EGU General Assembly (2020)
May 4-8, 2020

Understanding the spatio-temporal variability of soil moisture by integrating cosmic-ray neutron probes with SoilNet wireless sensor networks under a seasonal Mediterranean-climate regime

HS1.1.3.
Innovative methods for non-invasive monitoring of hydrological processes from field to catchment scale
scheduled for Monday, May 4, 2020: 08:30 AM-10:15 AM

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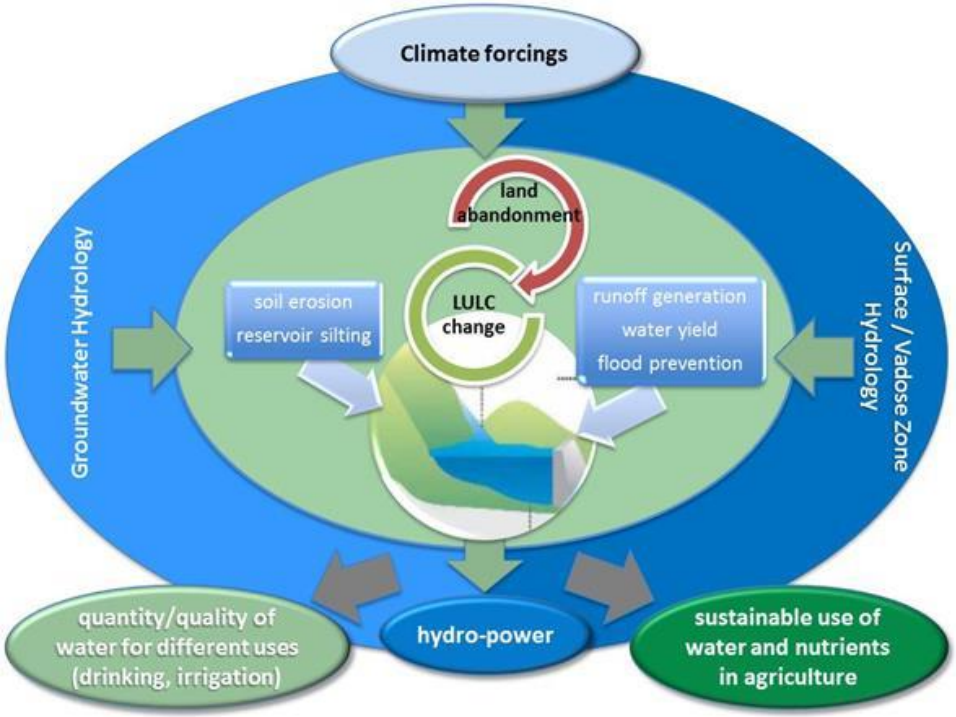
University of Napoli Federico II

Context:

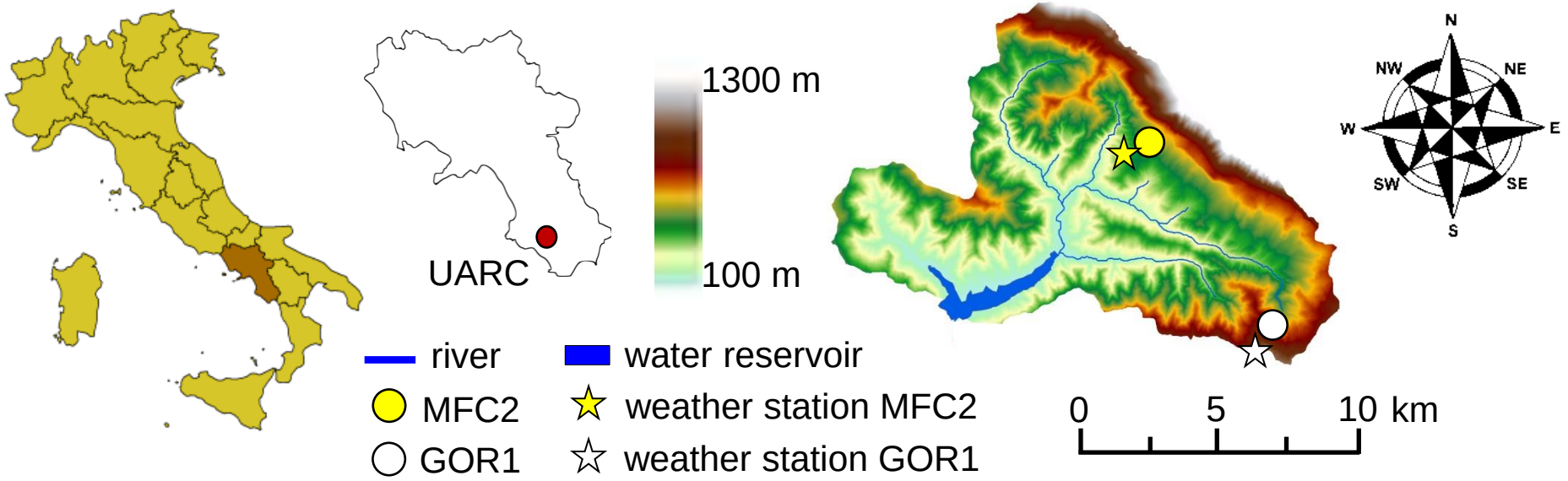
1) Adaptation options
2) Scenario-based projections
3) Advanced hydrological modeling
4) Monitoring

