Polarimetry SAR detectors for monitoring Mediterranean forest fires events

Conference or Workshop Item

Polarimetry SAR detectors for monitoring Mediterranean forest fire events

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Background

Generally, optical sensors are chosen for investigating landscapes transformation. However, this technology requires certain technical and environmental conditions (sunlight, no cloud-coverage) which are problematic when monitoring some regions of the world. Besides, optical sensors show a lower performance when monitoring the diverse evolutionary environmental processes taking place after land disturbances.

Objective: To investigate the capabilities of Synthetic Aperture Radar - SAR satellite sensors for detecting and monitoring long term disturbances in Mediterranean forests due to fire events.

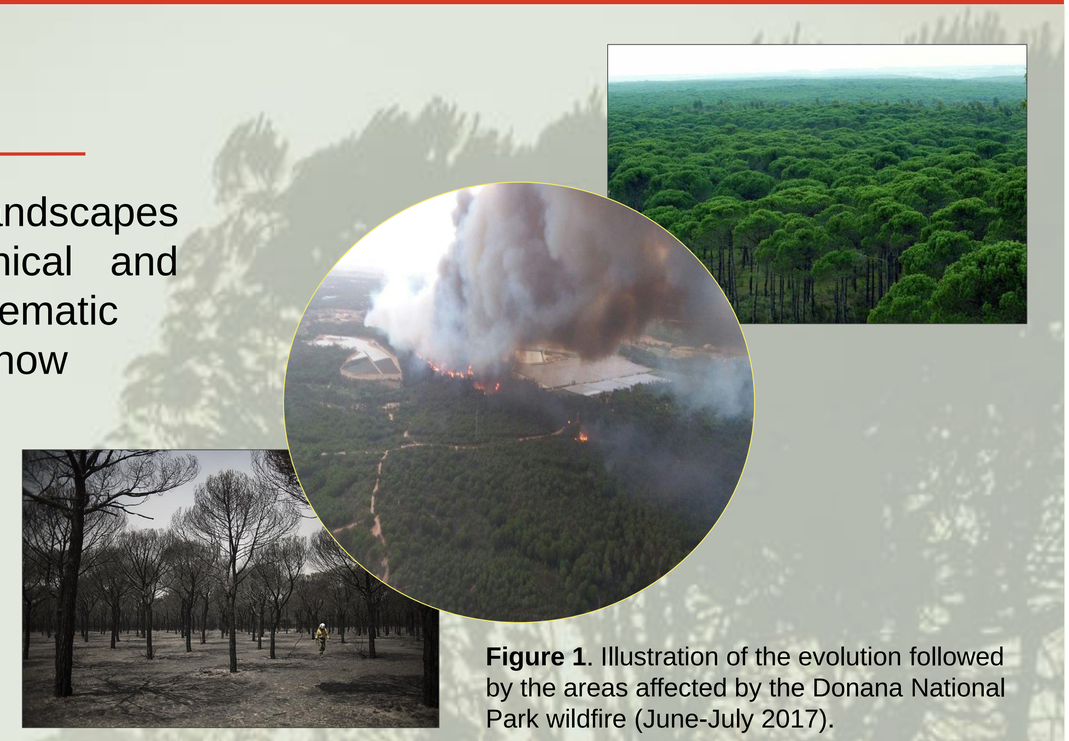

Figure 1. Illustration of the evolution followed by the areas affected by the Donana National Park wildfire (June-July 2017).

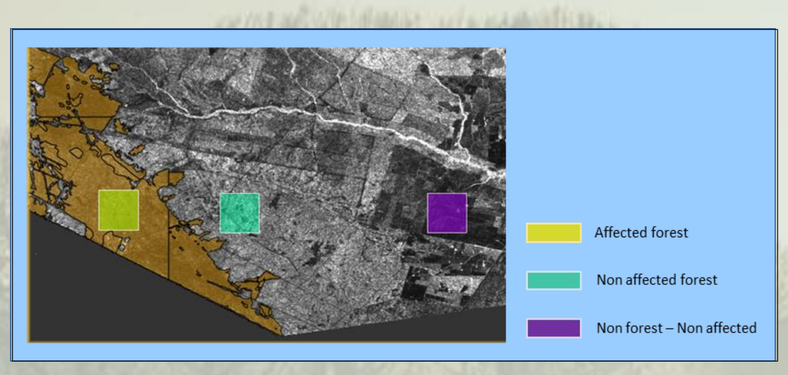

Figure 2. Sample areas selected for landscape typology differentiation. The background image corresponds to a VH channel processed Sentinel 1 product acquired 07th July 2017.

Methods

A preliminary exploration of both optical (ESA-Sentinel 2) and SAR images was performed to examine the environmental evolution of the areas affected by the wildfire.

