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1. INTRODUCTION

The NASA Langley Atmospheric Science Data Center (ASDC) is the archive and distribution center for data from the Tropospheric Emissions Spectrometer (TES) instrument. TES was launched into a sun-synchronous orbit aboard Aura, the third of NASA's Earth Observing System spacecraft, on July 15, 2004. The primary objective of TES is to make global, three-dimensional measurements of ozone and other chemical species involved in its formation and destruction.

2. TES INSTRUMENT OPERATION MODES

The TES instrument is a high-resolution imaging infrared Fourier-transform spectrometer that operates in both nadir and limb-sounding modes.

The Aura satellite flies in a sun-synchronous orbit at an altitude of 705 km, with an equator crossing time of 1:45 pm local time in the ascending node and an inclination angle of 98.21 degrees. This gives latitudinal coverage from 82N to 82S. There are 233 distinct orbital paths that repeat every 16 days.

TES makes global survey observations over a period of 16 orbits with a nominal duty cycle pattern of 16 orbits on and 16 orbits off. In addition, TES makes special observations using its ability to point at a specific location for a few minutes on any given orbit. This capability is used for targets such as gas-emitting volcanoes, biomass burning, and pollution events; for regional air quality studies; and in conjunction with field campaigns.

3. TES GROUND SYSTEM

TES telemetry data are received from the satellite at ground stations, which send the low-rate engineering data stream for monitoring satellite health and safety to the EOS Operations Center, and a high rate stream of science data to the EOS Data and Operations System (EDOS). The EDOS processes the telemetered science data into Level 0 data files and sends them to the NASA LaRC ASDC, where they are archived as well as forwarded to the TES Science Investigator-led Processing System (SIPS) facility in Pasadena, CA. The ASDC also collects and forwards to the TES SIPS

various external data sets such as Global Modeling and Assimilation Office (GMAO) atmospheric data, which are used in TES data processing.

The TES SIPS produces the various TES data products and sends them to the ASDC for archive and distribution. Data files are also sent to the TES SCF, the facility that supports the development of the TES science algorithms and the software required for standard and special products processing, data quality operations, and scientific research. The TES Ground System is illustrated in Figure 1.

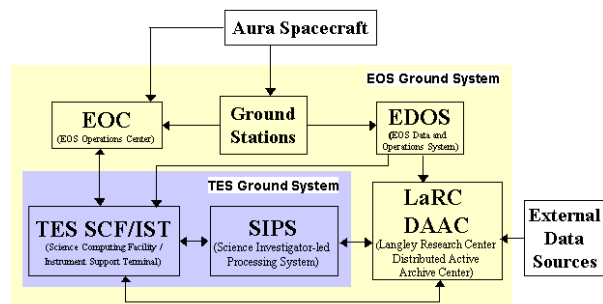


Figure 1. TES Ground System

3. TES DATA PRODUCTS

TES Level 1B data products contain radiometric calibrated spectral radiances and their corresponding noise equivalent spectral radiances (NESR) from nadir and limb views. The geolocation, quality and some engineering data are also provided. These products are written in the NCSA HDF5 format.

TES standard Level 2 data products include global-scale vertical profile and total column measurements of ozone, water vapor, carbon monoxide, methane, and nitric acid for 16 orbits every other day. Additional products include atmospheric temperature profiles, surface temperatures, and other ancillary data.

The Level 2 data products consist of information for one molecular species (or temperature) for an entire Global Survey (16 orbits). All TES L2 products report this information along a uniform UARS pressure grid ordered from ground to space. Separate Level 2 data products are produced for the Special Observations measurements. The Level 2 products are written in HDF-EOS5 (based on HDF5) format. The available Level 2 Global Survey standard products currently produced are listed in Table 1.

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Species	Nadir	Limb
CH4	X	
CO	X	
H2O	X	
HDO	X	
HNO3		X
O3	X	X
Atm Temp	X	X

Table 1. Current TES Standard Data Products

The validation status for the current version (indicated by F03_03 in the file name) of the Level 2 products is shown in Table 2. Definitions for the validation status maturity levels are given in Table 3. Data quality and versioning information are available from the ASDC TES web site.

Species	Validation Status
Nadir O3	Validated Stage 1
Nadir CO	Validated Stage 1
Nadir H2O	Provisionally Validated
Nadir Temp	Provisionally Validated
Surface Temp	Provisionally Validated
Nadir CH4	Beta (Provisional in 2007)
Nadir HDO	Provisionally Validated
Limb HNO3	Beta (Provisional in 2007)
Limb O3	Beta (Provisional in 2007)
Limb Temp	Beta (Provisional in 2007)

Table 2. Current version validation status.

Beta	Early release products for users to gain familiarity with data formats and parameters.
Provisional	Limited comparisons with independent sources have been made and obvious artifacts fixed.
Validated Stage 1	Uncertainties are estimated from independent measurements at selected locations and times.
Validated Stage 2	Uncertainties are estimated from more widely distributed independent measurements.
Validated Stage 3	Uncertainties are estimated from independent measurements representing global conditions.

