EXAMPLES OF DATA AND TRAINING DISTRIBUTION TO UTILIZE UNDER NORMAL AND UNUSUAL CIRCUMSTANCES

WMO Vlab and NOAA Train the Trainers Workshop - 6 August, 2022

Seth Clevenstine
seth.clevenstine@noaa.gov
NOAA

Diego Souza
diego.souza@inpe.br
INPE

Marcial Garbanzo
marcial.garbanzo@ucr.ac.cr
University of Costa Rica

Training Outline

- Summary of Data Access and Distribution Mechanisms
- Advantages and Disadvantages
- GEONETCast-Americas
  - Architecture and Possibilities
  - Portable Stations
  - Training, Admin and Charter Channels
  - International Disaster Charter Case Study
  - Latencies
- IDD
- Custom Data Processing

Examples of Data Access and Distribution Mechanisms

Direct Readout / Rebroadcast

GRB - GOES REBROADCAST

HRIT / EMWIN

HIGH RATE DATA - HRD

GEONETCAST-AMERICAS (GNC-A)

Cloud Services / Internet

amazon web services™

Environmental Data Commons

Google Cloud Platform

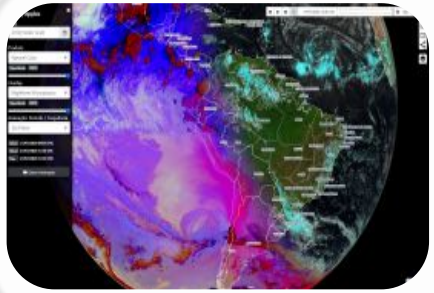
unidata IDD

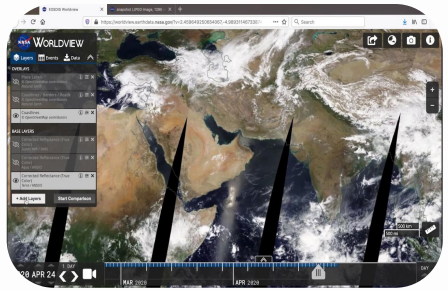
Archive

CLASS

EUMETSAT Data Centre

Webpages





Data Access Mechanisms: Advantages and Disadvantages

GRB - GOES REBROADCAST

Pro's

- **Highest availability and lowest latency for GOES users**
- **Contains all 16 Level 1b ABI radiances in native spatial and temporal resolution**
- **GLM 20-second data and Space Weather Products also available**
- **Free CSPP software available for users to download**

Con's

- **Ground station costs are expensive**

  Requires significant storage capabilities to obtain all data
- **Only contains data from the GOES satellite of interest, no other satellite data available**
- **Does not contain any Level II data except GLM, requires further processing**
- **CSPP software doesn't cover all Level II ABI data that NESDIS produces via the Product Distribution and Access system**

HIGH RATE DATA - HRD

Pro's

- **Highest availability and lowest latency for JPSS users**
- **Fine spatial resolution**
- **Includes the full set of science and calibration data from all the mission instruments**
- **Free CSPP software available for users to download**

Con's

- **Ground station costs are expensive**

Requires significant storage capabilities to obtain all mission data

- **Only contains data from the JPSS satellite downlink of interest, no other satellite data**
- **Raw data requiring further processing**
- **CSPP software doesn't cover all Level II data that NESDIS produces via the Product Distribution and Access system**

Data Access Mechanisms: Advantages and Disadvantages

GEONETCAST-AMERICAS (GNC-A)

Pro's

- **Alternative satellite source for GOES, JPSS and more:** 16 bands / 19 x Level II Products
  - GOES-West / METEOSAT data
  - JPSS Imagery and Products
  - GCOM-W1 Imagery and Products
  - LEO Blended Products, ISCS and more
- **Standard off-the-shelf components (lower costs)**
- **Portable stations**
- **Custom broadcast channels**
- **Regional data providers**

Con's

- **Broadcast Product Latency:** Data Providers > Uplink > Rebroadcast > Users
- **Possible Product Outages (PDA)**
- **Modified Spatial and Temporal Resolutions in some cases**
- **Broadcast Prioritization - Some products arrive first**
- **The maintenance can be more frequent**

BIG DATA PROJECT - CLOUD SERVICES

Pro's

- **Historical and NRT data access**
- **Multiple datasets (Imagery and Products)**
- **Minimum latency for data availability**
- **There's no cost for accessing data**

Con's

- **Good internet bandwidth required**
- **Possible Product Outages (PDA)**
- **There may be costs for data processing directly in the cloud**

Data Access Mechanisms: Advantages and Disadvantages

UNIDATA

unidata

Pro's

- Many datasets available (Satellite Imagery and Products, NWP, Radar, etc.)
- Redundancy (e.g.: Different GRBs as source)
- There's no cost for accessing data

Con's

- Good internet bandwidth required

LONG TERM ARCHIVE

Pro's

- Historical data access
- Complete NOAA and EUMETSAT databases
  - GOES series, POES, JPSS, JASON, DMSP, MSG, METOP, Copernicus and many more
- There's no cost for accessing data

