NASA Sounder Science Team Meeting

SNPP Sounder SIPS Status and Highlights

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A word about the Sounder SIPS

- **The SNPP/JPSS Sounder SIPS consists of two elements: JPL & GES DISC**

  - **JPL:** Software Integration, Test & Assessment
    - Integrate software from Science Teams into our local data system to 'execute on demand' in a production-like environment
    - Develop production-level PGEs which are delivered to GES DISC to put into operations
    - Product definition lead (coordinated effort): metadata, attributes, variables & units
    - Documentation: writing of Product User Guides and coordinate review of ATBDs
    - Produce test products for science assessment
    - Feedback to PIs assessment results of retrieval products and retrieval algorithm (Bjorn Lambrigtsen's team)
  - **GES DISC:** Data Product Generation (Operations)
    - Ingest and distribute SNPP & JPSS-1 Level 0 time-based data using the S4PA
    - Forward processing and reprocessing of NASA research sounder products for SNPP and JPSS-1: Level 1 – Level 3
    - Documentation Review
    - Ingest of ancillary/correlative products needed to support data processing
    - Transfer Level 1, Level 2 & Level 3 products to JPL via 'push' using the S4PA

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A word about the Sounder SIPS con't

- **Data Archive and Distribution**
  - SNPP/JPSS-1 Sounding data: Goddard DAAC
  - Provide a full suite of user services for distribution of products:
    - Data subscriptions
    - Ordering capabilities
    - Subsetting

- **Points of Contact**
  - **JPL** – Ruth Monarrez (ruth.monarrez@jpl.nasa.gov)
  - **GES DISC** – Dana Ostrenga (Dana.M.Ostrenga@nasa.gov) and Mike Theobald (Michael.l.Theobald@nasa.gov)
  - **General SIPS or ATMS L1** questions: sounder.sips@jpl.nasa.gov
  - **CrIS Level 1 team:** cris.l1b.support@ssec.wisc.edu

External Relationships / Acknowledgements

- **The Sounder SIPS works closely with:**
  - NASA Sounding Science Team
    - Overall direction coordinated with the SNPP Sounder Discipline lead, Chris Barnet
    - Coordination support through our Sounder Science Team liaison, Eric Fetzer
    - Retrieval system support from revolving Sounding Science Team members
  - CrIS Level 1 Algorithm Team (Univ of Wisc)
    - Joe Taylor (PI, UW) and Larrabee Strow (PI, UMBC)
    - Graeme Martin (Technical Manager)
  - ATMS Level 1 Algorithm Team (JPL)
    - Bjorn Lambrigtsen (PI), Evan Fishbein, Mathias Schreier
  - AIRS Project
    - Joao Teixeira (AIRS PI), Tom Pagano (AIRS Project Manager)
    - Algorithm and code sharing (where it makes sense)
    - Shared resources: hardware, software, personnel
    - Product assessment by AIRS Science Team
  - Earth Science Data and Information System (ESDIS) Project
    - NASA SIPS Guidance - John Moses, Evelyn Ho & Jeanne Behnke

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Core NASA Research Products

SNPP:

- L1A (ATMS & CrIS)
- L1B (ATMS & CrIS)
- L2 (CrIMSS)
  - CHART (V1, NSR only)
  - CLIMCAPS
  - ESSPA (V1, NSR only)
  - ESSPA-Ammonia
- L2 (ATMS)
  - RAMSES
- L3 (ATMS & CrIMSS)

JPSS-1:

- L1A (ATMS & CrIS)
- L1B (ATMS & CrIS)
- L2 (CrIMSS)
  - CLIMCAPS
  - ESSPA-Ammonia
- L2 (ATMS)
  - RAMSES
- L3 (ATMS & CrIMSS)

JPSS-2: (planned)

- L1A (ATMS & CrIS)
- L1B (ATMS & CrIS)
- L2 (CrIMSS)
  - CLIMCAPS
  - ESSPA-Ammonia
- L2 (ATMS)
  - RAMSES
- L3 (ATMS & CrIMSS)

Additional Products

ROSES TASNPP products:

- Climate Trend (Strow) – gridded radiances (L1) and averaged gridded radiances (L3) (AIRS, CrIS, IASI – L1)
- PAN (Payne) – Peroxyacytyl nitrate (CrIS L1)
- Single FOV (Liu) - Temp, water vapor, ozone, carbon monoxide, carbon dioxide, methane, nitric acid (AIRS/AMSU – L1, CrIS/ATMS – L1)
- Single FOV (Worden) – carbon monoxide (MOPITT, CrIS – L1)

Radiance Subset Products: To help monitor and compare the calibration of sounders

- Match-ups between different sensors
- Calibration Subsets
- Simultaneous Nadir Obs (SNO) between different sensors
- Gridded Averaged Radiances

IMG: VIIRS & CrIS (UW)

- Co-located CrIS L1B and VIIRS radiance + cloud mask

Granule MAPS (JPL)

- Assist in locating the granule associated with area of interest

Current instruments/sensors supported:

- IR: AIRS, CrIS (x2), IASI (x3)
- MW: AMSU (x5), ATMS (x2)

Sounder SIPS Products to date

Forward Processing at Sounder SIPS/GES-DISC:

Level 1	Version 2	Coverage	Public Released
SNPP ATMS	L1B	Entire mission	Spring 2018
SNPP CrIS	L1B	Entire mission (FSR starting Nov 2, 2015)	Spring 2018
JPSS-1 ATMS	L1B	Entire mission	August 2019
JPSS-1 CrIS	L1B	Entire mission (FSR)	April 2019

Sounder SIPS Products to date (con't)

Processing at Sounder SIPS/JPL:

Level 2/3	Version 1	Coverage Jan, April, July, Oct: 2013, 2015	Public Release
CrIMSS	CHART	X	Sept 2019
	CLIMCAPS	X	Sept 2019
	ESSPA*	X	Spring 2020
	ESSPA-NH3	X	Nov 2019
ATMS	RAMSES 2	X	Nov 2019

* - awaiting code delivery

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Upcoming Sounder SIPS Products

Processing at Sounder SIPS/GES DISC:

Level 2/3	Version 2	Coverage	Public Release
CrIMSS	CLIMCAPS* (NSR & FSR)	Full Mission (FSR starting Nov 2, 2015)	Late Fall / early Winter 2019
	ESSPA-NH3	Full Mission	Late Fall / early Winter 2019
ATMS	RAMSES 2	Full Mission	Late Fall / early Winter 2019

Level 1	Version 3	Coverage	Public Release
SNPP ATMS	L1B	Entire mission	Early Spring 2020
SNPP CrIS	L1B	Entire mission (FSR starting Nov 2, 2015)	Early Spring 2020
JPSS-1 ATMS	L1B	Entire mission	Early Spring 2020
JPSS-1 CrIS	L1B	Entire mission	Early Spring 2020

*-Also supports AQUA & JPSS-1

Where's the Data?

Q: Where can I get Level 1 SNPP & JPSS data?

A: You can it now, at https://disc.gsfc.nasa.gov/

(Hint: The best was to start searching for the data is to use the shortname.)

Q: Where can I get CrIMSS Level 2 and Level 3 products?

A: You can get Version 1 (limited edition) now, for CHART & CLIMCAPS at: https://disc.gsfc.nasa.gov/

Q: When/where can I get the latest version (V2) of CrIMSS Level 2 and Level 3 products?

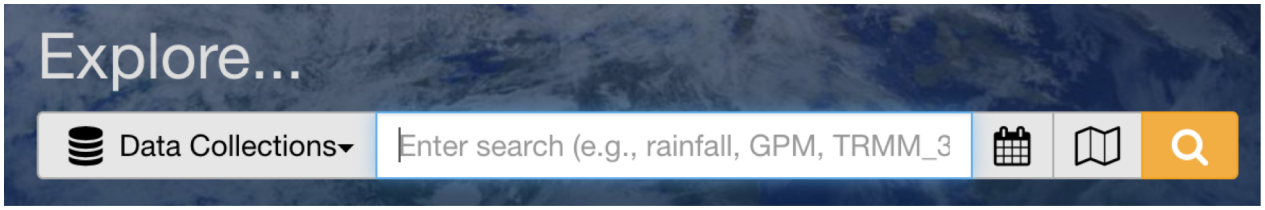
A: You can get Version 2 starting late November to December 2019 at https://disc.gsfc.nasa.gov/

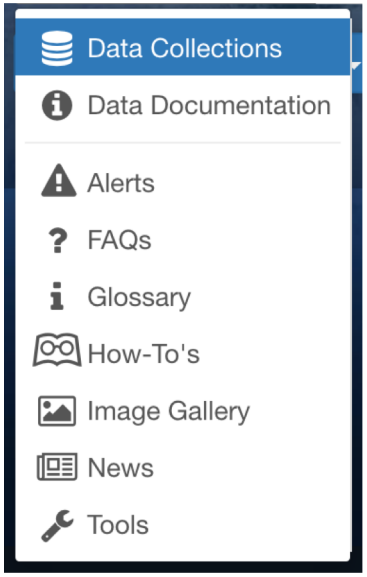
Where's the Data? (con't)

Q: Where can I get SNPP & JPSS data?

