ASSESSMENT OF REMOTE SENSING PRODUCTS OVER AGRICULTURAL SITES IN NORTHERN ITALY BASED ON COSMIC-RAY NEUTRONS SENSING

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SoMMet

Motivations…

Valuable to establish a network for monitoring spatial and temporal variability of soil water content SWC, e.g.:

- weather, flood, fire and landslide prediction
- Agriculture and irrigation
- …

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Difficulties to install sensors everywhere…

- The use of remote sensing

Current remote sensing practices

- Calibration and validation of remote sensing products based on ground measurements
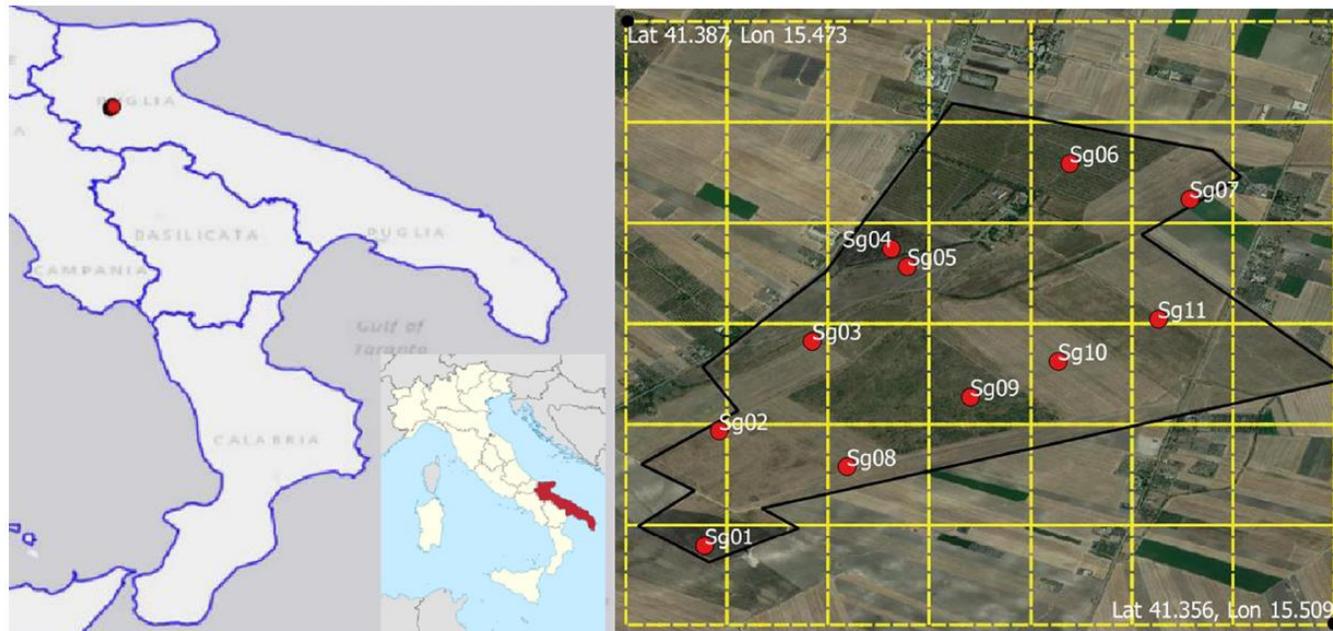
- Difficulties spatial mismatch: point-scale vs. pixel wise (e.g., 1 km^2)

Balenzano, Anna, Francesco Mattia, Giuseppe Satalino, Francesco P. Lovergine, Davide Palmisano, Jian Peng, Philip Marzahn, et al. "Sentinel-1 Soil Moisture at 1 Km Resolution: A Validation Study." *Remote Sensing of Environment* 263 (September 15, 2021): 112554. https://doi.org/10.1016/j.rse.2021.112554.

Fig. 1. Left panel: Location of the hydrological network (in red) at the Apulian Tavoliere site (Apulia region, Southern Italy). Right panel: distribution of the stations (red points) at the Segezia experimental farm (black line) over the S-1 soil moisture product grid with 520 m grid spacing (yellow lines). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

