National Aeronautics and Space Administration

Assessing the Needs of NASA's Near Real-time Earth Observation Products

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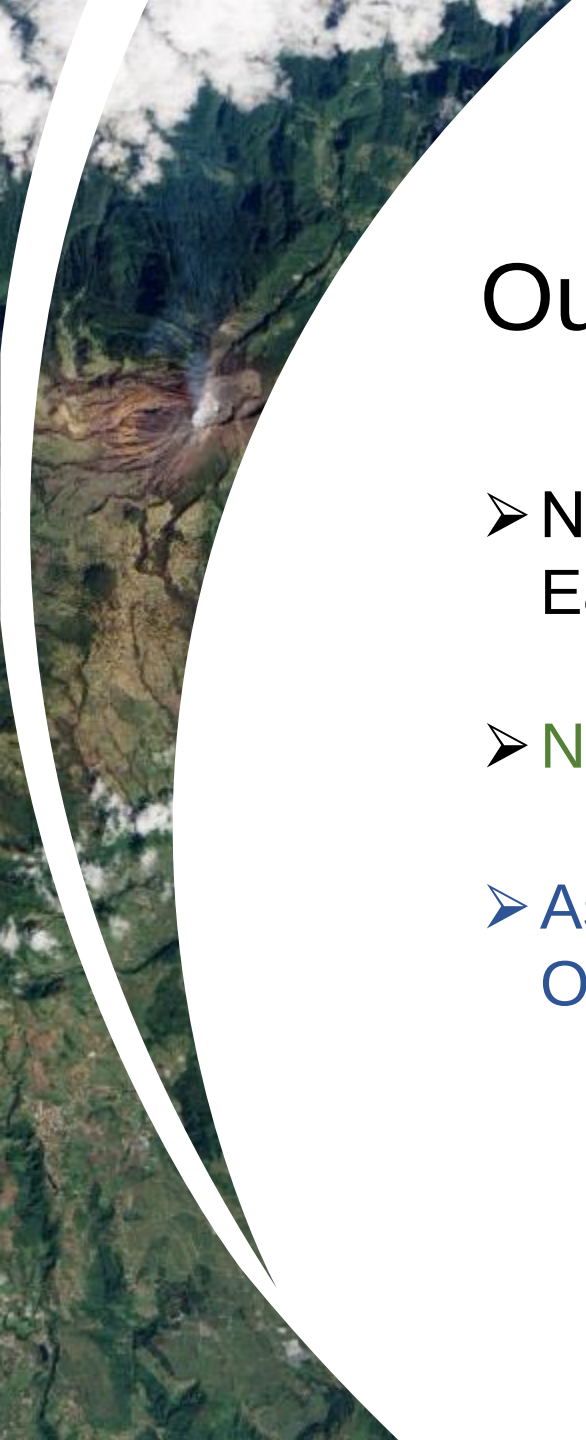


Outline

- NASA’s Land, Atmosphere Near Real-time Capability for Earth Observing Systems (LANCE)
- NASA Earth Science Applied Sciences Program
- Assessing the Needs of NASA's Near Real-time Earth Observation Products

NASA’s Land, Atmosphere Near Real-time Capability for Earth Observing Systems (LANCE)

Land, Atmosphere Near Real-time Capability for EOS

- Goal: provide global near real-time (NRT) data products within 3 hours of observation to meet the timely needs of applications users
- Data and imagery from 12 instruments much quicker than routine processing allows

  - AIRS - Atmospheric Infrared Sounder
  - AMSR2 - Advanced Microwave Scanning Radiometer 2
  - LIS ISS - Lightning Imaging Sensor on the International Space Station
  - ICESat-2 - Advanced Topographic Altimeter System (ATLAS) on the Ice, Cloud, and land Elevation Satellite
  - MISR - Multi-angle Imaging SpectroRadiometer
  - MLS - Microwave Limb Sounder
  - MODIS - Moderate Resolution Imaging Spectroradiometer
  - MOPITT - Measurements of Pollution in the Troposphere
  - OMI - Ozone Monitoring Instrument
  - OMPS - Ozone Mapping and Profiler Suite
  - SMAP - Soil Moisture Active Passive
  - VIIRS-Atmosphere - Visible Infrared Imaging Radiometer Suite
  - VIIRS-Land - Visible Infrared Imaging Radiometer Suite

- Virtual system: leverages existing Science Processing and Archive Components
- Supports multiple NRT applications

EARTHDATA
OPEN ACCESS FOR OPEN SCIENCE

Data Topics Learn Engage About

HOW TO ACCESS NRT LANCE DATA & IMAGERY

Self-Register at the Earthdata website url:
https://urs.earthdata.nasa.gov

LANCE Data products can be freely accessed via:

LANCE Website:
https://www.earthdata.nasa.gov/learn/find-data/near-real-time.