A: You can download data now, at https://disc.gsfc.nasa.gov/

(Hint: The best was to start searching for the data is to use the shortname.)



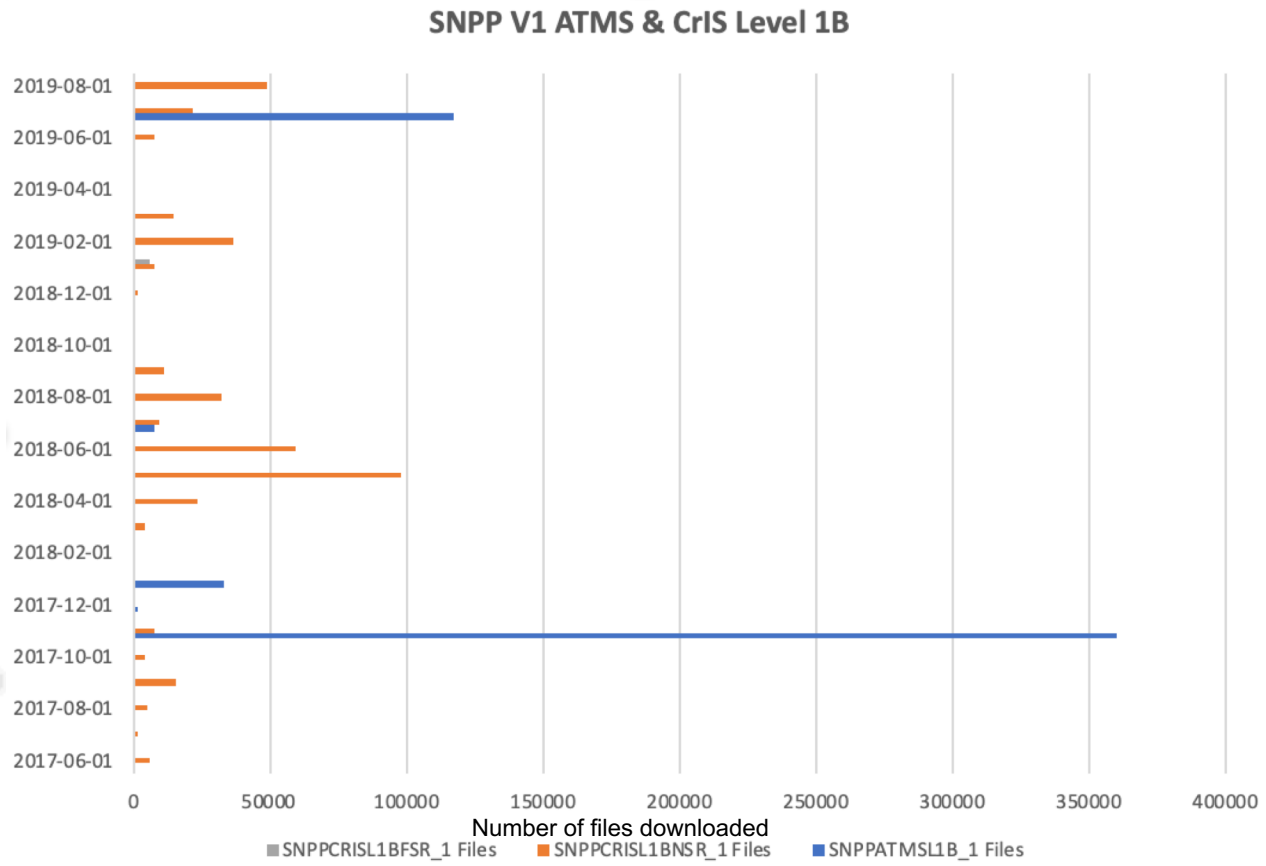


sndr

- **SNDR**J1ATMSL1B
- **SNDR**J1ATMSL1B_2
- **SNDR**J1CrISL1B
- **SNDR**J1CrISL1B_2
- **SNDR**SNIML2CCPCCRN
- **SNDR**SNIML2CCPCCRN_1
- **SNDR**SNIML2CCPRETN
- **SNDR**SNIML2CCPRETN_1
- **SNDR**SNIML2CHTCCRN
- **SNDR**SNIML2CHTCCRN_1
- **SNDR**SNIML2CHTRETN
- **SNDR**SNIML2CHTRETN_1
- **SNDR**SNIML3CDCCPN
- **SNDR**SNIML3CDCCPN_1
- **SNDR**SNIML3CDCHTN

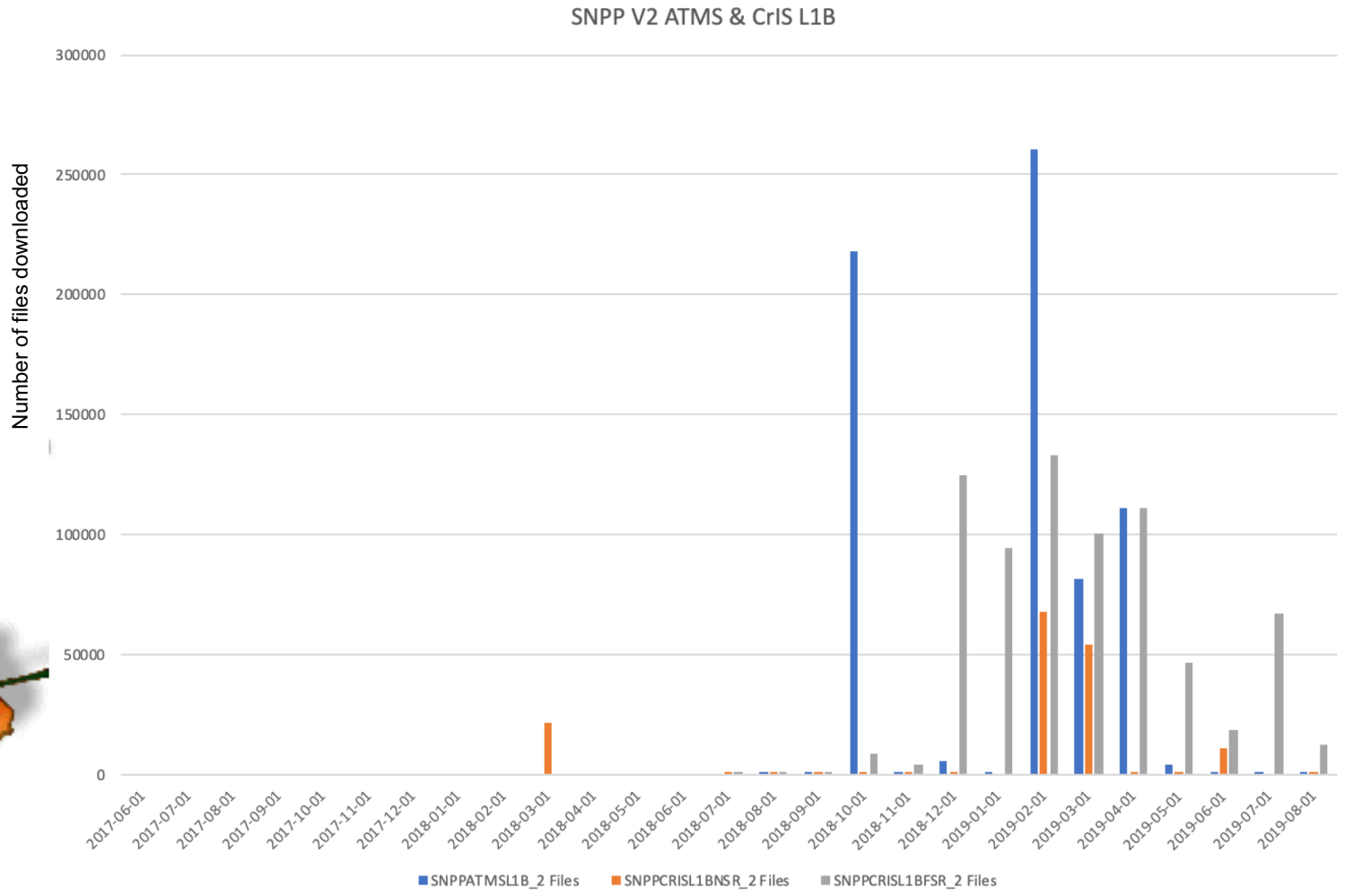
SNPP Metrics

SNPP Level 1 Version 1 data has been public since April 2017. Let's take a snapshot of Aug 2019 activity at GDAAC.



