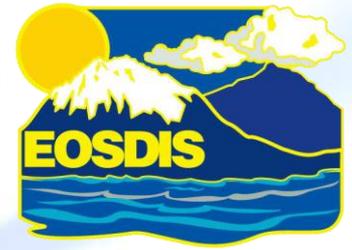


The NASA Earth Observing System Data and Information System (EOSDIS)

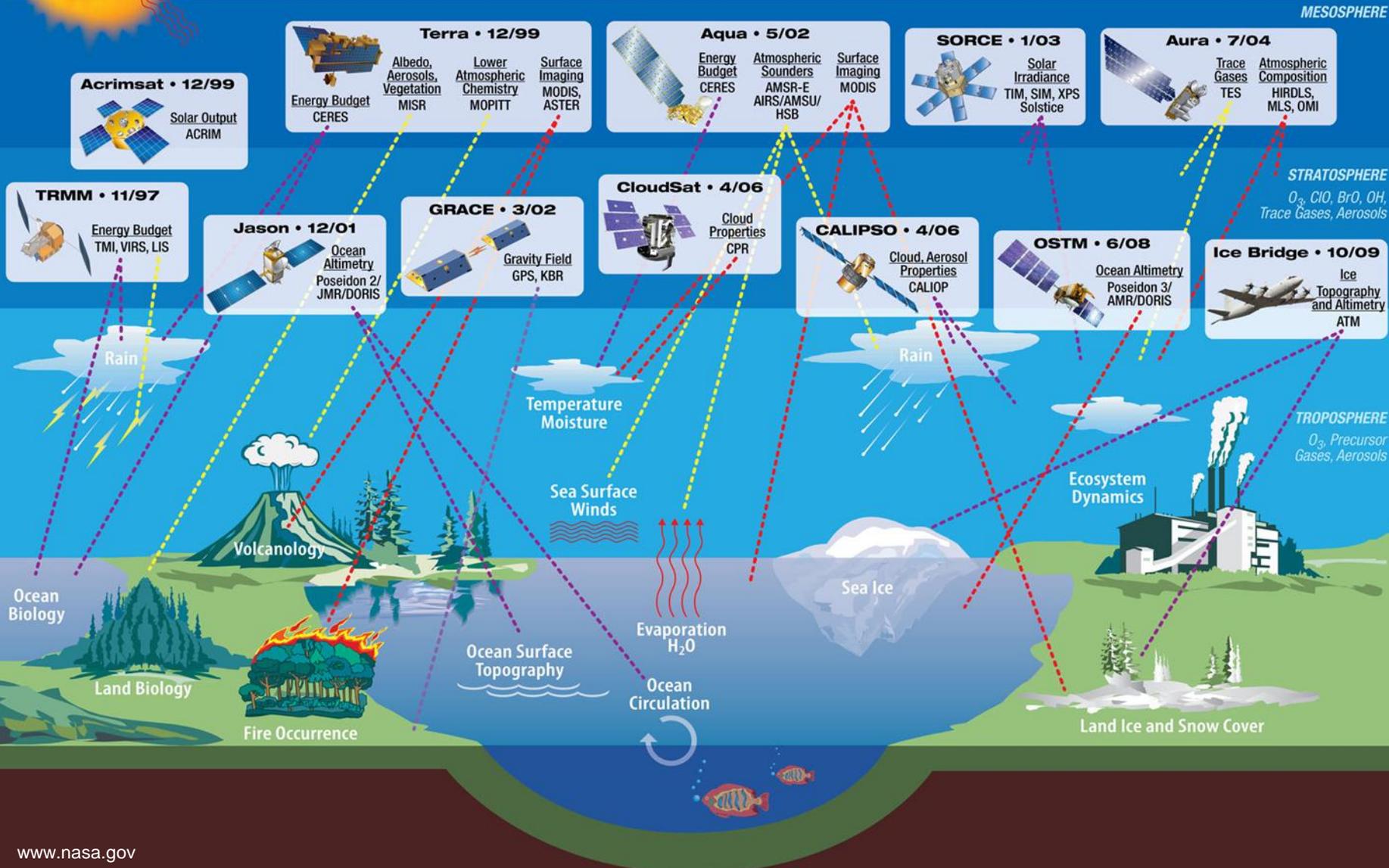


NASA Earth Science Data & Information Systems Project
June 04, 2014





Earth Science Measurements



Data Sources



Type	Example Missions
Satellite/on-orbit Missions	Terra, Aqua, Aura, Suomi-NPP
Airborne missions	IceBridge, Earth Ventures (5+ missions)
In Situ Measurement missions	Field campaigns on land (e.g., LBA-ECO) and in the ocean (e.g., SPURS)
Applications support	Near-real time creation and distribution of selected products for applications communities
Earth Science Research support	Research products from ROSES efforts like MEaSUREs. This also includes data from older, heritage missions (prior to EOS Program) that the DAACs rescue – e.g., Nimbus, SeaSat

Role of EOSDIS



- “Advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet.” -- *2014 NASA Strategic Plan*
 - NASA’s Earth Science Data Systems directly support this objective by providing end-to-end capabilities to deliver data and information products to users
- NASA’s Earth Science Data Policy promotes usage of data by the community
 - No period of exclusive access
 - Data available at no cost to all users on a non-discriminatory basis, except where agreed upon with international partners
- EOSDIS provides:
 - Interoperable Distributed Data Archives
 - Science Data Processing
 - Data Management
 - On-Line Data Access Services
 - Earth Science Discipline-Oriented User Services
 - Network Data Transport to distributed System Elements



