

## Daily Emission of Fine Particulate Matter (PM<sub>2.5</sub>) Associated with Biomass Burning in South America During 2002-2020

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**Abstract:** This file describes the dataset “Daily Emission of Fine Particulate Matter (PM<sub>2.5</sub>) Associated with Biomass Burning in South America During 2002-2020”. The analysis of this dataset is available on the manuscript “Updated Land Use and Land Cover Information Improves Biomass Burning Emission Estimates”, published in *Fire* 2023, 6(11), 426; <https://doi.org/10.3390/fire6110426>.

Emission fields from distinct sources, including Biomass Burning (BB), can be estimated using the emissions preprocessor tool PREP-CHEM-SRC with flexible spatial resolutions and projections (Freitas et al., 2011). The estimate of BB emissions in PREP-CHEM-SRC is performed based on the burned area approach (3BEM model) or the FRP approach (3BEM\_FRP model). We chose the FRP-based method to estimate BB emissions and other emission sources rather than BB were not considered in this dataset.

The domain adopted was a regular grid spatially distributed over South America at the spatial resolution of 0.1° (~11 km). 3BEM\_FRP inputs consisted of the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors active fire products (MOD14 and MYD14) collection 6.0 (Giglio et al., 2016), which provide a FRP estimate associated with the detected active fires. MODIS active fires preprocessing consisted excluding those outside South America and those with confidence level below 40% to remove misdetections and inaccuracies and applying a correction to minimize the bow-tie effect (Pereira et al., 2016; Pereira et al., 2022).

In the manuscript “Updated Land Use and Land Cover Information Improves Biomass Burning Emission Estimates”, we ran PREP-CHEM-SRC 1.8.3 under two

conditions: considering the current Land Use and Land Cover (LULC) information based on the MCD12Q1 product collection 5.1 and altering the LULC information based on MapBiomas annual maps collection 6.0 (from 2002 to 2020). This dataset contains only the estimates obtained using the new LULC information. The LULC preprocessing consisted of: (i) Downloading the MapBiomas collection 6.0 annual LULC maps for the 2002-2020 period from Google Earth Engine; (ii) Resampling the spatial resolution of the LULC maps from 30 meters to 500 meters following the majority of the LULC at the coarser spatial resolution; (iii) Reclassifying the LULC categories of MapBiomas to match the International Geosphere–Biosphere Programme (IGBP) classification scheme; and (iv) Converting the new LULC information to PREP-CHEM-SRC file format.

PREP-CHEM-SRC outputs consisted of the daily emissions of several species of trace gases and aerosols, including the  $PM_{2.5}$ , associated with BB in South America at the spatial resolution of  $0.1^\circ$ . On this stage, we converted the PREP-CHEM-SRC outputs from the Grid Analysis and Display System (GrADS) format to Geospatial Tagged Image File Format (GeoTIFF). Such a conversion was performed from a Shell script based on a function of the Climate Data Operators (CDO – a collection of command-line operators to manipulate and analyze climate and numerical weather prediction data) and the Geospatial Data Abstraction Library (GDAL – a translator library for raster and vector geospatial data formats). GeoTIFF files are easier to handle in well-known Geographical Information Systems (GIS) softwares (e.g., QGIS) and programming languages (e.g., Python, R). Moreover, at this stage we extracted only the estimates related to  $PM_{2.5}$  instead of all the 38 variables produced by PREP-CHEM-SRC.

After this processing, the daily outputs' unit is kg of  $PM_{2.5}$  emitted per  $m^2$ . To quantify the total emitted within each grid cell in kg, the estimated values must be multiplied by  $123,476,544 m^2$  – the spatial resolution of the grid cells ( $0.1^\circ$ ) converted to  $m^2$ . Since we have used only MODIS active fires as inputs in 3BEM-FRP, we recommend multiplying the daily emissions by 1.04 in order to simulate the estimates obtained when combining active fires derived from sensors onboard polar-orbiting and geostationary satellites, as proposed by Pereira et al. (2022).

More details on the method applied are described in de Oliveira et al. (2020), while 3BEM\_FRP and PREP-CHEM-SRC are fully detailed in Freitas et al. (2011), Pereira et al. (2016), Santos et al. (2021), and Pereira et al. (2022). The latter work also validated the estimates and compared them to global BB emissions inventories. Other studies analyzing PREP-CHEM-SRC outputs are available in Mataveli et al. (2019), Mataveli et al. (2021a), and Mataveli et al. (2021b).

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