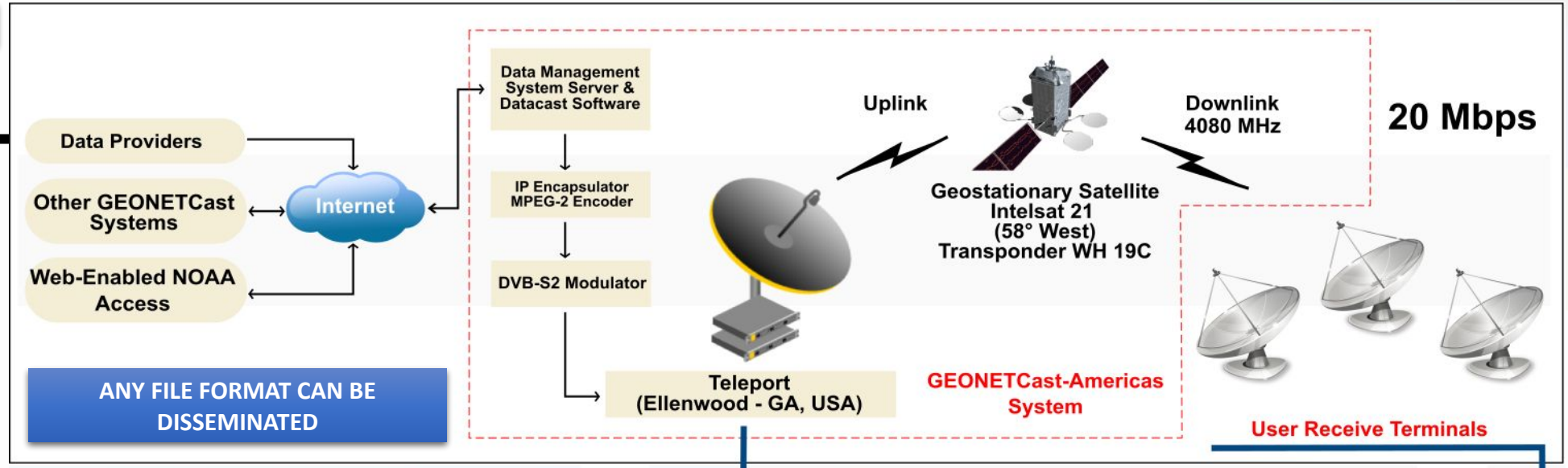
Con's

- Need to wait for FTP link
- Large datasets under request

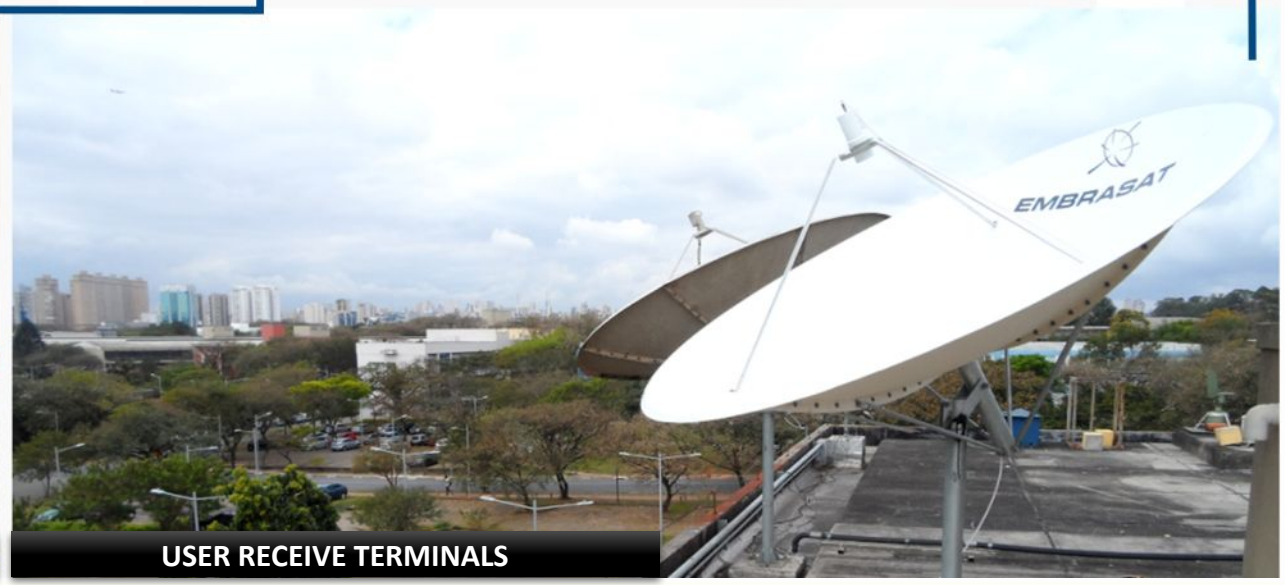
GEONETCast-Americas: Data Distribution and Possibilities

GNC-A DATA PROVIDERS

UCAR
INPE
NOAA
CONAE
MARN
Ministerio de Medio Ambiente y Recursos Naturales
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EUMETSAT
CIMSS
CIRA
imn
Instituto Meteorológico Nacional de Costa Rica

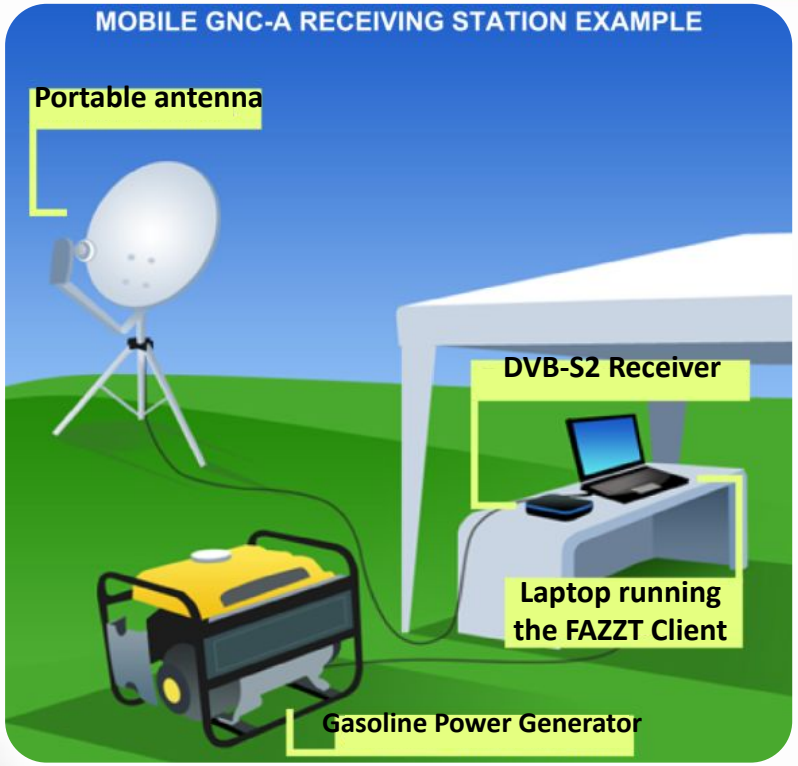


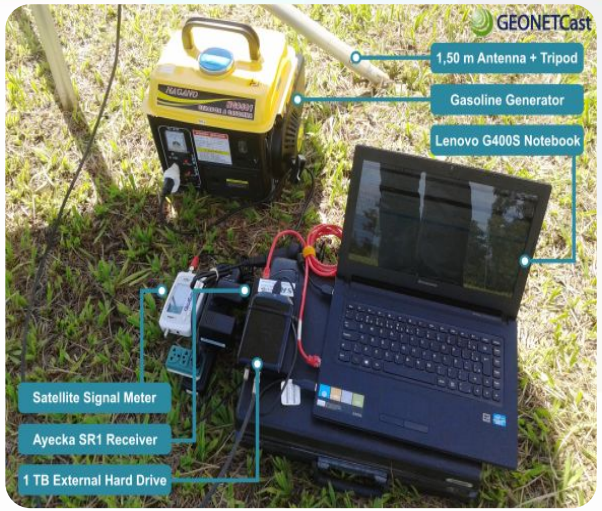
INTELSAT UPLINK



USER RECEIVE TERMINALS

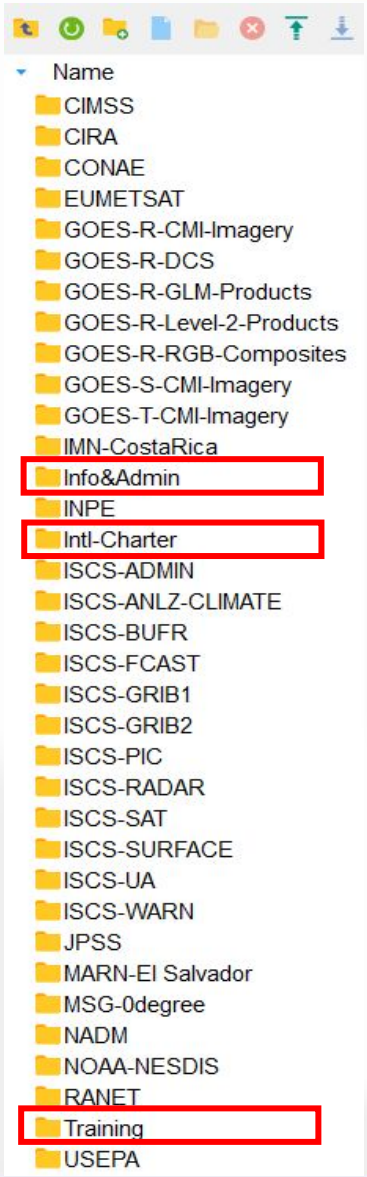
GEONETCast-Americas: Portable Stations

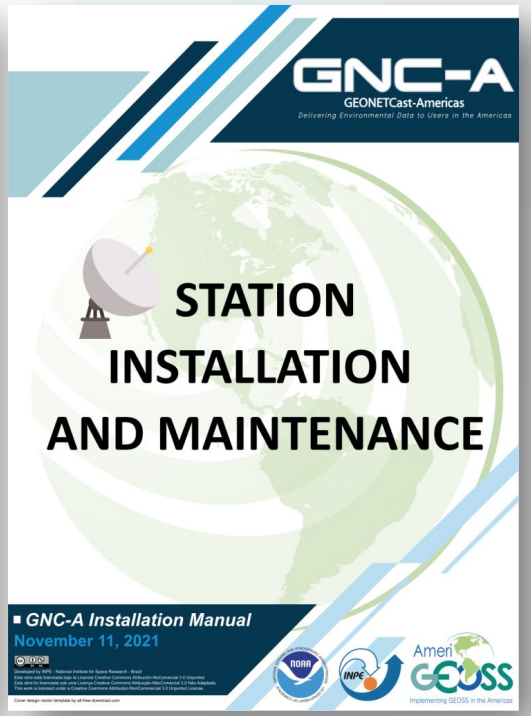




- Only need power for computer and DVB-S2 receiver
- No internet connection needed
- Ability to add data to the broadcast on a ad-hoc basis
- Ability to add data prepared within or outside the ROI
- GNC-A is uniquely situated to support the delivery of disaster response information

