AIRS Data Service at NASA Goddard Earth Sciences Data and Information Services (GES DISC) and Its Application to Climate Change Study

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The GES DISC is the distributor of AIRS data products to the public: AIRS operational products. We provide a range of value-added services in support of the AIRS user community. Generally, these services can be categorized into data search, access and retrieval, subsetting and format conversion, online data visualization and analysis. In addition, we work in partnership with users to meet their individual needs.

Introduction

The Atmospheric Infrared Sounder (AIRS) instrument suite is designed to observe and characterize the entire atmospheric column from the surface to the top of the atmosphere in terms of surface emissivity and temperature, atmospheric temperature and humidity profiles, cloud amount and height, and the spectral outgoing infrared radiation on a global scale. It is comprised of a space-based hyperspectral infrared instrument (AIRS) and two multichannel microwave instruments, the Advanced Microwave Sounding Unit (AMSU-A) and the Humidity Sounder for Brazil (HSB). The AIRS instrument suite is one of several instruments onboard the Earth Observing System (EOS) Aqua spacecraft launched May 4, 2002 and has been providing global coverage ever since. A six-year record of these data are available from the GES DISC.

The AIRS Data Support Team at the GES DISC provides data support to assist others in understanding, retrieving, and extracting information from the AIRS/AMSU/HSB data products. Various AIRS data products (Level-1B, Level-2 and Level-3) are available from the GES DISC. In addition, the GES DISC provides a range of value added services such as data search and access services, subsetting and format conversion services, online data visualization and analysis services.

Because number of years has passed since its operation started, the amount of data has reached a certain level of maturity where we can address the climate change study utilizing the AIRS data. In this presentation, we would like to list various services we provide and to demonstrate how to utilize/apply the existing service to long-term and short term variability study.

AIRS Data Products

Level-1B Products (Swath, CrossTrackDim=90, AlongTrackDim=135)

Product Names	Description
AIRIBRAD	Observed AIRS IR geolocated radiances in watts/cm^2/μm/steradian, 2378 channels from 649.612 to 2665.244 cm^{-1} (15.39 - 3.75 μm), $\lambda/\Delta\lambda$>1200.
AIRVBRAD	Observed Visible/NIR radiances in watts/cm^2/μm/steradian, 4 channels, 0.41 μm to 0.94 μm.
AIRABRAD	Observed AMSU-A1 & AMSU-A2 combined, geolocated & calibrated brightness temperatures, 15 bands.
AIRHBRAD	Observed HSB geolocated & calibrated brightness temperatures, 5 bands.
AIRXBCAL	Calibration subset for AIRS IR, Visible/NIR and AMSU-A

Level-2 Products (Swath, CrossTrackDim=30, AlongTrackDim=45, ~ 45 km @ nadir)

Product Names	Description
AIR[X | S | H]2RET	Standard retrieval product which contains retrieved estimates of cloud and surface properties, profiles of temperature, water vapor, and ozone. They are available in 3 flavors corresponding to the instruments used in the retrieval process: AIRS/AMSU, AIRS-only, AIRS/AMSU/HSB.
AIR[I | S | H]2CCF	Cloud cleared radiances product. The cloud cleared radiances are used to retrieve geophysical parameters in the standard product and are also available in 3 flavors corresponding to the instruments used in the production: AIRS/AMSU, AIRS-only, AIRS/AMSU/HSB.
AIR[X | S | H]2SUP	Support product, available in 3 flavors corresponding to the instruments used in the retrievals. Intended users are researchers interested in generating forward radiance or in examining research products, and the AIRS algorithm development team.

Level-3 Products (Grid, 1°x1° Global)

Product Names	Description
AIR[X | S | H]3STD	Standard daily products in 3 flavors.
AIR[X | S | H]3ST8	Standard 8-day products in 3 flavors.
AIR[X | S | H]3STM	Standard monthly products in 3 flavors.
AIR[X | S | H]3QP5	5-day quantized cluster analysis product, 5°x5°, in 3 flavors.
AIR[X | S | H]3QPM	Monthly quantized cluster analysis product, 5°x5°, in 3 flavors.

