Aura MLS Radiance Average Retrievals (RAR) HO_2 product guideline

Summary

Useful vertical range:	10–0.0032 hPa (daytime) day-minus-night differences required between 10 and 1 hPa
	1–0.0032 hPa (nighttime)
Latitude coverage:	80°S to 80°N
Vertical resolution:	varying from ∼4 km to 14 km

Significant averaging (monthly means) is required to obtain scientifically useful data.

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Introduction

A description of the retrieval methodology is given by:

Millán et al. (2015), Stratospheric and mesospheric HO_2 observations from the Aura Microwave Limb Sounder, Atmos. Chem. Phys., 15, 2889–2902, 2015, doi:10.5194/acp-15-2889-2015

In short, the retrieval algorithm produces a pair of zonal mean abundance fields for each day, one for the daytime part of the orbit and the other for the nighttime part on a grid with 6 surfaces per decade change in pressure (∼3 km). These are obtained from a 10° latitude bin zonal mean of radiances (sorted by solar zenith angle) interpolated onto 6 surface per decade pressure grid using the limb tangent pressure from the standard production data.

To minimize biases, day-minus-night differences between 10 and 1 hPa must be used as a more accurate measure of daytime HO_2.

Due to the small spectral signature of HO_2 in the MLS radiances, significant averaging (such as monthly zonal means) is required to obtain scientifically useful results.

Precision, Accuracy, and Vertical Resolution

In the usable pressure range, the vertical resolution varies from about 4 km at 10 hPa to about 14 km at 0.0032 hPa. Daily precision for a 10° latitude bin ranges from 0.1 ppbv in the upper stratosphere to up to 8 ppbv in the upper mesosphere, dropping to ∼1.4 ppbv and ∼0.5 ppbv for monthly and yearly averages,

respectively. Between 10 and 0.1 hPa, for both daytime and nighttime cases, the total systematic error is around 0.04 ppbv (up to $\sim 10 \times 10^6$ molec cm^{-3}), while for lower pressures (i.e., higher altitudes) the systematic error is as large as 1.2 ppbv ($\sim 0.2 \times 10^6$ molec cm^{-3}).

Data Format

All the MLS HO_2 data described here can be found at the NASA Goddard Space Flight Center Earth Sciences (GES) Data and Information Services Center DISC website.

All the data described here are stored in netCDF files.

The data are stored in files named according to the convention

`MLS-Aura_L3ZMRAR-HO2_v05-VV>-c<CC>_<yyyy>d<ddd>.nc4`

where `L3ZMRAR` stands for Level 3 Zonal Means Radiance Average Retrievals, `v05-VV>-c<CC>` is the version and cycle number. The files are produced on a one-day granularity and named according to the observation date where `<yyyy>` is the four digit calendar year and `<ddd>` is the day number in that year (001 = 1 January).

Each file contains two swaths: Daytime and Nighttime. Each swath contains the following fields:

Average	retrieved HO_2 data	[vmr]
Average ND	retrieved HO_2 data	[10^6 molecules cm^{-3}]
Error	precision	[vmr]
Error ND	precision	[10^6 molecules cm^{-3}]
lat	latitude	[-80°,-70°,-60°, ... ,80°]
lev	pressure levels	[hPa]
Solar_Zenith_Angle	solar zenith angle	[deg]
Local_Solar_Time	local solar time	[hours]

Data Screening

Bad data were set to -999.99 and should be avoided.

Due to the small signal to noise ratio many negative values are found throughout this data set. These values need to be included in any scientific study to avoid high biases in averages derived from these data.

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