GES DISC DAAC Data Guide:UARS HALOE Level 3AT Data Set Document

Summary:

The Halogen Occultation Experiment (HALOE) is one of 10 instruments aboard the Upper Atmosphere Research Satellite (UARS). The HALOE instrument uses solar HALOE uses the principle of satellite solar occultation to sound the stratosphere, mesosphere, and lower thermosphere. Through this technique, HALOE measures vertical profiles of atmospheric ozone (O_3), hydrogen chloride (HCl), hydrogen fluoride (HF), methane (CH_4), water vapor (H_2O), nitric oxide (NO), nitrogen dioxide (NO_2), aerosol extinction, and temperature. Data collection began 11 October 1991 and continues to the present. Currently, HALOE level 3AT version 19 data products are available from the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC).

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1. Data Set Overview

Data Set Identification:

UARS HALOE LEVEL 3AT DAILY TIME ORDERED DATA

Data Set Introduction:

The HALOE level 3AT data are a subset of the UARS dataset. HALOE level 3AT data are daily time-ordered data, arranged at time intervals of 65.536 seconds, or about 495 km intervals along the LOS tangent track. The reference time at which level 3AT data are arranged is common across all UARS level 3AT files.

Objective:

HALOE studies the dynamics of polar and other atmospheric regions using the tracers, HF, CH_4, and H_2O. Studying the trends in HCL and HF will help distinguish the relative importance of anthropogenic versus natural chlorine sources and analyze in detail the development and recovery of the Antarctic ozone hole. Additional studies are intended to identify and assess stratosphere/troposphere exchange.

Summary of Parameters:

Vertical profiles of O_3, HCL, HF, CH_4, H_2O, NO, NO_2, aerosol extinction, and temperature versus pressure.

Discussion:

The HALOE Level 3AT data files are written in the Standard Data Format Units (SFDU) format. Each file consists of three records called SFDU, LABEL, and DATA. SFDU and LABEL records contain descriptive information about the instrument and the data, such as start/stop time of the data, number of records in the file, etc. The DATA record contains the profile data and their standard deviations. Time, latitude longitude, local solar time, and solar zenith angles are provided with each DATA record. Each data file is accompanied by a short ASCII metadata file, which provides descriptive information such as the start and stop time of the data, file record lengths, and the UARS quality flag.

After the original level 3A file formats were agreed to, it was realized that additional parameters were needed to describe the MLS data. Level 3LP and 3TP parameter files were created to include values for the HALOE diagnostic quantities and retrieval quality indicators. These are needed to supply reliable interpretation of the data in the corresponding data files. Each level 3AT file for a given day is accompanied by a level 3TP file. The 3TP file also consists of the three record types SFDU, LABEL and DATA, and is

also accompanied by their own ASCII metadata files.

Related Data Sets:

All UARS level 3AL and 3AT files use the same formats to allow for intercomparisons of atmospheric profiles between the different instruments. Other UARS instruments which measure chemical species include the Cryogenic Limb Array Etalon Spectrometer (CLAES), the Improved Stratospheric and Mesospheric Sounder (ISAMS), and the Microwave Limb Spectrometer (MLS).

2. Investigators:

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Title of Investigation:

Halogen Occultation Experiment

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3. Theory of Measurements:

In a solar occultation experiment such as HALOE, the attenuation of the sun's radiation by the limb of the atmosphere is measured as the sun rises and sets relative to the satellite. The attenuated sunlight is measured in several IR wavebands using wide band and gas cell correlation radiometry techniques.The UARS orbit has an inclination of 57 degrees and a period of about 96 minutes. This results in HALOE viewing on average 15 sunrises and 15 sunsets each day. Due to the geometry, sunrise and sunset events occur separately at roughly constant latitudes each day, that is, all 15 sunrise events encircle a given latitude spaced about 25 degrees apart in longitude each day. As the orbit precesses, HALOE sweeps from 80S to 80N in latitude approximately every 30 days.