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On the use of cosmic-ray neutron sensing - CRNS
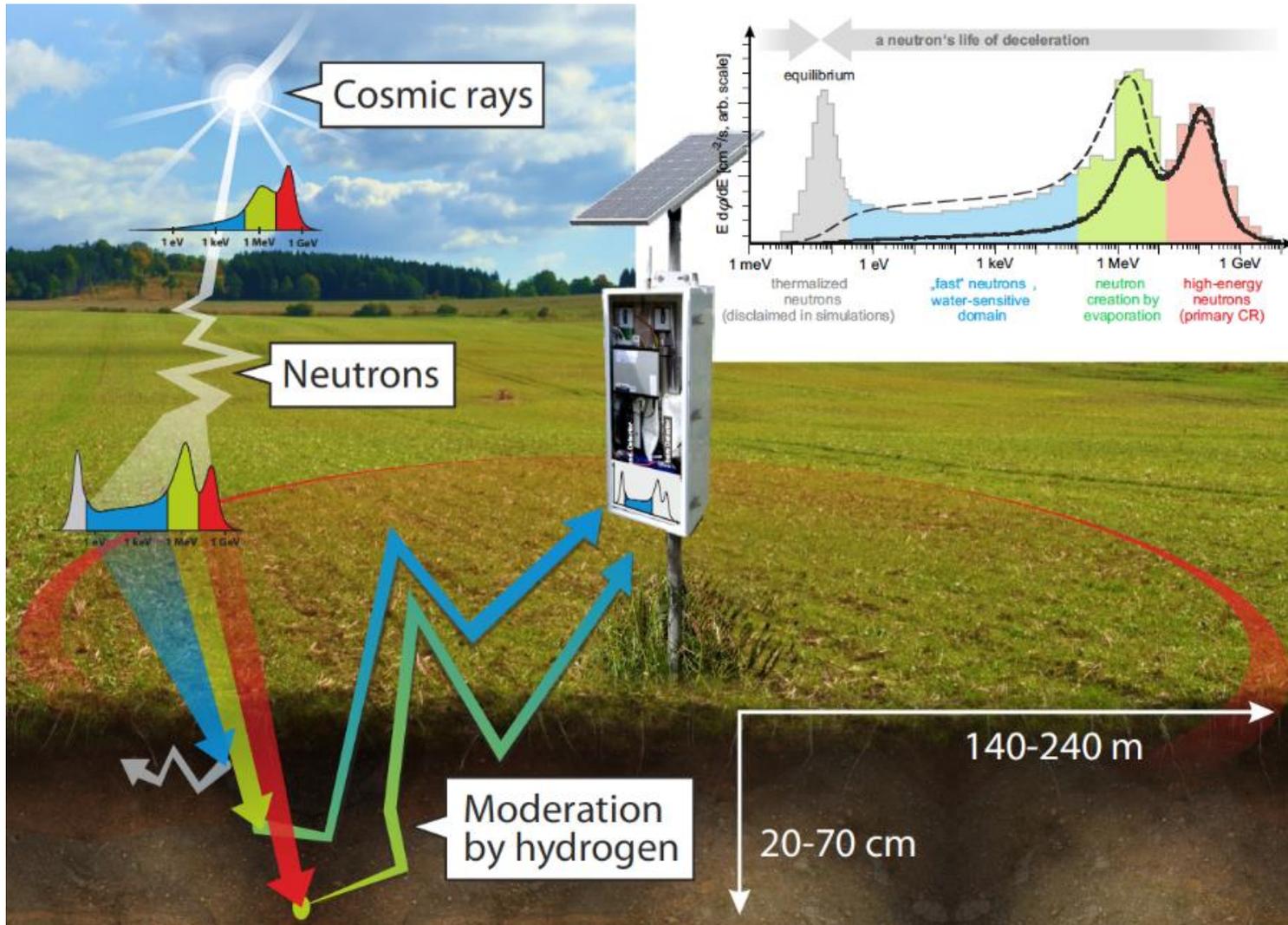
Non invasive

Large footprint
(5 ha, 50 cm depth)

Samller spatial scale mismatch

Slide courtesy of M. Schron

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Assessment of Copernicus Soil Water Index (SWI)

- The Copernicus Global Land Service provides **daily** Soil Water Index (SWI) **data at a 1 km** resolution for various depths over Europe.

