

Sounder Product and Services Updates at NASA GES DISC

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NASA Sounder Science Team Meeting
Greenbelt, MD
October 3, 2018

Outline

- New/updated sounder products at GES DISC
Suomi NPP L1B, TOVS Pathfinder, CO2 V6
- AIRS time aggregated L3 data service
L3 Data: OPeNDAP Hyrax, new How-to
- AIRS NRT imagery enhancement
Collaboration with AIRS Applications Development Team
- GES DISC User's in Using AIRS Data
What and How?

New/updated sounder product at GES DISC

- Suomi NPP L1B V2 product release

CrIS L1B V2: released in August 2018

release news:

<https://disc.gsfc.nasa.gov/information/news/5b621f61d928c91427bf04d7/nasa-ges-disc-announces-release-of-suomi-npp-cr-is-level-1-b-version-2-data>

Normal Spectral Resolution product (SNPPCrISL1BNSR)

Full Spectral Resolution product (SNPPCrISL1B)

ATMS L1B V2: released in September, 2018

release news:

<https://disc.gsfc.nasa.gov/information/news/5b74392e3f844a1c53250f9c/suomi-npp-atms-level-1-b-brightness-temperature-v-2-release>

Brightness Temperature product (SNPPATMSL1B)

SNPPCrISL1B V2 full spectral resolution product landing page

GES DISC

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🔒 https://disc.gsfc.nasa.gov/datasets/SNPPCrISL1B_V2/summary?keywords=

⋮ 📧 ☆ 🔍 Search

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EARTHDATA Find a DAAC

GES DISC

Data Collections ▾ snppcrisl1b_v2

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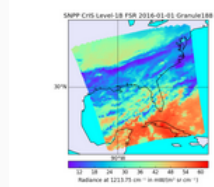
[Atmospheric Composition](#), [Water & Energy Cycles](#) and [Climate Variability](#)

⚠️ Feedback Help ▾ Login

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[Go to Search Results](#)

SNPPCrISL1B: Suomi NPP CrIS Level 1B Full Spectral Resolution V2



[View Full-size Image](#)

The Cross-track Infrared Sounder (CrIS) Level 1B Full Spectral Resolution (FSR) data files contain radiance measurements along with ancillary spacecraft, instrument, and geolocation data of the CrIS instrument on the Suomi National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (SNPP). In December 2014, the CrIS instrument on the SNPP satellite doubled the spectral resolution of shortwave infrared data being transmitted to the ground. In November 2015, additional points were included at the ends of the longwave and shortwave interferograms to improve the quality of the calibration. Prior to November 2, 2015 the data are only available in Normal Spectral Resolution (NSR), after November 2, 2015 at 16:06 UTC, the data are available in both NSR and Full Spectral Resolution.

The FSR files have 2,223 [...more](#)

Data Access

[Online Archive](#)

[Earthdata Search](#)

[OPENDAP](#)

[Get Data](#)

[Product Summary](#)

[Data Citation](#)

[Documentation](#)

Shortname: SNPPCrISL1B

Longname: Suomi NPP CrIS Level 1B Full Spectral Resolution V2

DOI: 10.5067/9NPOTPIPLMAW

Version: 2

Format: NetCDF

Spatial Coverage: -180.0,-90.0,180.0,90.0

Temporal Coverage: 2015-11-02 to [2018-09-24](#)

File Size: 124 MB per file

Data Resolution

Spatial: 14 km x 14 km

Temporal: 6 minutes

SNPPATMSL1B V2 product landing page

GES DISC

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🔒 https://disc.gsfc.nasa.gov/datasets/SNPPATMSL1B_V2/summary?keywords=

⋮ 📧 ☆

🔍 Search

⬇️ 📄 📅 ☰

EARTHDATA Find a DAAC ▾

?

GES DISC

Data Collections ▾ SNPPATMSL1B_002

📅 📖 🔍

🏠 ⚠️ Feedback Help ▾ Login

🐦 📄 📅 💬

Atmospheric Composition, Water & Energy Cycles and Climate Variability

Go to Search Results

SNPPATMSL1B: Suomi NPP ATMS Sounder Science Investigator-led Processing System (SIPS) Level 1B Brightness Temperature V2

SNPP ATMS Level 1B 2018-01-01T00:00:00 to 2018-09-26T00:00:00 Granule188

Antenna Brightness Temperature at channel 3 (55.3 GHz) in degrees K

[View Full-size Image](#)

The Advanced Technology Microwave Sounder (ATMS) Level 1B data files contain brightness temperature measurements along with ancillary spacecraft, instrument, and geolocation data of the ATMS instrument on the Suomi National Polar-orbiting Partnership Project (SNPP).

The ATMS instrument is a cross-track scanner with 22 microwave channels in the range 23.8-183.31 Gigahertz (GHz). The beam width is 1.1 degrees for the channels in the 160-183 GHz range, 2.2 degrees for the 80 GHz and 50-60 GHz channels, and 5.2 degrees for the 23.8 and 31.4 GHz channels. Since the SNPP satellite is orbiting at an altitude of about 830 km, the instantaneous spatial resolution on the ground at nadir is about 16 km, 32 km, or 75 km depending upon the channel. The brightness temperature data are contained in an array with 135 rows in the along-track direction, 9 ...more

Data Access

[Online Archive](#)

[Earthdata Search](#)

[OPENDAP](#)

[Get Data](#)

Product Summary

Data Citation

Documentation

Shortname: SNPPATMSL1B

Longname: Suomi NPP ATMS Sounder Science Investigator-led Processing System (SIPS) Level 1B Brightness Temperature V2

DOI: 10.5067/HFDD6A30MA10

Version: 2

Format: NetCDF

Spatial Coverage: -180.0,-90.0,180.0,90.0

Temporal Coverage: 2014-01-01 to [2018-09-26](#)

File Size: 10 MB per file

Data Resolution

Spatial: 14 km x 14 km

Temporal: 6 minutes

New/updated sounder product at GES DISC

- Enhanced TOVS Pathfinder product

Full record: fill coverage gaps in the previous archive

Data enhancement: netCDF format, meaningful variable names, detail variable attributes and meta data, ready for more service tools.

- Release soon

New/updated sounder product at GES DISC

- AIRS-only CO2 Version 6 product

V5 issue

AIRS+AMSU: 09/2002 ~ 02/2012

AIRS-only: 01/2010 ~ 02/2017

V6 improvement

Full Mission Coverage: 09/2002 ~ present

L3 product resolution from $2^{\circ} \times 2.5^{\circ}$ to $1^{\circ} \times 1^{\circ}$

- Release soon

AIRS time aggregated data service

- Use case:

Need a variable for many days/months at a local region

Don't want get many data files but one(a few) data file(s)

- AIRS L3 time aggregated data service

OPeNDAP Hyrax:

daily product -> one year aggregation

monthly product -> mission period aggregation

GES DISC homepage->OPeNDAP and GDS ->AIRS

<https://acdisc.gesdisc.eosdis.nasa.gov/opendap/hyrax/ncml/aggregation/contents.html>

- New How-to published

[How To Download Long Term AIRS L3 Data in a Small Region into one ASCII File Using the AIRS Aggregated Data Service in OPeNDAP](#)

Enhanced AIRS NRT Imagery

- Collaboration of GES DISC and AIRS Applications Development Team
- Enhance images to LANCE GIBS/Worldview
- New visualization algorithm
Orbit-based, more smooth image
- New colorbar and scale range

Enhanced AIRS NRT Imagery

- Variable Changes

Total Column CO -> CO at 500hPa

Only keep 850hPa, 700hPa, 500hPa (remove 600hPa, 400hPa) Temperature and Relative Humidity