4. Equipment:

Instrument Description:

HALOE is a satellite solar occultation experiment designed to monitor the vertical distributions of HCl, HF, Ch2, and NO by gas filter correlation radiometry and H2O, NO2, O3, and temperature versus pressure using CO2 absorption by broadband filter radiometry (Russell et al., 1993a). Aerosol extinction is directly measured in each of the gas filter channel wavelengths which range from 2.5 to 5.26 m (Hervig, et al., 1993). The broad band radiometer measurements range from 2.7 to 10 m wavelength. The absorption of solar energy at selected spectral bands is used to infer vertical profiles of atmospheric temperature, pressure, and mixing ratios of key gases involved in ozone chemistry. The HALOE instrument includes both broadband and gas filter channels covering the spectral range from 2.45 to 10.04 microns.

As viewed from UARS, there are typically 15 sunrises and 15 sunsets per day. For each sunrise and sunset event, HALOE automatically acquires the sun and goes through a series of operational modes. These modes include balance of the gas filter correlation channels, limb to limb scans of the solar disk, a calibration sequence involving viewing the sun through a series of gas cells and neutral density filters, and finally an atmospheric track mode.

Collection Environment:

Satellite data are collected from a near-circular Earth orbit of about 585 km altitude and 57 degree inclination.

Platform:

Upper Atmosphere Research Satellite (UARS)

Platform Mission Objectives:

UARS was launched September 12, 1991 with the mission of investigating the chemical and dynamical processes of the Earth's upper atmosphere. See the UARS Project document for more information.

5. Data Acquisition Methods:

Data are telemetered from UARS through the Tracking and Data Relay Satellite System (TDRSS) to the Data Capture Facility (DCF) at NASA GSFC. From there the data are given an initial quality check, and are then forwarded to the UARS Central Data Handling Facility (CDHF). The instrument PI teams are connected to the CDHF through remote analysis computers (RACs), where they have developed software to convert the raw data to higher level processed data. The CDHF uses the production software to convert the level 0 (raw) data to level 1, 2, 3A and 3B data. The Goddard DAAC acquires the UARS data from the CDHF.

6. Observations:

Data Notes:

The HALOE processing produces retrieved profiles of temperature, pressure, HCl, HF, Ch2, NO, NO2, O3, and H2O. In addition, aerosol extinction profiles are retrieved for each modulation channel wavelength, 2.45, 3.4, 3.47 and 5.26 microns and the CO2 channel wavelength of 2.8 microns. Although some improvements are still to come, current results for all products are suitable for research use, if quality and error estimates are closely observed.

NOTE: The AEXTCO2 subtype is not available in version 19.

7. Data Description:

Spatial Characteristics:

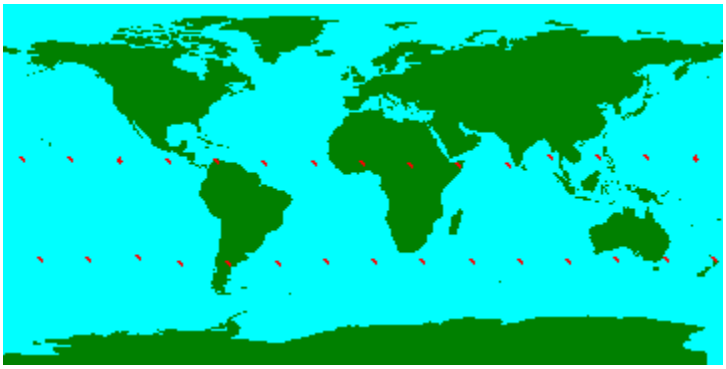
Spatial Coverage:

Latitudinal coverage is from 80 S to 80 N over the course of a year and includes extensive observations of the Antarctic region during spring. The latitude and longitude locations of the actual retrievals vary with each retrieval point due to motion of the spacecraft during the length of the occultation event. For this reason,

two HALOE Level 3TP parameter files are produced, one containing the latitude and one containing the longitude at each UARS pressure level for each HALOE event. Also, the Level 3AT data are assigned a latitude/longitude location corresponding to that of the 30 km retrieval point.

The altitude range of the measurements extends from about 15 km to 60 through 130 km, depending on channel.

Spatial Coverage Map:



Data coverage for HALOE on 5/23/1992.

Spatial Resolution:

Horizontal resolution is 4 degrees for level 3AL files, and about 495 km along the orbital track for level 3AT files.

Vertical resolution for level 3A files is about 2.5 km between pressure surfaces.