GNC-A: Training, Admin and Intl. Charter Channels





ANY FILE FORMAT CAN BE DISSEMINATED

Index of /geonetcast/Info&Admin

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GNC-A Product List -..>	2022-04-15 07:33	15M	
GNC-A_UGW_13_v2022-0..>	2022-04-18 10:05	423K	
GOESWKLY.SCHED	2022-04-18 10:03	5.4K	
WMO_Regional_Survey_..>	2022-04-18 10:05	96K	

Index of /geonetcast/Training

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SHOWCast_v_2_5_1 (1)..>	2022-04-17 11:28	368M	

GEONETCast-Americas: International Charter Case Study

EVENT

- Flooding

LOCATION

- Northern Region of Brazil

CHARTER ACTIVATION

- March 21, 2014

REQUESTER

- National Center for Risk and Disaster Management (CENAD)

PROJECT MANAGER

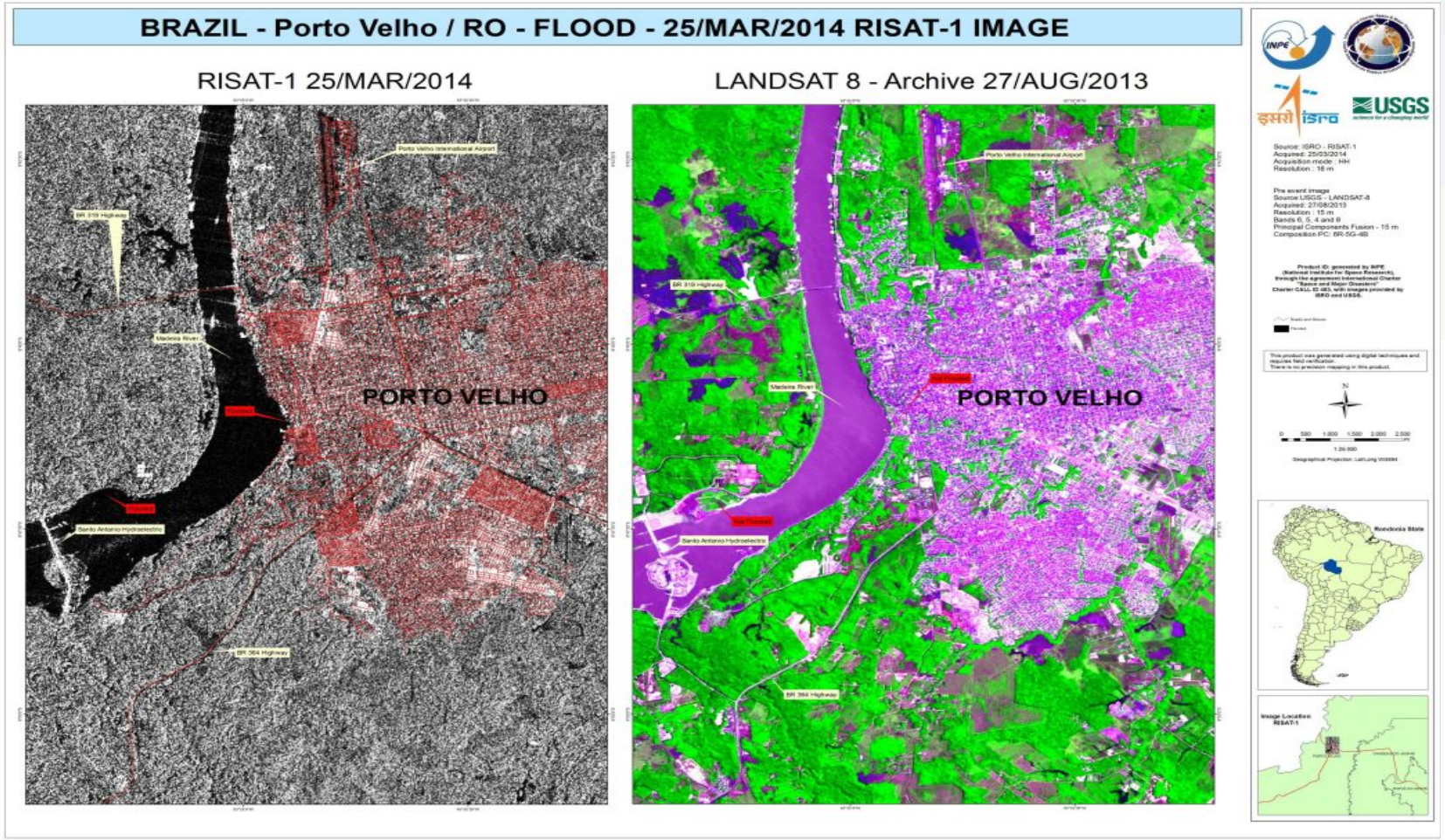
- INPE

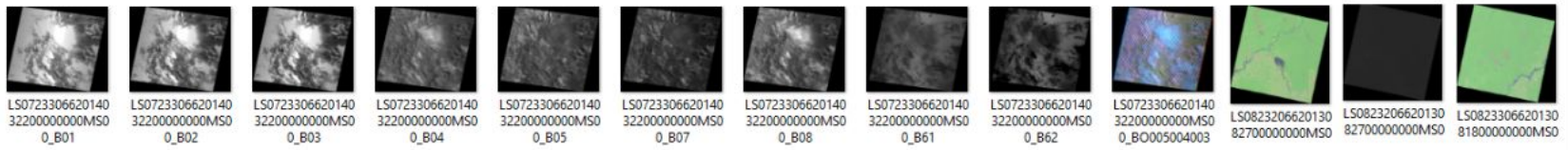
VALUE ADDED SPECIALIST

- INPE

DATA

- Landsat-8 18/08/2013
- Landsat-8 27/08/2013
- Landsat-7 22/03/2014
- 3.7 GB





GEONETCast-Americas: Latencies

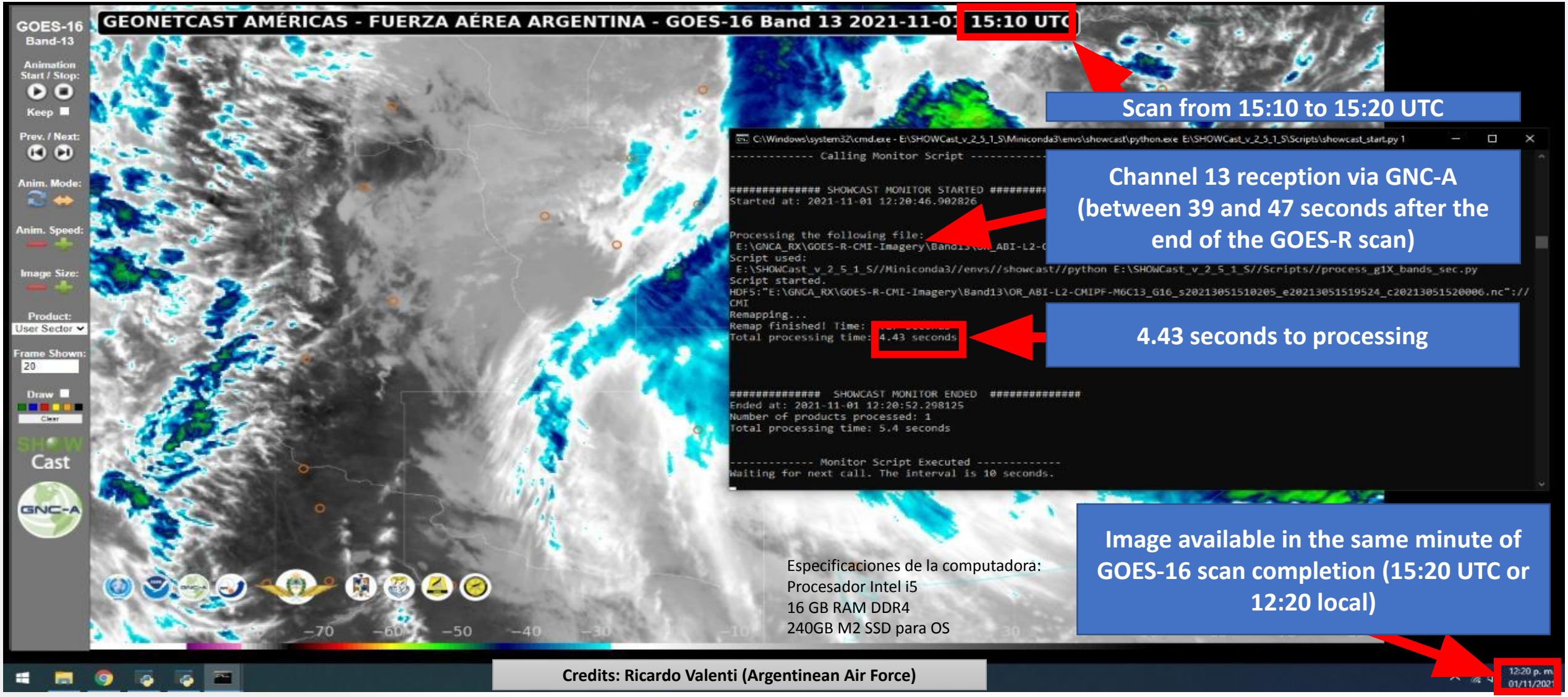
Product	Best Latency	Worst Latency
Canal 01	02:27	05:02
Canal 02	01:57	03:50
Canal 03	02:32	05:09
Canal 04	02:30	05:51
Canal 05	01:40	03:10
Canal 06	01:46	03:46
Canal 07	00:47	00:58
Canal 08	01:24	01:28
Canal 09	00:47	00:48
Canal 10	01:25	01:26
Canal 11	02:13	03:51
Canal 12	02:10	03:48
Canal 13	00:39	00:47
Canal 14	01:30	01:30