CH₄ at 400hPa

Surface Temperature and Relative Humidity

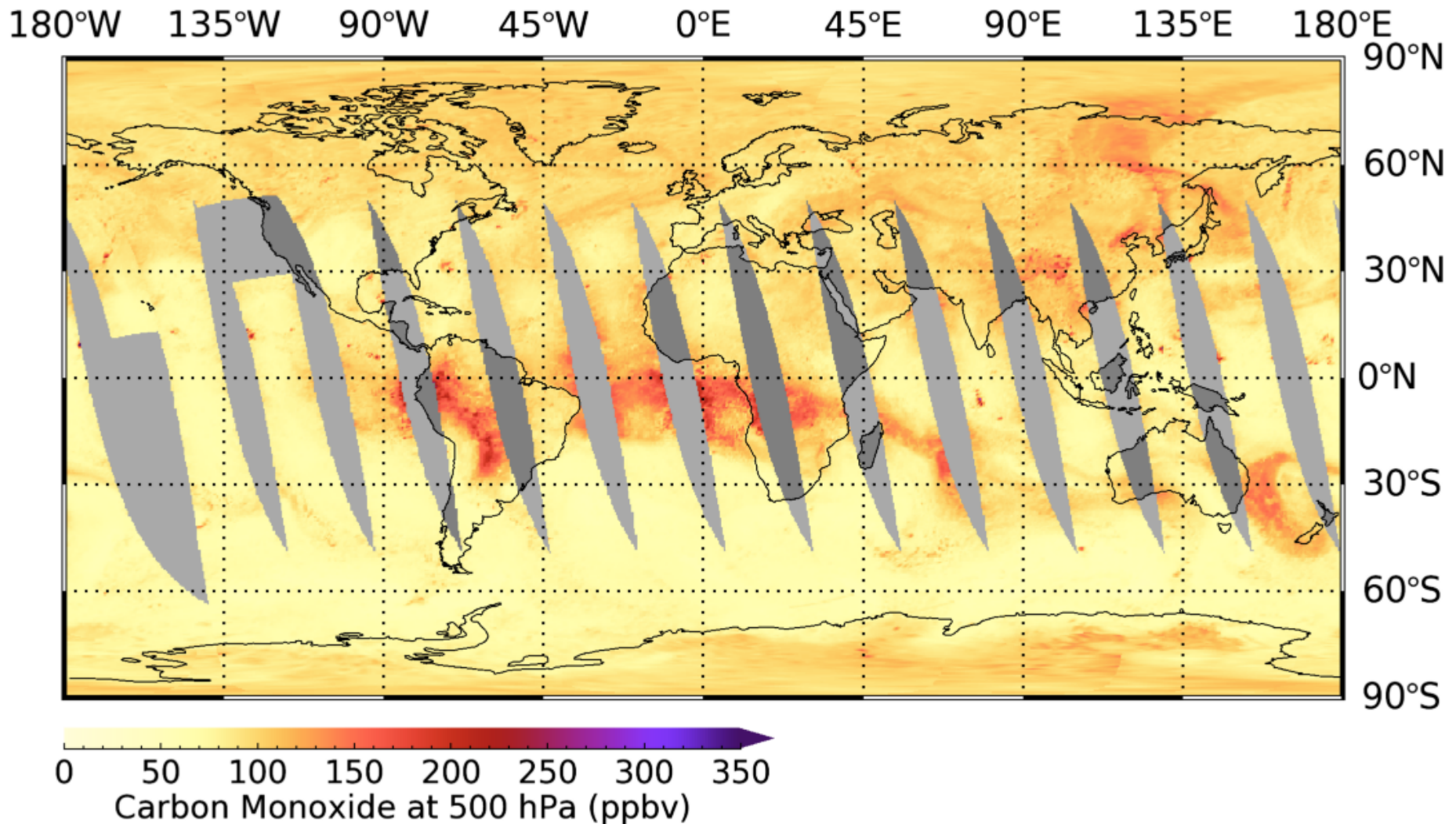
Total Cloud Fraction

Cloud Top Height

- Forward processing in test run mode
- Will reprocess images in whole mission period