SNPP Metrics (con't)

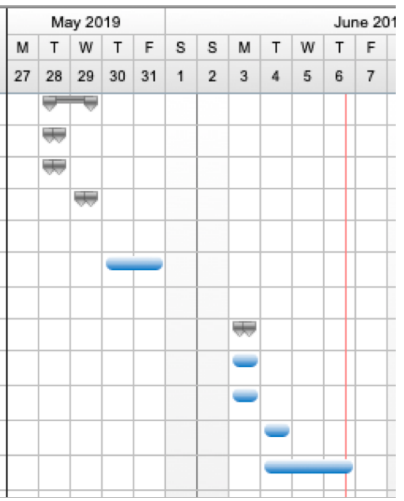
SNPP Level 1 Version 2 data has been public July 2018. Let's take a snapshot of Aug 2019 activity at GDAAC:



Sounder SIPS Hardware Move

- Sounder SIPS & AIRS TLSCF hardware move to bldg 230 is complete
- Physical move of hardware started on May 29, 2019 and was completed in 2 days.
- Down-time was on the order of 8 days.
- Have not powered off all hardware in bldg 600. Planned for end of calendar year.

Activity Name	Duration (Days)	Successors	Start Date	Finish Date
Shut Down activities	2.00		5/28/19	5/29/19
Ops...	1.00		5/28/19	5/28/19
DBA...	1.00		5/28/19	5/28/19
SA...	1.00		5/29/19	5/29/19
Move	2.00		5/30/19	5/31/19
Start Up Activites	1.00		6/3/19	6/3/19
SA...	1.00		6/3/19	6/3/19
DBA...	1.00		6/3/19	6/3/19
DevOps/CM...	1.00		6/4/19	6/4/19
OPS...	3.00		6/4/19	6/6/19



THAT'S ALL FOLKS!

BACKUP SLIDES

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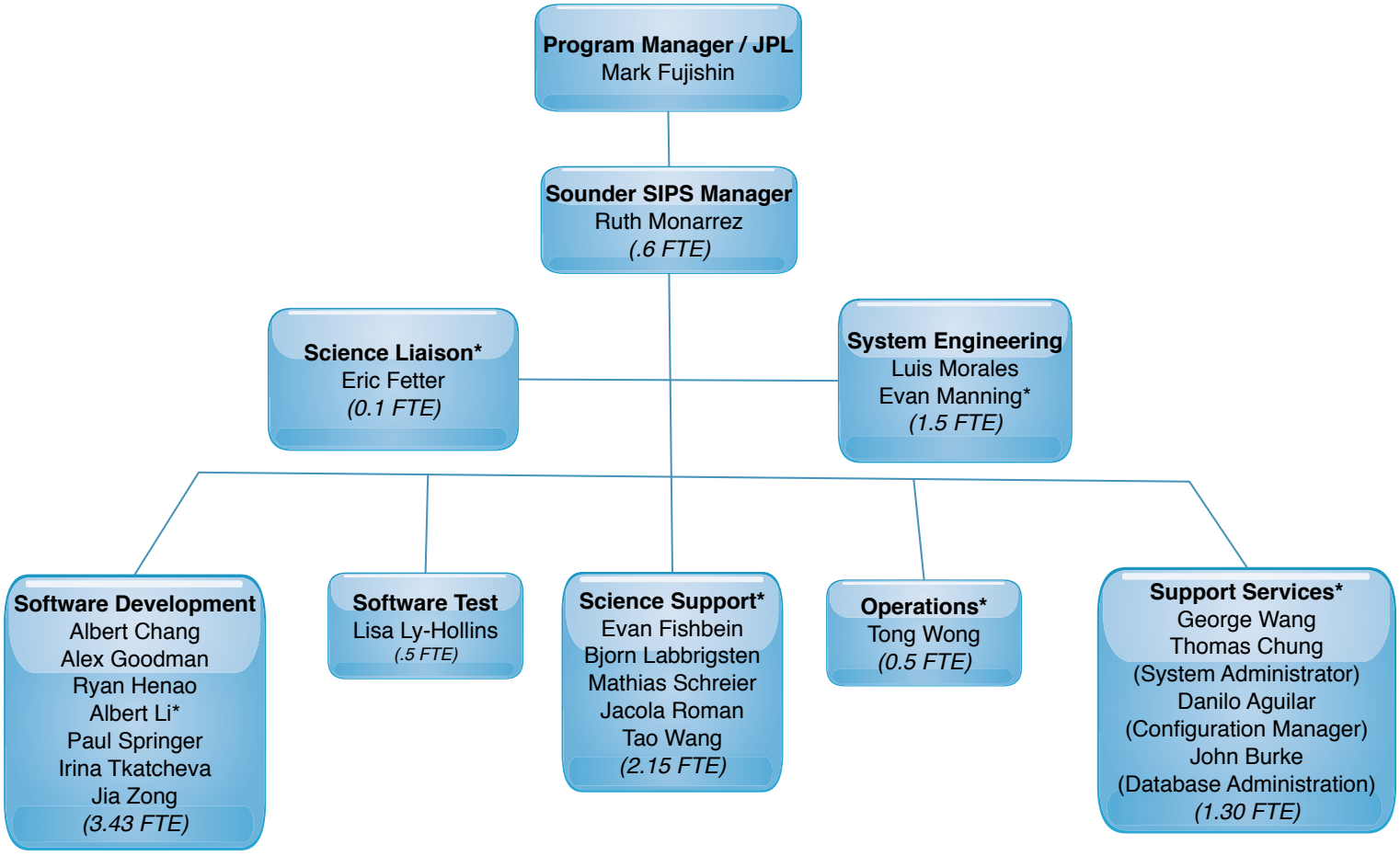
Sounder SIPS Organization (JPL)



** - Support Sounder SIPS and AIRS project*

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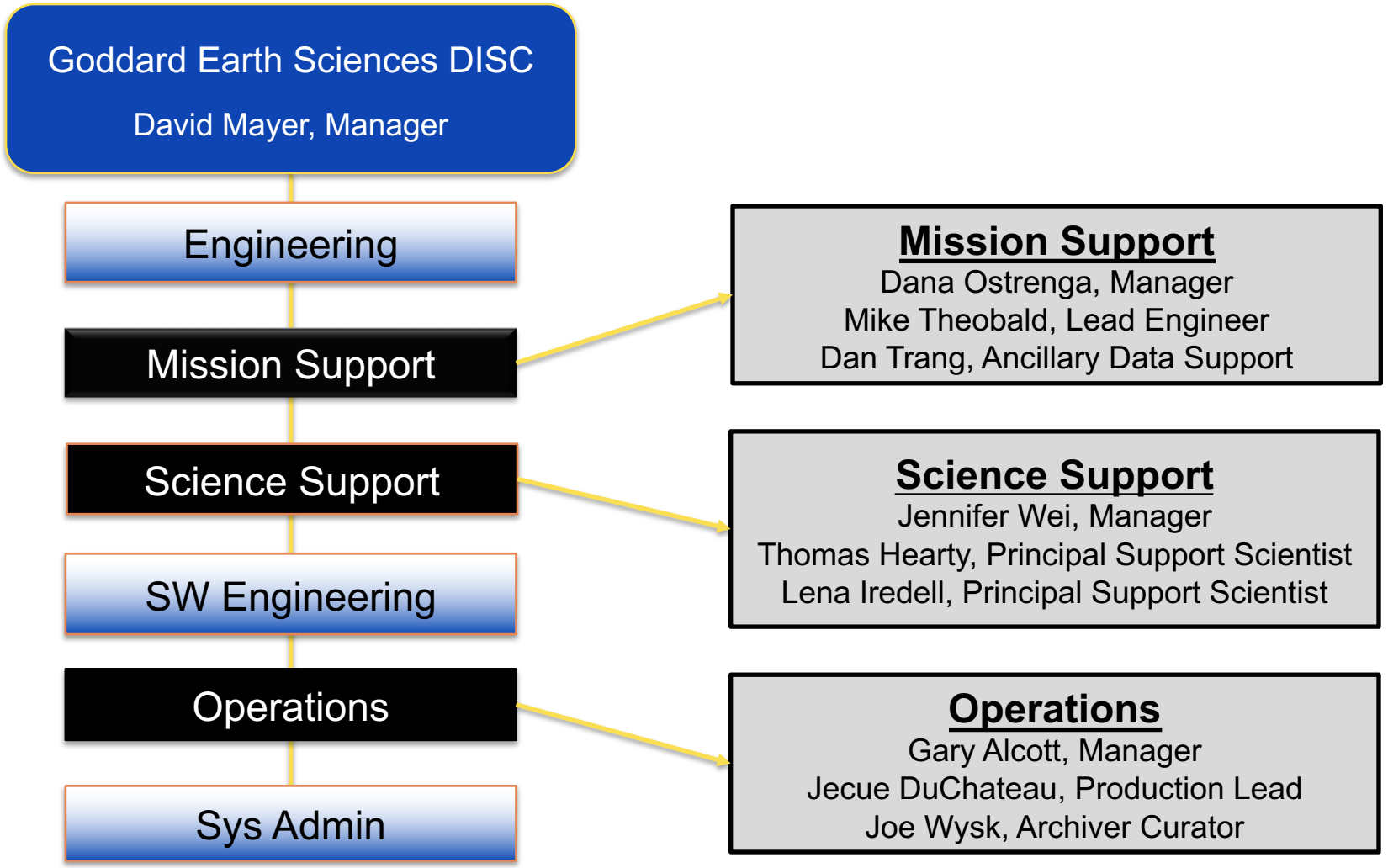
Sounder SIPS Points of Contact (GSFC)



