UNIVERSITY OF HOHENHEIM

Carl Zeiss Stiftung

Land Atmosphere Feedback Observatory (LAFO) and heterogeneous terrain in its footprint

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LAFO scientific objectives

- Determine water and energy balances, and land-atmosphere feedback as a function of the conditions of the soil, vegetation, and atmosphere in a study region with an agricultural landscape.
- Investigate the heterogeneity of the fluxes at the land surface and in the boundary layer.
- Develop new parameterizations of the fluxes at the land surface taking into account the vegetation dynamics and the turbulence in the atmospheric boundary layer

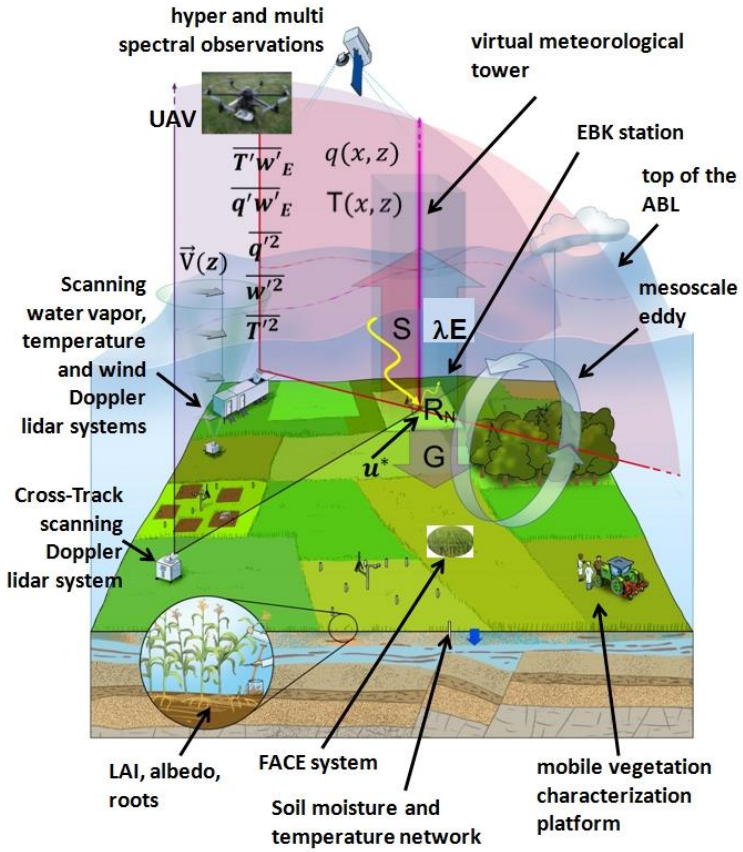


Figure 1

LAFO setup and sensors

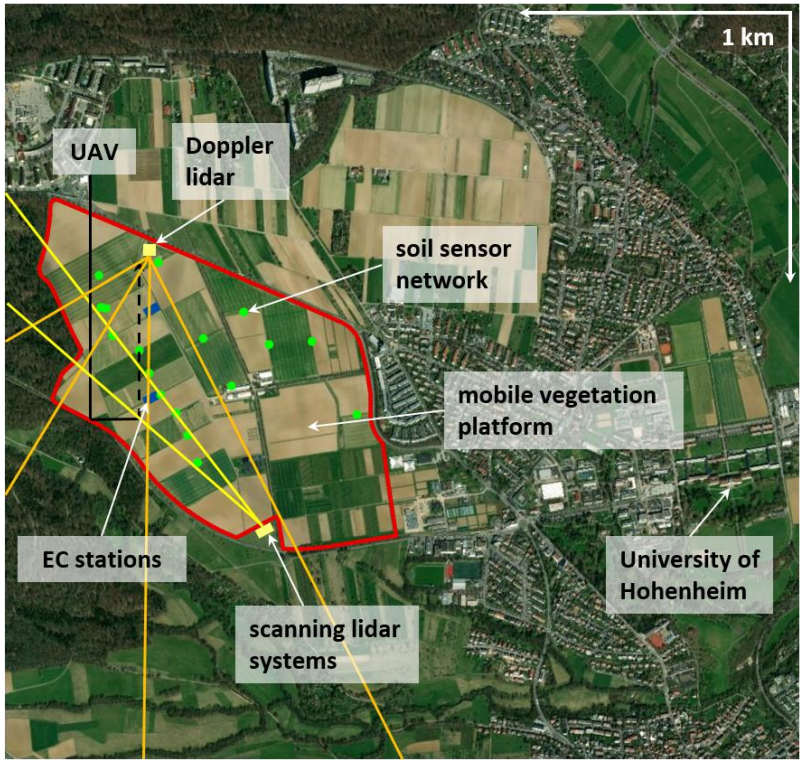


Figure 2.
Site: experimental station Heidfeldhof (red outline)

Atmosphere
- Scanning lidars (DIAL, RRL, DL) at Lidar Site
- Scanning Doppler lidar for cross-scanning
- Doppler Cloud Radar (DCR)
- Micro Rain Radar (MRR)
- Distrometer

Near surface/canopy
- UAV
- BreedVision (Busemeyer et al. 2013)
- Canopy Sensors
- LAI Sensor
- 2x eddy covariance stations (height 2.6 m) *

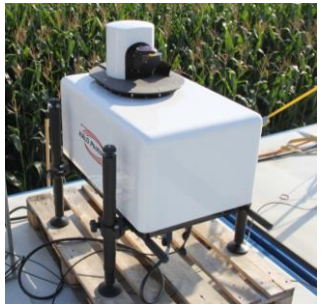
Soil
- Soil network with soil moisture and soil temperature sensors and tipping buckets *

* continuous measurements

LAFO setup and sensors

Figure 3.

Eddy covariance station



Scanning Doppler Lidar

Soil network

Temperature Raman Lidar

Scanning water vapor DIAL

UAV with hyperspectral camera

BreedVision

LAFO - EC stations

- Eddy covariance stations EC-N and EC-S were installed in July 2018
- Processed data (weather, flux and soil variables) have a 30 min resolution

