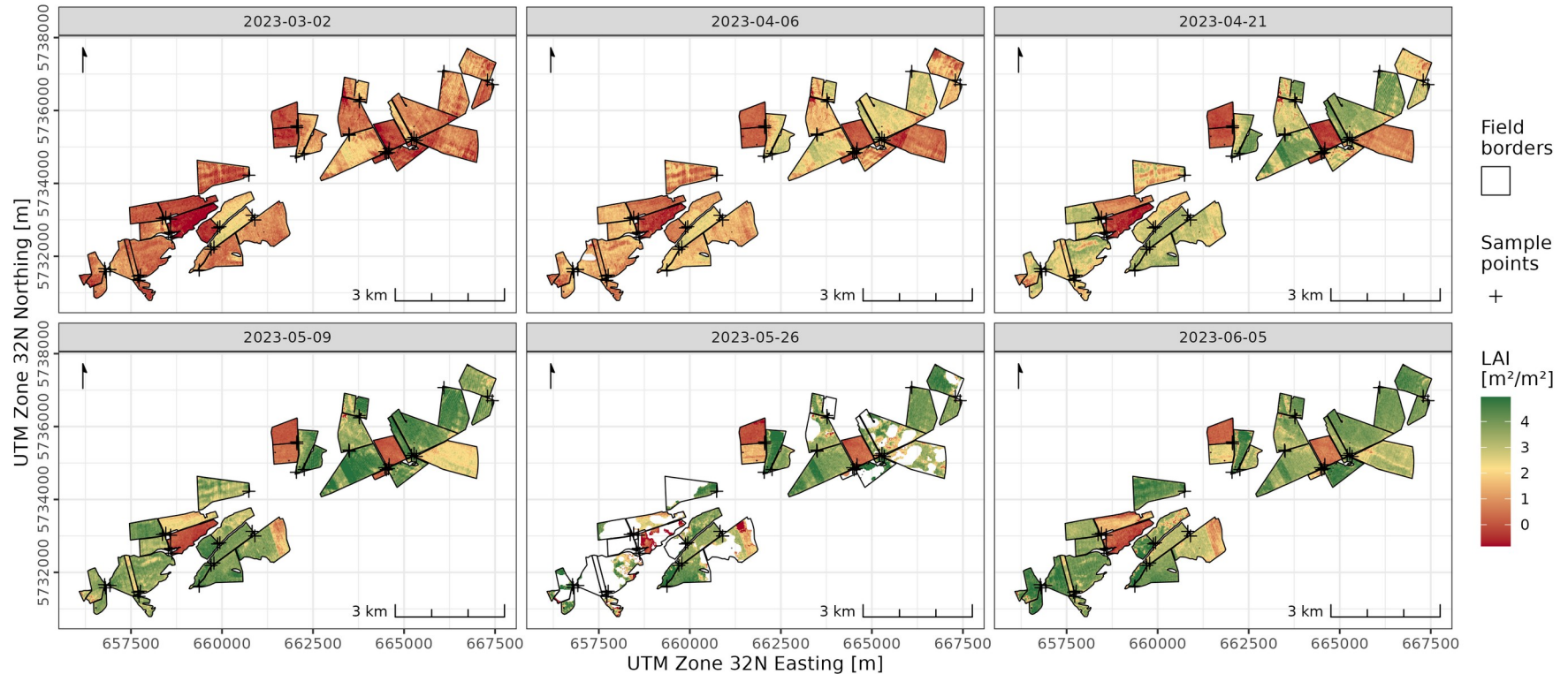
Default PROSAIL parameterization using value ranges from the Sentinel-2 Toolbox ATBD and spectral resampling