Earthdata Search Client:
https://search.earthdata.nasa.gov/search

- Note: Filter by Latency 1-3 hours for LANCE data

Subscription through LANCE elements

Hazards and Disasters pages:

https://www.earthdata.nasa.gov/learn/find-data/near-real-time/hazards-and-disasters

LANCE Imagery can be freely accessed via:

Worldview
https://earthdata.nasa.gov/worldview

Global Imagery Browse Services
https://earthdata.nasa.gov/gibs

Worldview Snapshots
https://www.earthdata.nasa.gov/worldview/worldview-snapshots

The New Earth Information Center
Highlights some LANCE imagery
https://gis.earthdata.nasa.gov/portal/apps/sites/#/earth-information-center

NASA Disasters Portal:
https://disasters-nasa.hub.arcgis.com/

LANCE Hotspot/Active Fire Data can be freely accessed via:

Fire Information for Resource Management (FIRMS)
https://www.earthdata.nasa.gov/learn/find-data/near-real-time/firms

US/Canada FIRMS
https://firms.modaps.eosdis.nasa.gov/usfs/map

CAPACITY BUILDING

Backgrounders:

Informational articles on key topics in Earth science to aid in understanding data and data use. LANCE topics include: What is Data Latency? Nighttime Lights

Data Pathfinders:

Guides the process of selecting application-specific datasets and learning how to use them.

Data Toolkits:

Entry points to access NASA Earth science data resources, organized by topic, with links to datasets, tutorials, feature articles and Data User Profiles.

Webinars and Tutorials:

step-by-step instructions for working with NASA Earth science resources. LANCE / NRT topics include webinars on Worldview and FIRMS

How to use NASA FIRMS

https://www.earthdata.nasa.gov/learn/webinars-and-tutorials/how-use-nasas-fire-information-resource-management-system-firms

Getting started with NASA Worldview

https://www.earthdata.nasa.gov/learn/webinars-and-tutorials/new-getting-started-with-nasa-worldview-tutorial

FIRMS Resources:

Information on new features and how to use them can be found in the FIRMS Blog, Tutorials, FAQs and Story Map

FIRMS Blog:

https://wiki.earthdata.nasa.gov/pages/viewrecentblogposts.action?key=FIRMS

FIRMS Resources

https://firms.modaps.eosdis.nasa.gov/resources/

Worldview Tutorials / Story Maps:

Interactive stories to learn more about Worldview, the satellite imagery we provide and events occurring around the world

Story Maps:

Worldview story maps often use LANCE NRT imagery to visually explore our dynamic planet from a satellite's perspective. These stories include: assessing floodwater, night lights, satellite active fire detections, dust storms, hurricanes and volcanoes

https://worldview.earthdata.nasa.gov

NASA Earth Science Applied Sciences Program

NASA Earth Science Applied Sciences Program Areas

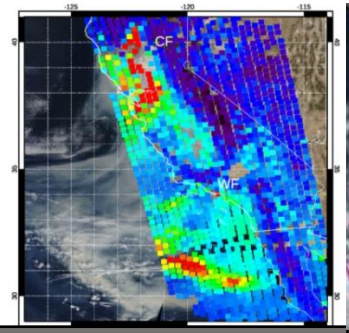
								
CAPACITY BUILDING	**DISASTERS**	**HEALTH & AIR QUALITY**	**WATER RESOURCES**	**AGRICULTURE**	**ECOLOGICAL FORECASTING**	**CLIMATE & RESILENCE**	**WILDLAND FIRE**	**EARTH MISSION ENGAGEMENT**
Our skill-building initiatives empower people around the world to solve local challenges using Earth observations and remote sensing technologies.	Resilience. Response. Recovery. When disaster strikes, our team provides decision-makers, communities and governments with life-saving Earth observations.	We use Earth-observing data to inform air quality standards and support solutions for public health initiatives — all to strengthen our communities' well-being.	Water is one of our most invaluable resources. We help monitor the demand, supply and quality of water around the world and the development of tools to promote conservation.	From individual farmers to global food chains, we help optimize decision-making about food availability and access through Earth-observing data.	To protect our natural land, marine and freshwater resources, we promote the use of Earth observations in conservation, sustainability and resource management.	The Climate & Resilience program area uses Earth observations to help communities adapt to our changing climate and inform public and private sector decision-making.	We leverage Earth-observing data, applied research, and partnerships to reduce risk before, during, and after a fire.	Mission data enables organizations worldwide to take action and advance research. Applications are a user-friendly and often innovative way people can use mission data to benefit society.

