



MODIS time series for the analysis and characterization of vegetation dynamics before and after fire occurrence

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This paper aims to perform a dynamical characterization of vegetation dynamics before and after fire occurrence using time series of remotely sensed data obtained from MODIS satellite using detrended fluctuation analysis (DFA).

The DFA has already been applied to time series of NDVI derived from SPOT-VEGETATION (Telesca et al.) but, up to now, has not been applied to MODIS time series, which should provide significant improvements due the higher spectral (36 spectral bands ranging from 0.4 micrometers to 14.4 micrometers) and spatial resolutions (acquisition from 250 m to 1 km).

We focused on two sites Crotone in Calabria and Andriace, near Scanzano Jonico, in Basilicata, characterized by a mixture of natural vegetation and agricultural cover.

Both NDVI(Normalized Difference Vegetation Index) and NBR(Normalized Burn Ratio) have been processed. The NDVI index is expressed by the following relation

$$\text{NDVI} = [b_2 - b_1] / [b_2 + b_1].$$

The NBR index is defined as:

$$\text{NBR} = [b_2 - b_7] / [b_2 + b_7].$$

In order to eliminate the phenological fluctuations, we focused on the departure series from 2000 to 2009 of NDVI_d and NBR_d which are defined as NDVI_d = [NDVI - <NDVI>] / std (NDVI)

where <NDVI> is the mean over 8-days and std(NDVI) is the standard deviation

$$\text{NBR}_d = [\text{NBR} - \langle \text{NBR} \rangle] / \text{std}(\text{NBR})$$

where <NBR> is the mean over 8-days and std(NBR) is the standard deviation

The 8-days mean and the standard deviation were calculated for each 8-days, by averaging over all years in the record.

All the values of scaling for both sites are larger than 1 / 2 which means that the fluctuations of time series are persistent that the values of the indices are positively correlated.

The estimated scaling exponents of both sites suggest a persistent character of the vegetational dynamics. But, for both sites pre-fire exponents were higher than those calculated for the post-fire. This unexpected behavior suggested that, after the fire occurrence the agricultural activities were very likely more intense for both the investigated areas.

Reference

- L. Telesca, R. Lasaponara, A. Lanorte, "1/f fluctuations in the time dynamics of Mediterranean forest ecosystems by using normalized difference vegetation index satellite data" *Physica A*, Vol. 361, Issue 2, p. 699-706, 2006;
L. Telesca, R. Lasaponara, "Fire-induced variability in satellite SPOT-VGT NDVI vegetational data, *International journal of Remote Sensing*, 27, 3087-3095, 2006.