

# Land, Atmosphere Near Real-time Capability for EOS

Terra, Aqua, S-NPP Land Virtual Workshop  
July 1, 2020

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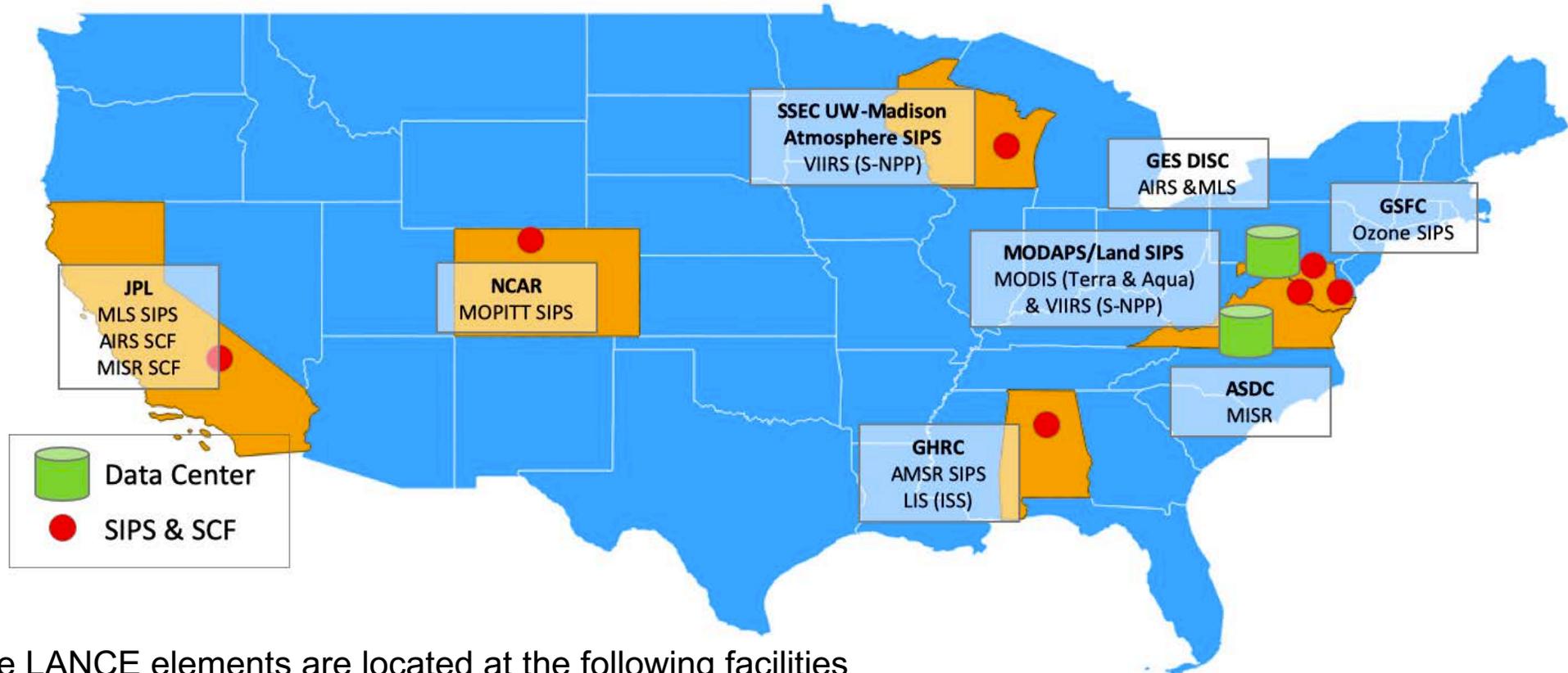
# Land, Atmosphere Near Real-time Capability for Earth Observing Systems (LANCE)

- LANCE provides near real-time (NRT) data products within 3 hours of observations to meet the timely needs of applications users including disasters.
- Imagery is available within 3-5 hours from GIBS and Worldview.
- LANCE is used by a broad range of operational and applications users in 216 countries



