EGU22-4859
https://doi.org/10.5194/egusphere-egu22-4859
EGU General Assembly 2022

A predictive model of spatial soil ECa variability in the vineyard to support the monitoring of plant status

Carmine Cutaneo[1], Eugenia Monaco[2], Maurizio Buonanno[2], Raffaele Castaldo[1], Pietro Tizzani[1], Haitham Ezzy[2], Arturo Erbaggio[2], Veronica De Micco[3], and **Antonello Bonfante**[2]

[1]National Research Council of Italy (CNR), Institute for electromagnetic sensing of the environment (IREA), IREA, Napoli, Italy
[2]National Research Council of Italy (CNR), Institute for Mediterranean Agricultural and Forest Systems, ISAFOM, Portici, Italy
[3]Department of Agricultural Sciences, University of Naples Federico II, Portici (Naples), Italy

In a vineyard, plant water status variability is strongly dependent on soil spatial variability, whose physical characteristics drive the processes involved in the soil water balance. The more the soil and its characteristics vary in space (horizontally and vertically), the less homogeneous the productive and qualitative response within the vineyard will be. In this context, the proximal sensing of apparent soil Electrical Conductivity (ECa) and its monitoring during the growing season can help understanding the nature of spatial variability of vineyard, supporting both viticultural microzoning (identifying Homogeneous and functional Homogeneous Zones, HZs and fHZs) and field experiments. In this contribution, the importance of use of ECa spatial monitoring during the grapevine growing season will be showed, highlighting its importance in the evaluation of the vineyard response and identification of FHZs.

In this direction, a predictive model of soil ECa is proposed. It consists of the spatial prediction of ECa starting from punctual measurements obtained by a network of TDR probes able to measure ECA. In order to realise this model, a machine learning method based on Random Forests was used. It was trained to derive the spatial relationships between the apparent value of ECa measured with geophysical instrument and the ECa measured with the ACCLIMA TDR probes. In this way, a spatial prediction of the ECa values of the surveyed area is possible.

The study was realized in a vineyard of southern Italy on Greco (white) grapevine, where detailed and precise records on soil and atmosphere systems, *in-vivo* plant monitoring of eco-physiological parameters have been conducted in 2020 and 2021, and spatial variability of plant status in vineyard monitored by means of UAV multispectral images. Apparent soil ECa was measured five timesduring the growing season 2021 by using the PROFILER EMP 400 electromagnetometer both in vertical and horizontal dipole mode. This instrument allows to simultaneously work with three frequencies (5000, 10000 and 15000 Hz) and explore different depth volumes of sub-soil. The predictive model results were processed in MATLAB and Python software and validated on plant responses obtained from vegetational indexes calculated from UAV multispectral images. The obtained results have shown how the ECa can be estimated by the predictive model carrying out important information to support vineyard monitoring.