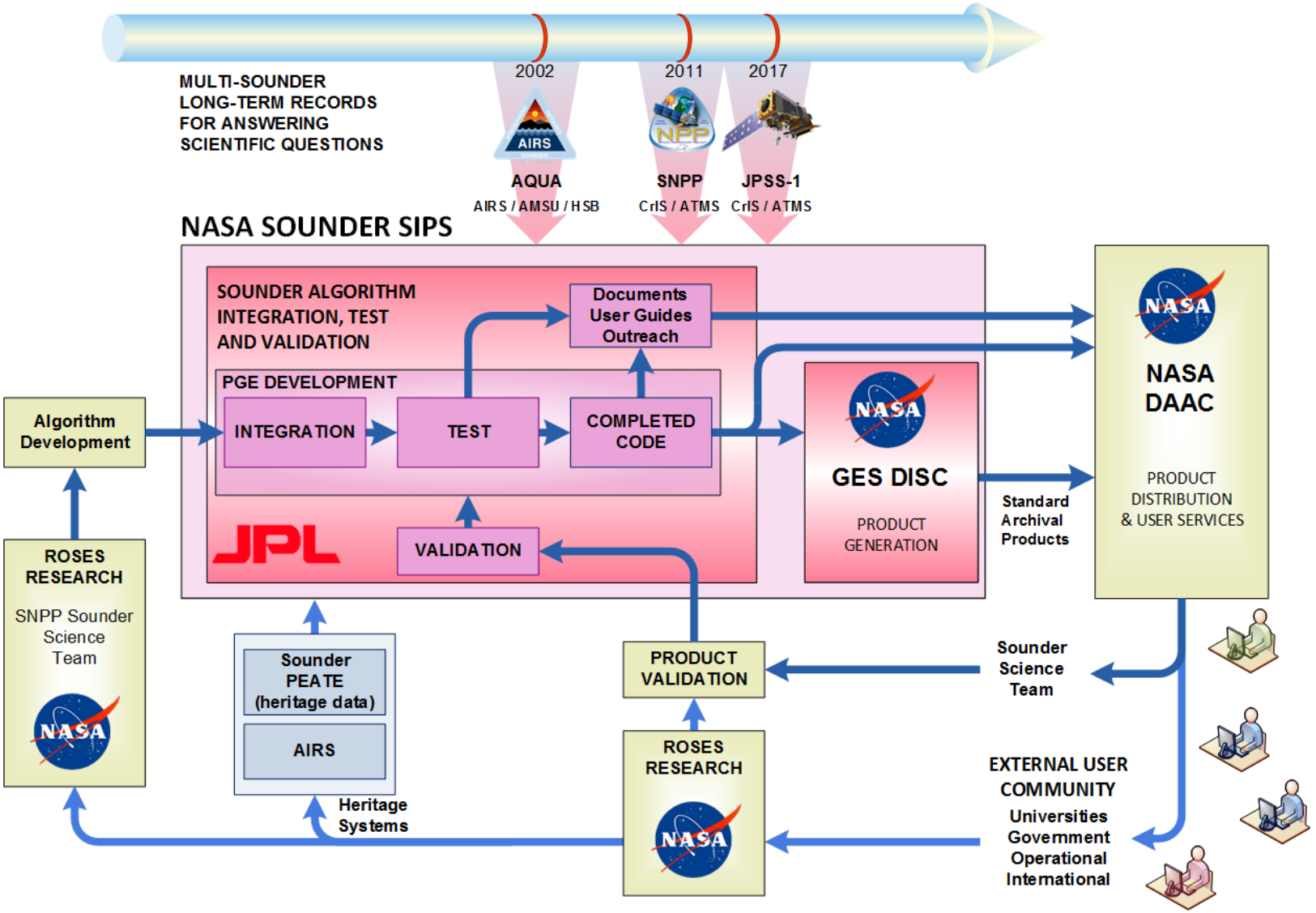
TASNPP Sounder SIPS Support

TERRA, AQUA and SUOMI-NPP Awardees

Additional retrievals / research to be supported:

PI	Affiliation	Instruments	ROSES Topic
Barnet, Chris	STC	AIRS/AMSU CrIS/ATMS	CLIMCAPS: Sounder core algorithm
Cady-Pereira, Karen	AER	CrIS	Ammonia (NH_3) Alg
Elsaesser, Gregory	Columbia	AIRS L2	Deep Conv. Clouds
Henze, Daven	U.Colo.	CrIS	NH3 Inv. Model
Huang, Xianglei	U.Mich.	AIRS, CERES, CrIS	cloud radiative effect
Lambrigtsen, Bjorn	JPL	AMSU, ATMS	ATMS L2
Liu, Xu	LaRC	AIRS/AMSU CrIS/ATMS	CLARREO Climate Fingerprinting
Milstein, Adam	MIT/LL	AIRS, CrIS	NN L2 alg
Payne, Vivienne	JPL	CrIS	PAN
Reale, Oresete	USRA	AIRS, CrIS L2	R, CCR DA
Santek, David	U.Wisc	AIRS, CrIS L2	H2O,O3 winds
Soden, Brian	U.Miami	AIRS, CERES, MODIS	radiative kernels to quantify CMIP6 fluxes
Strow, Larrabee	UMBC	AIRS, CrIS, IASI	Climate trends
Tian, Baijun	JPL	AIRS/AMSU	CMIP5/6
Worden, Helen	UCAR	MOPITT, CrIS	Carbon Monoxide (CO)
Ruston, Benjamin	NRL	AIRS, CrIS, CALIOP, MODIS, MISR	dust correction within R DA
Tan, Ivy	UMBC	MODIS, AIRS, CERES, AMSR	cloud feedback