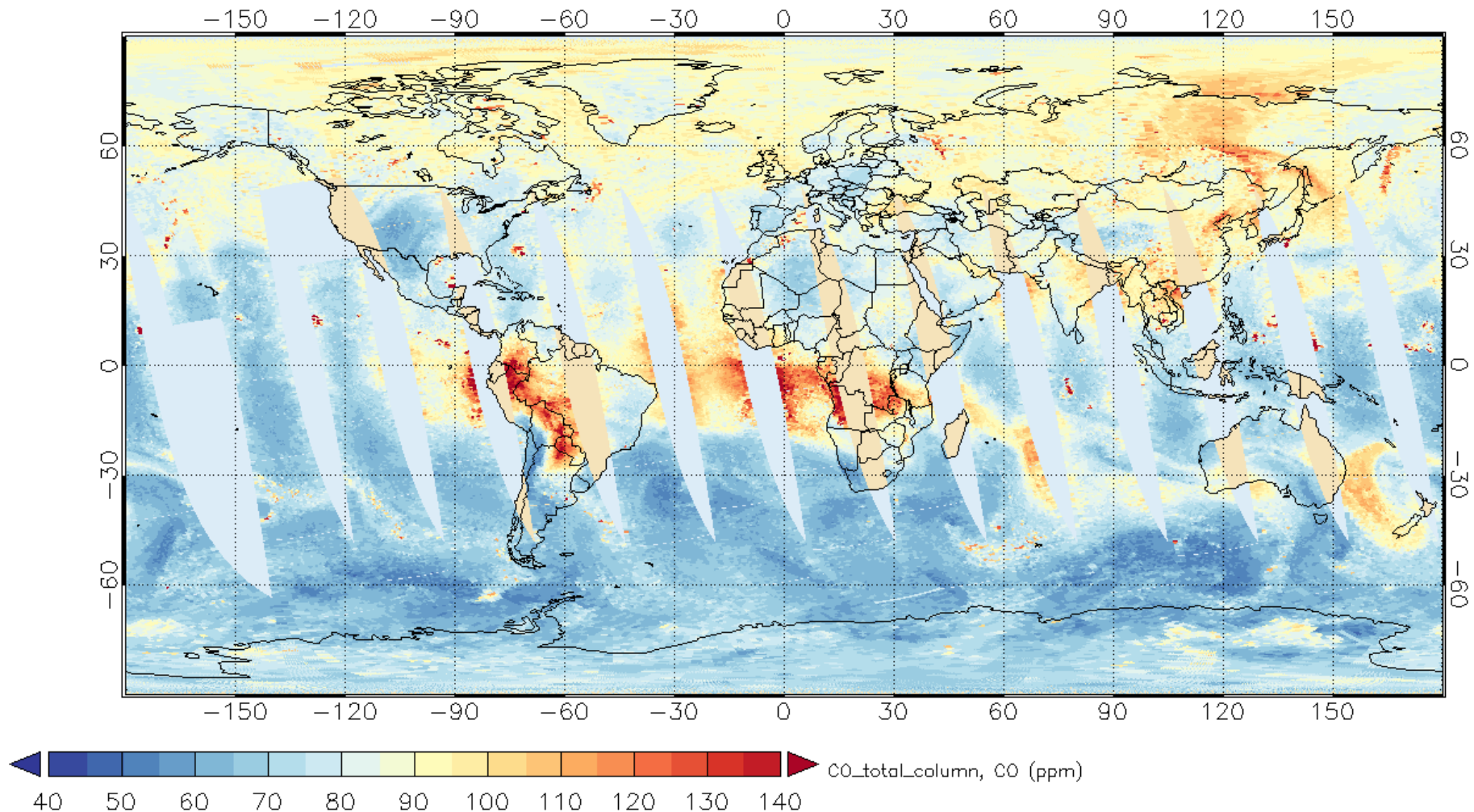
Enhanced AIRS NRT Imagery

CO at 500hPa 9/12/2018



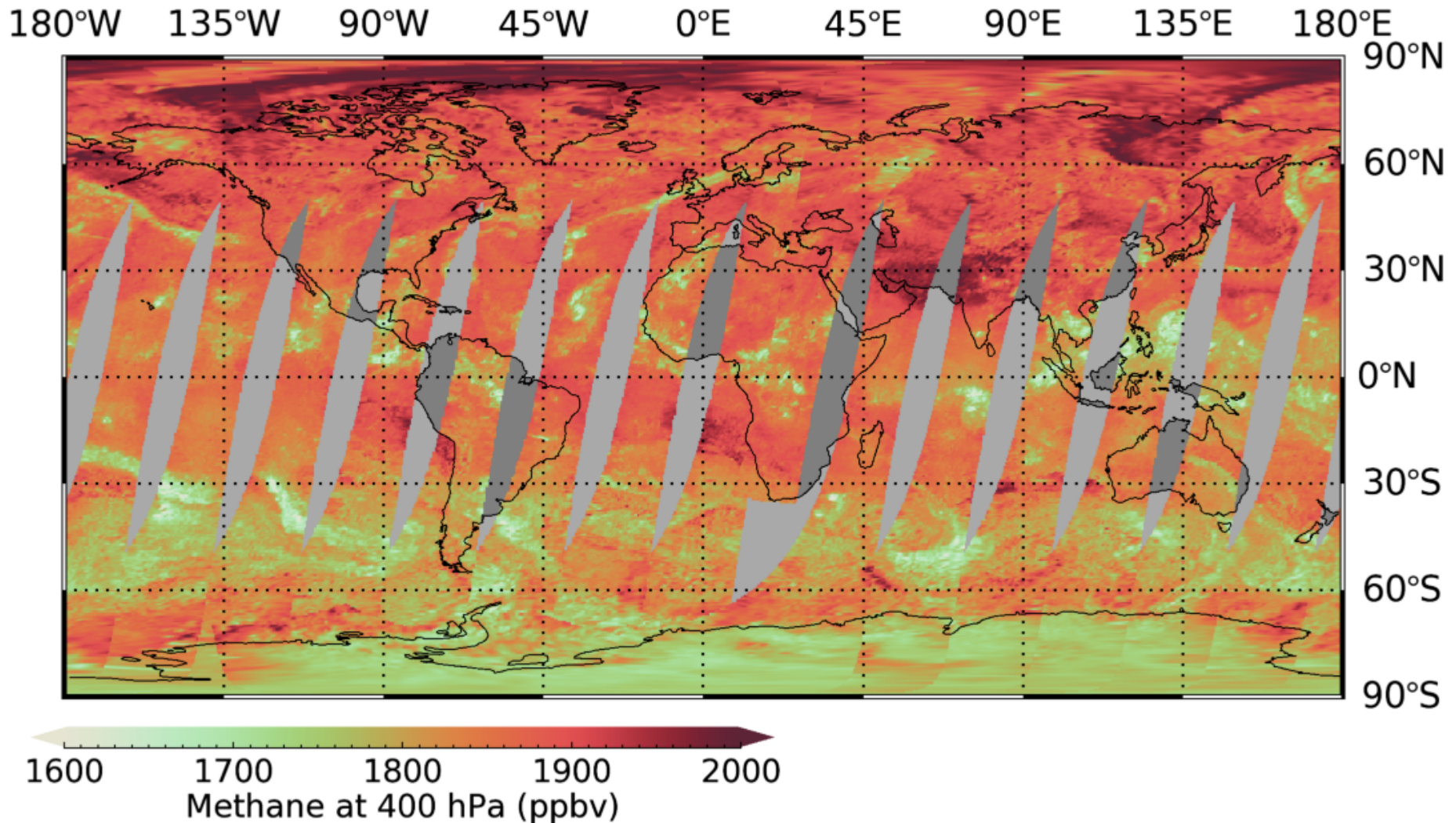
Enhanced AIRS NRT Imagery

Current Total Column CO 9/12/2018



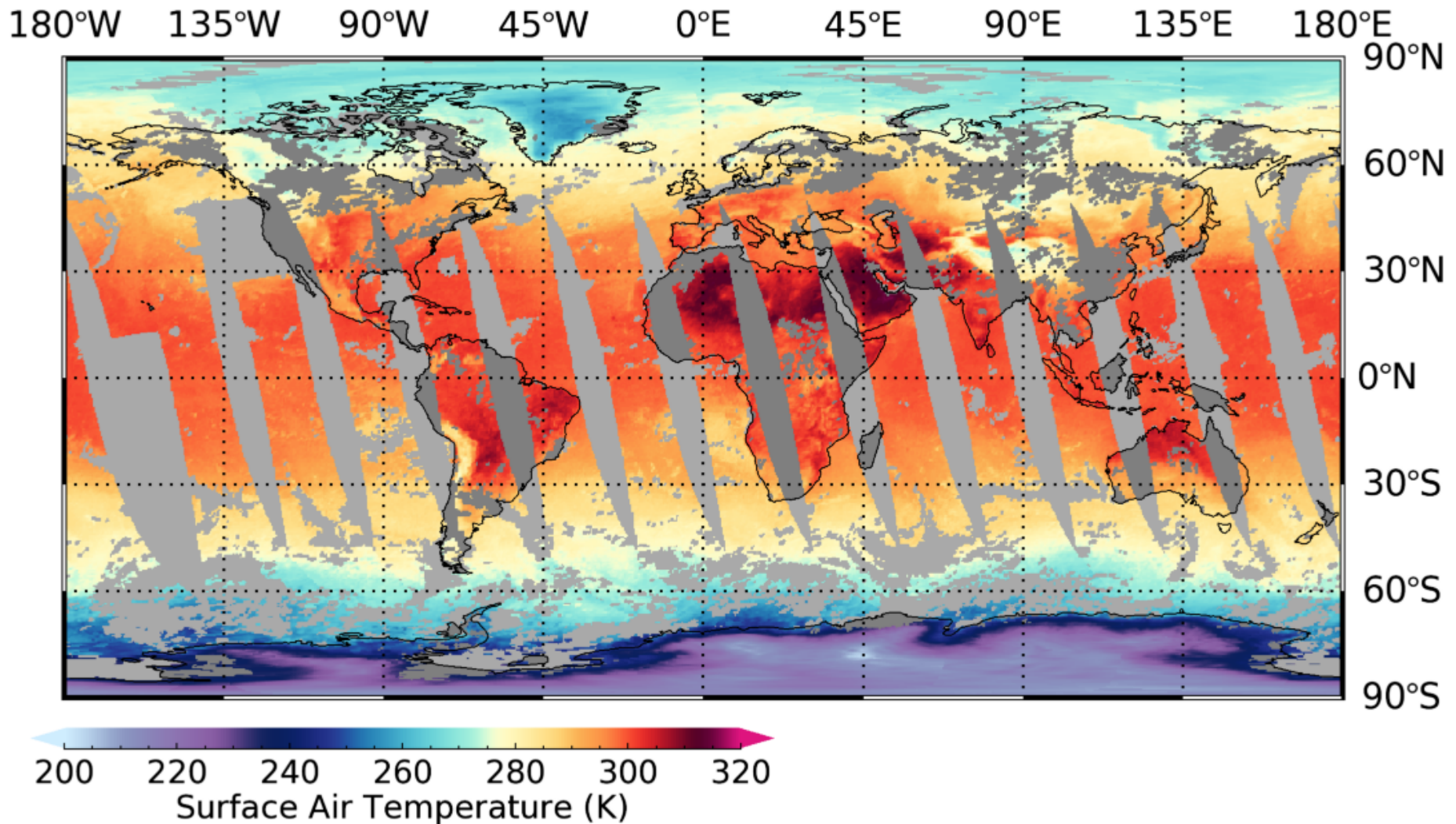
Enhanced AIRS NRT Imagery

Added CH₄ at 400hPa 9/12/2018



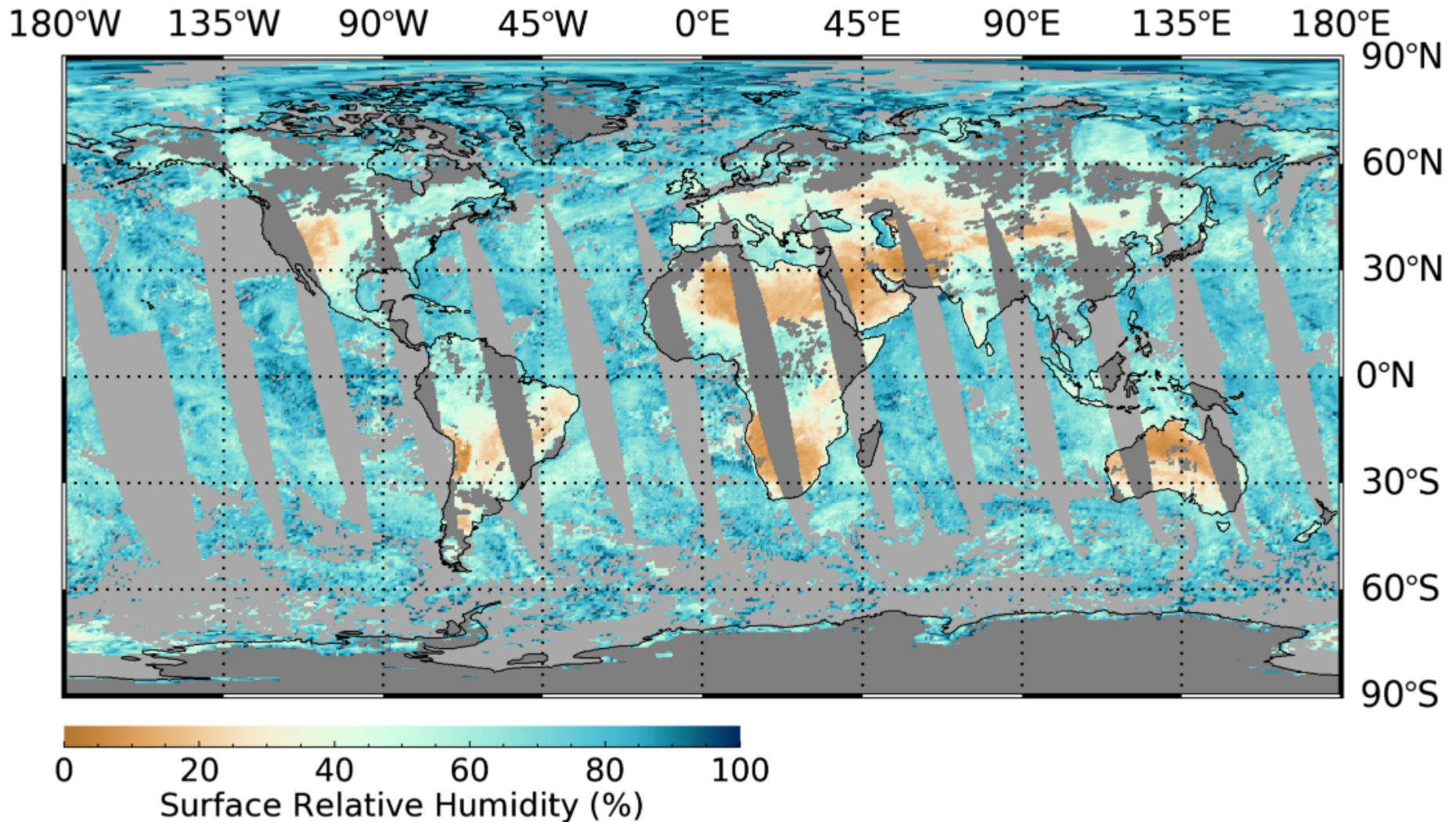
Enhanced AIRS NRT Imagery

Added Surface Air Temperature 9/12/2018

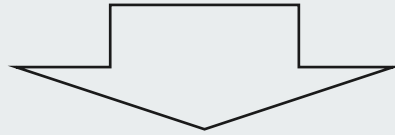


Enhanced AIRS NRT Imagery

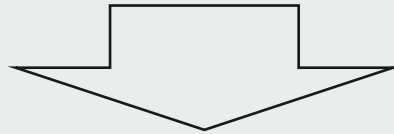
Added Surface Relative Humidity 9/12/2018



Do we know what data users want?



Users (esp. novelty users) don't know what they want.



Can we infer what data users want?

What users are asking for wrt AIRS products?

- Most popular data
 - What and who they are
- User request
 - Documents
 - Complaints
 - Concerns/Queries
 - Suggestions
- Application



Data Access/Usage Metrics



User Assistance Records