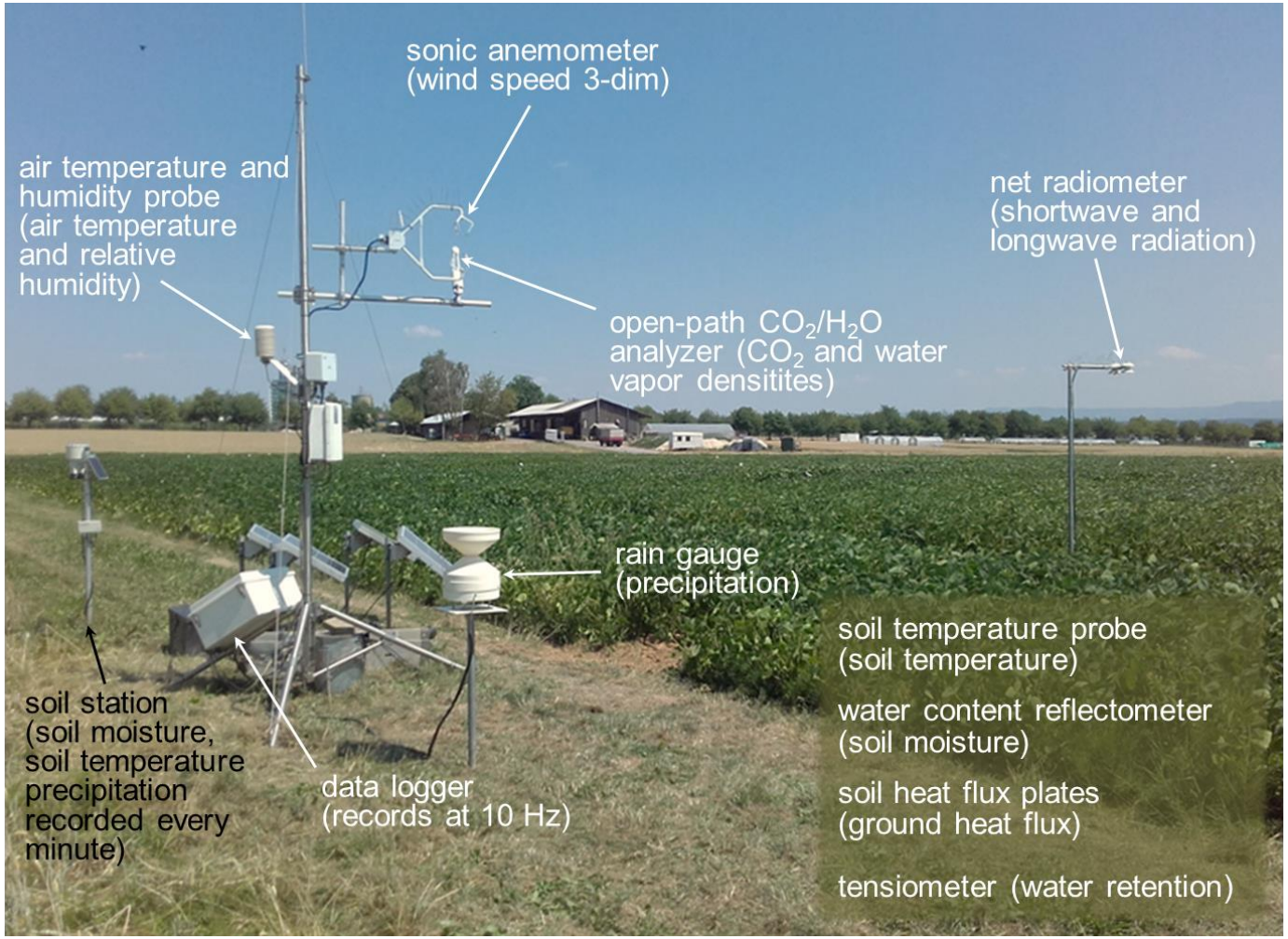


Figure 4.
Eddy covariance station EC-S and its sensors

LAFO - EC stations and heterogeneity

- Canopy around EC-S in 2019
  plot south winter wheat (ripening beginning July),
  plot north winter rape (ripening mid June)
- Diurnal variations of latent and sensible heat fluxes show differences depending on wind directions (at EC-S higher latent heat fluxes for wind direction south, i.e. when contribution from green winter wheat dominates)