Functional Interfaces



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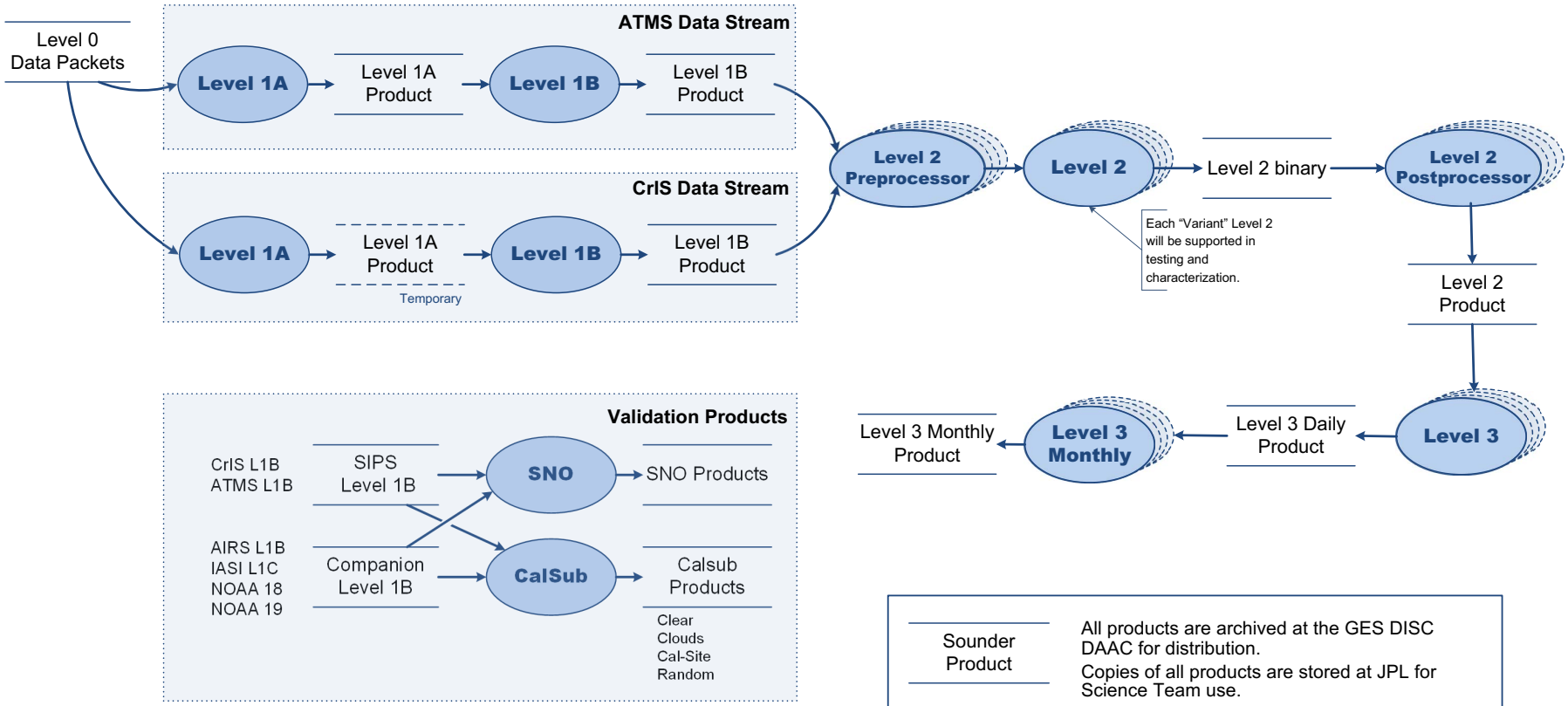
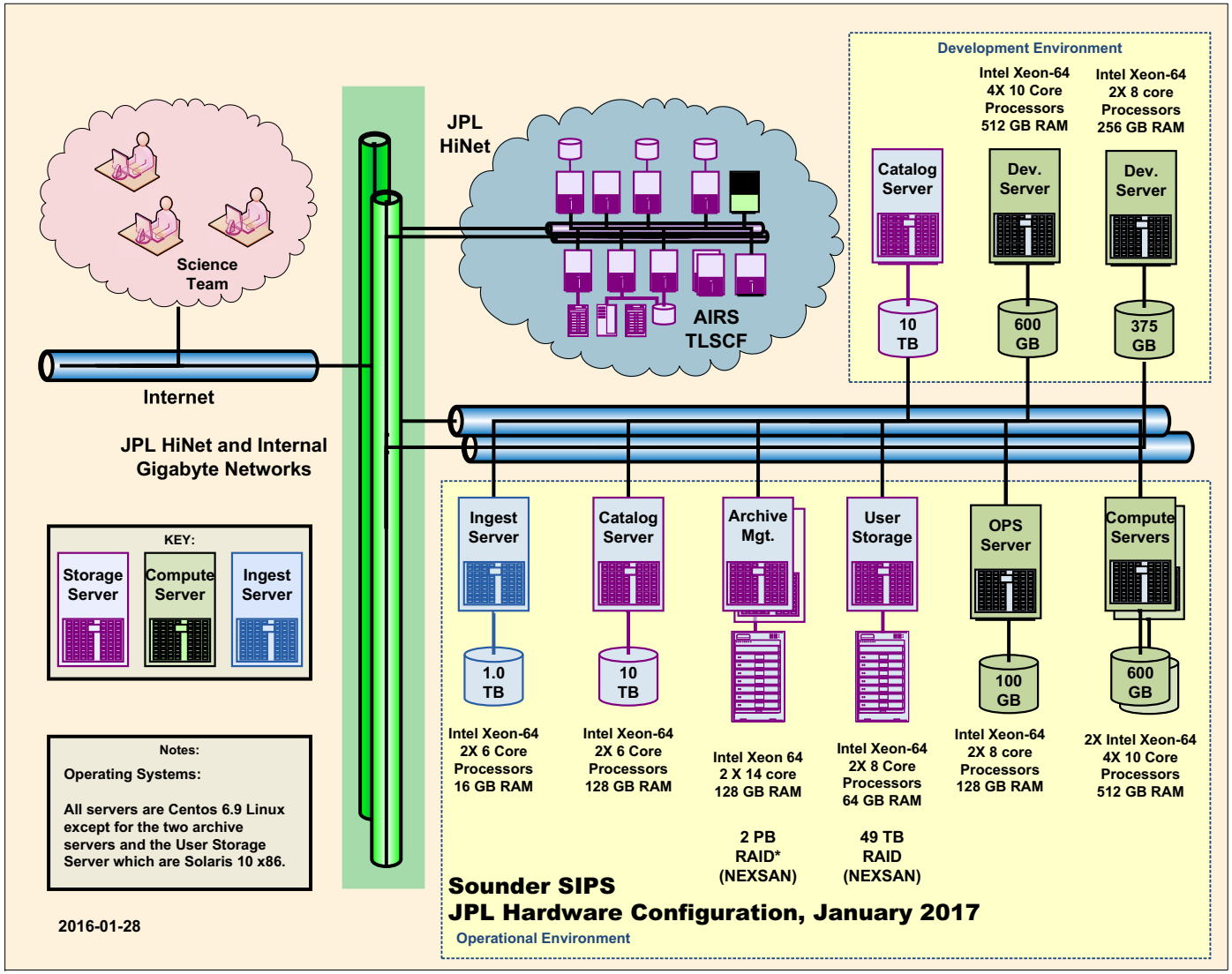
Sounder SIPS Data Flow



Sounder SIPS Hardware (JPL)