Earth Science Data Operations

Mission Operations

Science Operations

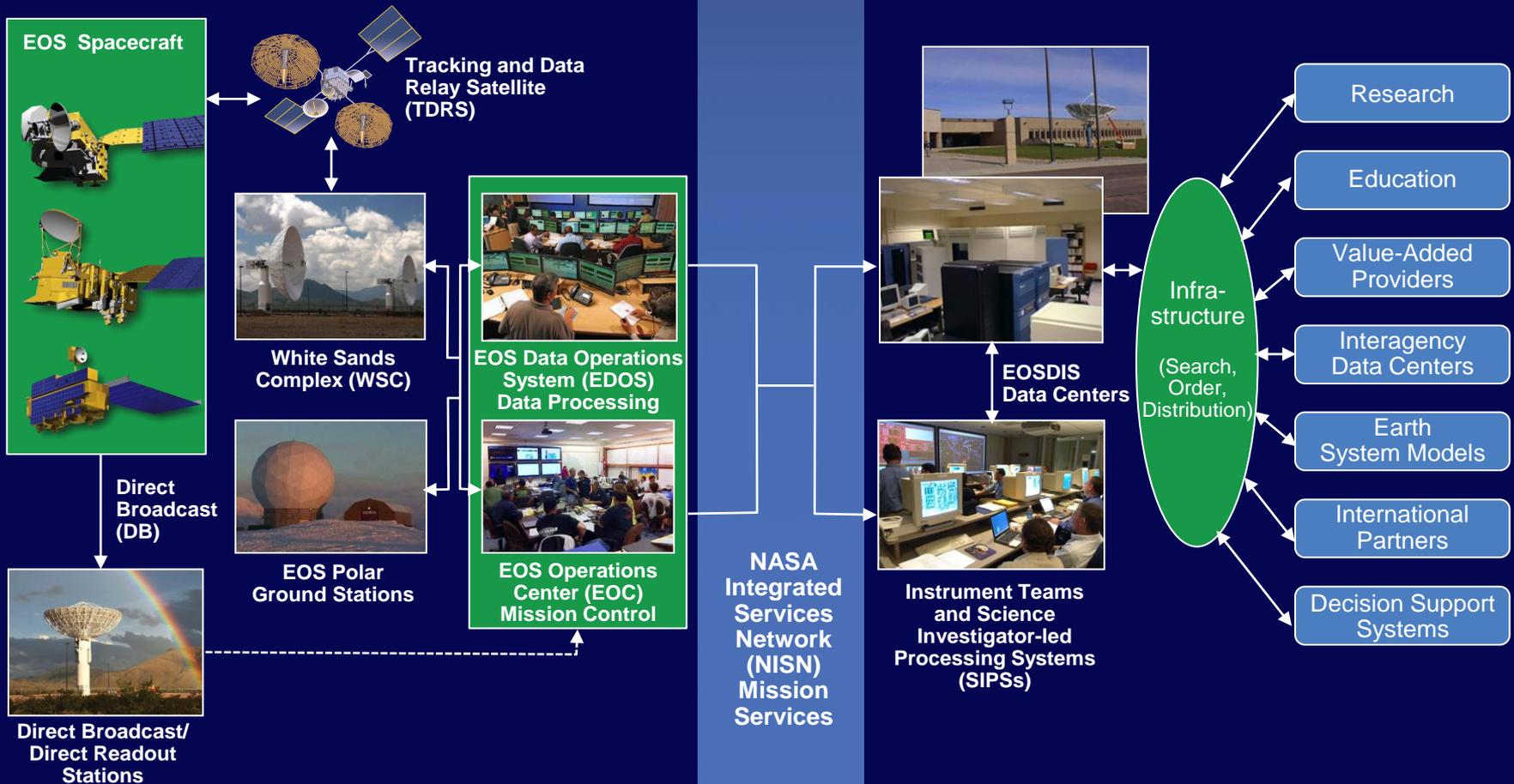
Data Acquisition

Flight Operations, Data Capture, Initial Processing, Backup Archive

Data Transport to Data Centers/SIPSs

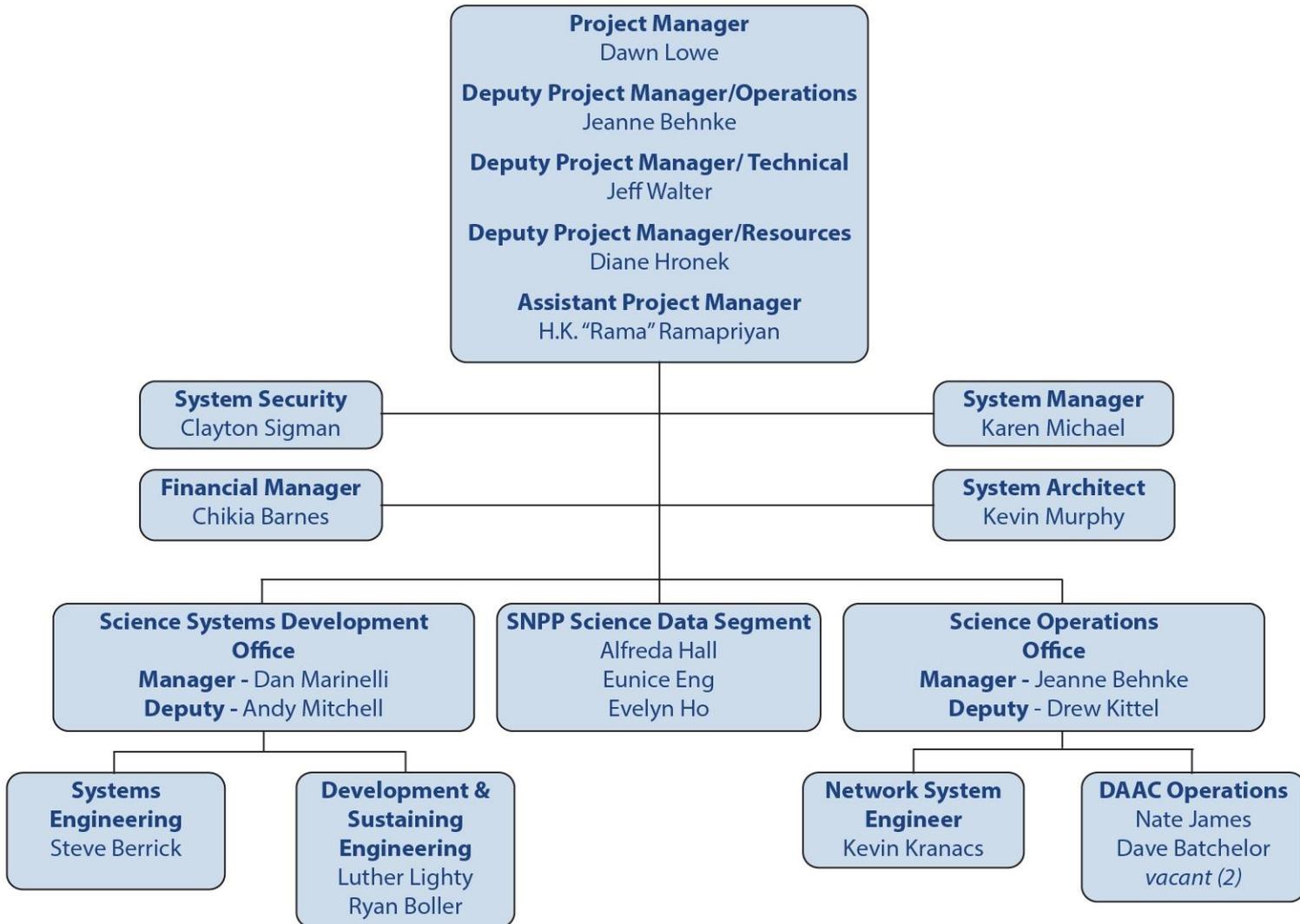
Science Data Processing, Data Management, Interoperable Data Archive, and Distribution