Data Access

Main AIRS Page (http://disc.sci.gsfc.nasa.gov/AIRS/)

Data Holdings
list all the publicly available products (V4 and V5) and data access methods

Data Access
through WHOM and Mirador

Data Services

AIRS data available in NetCDF from Mirador Search Engine
(http://mirador.gsfc.nasa.gov)

Aqua AIRS data products are now available in NetCDF. An on-the-fly HDF-EOS to NetCDF converter has been developed for AIRS Level 2 standard and support products as well as all Level 3 standard products (global grid).

AIRX2RET, AIRSH2RET, AIRS2RET, AIRX2SUP, AIRH2SUP, AIRS2SUP, AIRX3STD, AIRH3STD, AIRS3STD, AIRX3ST8, AIRH3ST8, AIRS3ST8, AIRX3STM, AIRH3STM, AIRS3STM

Attempt is being made to ensure that the converted files are compliant with the NetCDF Climate and Forecast (CF) Metadata Conventions.

NetCDF conversion (bulk conversion available from the shopping cart)

Data Subsetting by parameter, channel and location for L1B, L2 products

Level 1B:
- AIRIBRAD, AIRABRAD, AIRVBRAD, AIRHBRAD: channel
- AIRXBCAL: parameter/channel/location/reason code

Level 2:
- AIRX2RET/AIRH2RET/AIRS2RET: parameter
- AIRX2SUP/AIRH2SUP/AIRS2SUP: parameter
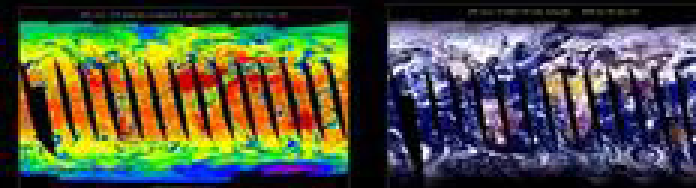- AIRI2CCF/AIRH2CCF/AIRS2CCF: channel

Near-Real Time Products available for L1B and L2 products

AIRS NRT products are currently produced for Level-1B and Level-2, and are specially useful for users whose main interest is the low latency for data availability. NRT data are usually available within 3 hours of observation for:

Level 1B : ftp://airscal1u.ecs.nasa.gov/data/s4pa/Aqua_AIRS_NearRealTime/
Level 2 : ftp://airscal2u.ecs.nasa.gov/data/s4pa/Aqua_AIRS_NearRealTime/

Near-Real Time Global Visualization Products are also available (or planned) for:
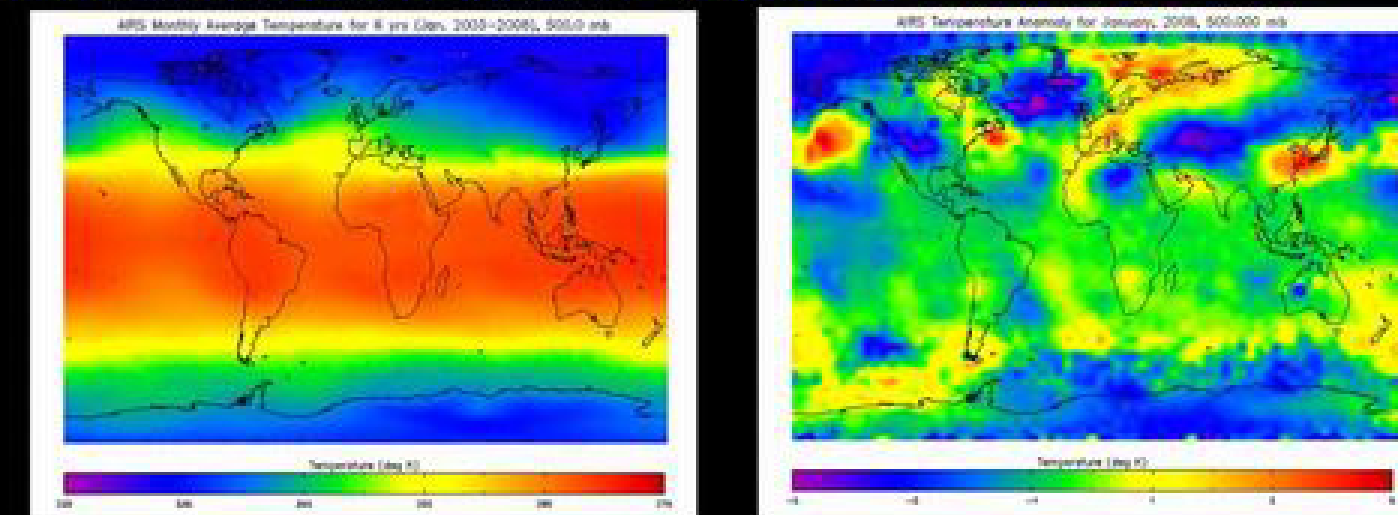
Level 1B : VIS and IR (@11μm)
Level 2 : CO, CH4 and O3, etc. (planned)
ftp://airscal1u.ecs.nasa.gov/data/global_browse/Aqua/AIRS/