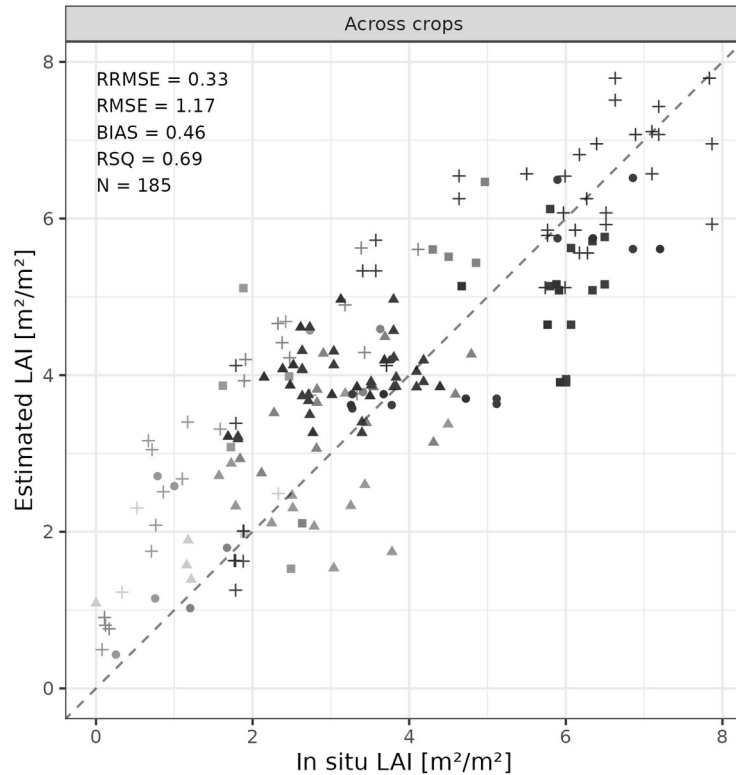
- Establishment of a hybrid PROSAIL inversion workflow



Application of Gaussian process LAI regression model to Sentinel-2 imagery of the Harz gradient test site