Projection:

Not Applicable.

Grid Description:

All HALOE level 3A data have been referenced to the UARS standard pressure grid. The index of the data array defines the pressure level (in millibars) given by:

```
P(i) = 1000 x 10**(-i/6) mb, where i=0,1,2,...54
```

Temporal Characteristics:

Temporal Coverage:

Temporal coverage is from 11 October 1991 to 9 November 1997. Below is a list of dates within the above time period for which HALOE data are missing or unavailable:

Days Since Launch	Date Ranges
33	(14-OCT-1991)
35	(16-OCT-1991)
100 to 110	(20-DEC-1991 to 30-DEC-1991)
174 to 179	(03-MAR-1992 to 08-MAR-1992)
211 to 216	(09-APR-1992 to 14-APR-1992)
264	(01-JUN-1992)
266 to 303	(03-JUN-1992 to 10-JUL-1992)
360	(05-SEP-1992)
460 to 472	(14-DEC-1992 to 26-DEC-1992)
477	(31-DEC-1992)
533 to 538	(25-FEB-1993 to 02-MAR-1993)
540	(04-MAR-1993)
641 to 651	(13-JUN-1993 to 23-JUN-1993)
658	(30-JUN-1993)
694 to 697	(05-AUG-1993 to 08-AUG-1993)
716 to 719	(27-AUG-1993 to 30-AUG-1993)
744	(24-SEP-1993)
821 to 831	(10-DEC-1993 to 20-DEC-1993)
895 to 898	(22-FEB-1994 to 25-FEB-1994)
902	(01-MAR-1994)
1001 to 1012	(08-JUN-1994 to 19-JUN-1994)
1077 to 1082	(23-AUG-1994 to 28-AUG-1994)
1181 to 1194	(05-DEC-1994 to 18-DEC-1994)
1252 to 1263	(14-FEB-1995 to 25-FEB-1995)
1316 to 1321	(19-APR-1995 to 24-APR-1995)
1342 to 1349	(15-MAY-1995 to 22-MAY-1995)
1354	(27-MAY-1995)
1362 to 1374	(04-JUN-1995 to 16-JUN-1995)
1388 to 1395	(30-JUN-1995 to 07-JUL-1995)
1418 to 1419	(30-JUL-1995 to 31-JUL-1995)
1435 to 1443	(16-AUG-1995 to 24-AUG-1995)
1450 to 1451	(31-AUG-1995 to 01-SEP-1995)
1495 to 1497	(15-OCT-1995 to 17-OCT-1995)
1527 to 1528	(16-NOV-1995 to 17-NOV-1995)
1541 to 1553	(30-NOV-1995 to 12-DEC-1995)
1568 to 1569	(27-DEC-1995 to 28-DEC-1995)
1605 to 1623	(02-FEB-1996 to 20-FEB-1996)
1674 to 1676	(11-APR-1996 to 13-APR-1996)
1706 to 1709	(13-MAY-1996 to 16-MAY-1996)
1721 to 1734	(28-MAY-1996 to 10-JUN-1996)
1747 to 1749	(23-JUN-1996 to 25-JUN-1996)
1776 to 1784	(22-JUL-1996 to 30-JUL-1996)