NASA Earth Science Applied Sciences Website: https://appliedsciences.nasa.gov/

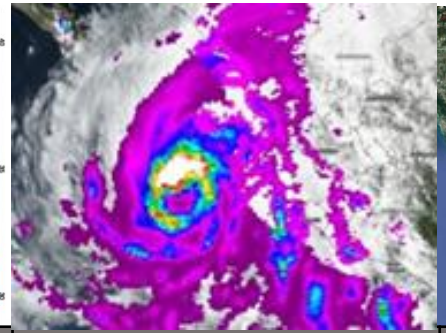
Assessing the Needs of NASA's Near Real-time Earth Observation Products

NASA's Near Real-time (NRT) Earth Observation Products for Time-sensitive Applications

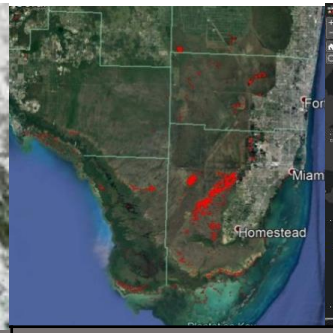
- With satellite data products that are made available much quicker than routine processing, NASA's LANCE data system provides a continuous and complete view of the entire Earth every day in NRT.
- Users could observe areas of interest, discover patterns, identify infrastructure destructions, detect and track changes in the environment and make timely decisions.
- Time-sensitive applications include detecting wildland fires and volcanic eruptions, tracking smoke, ash and dust plumes, monitoring air quality for criteria pollutants (aerosols, CO and SO_2) and tracking extreme weather events.



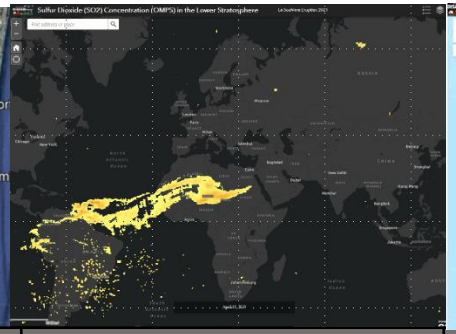
MOPITT CO Total Column Product



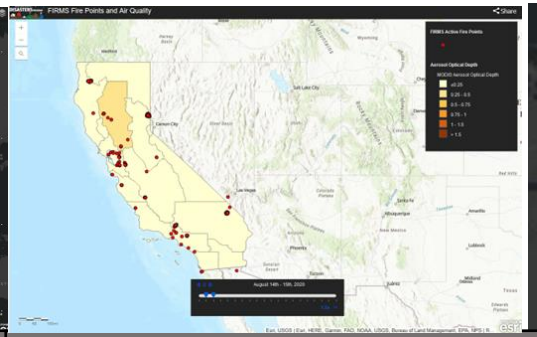
AMSR2 Surface Precipitation Rates product



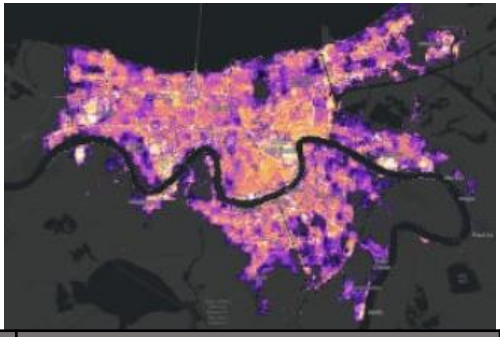
MODIS Flood Product



OMPS SO_2 Product



MODIS and VIIRS Active Fire Product



VIIRS Black Marble Night-time Light Product Suite

User Feedback Collection and Prioritization: ASP Internal Surveys for NRT and Low Latency Products

Survey Objectives

- To better understand how widely NRT and low latency data products are used within NASA Earth Applied Sciences Program.
- To identify user needs gaps for new NRT and low latency products.