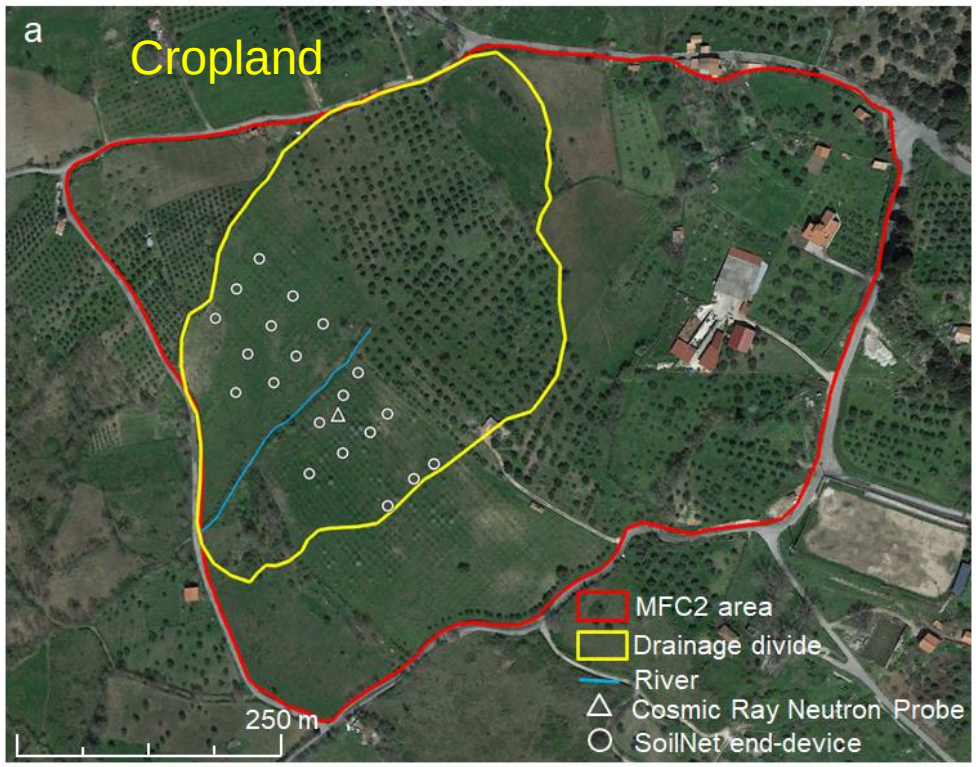


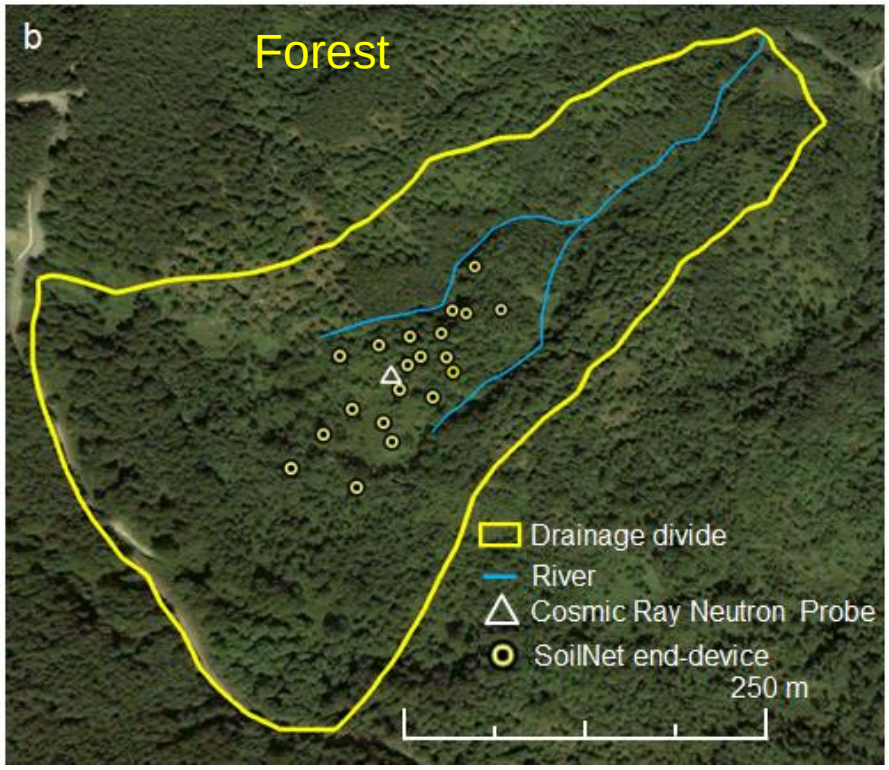
Goals:

1) Characterizing the hydrological behavior of two experimental sites by integrating invasive and non-invasive monitoring sensors
2) Establishing a field-scale water retention function
3) Showing the impact of rainfall seasonality on soil moisture pdfs

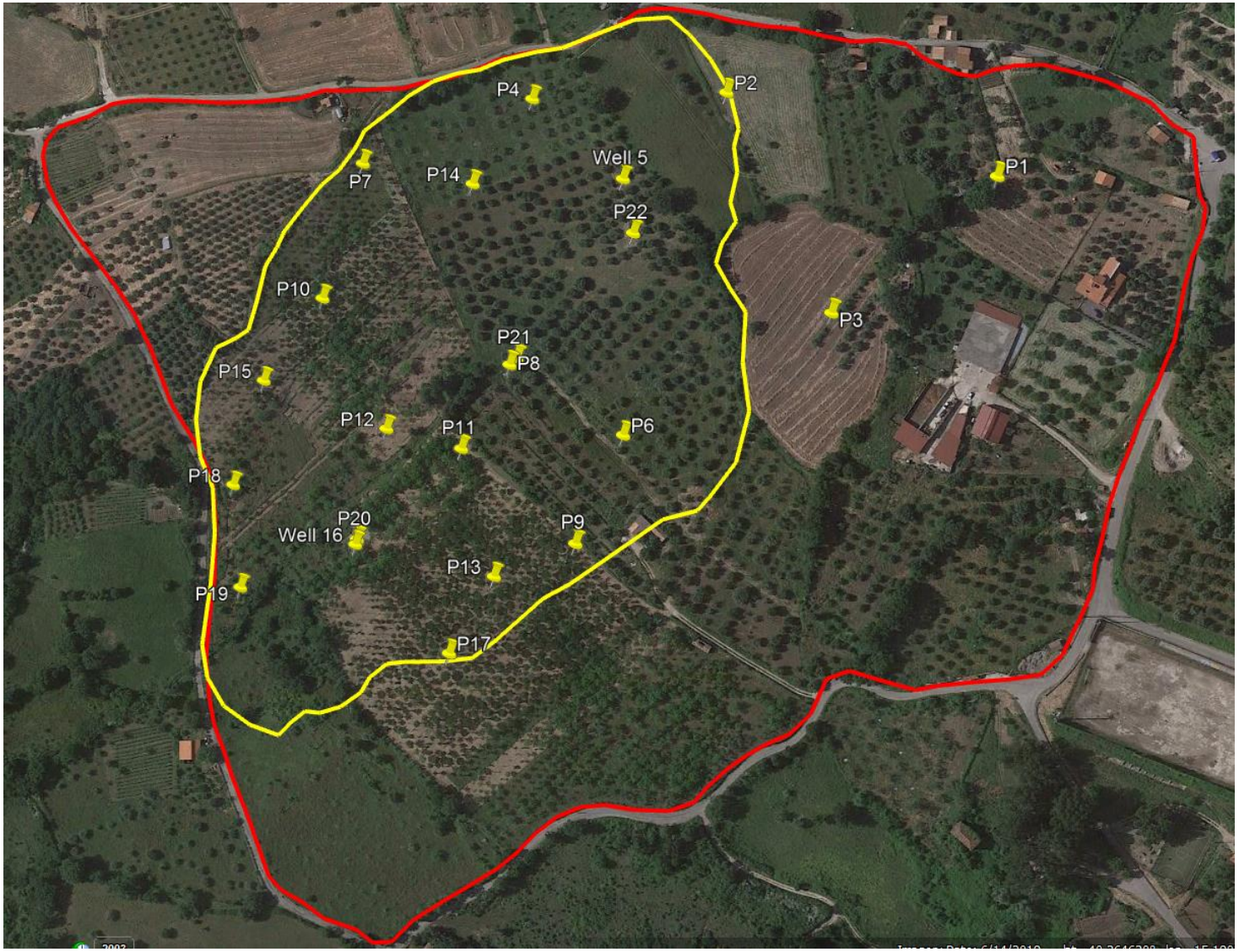
The Alento Hydrological Observatory (AHO)