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1794 to 1808            (09-AUG-1996 to 23-AUG-1996)
1815 to 1820            (30-AUG-1996 to 04-SEP-1996)
1854 to 1860            (08-OCT-1996 to 14-OCT-1996)
1883 to 1891            (06-NOV-1996 to 14-NOV-1996)
1902 to 1914            (25-NOV-1996 to 07-DEC-1996)
1928 to 1932            (21-DEC-1996 to 25-DEC-1996)
1958 to 1959            (20-JAN-1997 to 21-JAN-1997)
1973 to 1984            (04-FEB-1997 to 15-FEB-1997)
1997 to 2000            (28-FEB-1997 to 03-MAR-1997)
2034 to 2039            (06-APR-1997 to 11-APR-1997)
2046                    (18-APR-1997)
2062                    (04-MAY-1997)
2066 to 2069            (08-MAY-1997 to 11-MAY-1997)
2083 to 2094            (25-MAY-1997 to 05-JUN-1997)
2101 to 2103            (12-JUN-1997 to 14-JUN-1997)
2108 to 2111            (19-JUN-1997 to 22-JUN-1997)
2130 to 2136            (11-JUL-1997 to 17-JUL-1997)
2139 to 2140            (20-JUL-1997 to 21-JUL-1997)
```

Temporal Resolution:

The temporal resolution of HALOE level 3A data granules is daily.

Data Characteristics:

Parameters:

There are 13 parameters for HALOE level 3AT data products. The measured parameters are listed below with the original HALOE subtype name, DAAC parameter name, and units:

Subtype	DAAC Parameter Name	Units	Altitude Range
HCL	HYDROGEN CHLORIDE	vmr	10-60 km
HF	HYDROGEN FLOURIDE	vmr	10-60 km
Ch2	METHANE	vmr	15-75 km
NO	NITRIC OXIDE	vmr	10-130 km (below 78 km) 10-20 km (above 78 km)
O3	OZONE	vmr	10-85 km
H2O	WATER VAPOR	vmr	10-75 km
NO2	NITROGEN DIOXIDE	vmr	10-55 km
Temperature	ATMOSPHERIC TEMPERATURE	K	10-130 km
AEXTCh2	AEROSOL EXTINCTION AT 3.46 Âµm	km -1	10-50 km

AEXTCO2	AEROSOL EXTINCTION AT 2.80 Âµm	km -1	10-50 km
AEXTHCL	AEROSOL EXTINCTION AT 3.40 Âµm	km -1	10-50 km
AEXTHF	AEROSOL EXTINCTION AT 2.45 Âµm	km -1	10-50 km
AEXTNO	AEROSOL EXTINCTION AT 5.26 Âµm	km -1	10-50 km

NOTE: volume mixing ratio (vmr) equals $10e^{-6}$ ppmv.

NOTE: AEXTCO2 subtype is not available in version 19)

8. Data Organization:

Data Granularity:

Level 3AT data is organized into thirteen files (granules) per day, one each for temperature, mixing ratios of H2O, NO2, O3, NO, Ch2, HCl, and HF, and aerosol extinction values for CO2, NO, Ch2, HCl, and HF channels. Each file (granule contains the retrievals for the sunrise and sunset events for the day (typically 29 or 30 total), and files are organized by event. The two Level 3TP files are latitude and longitude for each pressure level of each event for the day.

Each HALOE level 3A granule is a multi-file granule consisting of six files:

1 The binary data file (files ending with PROD, or *PROD extension) which contains the vertical profile data, and quality (standard deviations), along with time, average latitude and longitude, local solar time, and solar zenith angle.

2

3 An ASCII metadata file (files ending with META, or *META extension) associated with the data file containing items such as the begin date, end date, PI assigned quality flag and record length size of the data file.

4

5 Two binary parameter files (also *PROD extension) designated 3TP for 3AT granules. The subtypes for these files are LAT and LON. The first contains the latitude values for each individual pressure level and the second contains the corresponding longitudes.

6

7 Two ASCII metadata file associated with the parameter files (also *META extension). The information is identical to the metadata file associated with the data

file, except that the record length applies to the parameter file.

The naming convention for UARS files distributed by the Goddard DAAC is as follows:

HALOE_Llll_**S**ssss_**D**dddd **.V**vvvv_**C**cc_xxxx,

The format for granule file names is **HALOE_L**lll_**S**ssss_**D**dddd **.V**vvvv_**C**cc_xxxx, where

lll
is the UARS processing level (3AT or 3TP),
ssss
is the subtype or parameter,
dddd
is the UARS acquisition day (0001 = 12 September 1991),
vvvv is the data version number,
cc
is the data version cycle number, and