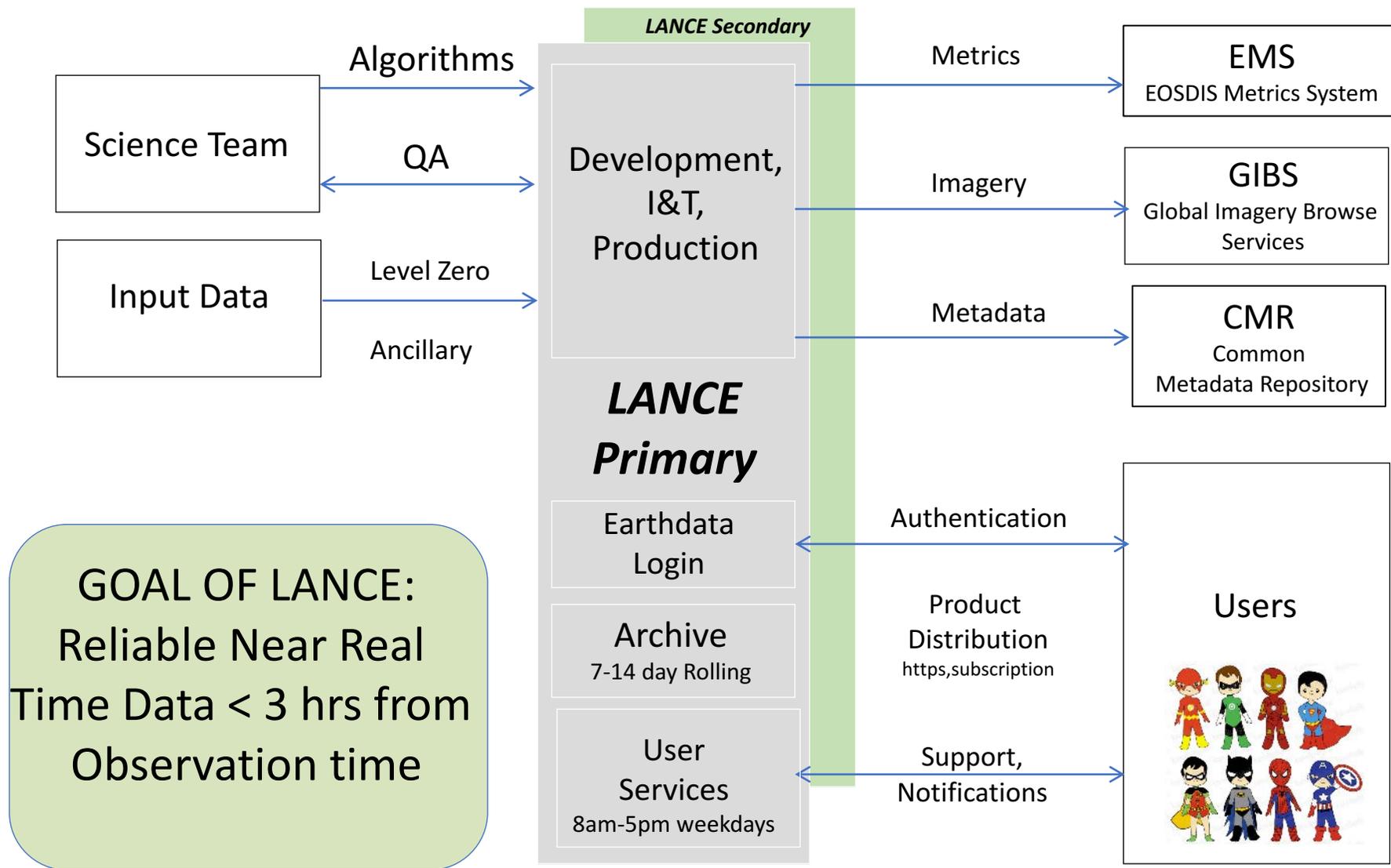
*LANCE supports the following applications Air Quality, Dust storms, Fires, Vegetation changes, floods, ash plumes, drought, smoke plumes, sea ice mapping, and severe storms*

# LANCE FACILITIES



The LANCE elements are located at the following facilities

- **GSFC Earth Sciences Data and Information Services Center (GES DISC)** is providing AIRS with support from the AIRS Science Computing Facility (SCF) at JPL, and MLS data via the MLS SIPS at JPL
- **Atmospheric Science Data Center (ASDC)** is providing MISR data with support from the MISR SCF at JPL
- **AMSR Science Investigator-led Processing System (SIPS)** is providing AMSR2 and LIS data
- **MODIS Adaptive Processing System (MODAPS) and Land SIPS** are providing MODIS and VIIRS Land data
- **Ozone Science Investigator-led Processing System (SIPS)** is providing OMI and OMPS data
- **MOPITT SIPS (National Center for Atmospheric Research (NCAR))** is providing MOPITT data
- **Atmosphere SIPS (Space Science and Engineering Center (SSEC) University of Wisconsin)** is providing VIIRS Atmosphere data