Distribution and Data Access



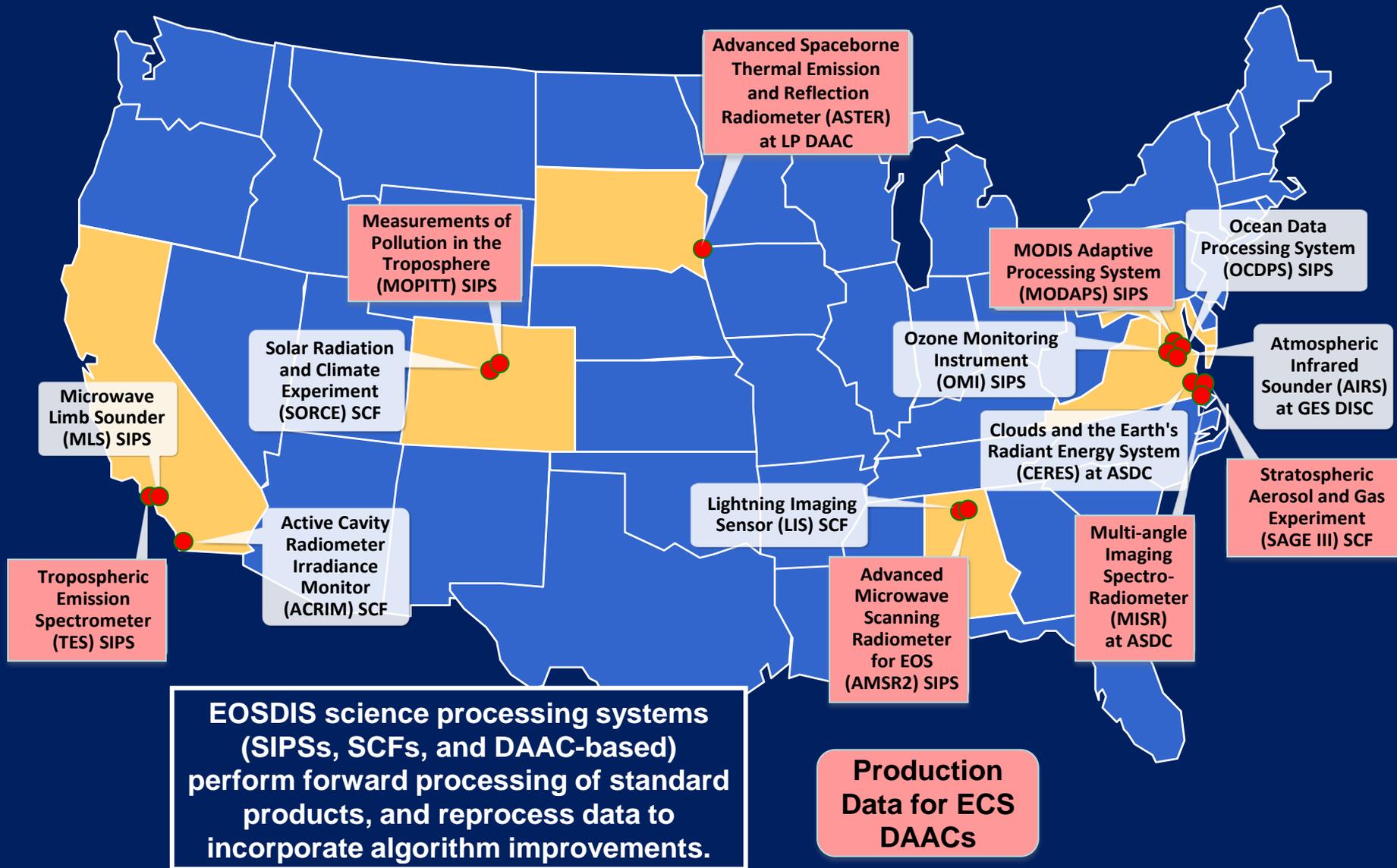


Earth Science Data and Information System (ESDIS) Project - Code 423



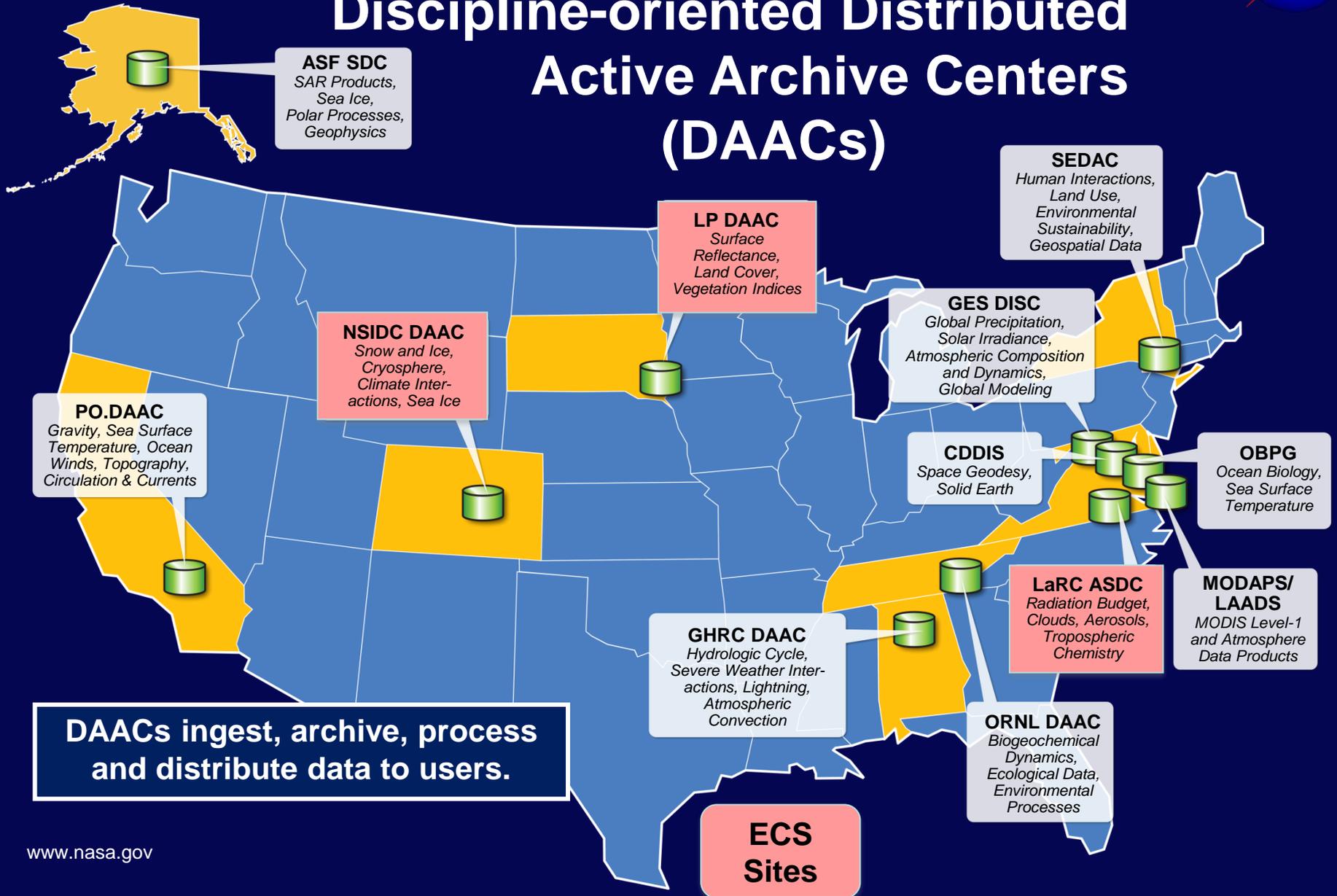


Science Processing Systems for EOSDIS

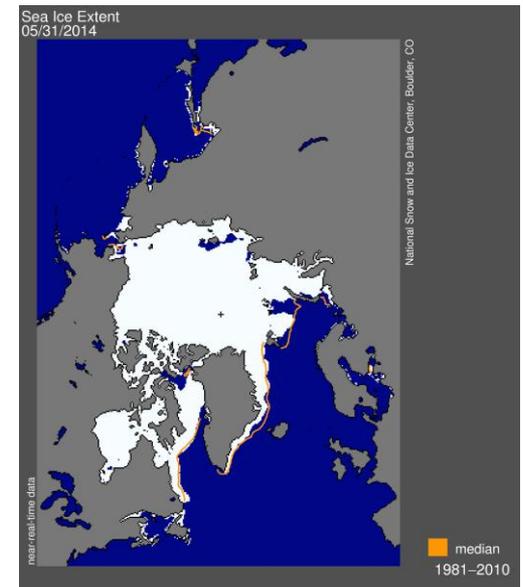




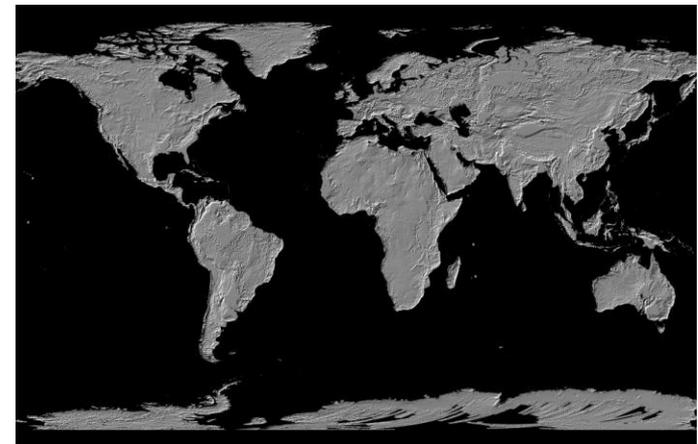
Discipline-oriented Distributed Active Archive Centers (DAACs)