Climatology data available soon from Giovanni:
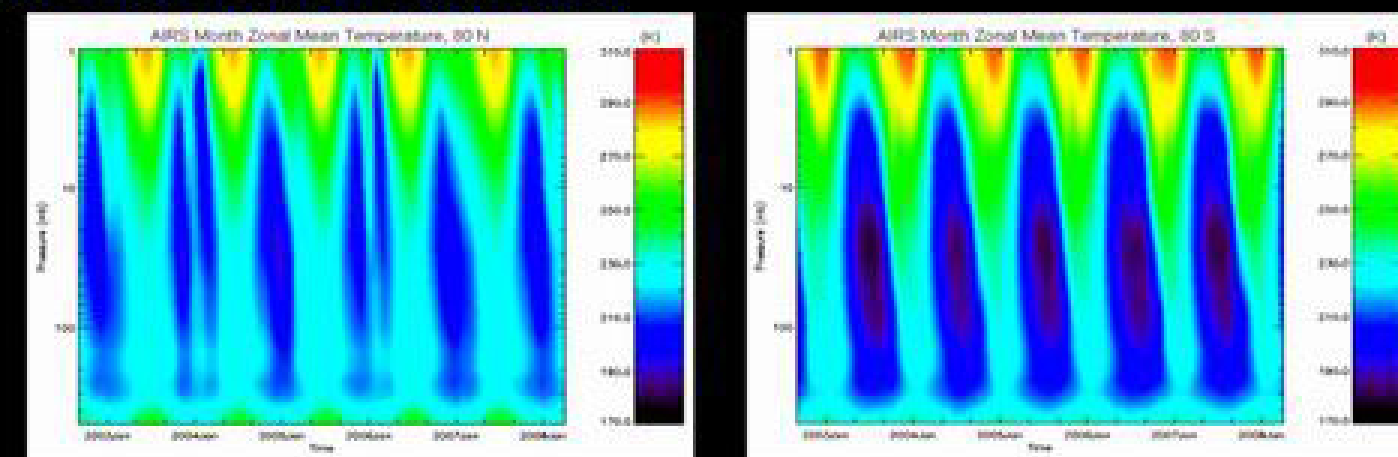### Online Visualization and Analysis Tool (http://disc.sci.gsfc.nasa.gov/giovanni/)

Left: Interface for visualization and analysis of the MODIS Monthly Global Products.
Above: Monthly (July) climatology of MODIS Aerosol optical thickness. Also available is the anomaly of the parameter. The same climatology service is being developed for AIRS parameters and will be available soon.

Climatology of Monthly Average and Anomaly

Monthly temperature averaged over 6 year period (2003-2008) and anomaly for January, 2008. Climatology and anomaly data will be available from Giovanni for selected AIRS parameters.

Time Series of AIRS Temperature

Time series plots of vertical-cross section for monthly zonal mean temperature at 80N and 80S. Stratospheric Sudden Warning (SSW) signatures are clearly seen during 2003/2004 and 2005/2006 winters at Arctic, but not at Antarctic.

Summary

We plan to extend investigating the variation of temperature using various sources of observations by analyzing various available satellite measurements including Aqua/AIRS, Aura/MLS to get a better insight into the characteristics of temperature and wind variations at different temporal and spatial scales.
This study will demonstrate synergistic way of using multi-sensor data that are archived at the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC), which is the home to numerous other satellite data sets and user-focused data services.

Web Resources

For the latest information on AIRS at NASA GES DISC, please visit following web pages:
- Main Landing Page: http://disc.gsfc.nasa.gov/AIRS
- Documentation: http://disc.gsfc.nasa.gov/AIRS/documentation.shtml
- Data Products: http://disc.gsfc.nasa.gov/AIRS/data_products.shtml
- Data Access: http://disc.gsfc.nasa.gov/AIRS/data_access.shtml