# LANCE UWG Members

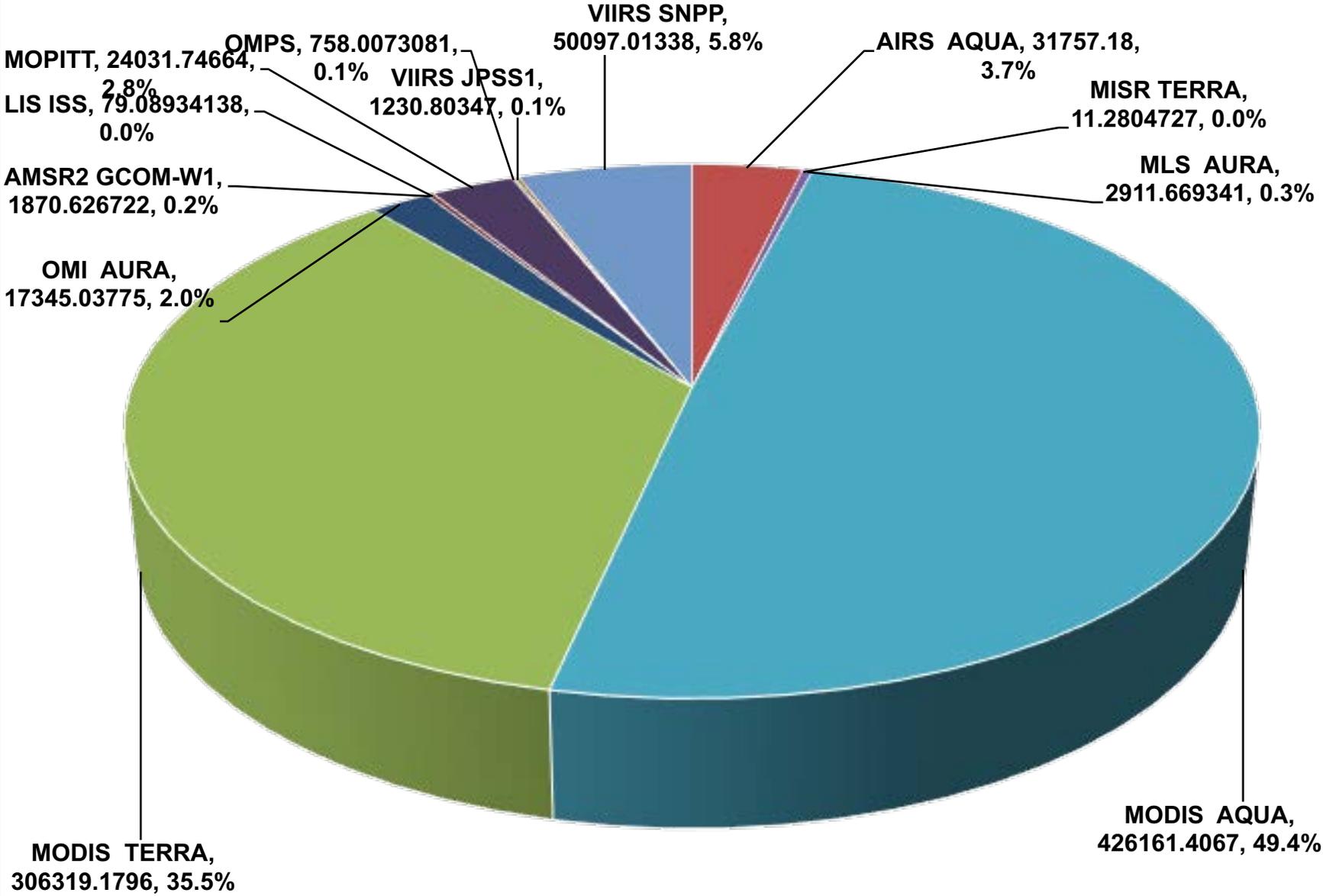
Name	Affiliation	Element of Interest
Miguel Roman	Universities Space Research Association Earth from Space Institute (EfSI)	Chair
Robert Brakenridge	Colorado/Dartmouth Flood Observatory	MODIS
Arlindo da Silva	NASA/Goddard	MODIS, AIRS
Vanessa Escobar	NOAA/NESDIS	GEO-XO
Mike Fromm	NRL/Washington DC	MODIS, VIIRS
Sean Helfrich	NOAA/NESDIS/OSPO	MODIS, VIIRS
Steve Miller	Colorado State University	All Elements
Ana Prados	UMBC/ARSET	Applications
Brad Quayle	USFS	MODIS, VIIRS
Josh Cossuth	NRL/Monterey/Washington DC	MODIS, VIIRS, AMSR
Mark Trice	MD DNR	MODIS, VIIRS
Mike Budde	USGS	MODIS, VIIRS
Paul Meyer	NASA/MSFC/SPoRT	MODIS, VIIRS, AIRS, AMSR

# LANCE Users and Metrics

LANCE products are routinely used by **direct users**, who access data for their own purposes, and by **brokers** who add value to the data by combining it with other specialist knowledge and serve it to targeted end users.



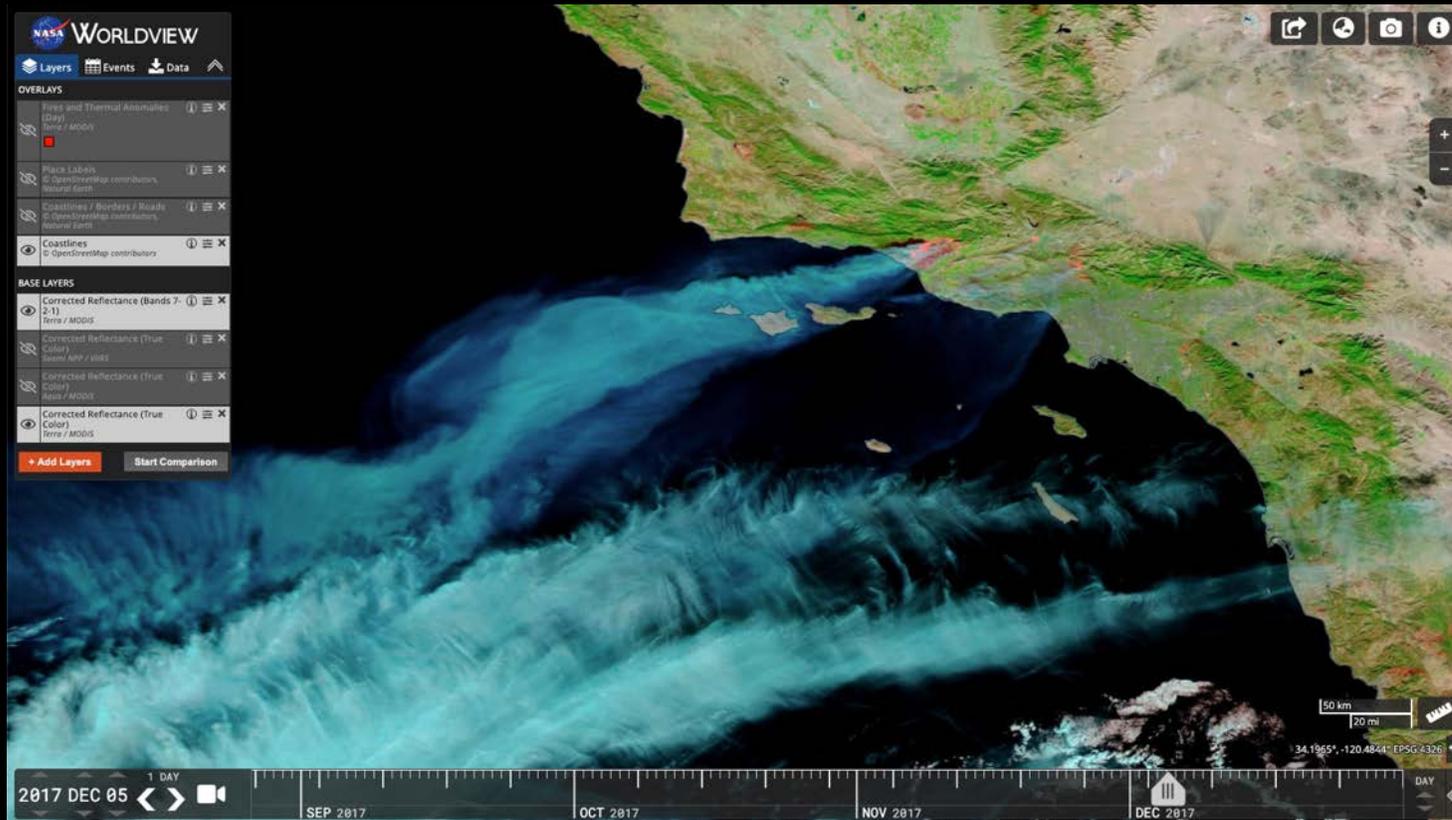
# NRT Products Data Volume (GB) Distributed by LANCE (FY19)