- The DAAC is located at the University of Colorado in Boulder, CO at the National Snow and Ice Data Center.
- Ingests, archives and distributes spaceborne data from AMSR-E, ICESat/GLAS, MODIS on Terra and Aqua (via ECS)
 - Preparing for SMAP launch 2014
- Ingests, archives and distributes airborne data from NASA's ICEBridge missions
- Provides tools and services for discovery of cryosphere data
- Systems consist of a mix of servers, 465 TB of disk storage, and 157 TB of tape storage (for back-up)



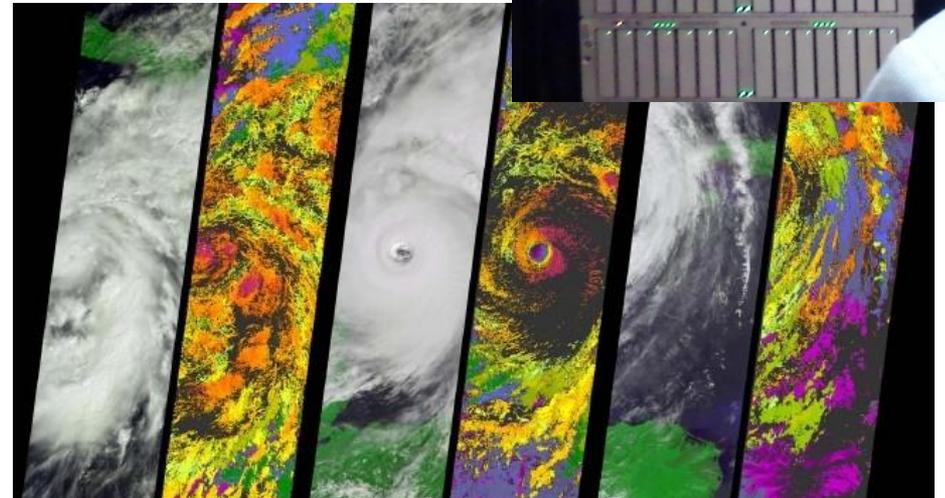
- The LP DAAC is located at the U.S. Department of the Interior, U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center in Sioux Falls, SD.
- Processes ASTER data from Terra including the ASTER Global DEM via “S4PM” (Open source system developed by the GES DISC).
- Archives and distributes ASTER data via ECS
- Archives and distributes MODIS from Terra and Aqua via ECS.
- Provides tools and services for discovery and analysis of NASA’s land cover and land use data.
- Systems consist of a mix of servers, 2.4 PB of disk storage, and 1 PB of tape storage (for backup)



Atmospheric Science Data Center (ASDC)



- The ASDC is in the Science Directorate at NASA Langley Research Center, in Hampton, VA.
- Processes production science data products for CERES and MISR science teams via “S4PM”
- Archives and distributes data from MISR, SAGE III, MOPITT, and TES *via ECS*
- Archives and distributes CERES via locally developed *ANGe*
- Provides sensor-specific search tools as well as more general tools and services such as atmosphere product subsetting
- Systems consist of a mix of servers, 1.3 PB of disk storage, and 931 TB of tape storage (for backup)



ECS Metrics for DAACs



	Archive Volume	
	2014	
	Granules	GB
ASDC Total	20,368,172	900,698
LPDAAC Total	74,703,267	2,180,462
NSIDC Total	17,706,152	250,894

Archive – total size of the collection of data in the ECS system at each DAAC. As new data is processed, it is added to the DAACs. Some interim files and datasets may be deleted on a daily basis.

	Daily Ingest			
	2014		Peak Day	
	Granules	MB	Granules	MB
ASDC Total	5,091	293,389	22,273	2,322,227
LPDAAC Total	22,051	491,504	149,291	5,460,095
NSIDC Total	9,364	183,925	208,875	1,927,491

Ingest – this represents the number of files that are put into the archive on a daily basis.

	Daily Distribution			
	2014		Peak Day	
	Granules	MB	Granules	MB
ASDC	34,586	1,286,579	228,162	9,010,713
LPDAAC	483,125	5,431,609	2,000,778	34,526,159
NSIDC	95,750	513,541	861,129	5,488,084

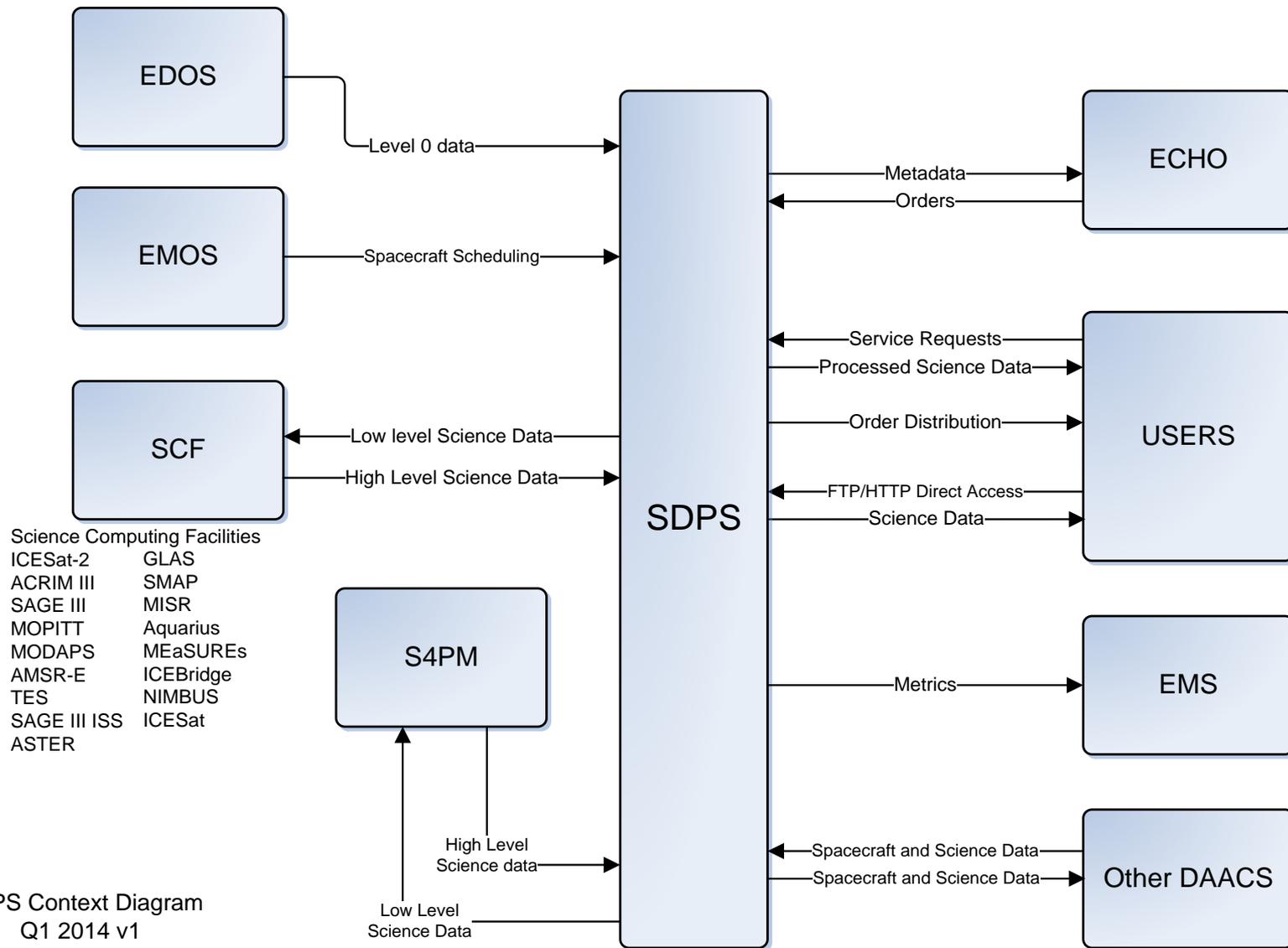
Distribution – this represents all data distributed out of the ECS system on a daily basis, typically through FTP or HTTP at each DAAC.