Publication and Giovanni

Caution: Always keep in mind of sampling bias when looking at STATS

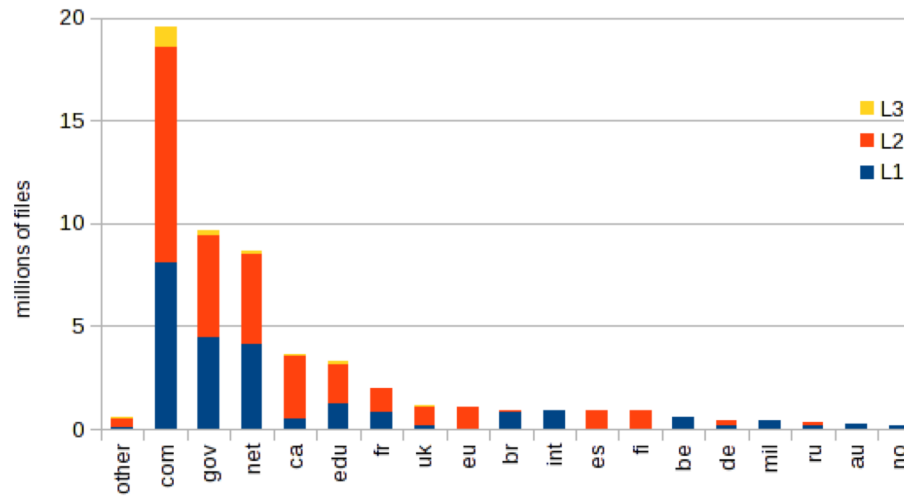
Detail Table



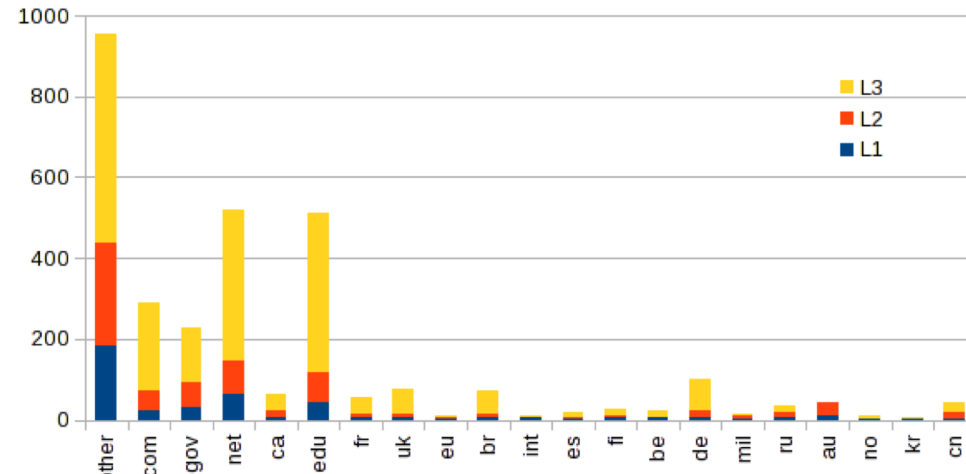
- AIRS3STD
- AIRX3STD

Who they are? How they use?

Top 20 Domains, by # Files



Number of Distinct Users per Domain

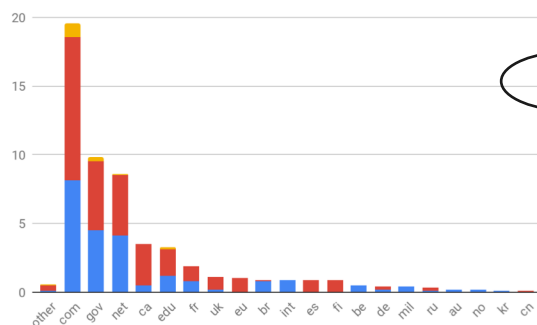


- 130 total domains representing over 115 countries.
- Top 25 domain list by # users also includes: in, jp, id, co, mx, nl, it, tw, pk, se and ch.
- Nearly 50% of IPs are unresolvable and are **not** included in above charts.

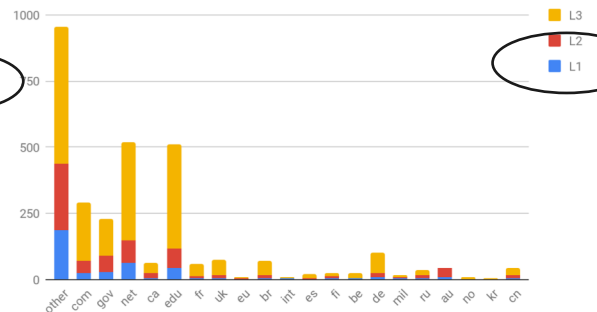
Where are they?

Level 1 data users

Top 20 Domains, by # of Files (millions)



Distinct Users by Domain

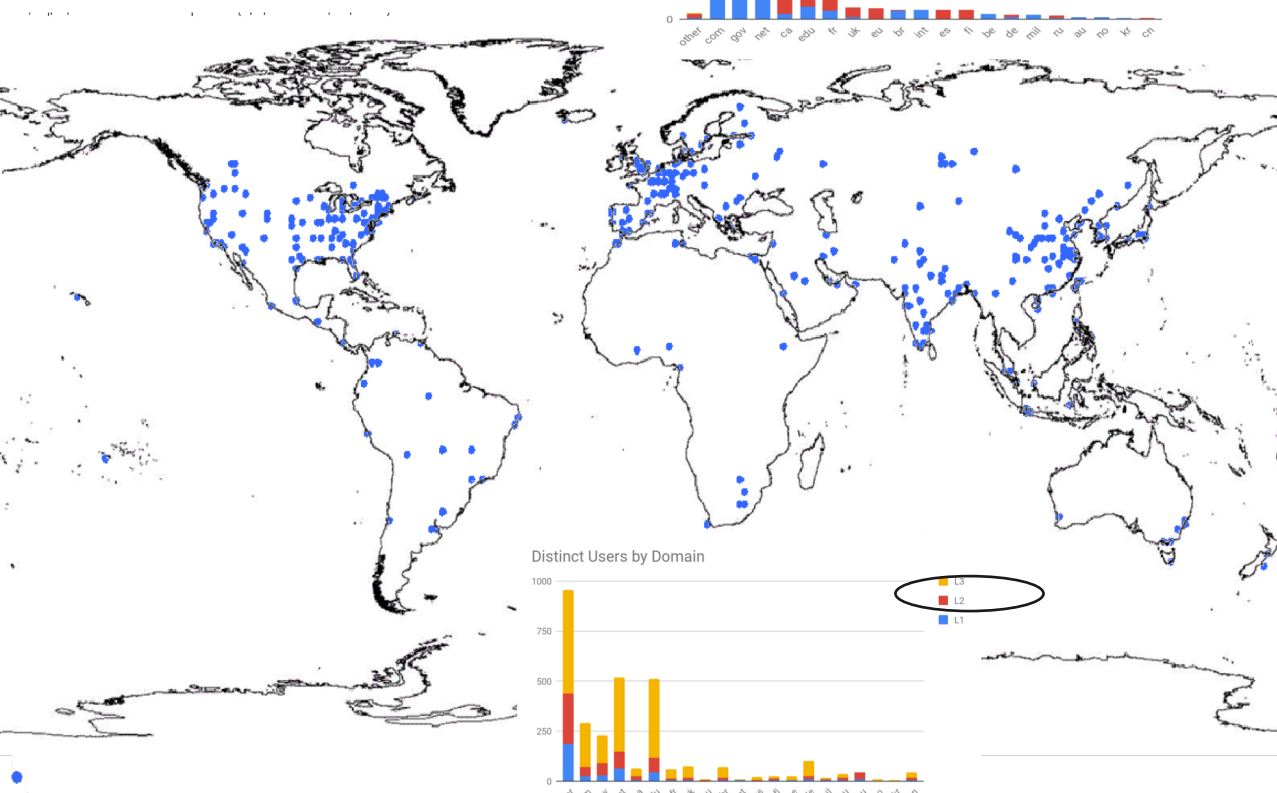


Top Level 1 parameters (**99%** of L1 parameter subsets):

scanang, dust_flag, topog, satazi, sun_glint_distance, solazi, CalFlag, radiances, topog_err

Where are they?