- SWI is calculated by **combining** Surface Soil Moisture (SSM) observations from Sentinel-1 C-band SAR and Metop ASCAT sensors.
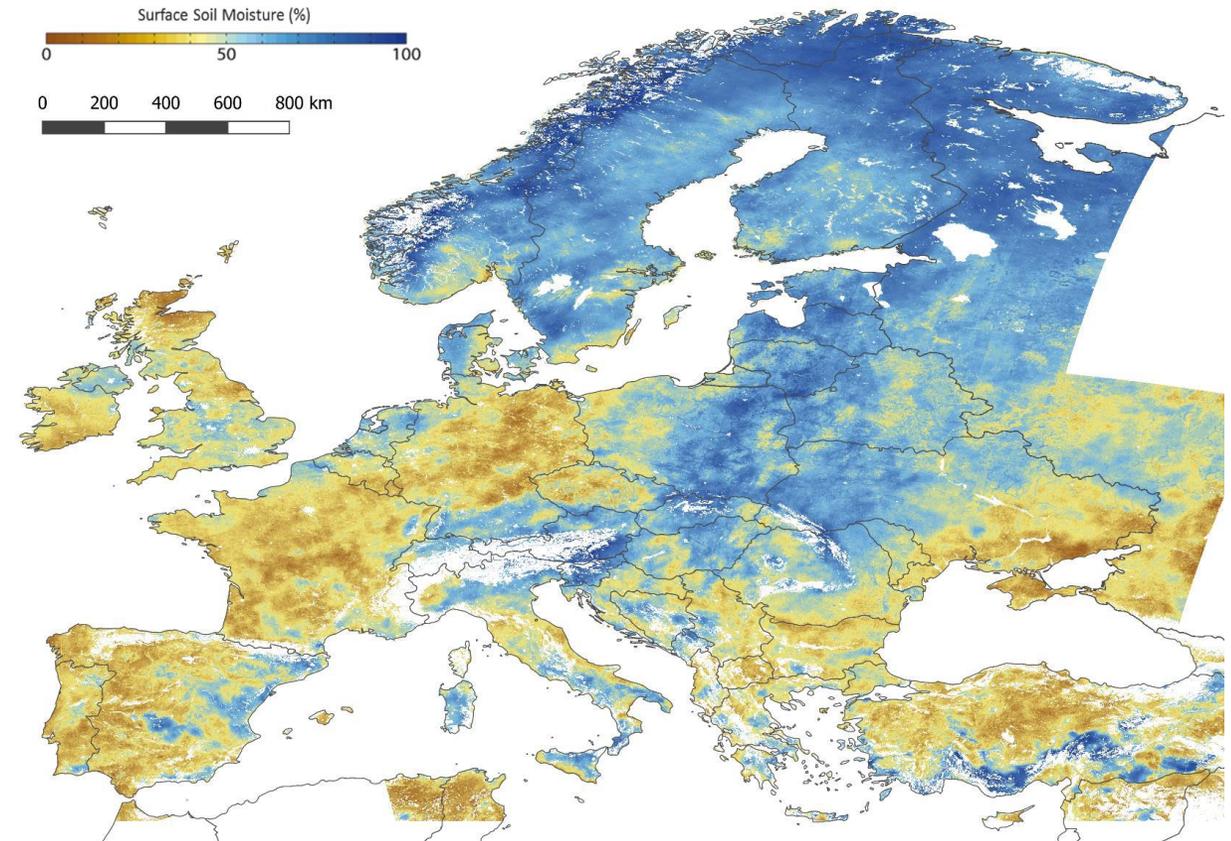
Field sites

- We compare remote sensing and non-invasive CRNS sensors across **four diverse agricultural sites in Northern Italy**

- The data covers the **2021 growing season,** encompassing wet and dry periods, with SWI estimating soil moisture at various depths (2.5 cm and 10 cm)