xxxx
is the file extension (PROD for the binary files, or META for the ASCII metadata files)

For a full description of the naming convention see the "meta_desc.doc" file.

Average granule size is about 15 Kb for HALOE_L3AT_DAILY granules. The *META files are small, only about 730 bytes each.

Data Format:

The data are in a native UARS format. The files were originally created on a VAX/VMS system at the UARS CDHF, and now exist as UNIX stream files at the Goddard DAAC. HALOE data file structures are presented in the Standard Formatted Data Units (SFDU) documents listed in the References section.

9. Data Manipulations:

Formulae:

Derivation Techniques and Algorithms:

The mixing ratios are interpolated to the UARS standard pressure array from the Level 2 data file using a first-order linear interpolation based on ln(pressure). The interpolated quality indicators are the higher of the surrounding standard deviation

values except for temperature.

Data Processing Sequence:

Processing Steps:

The data processing is divided into three main jobs. The first job reads the raw telemetry files or level 0 data and interprets the data packet headers. The measurements are separated according to the atmospheric line observed and saved in intermediate files. Next the instrument calibration data is used to subtract dark current and to convert the count rate per bin to a line of sight intensity given in rayleighs. Once the known instrument corrections are made effects due to the UARS spacecraft are determined. The orbit attitude data are used to compute the location of the tangent point for each line of sight for each measurement bin. The frequent phase measurements are also processed in the first job step. The level 1 data, cataloged at the end of job step 1, contain the calibrated data and the geo-referencing data. These data are input to job step 2.

The second step uses transmission profiles, difference signal profiles from the gas filter channels, and solar source functions from the solar scans to retrieve temperature, pressure, and mixing ratios of HCl, HF, Ch2, H2O, O3, NO, NO2, aerosol and temperature versus pressure. The retrieval method incorporates a simple "onion peel" procedure stabilized at the top and bottom of the profile with a scalar optimal estimation formulation [Connor and Rodgers, 1989]. The forward model for the gas filter channels (HF, HCl, Ch2, NO) is a rigorous line-by-line code which is necessary for the effective high spectral resolution of these channels. All spectral dependence, including thermal and Doppler shift effects, is explicitly modeled. Along-path mixing ratio gradients are also included in the forward model for the diurnally active gases NO, NO2, and O3.

The final job step uses transmission profiles, difference signal profiles from the gas filter channels, and solar source functions from the solar scans to retrieve temperature, pressure, and mixing ratios of HCl, HF, Ch2, H2O, O3, NO, NO2, aerosol and temperature versus pressure. The retrieval method incorporates a simple "onion peel" procedure stabilized at the top and bottom of the profile with a scalar optimal estimation formulation [Connor and Rodgers, 1989]. The forward model for the gas filter channels (HF, HCl, Ch2, NO) is a rigorous line-by-line code which is necessary for the effective high spectral resolution of these channels. All spectral dependence, including thermal and Doppler shift effects, is explicitly modeled. Along-path mixing ratio gradients are also included in the forward model for the diurnally active gases NO, NO2, and O3.

HALOE Level 3 processing uses one Level 2 daily product file as input with some exceptions when the first event is in the previous day's Level 2 file. Each Level 3AT file includes the complete set of retrievals for the sunrise and sunset events which begin during that day. The Level 2 profiles are on a vertical grid. Level 3AT

processing produces profiles for these parameters on the UARS standard pressure grid of

