An updated observation-based global monthly gridded sea surface pCO_2 and air-sea CO_2 flux product from 1982 through 2015 and its monthly climatology.

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Method:

The observation-based pCO_2 fields were created using a 2-step neural network method extensively described and validated in Landschützer et al. 2013, 2014, 2016. The method first clusters the global ocean into biogeochemical provinces and in a second step reconstructs the non-liner relationship between CO_2 driver variables and observations from the 4^{th} release of the Surface Ocean CO_2 Atlas (SOCATv4, Bakker et al. 2016). This file contains the resulting monthly pCO_2 fields at 1°x1° resolution covering the global ocean with the exception of the Arctic Ocean and few marginal seas. The air-sea CO_2 fluxes are computed from the air-sea CO_2 partial pressure difference and a bulk gas transfer formulation following Landschützer et al. 2013, 2014, 2016. Furthermore, the monthly climatology is created from the monthly average of the period 1985-2015.

Run ID:

MPI-SOM-FFN_v2016

Updates to previous versions:

The following table lists update to previously published products

Older version	List of significant updates from

	listed version in the new release
ETH-SOM-FFN (G05) 1998-2011 (https://www.nodc.noaa.gov/ocads/oceans/SPCO2_1982_2011_ETH_SOM_FFN.html)	Timeseries has been extended to the period 1982-2015; Observations have been updated to a newer SOCAT release (SOCATv4, Bakker et al 2016). Input data are updated, i.e. MLD has changed to the de Boyer Montegut et al 2004 climatology, salinity has been updated to the Hadley Centre EN4 salinity (Good et al 2013) and atmospheric xCO2 has been updated to the NOAA marine boundary layer reference product (https://www.esrl.noaa.gov/gmd/ccgg/mbl/). Chlorophyll-a (www.globcolour.info) before the satellite era is estimated from the climatological mean from 1998 onwards.
ETH-SOM-FFN (ETH30yr) 1982-2011 (https://www.nodc.noaa.gov/ocads/oceans/SPCO2_1982_2011_ETH_SOM_FFN.html)	Timeseries has been extended to the period 1982-2015; Observations have been updated to a newer SOCAT release (SOCATv4, Bakker et al 2016). Input data are updated, i.e. atmospheric xCO2 has been updated to the NOAA marine boundary layer reference product (https://www.esrl.noaa.gov/gmd/ccgg/mbl/).

Content:

File 1: spco2_1982-2015_MPI_SOM-FFN_CDIAC_v2016.nc

The netcdf file contains:

- lat: latitude in degrees north (89.5°S – 89.5°N with 1° resolution)
- lon: longitude in degrees east (179.5°W-179.5°E with 1° resolution)
- time: time in seconds since 2000-01-01-00:00 (monthly resolution)
- spco2_raw: The raw 2-step neural network sea surface pCO_2 output in µatm
- fgco2_raw: The air-sea flux density, calculated from the raw sea surface pCO_2 in mol m^{-2} yr^{-1}.
- spco2_smoothed: A smoothed product of the raw pCO_2, created by the spatial and temporal mean of each points neighboring pixels (the 3x3x3 pixel neighborhood domain) in µatm.
- fgco2_smoothed: A smoothed product of the raw air-sea CO_2 flux, created by the spatial and

temporal mean of each points neighboring pixels (the 3x3x3 pixel neighborhood domain) in mol m^{-2} yr^{-1}.

- aco2: Atmospheric pCO2 in µatm for the air-sea flux calculation, derived from the NOAA-ESRL marine boundary layer reference dry air mixing ratio of atmospheric CO2 (https://www.esrl.noaa.gov/gmd/ccgg/mbl/) xCO2 product and SST (Reynolds et al. 2002) as well as sea level pressure (Kalnay et al. 1996) following Dickson et al. 2007.
- dco2: Delta pCO_2 calculated from the CO_2 partial pressure difference between atmosphere and the raw surface ocean partial pressure.
- dco2_smoothed: Delta pCO_2 calculated from the CO_2 partial pressure difference between atmosphere and the smoothed surface ocean partial pressure.
- kw: The gas transfer velocity calculated from the ERA-interim wind product (Dee et al. 2011) as described in Landschützer et al. 2014 in m yr^{-1}.
- sol: The CO_2 solubility in mol m^{-3} μatm^{-1} calculated from sea surface temperature (Reynolds et al. 1996) and Hadley centre EN4 sea surface salinity (Good et al. 2013) following Weiss 1974.
- ice: The percentage of sea ice from the Rayner et al. 2003 sea ice product.
- lsmask: The land-sea mask.

File 2: spco2_clim_1985-2015_MPI_SOM-FFN_CDIAC_v2016.nc

- lat: latitude in degrees north (89.5°S – 89.5°N with 1° resolution)
- lon: longitude in degrees east (179.5°W-179.5°E with 1° resolution)
- spco2_clim: Sea surface pCO_2 climatology in µatm
- fgco2_clim: Climatology of the air-sea flux density in mol m^{-2} yr^{-1}.

Inquiries:

Inquiries should be sent to Peter Landschützer: peter.landschuetzer@mpimet.mpg.de. Other data formats (e.g. matlab) available upon request.

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