- **Representativeness:** we also explore the NDVI (**Normalized Difference Vegetation Index**) over the area as an indicator of vegetation vigor and biomass. NDVI were acquired using Bottom-of-Atmosphere Sentinel-2 images with the cloud filtering percentage of 40
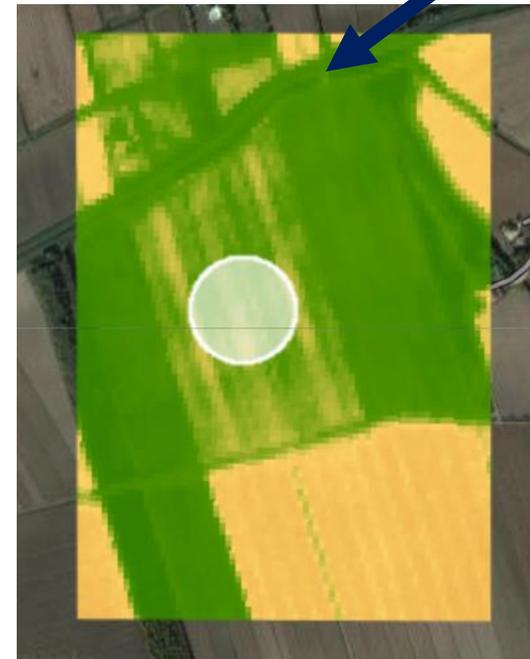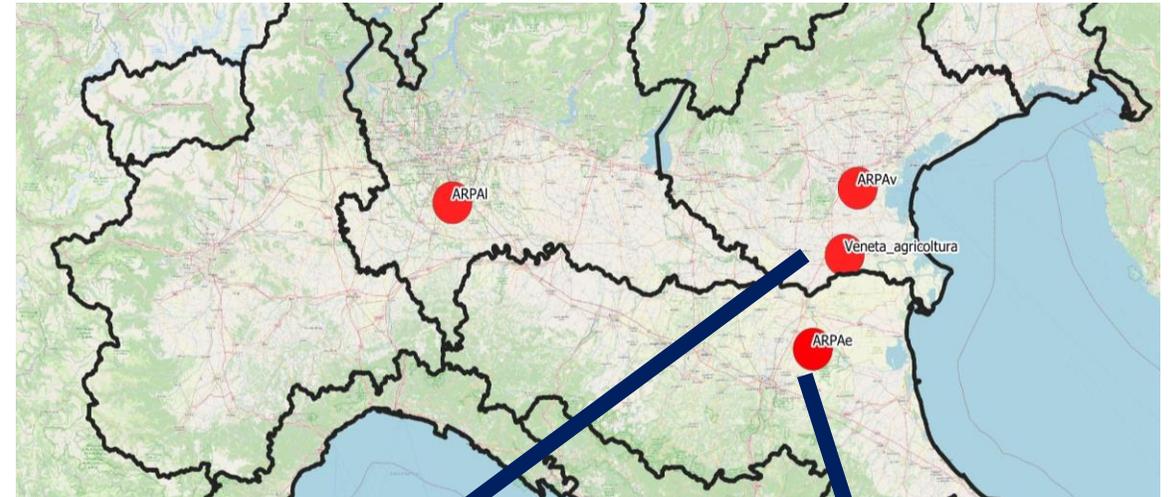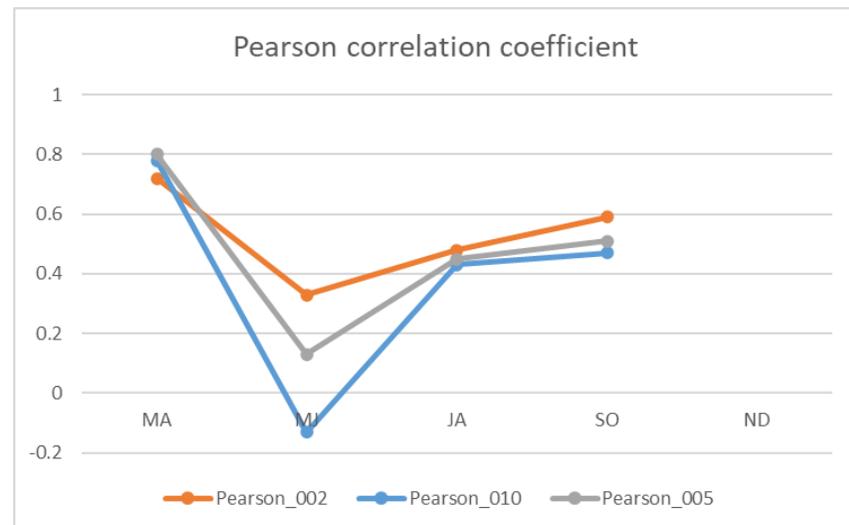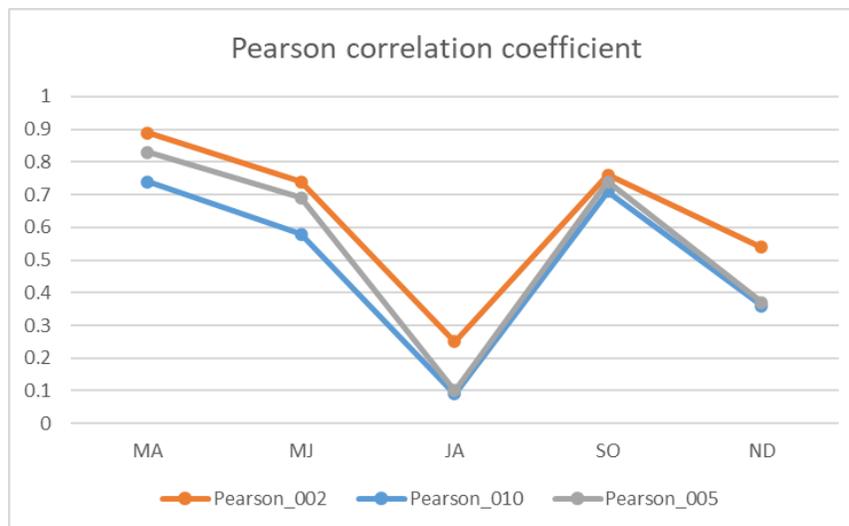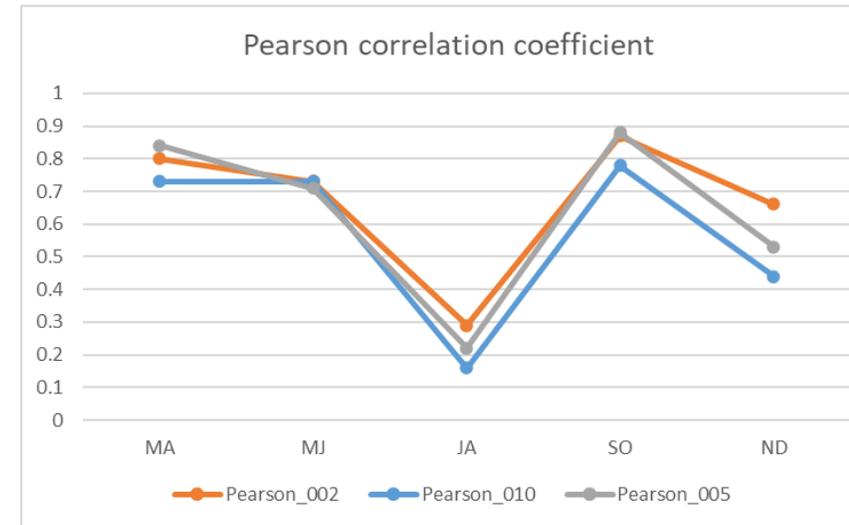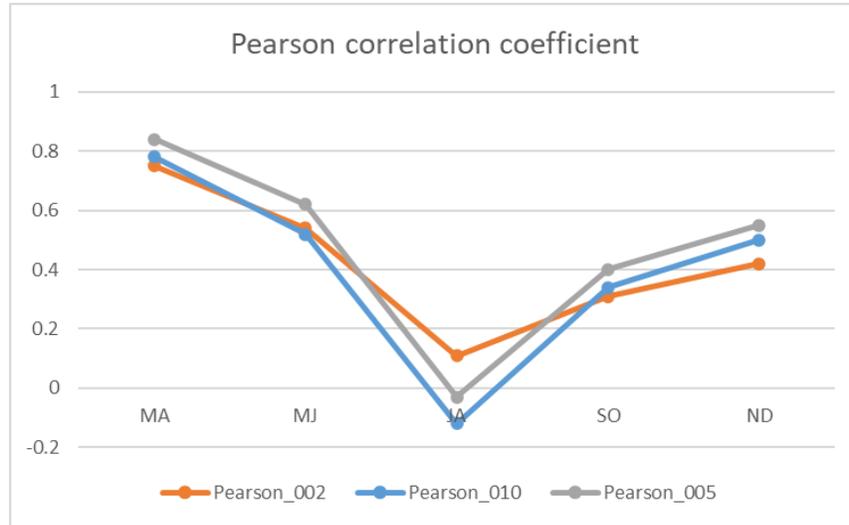
Example Site 1 - Ceregnano (Ro)

