Earth Syst. Sci. Data, 14, 271-293, 2022
https://doi.org/10.5194/essd-14-271-2022

Open Access Earth System Science Data

PAPILA dataset: a regional emission inventory of reactive gases for South America based on the combination of local and global information

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Received: 2 July 2021 – Discussion started: 16 July 2021
Revised: 12 December 2021 – Accepted: 13 December 2021 – Published: 27 January 2022

Abstract. The multidisciplinary project Prediction of Air Pollution in Latin America and the Caribbean (PAPILA) is dedicated to the development and implementation of an air quality analysis and forecasting system to assess pollution impacts on human health and economy. In this context, a comprehensive emission inventory for South America was developed on the basis of the existing data on the global dataset CAMS-GLOB-ANT v4.1 (developed by joining CEDS trends and EDGAR v4.3.2 historical data), enriching it with data derived from locally available emission inventories for Argentina, Chile, and Colombia. This work presents the results of the first joint effort of South American researchers and European colleagues to generate regional maps of emissions, together with a methodological approach to continue incorporating information into future versions of the dataset. This version of the PAPILA dataset includes CO, NO_x, NMVOCs, NH_3, and SO_2 annual emissions from anthropogenic sources for the period 2014–2016, with a spatial resolution of $0.1\times0.1^{\circ}$ over a domain that covers 32–120° W and 34° N–58° S. The PAPILA dataset is presented as netCDF4 files and is available in an open-access data repository under a CC-BY 4 license: https://doi.org/10.17632/btf2mz4fhf.3 (Castesana et al., 2021). A comparative assessment of PAPILA–CAMS datasets was carried out for (i) the South American region, (ii) the countries with local data (Argentina, Colombia, and Chile), and (iii) downscaled emission maps for urban domains with different environmental and anthropogenic factors. Relevant differences were found at both country and urban levels for all the compounds analyzed. Among them, we found that when comparing PAPILA total emissions versus CAMS datasets at the national level, higher levels of NO_x and considerably lower levels of the other species were obtained for Argentina, higher levels of SO_2 and lower levels of CO and NO_x for Colombia, and considerably higher levels of CO, NMVOCs, and SO_2 for Chile. These discrepancies are mainly related to the representativeness of local practices in the local emission estimates, to the improvements made in the spatial distribution of the locally estimated emissions, or to both. Both datasets were evaluated against surface concentrations of CO and NO_x by using them as input data to the WRF-Chem model for one of the analyzed domains, the metropolitan area of Buenos Aires, for summer and winter of 2015. PAPILA-based modeling results had a smaller bias for CO and NO_x concentrations in winter while CAMS-based results for the same period tended to deliver an underestimation of these concentrations. Both inventories exhibited similar performances for CO in summer, while the PAPILA simulation outperformed CAMS for NO_x concentrations. These results highlight the importance of refining global inventories with local data to obtain accurate results with high-resolution air quality models.

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