ESA MesosphEO

MesosphEO WP 4.3: GOMOS Climatologies ReadMe

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1. Introduction

This document explains the netCDF4 format used for GOMOS trace gas climatologies (O_3, NO_2, NO_3) in the ESA's MesosphEO project. For users' convenience climatologies are also provided in Matlab-format (similar variable names as in netCDF) and example plots are provided. GOMOS climatologies are named as:
gomos_climat_gasname_year_version.filetype. Example:

gomos_climat_no2_2002_v1.nc

2. Source data

Source data are vertically gridded GOMOS user friendly products (example 'GOMOS_UFP_gridded_O3_2011v01.nc'), but the production has actually used the equivalent matlab-files for practical reasons. **Note:** Both these products are corrected in the beginning of 2017 (bug in the range of ozone_star_flag).

3. Data selection

Only those GOMOS occultations having the solar zenith angle larger than 104° are accepted.

For ozone we have applied the following flags:
ozone_star_flag=0
ozone_strato_flag=0
ozone_meso_flag=0.

For NO_2 and NO_3 no flags applied.

4. Data gridding and statistical estimates

Original trace gas profiles are linearly interpolated to a geometric altitude grid 1, 2,...,110 km. Data are collected to a latitude grid from 90°S to 90°N with 10 degree latitude zones and averaged monthly. The grid is then 110x18x12 or altitudes x latitude zones x months. The data are given as yearly data for 2002-2012.

The basic unit of GOMOS climatologies is number densities in $1/cm^3$. Climatologies are also given as mixing ratios using ECMWF and MSIS90 data for neutral density, but these cannot be taken as genuine GOMOS products.

We show averages with several estimators like mean, median, std, quartiles, error of mean. Traditionally GOMOS data have been more trustworthy if robust estimators have been applied (median etc.). The minimum number accepted is 5, otherwise the NaN notation is used.

The sub-cell description of the measurements are provided by the same variables as in the SPARC-DI project: mean day of month, mean latitude, mean, minimum, and maximum of local time.

5. User guidance

The general guidance for valid altitude ranges of GOMOS individual trace gas profiles:
O_3: 15-100 km for ozone_star_flag=0. For the UTLS, see Sofieva et al., 2016.
NO_2: 20/25-50 km. In polar areas during enhanced NO2 events the upper limits may reach 75 km.
NO_3: 20/25-50 km.

For individual occultations valid altitude ranges depend strongly on occulted star's spectrum and luminosity that are the main factors controlling the S/N-ratio. The gridded GOMOS UFP profiles include estimates of the valid ranges, but these estimates have not been used in constructing the present climatologies. The validity of the climatologies may, however, be estimated using the provided error characteristics (quartiles, std, mean error) and remembering the general guidance for the altitude ranges presented above.

6. NetCDF4 format for GOMOS climatologies

No	Variable	Unit	Dim	Attribute
1	number_measurements	number	110x18x12	Number of measu-rements in the altitude-latitude-month grid
2	time	days since 0h Jan 1, 1900	110x18x12	Mid-month time since 1.1.1900.
3	latitude_grid	degrees_north	19	Latitude grid -90:10:90
4	latitude_axis	degrees_north	18	Latitude zone mid points -85:10:85
5	altitude_grid	km	110	Data are interpolated to this altitude grid
6	density_median	cm-3	110x18x12	Number density median
7	density_std	cm-3	110x18x12	Number density standard deviation
8	density_mean	cm-3	110x18x12	Number density mean
9	density_q1	cm-3	110x18x12	Number density first quartile
10	density_q3	cm-3	110x18x12	Number density third quartile
11	density_meanerr	cm-3	110x18x12	Number density error of mean

12	mixdensity_median	ppm/ppb/ppt	110x18x12	Mixing ratio median
13	mixdensity_std	ppm/ppb/ppt	110x18x12	Mixing ratio standard deviation
14	mixdensity_mean	ppm/ppb/ppt	110x18x12	Mixing ratio mean
15	mixdensity_q1	ppm/ppb/ppt	110x18x12	Mixing ratio first quartile
16	mixdensity_q3	ppm/ppb/ppt	110x18x12	Mixing ratio third quartile
17	mixdensity_meanerr	ppm/ppb/ppt	110x18x12	Mixing ratio error of mean
18	air_temperature_ecmwf	K	110x18x12	ECMWF+MSIS90 temperature
19	lst_mean	hours	18x12	Mean local solar time of measurements at 30 km
20	lst_min	hours	18x12	Min local solar time of measurements at 30 km
21	lst_max	hours	18x12	Max local solar time of measurements at 30 km
22	dom_mean	days	18x12	Mean day of month of measurements
23	lat_mean	degrees_north	18x12	Mean latitude of measurements
24	title	string		GOMOS dark limb climatology
25	constituent	string		Constituent name
26	data filtering	string		Solar zenith at tangent point >104 deg.
27	GOMOS_FMI_climat_dataversion	number		This product (v. 1)
28	GOMOS_UFP_dataversion	number		GOMOS Level 2 UFP_gridded data (v.1)
29	GOMOS_IPF_dataversion	number		GOMOS Level 2 ESA data (v. 6.01)
30	file_creation_date	date		Date of file creation
31	file_created_by	string		Person responsible name
32	file_created_by_email	string		Person responsible email
33	project	string		Project
34	institute	string		Institute
35	value_for_nodata	string		NaN
36	platform	string		Satellite name
37	instrument	string		Instrument name

7. References

Kyrölä et al., ALGOM WP5: GOMOS User Friendly Products: Read Me-document, FMI-ALGOM-TN-005, 2016

Sofieva, V. F. et al., Harmonized dataset of ozone profiles from satellite limb and occultation measurements, Earth Syst. Sci. Data, 5(2), 349–363, 2013, doi:10.5194/essd-5-349-2013. [online]
Available from: http://www.earth-syst sci-data.net/5/349/2013/

Sofieva, V. F., et al., Improved GOMOS/Envisat ozone retrievals in the upper troposphere and the lower stratosphere, Atmos. Meas. Tech., 10, 231-246, doi:10.5194/amt-10-231-2017, 2017.

ESA MesosphEO project plan, version 1.5, 2016

SPARC-DI project