NDVI over the pixel (box plot)
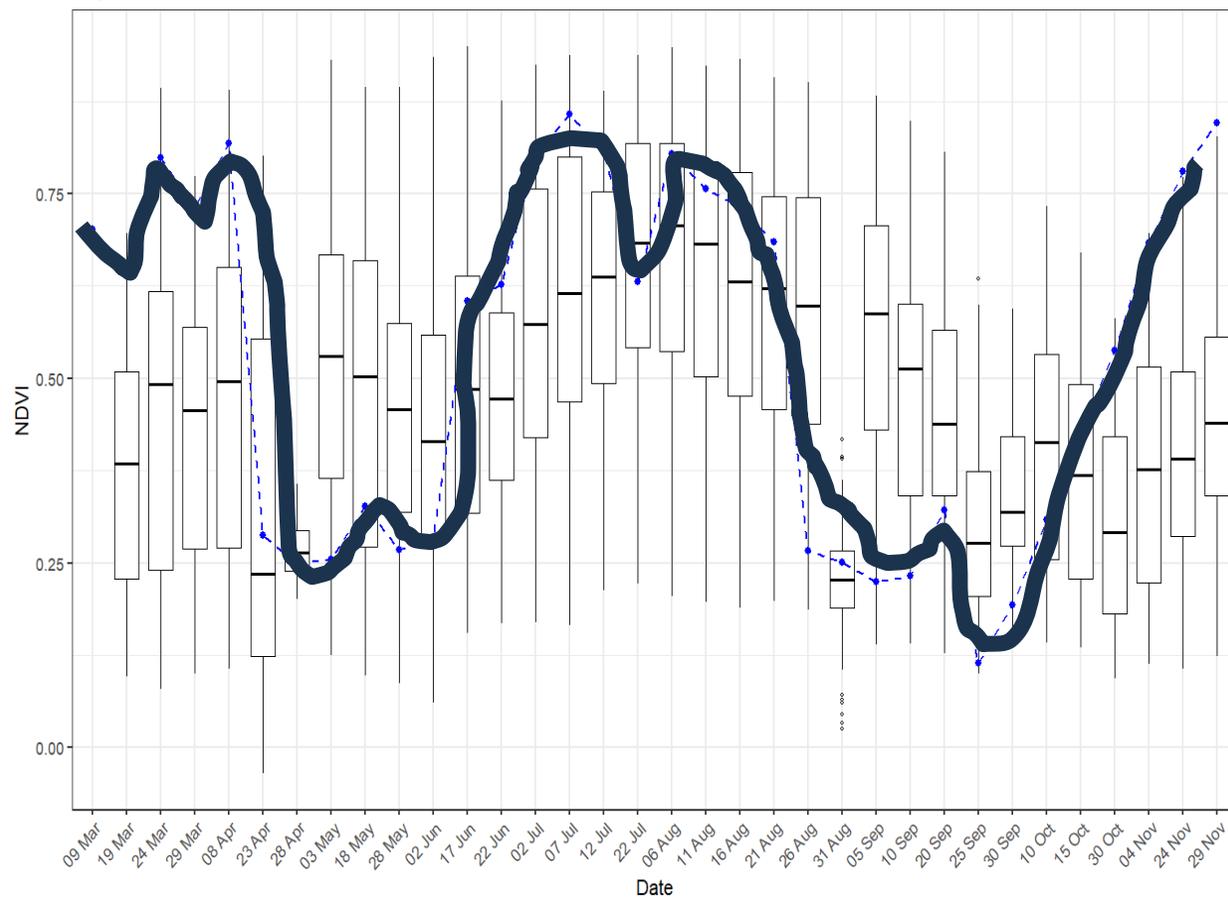
Median NDVI over the CRNS (line)

