Earth Syst. Sci. Data, 16, 501-523, 2024
https://doi.org/10.5194/essd-16-501-2024

Open Access Earth System Science Data

CoCO2-MOSAIC 1.0: a global mosaic of regional, gridded, fossil, and biofuel CO_2 emission inventories

Ruben Urraca[1], Greet Janssens-Maenhout[1,12], Nicolás Álamos[2], Lucas Berna-Peña[3], Monica Crippa[4], Sabine Darras[5], Stijn Dellaert[6], Hugo Denier van der Gon[6], Mark Dowell[1], Nadine Gobron[1], Claire Granier[7,8], Giacomo Grassi[1], Marc Guevara[9], Diego Guizzardi[1], Kevin Gurney[10], Nicolás Huneeus[2], Sekou Keita[7], Jeroen Kuenen[6], Ana Lopez-Noreña[3], Enrique Puliafito[3], Geoffrey Roest[10], Simone Rossi[11], Antonin Soulie[7], and Antoon Visschedijk[6]

[1]European Commission, Joint Research Centre, Via Enrico Fermi 2749, 21027 Ispra, Italy
[2]Center for Climate and Resilience Research, Universidad de Chile, 8320000 Santiago, Chile
[3]Research Group for Atmospheric and Environmental Studies (GEAA), Mendoza Regional Faculty, Mendoza, M5500, Argentina
[4]Uni Systems Italy, Via Michelangelo Buonarroti 39, 20145 Milano, Italy
[5]Observatoire Midi-Pyrénées, 31400 Toulouse, France
[6]TNO, Department of Climate, Air and Sustainability, Princetonlaan 6, 3584 CB Utrecht, the Netherlands
[7]Laboratoire d'Aeìrologie, CNRS-Université de Toulouse, 31400 Toulouse, France
[8]NOAA Chemical Sciences Laboratory, CIRES, University of Colorado Boulder, 80309 Boulder, CO, USA
[9]Barcelona Supercomputing Center, 08034 Barcelona, Spain
[10]School of Informatics, Computing, and Cyber Systems, Northern Arizona University, 86011 Flagstaff, AZ, USA
[11]Arcadia SIT, Via Pessano, 20151 Milano, Italy
[12]Ghent University, Faculty of Engineering and Architecture, Technology Park, 9052 Zwijnaarde, Ghent, Belgium

Correspondence: Ruben Urraca (ruben.urraca-valle@ec.europa.eu)

Received: 31 May 2023 – Discussion started: 27 June 2023
Revised: 31 October 2023 – Accepted: 20 November 2023 – Published: 22 January 2024

Abstract. Gridded bottom-up inventories of CO_2 emissions are needed in global CO_2 inversion schemes as priors to initialize transport models and as a complement to top-down estimates to identify the anthropogenic sources. Global inversions require gridded datasets almost in near-real time that are spatially and methodologically consistent at a global scale. This may result in a loss of more detailed information that can be assessed by using regional inventories because they are built with a greater level of detail including country-specific information and finer resolution data. With this aim, a global mosaic of regional, gridded CO_2 emission inventories, hereafter referred to as CoCO2-MOSAIC 1.0, has been built in the framework of the CoCO2 project.

CoCO2-MOSAIC 1.0 provides gridded (0.1°×0.1°) monthly emissions fluxes of CO_2 fossil fuel (CO_2ff, long cycle) and CO_2 biofuel (CO_2bf, short cycle) for the years 2015–2018 disaggregated in seven sectors. The regional inventories integrated are CAMS-REG-GHG 5.1 (Europe), DACCIWA 2.0 (Africa), GEAA-AEI 3.0 (Argentina), INEMA 1.0 (Chile), REAS 3.2.1 (East, Southeast, and South Asia), and VULCAN 3.0 (USA). EDGAR 6.0, CAMS-GLOB-SHIP 3.1 and CAMS-GLOB-TEMPO 3.1 are used for gap-filling. CoCO2-MOSAIC 1.0 can be recommended as a global baseline emission inventory for 2015 which is regionally accepted as a reference, and as such we use the mosaic to inter-compare the most widely used global emission inventories: CAMS-GLOB-ANT 5.3, EDGAR 6.0, ODIAC v2020b, and CEDS v2020_04_24. CoCO2-MOSAIC 1.0 has the highest CO_2ff (36.7 Gt) and CO_2bf (5.9 Gt) emissions globally, particularly in the USA and Africa. Regional emissions generally have a higher seasonality representing better the local monthly profiles and are generally distributed over a

higher number of pixels, due to the more detailed information available. All super-emitting pixels from regional inventories contain a power station (CoCO2 database), whereas several super-emitters from global inventories are likely incorrectly geolocated, which is likely because regional inventories provide large energy emitters as point sources including regional information on power plant locations. CoCO2-MOSAIC 1.0 is freely available at zenodo (https://doi.org/10.5281/zenodo.7092358; Urraca et al., 2023) and at the JRC Data Catalogue (https://data.jrc.ec.europa.eu/dataset/6c8f9148-ce09-4dca-a4d5-422fb3682389, last access: 15 May 2023; Urraca Valle et al., 2023).

https://doi.org/10.5194/essd-16-501-2024