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Daily estimates of fire danger using multitemporal satellite MODIS data: the experience of FIRE-SAT in the Basilicata Region (Italy)

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In the recent years the Basilicata Region (Southern Italy) has been characterized by an increasing incidence of fire disturbance which also tends to affect protected (Regional and national parks) and natural vegetated areas. FIRE_SAT project has been funded by the Civil Protection of the Basilicata Region in order to set up a low cost methodology for fire danger/risk monitoring based on satellite Earth Observation techniques. To this aim, NASA Moderate Resolution Imaging Spectroradiometer (MODIS) data were used. The spectral capability and daily availability makes MODIS products especially suitable for estimating the variations of fuel characteristics.
This work presents new significant results obtained in the context of FIRE-SAT project.
In order to obtain a dynamical indicator of fire susceptibility based on multitemporal MODIS satellite data, up-datable in short-time periods (daily), we used the spatial/temporal variations of following parameters:
(1) Relative Greenness Index
(2) Live and dead fuel moisture content
(3) Temperature
In particular, the dead fuel moisture content is a key factor in fire ignition. Dead fuel moisture dynamics are significantly faster than those observed for live fuel. Dead fine vegetation exhibits moisture and density values dependent on rapid atmospheric changes and strictly linked to local meteorological conditions. For this reason, commonly, the estimation of dead fuel moisture content is based on meteorological variables. In this study we propose to use MODIS data to estimate meteorological data (specifically Relative Humidity) at an adequate spatial and temporal resolution.
The assessment of dead fuel moisture content plays a decisive role in determining a fire dynamic danger index in combination with other factors.
This greatly improves the reliability of fire danger maps obtained on the basis of a integrated approach of the dynamic factors mentioned above and the static factors (fuel physical properties, morphological parameters and social-historical factors).
The validation of the fire danger indices was carried out by the use of statistics of occurred forest fires. The validation results show satisfactory agreement with the fire danger map taking into account that . fire events are indirect indicator of fire danger; indeed, many factor influence fire ignition and spread such as human pressure, fire-fighting conditions, wind, etc.. Therefore, in this study we have defined and used several fire statistic data useful for the validation of the fire danger maps in order to create the basic elements for the design of a validation protocol.