

# Product User Manual for the Blended TROPOMI+GOSAT Product

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## 1) Introduction

The blended TROPOMI+GOSAT files are formed by applying the correction described in [Balasus et al. \(2023\)](#) to the variable *methane\_mixing\_ratio\_bias\_corrected* in the RPRO (until 17 July 2022) or OFFL (after 17 July 2022) TROPOMI files. This adds the new variable of *methane\_mixing\_ratio\_blended*. The correction is applicable to the files with a processor version of 02.04.00 or 02.05.00 (these processors are identical for the methane files). The following sections describe downloading the data, the file names, the file contents, and how to plot the file contents using Python.

## 2) Downloading the data

The data is located at <https://dataverse.harvard.edu/dataverse/blended-tropomi-gosat-methane> and is updated monthly (and thus extends from April 2018 to present). The data is organized into folders approximately by month (such as 2018-4 and 2018-05) although acquiring a full month of data might require downloading the first file from the next month and the last file from the previous month as orbits cross months. For each month, a ZIP of the orbit files for the entire month can be downloaded (typically about 440 netCDF files and 3 GB) or a subset of individual netCDF files can be downloaded.

## 3) File Names

An example file name is:

*S5P\_BLND\_L2\_CH4\_20191215T112041\_20191215T130211\_11252\_03\_020400\_20230614T125420.nc*

S5P -> Sentinel-5 Precursor, the mission name

BLND -> indicates the blended TROPOMI+GOSAT product

L2 -> level 2 data (i.e., individual retrievals)

CH4 -> methane files

20191215T112041 -> start time of the granule in UTC

20191215T130211 -> end time of the granule in UTC

11252 -> the orbit number

03 -> collection number

020400 -> processor version

20230614T125420 -> file generation time in UTC

The only differences between the original operational file name (below) and the blended TROPOMI+GOSAT file name is the replacement of the processing type (RPRO/reprocessed or OFFL/offline) with BLND and the overwriting of the file generation time.

*S5P\_RPRO\_L2\_CH4\_\_\_\_20191215T112041\_20191215T130211\_11252\_03\_0  
20400\_20221119T003414.nc*

#### 4) File Contents

The files contain the subset of soundings from the OFFL/RPRO files that had a *qa\_value* == 1.0. All other observations are excluded because the blended TROPOMI+GOSAT correction is not valid to apply to them. Additionally, only a subset of variables is included in the BLND files (and they no longer reside in netCDF groups). The files have dimensions of *nobs*, *layer*, and *corner*. All variables are the same as described in the TROPOMI methane PUM except for *methane\_mixing\_ratio\_blended* (derived in this work) and *time\_utc* (expanded to all observations in these files). The following is an example for the orbit number 11252 file listed above.

```
<class 'netCDF4._netCDF4.Dataset'>  
root group (NETCDF4 data model, file format HDF5):  
  Title: Blended TROPOMI+GOSAT Methane Product  
  Contact: Nicholas Balasus (nicholasbalasus@g.harvard.edu)  
  dimensions(sizes): nobs(136308), layer(12), corner(4)  
  variables(dimensions): uint8 qa_value(nobs), float32 latitude(nobs), float32  
  longitude(nobs), float32 methane_mixing_ratio(nobs), float32  
  methane_mixing_ratio_precision(nobs), float32  
  methane_mixing_ratio_bias_corrected(nobs), <class 'str'> time_utc(nobs), float32  
  latitude_bounds(nobs, corner), float32 longitude_bounds(nobs, corner), float32  
  chi_square_SWIR(nobs), float32 surface_albedo_SWIR(nobs), float32  
  surface_albedo_NIR(nobs), float32 surface_albedo_SWIR_precision(nobs), float32  
  surface_albedo_NIR_precision(nobs), float32 aerosol_size(nobs), float32  
  aerosol_size_precision(nobs), float32 column_averaging_kernel(nobs, layer), float32  
  surface_altitude(nobs), float32 surface_altitude_precision(nobs), uint8  
  surface_classification(nobs), float32 surface_pressure(nobs), float32  
  pressure_interval(nobs), float32 reflectance_cirrus_VIIRS_SWIR(nobs), float32  
  methane_profile_apriori(nobs, layer), float32 dry_air_subcolumns(nobs, layer), float32  
  methane_mixing_ratio_blended(nobs)  
  groups:
```

#### 5) Plotting

Included here is a simple example for how to plot the data in Python. The pixels are shown as their full extents (using latitude and longitude bounds), though a scatter plot of the latitude and longitude centers can be used for a quick look.

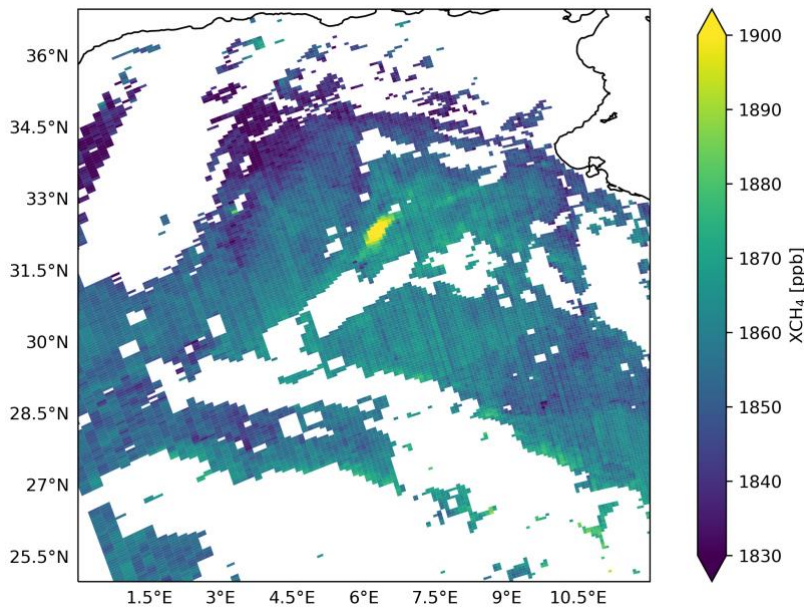
```
import matplotlib.pyplot as plt  
import numpy as np  
import cartopy.crs as ccrs  
from matplotlib.collections import PolyCollection
```

```
fig, ax = plt.subplots(figsize=(10, 6), subplot_kw={"projection": ccrs.PlateCarree()})

dataset_file = "S5P_BLND_L2_CH4____20191215T112041_20191215T130211_11252_03_020400_20230614T125420.nc"
with Dataset(dataset_file) as ds:
    lon_bounds = ds["longitude_bounds"][:]
    lat_bounds = ds["latitude_bounds"][:]
    xch4_blended = ds["methane_mixing_ratio_blended"][:]

verts = [np.column_stack((lon_bounds[i, :], lat_bounds[i, :])) for i in range(len(xch4_blended))]
pc = ax.add_collection(PolyCollection(verts, array=xch4_blended))
pc.set_clim(vmin=1830, vmax=1900)

ax.coastlines()
ax.set_extent([0, 12, 25, 37])
gl = ax.gridlines(draw_labels=True, zorder=-1, linewidth=0)
gl.top_labels = gl.right_labels = False
plt.colorbar(pc, ax=ax, extend="both", label=r"XCH4. 4$ [ppb]")
```



## 6) Contact

If you have questions about the data, please contact Nicholas Balasus at [nicholasbalasus@g.harvard.edu](mailto:nicholasbalasus@g.harvard.edu).