```
P(i) = 1000.0 * ( 10**(-i/6) ),  i = 0,1,...54.
```

Level 3AT processing consists of one program (L3ATLIN) whose function is to produce Level 3AT and 3TP product files on the UARS standard pressure grid from a Level 2 product file. L3ATLIN processes sequentially through each event (sunrise/sunset) in a day of Level 2 data and produces separate files for each of the eight parameters and associated aerosol data along with one latitude 3TP file and one longitude 3TP file. The Level 3AT and 3TP files are arranged by event in the time order of the measurements.

Processing Changes:

Reprocessing of the data occur about once a year.

Calculations:

Special Corrections/Adjustments:

None.

Calculated Variables:

None.

10. Errors:

Sources of Error:

The data quality is given by the standard deviation of the quantity. Each data element in each file is stored along with a standard deviation which has been calculated by the analysis software. The nominal error is 10 m/s for the wind and 25 K for temperature.

Quality Assessment:

The quality indicator associated with each data point is the precision of the HALOE measurement in the form of a standard deviation as calculated in the Level 2 processing. In Level 3AT, if no value is available for a pressure level, the highest standard deviation around this 3AT pressure level is taken from the Level 2 data.

Data Validation by Source:

All data are checked by the WINDII science team and assigned quality values. These values appear as the DATA_QUALITY_UARS fields in the ASCII metadata files. The format for DATA_QUALITY_UARS is a 3 character field of the form "p.q" where:

	VALUE	MEANING
for p	0	Machine inspected
	1	Qualitative evaluation
	2	Intensive analysis
for q	1	less than 50% good data
	2	50% - 75% good data
	3	76% - 98% good data
	4	better than 98% good data

Measurement Error for Parameters:

Error estimates in the data set do not include systematic components. Only noise error and error due to aerosol correction are estimated and root sum squared. This underestimates errors where these two mechanisms are not the dominant error source but is accurate at high altitudes and in conditions of heavy aerosol for O3, H2O and NO2. For HF, HCl, Ch2, NO and aerosol the total error at low altitudes (below 20 km) is greater than indicated by the recorded error. Systematic components are reported in the validation papers submitted for the JGR UARS Special Validation Issue. The high altitude errors listed in the files accompanying the data can over estimate the error in conditions of low signal to noise (S/N) by sometimes as much as a factor of four. This is due to low signal smoothing and retrieval stability procedures that were not correctly incorporated in the error estimates. For retrieved values that are a factor of 2 or more larger than estimated errors, the estimates are accurate. Much of the improved low S/N results come at the expense of lower resolution.

Additional Quality Assessments:

The quality indicator associated with each data point is the precision of the HALOE measurement in the form of a standard deviation as calculated in the Level 2 processing. In Level 3AT, if no value is available for a pressure level, the highest standard deviation around this 3AT pressure level is taken from the Level 2 data.

Data Verification by Data Center:

Data files are checked to ensure that they are properly transferred and translated from their original VAX/VMS format at the UARS CDHF to the DAAC's UNIX format. No additional data checks are performed by the DAAC.

11. Notes:

Limitations of the Data:

The data files exist as UNIX stream files at the DAAC. Binary data are IEEE formatted. The binary data files should be read on 32 bit machines running UNIX operating systems. This is especially important for fields which are IEEE floating point values, such as the profile data and quality values. If you are going to use a non 32-bit and/or non-UNIX machine, then you will need to write your own conversion routines to read the data files.

File record length information is only listed in the ASCII metadata files (*META extension) which accompany the data and parameter files.

Known Problems with the Data:

None at this time.

Usage Guidance:

Level 3AT data consists of atmospheric profiles on a vertical spacing corresponding to the standard UARS pressure grid. In many cases this vertical spacing is much broader than the HALOE Level 2 point spacing. For this reason, HALOE Level 3AT data is not always representative of the HALOE Level 2 data from which it was produced. Therefore, care should be taken in interpreting the HALOE Level 3AT data between the UARS standard pressure levels. Also, the temperature profiles are retrieved on a 1.5 kilometer grid, interpolated to a 0.3 kilometer grid, and then interpolated to the UARS Level 3AT pressure grid. The temperature standard deviation values, on the other hand, are taken directly from the 1.5 kilometer gridded values. The standard deviation value of -999.0 indicates a temperature value from NMC or climatology.

With the last few points of all HALOE Level 2 profiles being suspect, large variations may occur at the bottom of the profiles. On rare occasions the Level 3AT interpolation will wash out these variations and they will be reduced or not appear at all in the interpolated 3AT profile. In cases where this occurs, the comment associated with the quality number will not accurately describe the bottom of the profiles.