Pixel-specific Harz gradient in situ validation of Sentinel-2 LAI estimates

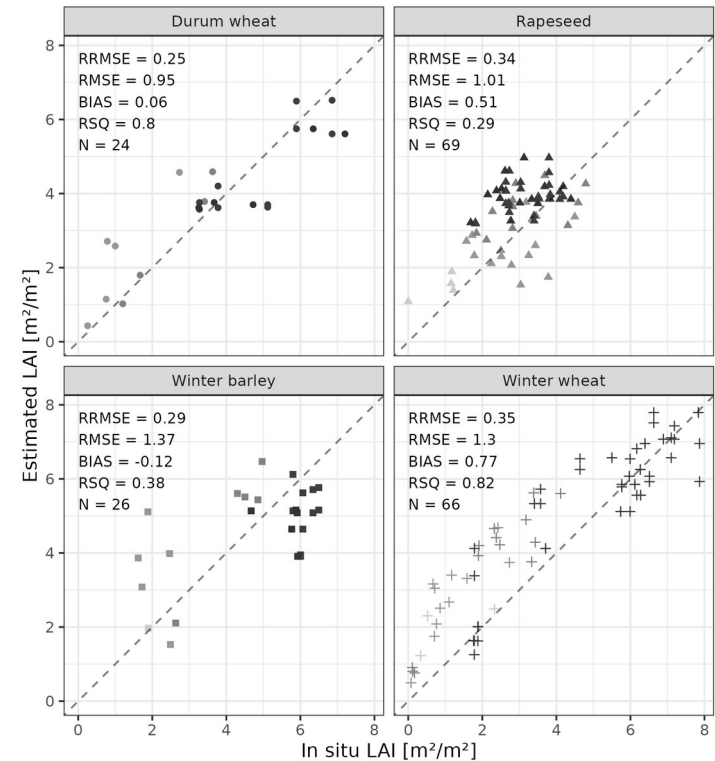


Crop

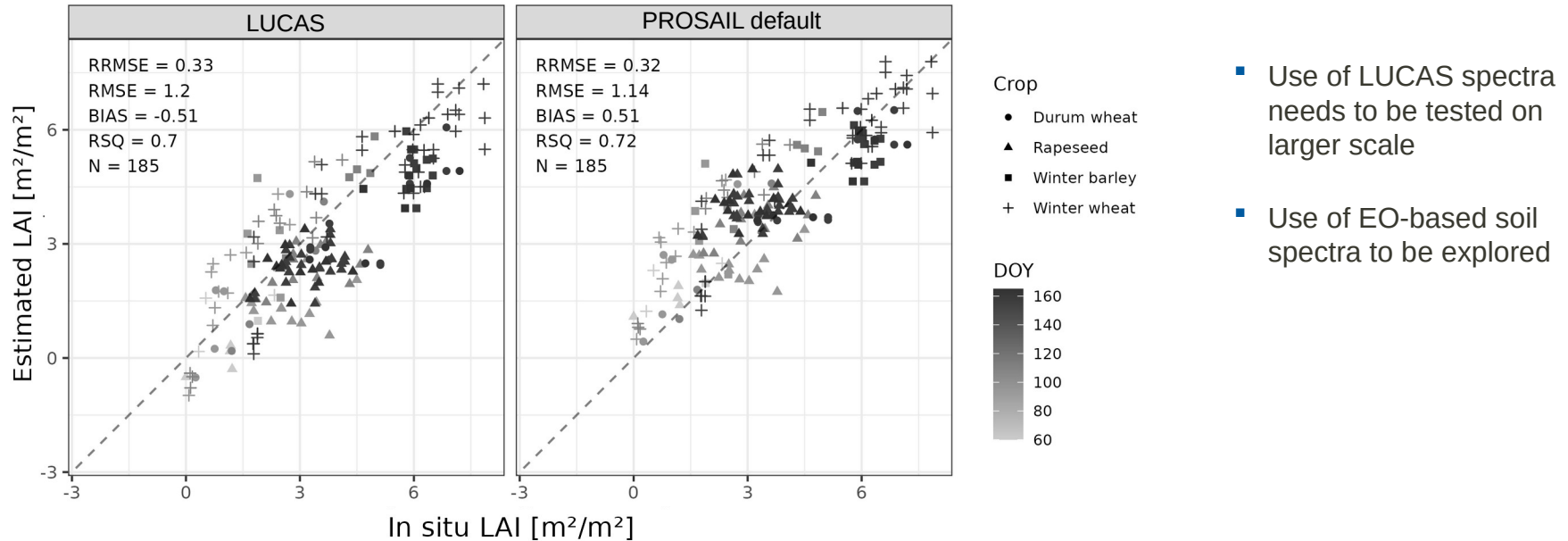
- Durum wheat
- ▲ Rapeseed
- Winter barley
- + Winter wheat

DOY

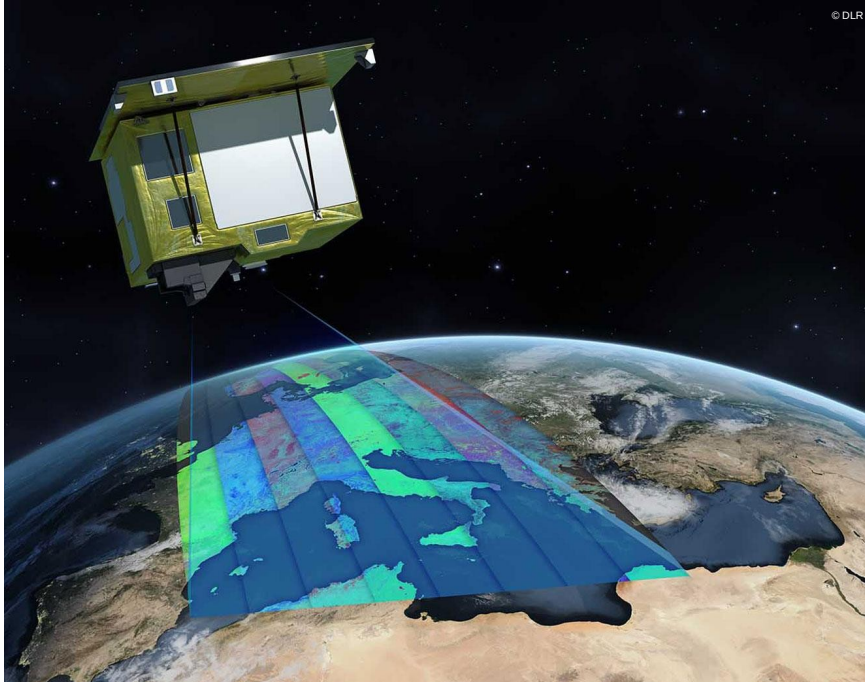
160
140
120
100
80
60



How does the use of site-specific LUCAS topsoil spectra affect the Sentinel-2 LAI retrieval?



- Use of LUCAS spectra needs to be tested on larger scale
- Use of EO-based soil spectra to be explored



Thank you for listening