Level 2 data users



About **30%** of Level 2 requests are for subsets, with the remainder being for full granules.

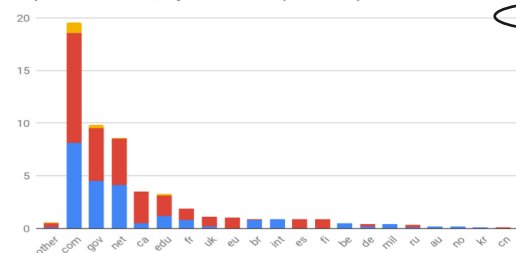
Top 25 Level 2 **Standard** parameters (60% of L2 Std subsets): GP_Tropopause, TAirStd, GP_Height, CldFrcStd, H2OMMRSat_liquid, CldFrcStdErr, H2O_verticality, H2OMMRSat, MWSurfClass, H2OMMRStd, H2OMMRStdErr, PTropopause, PBest, PGood, PSurfStd, TSurfAir, O3VMRStd, TSurfAirErr, TSurfStd, O3VMRStdErr, glintlat, clolr, glintlon, TAirMWOnlyStd, TAirStdErr

Top 25 Level 2 **Support** parameters: (99% of L2 Sup subsets): CldEmis, CldRho, CO_VMR_eff, H2OCDSup, H2OCDSupErr, O3CDSup, PCldTopStd, PCldTopStdErr, PGood, PSurfStd, TAirMWOnly, TAirSup, TAirSupErr, TCldTopStd, TSurfStd, TCldTopStdErr, TSurfStdErr, T_Tropopause, numCloud, pressSupp, pseudo_lapse_rate, toH2OStd, tsurf_forecast

Where are they?

Level 3 data users

Top 20 Domains, by # of Files (millions)



About **20%** of requests for Level 3 products are via **Giovanni**. Another **30%** of requests are for parameter **subsets**, with the remaining 50% being for full granule downloads.

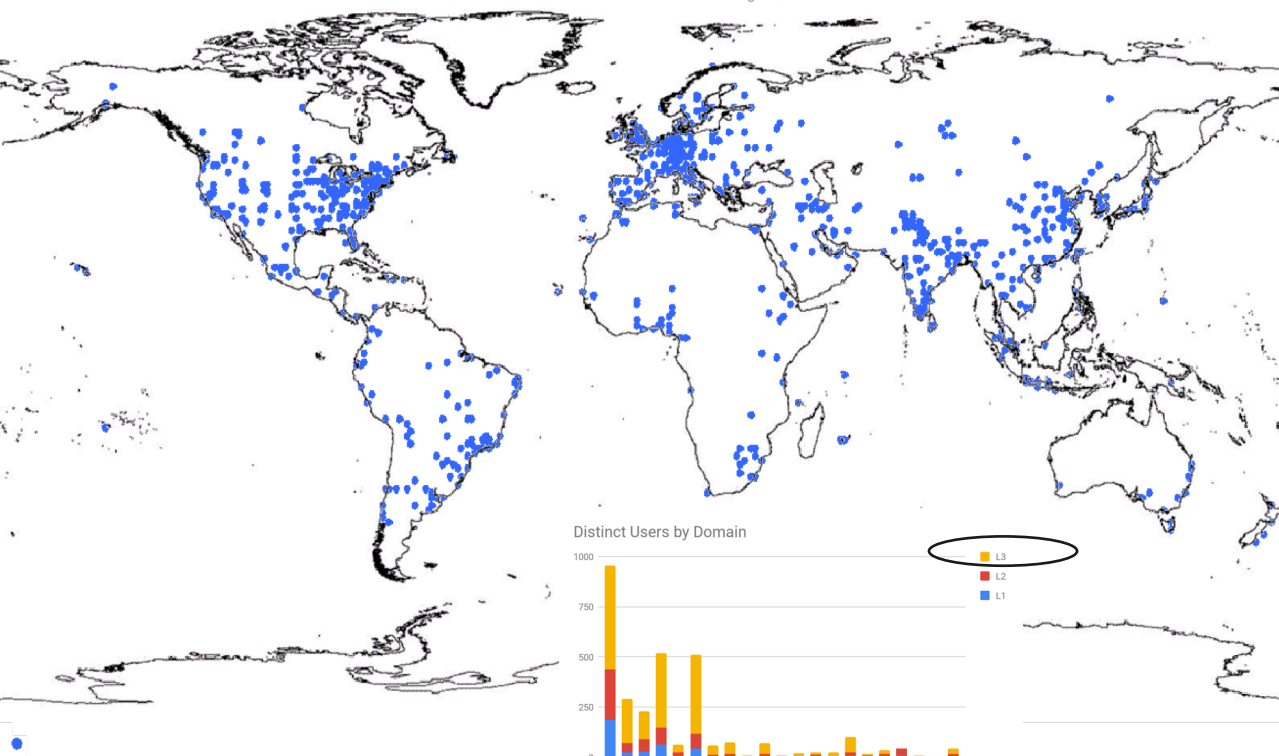
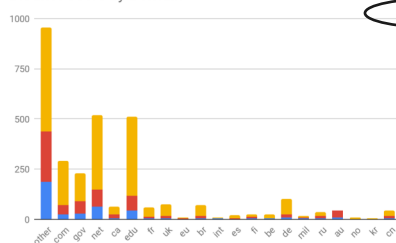
Top 25 Level 3 **Standard** parameters (60% of L3 Std subsets):

Temperature_D, SurfAirTemp_D, SurfAirTemp_A, Temperature_A, RelHumSurf_A, TotH2OVap_A, CloudFrc_A, TotH2OVap_D, H2O_MMR_A, H2O_MMR_D, RelHum_A, TotCH4_A, CO_VMR_A, CO_VMR_D, TotO3_A, TotCO_A, O3_VMR_A, O3_VMR_D, RelHum_D, SurfAirTemp_A_max, SurfAirTemp_A_min, TotO3_D, SurfAirTemp_A_sdev, RelHumSurf_D

Top 25 Level 3 **Support** parameters (60% of L3 Sup subsets):

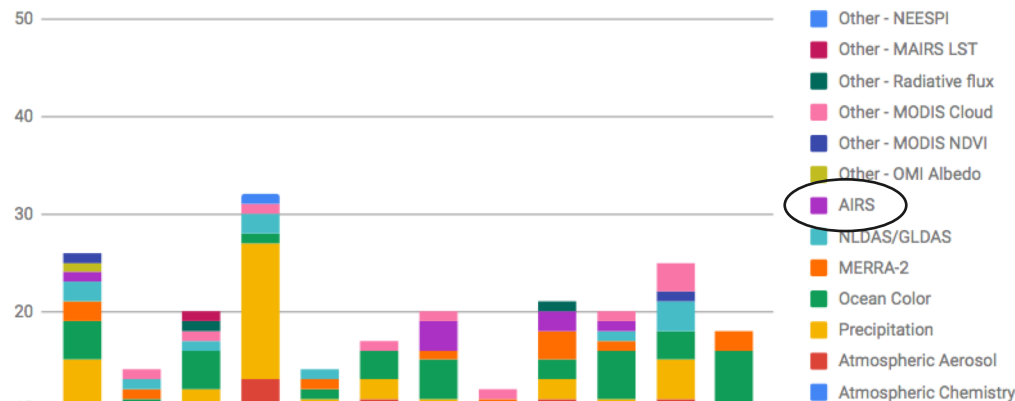
bndry_lyr_top_A, TAirsup_A, TAirsup_D, bndry_lyr_top_D, bndry_lyr_top_A_sdev, bndry_lyr_top_D_sdev, bndry_lyr_top_A_min, bndry_lyr_top_A_max, bndry_lyr_top_A_ct, bndry_lyr_top_D_ct, bndry_lyr_top_D_max, bndry_lyr_top_D_min, MODIS_LST_A, MODIS_LST_D, H2OCDSup_A, H2OCDSup_D, IR_Precip_Est_A, IR_Precip_Est_D, Topography, COCDSup_A, TAirsup_A_max, TAirsup_A_min, TAirsup_D_max, TAirsup_D_min