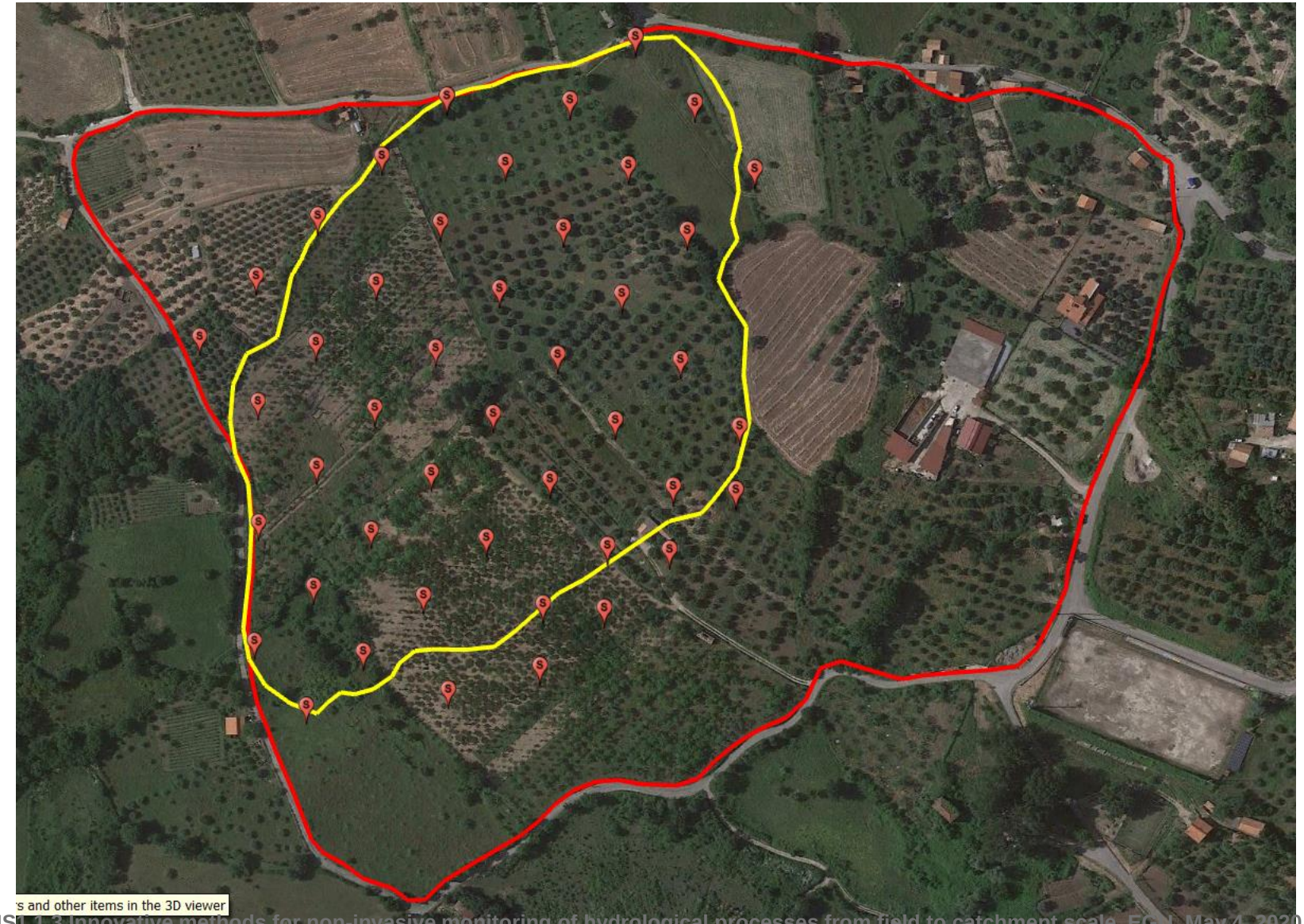




Position of 22 piezometers



Sampling positions. Soil physical and hydraulic properties will be determined in the Hydrology Laboratory



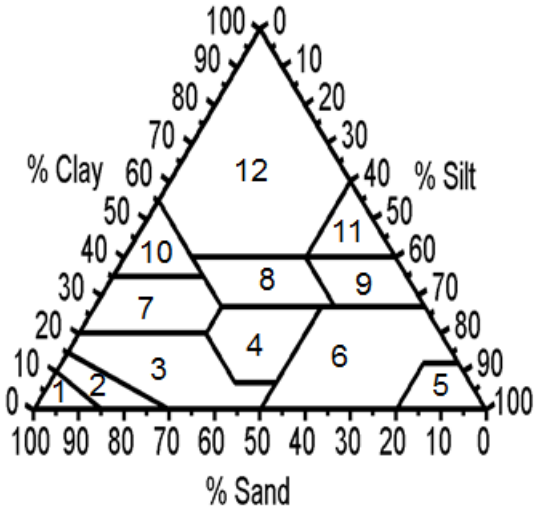
Environmental characteristics of the two sites

Site	Year	Units	2017	2018	2019
MFC2	R_a	mm	865.8	1481.6	1296.7
	T	°C	16.0	16.2	14.2
	ET_0,a	mm	710.9	596.7	579.3
GOR1	R_a	mm	599.6	874.8	735.8
	T	°C	13.5	13.7	13.7
	ET_0,a	mm	685.2	464.6	565.8