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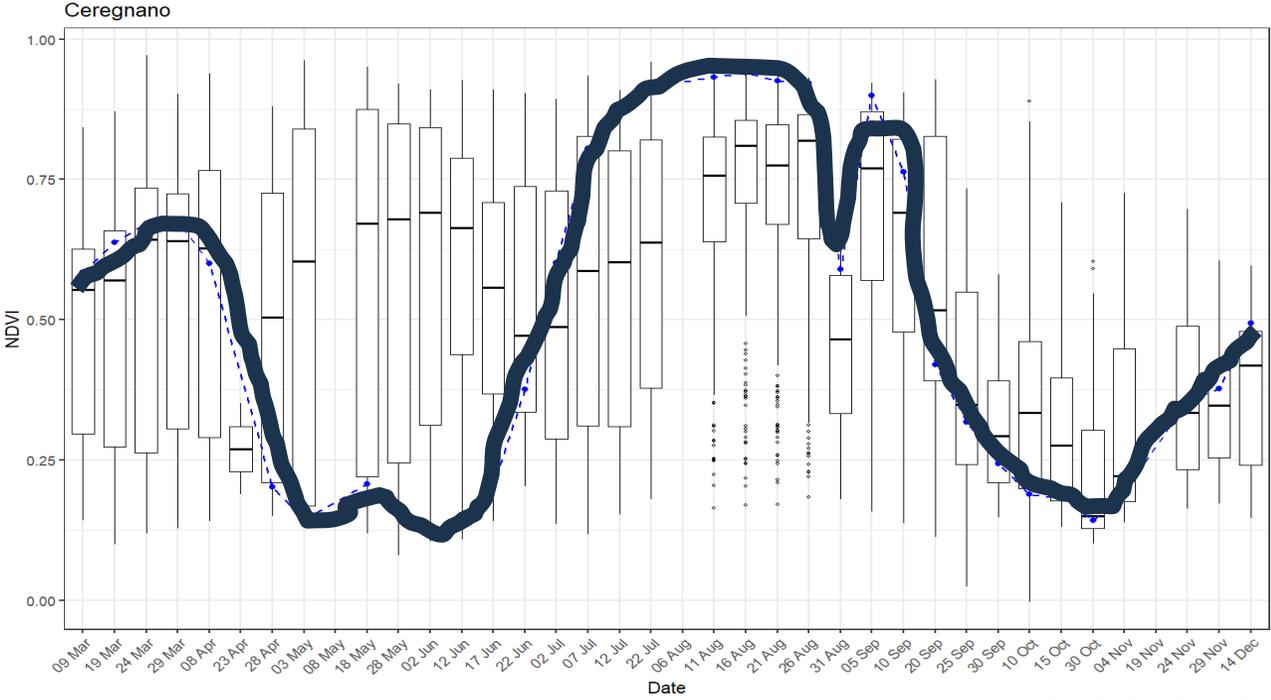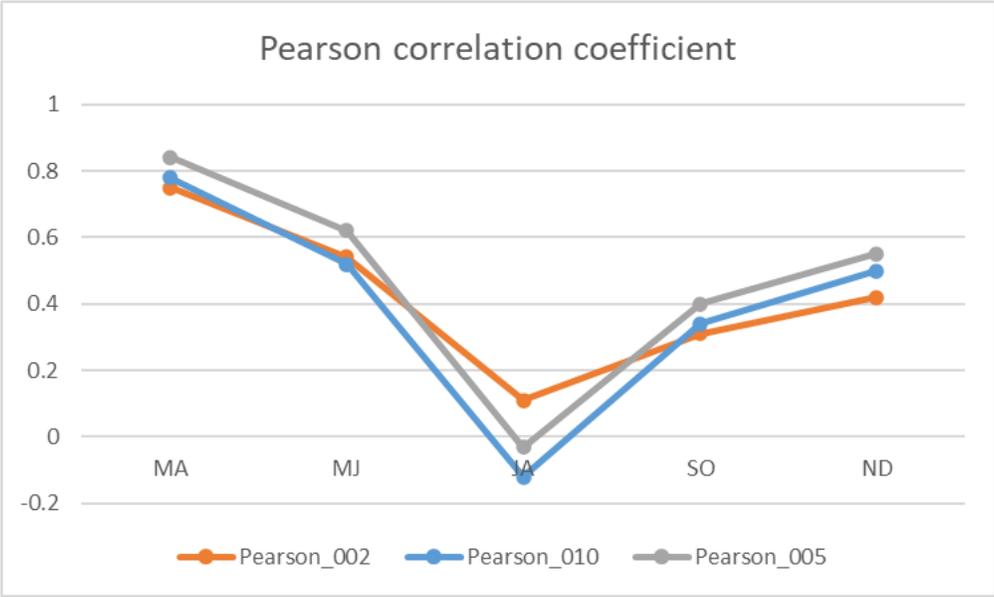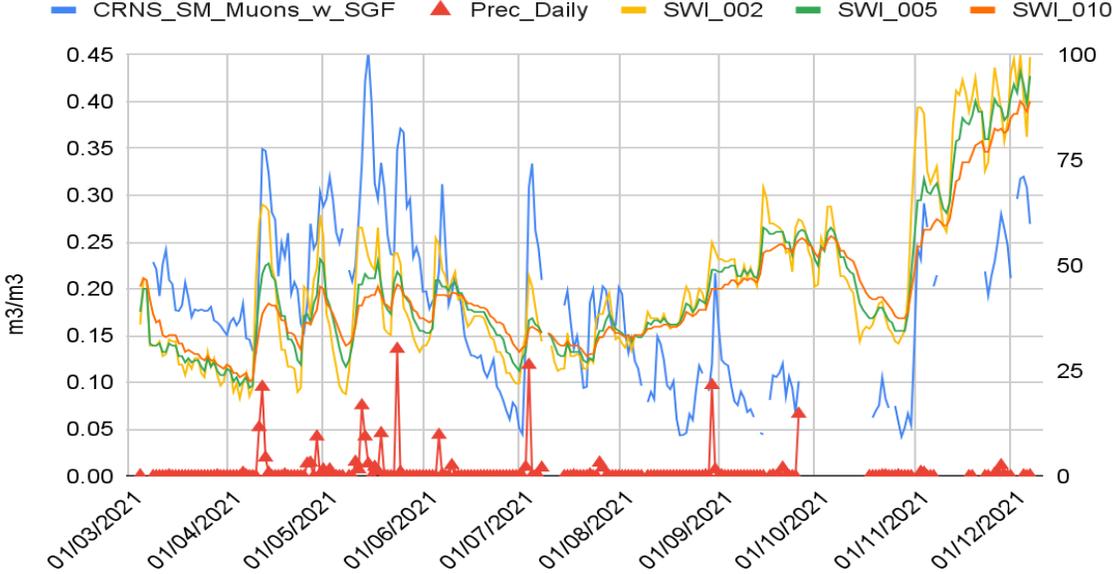
Pearson correlation coefficient at the four sites