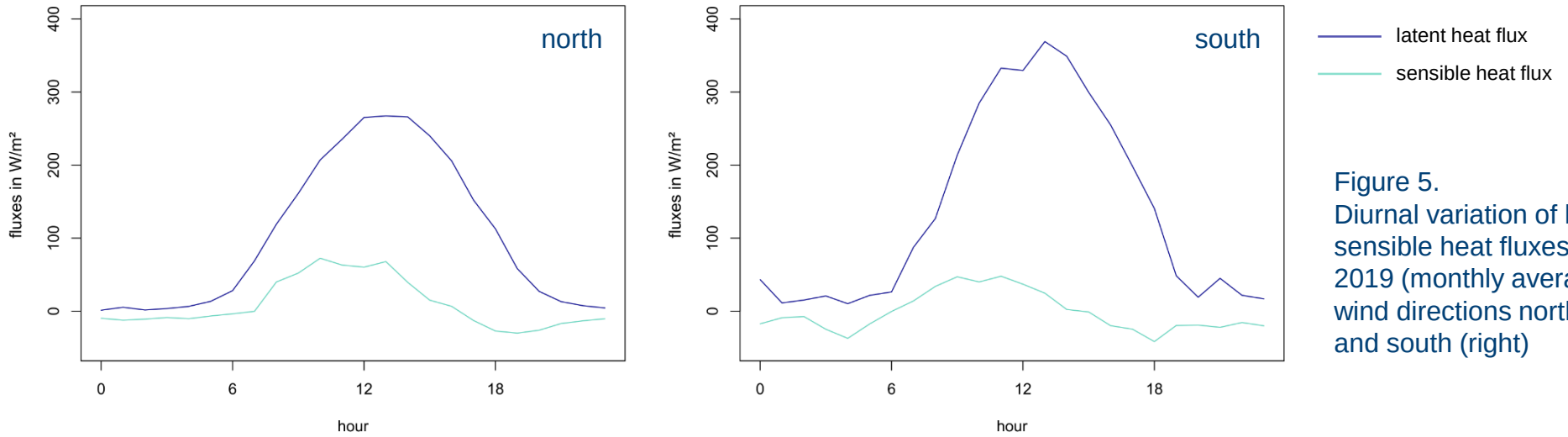


Figure 5.
Diurnal variation of latent and sensible heat fluxes in June 2019 (monthly average) for wind directions north (left) and south (right)

LAFO heterogeneous terrain

- Highly heterogeneous cropland with mainly winter rape, wheat, triticale, maize and barley