Distinct Users by Domain



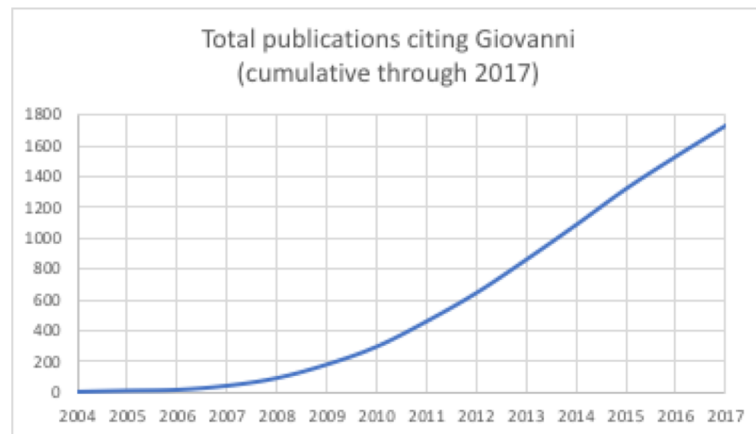
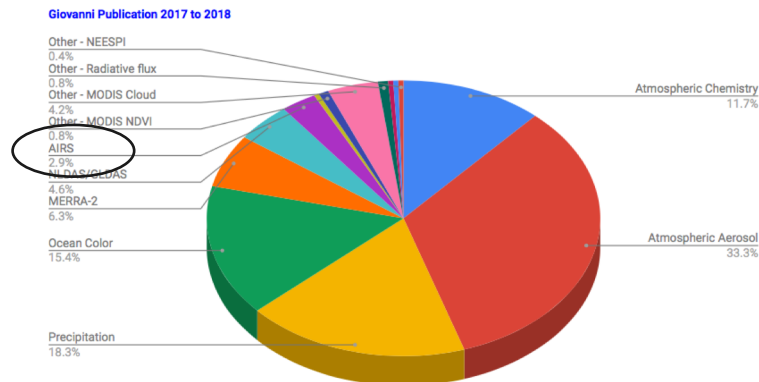
Giovanni Publication (2017 Sep to 2018 Aug)

Giovanni Publication

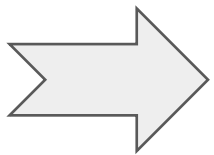


- Top 25 parameters in Giovanni, in decreasing popularity (80% of AIRS Giovanni usage):

O3_VMR_A, CH4_VMR_A, Temperature_A, CO_VMR_A, SurfSkinTemp_D, SurfAirTemp_A, TotO3_A, SurfSkinTemp_A, mole_fraction_of_carbon_dioxide_in_free_troposphere, CH4_VMR_D, O3_VMR_D, SurfAirTemp_D, CO_VMR_D, RelHumSurf_A, TotH2OVap_A, TotO3_D, RelHumSurf_D, OLR_A, ClrOLR_A, ClrOLR_D, OLR_D, TotCH4_A, TotCO_A, TropPres_A, TropTemp_A



- Dedicated User support
 - Web Content (currently 9 content types)
 - Feedback
 - Inquiry
 - Forum (coming soon)

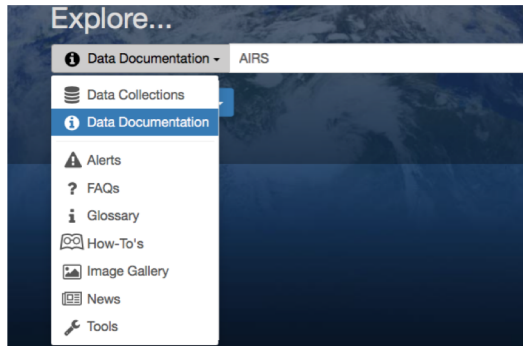


gsfc-help-disc@lists.nasa.gov

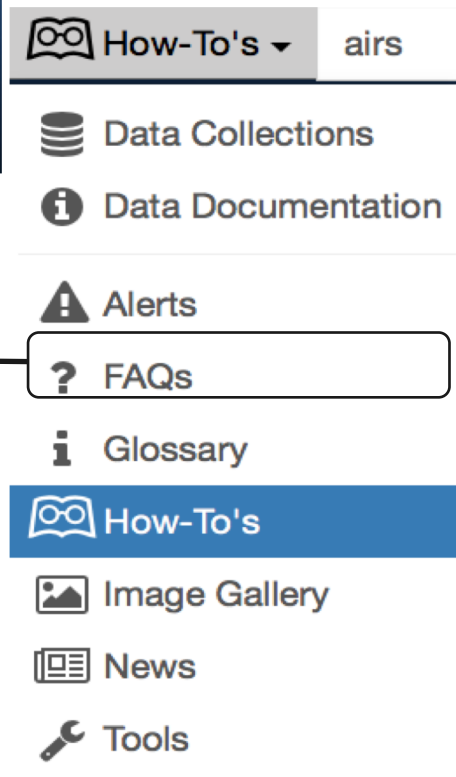
Sounder Document FAQs + HowTo

Total Records:

1050

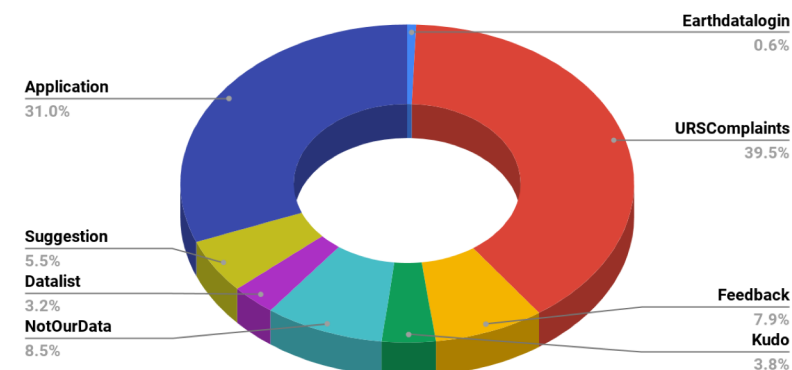
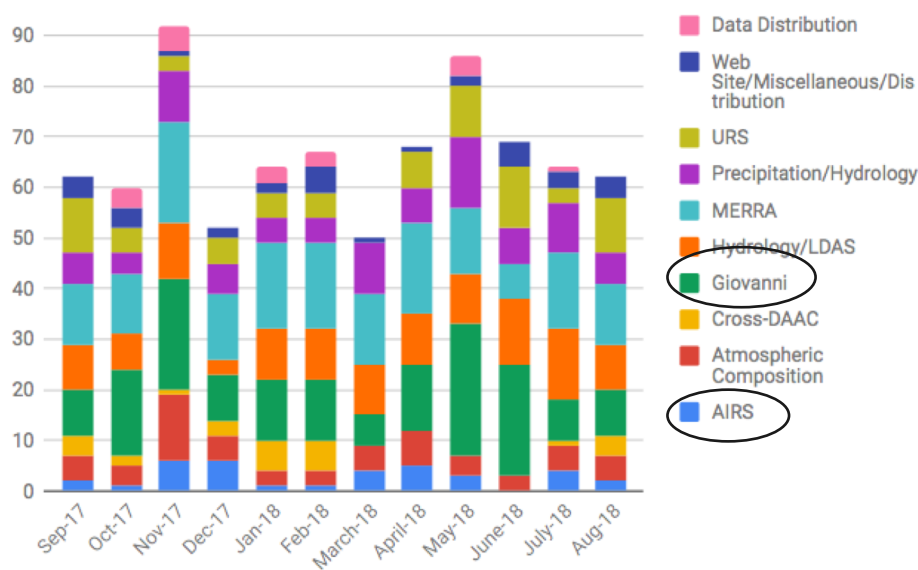


- Data Access [7]
- Algorithm [2]
- Information [24]
- Download [1]
- QA/QC [1]
- Reader [2]
- Services/Visualization [11]