Elements and Capabilities



- **Science Data Processing System:** The Science Data Processing System is known also known as the EOSDIS Core System (ECS) supporting the ingest, archive and distribution of data at 3 DAACs.
- **EarthData:** the EOSDIS website (*Earthdata.nasa.gov*) provides a focal point for cross-DAAC and EOSDIS content and news sharing, and access to Earth science data and services
- **ECHO/Reverb:** The EOS ClearingHouse (ECHO) is a metadata catalog of NASA's EOS data and a registry for related data services (e.g. reformatting, pattern recognition). Reverb allows users to search science data holdings, view browse images, and submit orders via ECHO to the appropriate data providers
- **Common Metadata Repository:** The Common Metadata Repository (CMR) builds on the work done by ECHO and the GCMD to provide a unified, authoritative repository for NASA's Earth Science metadata.
- **User Registration System:** provides a centralized and simplified mechanism for user registration and account management for all EOSDIS system components.

Science Data Processing System (SDPS) Context



SDPS Context Diagram
Q1 2014 v1

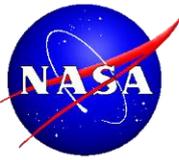


Earthdata is aimed at improving EOSDIS web presence and services, as well as representing EOSDIS as an efficient and interoperable program to support NASA's Earth science research.

Earthdata reorganized the information into an intuitive, logical structure facilitating users' discovery of the wide array of services and content offered throughout EOSDIS (refer to <http://earthdata.nasa.gov>).

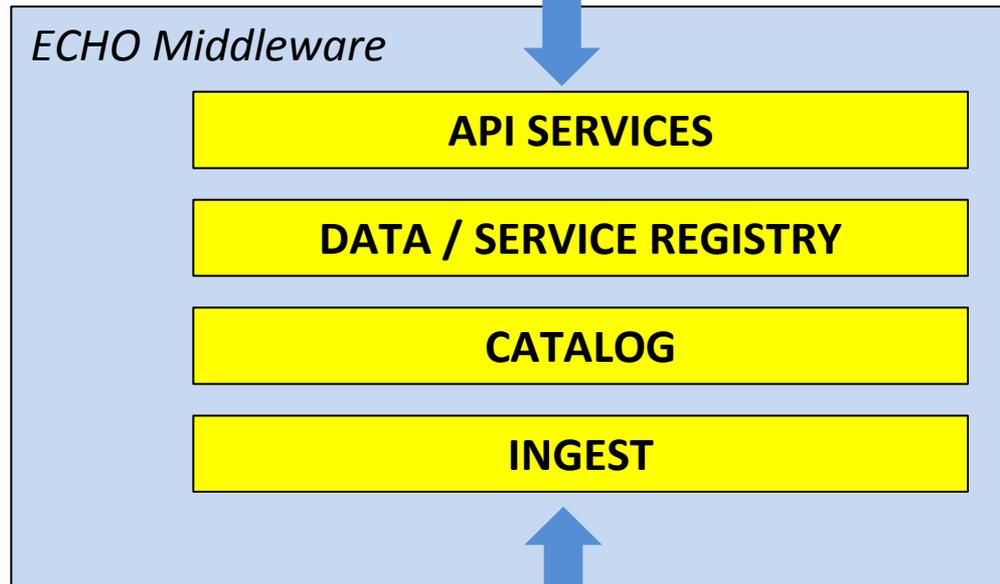


“ECHO Architecture”



Search, Browse, Order

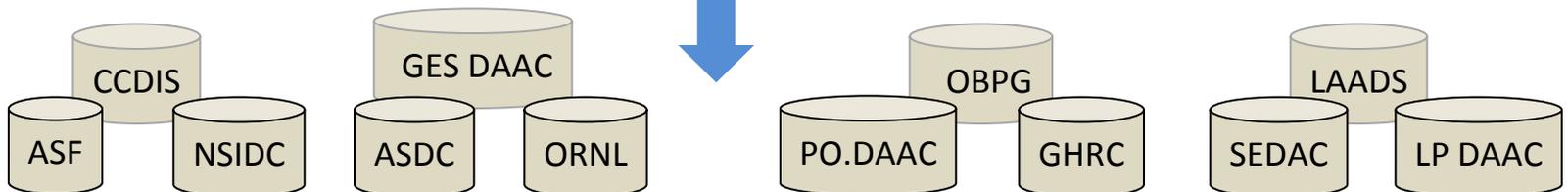
ECHO is NASA's middleware layer between Earth science data and users via a service-oriented architecture. Designed to improve the discovery and access of NASA data.



Acts as an order broker between end users and EOSDIS Data Centers who provide metadata for their data holdings and other Earth science-related data holdings.

User-defined specialized “clients” can be easily developed to give science data users of their community access to data and services using ECHO's open APIs.

Metadata, Browse, Orders



ECHO Holdings and Availability



- ECHO maintains a +98% uptime in all operational systems

Reports > Uptime reports > Uptime report

05/18/2014 - 05/25/2014

Uptime Report									
Probe group: ECHO OPS									
Probe	Last Checked	Errors Last 24 hours	Total Time Last Check	Last 24 hours	Uptime Last 24 hours	Last 7 days	Last 30 days	Last 90 days	Last 365 days
ECHO Browse	1:12 PM	0	0.447	0.948	100.00%	100.00%	99.73%	99.90%	99.94%
ECHO EIAT	1:10 PM	0	1.889	1.166	100.00%	99.95%	99.28%	99.21%	99.55%
ECHO Open Search API	1:11 PM	0	3.383	2.207	100.00%	99.95%	99.36%	99.68%	99.81%
ECHO PUMP	1:09 PM	0	1.936	1.272	100.00%	100.00%	99.45%	99.76%	99.88%
ECHO REST API	1:09 PM	0	2.688	1.700	100.00%	100.00%	99.40%	99.70%	99.82%
ECHO Reverb (HTTP)	1:12 PM	0	0.936	1.653	100.00%	100.00%	99.29%	99.57%	99.74%
ECHO Reverb (HTTPS)	1:10 PM	0	1.915	1.926	100.00%	100.00%	99.26%	99.60%	99.76%
ECHO SOAP API	1:11 PM	0	0.506	1.274	100.00%	100.00%	99.44%	99.76%	99.86%
Total		0		1.518	100.00%	99.99%	99.40%	99.65%	99.79%