# GIBS and NASA Worldview

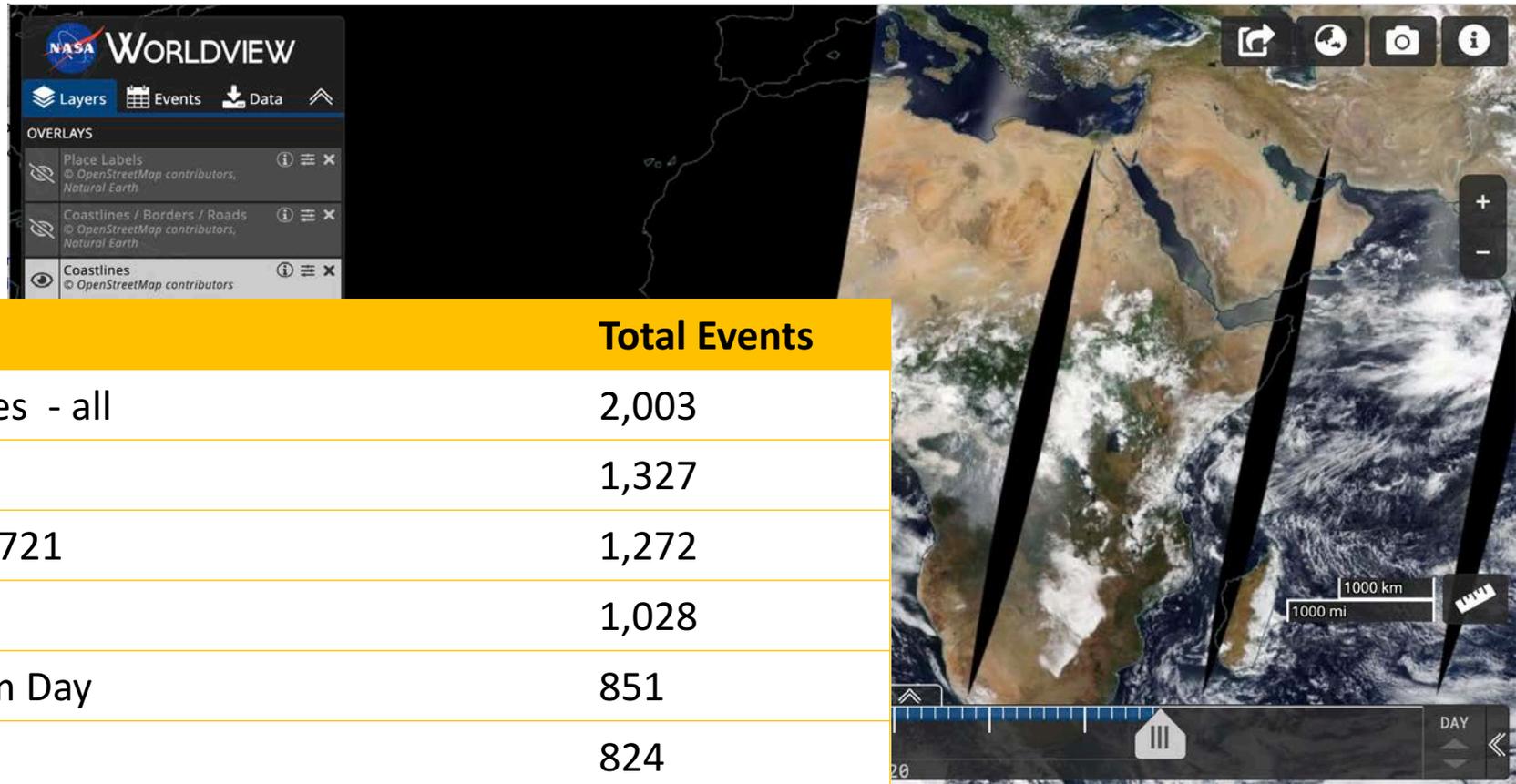
LANCE NRT products are available through GIBS and Worldview. Users interactively explore the imagery, and download the underlying data behind this imagery.

NRT imagery is replaced with standard quality imagery as it becomes available.