A SAR Time series, composed of 15 images (May - December) acquired by ESA-Sentinel 1 as Level-1 Ground Range Detected (GRD) - Co & Cross polarized (VV, VH), was used to investigate the radar backscatter signal behaviour.

The study area was divided into 3 classes: (1) *Affected forest*, (2) *Non-affected forest* and (3) *Non forest - Non affected* (see figure 2), following a classification criterion based on the land natural condition and the pre&post fire state.

Results

1. The visual inspection of the time series revealed that we could not use optical sensors to detect environmental variations over long time periods.

2. Sentinel 1 processed images showed a consistent trend characterized by the progressive reduction of the radar backscatter signal.

3. The progressive decrease in the intensity of burnt areas´ radar signal responds to the appearance of the first symptoms of land degradation and desertification.

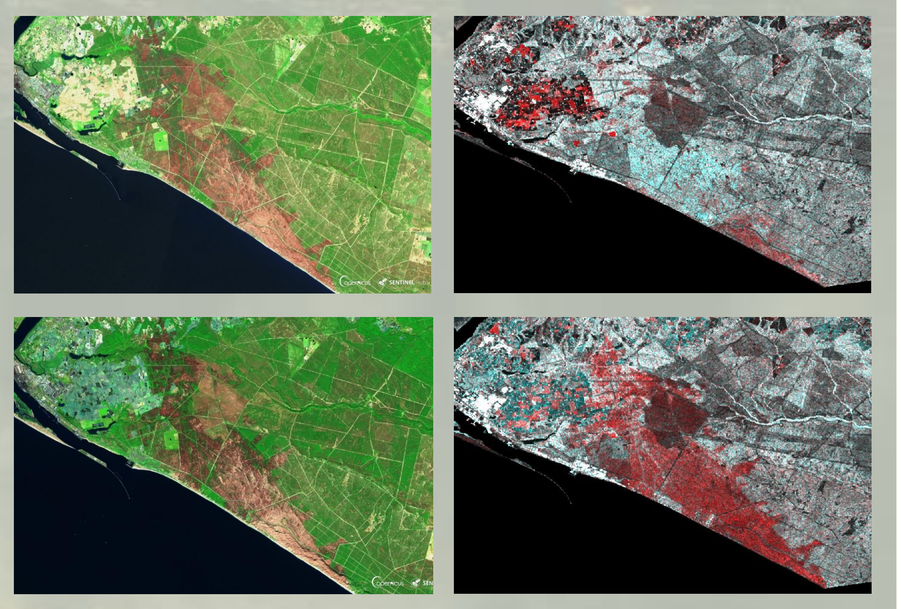

Figure 3. Comparison of Sentinel 2-NDWI (left) and Sentinel 1-RGB composites (right) at different times; 1) Post-fire: 21st July 2017; 2) 5 months after: 18th November 2017.

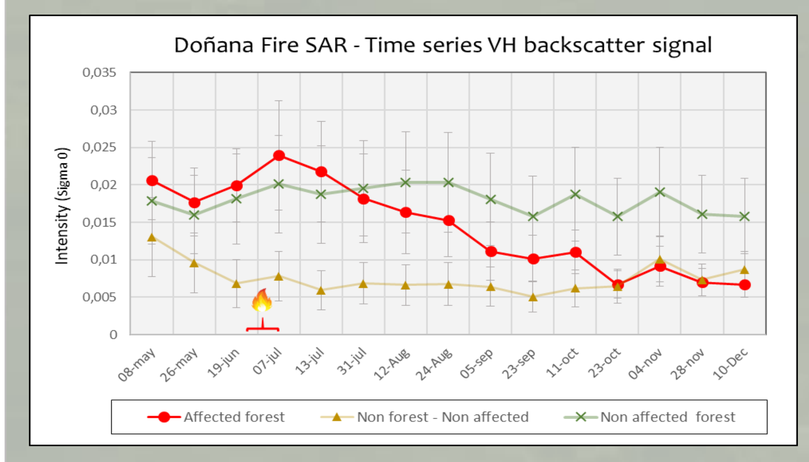

Figure 4. Line graph illustrating the radar backscatter signal intensity during the whole time-series.

Conclusions

The use of long time-series of SAR images stands out as a great method for detecting and mapping historical fire scars.

Sentinel 1 images provide a valuable alternative for near-real time wildfire detection in those regions where technical conditions (eg. cloud coverage and sunlight) do not allow the use of optical sensors.

SAR sensors emerged as a solution for long-term monitoring of post-fire changes. Providing valuable information about many natural processes (eg. Soil moisture, desertification, erosion, forest regrowth).

References

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