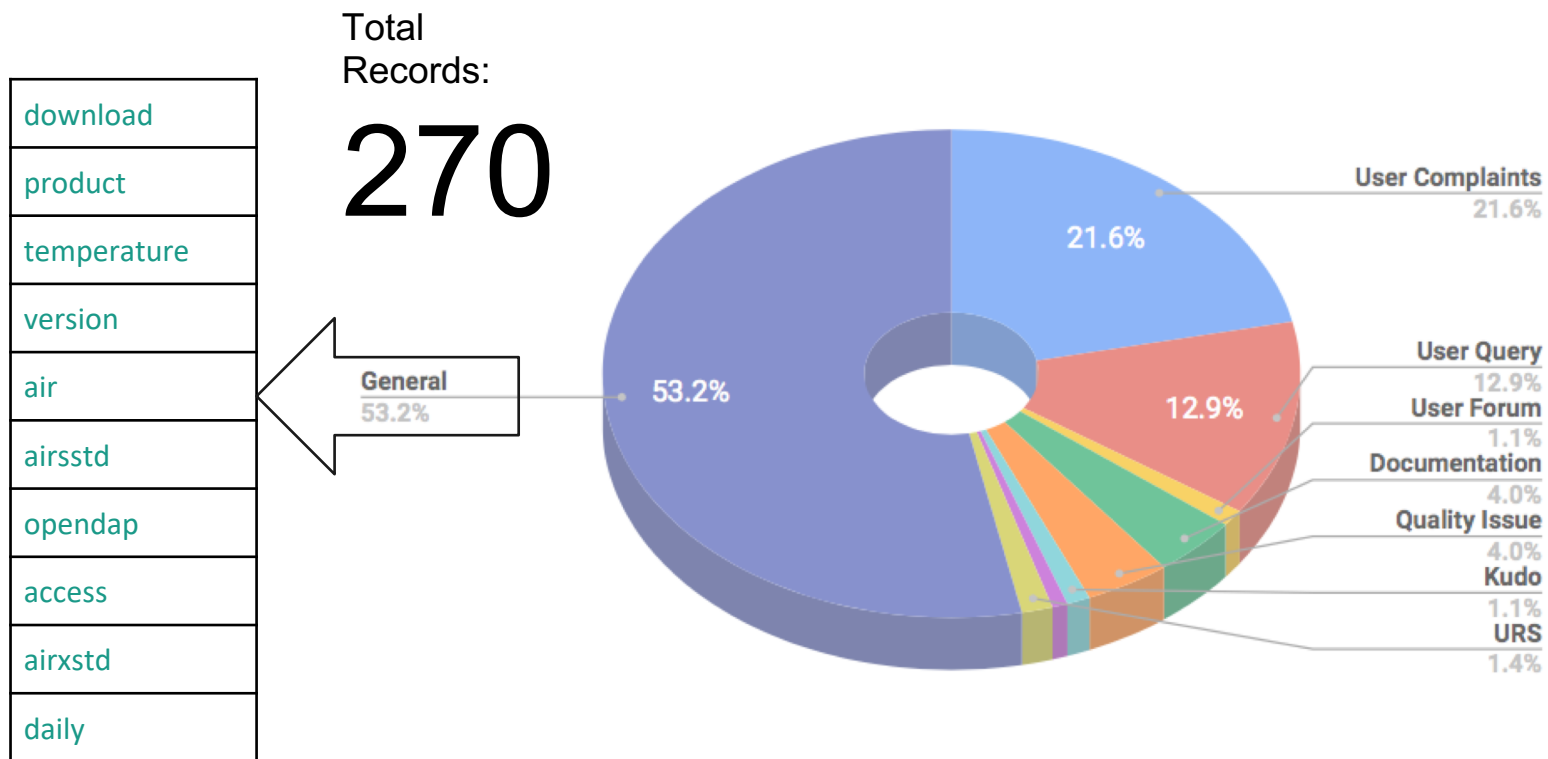
- Science Topic Example [2]
 - [How to calculate greenhouse gas growth rates](#)
 - How to Obtain Data for Conducting Hurricane Case Study
- Download [3]
 - [How To Download Long Term AIRS L3 Data in a Small Region into one ASCII File Using the AIRS Aggregated Data Service in OPeNDAP](#)
 - [How to download and obtain parameter and pixel subset of AIRS NRT data using OPeNDAP](#)
 - [How to Obtain Data in NetCDF Format via SSW](#)
- Visualization [3]

User Inquiry Records (2017-Sep to 2018-Aug)



- We get about 60 user requests on the average
- MERRA, Giovanni and Hydrology are the top 3 inquired areas
- Still users need help in Earthdata Login (URS)
- Science teams and data providers are requesting these metrics routinely

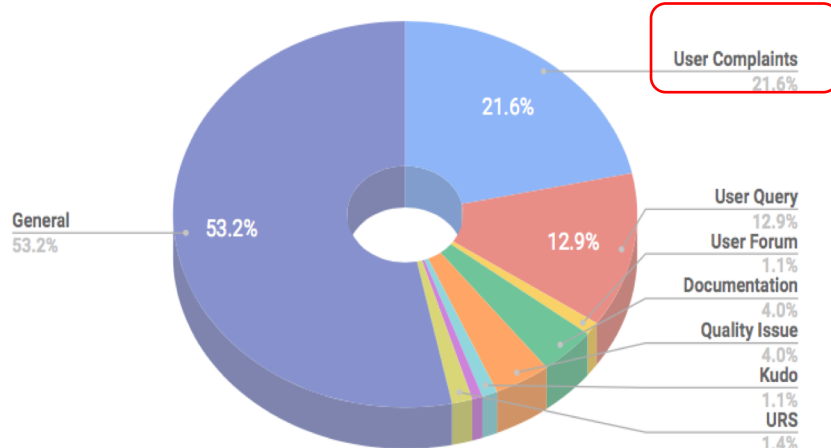
User Assistance Records for Sounder Products



What are users complaining about?

Total
Records:

60



Word
data
download
level
missing
problem
airstd
airxret
error
lb
feedback

Additional Information



Data Collection	Longname	January through December 2017		January through August 2018		Total Number of Files
		Number of Users	Number of Files	Number of Users	Number of Files	
Level-3						
AIRS3STM	Monthly Standard Retrieval (AIRS-only)	146	18268	119	9173	27441
AIRX3STM	Monthly Standard Retrieval (AIRS+AMSU)	138	11688	70	6907	18595
AIRH3STM	Monthly Standard Retrieval (AIRS+AMSU+HSB)	11	46	6	87	133
AIRS3SPM	Monthly Support Retrieval (AIRS-only)	63	2162	50	2513	4675
AIRX3SPM	Monthly Support Retrieval (AIRS+AMSU)	81	16038	32	7278	23316
AIRH3SPM	Monthly Support Retrieval (AIRS+AMSU+HSB)	11	51	7	90	141
AIRS3STD	Daily Standard Retrieval (AIRS-only)	181	238922	156	344449	583371
AIRX3STD	Daily Standard Retrieval (AIRS+AMSU)	922	241908	1937	75866	317774
AIRH3STD	Daily Standard Retrieval (AIRS+AMSU+HSB)	18	1141	5	384	1525
AIRS3SPD	Daily Support Retrieval (AIRS-only)	106	52418	64	11393	63811
AIRX3SPD*	Daily Support Retrieval (AIRS+AMSU)	0	0	5	63	63
AIRH3SPD	Daily Support Retrieval (AIRS+AMSU+HSB)	13	1113	4	383	1496
AIRS3ST8	8-day Standard Retrieval (AIRS-only)	40	6283	21	5432	11715
AIRX3ST8	8-day Standard Retrieval (AIRS+AMSU)	29	2499	13	1232	3731
AIRH3ST8	8-day Standard Retrieval (AIRS+AMSU+HSB)	10	174	4	112	286
AIRS3SP8	8-day Support Retrieval (AIRS-only)	35	2777	16	1274	4051
AIRX3SP8*	8-day Support Retrieval (AIRS+AMSU)	0	0	2	46	46
AIRH3SP8	8-day Support Retrieval (AIRS+AMSU+HSB)	14	154	7	112	266
AIRS3QPM	Monthly Quantization (AIRS-only)	35	1614	8	444	2058
AIRX3QPM	Monthly Quantization (AIRS+AMSU)	19	677	4	70	747

Data Collect ion	Longname	January through December 2017		January through August 2018		Total Number of Files
		Number of Users	Number of Files	Number of Users	Number of Files	
Level-3 cont inued						
AIRH3QPM	Monthly Quant izat ion (AIRS+AMSU+HSB)	12	45	4	79	124
AIRS3QP5	Daily Quant izat ion (AIRS-only)	31	7897	17	2379	10276
AIRX3QP5	Daily Quant izat ion (AIRS+AMSU)	7	1275	3	71	1346
AIRH3QP5	Daily Quant izat ion (AIRS+AMSU+HSB)	12	229	5	135	364
AIRS3C2M	Monthly CO2 (AIRS-only)	79	2953	54	2185	5138
AIRX3C2M	Monthly CO2 (AIRS+AMSU)	73	3354	42	1390	4744
AIRS3C2D	Daily CO2 (AIRS-only)	41	39441	22	17909	57350
AIRX3C2D	Daily CO2 (AIRS+AMSU)	19	19500	10	18949	38449
AIRS3C28	8-Day CO2 (AIRS-only)	27	1784	18	1612	3396
AIRX3C28	8-Day CO2 (AIRS+AMSU)	20	471	7	715	1186

Protocols used were HTTPS, OpenDAP, SUBSET_AIRSL1L2, and SUBAIRSL2_DQS

* Note, AIRX3SPD and AIRX3SP8 were missing from Metrics logs until mid-May 2018.