Left: Screenshot of Worldview showing Corrected Reflectance Imagery (Bands 7,2,1) from MODIS Terra. The image shows thick smoke streaming from several fires in southern California

# Top 10 Layers Added to Worldview for May 2020



Event Label	Total Events
MODIS Combined Thermal Anomalies - all	2,003
Orbit Tracks Aqua Ascending	1,327
MODIS Aqua Corrected Reflectance 721	1,272
VIIRS NSPP DNB ENCC	1,028
VIIRS SNPP Thermal Anomalies 375m Day	851
OMI Aerosol Index	824
MODIS Terra Corrected Reflectance 721	775
MODIS Combined Value Added AOD	757
VIIRS SNPP Thermal Anomalies 375m Night	702
AIRS L2 Carbon Monoxide 500hPa volume mixing ratio Day	678

# Worldview Snapshots: Top 10 Images Downloaded for May 2020



wvs.earthdata.nasa.gov



## Worldview Snapshots

[Feedback](#)

LAYERS	count	percent
MODIS_Terra_CorrectedReflectance_TrueColor	912434	60.392257
VIIRS_SNPP_CorrectedReflectance_TrueColor	260777	17.260330
MODIS_Aqua_CorrectedReflectance_TrueColor	252876	16.737378
MODIS_Terra_CorrectedReflectance_Bands721	21395	1.416094
MODIS_Aqua_CorrectedReflectance_Bands721	13760	0.910748
VIIRS_SNPP_DayNightBand_ENCC	7860	0.520238
Coastlines	4901	0.324388
Himawari_AHI_Band13_Clean_Infrared	4625	0.306120
AIRS_L2_Carbon_Monoxide_500hPa_Volume_Mixing_Ratio_Day	4230	0.279976
MODIS_Terra_CorrectedReflectance_Bands367	4198	0.277858

# MODIS NRT

- Products produced within 2-hours of acquisition of the instrument data
  - Gridded daily and n-day composite L3 products are produced a few hours after the end of the day.
  - Products include L1, L2 land and atmosphere products, L3 LSR, VI, BRDF-Albedo and MAIAC produced daily
    - MODVOLC released in April 2019 – available via University of Hawaii
    - MAIAC released in June 2019
  - L1 and Atmosphere products are C61
  - Land is currently using a C6 PGEs in NRT.
  - For Flood Mapping the L3 multi-day Water Composite product is being produced but is still undergoing validation

# Near Real Time PGEs: SNPP and NOAA-20/J1

- SNPP
  - C1 operational PGEs currently in use.
  - Active Fire Imagery uses C2 Fire algorithm processing the NASA L1B. Use of IDPS heritage L1 SDR resulted in too many false fires.
  - Products currently in processing and available to public: L2 Corrected Reflectance, Land Surface Reflectance, Fire Imagery, Land Surface Temperature, Snow, Sea Ice and Ice Surface Temperature, L2G surface reflectance.
  - Transition for full suite to C2 expected in July/Aug after start of C2 in standard processing.
- NOAA-20/J1
  - C2 L1 operational since Aug 2019
  - L2 Corrected reflectance and Active Fire imagery since Jan 2020 using C2 version of the PGEs.
  - Remaining L2 products to be operational in Sept 2020 after start of C2 in standard processing

# Black Marble Product Status



[VNP46A1 QA browse imagery for 24 February 2020](https://go.nasa.gov/2YCIYhW) (<https://go.nasa.gov/2YCIYhW> )

VNP46A1 is under operational production and will be transitioned to NRT in LANCE in the Fall of 2020.

# Enhanced Near Constant Contrast (ENCC) and Day Night Band (DNB) in LANCE

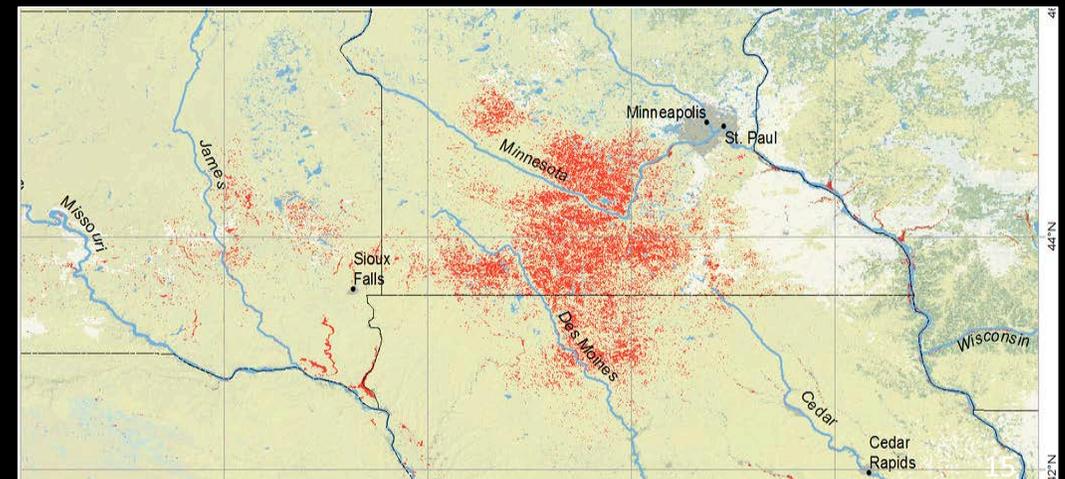
- Currently ENCC is produced by DRL and imagery is made available for LANCE and Worldview
  - ENCC is not an operational product
- VNP46A1 (standard product) will be transitioned in to LANCE in Fall 2020
- When both VNP46A1 and ENCC are in LANCE and Worldview the ST and LANCE UWG will assess whether both are required
  - ENCC are currently being used to see:

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>• Low cloud/fog via moonlight</li><li>• Flames from active fires</li><li>• Lightning flashes</li><li>• Aurora and Bolides</li></ul> | <ul style="list-style-type: none"><li>• Biomass smoke via moonlight</li><li>• Dust storms via moonlight</li><li>• Airglow and gravity waves in airglow</li><li>• Other natural light phenomenon that are ephemeral</li></ul> |
|---|--|

# NRT Flood Map Development Status

Step	Component	Description	Status	Estimated Delivery
1	PGE152	Water detection	In current NRT production	
2	PGE155	Level-2 gridding	In current NRT production	
3	PGE159	Level-3 Compositing and Flood Identification	In current NRT production for testing	
4	PGExxx	Imagery available in GIBS	Prototype imagery provided to GIBS.	Summer 2020
5	Prod	Web Content		Fall 2020

Midwest Flood  
March 22, 2019



# NRT Flood Map Development Status

Unlike most NRT products there is no standard counterpart.

