ESTIMATION OF THE BURNED BIOMASS BASED ON THE QUASI-CONTINUOUS MSG/SEVIRI EARTH OBSERVATION SYSTEM

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Abstract.
The estimate of the burned biomass starts from the computation of the FRP (Fire Radiative Power) that is the radiative power released by the fire. By integrating this quantity in the time it is possible to estimate the FRE (Fire Radiative Energy) and the burned biomass, if coefficients providing the burning efficiency of the vegetation interested by the fire are available. The FRP can be estimated by following three different approaches:

1. in a case, following the method proposed for the MODIS sensor, the FRP can be computed by using a product of the eighth power of the brightness temperature of the fired pixel times a suitable coefficient [1];

2. a second method, based on the hypothesis that the fire size and its burning temperature can be computed by using a Dozier approach [2], estimates the FRP by using the Stefan-Bolzmann relationship (FRP_{SB});

3. a third method, that allows avoiding the computation of the brightness temperature of the fired pixel, is based on the approach proposed by Wooster [3] (FRP_W), in which the spatial resolution of the satellite image and the fired pixel emitted radiance are considered.

Since the fire sizes and burning temperatures, result relevant parameters to characterize much in detail the fire condition they have been estimated by using a Dozier based approach.
In principle, if the FRP is computed by using the Wooster approach its value can be used to correct the estimated fire size and temperature by forcing the two quantities FRP_W and FRP_{SB} to be equal. Due to the high temporal frequency of the SEVIRI observations, the integration with the time of the FRP (computed every 15 min) can be carried out allowing to estimate the total energy released by the fire (FRE). This quantity can be used to estimate the amount of burned biomass, BB. In fact assuming , as described in [3], for the biomass a given combustion rate the BB results proportional to the estimated FRE.
The paper aims at analyzing the suitability of this approach by focusing on the Sardinia region (Italy). The automatic detection of the fires of very small sizes, compared with the size of the SEVIRI pixel, is performed by using the SFIDE® algorithm developed at CRPSM. The availability of the sizes of burned areas, provided by the CFVA (Corpo Forestale e di Vigilanza Ambientale) of the Sardinia region, when the fire has been extinguished allows to check the retrieved BB value by estimating the density of the burned biomass and assessing its consistency with the vegetation type available in the area of interest.
The analysis covers the time period from 2006 to 2008.

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[2] J. Dozier, A method for satellite identification of surface temperature fields of sub-pixel resolution. Remote Sensing of Environment 11: 221– 229, 1981.

[3] M. J. Wooster, G. Roberts and G. L. W Perry., Retrieval of biomass combustion rates and totals from fire radiative power observations: FRP derivation and calibration relationships between biomass consumption and fire radiative energy release. Journal of Geophysical Research 110, D24311, 2005.