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Use of spectral channels and vegetation indices from satellite VEGETATION time series for the Post-Fire vegetation recovery estimation

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Satellite data can help monitoring the dynamics of vegetation in burned and unburned areas.
Several methods can be used to perform such kind of analysis.
This paper is focused on the use of different satellite-based parameters for fire recovery monitoring.
In particular, time series of single spectral channels and vegetation indices from SPOT-VEGETATION have investigated.
The test areas is the Mediterranean ecosystems of Southern Italy.
For this study we considered:
1) the most widely used index to follow the process of recovery after fire: normalized difference vegetation index (NDVI) obtained from the visible (Red) and near infrared (NIR) by using the following formula NDVI = (NIR_Red)/(NIR + Red),
2) moisture index MSI obtained from the near infrared and Mir for characterization of leaf and canopy water content.
3) NDWI obtained from the near infrared and Mir as in the case of MSI, but with the normalization (as the NDVI) to reduce the atmospheric effects.

All analysis for this work was performed on ten-daily normalized difference vegetation index (NDVI) image composites (S10) from the SPOT- VEGETATION (VGT) sensor. The final data set consisted of 279 ten-daily, 1 km resolution NDVI S1O composites for the period 1 April 1998 to 31 December 2005 with additional surface reflectance values in the blue (B; 0.43-0.47,um), red (R; 0.61-0.68,um), near-infrared (NIR; 0.78-0.89,um) and shortwave-infrared (SWIR; 1.58-1.75,um) spectral bands, and information on the viewing geometry and pixel status. Preprocessing of the data was performed by the Vlaamse Instelling voor Technologisch Onderzoek (VITO) in the framework of the Global Vegetation Monitoring (GLOVEG) preprocessing chain. It consisted of the Simplified Method for Atmospheric Correction (SMAC) and compositing at ten-day intervals based on the Maximum Value Compositing (MVC) criterion.
All the satellite time series were analysed using the Detrended Fluctuation Analysis (DFA) to estimate post fire vegetation recovery. The DFA is a well-known methodology, which allows the detectin of long-range power-law correlations in signals possibly characterized by non-stationarity, which features most of the observational and experimental signals.
We analyzed time variation of both single channels and spectral indices from 1998 to 2005 of fire- affected and fire unaffected areas. In order to eliminate the seasonal and/or phenological fluctuations, for each decadal composition, we focused on the normalized departure:
1) NDVI; 2) NDWId, 3) MSId.
Results from our analysis point out that the persistence of vegetation dynamics is significantly increased by the occurrence of fires. In particular, a scaling behavior of two classes of vegetation (burned and unburned) has been best revealed by NDVI. The estimated scaling exponents of both classes suggest a persistent character of the vegetation dynamics. But, the burned sites show much larger exponents than those calculated for the unburned sites. Small variations have been observed between the estimated scaling exponents of both fire-affected and fire-unaffected areas.