Key Results

Survey results were provided as feedback to the LANCE User Working Group (UWG).

Recommendations

If there is a well supported need to add new NRT or low latency products to LANCE, it would be considered by the UWG for future implementation.

Selected Survey Results: Current Usage of NRT and Low Latency Products in Your Work

Active Fire products in LANCE FIRMS	Precipitation products	MODIS/ VIIRS products	Air quality products	GOES products	Altimetry products
47%	42%	42%	21%	11%	5%
					

User Preferences in Data Formats: Insights from the Surveys

GeoTIFF

GeoTIFF is usually a favorite. It is often useful for applied users, that can be directly ingested into a GIS mapping software.

HDF-EOS and HDF

HDF5 is common, but it always goes through some conversion to a more friendly format along the way.

NetCDF

NetCDF is a widely used data format in research, but it may require conversion to a more accessible format for practical applications and decision-making purposes.

CSV

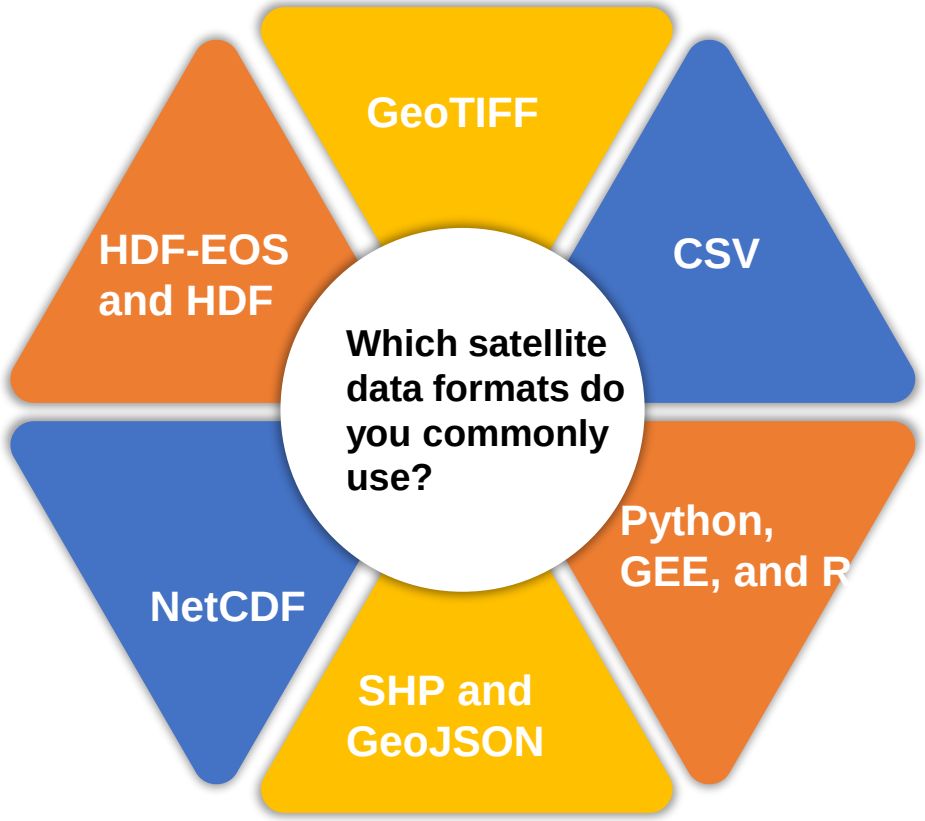
CSV is great when we're looking to communicate point-based information.

SHP and GeoJSON

Vector and feature data format.

Python, GEE, and R

We work with their versions of arrays, raster stacks, etc.



Selected User Feedback and Identified Gaps on Current NRT Earth Observation Products

- **GIS Data Format**: Highly valuable for applied users and general public.
- **Data Consistency and Continuity**: Critical for effective use.
- **Accessing Data Products**: Google Earth Engine (GEE) and/or Amazon Web Services (AWS).
- **Reducing Cloud Cover Issues**: 1) Low-latency SAR data products in Tropical regions. 2) Morning observations of optical data products.
- **Efficient Data Selection and Download**: Tools for specific geographic areas. This capability facilitates satellite data access for users who experience bandwidth limitations.