Canal 15	01:29	01:30
Canal 16	02:49	05:59

Product	Best Latency	Worst Latency
Cloud Top Height (ACHAF)	02:25	10:15
Cloud Top Temp. (ACHTF)	02:59	11:13
Clear Sky Masks (ACMF)	02:23	05:18
Cloud Top Phase (ACTPF)	12:32	15:26
Aerosol Detection (ADPF)	02:14	05:31
Aerosol Opt. Dep. (AODF)	02:22	06:15
Cloud Optical Depth (CODF)	05:11	13:06
Cloud Particle Size (CPSF)	05:28	13:42
Cloud Top Pres. (CTPF)	02:26	10:15
Der. Winds B02 (DMWF-C02)	50:15	53:46
Der. Winds B07 (DMWF-C07)	51:49	52:03
Der. Winds B08 (DMWF-C08)	52:06	52:10
Der. Winds B09 (DMWF-C09)	52:06	52:10
Der. Winds B10 (DMWF-C10)	52:05	52:12
Der. Winds B14 (DMWF-C14)	51:52	50:29
Der. Winds B08 (DMWVF-C08)	52:05	52:10

Product	Best Latency	Worst Latency
Derived Stability Indices (DSIF)	02:35	05:25
Dowward SW (DSRF)	06:40	15:09
Fire-Hot Spot Char. (FDCF)	01:33	01:40
Land Surface Temp. (LSTF)	02:37	03:40
Rainfall Rate (RRQPEF)	01:26	01:33
Reflected SW (RSRF)	05:38	05:45
Sea Surface Temp. (SSTF)	01:33	01:39
Total Precip Water (TPWF)	05:45	05:38
GOES-17 Band02	02:52	05:16
GOES-17 Band09	03:03	04:56
GOES-17 Band13	03:11	05:10
Note: Statistics from 01 October 2021	05:00 UTC	17:00 UTC

Importance of Reduced Latencies and Optimized Processing

Latencias Optimizadas



Scan from 15:10 to 15:20 UTC

Channel 13 reception via GNC-A (between 39 and 47 seconds after the end of the GOES-R scan)