Archive:
Increased from
640 TB to 2 PB



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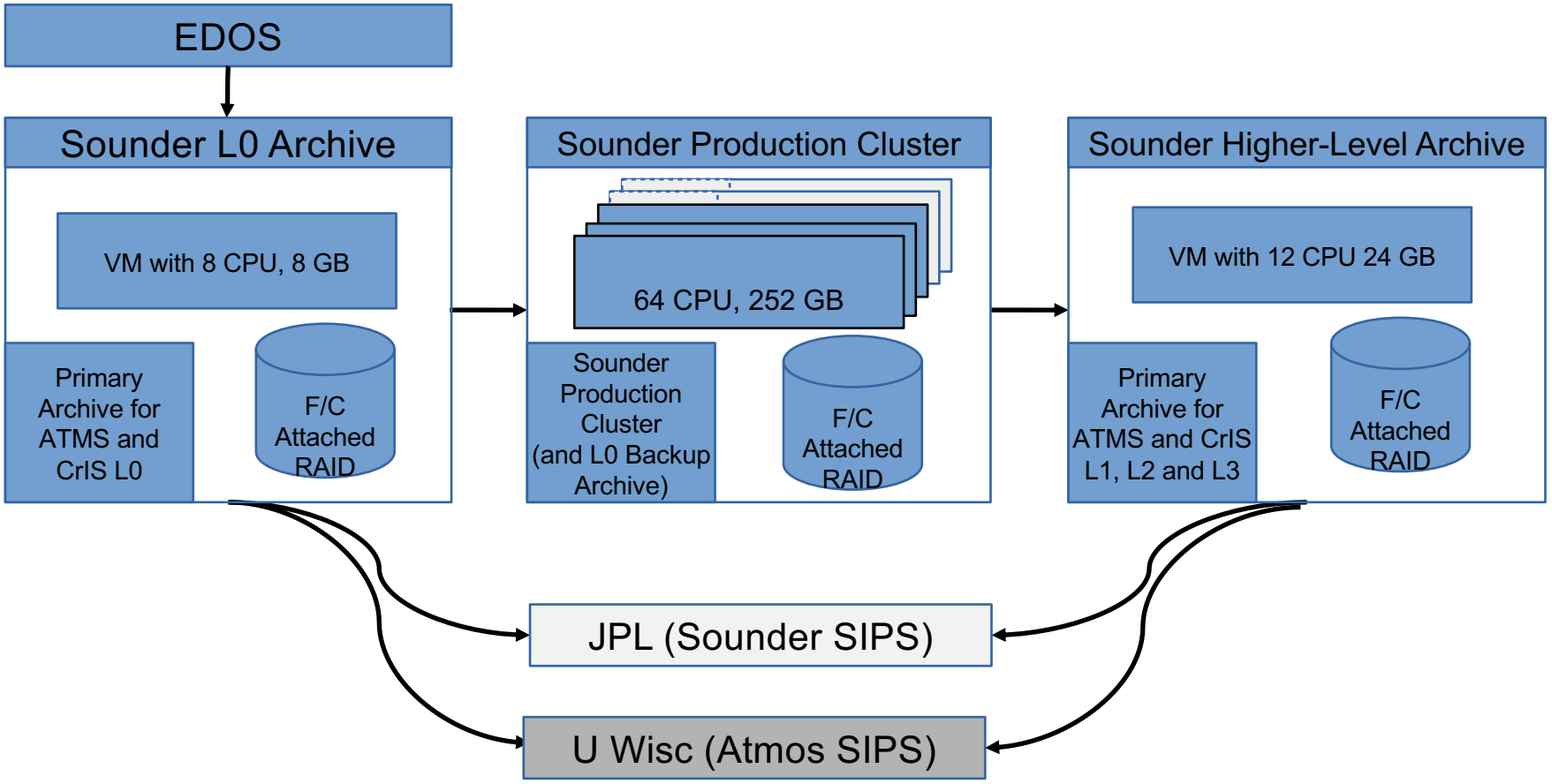
Sounder SIPS Hardware (GES DISC)



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Sounder SIPS Requirements Summary

- Develop and/or integrate PGEs delivered by Science Team Members
- Production of Level 1, 2 and 3 data products from SNPP Sounding instruments: ATMS and CrIS
- Support the Sounder Science Team in data validation activities
- Document and deliver source code, executables, user guide and ATBDs to the GES DISC for long-term storage and access
- All Sounder SIPS products will be produced in accordance to the NASA data policy (https://science.nasa.gov/earth-science/earth-science-data/data-information-policy)

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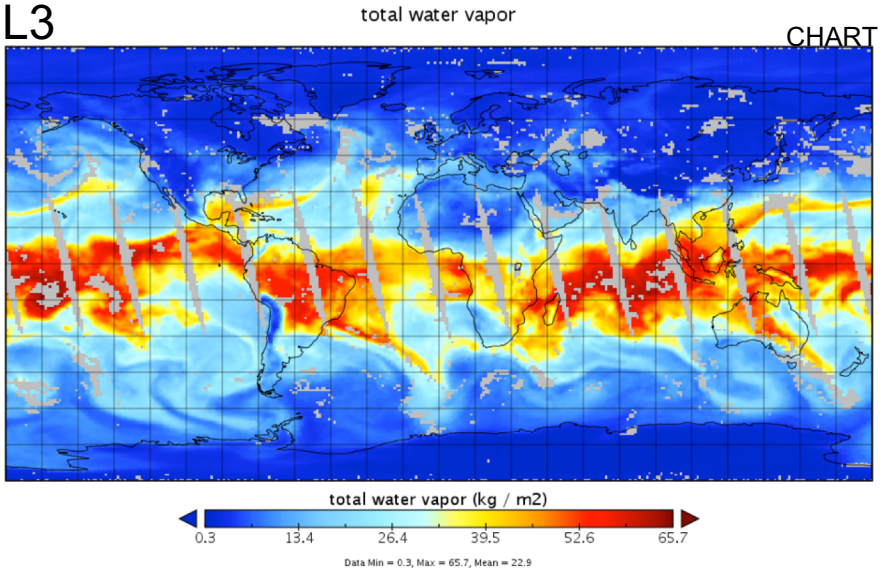
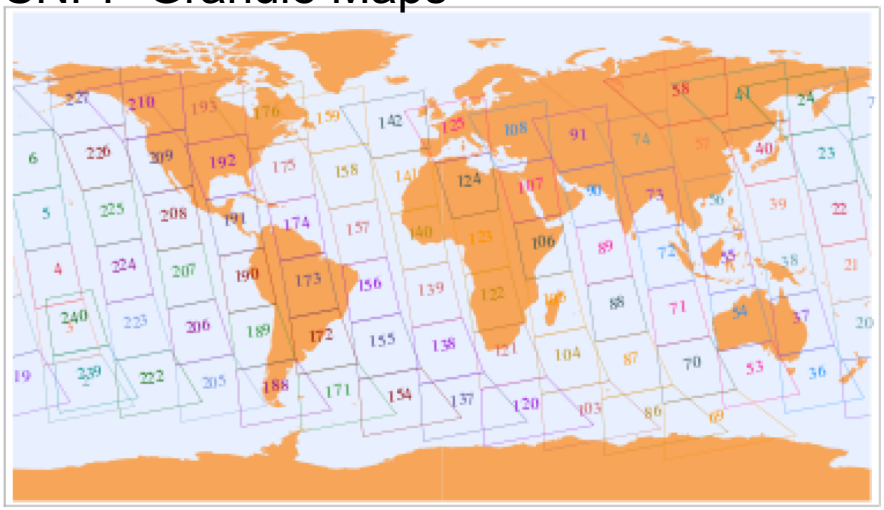
Product Samples