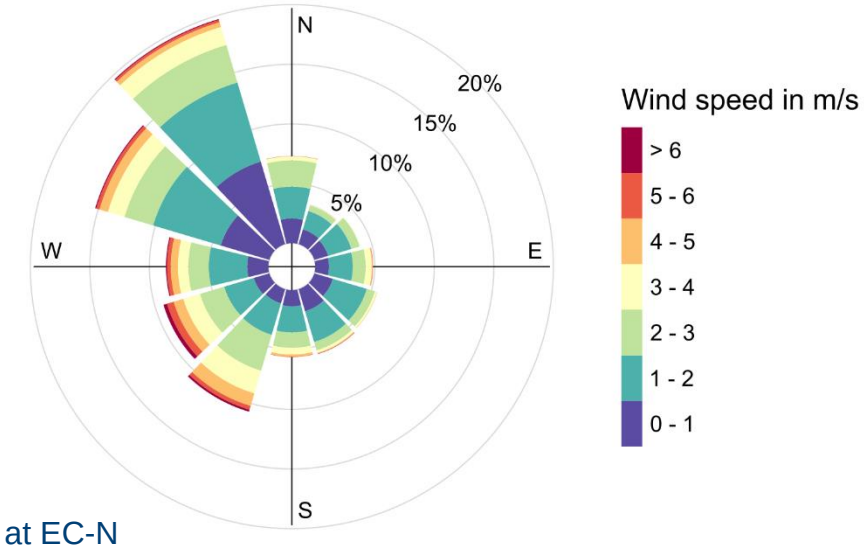


Figure 6.
Wind rose at EC-N for 2019

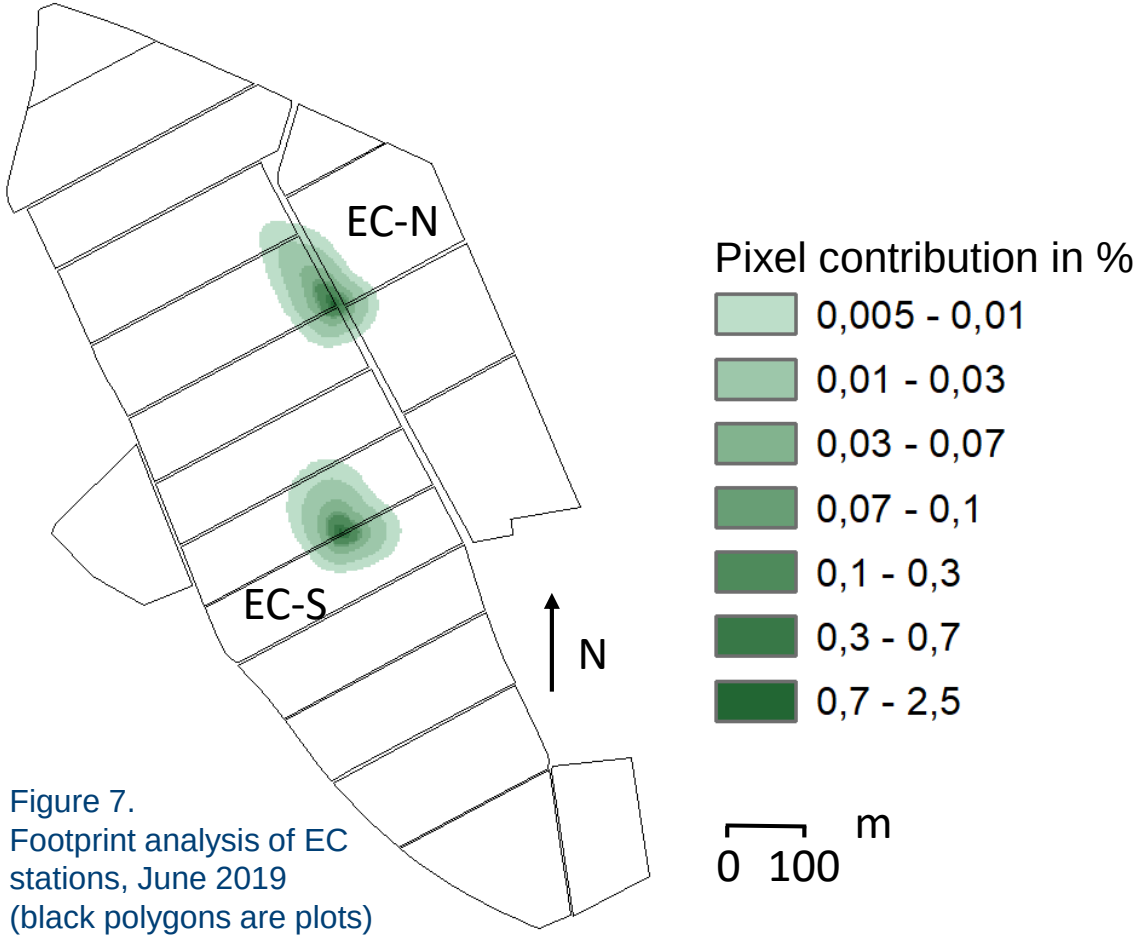


Figure 7.
Footprint analysis of EC stations, June 2019
(black polygons are plots)

LAFO heterogeneous terrain

- Highly heterogeneous cropland with mainly winter rape, wheat, triticale, maize and barley
- Footprint analysis of EC data with TK31
- EC-S main contribution from
  plot south winter wheat (ripening beg July),
  plot north winter rape (ripening mid June)

