TROPESS Deuterated Water Vapor Level 2 Summary Data Product User Guide

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1 Introduction

1.1 Overview and Document Scope

This document is to be used as a quick start user guide for using the TROPESS Deuterated Water Vapor (HDO) Level 2 Summary Product Files.

1.2 Dataset Description

This user guide describes the TROPESS Level 2 Summary Product Files for δ-Deuterium content of water (HDO.)

Table 1. Dataset Description

Product Information	Description
Parameters	See Table 2, in section 2.1
Data Product Provenance	Refer to ReadMe document, section 1.3.4 Algorithm Version
Approximate file size	2MB AIRS, 3MB CrIS
Spatial coverage	Regular collections have global coverage: Nominal latitude range: 70 N to 50 S Nominal longitude range: -180 to 180 Special collections: Spatial coverage varies by collection
Temporal coverage	Each L2 Summary file contains 1 day of data
File format	Netcdf
Vertical sensitivity	Estimates of the deuterium content of water vapor are most sensitive to deuterium variability between 825 and 400 mb.
Data quality	The data have undergone a pre-quality check, which involves checks for retrieval convergence and measurement sensitivity. There are no checks for clouds or land versus ocean as we do not find these to substantively affect the quality of the retrieval as long as the retrieval has converged.
Observational uncertainty	Profiles have approximately 3-5% uncertainty (or ~ 40 per mil). Integrated values between 825 and 400 mb have approximately 3% (or 30 per mil) uncertainty
Validation Stage	AIRS HDO data are at validation Stage 3 and CRIS HDO data are at validation stage 2 according to NASA guidelines https://science.nasa.gov/earth-science/earth-science-data/data-maturity-levels" See validation section summary (Section 5) for rationale
Retrieval Levels	17 levels from surface to top-of-atmosphere

FillValues	-999
Retrieval terminology	Retrieval terminology is defined in TES ATBD TROPESS_ATBDv1.1.pdf (nasa.gov)

1.3   Filename

The Level 2 Summary Products adhere to the following filename convention:

[ProjectID]_[Instrument-Platform]_[ProductLevel]_[ProductType]_[ProductName]_[DateStamp]_[AlgorithmName]_[AlgorithmVersion]_[ProcessingStrategy]_[FormatVersion]**.**nc

Example:

TROPESS_AIRS-Aqua_L2_Summary_HDO_20200912_MUSES_R1p11_FS_F0p1.nc

2   Product File Contents and Parameter Description

2.1   Variables included in the L2 Summary Product

All data fields in HDO summary products are shown in Table 2.

Table 2. Data Fields

Data Field Name	Long_Name/Description	Type	Dimensions	Undefined Value	Units
longitude	longitude of earth view target center	float	target	-999.0	degrees_east
latitude	latitude of earth view target center	float	target	-999.0	degrees_north

Data Field Name	Long_Name/Description	Type	Dimensions	Undefined Value	Units
time	Earth view target mid time as International Atomic Time (TAI) seconds since 1993-01-01 00:00:00	double	target	-999.0	seconds since 1993-01-01 00:00:00
datetime_utc	UTC expressed as an array of integers year, month, day, hour, minute, second	int	target, datetime_utc_dim	-999	1
year_fraction	Year plus fraction of the year	double	target	-999.0	year
altitude	Altitude at each target	float	target, level	-999.0	m
pressure	Atmospheric pressure used for retrieval at each target.	float	target, level	-999.0	hPa
target_id	Unique id that identifies observations across all product files.	long	target	-999	1
x	HDO / H2O ratio (includes bias correction)	float	target, level	-999.f	1
x_h2o	H2O only (includes bias correction)	float	target, level	-999.f	1
dd_col_p	Delta-D: Averaged deuterated water vapor content for the partial column between 850 and 250 hPa, expressed in	double	target	-9999	1e-3

Data Field Name	Long_Name/Description	Type	Dimensions	Undefined Value	Units
	parts per thousand relative to the deuterium content of ocean waters				
dd_col_p_error	Observational uncertainty of mean Delta-D for the partial column between 850 and 250 hPa	double	target	-9999	1e-3
dd_004	Delta-D 004: Deuterated water vapor content for water vapor volume mixing ratio of 0.004, expressed in parts per thousand relative to the deuterium content of ocean waters	double	target	-9999	1e-3
x_h2o_col_p	Column averaged dry air mixing ratio of water vapor content for the partial column between 850 and 250 hPa	double	target	-999	1e-6
x_h2o_col_p_error	Observational uncertainty of the volume mixing ratio of water vapor for the partial column between 850 and 250 hPa	double	target	-999	1e-6
land_flag	If target is over land == 1, otherwise == 0	Int	target	-999	N/A
day_night_flag	If target is during the day	Int	target	-999	N/A

Data Field Name	Long_Name/Description	Type	Dimensions	Undefined Value	Units
	== 1, otherwise == 0				

3   References

Please cite the following references if you intend to use these data:

1. Worden, J. R. et al. (2019), Characterization and evaluation of AIRS-based estimates of the deuterium content of water vapor, *Atmospheric Measurement Techniques*, *12*(4), 2331–2339, doi:10.5194/amt-12-2331-2019.
2. Herman, R. L., J. Worden, D. Noone, D. Henze, K. Bowman, K. Cady-Pereira, V. H. Payne, S. S. Kulawik, and D. Fu (2020), Comparison of optimal estimation HDO/H2O retrievals from AIRS with ORACLES measurements, *Atmospheric Measurement Techniques*, *13*(4), 1825–1834, doi:10.5194/amt-13-1825-2020.
3. Worden, J. et al. (2006), Tropospheric Emission Spectrometer observations of the tropospheric HDO/H2O ratio: Estimation approach and characterization, *Journal of Geophysical Research-Atmospheres*, *111*(D16), doi:10.1029/2005JD006606.

The following references were also used in the development of this documentation and should be cited for model/data comparisons.

1. Risi, C. et al. (2012), Process-evaluation of tropospheric humidity simulated by general circulation models using water vapor isotopologues: 1. Comparison between models and observations, *J. Geophys. Res*, *117*(D5), D05303, doi:10.1029/2011JD016621.

2. Risi, C., D. Noone, C. Frankenberg, and J. Worden (2013), Role of continental recycling in intraseasonal variations of continental moisture as deduced from model simulations and water vapor isotopic measurements, *Water Resour. Res.*, *49*(7), 4136–4156, doi:10.1002/wrcr.20312.

4 Validation Summary

See L2 Standard Products User's Guide for Validation Summary.

1. Appendix A. Bias correction and quality flags

The data in the L2 Summary Products have been pre-filtered for quality and bias corrected. See L2 Standard Product Use's guides for definitions.

2. Acknowledgement

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