Framework for a near-surface soil sampling survey and C-band SAR-based soil moisture mapping in the Alento terrestrial observatory, South Italy

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Spatially explicit soil moisture (θ) information in a high temporal resolution plays an essential role in environmental modeling for improving risk assessment, for quantifying the effects of rainfall seasonality and climatic variability, and for addressing ecosystem services. Remote sensing data, particularly from the Copernicus mission is highly acknowledged to serve as a fast and available supplier for the derivation of area wide and high-resolution spatial-temporal information. To reliably estimate near-surface soil moisture patterns based on remote sensing, robust ground-truthing for cal/val procedures is required.

Alento terrestrial observatory within the TERENO (TERrestrial ENvironmental Observatories) network across the Mediterranean region

Study site

Salerno province, Italy

Orthophoto TreMorene from Nov 13, 2018

Regular manual sampling to keep field and condition throughout the entire monitoring period

20 m

20 m

Station | X (UTM 33N) | Y (UTM 33N) | Altitude (m a.s.l., DEM 5 m) | Slope angle (°, DEM 5 m)
------- | ---------- | ---------- | ----------------- | ------------
MFC2    | 515606     | 4468329   | 432.3             | 9.6          
TreMorene | 515404     | 4467589   | 351.9             | 17.1          

Monitoring
- Monitoring at agricultural plot MFC2 (a) and at bare soil plot (b) TreMorene (reference plot)
- Parameters at 0-5 cm depth: θ (%), soil temperature (°C), electrical conductivity (S m⁻¹), dielectric constant, recording time is 1 min
- Period from Nov 08, 2018 – Mar 28, 2019 (141 days)
- Mobile θ measuring campaign at 20 SoilNet plots in MFC2 during satellite overpasses of Sentinel-1 A/B (04:58-05:06 am, 04:51-05:04 p.m.), period Nov 10-28, 2018

Sampling
- Volumetric soil water content for sensor calibration at satellite overpasses
- Vegetation properties (e.g., LAI, vegetation cover at days of satellite overpass
- Soil properties (e.g., texture, bulk density, C₀)

Database
- Radar data Sentinel-1 (A/B) SLC, IW, HH/VH, 24 satellite overpasses during observation period
- Optical data Sentinel-2 A/B (MSI2LA), 8 cloud-free images (i.e., NDVI)
- UAV orthophotos (i.e., soil surface roughness)
- Climate data (i.e., precipitation)

Analysis
- To estimate θ by means of environmental covariates
- To test different mapping approaches (e.g., Water Cloud model, Random Forest, Gaussian Process Regression)
- To develop a workflow on deriving time series of θ in a high spatial-temporal resolution (~ 20 m, 6 d)
- To link remote sensing with hydrological models for supporting environmental modeling

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