Table 3. Data Maturity Level Definitions

New processing algorithms are being implemented and will be used with forward processing as well as reprocessing beginning in December 2006, depending on the availability of GEOS-5 version of the GMAO atmospheric input data used in TES processing. The new TES data version will include limb profiles with retrievals extended into the upper troposphere (the current version contains only stratospheric limb retrievals), further improvements to the temperature retrieval, and species dependent quality control information. The new data algorithms will also produce a Level 2 summary product which includes data for multiple species. Subsetting of the Level 2 data through the data ordering interface will become available with the release of this new data version.

4. DATA AND INFORMATION ACCESS

The TES Data Sets web page (Figure 2) at the NASA Langley ASDC provides information about and access to the available data, services and tools for the TES experiment, along with links to related sites. New services, such as subsetting, and new tools, such as visualization software, will be advertised here as they become available. Users can also sign up for the TES news list to receive via e-mail information and announcements relating to TES data.

TES data are available at no cost through the EOS Data Gateway web-based search and order interface. The Level 2 data are also available on the ASDC Data Pool, an on-line disk system, for direct or scripted ftp download or through the Data Pool's web GUI search interface. Links to all the access methods are available from the ASDC TES web pages.

The ASDC provides data access, services and tools for over 40 projects in the discipline areas of Earth's radiation budget, clouds, aerosols and tropospheric chemistry. Additional information is available from our web site, <http://eosweb.larc.nasa.gov>.

TES Data Sets



The Tropospheric Emission Spectrometer (TES) launched into sun-synchronous orbit aboard Aura, the third of NASA's Earth Observing System (EOS) spacecraft, on July 15, 2004. The primary objective of TES is to make global, three-dimensional measurements of ozone and other chemical species involved in its formation and destruction.

TES is a high-resolution imaging infrared Fourier-transform spectrometer that operates in both nadir and limb-sounding modes. TES global survey standard products include profile measurements of ozone, water vapor, carbon monoxide, methane, nitrogen dioxide, and nitric acid for 16 orbits every other day. TES Special Observations are research measurements of targeted locations or regional transects which are used to observe specific phenomena or to support local or aircraft validation campaigns.

The TES Level 1B products are written in NCSA's [HDF5](#) format. The Level 2 data products are written in [HDF-EOS5](#) (based on HDF5) format.

Due to instrument life-time concerns, the acquisition of TES limb data has been suspended during nominal Global Survey operations following April 10, 2005 (Runs greater than 2861).



[Tracking Global Pollution Drift](#)

Scientists use TES Level 2 Global Survey Standard Products to study drifting pollution and its sources.

Obtaining Data	Documentation	Tools	Related Links
<ul style="list-style-type: none"> • Available Data Products with links for specific data access • Archived Level 2 Products • Archived Level 1B Products • Science Observations Calendar <p>General data access tools:</p> <ul style="list-style-type: none"> • Data Pool • EOS Data Gateway (EDG) Locations • EDG Search and Order Tips • WIST available for Beta testing 	<ul style="list-style-type: none"> • Project Guide <p>Product Information:</p> <ul style="list-style-type: none"> • Data Products Specifications • Level 2 Data User's Guide (PDF) • Data Versioning <ul style="list-style-type: none"> ◦ Validation Status • Data Quality Statements <p>Detailed Information:</p> <ul style="list-style-type: none"> • Validation Report (PDF) • Algorithm Theoretical Basis Documents 	<p>Software for working with data:</p> <ul style="list-style-type: none"> • HDFView • Level 1B Read Routines • Level 2 Read Routines 	<ul style="list-style-type: none"> • Join TES News List • TES Home Page • TES News • EOS Aura Mission • Aura Validation Data Center

A Portable Document Format (PDF) reader (such as [Adobe Acrobat Reader](#)) is required to open and view PDF documents.

Available Data Products

Product	Description
Level 2 Global Survey Standard Products	Retrieved species (CH ₄ , CO, H ₂ O, HDO, HNO ₃ , O ₃) volume mixing ratio or temperature profiles at the observation targets and the estimated errors for a global survey of up to 16 orbits
Level 2 Special Observation Products	Retrieved species (CH ₄ , CO, H ₂ O, HDO, HNO ₃ , O ₃) volume mixing ratio or temperature profiles and the estimated errors for research observations
Level 1B Standard Products	Radiometric calibrated spectral radiances and their corresponding noise equivalent spectral radiances (NESR) for a single TES orbit
Level 1B Special Observation Products	Radiometric calibrated spectral radiances and their corresponding noise equivalent spectral radiances (NESR) for research observations

[ASDC Home Page](#) | [Access Data](#) | [Questions/Feedback](#)



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Figure 2. ASDC TES Data Sets Web Page, http://eosweb.larc.nasa.gov/PRODOCS/tes/table_tes.html