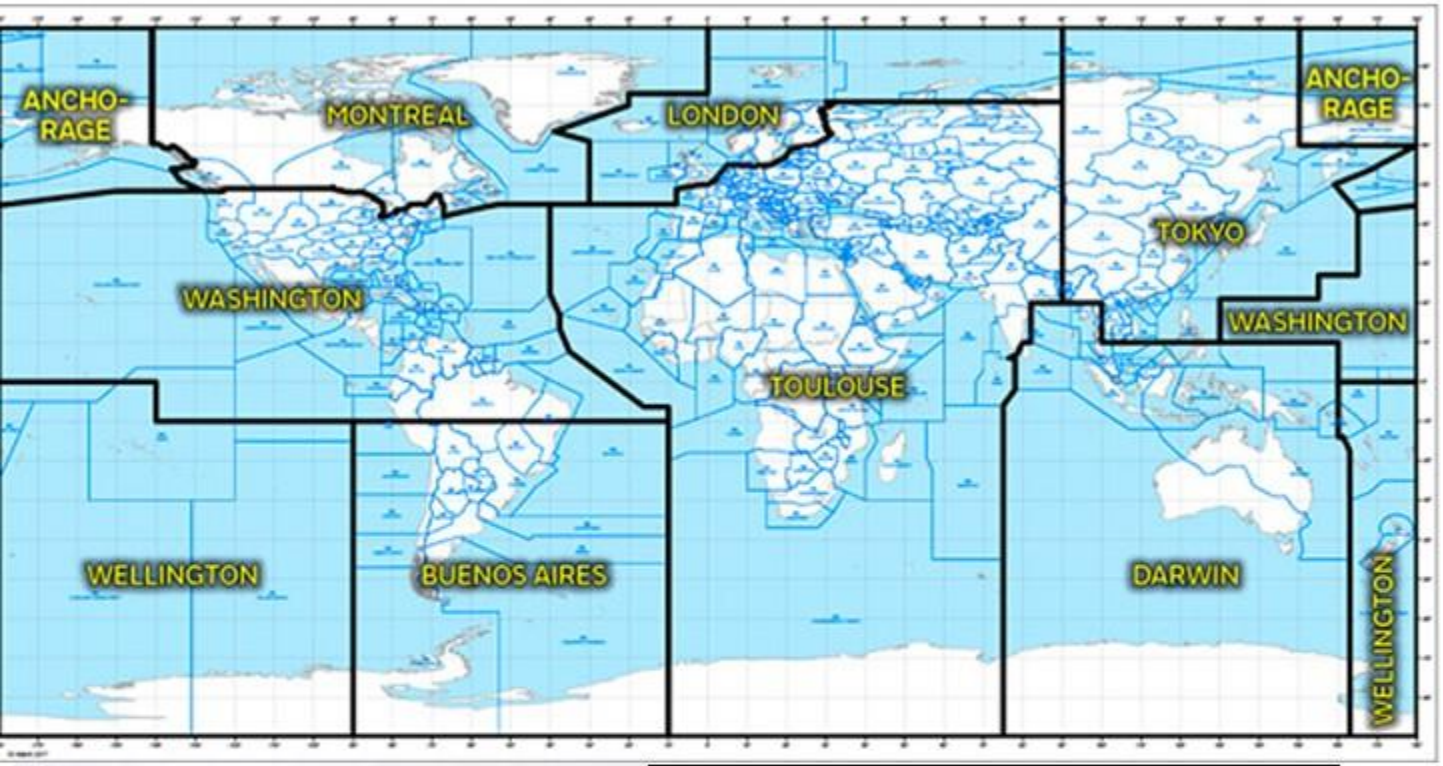
The NASA-VAAC initiative

Objectives :

- Improve dialogues between NASA satellite teams and the VAACs
- Enhance use of satellite data to monitor volcanic ash
- Receive feedbacks from the VAACs to design the next generations of satellite observations

Bi-annual workshop between NASA and the VAACs
3 workshops took place since 2022
Well attended by the VAACs
Example of the recent Shiveluch eruption