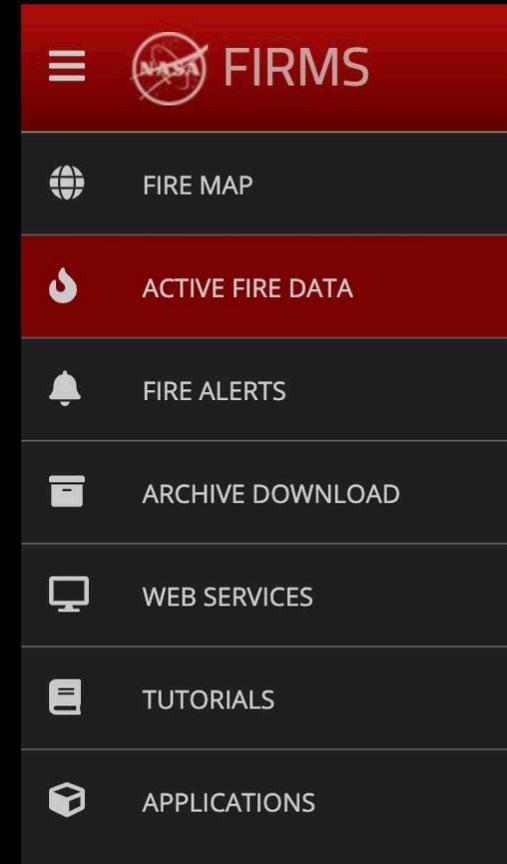
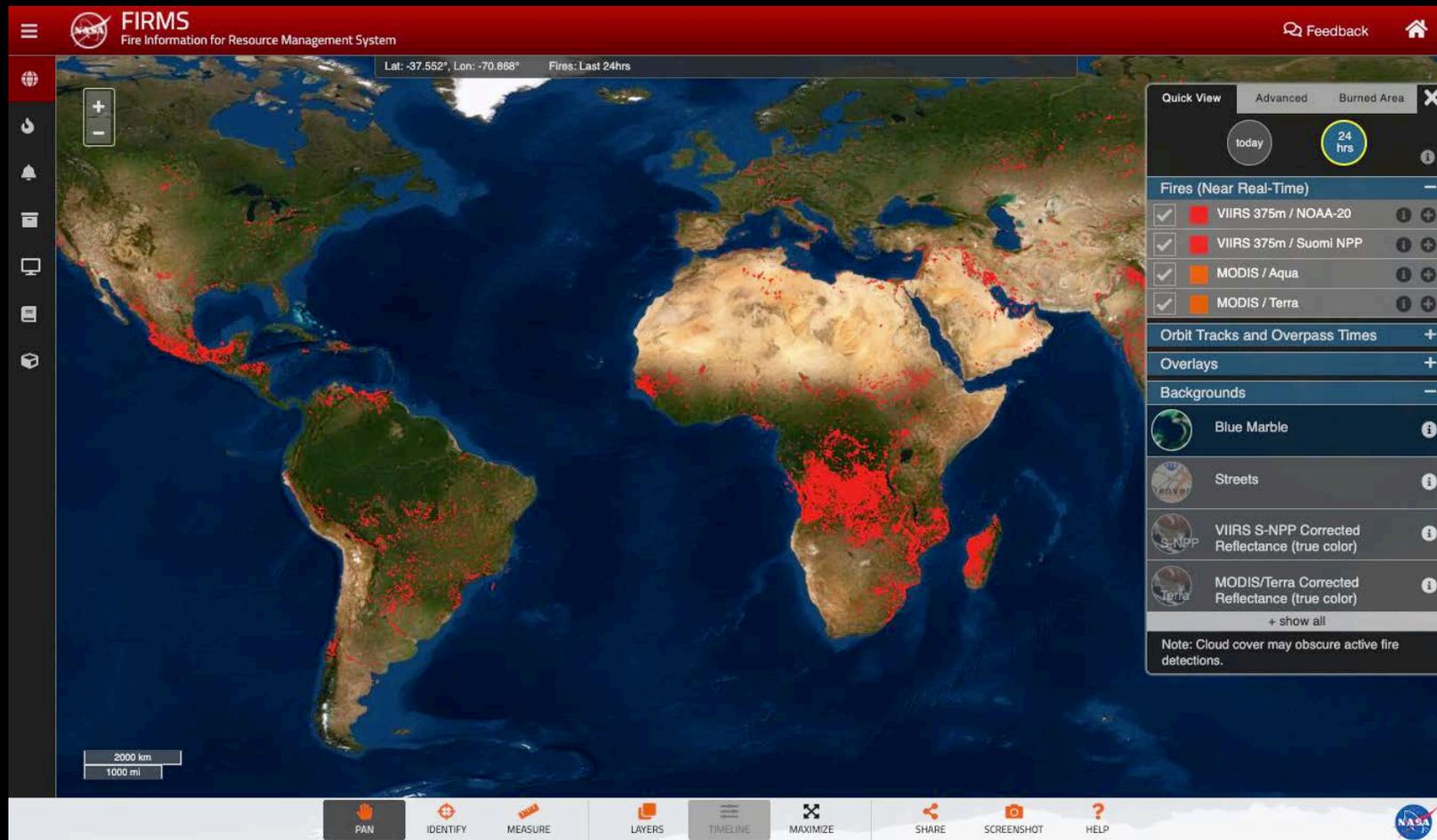
Historical data will be required:

- For validating the flood product (limited amount)
- For updating the flood water mask
- For end users to understand what areas flooded in previous years
- For users to download for routine applications (historical context)

Options:

- Long term: Standard science quality product (usually via ROSES call)
- Near term: Applications/experimental product
  - ESDIS and MODAPS are evaluating this option

# Fire Information for Resource Management System (FIRMS)



- provides global NRT active fire/thermal anomaly data from MODIS & VIIRS, and burned area data from MODIS.