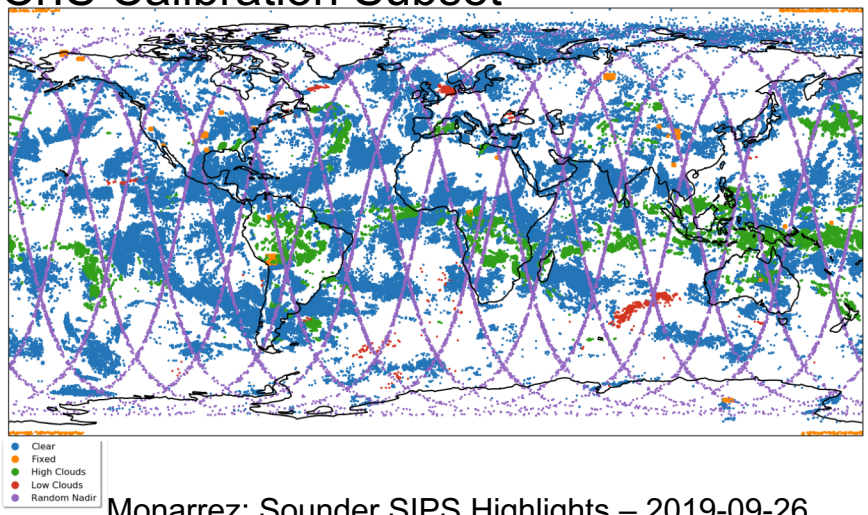
L3



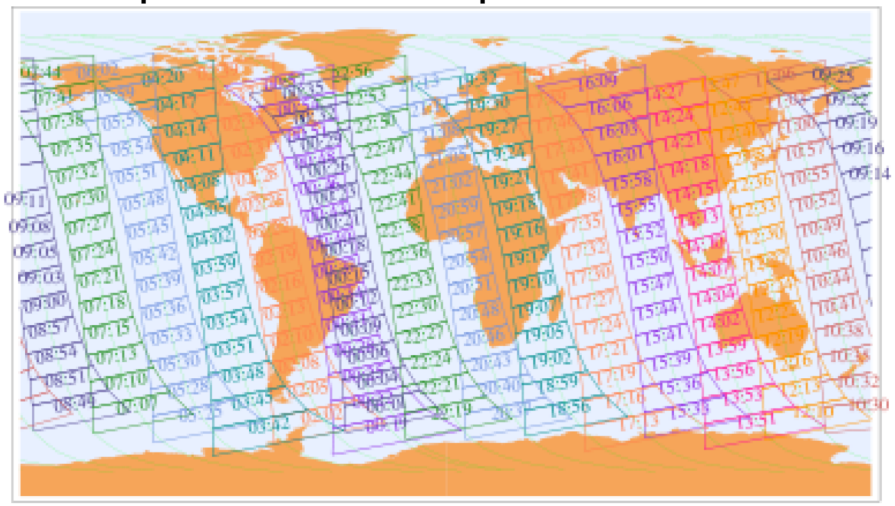
SNPP Granule Maps



CrIS Calibration Subset



MetOp-B Granule Maps



L2 Retrieval Systems

- **Retrieval Systems supported at Sounder SIPS/JPL**
  - Delivered and Integrated:
    - **C**limate-oriented **H**eritage **A**IRS **R**etrieval **T**echnique (CHART) - GSFC
    - **C**ommunity **L**ong-term **I**nfrared **M**icrowave **C**oupled **A**tmospheric **P**roduct **S**ystem (CLIMCAPS) – STC
    - ESSPA-TraceGas: Amonia (HN_3) Retrieval – AER
    - **R**etrieval **A**lgorithm for **M**icrowave **S**ounders in **E**arth **S**cience– JPL
  - Still to be delivered and integrated:
    - **E**arth **S**ystem **S**cience **P**rofiling **A**lgorithm (ESSPA) – AER
- **Retrieval Systems to be delivered and installed at Sounder SIPS/GES DISC**
    - **C**ommunity **L**ong-term **I**nfrared **M**icrowave **C**oupled **A**tmospheric **P**roduct **S**ystem (CLIMCAPS) – STC
    - ESSPA-TraceGas: Amonia (HN_3) Retrieval – AER
    - **R**etrieval **A**lgorithm for **M**icrowave **S**ounders in **E**arth **S**cience (RAMSES) 2 – JPL

Sounder SIPS Product Specification

- **Data Product Specifications (SounderCDF)**
  - All products will be formatted to conform to netCDF-4 / HDF 5 specification
  - Product metadata will conform to the Climate and Forecasting (CF), Attribute Conventions for Data Discovery (ACDD) guidelines and ISO 19115 Standard
  - Granule Sizes:
    - Level 1B ATMS and CrIS: 6-minute granules
    - Level 2: 6-minute granules, matching CrIS & ATMS granules
    - Level 3 Daily: Gridded global data
      - Two groups: ascending and descending
      - 1º x 1º gridded data.
    - Level 3 Monthly products follow same pattern as daily
    - Daily Granule Maps
    - SNO and CalSub will continue to be RTP3* format temporarily (refactoring to “SounderCDF” netCDF4/HDF5 format)

*RTP3 developed by the Sounder PEATE

Data Reprocessing Plans

- **Reprocessing Plans**
  - Full-mission processing of L2 & L3 with Level 2 algorithm:
    - CrIMSS: CLIMCAPS
    - ATMS: RAMSES 2
  - Full-mission reprocessing with major release of software that includes significant science code changes/improvements
  - Failed Granules: a fix may be put into forward processing and failed granules will be reprocessed. In this case, the version in the filename of the reprocessed granules will match the other products but internal metadata will indicate the correct software version. Ex: product_version = v02_01_00 will become v02_01_01 but the filename will remain the same

Evolution

- **In the next 5 – 10 years, where will the Sounder SIPS be …**
- **Have continuity between AIRS and CrIS products**
  - Level 2 algorithms will be handling both CrIS and AIRS
- **Infrastructure at Sounder SIPS/JPL continues to mature to seamlessly support ongoing missions with similar instruments**
  - We have defined formats that accommodate future sounding instruments
  - Grow our archive with additional products to cross reference JPSS products as well as other sounders
  - Table-driven architecture allows for effortless growth in PGE & products: integration of future retrieval algorithms
- **Conduct a cloud trade study to determine if it's feasible and cost-effective to take advantage of elastic processing resources to support future reprocessing campaigns**

Evolution (cont'd)

- **Have continuity with J1, J2, J3**
  - Level 2 algorithms are designed to be adaptable to the sounding instruments on future platforms provided they are similar
  - Continue creating Calibration Subsets, Simultaneous Nadir Observations and Matchups to track instrument performance
    - **CalSub** is a focused subset of L1 data which makes it easy to compare, say, clear scenes from one instrument to clear scenes from another.
    - **SNO**s are near-simultaneous observations from two instruments, which are used in direct comparisons to assess instrument differences.
    - **Matchups** are subsets of observations matched to correlative data so each instrument can be similarly compared to "truth".
- **Challenges:**
  - Coordinating support for several algorithms and their nuances

Product Stewardship

	ATBD	User Guide	Report
ATMS L1B	X	X	Science Assessment
CrIS L1B	X	X	Science Assessment
CHART	X	X	Science Assessment
CLIMCAPS	X	X	Science Assessment
ESSPA	X	X	Science Assessment
ESSPA-TraceGas	X	X	Science Assessment
RAMSES 2	X	X	Science Assessment
Project Docs: Data Management Plan Iinterface Control Doc Requirements Task Plan			

ATBD: responsibility of each PI
User Guides: Lead by Sounder SIPS with input from PI
Science Assessment: Sounder Science Team

Incorporating New or updated Algorithms

- **When new or updated algorithms become available the following basic process is followed:**
  - New Algorithm
    - Establish account on resident SIPS machines (if new team)
    - Algorithm teams ports software to SIPS/JPL and tests in environment
    - SIPS/JPL team writes wrapper code to science code
    - Internal delivery of the code
    - Test data is processed then validated by the science team (iteration point)
    - Software delivered to GES DISC for processing
  - Changes to Algorithm
    - Algorithm teams ports updates to SIPS/JPL and tests in environment
    - Internal delivery of the changes
    - Test data is processed then validated by the science team (iteration point)
    - Software delivered to GES DISC for processing

