Monitoring fire activity in a Mediterranean ecosystem using SEVIRI geostationary imagery: a case study

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Abstract – Fire is a frequent phenomenon in the Mediterranean region mostly caused by human activities. It affects ecosystems and has a relevant impact on local air pollution releasing significant amount of gases and particulates. The magnitude of such emissions is known to be considerable, but high uncertainties are still attached to current estimates. This is mostly due to the parameters used by current models. Among others burned biomass is the most difficult factor to determine. In this study we present the first results from an application with MSG-SEVIRI imagery. Active fires are monitored and characterized in a case study in Italy. Fire Radiative Power is derived from the satellite images in order to retrieve the amount of burned biomass (Wooster et al., 2005). Moreover results from the application are compared to ground truth data collected during a field campaign.

Fire detection algorithm
The concept for the fire detection methodology is based on a multi-channel contextual approach already used for MODIS imagery (Flasse and Ceccato, 1995; Roberts et al., 2005). A set of thresholds has been defined using the brightness temperature of MIR and TIR channels. The thresholds change according to the time of image acquisition since the variability of ambient background temperature is different on daytime and night-time images. In the figure below fire detection approach is summarized in a scheme.

Fire Radiative Power
It is defined as below:
$$A_{sample} = \frac{a}{(L_{MIR} - L_{B,MIR})}$$

$\gamma_{MIR}$ and $L_{B,MIR}$ are the MIR radiance on the active fire and the mean MIR radiance in the ambient background; $A_{sample}$ is the pixel sampling area; $a$ is the Stefan-Boltzmann’s constant ($5.67 \times 10^{-8}$ J s$^{-1}$ m$^{-2}$ K$^{-4}$); $a$ is a constant sensor-dependent (3.06 · 10$^{-9}$ for SEVIRI sensor).

Comparison with field data
Fire events: 14-18th of February 2005

Vegetation type affected: Pinus pinea, the understorey being mainly constituted by Erica arborea and Arbutus unedo.

Site1: Pegli
Burned area: 1600 ha

Site2: Savona
Burned area: 950 ha

Conclusions
The analysis of SEVIRI data has produced active fire maps which show little number of false alarms when the condition on BRF is used. The Fire Radiative Power derived from each scene has been integrated in time to obtain Fire Radiative Energy which is used to quantify burned biomass.

The comparison between burned biomass derived from the RS application and the ground truth show high agreement which makes such methodology very promising.

References

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