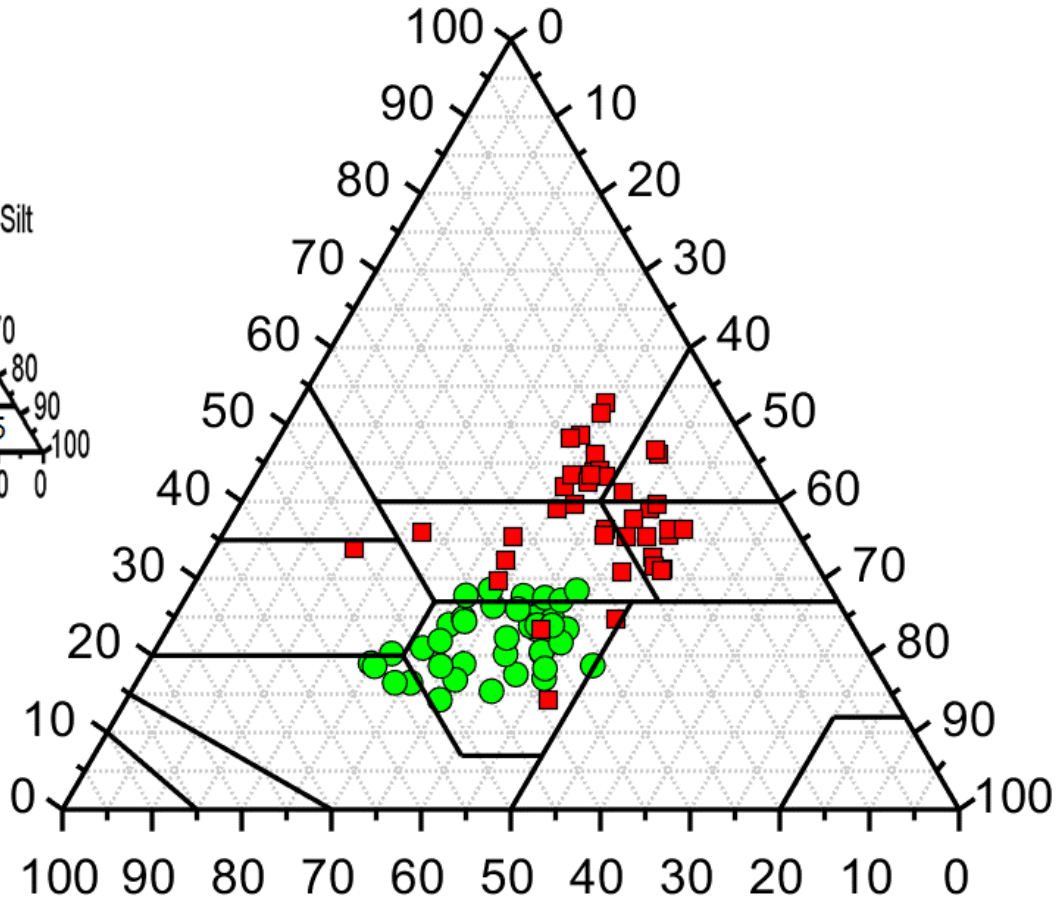
Data analysis is available for three full years (2017-2019)

Legend

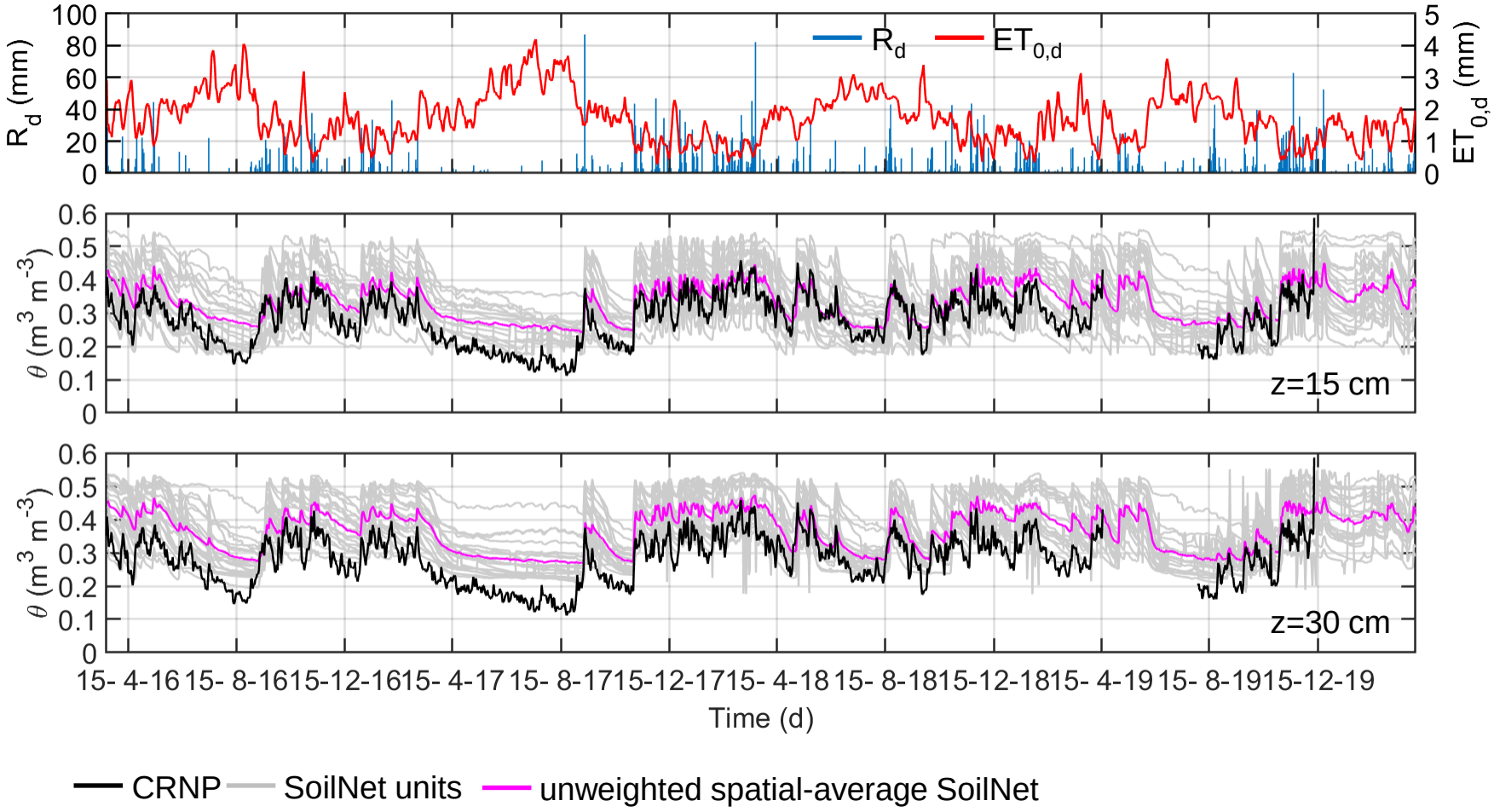
1 Sa
2 Lo-Sa
3 Sa-Lo
4 Lo
5 Si
6 Si-Lo
7 Sa-Cl-Lo
8 Cl-Lo
9 Si-Cl-Lo
10 Sa-Cl
11 Si-Cl
12 Cl