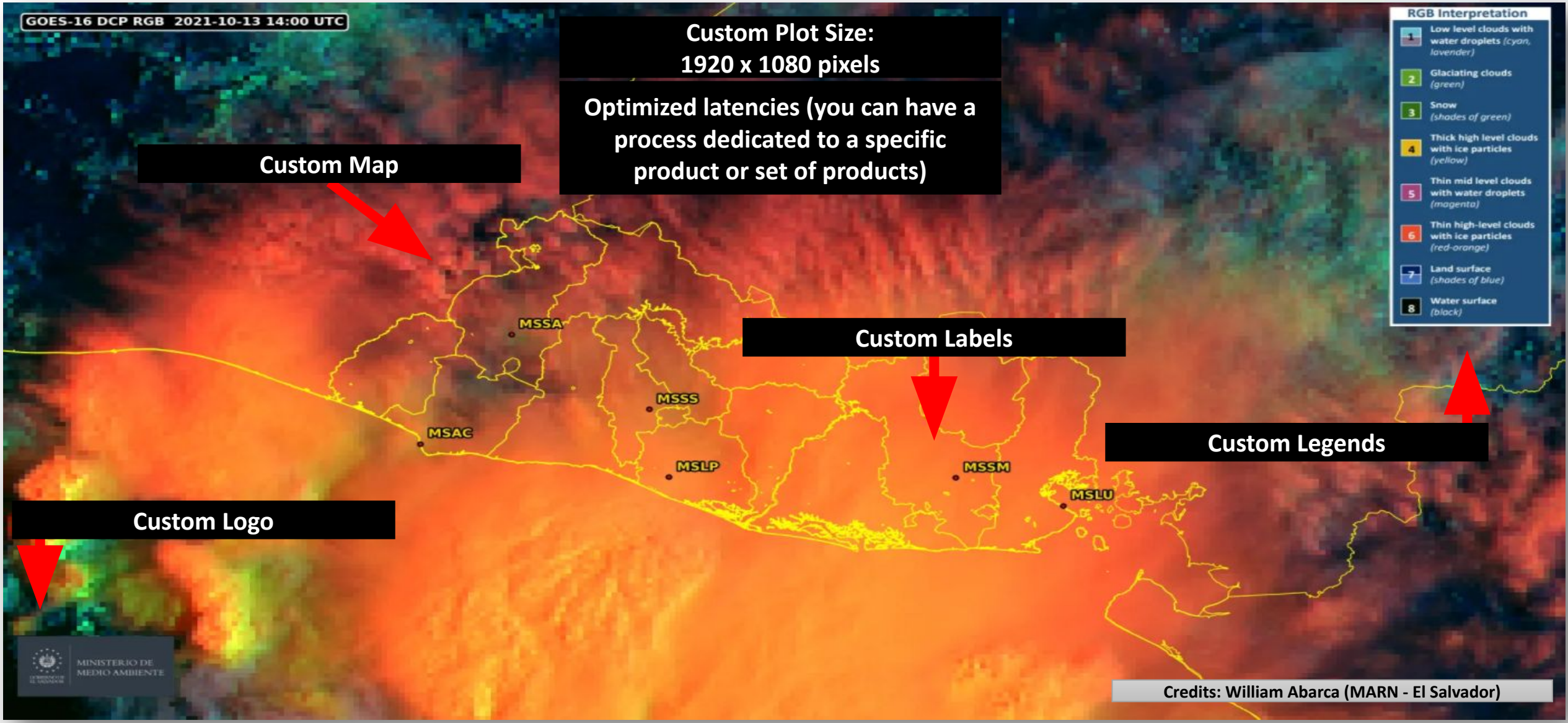
4.43 seconds to processing

Image available in the same minute of GOES-16 scan completion (15:20 UTC or 12:20 local)

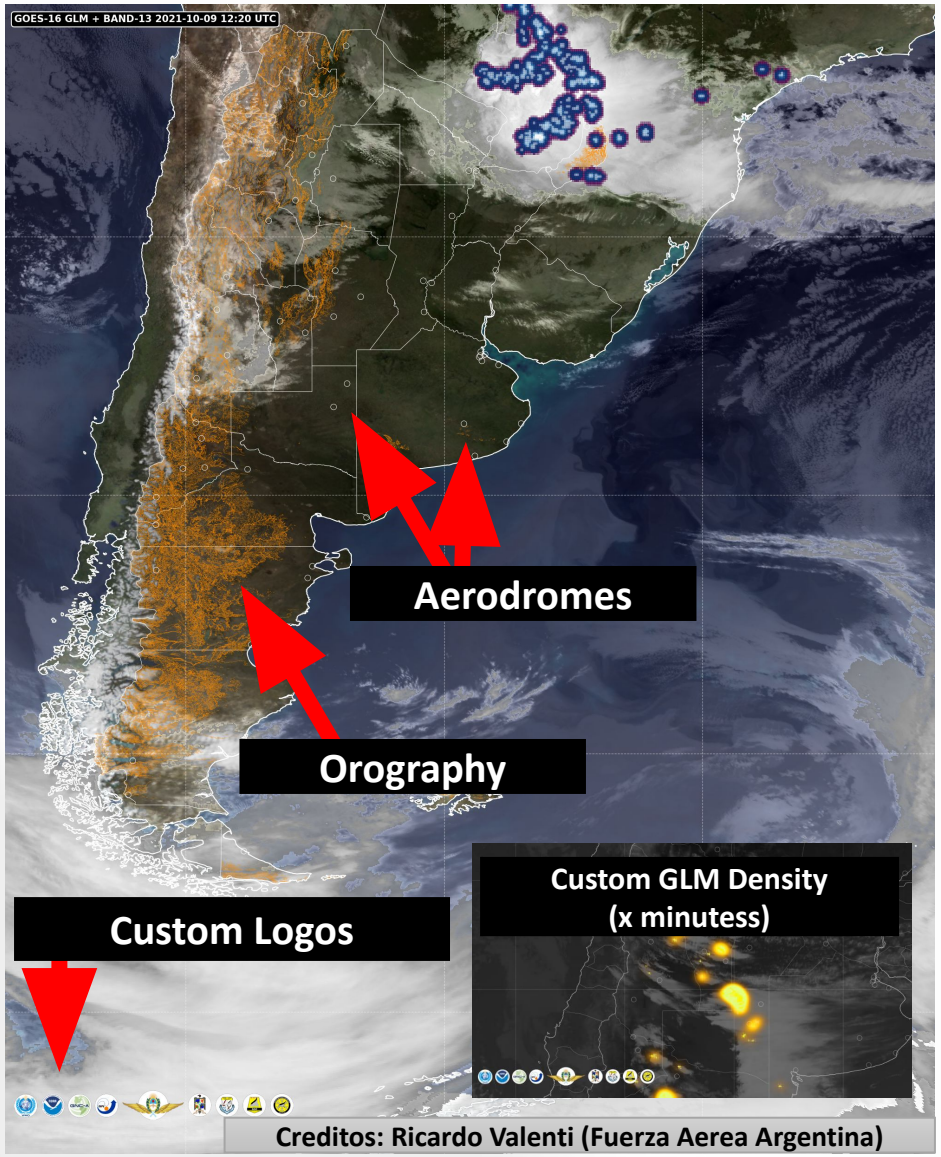
Especificaciones de la computadora:
Procesador Intel i5
16 GB RAM DDR4
240GB M2 SSD para OS

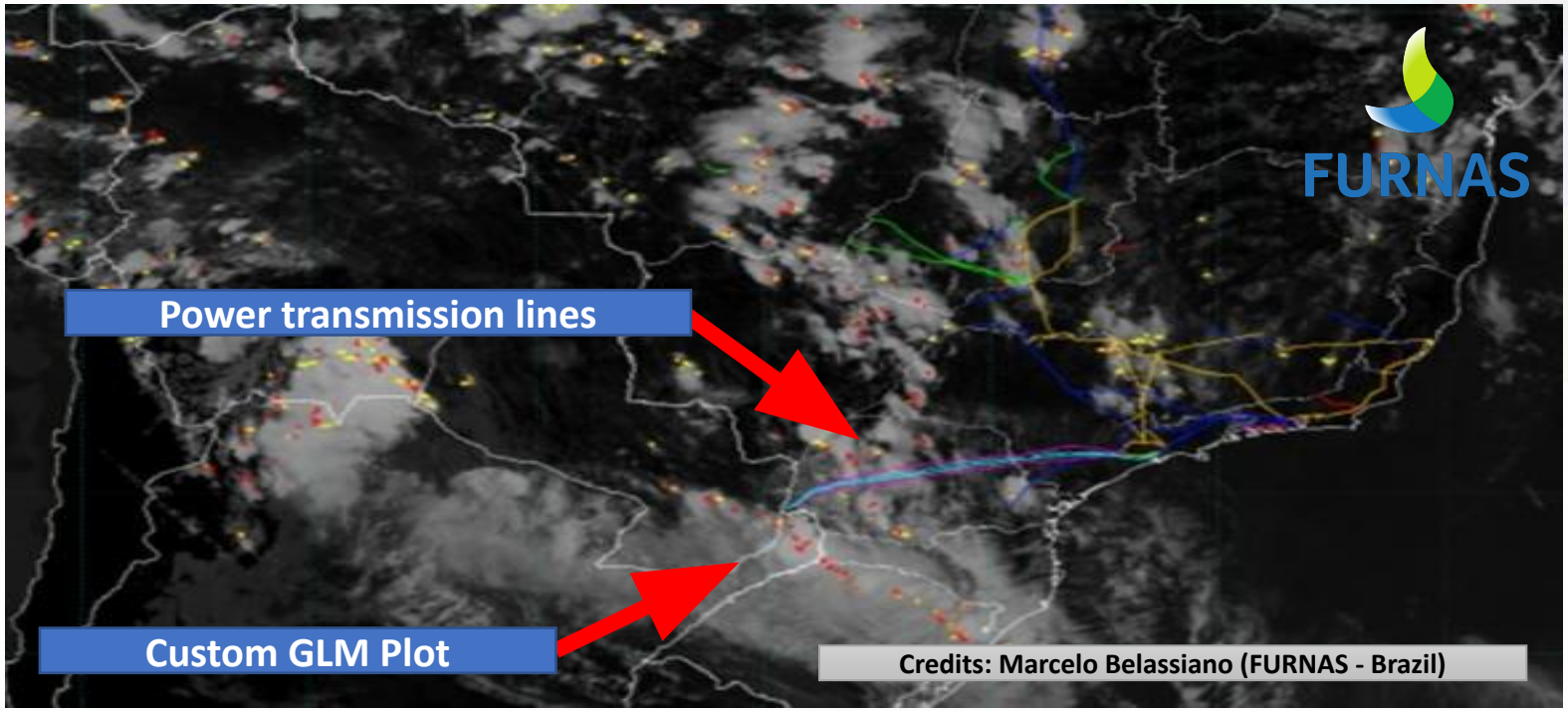
Credits: Ricardo Valenti (Argentinean Air Force)