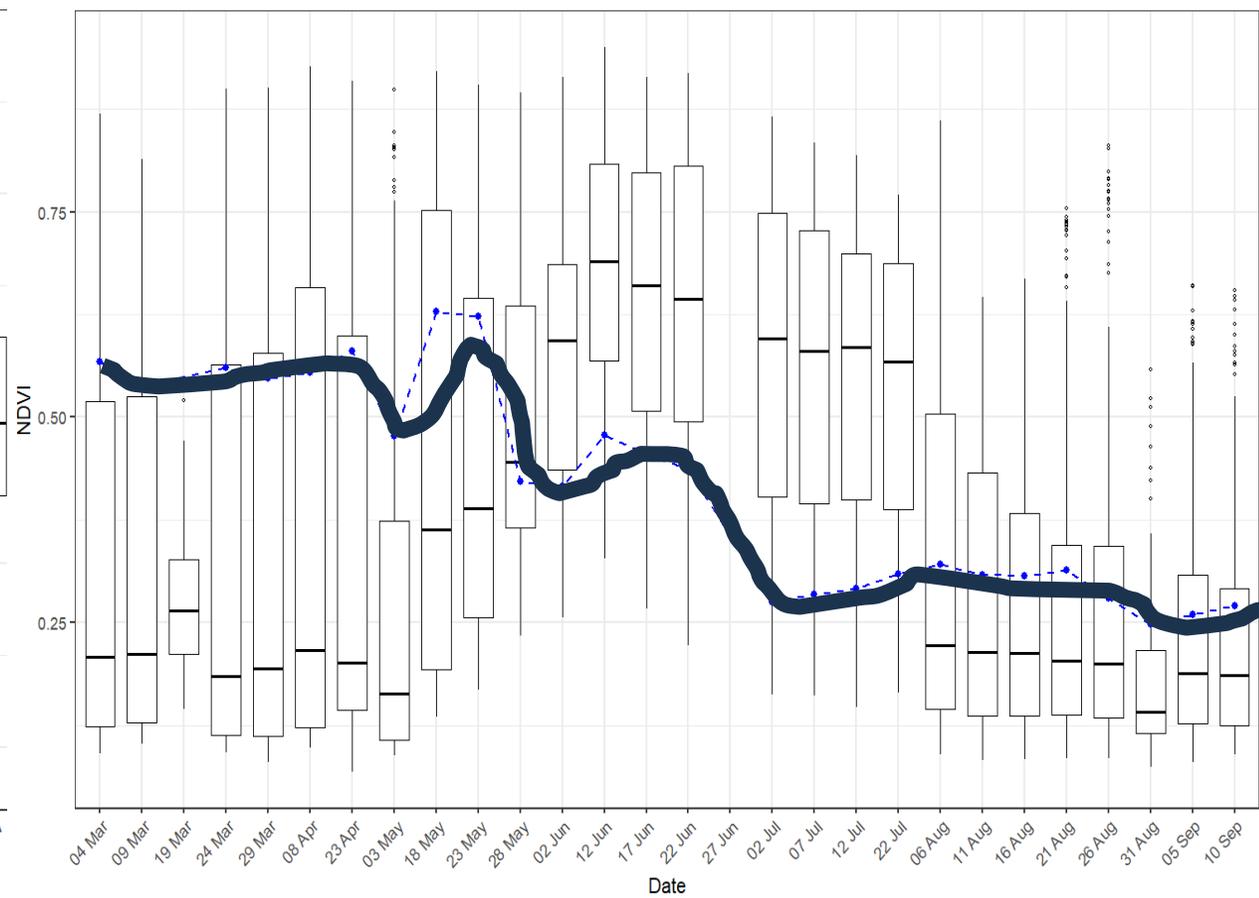# NDVI over the pixel (box plot)
median NDVI over the CRNS (line)

Discussion so far

- The analysis showed **a strong dynamic in the correlation** between CRNS data with the Soil Water Index (SWI) at a 1-kilometer resolution.

- Across all sites, the most favorable statistical scores are consistently found during the **March-April** period and **November-December period**, which warrants deeper and more comprehensive analysis.

- **Representativeness** in the measurements and locations should be better quantified

- Looking at both **soil moisture and NDVI** values provides deeper insights into the relationships and dynamics between soil moisture and vegetation, enhancing our overall analysis.

THANK YOU FOR THE ATTENTION

Aknowledgments

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