As of May 24, 2014

- Current Holdings:
 - Datasets: 3,855 total
 - Granules: 157 million
 - Browse: 76 million total
- Registered Users: 86,322 total

Recent ECHO Improvements



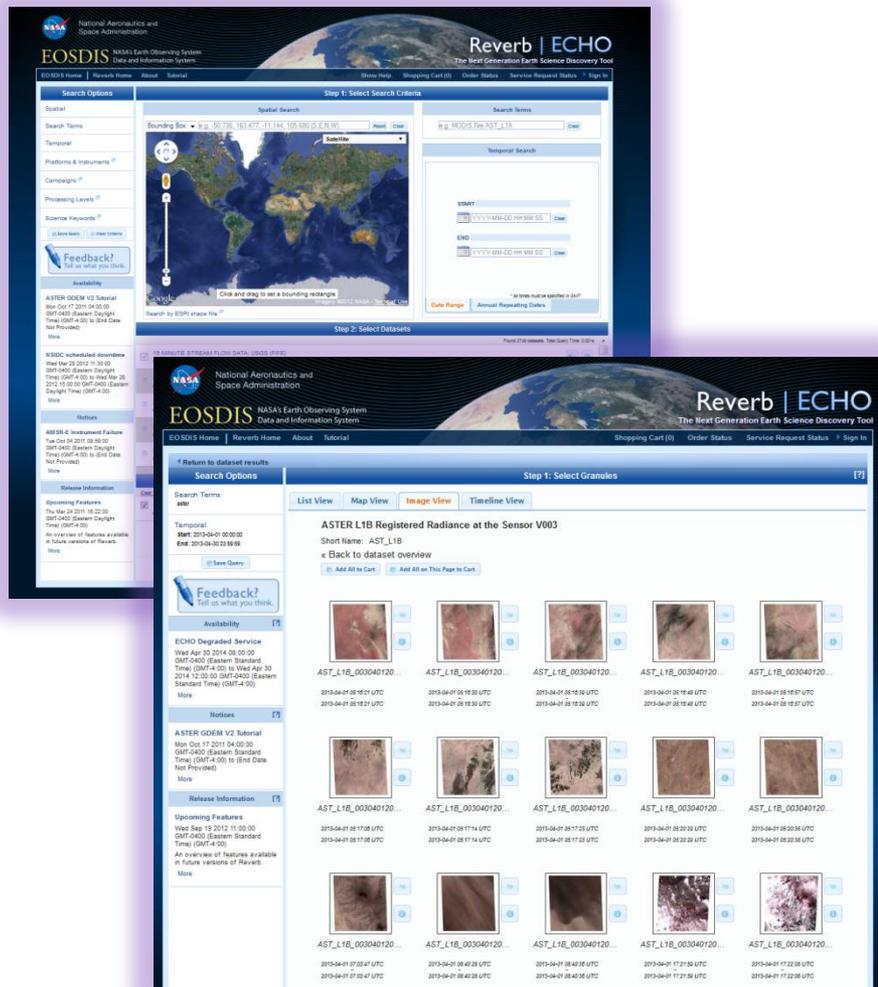
- ECHO was re-architected to provide full redundancy of all critical components, virtually eliminating need for preventive maintenance downtime, and increased stability.
 - Average operational availability: 99%

- ECHO search performance has been significantly improved in the past 5 years: Average query time now 4 seconds (from 30 seconds)
 - Will be implementing sub-second performance

- Average Ingest performance improved by a factor of 10

- ECHO is working to simplify efforts of Client developers:
 - Added 2 new API formats last year: OpenSearch and REST
 - Benefits: Lightweight architecture and ease-of-use for Client developers

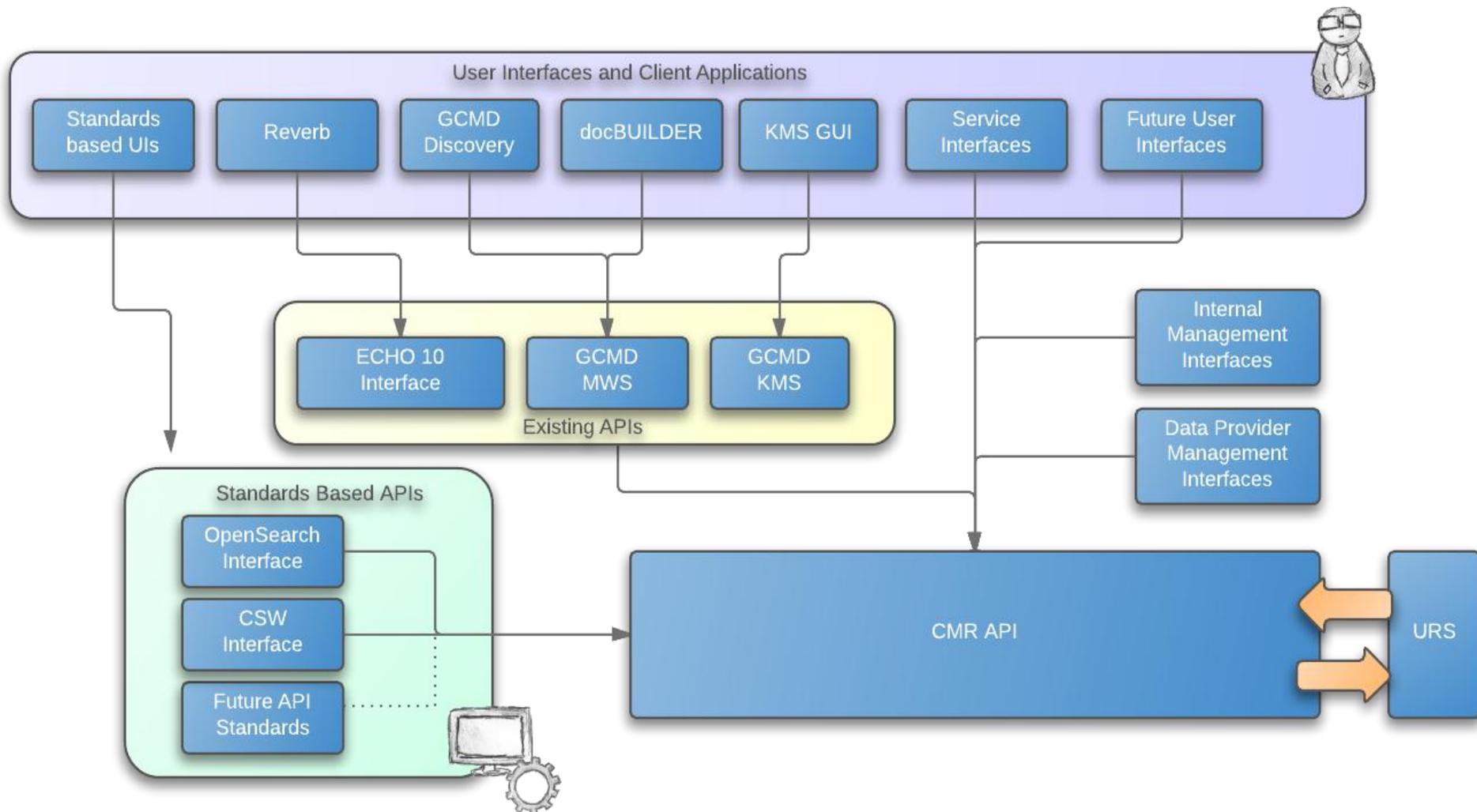
REVERB - Data and Service Access Client



- Reverb is the primary web-based client for discovering and ordering cross-discipline data from all of ECHO's metadata holdings.
- Reverb allows users, including those without specific knowledge of the data, to search science data holdings, retrieve high-level descriptions of the data inventory, view browse images, and submit orders via ECHO to the appropriate data providers.
- Users are able to submit queries using spatial and temporal criteria and examine search results for relevancy using built-in tools.