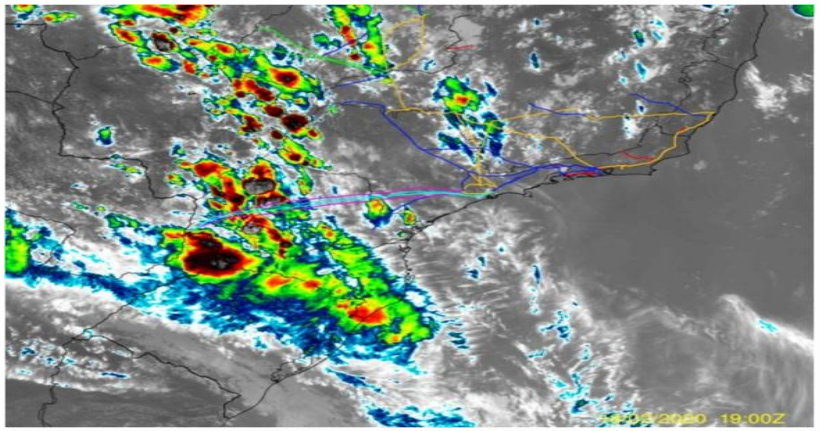
Importance of Custom Data Processing



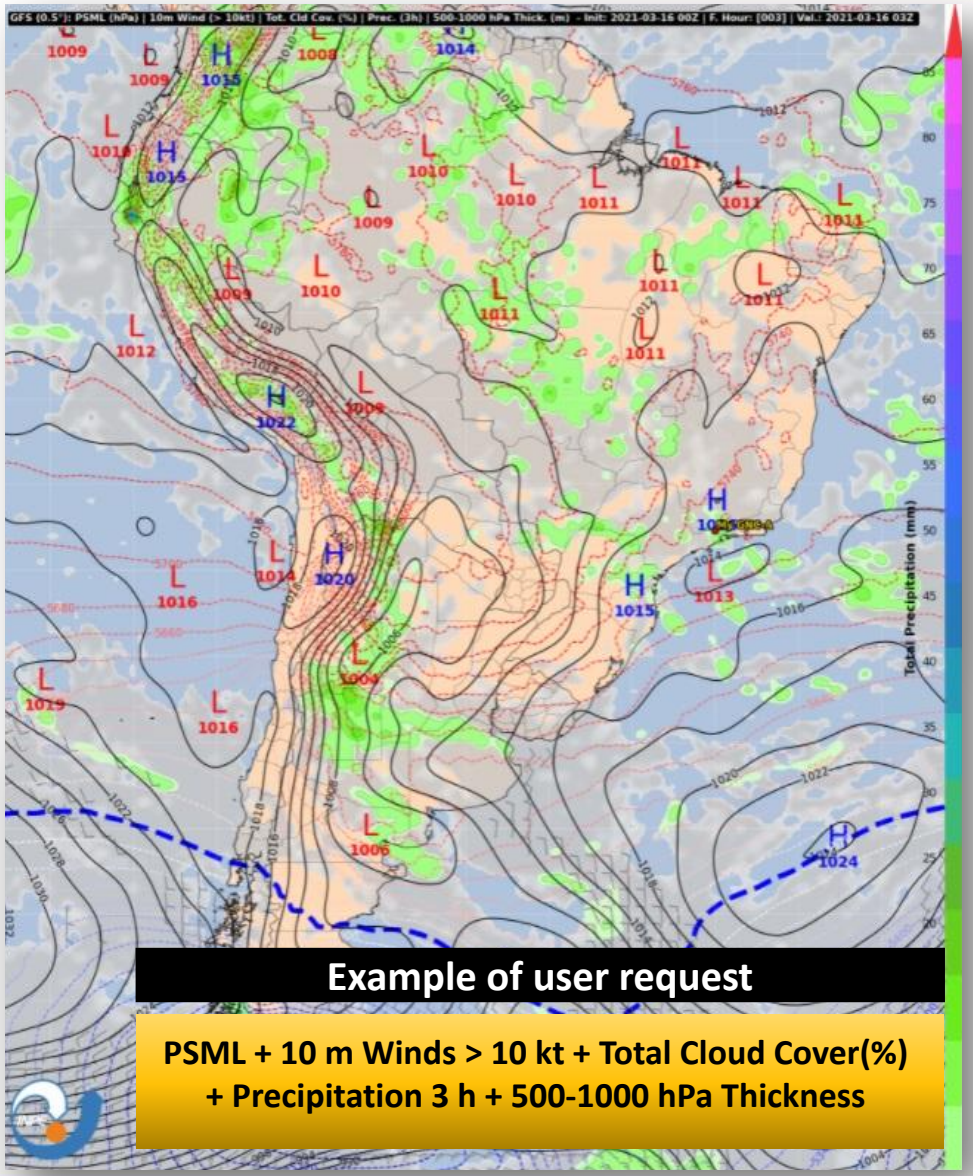
Importance of Custom Data Processing





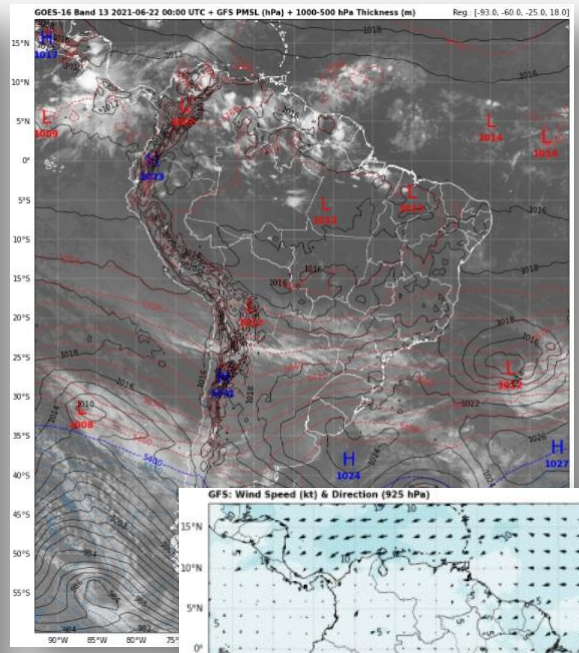


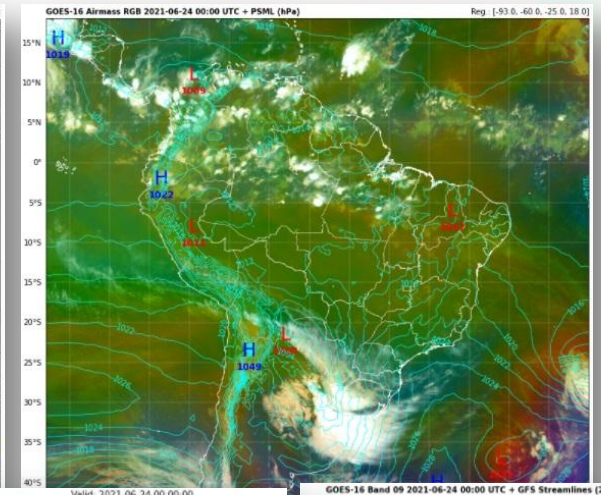
Importance of Custom Data Processing

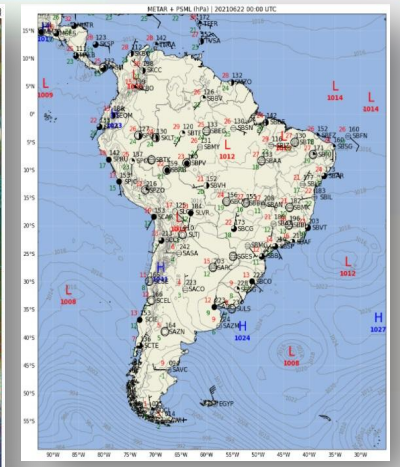


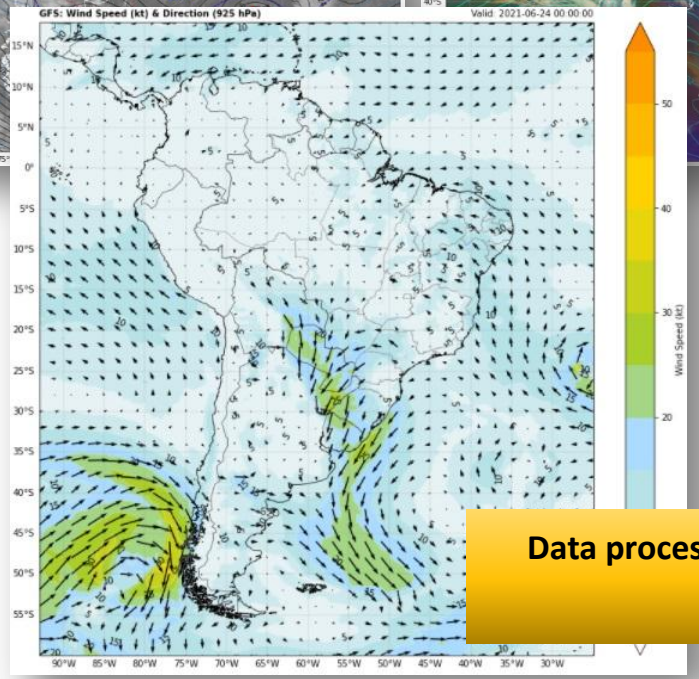
Example of user request

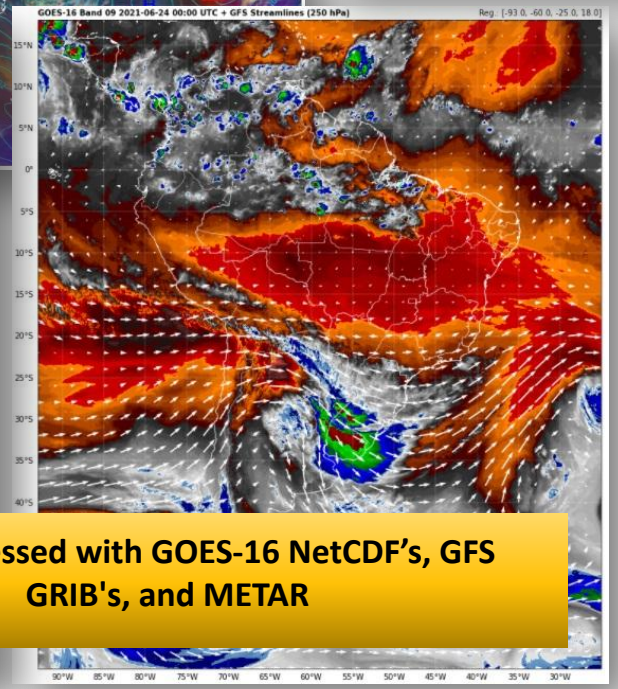
PSML + 10 m Winds > 10 kt + Total Cloud Cover(%) + Precipitation 3 h + 500-1000 hPa Thickness











Data processed with GOES-16 NetCDF's, GFS GRIB's, and METAR

Internet Data Distribution (IDD): Definition

The Unidata community of over 260 universities is building a system for disseminating near real-time earth observations via the Internet. Unlike other systems, which are based on data centers where the information can be accessed, **Unidata Internet Data Distribution (IDD)** is designed so a university can request that certain data sets be delivered to computers at their site as soon as they are available from the observing system. The IDD system also allows any site with access to specialized observations to inject the dataset into the IDD for delivery to other interested sites.

Unidata Local Data Manager (LDM) is a collection of cooperating programs that select, capture, manage, and distribute arbitrary data products. The system is designed for event-driven data distribution of the kind used in the Unidata Internet Data Distribution project.

The Unidata IDD has been in operation on a 24x7 basis since 1995, when it replaced a real-time data delivery system that used a sideband on satellite TV broadcasts. The satellite delivery system required that user sites pay a subscription fee and have a special receiver to decode the data stream. The switch to IDD did away with the subscription fee and the need for a special receiver, which made it possible for many more sites to receive a greatly expanded menu of data streams. The reach of the IDD has been expanded internationally and it is now being used to ship real time data in all directions to virtually every continent on the globe.

Internet Data Distribution (IDD): Problem

In spite of Unidata's success in the atmospheric science community, it is still difficult to adapt current systems to provide new kinds of data to all educational institutions that need them. While commercial providers and government agencies are making important contributions in terms of making new data sources available, the current approach requires that raw data be transported to the satellite uplink site to be included in the broadcast.