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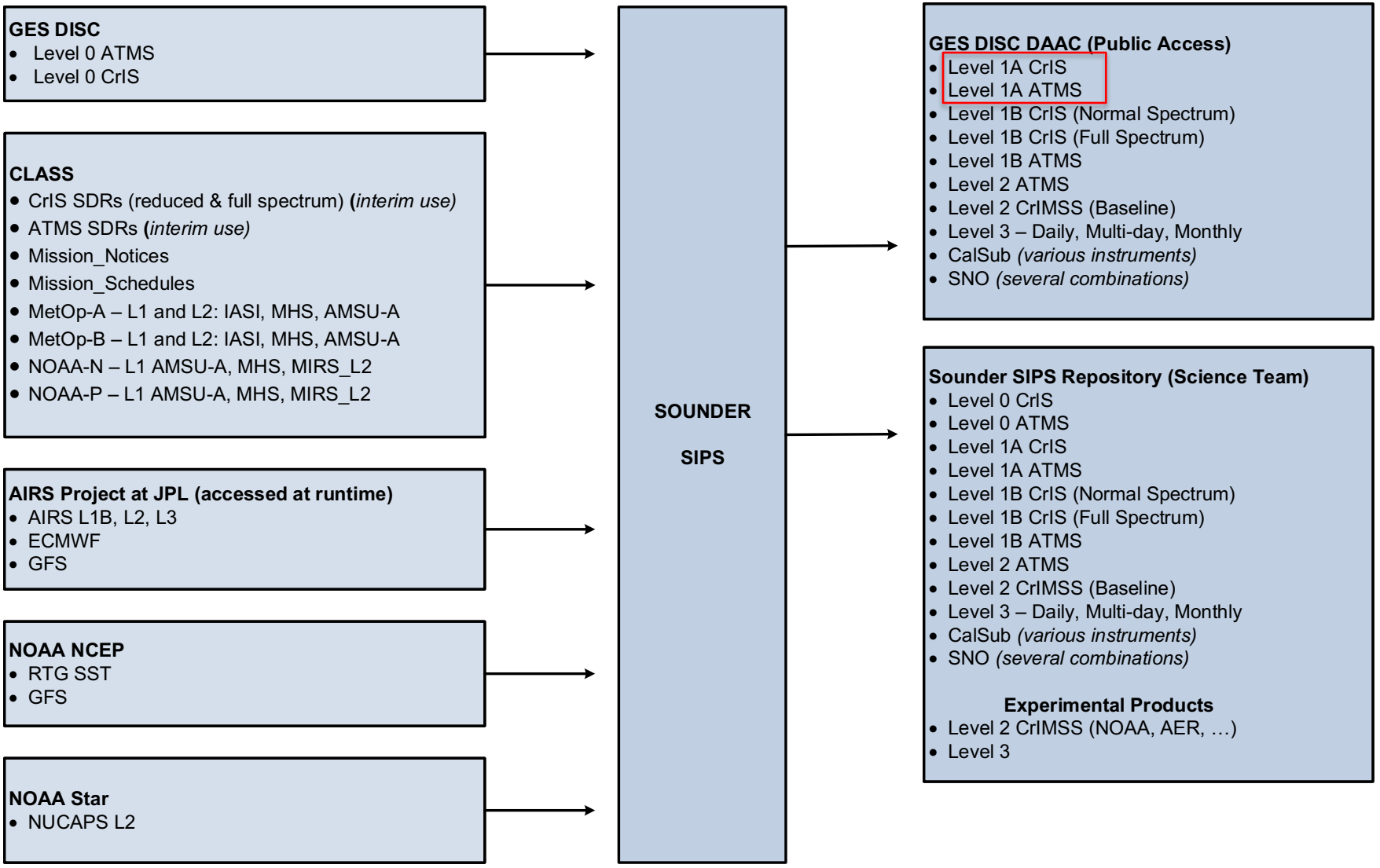
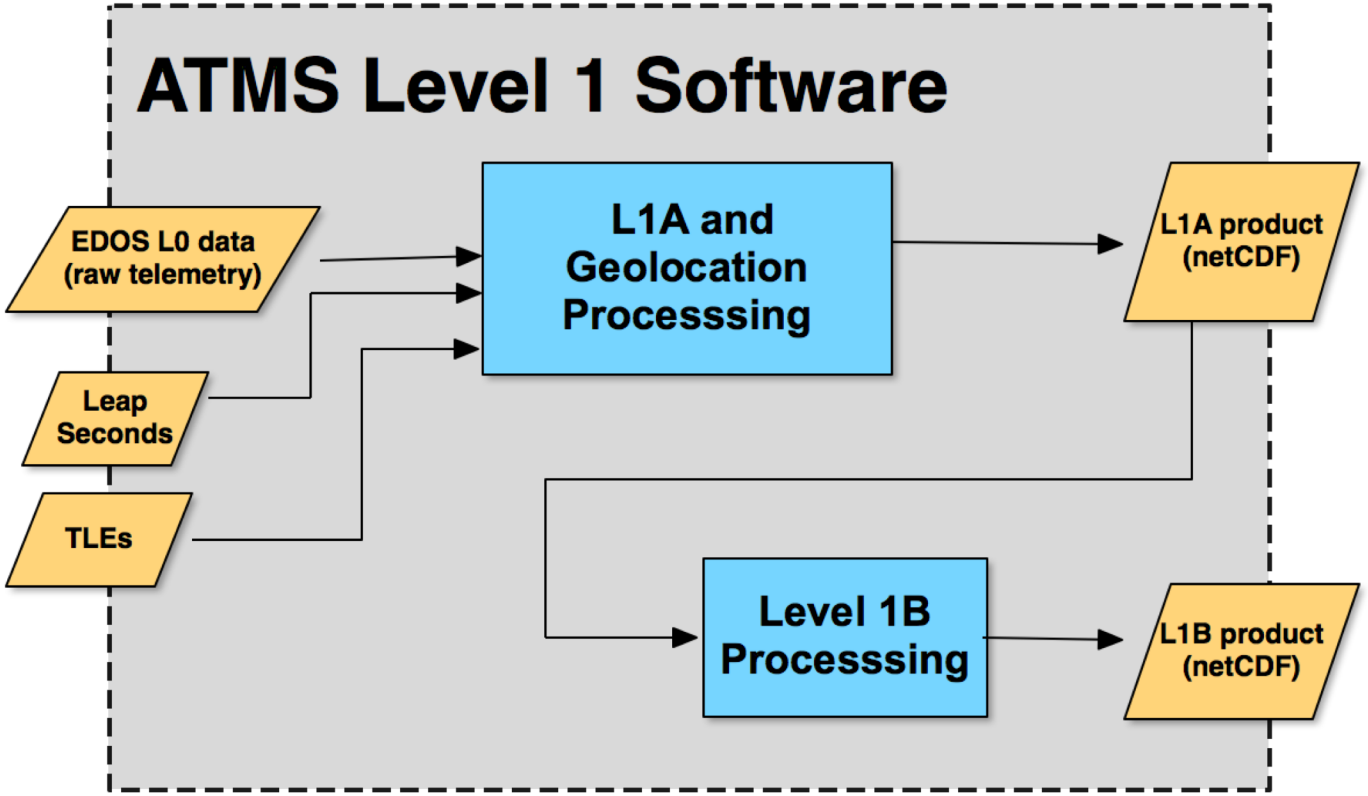
Data Products Interfaces



Sounder SIPS Software Flow: ATMS



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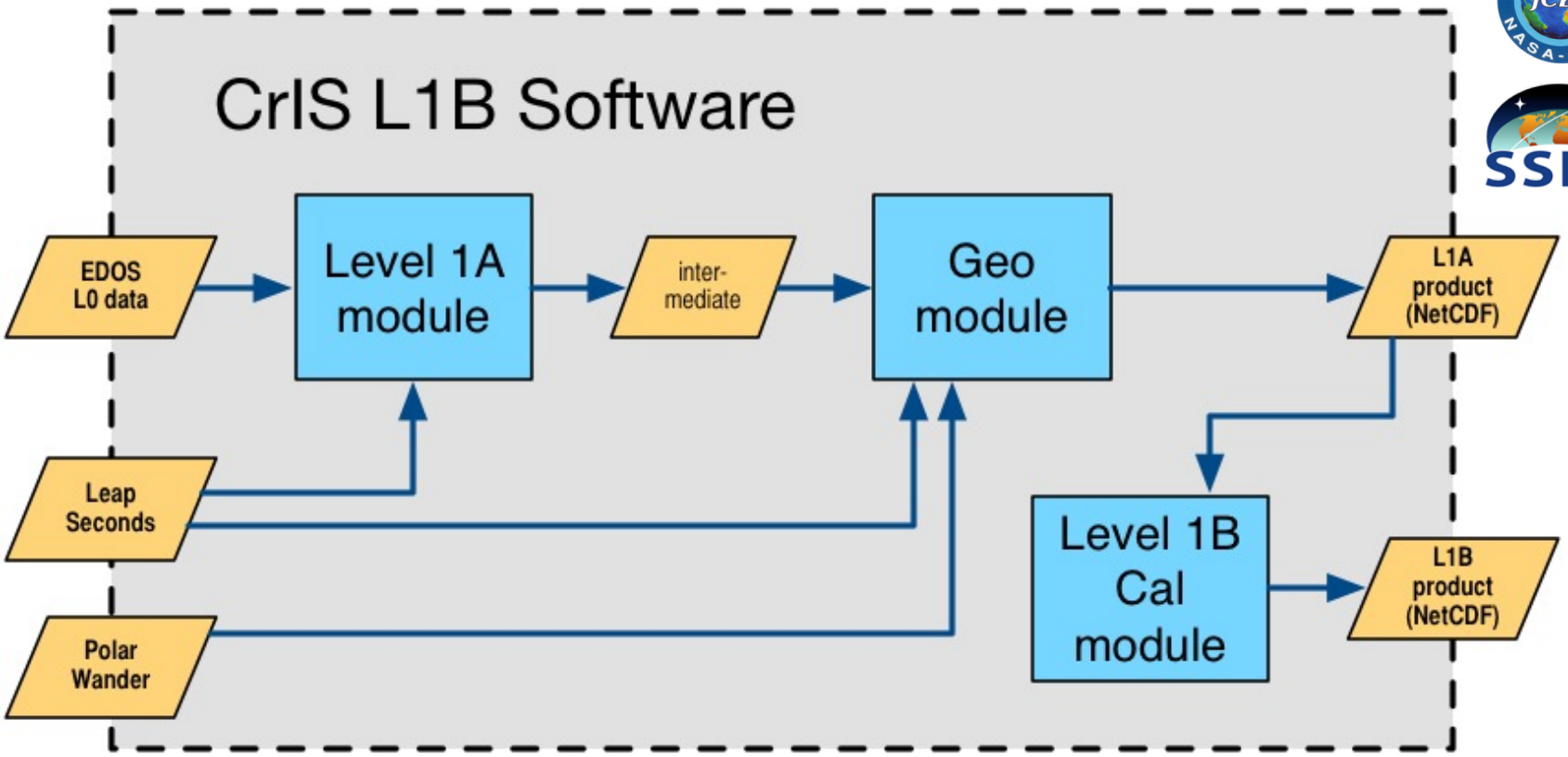
Sounder SIPS Software Flow: CrIS