MFC2
GOR1



Soil moisture measured by SoilNet wireless sensor network (15 cm and 30 cm), and Cosmic Ray Neutron Probe



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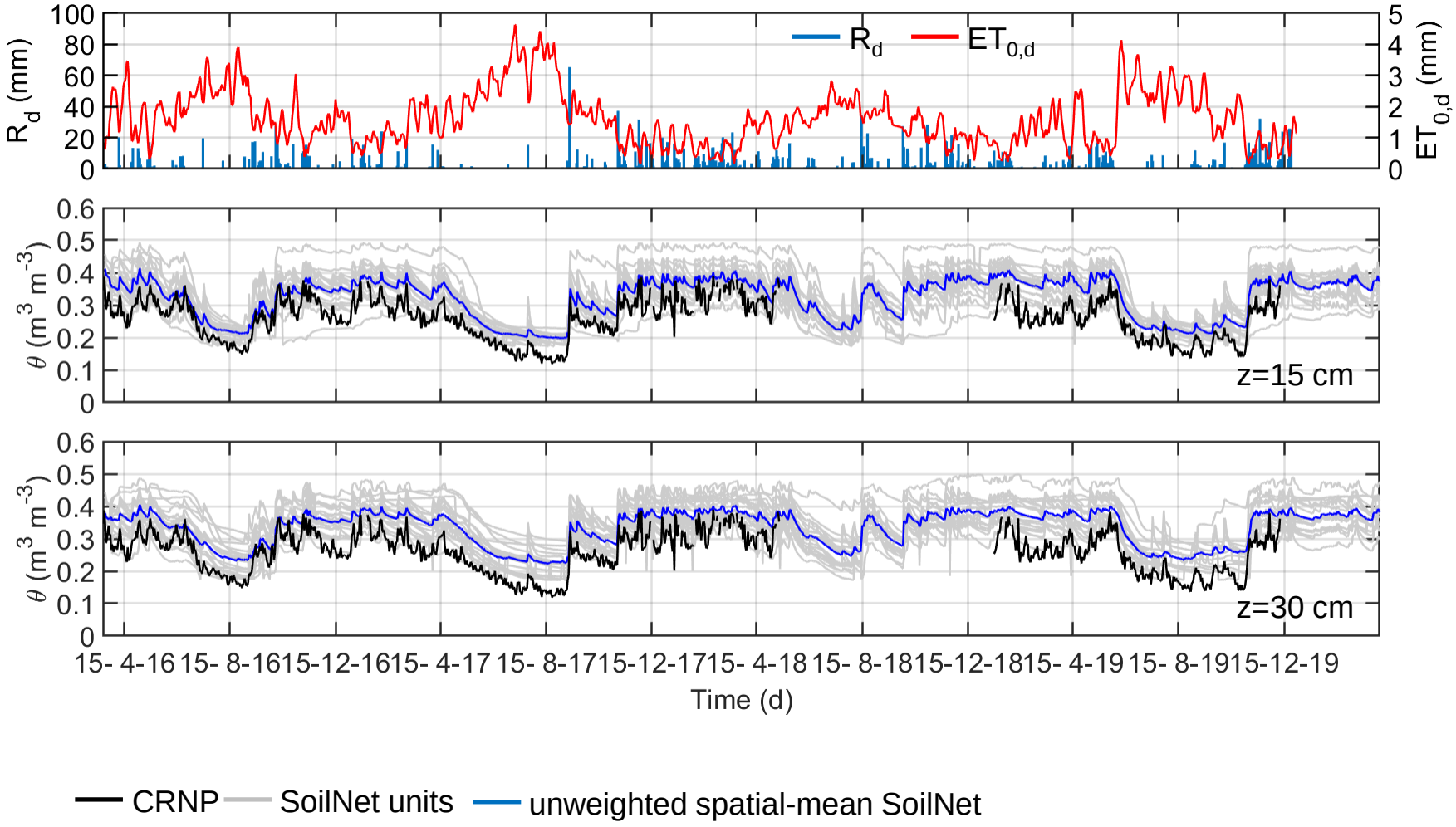
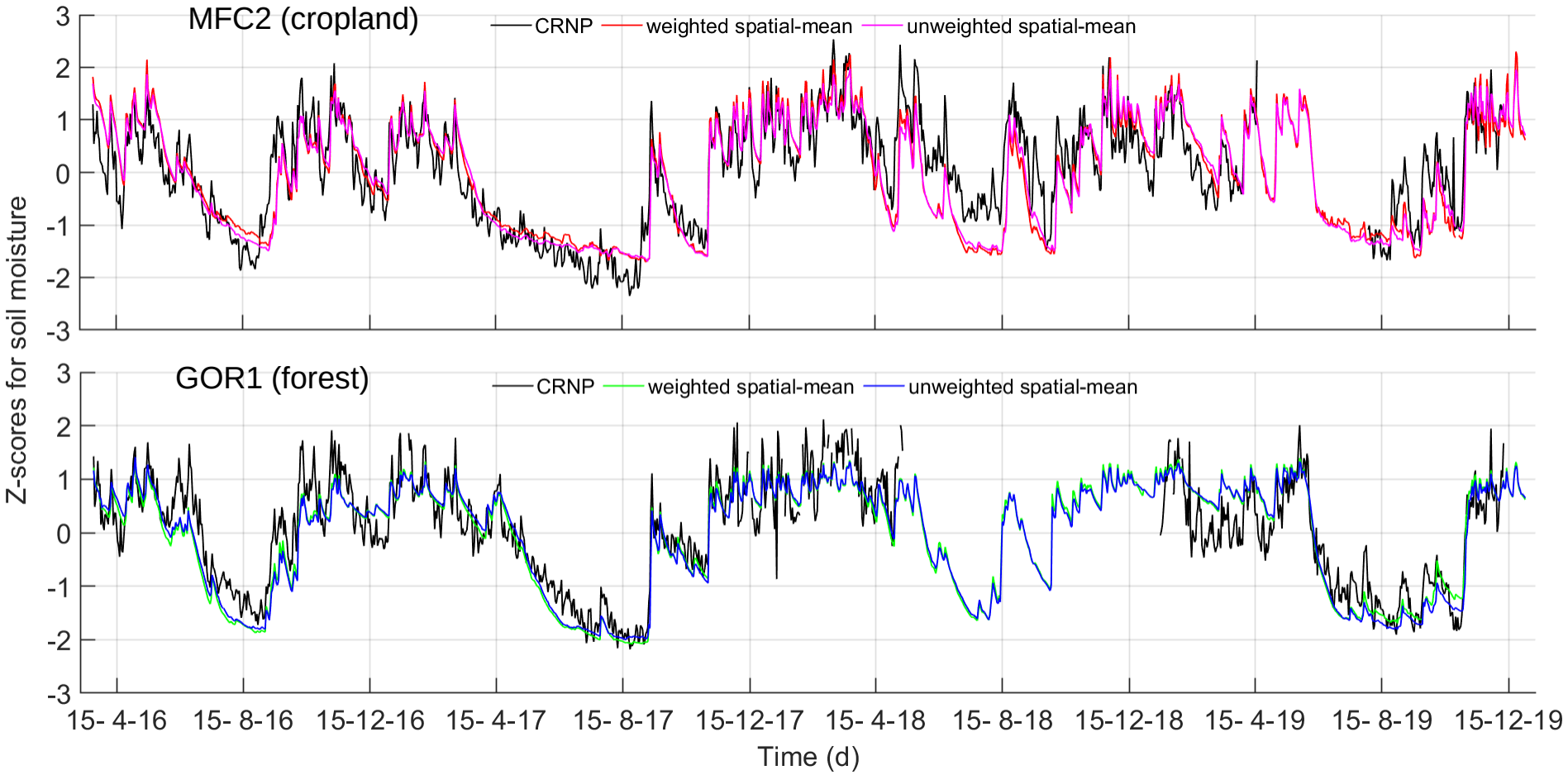
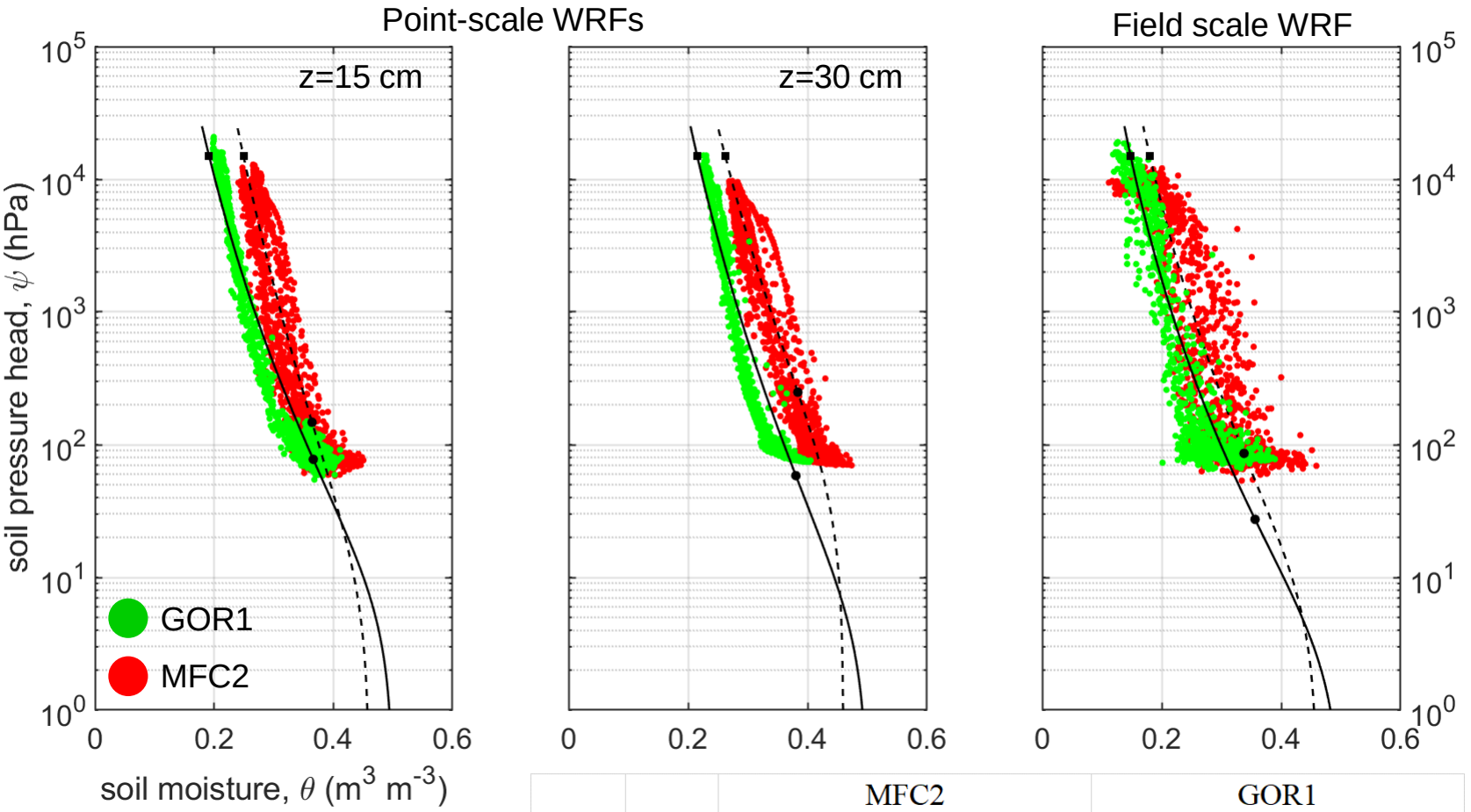


