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Monitoring the amount of carbon released into the atmosphere in Portugal due to forest fires based on LSA SAF products

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The spectral characteristics, temporal resolution and coverage of meteorological satellites, allow, in addition to weather monitoring, surveillance and forecast their use in other areas of activity, such as climate monitoring, agriculture and forestry support or forest fires monitoring.
The operation of the European System of Geostationary Satellites (METEOSAT SECONG GENERATION – MSG) is under the responsibility of EUMETSAT (https://www.eumetsat.int/). EUMETSAT ground segment includes not just a central unity, *Central Application Facility* (CAF), but also several different centres of satellite applications, Satellite Application Facilities (SAF). The Portuguese Sea and Atmosphere Institute (IPMA) is responsible for the *Land Surface Analysis Satellite Application Facilities* (LSASAF), ensuring the development of algorithms for obtaining various biophysical parameters on the ground, such as descendant radiative fluxes on small and long wavelength (DSSF and DSLF), the surface temperature of the earth (LST), various vegetation parameters (LAI, FVC, fAPAR) and also the radiative power of forest fires (FRP).

Making use of the *Fire Radiative Power* (FRP), it is possible to estimate the amount of carbon emitted into the atmosphere, due to forest fires. These parameters can be used in various fields of applications, such as mapping carbon emissions over the country, allowing strategic decisions to minimize the effects as for example reducing the health impact of such emissions.

The equivalent amount of CO_2 released into the atmosphere, can be estimated also from the carbon concentration that is approximately four times higher. It presents a good fit with the burnt area provided by the Institute of Nature Conservation and Forestry (ICNF) as it is illustrated in Figure 1, for 2015 fire season.

The main objective of this paper is to show the different uses of FRP products for monitoring forest fires

Navigation of fire occurrences (pixel) can be use to map CO_2 over Portugal (Figure 2) where it is possible to see the fire map for Portugal (January to September 2015).

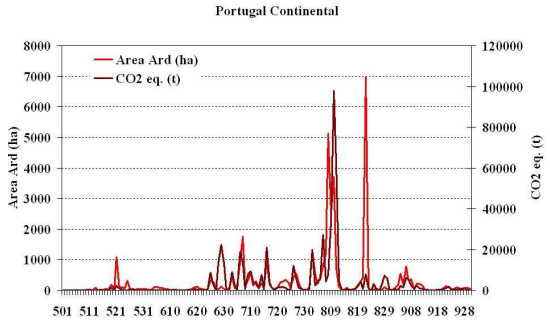
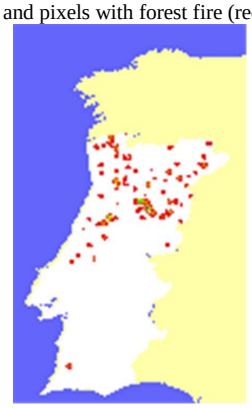


Figure 1 - Daily evolution of the equivalent amount of CO2 released into the atmosphere by forest fires across the country (brown) based on FRP and burned area provided by ICNF updated on November 2015 **(**red, ha).

Figure 2 - Forest fires map from January to September 2015, based on FRP-Pixel LSA SAF product. MSG resolution and colours indicating ocean (cyan), Spain (yellow), pixels without forest fire (white) and pixels with forest fire (red).



This paper aims to show the possibility of using this product for monitoring forest fires in the country, for selected areas, such as districts, municipalities or other areas of interesting. Monitoring specific areas during consecutive days to get information about the evolution of large fires can also be done.

For example, Figure 3, during the large fire occurred in the region of Caramulo, from 21 to 30 August 2013, with 9416 ha according data provide by ICNF, it was possible to follow, in a pre-defined area around the forest fire, the energy (or CO_2 equivalent) released by the fire

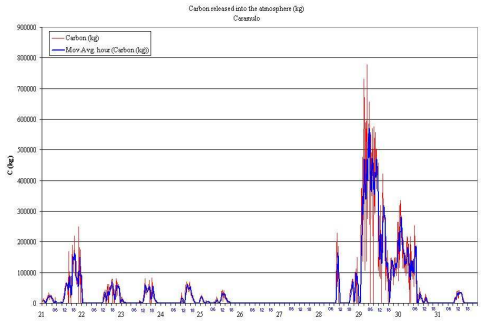


Figure 3 - Daily evolution of the equivalent amount of CO2 released into the atmosphere by forest fires across the Caramulo area

The results obtained so far show a good correlation between burning areas and CO_2 dispersion, especially in the case of the 2 large fire events of 2013. This tool proves to be a good way to monitoring the dispersion of the CO2 release to the atmosphere in forest fires.

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