ROBUST SATELLITE TECHNIQUES FOR MONITORING THE VINEYARDS OF BASILICATA (ITALY)

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The project On Demand Services For Smart Agriculture (OD4SA), which is funded by the Basilicata Region (Italy) through the PO FESR 2014-2020 program, is aimed to offer advanced products and services to operators in the agricultural sector, researchers and public authorities. In particular, the OD4SA project aims to contribute:

- to set-up an innovative and integrated environmental monitor system for precision farming, able to support the farmers for the ordinary and extraordinary management of crops,
- to build an interoperable system for automation and decision support,
- to develop an ICT platform for the supply of on-demand services for agriculture in Basilicata, as well as new methods and algorithms, based on satellite data and products, for monitoring agriculture resources.

Since 1998, the general change detection approach, named Robust Satellite Techniques (RST, [1, 2]) has been successfully applied in different fields like seismic (e.g. [3, 4]), volcanic (e.g., [5, 6]), fire (e.g. [7]) and hydrological (e.g. [8]) risks monitoring, as well as in the context of cloudy-radiances detection (e.g. [9]), Saharan dust (e.g. [10]), sea quality (e.g. [11, 12]), gas flaring (e.g. [13]) and vegetation monitoring (e.g. [14]). RST identifies as "anomalous" that signal that deviates significantly from its expected behavior (in normal conditions) at a specific place and time of observation. It relies on the Absolutely Llocal Index of Change of the Environment (ALICE; [1]), so defined:

$$\otimes_V (x,y,t) \equiv \frac{V(x,y,t) - \mu_V(x,y)}{\sigma_V(x,y)}$$

where V(x,y,t) is the value of the V signal, measured at the place with coordinates (x,y) and at the time t. $\mu_{V(x,y)}$ and $\sigma_{V(x,y)}$ are the temporal mean and standard deviation of V(x,y,t) computed over a long-term data set of images computed in similar (same time of day, same month of the year, etc.) observational conditions. They represent, respectively, the expected value and the normal variability of the signal V(x,y,t) itself.

In the framework the OD4SA project, the RST methodology has been applied to long-term time-series of medium high spatial resolution optical satellite data with the purposes to timely detect short-medium term changes in the crop's health (due to hydrological stress, pathogens, etc.), as well as long-term ones possibly related to climate changes.

Exploiting the high computation capabilities of the Google Earth Engine (GEE) platform [16], hundreds of satellite imageries acquired over Basilicata Region (Southern Italy) by Sentinel 2/MSI (MultiSpectral Instrument) and Landsat 8-9/ OLI 1-2 (Operational Land Imager) have been processed and used for the computation of the Normalized Difference Vegetation Index (NDVI; [16]) over the vineyards identified as testing sites.

Results achieved during the first year of the OD4SA project, by applying the RST approach to NDVI time-series obtained from Sentinel 2/MSI and Landsat 8-9/OLI 1-2 images, are here presented and discussed. Moreover, with the aim to facilitate the dissemination of the generated products, as well as their analysis and handling by not expert users (i.e. farmers), a GEEApps is under development (figure 1). The latter will allow the vineyard's monitor, by plotting the NDVI trend in the selected points and by visualizing updated prescription maps, will also be shown and discussed here.

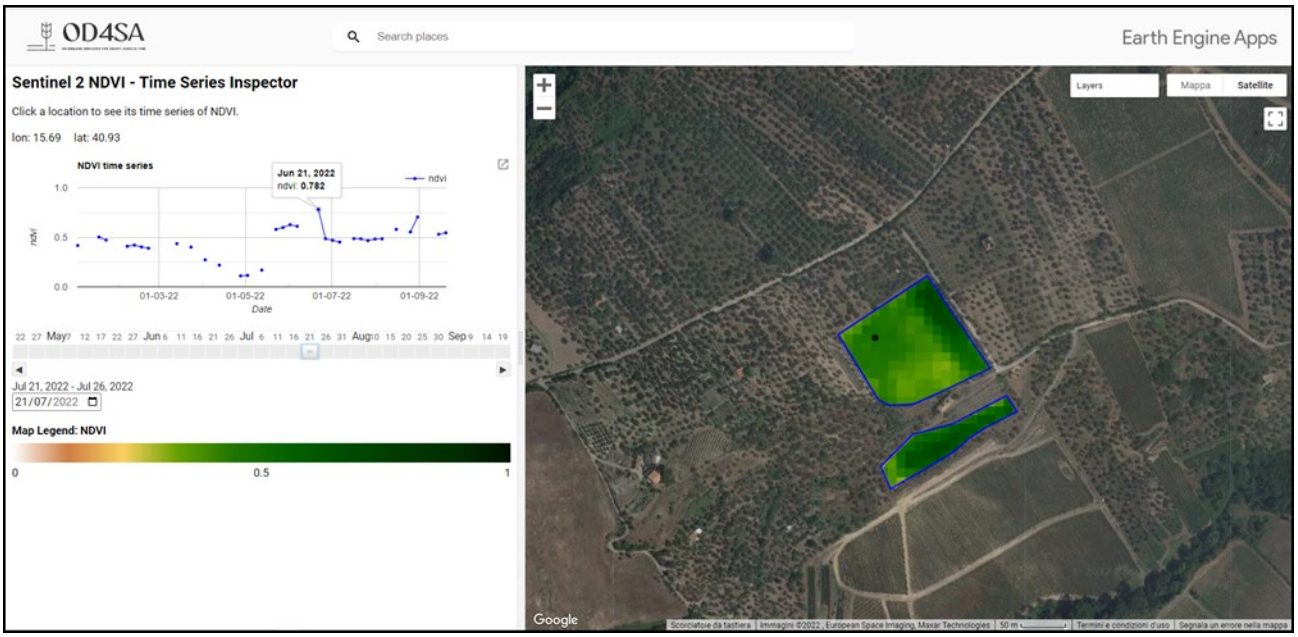

Figure 1. A screenshot of the GEE-App underdevelopment.

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