Comparison between CRNP-based and SoilNet-based soil moisture z-scores

1) CRNP-based soil moisture
2) Unweighted spatial-mean SoilNet-based soil moisture
3) Schron's weighting procedure to obtain the weighted spatial-mean SoilNet-based soil moisture



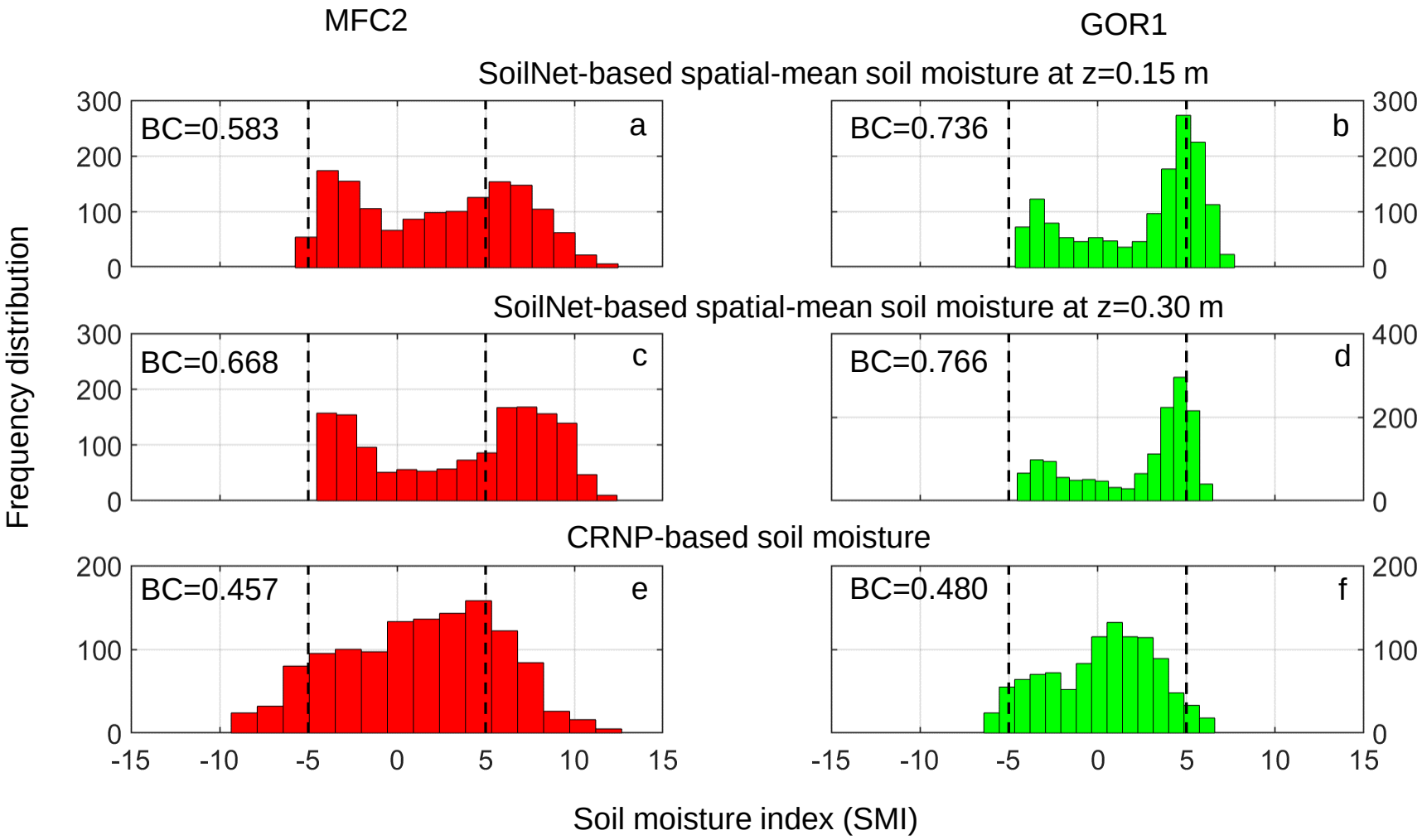
Comparison between point-scale and field-scale water retention functions (WRFs)



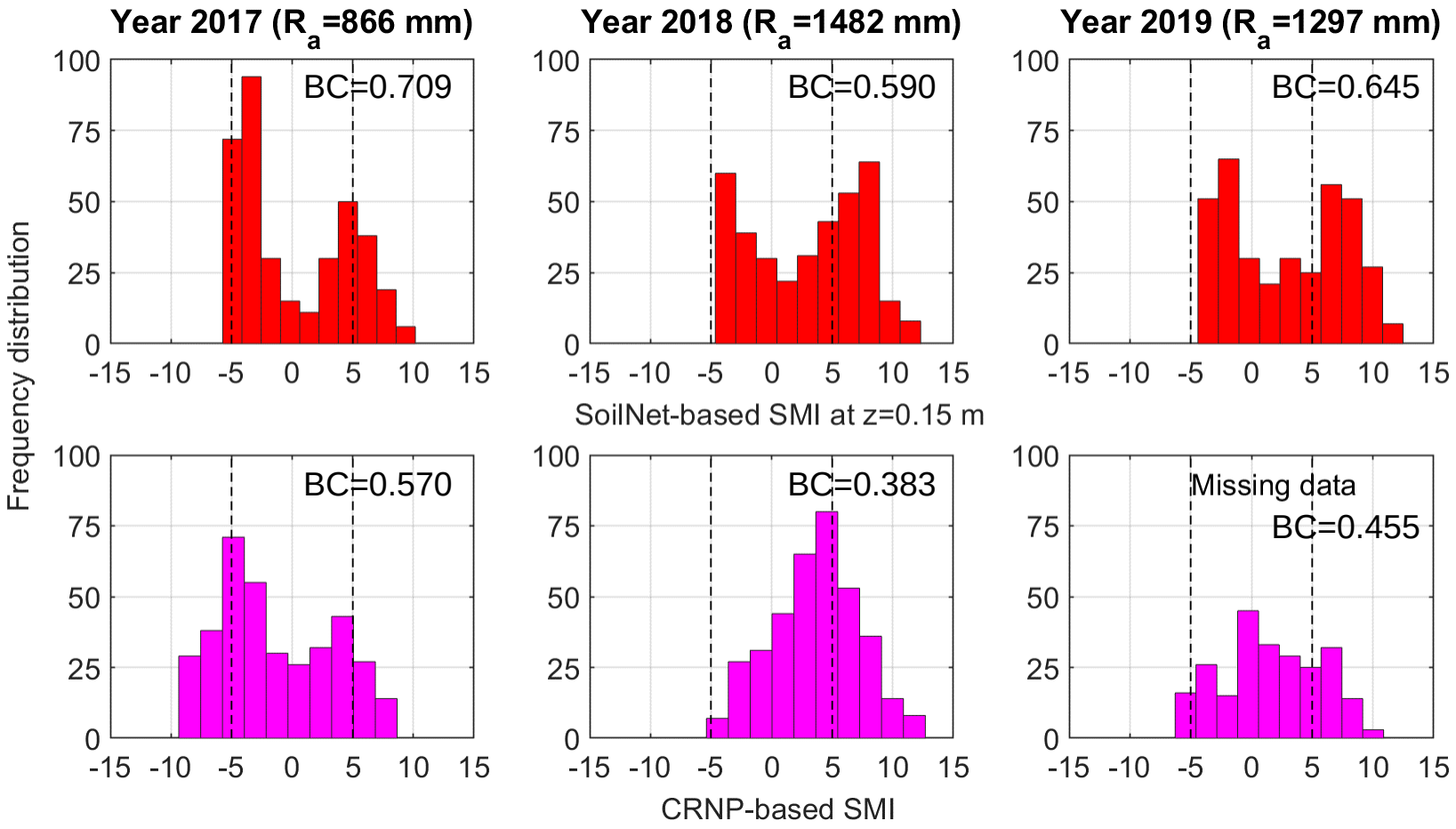
		MFC2			GOR1		
		z=15 cm	z=30 cm		z=15 cm	z=30 cm	
		point-scale		field-scale	point-scale		field-scale
θ_s	m^3 m^{-3}	0.46	0.46	0.46	0.5	0.5	0.5
α_{vG}	cm^{-1}	0.108	0.024	0.135	0.149	0.228	0.374
n_{vG}	-	1.08	1.09	1.12	1.13	1.12	1.14
θ_{FC}	m^3 m^{-3}	0.36	0.38	0.34	0.37	0.38	0.36
θ_{WP}	m^3 m^{-3}	0.25	0.26	0.18	0.19	0.22	0.15
RMSE	m^3 m^{-3}	0.020	0.017	0.037	0.017	0.014	0.029

