

Spatial and temporal patterns of burned area over Brazilian Cerrado from 2005 to 2015 using remote sensing data

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Although Cerrado is a fire-dependent biome, current agriculture practices have significantly modified the native fire regime. Moreover, over the last decades, climate conditions, such as intensive droughts, have contributed to enhance the effects of anthropogenic activities, and consequently fire, over the region. For instance, during the 2010 extreme drought there was an increase of 100% in the number of fire pixels detected by just one polar orbiting satellite (information online at <http://www.cptec.inpe.br/queimadas>).

A better characterization of spatial and temporal fire patterns over Cerrado is therefore crucial to uncover both climate and anthropogenic influences in this ecosystem. Additionally, information about the extent, location and time of burned areas (BA) over Cerrado is especially useful to a wide range of users, from government agencies, research groups and ecologists, to fire managers and NGOs.

Instruments on-board satellites are the only available operational means to collect BA data at appropriated spatial and temporal scales and in a cost-effective way. Several global BA products derived from remote sensed information have been developed over the last years using a variety of techniques based on different spatial, spectral and temporal resolutions. Although presenting similar inter-annual variability, there are marked differences among the products both in magnitude and location of the area burnt. The development of regional algorithms which take into account local characteristics such as vegetation type, soil and climate is therefore an added value to the existing information. We present a monthly BA product (AQM) for Brazil based on information from MODIS 1km. The algorithm was specifically designed for ecosystems in Brazil and the procedure represents the first initiative of an automated method for BA monitoring using remote sensing information in the country. The product relies on an algorithm that takes advantage of the ability of MIR reflectances to discriminate BA. Validation over Cerrado biome indicates that the product is in accordance with BA maps from reference data, making the product suitable for applications in fire emission studies and ecosystem management.

The AQM regional database covers the 11-year period 2005-2015 over Cerrado and allows analyzing the overall temporal and spatial distribution patterns of BA for the last decade. The highest monthly mean amount is observed in September, followed by October, and March presents the lowest amount. The most severe year is 2007, followed by 2005 and 2010; 2006 and 2009 are the years with less area burned, followed by 2008. The spatial pattern of BA shows that the north region of Cerrado presents the highest frequency of occurrence. The intra and inter-annual variability of BA over Cerrado are closely related to variability of precipitation but it is worth emphasizing that, despite the major role played by climate conditions, the human factor has also a prominent role on fire dynamics in this region and cannot be disregarded.