<http://earthdata/reverb>

Common Metadata Repository 1 of 2



Common Metadata Repository 2 of 2



User Interfaces and Client Applications

Standards based UIs

Reverb

GCMD Discovery

docBUILDER

KMS GUI

Service Interfaces

Future User Interfaces

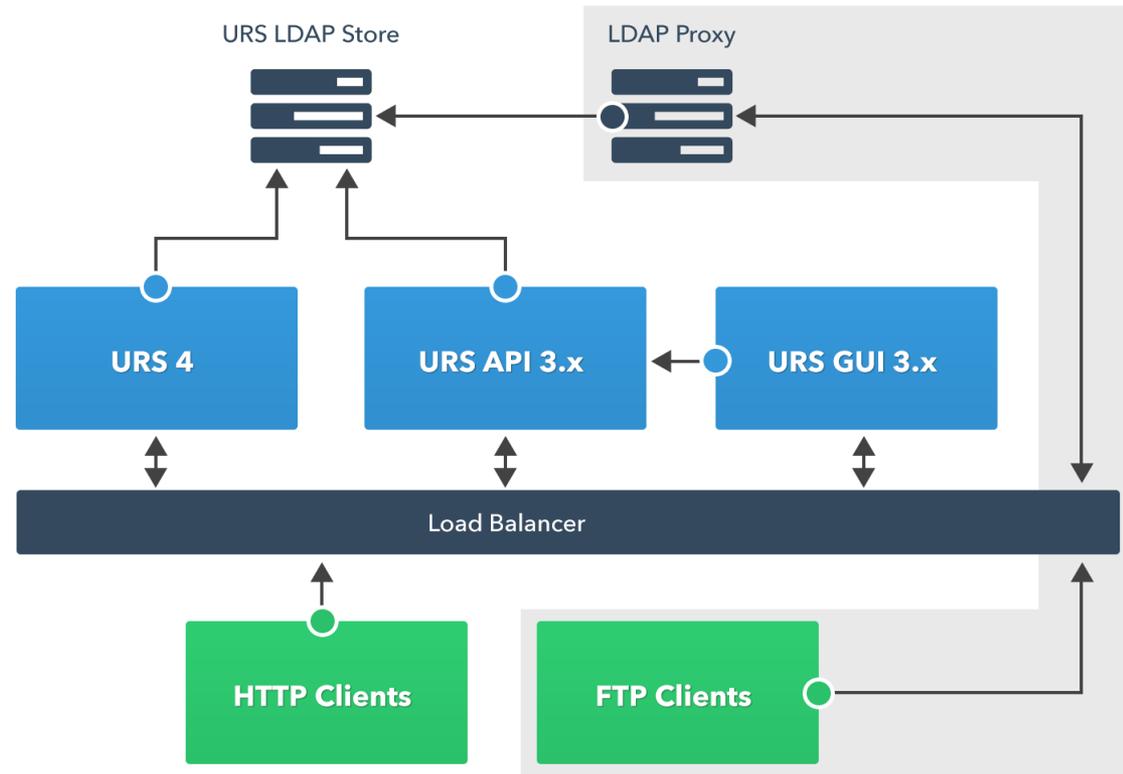


End user applications will continue to work

EOSDIS User Registration System (URS)



- Consolidation of Similar Registration Systems into an EOSDIS Wide User Registration System
- Improve the User Experience
 - Simplified and Consistent User Registration & Authentication
 - Integrated with Coherent Web (Earthdata.NASA.gov)
 - <https://urs.eosdis.nasa.gov/>
- Standardized Method of Metrics Collection & Reporting (via EOSDIS Metrics System - EMS)
 - Understand User Demographics and Access Patterns
- Enable Status Change Notifications to Users
 - By access pattern, data product, site, application, etc.
- Establish Framework for Future Capabilities
 - User Tailoring, Customized Views
 - Saved Queries, Order Management
- Goal for phase-in by all DAACs is mid 2015



URS Technical Architecture

URS GUI



URS REGISTER

EOSDIS User Registration System

USERNAME

PASSWORD

I don't remember my username
 I don't remember my password

ECHO **REVERB** ECE **LANCE** ASF **OBPG** ECC **GCMD**

What is URS?

The EOSDIS URS provides a centralized and simplified mechanism for user registration and account management for all EOSDIS system components. End users may register and edit their account information in one location allowing them access to the wide array of EOSDIS data and services. The EOSDIS URS also helps the EOSDIS program better understand the user demographics and access patterns in support of planning for new value-added features and customized services that can be directed to specific users or user groups resulting in better user experience.

For questions regarding the EOSDIS URS, please contact [Earthdata support](#).

Log in with URS

REVERB

Get access to all your favorite EOSDIS sites

As of May 24, 2014

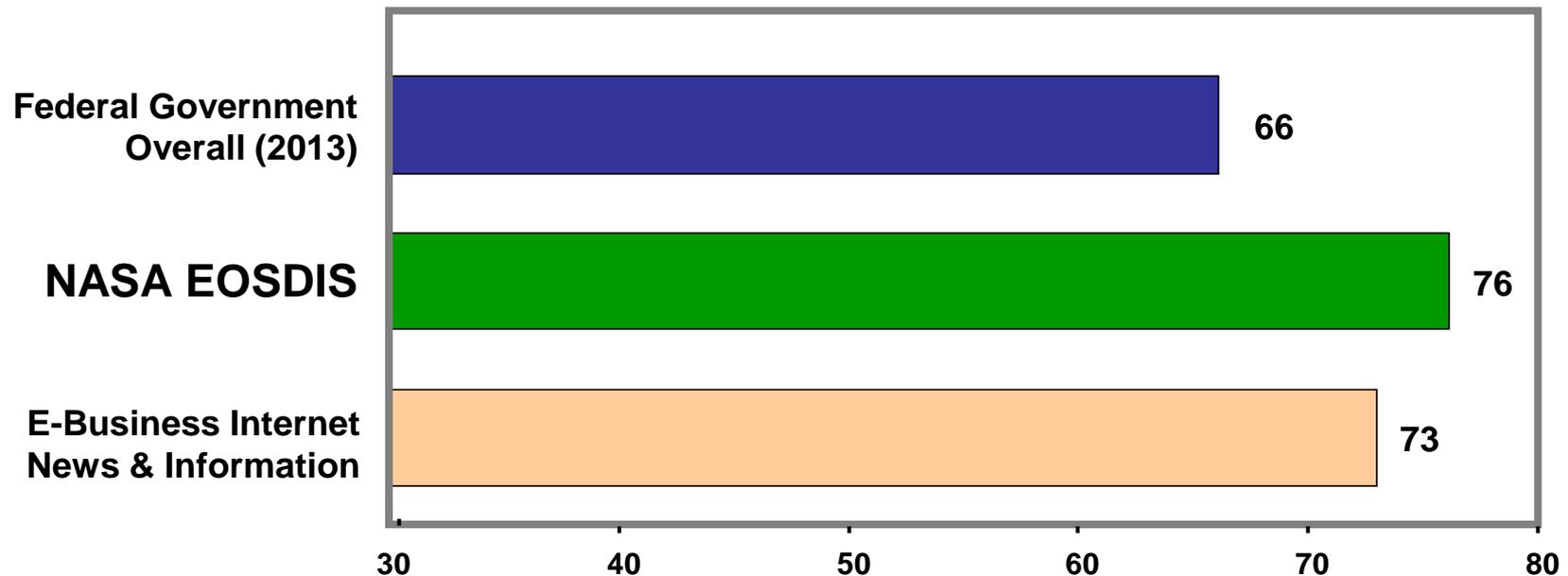
- Total Users: 107,818 (Increasing 400+ new users per week)
- Authentications: Averaging 1.2 million weekly
- Operational Systems: ECHO (Reverb), LANCE, Earthdata (including ECE & wiki), EMS, GCMD, LP DAAC, OBPG (MERIS) and ASF (more to come...)