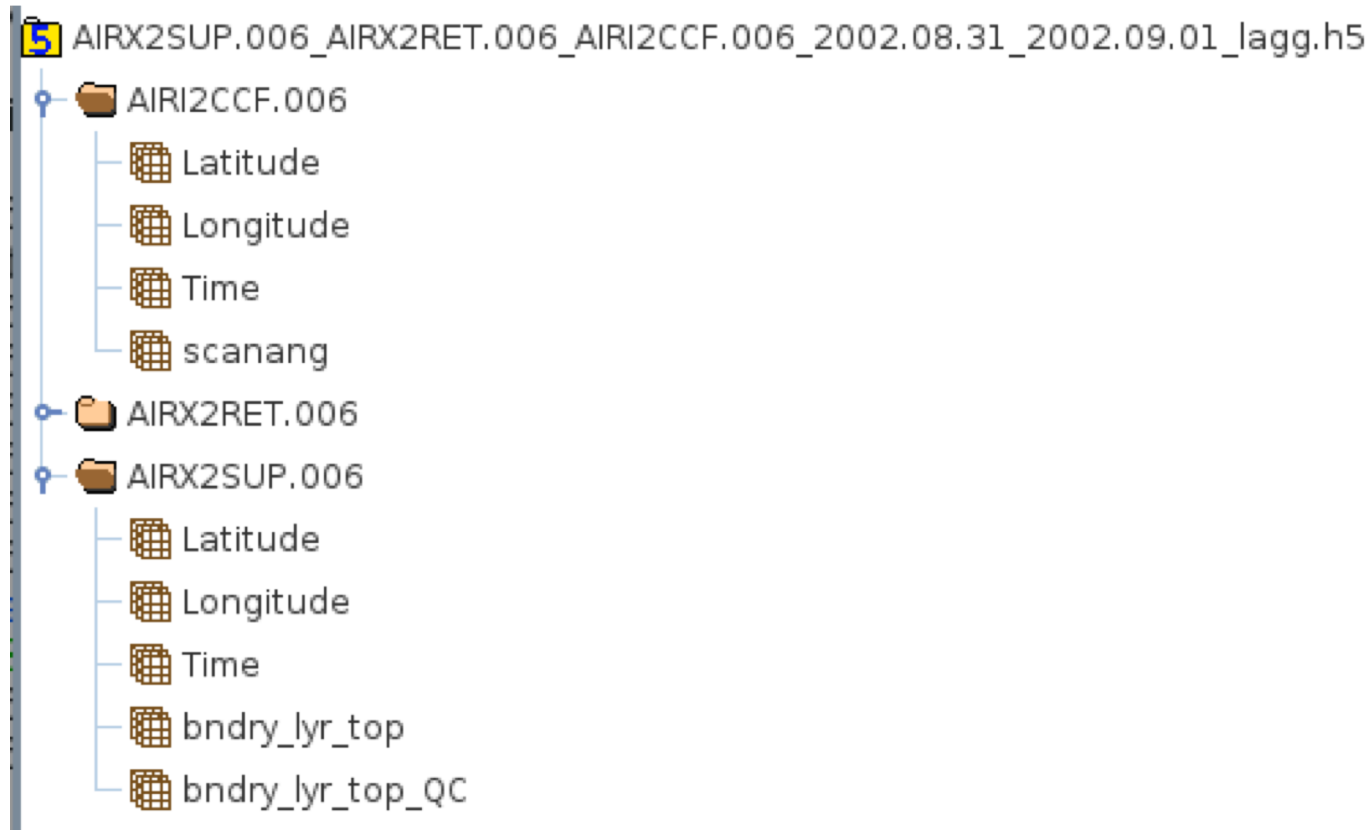
Data Collection	Longname	January through December 2017		January through August 2018		Total Number of Files
		Number of Users	Number of Files	Number of Users	Number of Files	
Level-2						
AIRS2RET	Standard Retrieval (AIRS-only)	191	6053604	174	4279785	10333389
AIRX2RET	Standard Retrieval (AIRS+AMSU)	168	9603227	68	2819898	12423125
AIRH2RET	Standard Retrieval (AIRS+AMSU+HSB)	22	545	5	78	623
AIRS2RET_NRT	Near Real Time Standard Retrieval (AIRS-only)	223	7524302	206	4647418	12171720
AIRX2RET_NRT	Near Real Time Standard Retrieval (AIRS+AMSU)	168	9603227	68	2819898	12423125
AIRS2SUP	Support Retrieval (AIRS-only)	86	599530	83	696302	1295832
AIRX2SUP	Support Retrieval (AIRS+AMSU)	63	4904681	52	436260	5340941
AIRH2SUP	Support Retrieval (AIRS+AMSU+HSB)	10	190	9	82	272
AIRS2SUP_NRT	Near Real Time Support Retrieval (AIRS-only)	124	724400	117	747867	1472267
AIRX2SUP_NRT	Near Real Time Support Retrieval (AIRS+AMSU)	63	4904681	52	436260	5340941
AIRS2STC	CO2 (AIRS-only)	13	1209309	11	2771615	3980924
AIRX2STC	CO2 (AIRS+AMSU)	9	972008	4	77	972085
AIRS2SPC	CO2 Support Retrieval (AIRS-only)	17	141631	13	8005	149636
AIRX2SPC	CO2 Support Retrieval (AIRS+AMSU)	15	87557	3	79	87636
AIRS2CCF	Cloud-Cleared IR Radiances (AIRS-only)	24	20752	16	878896	899648
AIRI2CCF	Cloud-Cleared IR Radiances (AIRS+AMSU)	16	4593	14	152869	157462
AIRH2CCF	Cloud-Cleared IR Radiances (AIRS+AMSU+HSB)	9	45790	3	72	45862
AIRS2CCF_NRT	NRT Cloud-Cleared IR Radiances (AIRS-only)	31	30784	21	878968	909752
AIRI2CCF_NRT	NRT Cloud-Cleared IR Radiances (AIRS-AMSU)	16	4593	14	152869	157462
AIRG2SSD	L2G Precipitation Estimate (AIRS-only)	24	8480	9	998	9478

Data Collect òn	Longname	January through December 2017		January through August 2018		Total Number of Files
		Number of Users	Number of Files	Number of Users	Number of Files	
Level-1						
AIRABRAD_NRT	NRT AMSU (A1/A2) geolocated calib bright temp	52	832449	54	348293	1180742
AIRIBRAD_NRT	NRT IR geolocated calib bright temp	190	6119970	147	5361962	11481932
AIRVBRAD_NRT	NRT Visible/Near IR geolocated calib bright temp	26	19335	18	263	19598
AIRIBRAD_NRT_BUFR	NRT IR geolocated calib bright temp BUFR format	204	6163784	153	5443936	11607720
AIRIBRAD_NRT_GMAO	NRT IR geolocated calib bright temp GMAO format	192	6214098	148	5416109	11630207
AIRABRAD	AMSU (A1/A2) geolocated calib bright temp	31	723500	37	295834	1019334
AIRIBRAD	IR geolocated calib bright temp	138	5973596	111	5239243	11212839
AIRVBRAD	Visible/Near IR geolocated calib bright temp	8	17	4	80	97
AIRVBQAP	Visible/Near IR quality assurance subset	9	32	4	101	133
AIRIBQAP	IR quality assurance subset	19	226437	9	423462	649899
AIRICRAD	IR resampled and corrected radiances	18	491	9	50428	50919
AIRXBCAL	Calibrat òn subset	10	1433	13	2402	3835

Protocols used were HTTPS, OpenDAP, SUBSET_AIRSL1L2, and SUBAIRSL2_DQS

* Note, AIRX3SPD and AIRX3SP8 were missing from Metrics logs until mid-May 2018.

L2 Aggregation Prototype



We can aggregate data from different granules:

- Aggregation in Time (e.g., daily or longer time series files)
- Aggregation from different products (e.g., **scanang** from the “Cloud Clear Radiance” product and **bndry_lyr_top** from the “Support” product can be added to variables from the standard product)

L2 Aggregation: Problems and Possibilities

- It takes just over a minute to aggregate a day of one standard profile variable with quality control and geolocation. More variables would take longer. Thus, it cannot be run as an **on-the-fly service**.
- Daily aggregated files with the main AIRS Level 2 Standard Temperature and Water Vapor profile data are ~ **350 MB**.
- Aggregated files could be pregenerated and provided as **value added products**.
- Daily aggregated files of MERRA-2 data synchronized in time and space with AIRS Level 2 could be possible as **value added products**.
- It could be possible to achieve similar results using OPeNDAP but it would require more processing by users.