Originally developed at the University of Maryland in partnership with the United Nations (UN) Food and Agriculture Organization (FAO). FIRMS became part of LANCE in 2012

# USFS - FIRMS Prototype for US and Canada



USFS – FIRMS will be tailored to meet the needs of Active Fire Mapping Program end users. There will be a phased introduction starting in late 2020. The prototype will integrate some current FS Active Fire Mapping capabilities as well as introduce several additional capabilities/functions.

# More information on LANCE

## Data products

- LANCE: <https://earthdata.nasa.gov/lance>

## Hotspot/Active Fire data

- Fire Information for Resource Management System (FIRMS): <https://earthdata.nasa.gov/firms>

## Imagery

- Worldview: <https://earthdata.nasa.gov/worldview>
- Worldview Snapshots: <https://earthdata.nasa.gov/snapshots>
- Global Imagery Browse Services: <https://earthdata.nasa.gov/gibs>

Questions: [diane.k.davies@nasa.gov](mailto:diane.k.davies@nasa.gov) or [karen.a.michael@nasa.gov](mailto:karen.a.michael@nasa.gov)



Back up Slides

# MODIS LANCE Product Details (1 of 2)

Products	Resolution	Ver	Number of Prod			GIBS+	Comment
			Terra	Aqua	Comb		
L0, L1A	all	C6.1	4	6			
L1 Geo/Rad	250 m, 500 m, 1 km, 5 km	C6.1	5	5		Yes	5 km subset discontinued
L2 Atm Temp/Prof	5 km	C6.1	1	1			
L2 Cloud Mask	250 m, 1 km	C6.1	1	1			
L2 Aerosol	3 km, 10 km	C6.1	2	2		Yes	
L2 Tot Precip Water	1 km, 5 km	C6.1	1	1		Yes	
L2 Clouds	1 km, 5 km	C6.1	1	1		Yes	
L2 Volcano Alert	1 km	C6.0	1	1			Only distributed to U of Hawaii
L3 Val Add Aerosol - 6 hr	0.5 deg	C6.1	1	1	1		
L2 Snow	500 m	C6.0*	1	1		Yes	
L2 Sea Ice Extent	1 km	C6.0*	1	1		Yes	
L2 Thermal Anom/Fire	1 km	C6.0*	1	1		Yes	GIBS through FIRMS
L2 Surf Refl	250 m, 500 m, 1 km	C6.0*	1	1		Yes	

+ MODIS NRT images are generated and delivered to GIBS via PDR interface

\* C6.1 being evaluated – polarization correction required for Terra

# MODIS LANCE Product Details (2 of 2)

Products	Resolution	Ver	Number of Prod			GIBS	Comment
			Terra	Aqua	Comb		
L2 Surf Temp (Wan)	1 km	C6.0*	1	1		Yes	
L2 Surf Temp (JPL)	1 km	C6.1	1	1			Could be released soon
L2G Pointer/Geo	250 m, 500 m, 1 km	C6.0*	3	3			
L2G Surf Refl	250 m, 500 m, 1 km	C6.0*	5	5			
L2G Therm Bands	1 km	C6.0*	1	1			
L3 Aerosol Opt Thick - day	0.05 deg	C6.0*	1	1			
L3 Surf Refl - day	0.05 deg	C6.0*	1	1			
L3 Surf Refl - 8 day roll	500 m, 250 m	C6.0*	2	2			
L3 Veg Index - 8 day roll	500 m, 250 m	C6.0*	2	2			
L3 BRDF/Albedo - 16 day roll	500 m, 1 km CMG	C6.0*			5		1 km CMG only to GMAO
L3 MIAIC (A2, A3) - n day roll	1 km	C6.0			2	Yes	
L3 Flood mapping - 3 day roll	1 km	C6.1	1	1			Summer 2020
<b>Total</b>			<b>42</b>	<b>44</b>	<b>11</b>		

\* C6.1 being evaluated – polarization correction required for Terra

# S-NPP VIIRS-Land LANCE Product Details

Products	Resolution	S-NPP Ver	JPSS-1 Ver	Num of Prod		GIBS	Comments
				SNPP	JPSS-1		
L1A (all)	375 m, 750 m	C1.0*	C2.	1	(a)		(a) JPSS-1 C2.0 L1s Planned release Apr/May '19
L1 Geo (Img, Mod, DNB)	375 m, 750 m	C1.0*		3	(a)		* SNPP C2.0 Planned release Aug/Sept '19
L1 Rad (Img, Mod, DNB)	375 m, 750 m	C1.0*		3	(a)	Yes	
L2 Surf Refl	375 m, 750 m	C1.0*		1	(b)		(b) JPSS-1 C2.0 L2+ Planned release Aug/Sept '19
L3 Surf Refl - day	500 m, 1 km	C1.0*		1	(b)		
L2 Snow	375 m	C1.0*		1	(b)	Yes	
L2 Thermal Anom/Fire	375 m	C1.0*	C2.0	2	(b)	Yes	GIBS through FIRMS
L2 Surf Temp	750 m	C1.0*		1	(b)	Yes	
L2 Sea Ice Cover	375 m	C1.0*		1	(b)	Yes	
L2 Sea Ice Temp	750 m	C1.0*		1	(b)	Yes	
L3 BRDF/Albedo	1 km	C1.0*		8	(b)		
L3 Black Marble	750 m	C1.0*		1	(b)		PGE not ready yet
<b>Total</b>				<b>24</b>	N/A		