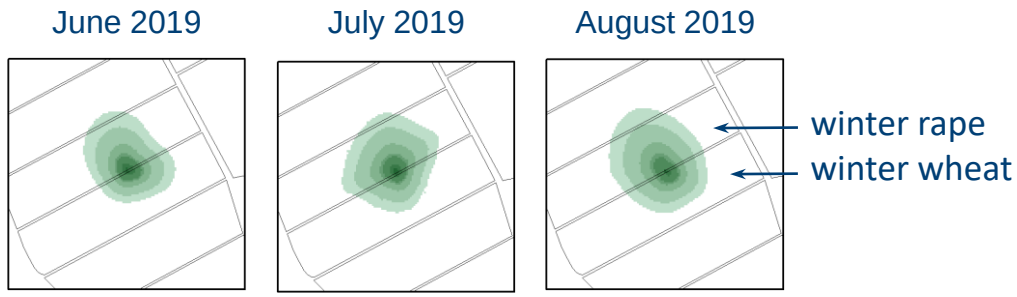


Figure 8.
Footprint analysis of EC-S

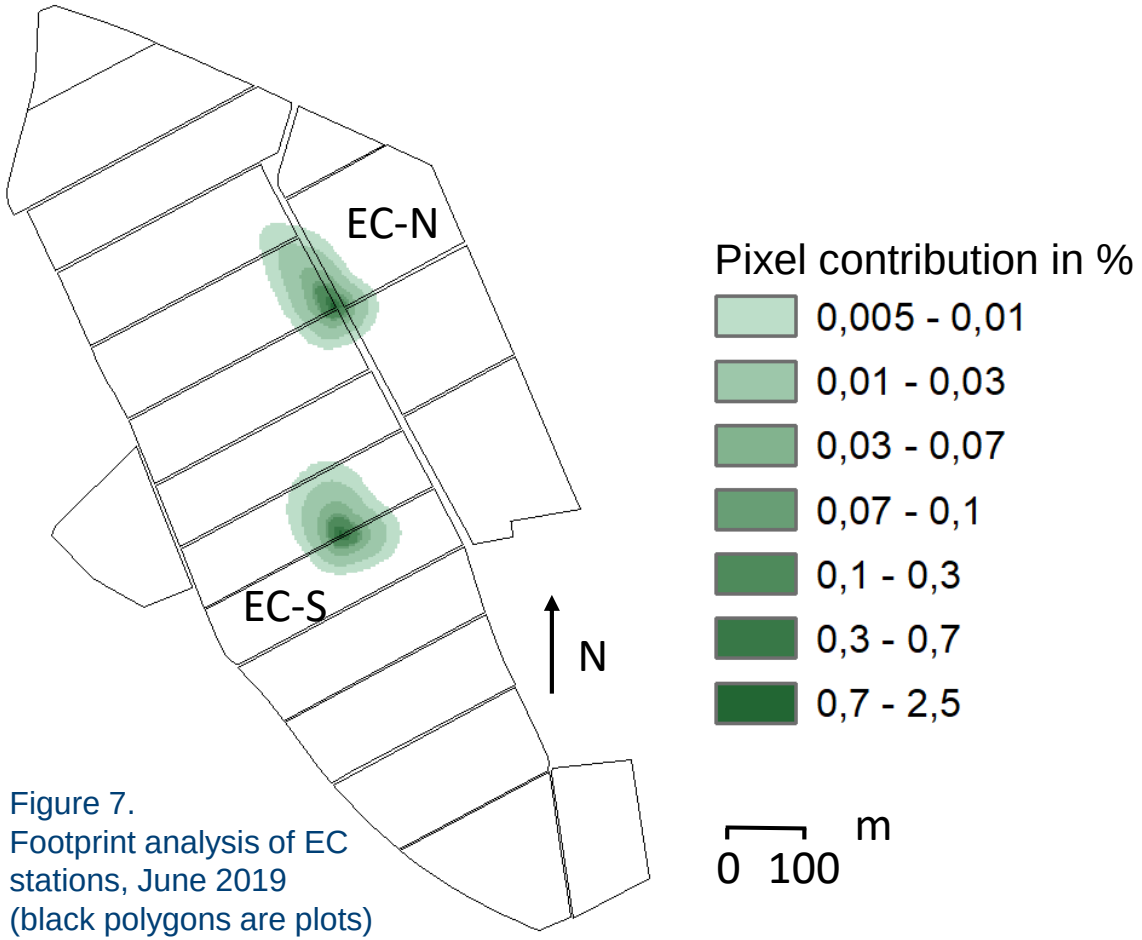


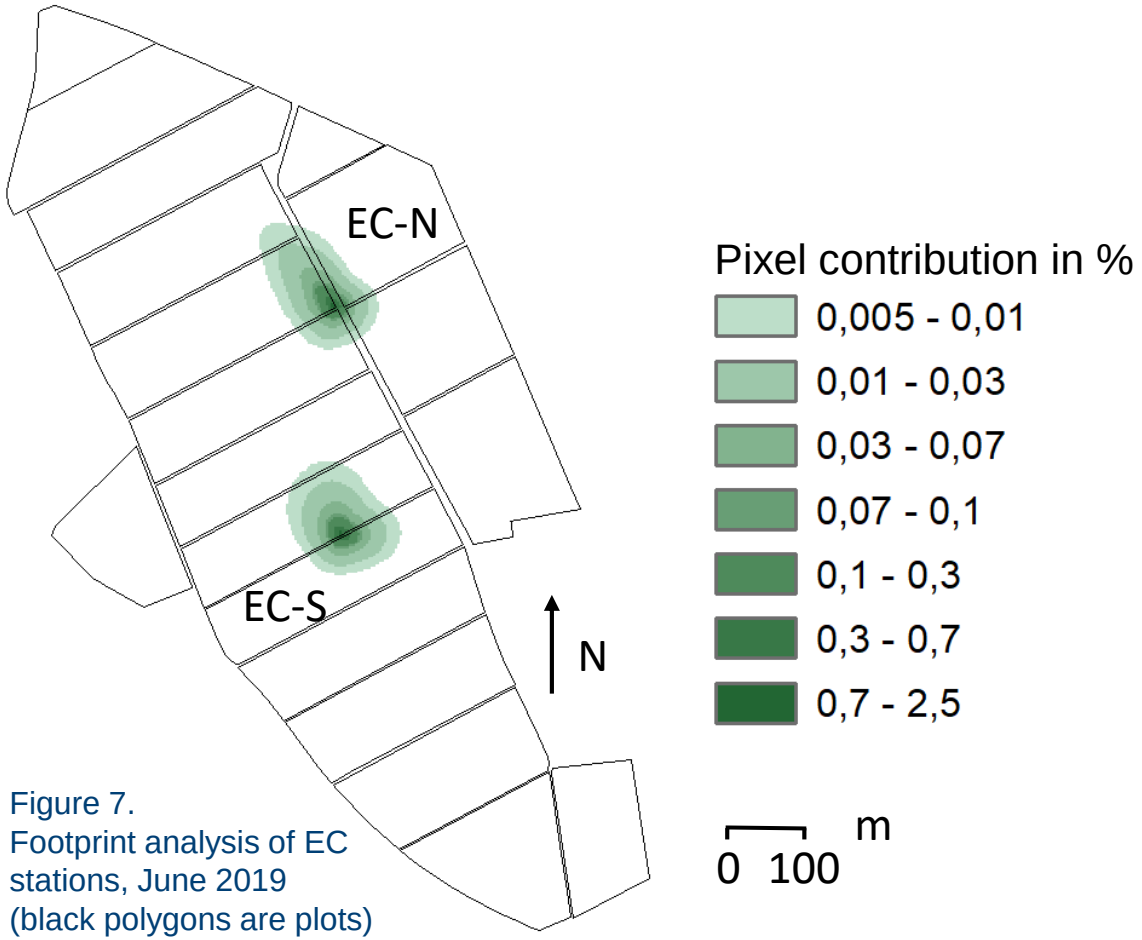
Figure 7.
Footprint analysis of EC stations, June 2019
(black polygons are plots)

LAFO heterogeneous terrain

- Highly heterogeneous cropland with mainly winter rape, wheat, triticale, maize and barley
- Footprint analysis of EC data with TK31
- EC-S main contribution from:
  plot south winter wheat (ripening beg July),
  plot north winter rape (ripening mid June)
- EC-N footprint is more complicated due to location (4 neighboring plots and driveway)

➢ **Complex footprints stretching over multiple plots with different crops**

➢ **Radiation and ground flux measurements only in plot north of station, extension to plot south planned**



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Footprint analysis of EC stations, June 2019
(black polygons are plots)

Outreach

Coordinated observations with all available instrumentation will be performed. You are welcome to join our observatory for a joint campaign with your instruments to target your research questions with a data set as comprehensive as possible.

Please get in contact with us! → lafo.uni-hohenheim.de

Acknowledgements

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