Comparison between MFC2 and GOR1

Use of bimodality coefficient (BC) to assess if the pdf is unimodal or bimodal. If BC>0.555 distribution is bimodal



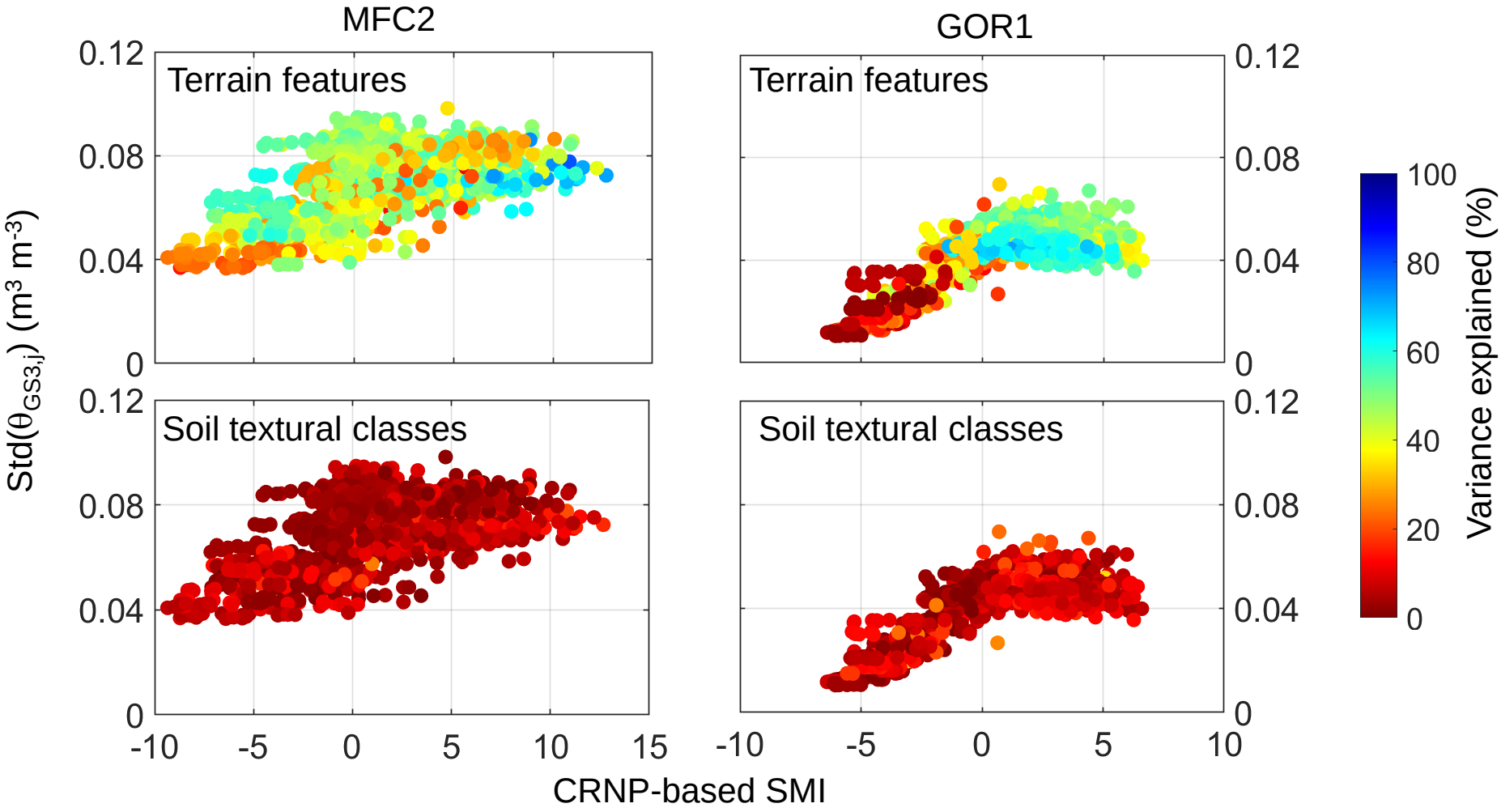
Frequency distributions of SMI in 2017, 2018, 2019 in MFC2



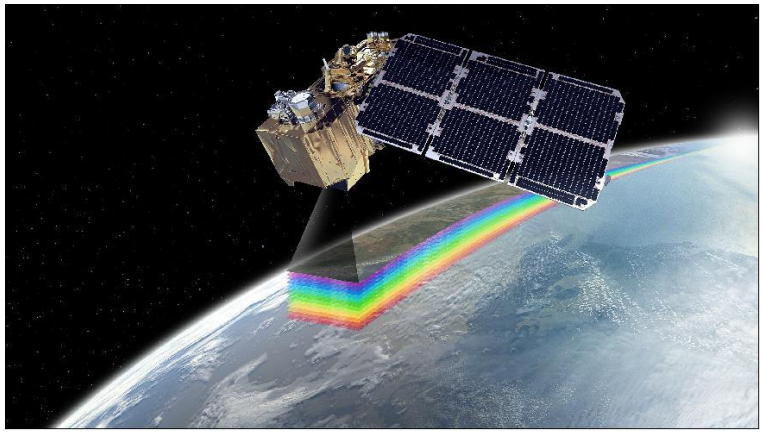
If BC>0.555 the frequency distribution is considered bimodal

Comparison between MFC2 and GOR1

Relationship between CRNP-based SMI and SoilNet spatial standard deviation of soil moisture values at z=0.15 m



- Field surveys using geophysical methods and isotopic campaigns (streamflow, groundwater, soil and plant).
- Visible and near infrared spectroscopy (UAV) for developing site-specific PTFs.
- Integrating ground-based (SoilNet wireless sensor networks, Cosmic Ray sensors) with remote-based (Sentinel-1) measurements of soil moisture.
- Sharing our data set in ENOHA portal with other TERENO observatories across Europe.



Thank you. Grazie.

MiUR-PRIN Project “Innovative methods for water resources management under hydro-climatic uncertainty scenarios” (grant 2010JHF437)

Development of a Multi-Sensor Concept for Earth Observation based Monitoring of Ecosystem Services in a Changing Environment (grant BayIntAn_UWUE_2019_95)