The IDD approach addresses the critical remaining need for a more flexible, affordable data delivery system for the education and research community. Given the need for automated real-time data dissemination on a national scale, existing network facilities (FTP, USENET News polling model, distributed file systems) are inadequate to solve the problem with the required degree of timeliness, automation, and reliability.

Internet Data Distribution (IDD): History

Universities across the nation are transforming their teaching and research efforts through increased use of a rapidly expanding menu of environmental data. With funding from the Atmospheric Sciences Division (ATM) of the National Science Foundation (NSF), the Unidata Program is playing, and will continue to play, a central role in this transformation by enabling universities to employ innovative computing and networking technologies to acquire such datasets in real-time and use them routinely in their classrooms and research labs.

The Unidata Program has embarked on another endeavor that promises to deepen and broaden this fundamental transformation. The new Internet Data Distribution (IDD) initiative addresses an issue facing the atmospheric sciences community in the immediate future: how to cope with the immense volume of data scheduled to become available as part of new initiatives in NOAA and other agencies2. As an example, the National Weather Service modernization will soon create a real-time NOAAPort data stream of 2 megabits per second. The concept further enables education-oriented institutions that thus far have lacked the requisite equipment and expertise to integrate the new technologies into their programs gradually. The Unidata Program Center (UPC) will continue to act as a catalyst and facilitator for outreach activities at its member universities.

Internet Data Distribution (IDD): Goals

The concept behind the Unidata IDD is to develop a system for disseminating real-time scientific data which will build on Internet facilities as the underlying mechanism for data distribution and for broadening the community of users who can utilize the information. The system will:

- enable scientists and educators to use their local workstations and personal computers to access scientific data from a wide variety of observing systems and computer models in near real-time;
- allow data to be injected into the system from multiple sources at different locations; and
- enable universities to capture these data, process them, and pass them on in easy-to-understand and easy-to-access forms (such as electronic weather maps in raster image files) to other institutions having more modest data needs as well as more modest equipment resources and technical expertise.