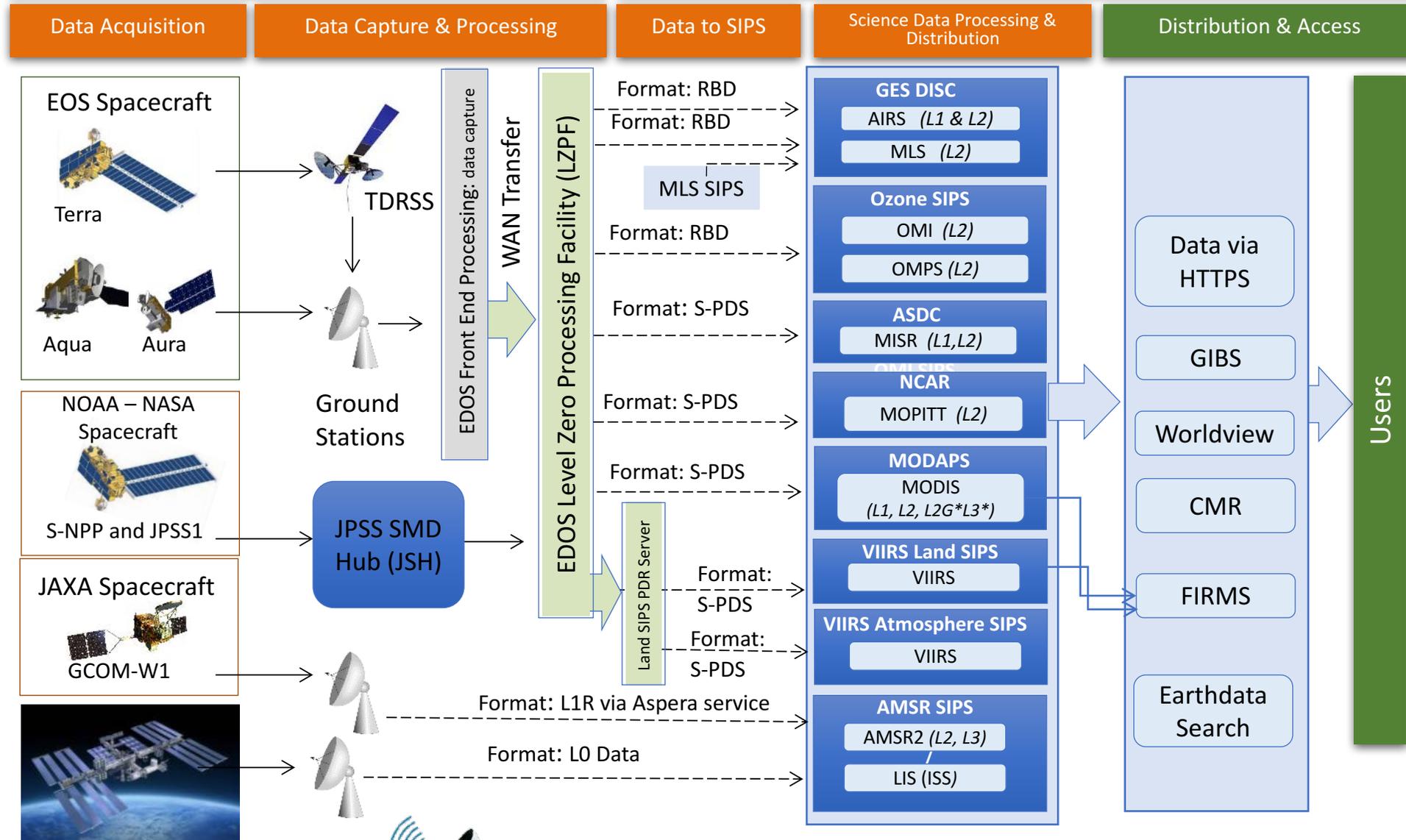
## Yearly NRT Products Data Volume and Files Distributed by LANCE (October 1, 2009 to September 30, 2019)



# Earth Science Data Operations

## Earth Science Mission Operations

## ESDIS



RBD: Rate Buffered Data, S-PDS: Session Based Production Data Set, T-PDS: Time Based Production Data Set  
 \*L2G and L3 products have a latency of 27 – 48 hours  
 SIPS: Science Investigator-led Processing Systems, TDRSS: Tracking and Data Relay Satellite System

# Initial FIRMS US/Canada Capabilities and Functions

- Map Viewer
  - Active fire detections
    - Symbolized by time since detection, FRP and confidence
  - Additional contextual layers
    - Current US and Canada large incident locations
    - Current/historical satellite imagery (MODIS, VIIRS, GOES)
    - US and Canada administrative ownership
    - Daily fire danger forecasts
    - Current NWS fire weather watch/red flag warning areas
- Data Downloads
  - NRT and science quality active fire data
  - NRT active fire data KMLs
  - Custom current/historical MODIS/VIIRS image subsets (Worldview Snapshots)
- Web Services
  - WMS and WMS-T MODIS/VIIRS active fire data
  - WMS and WMS-T MODIS/VIIRS imagery services (GIBS)
- Alerts
  - Fire alert subscription service