Any other Relevant Information about the Study:

None.

12. Application of the Data Set:

Anticipated uses of these data are in the fields of understanding unperturbed atmospheric chemistry and dynamics, tracking global change and long term atmospheric trends, predicting atmospheric response to chemical or energetic perturbations, environmental and agricultural planning, weather forecasting, atmospheric energy input and loss studies, and radiation budgets.

13. Future Modifications and Plans:

Future reprocessing of the data are possible.

14. Read Software:

Software Description:

Simple read/dump programs are available for reading the HALOE level 3A data files. The read programs are available in C and IDL languages.

Software Access:

To get the software use the links below:

- readuars.c
- readuars_idl.tgz

15. Data Access:

Contacts Information:

Name:
Help Desk
Addresses:
NASA Goddard Space Flight Center
Code 610.2
Greenbelt, MD 20771
Telephone Numbers:
Phone: 1-301-614-5224
FAX: 1-301-614-5268
Electronic Mail Address:
gsfc-help-disc@lists.nasa.gov

Archive Identification:

The UARS HALOE data are archived at the GES DISC under the UARS Project.

Procedures for Obtaining Data:

The HALOE level 2 and level 3AT data files can be obtained from the GES DISC by several mechanisms. These include the following:

- The GES DISC Web-Based Interface (Mirador) provides a means for searching and downloading data. From the GES DISC Home Page select the Mirador link. You can search by keyword (click the Keyword tab), or by project (click the Project tab). The web address for Mirador is http://mirador.gsfc.nasa.gov.
- Earth Observing System Warehouse Inventory Search Tool (WIST). You can search for UARS data using WIST. WIST also allows you to search for data products from other data centers. The web address for the WIST is http://wist.echo.nasa.gov/~wist/api/imswelcome/.

Data Archive Status/Plans:

The GES DISC currently supports HALOE level 2 and 3AT data products.

16. Output Products and Availability:

The HALOE level 3A data are available. See the section above on Procedures for Obtaining Data for specific information. For more information on HALOE, please refer to the HALOE Home Page.

17. References:

Satellite/Instrument/Data Processing Documentation:

Reber, C. A., C. E. Trevathan, R. J. McNeal, and M. R. Luther, The Upper Atmosphere Research Satellite (UARS) Mission, J. Geophys. Res. 98, D6, 10643-10647, 1993.

Journal Articles and Study Reports:

A list of relevant journal articles is available on the HALOE Home Page.

Hervig, M.E., J. M. Russell III, L. L. Gordley, J. H. Park, and S. R. Drayson, Observations of Aerosol by the HALOE Experiment Onboard UARS: A Preliminary Validation, Geophysical Research Letters, 20, No. 12, 1291-1294, June 18, 1993

Russell, James M., III, Gordley, Larry L., Park, Jae H., Drayson, S. Roland, Hesketh, W. Donald, Cicerone, Ralph J., Tuck, Adrian F., Frederick, John E., Harries, John E., and Paul J. Crutzen, "The Halogen Occultation Experiment," Journal of Geophysical Research, vol. 98, no. D6, June 20, 1993

Goddard DAAC IMS online documentation:

HALOGEN OCCULTATION EXPERIMENT (HALOE), NURSHA03.

Horne, C., UARS Granule Level File (*META) Description, July 1994.

18. Glossary of Terms:

DATA PRODUCT

A collection of parameters packaged with associated ancillary and labeling data. Uniformly processed and formatted. Typically uniform temporal and spatial resolution. HALOE level 3A data products include HALOE_L3AL_DAILY and HALOE_L3AT_DAILY. The HALOE data product class is divided into data product subclasses according to measured parameters.

DATA SET

A logically meaningful grouping or collection of similar or related data. Data having mostly similar characteristics (source or class of source, processing level and algorithms, etc.) HALOE is a subset of the UARS data set.

GRANULE

A Granule is the smallest aggregation of data which is independently managed.

PARAMETER

A measurable or derived variable represented by the data (e.g. air temperature, snow depth, relative humidity). At the Goddard DAAC, parameters are grouped into a Parameter General category, which is broken down into Parameter Specific.

19. List of Acronyms:

CDHF	Central Data Handling Facility
CH_4	methane
CO_2	carbon dioxide
DAAC	Distributed Active Archive Center
DCF	Data Capture Facility
EOS	Earth Observing System
FOV	field of view
GSFC	Goddard Space Flight Center
H_2O	water vapor
HCl	hydrogen chloride
HF	hydrogen fluoride
hPa	hecto-pascal
IMS	Information Management System
JPL	Jet Propulsion Laboratory
K	Kelvin
km	kilometer
LOS	line of sight
m	meter
mb	millibar
HALOE	Halogen Occultation Experiment
NASA	National Aeronautics and Space Administration
NMC	National Meteorological Center
NO	nitric oxide
NO_2	nitrogen dioxide
O_3	ozone
PI	Principal Investigator
ppmv	parts per million by volume
RAC	Remote Analysis Computer
SFDU	Standard Formatted Data Units
TDRSS	Tracking and Data Relay Satellite System
UARS	Upper Atmosphere Research Satellite
USO	User Services Office

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