Internet Data Distribution (IDD): ldm for sharing data

The IDD is based on the ldm program.

The Unidata **L**ocal **D**ata **M**anager (LDM) system includes network client and server programs designed for event-driven data distribution, and is the fundamental component comprising the Unidata Internet Data Distribution (IDD) system.

This program is very small and very efficient in getting and transporting information.

The latency of satellite data with ldm is usually fractions of seconds or seconds in good connections and can be 2 minutes under non-ideal circumstances.

THERE IS NO CHARGE, SUBSCRIPTIONS OR FEES.

Internet Data Distribution (IDD): Feeds

The IDD is based on FEEDS.

A computer with ldm installed can send or receive data.

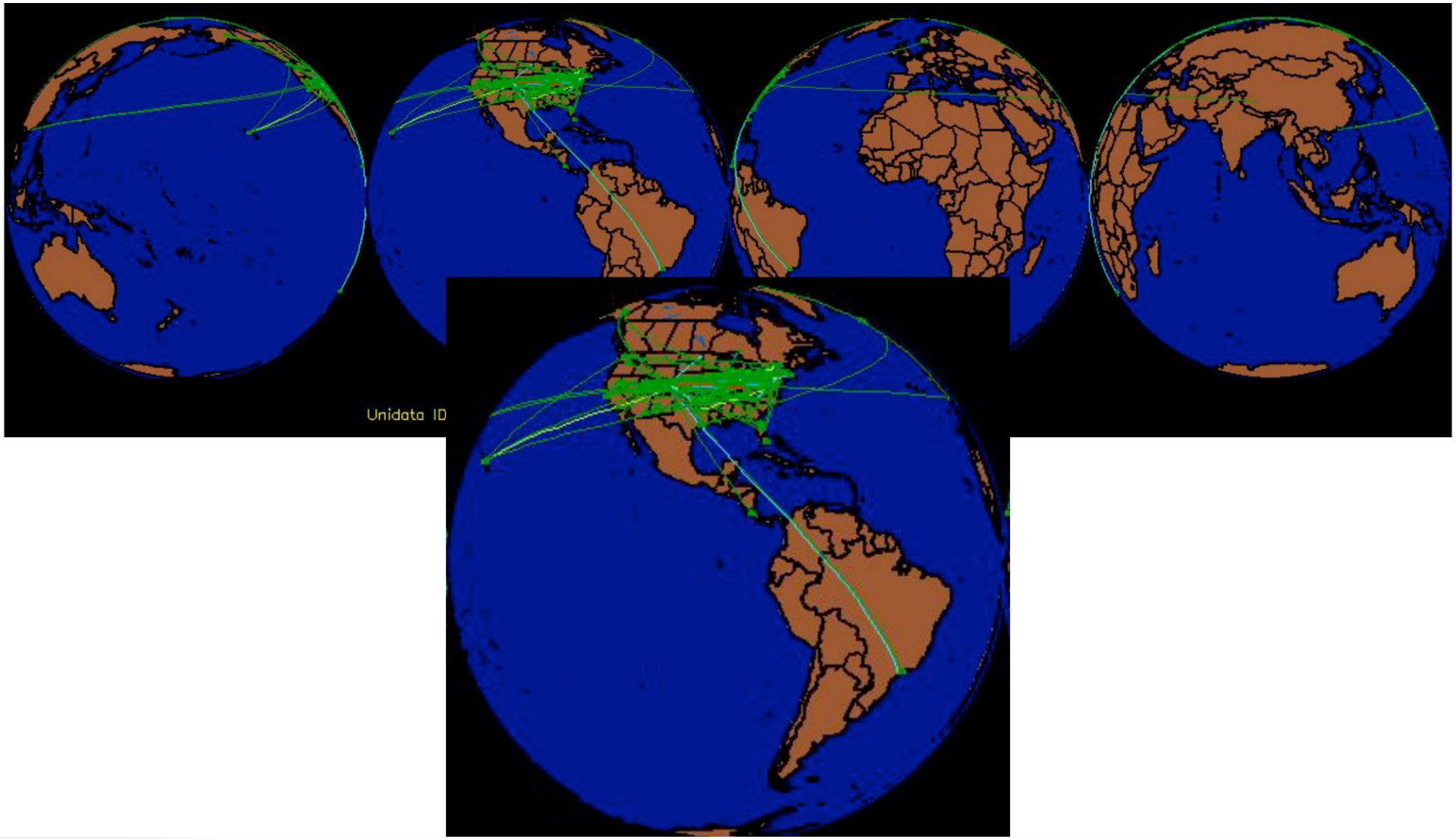
Whoever has data (any data) can create a **Feed** and allow others to access it. Whoever needs the data (once allowed in ldm) can request the data that goes into the Feed.

It is a team effort. Usually the main feed is sent to some users and they will share the same feed data with others.

There are several feeds created by Unidata:

https://www.unidata.ucar.edu/software/ldm/ldm-current/basics/feedtypes/

Internet Data Distribution (IDD): Structure



Internet Data Distribution (IDD): Feeds

UNIWISC	FT5, MCIDAS	Satellite imagery and derived products created by Unidata in McIDAS AREA format
PCWS	FT6, ACARS	ACARS data from commercial aircraft
FSL2	FT7, PROFILER	Wind profiler data
FSL3	FT8	Reserved for NOAA/GSL use
FSL4	FT9	Reserved for NOAA/GSL use
FSL5	FT10	Reserved for NOAA/GSL use
GPSSRC	FT11, NMC1, AFOS	SuomiNet GPS data gathering
CONDUIT	FT12, NMC2, NCEPH	NCEP high-resolution model output
FNEXRAD	FT13, NMC3	NEXRAD Level-III composites and MRMS data
LIGHTNING	FT14,NLDN	Lightning data
WSI	FT15	NEXRAD Level-III (NIDS) radar products (Private network: not in the IDD)
SATELLITE	FT16	GOES East & West Satellite imagery in GRB format
FAA604	FT17, FAA, 604	FAA604 products for NWS use (private network), but available for IDD use
GPS	FT18	SuomiNet GPS data
FNMOC	FT19, SEISMIC, NOGAPS	NOGAPS and COAMP model output from Fleet Numerical
GEM	FT20, CMC	Canadian Meteorological Center GEM model output
NIMAGE	FT21, IMAGE	NOAAport satellite imagery and level 2 products
NTEXT	FT22, TEXT	NOAAport textual products (for future use)
NGRID	FT23, GRID	NOAAport high-resolution model output
NPOINT	FT24, POINT, NBUFR, BUFR	NOAAport point products (for future use)
NGRAPH	FT25, GRAPH	NOAAport Redbook Graphics (for future use)

Internet Data Distribution (IDD): Pilot program for RA-IV

IDD-CCASA

Cimientos para la Distribución de Datos por Internet - Caribe, CentroAmérica y SurAmérica.

Foundations for the Internet Data Distribution - Caribbean, Central America and South America.

Internet Data Distribution (IDD): Pilot program for RA-IV

El Receptor de Datos del GOES-R por Internet (GIDaRe) brinda resolución completa y productos en tiempo real para ABI, GLM, SUVI, SEISS, EXIS, MAG. Existen dos versiones: GIDaRE-ATMOS y GIDaRe-ESPACIO.

The GOES-R Internet Data Receiver (GIDaRe) provides full resolution, real time products for ABI, GLM, SUVI, SEISS, EXIS, MAG. There are 2 versions: GIDaRE-ATMOS and GIDaRe-SPACE.

THANK YOU!

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seth.clevenstine@noaa.gov
NOAA

Diego Souza
diego.souza@inpe.br
INPE

Marcial Garbanzo
marcial.garbanzo@ucr.ac.cr
University of Costa Rica