<https://urs.eosdis.nasa.gov/>

EOSDIS ACSI Customer Satisfaction Survey 2013: Relative Rankings



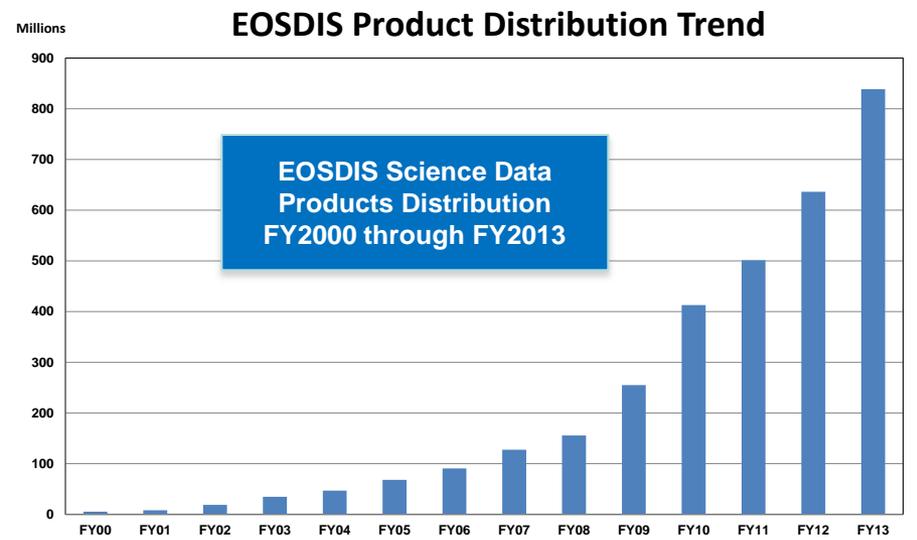
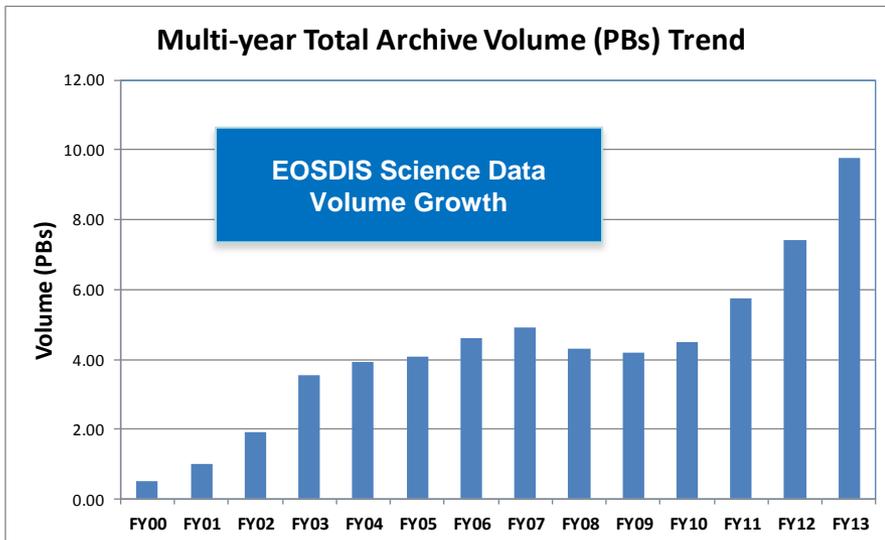
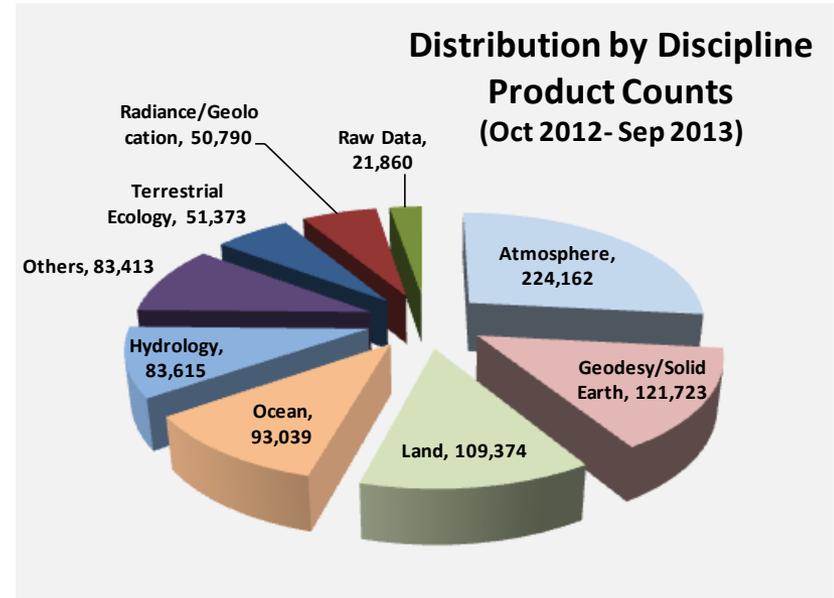
- EOSDIS sponsors an annual independent customer survey in conjunction with the American Customer Satisfaction Index (ACSI)
- EOSDIS consistently exceeds the Federal Government average
- Ratings in the mid to upper 70s are considered “very good” by the rating organization, the CFI Group
- 2013 Survey results based on 4,146 responses (~4.3%)
- Comments in surveys help define system improvements



Example EOSDIS Metrics



EOSDIS Metrics FY2013 (Oct 1, 2012 to Sept 30, 2013)	
Unique Data Products	6,861
Distinct Users of EOSDIS Data and Services	1.7 M
Average Daily Archive Growth	8.5 TB/day
Total Archive Volume	9.8 PB
End User Distribution Products	839 M
End User Average Daily Distribution Volume	22 TB/day



Summary



- EOSDIS is one of the largest science information systems in the world.
- The ECS/SDPS, EarthData, ECHO, Reverb, User Registration are critical components of the EOSDIS.
 - The ECS SDPS archives > 3 petabytes of data across three DAACs, and distributes an average of ~ 7 terabytes of data per day from NASA's EOS and other missions
 - ECS is highly tuned to support efficient transfer of high data volumes
 - Earthdata, ECHO, Reverb, User Registration support *all* EOSDIS DAACs, and *all* EOSDIS data holdings.
- Continued reliable, responsive, and efficient service by EOSDIS to NASA's Earth science data users is essential.