



Improving global SO₂ emission inventories using Sentinel-5P TROPOMI satellite data

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We provide a global database of SO₂ emissions from point sources generated from TROPOMI observations of SO₂ (COBRA product) for the time range from May 2018 to July 2022. Our algorithm derives the advection of SO₂ by combining TROPOMI SO₂ column densities and ERA5 wind fields, i.e., taking the product of the vertical column density gradient and the horizontally projected wind speed. In addition, several corrections, e.g., for satellite sensitivity and topography, are applied. For each point source, error estimates are given, considering the uncertainties of the various retrieval steps.

A fully automated iterative detection algorithm of point sources from around the world forms the basis of our catalog. The catalog includes a list of 130 locations identified as substantial anthropogenic SO₂ point sources. Most of these locations are close to power plants included in the Global Power Plant Database (GPPD) or match entries in previously compiled SO₂ inventories.

The emissions in our catalog are in good agreement (Pearson correlation coefficient (*r*) of 0.82) with those recorded in existing SO₂ datasets (Fioletov et al., 2023) but are higher by about 36%.

By comparing our SO₂ catalog with matches in the global NO_x catalog compiled by Beirle et al. (2023), information on the used fuel and applied filtering measures is provided. We observe an SO₂ to NO_x mass ratio ranging from 0.8 to 141.5 with a mean of about 10 for the selected point sources.

The SO₂ catalog was created as part of the World Emission (2022) project, funded by ESA, which focuses on quantifying emissions of different species that can be detected by satellite instruments. The complete SO₂ catalog will be made publicly available through the World Emission Portal at <https://app.world-emission.com>.