Volcanic Ash : A threat for aviation

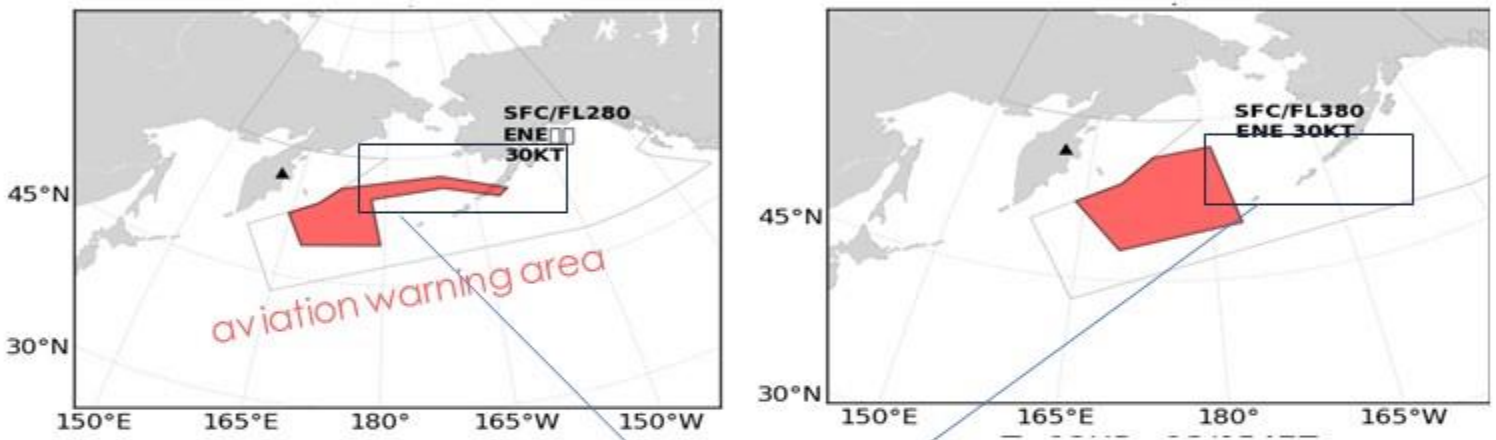


- ✓ Volcanic ash can damage aircraft engines and represent a threat for aviation
- ✓ Icelandic eruption in 2011 costed 1.7 b$ for US aviation industry
- ✓ 9 Volcanic Ash Advisory Centers worldwide monitor the presence of volcanic ash to warn aviation

NASA engagement with the VAACs to enhance use of satellite data to monitor volcanic ash

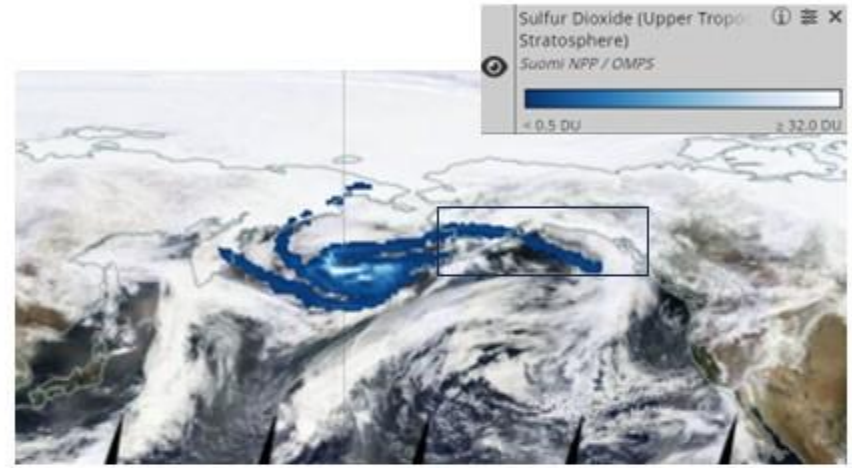
NASA Day-Night monitoring of volcanic SO2 and Ash for aviation (PI: Nick Krotkov, NASA GSFC)

Eruption of Shiveluch volcano on April 11, 2023



1200Z 12 April 2023

1747Z 12 April 2023



OMPS 12 April 2023 NASA worldview

Area removed by the VAACs using SO2 information from VIIRS

"Using the GOES ash RGB with both VIIRS SO_2 and ash index products proved useful in the analysis and provided confidence in the RGB analysis of an SO_2 filament extending eastward over the Bering. This area was removed from the warning area before 18Z."

- Nate Eckstein, Anchorage VAAC

- VAAC use NASA data to refine their ash advisories during the Shiveluch eruption
- Presence of SO_2 and absence of ash led to the Anchorage VAAC to remove areas from ash warnings.

New Capabilities of Current and Future Missions

Current and future missions will increase our capabilities to bridge the gaps between scientific capability and users' needs.

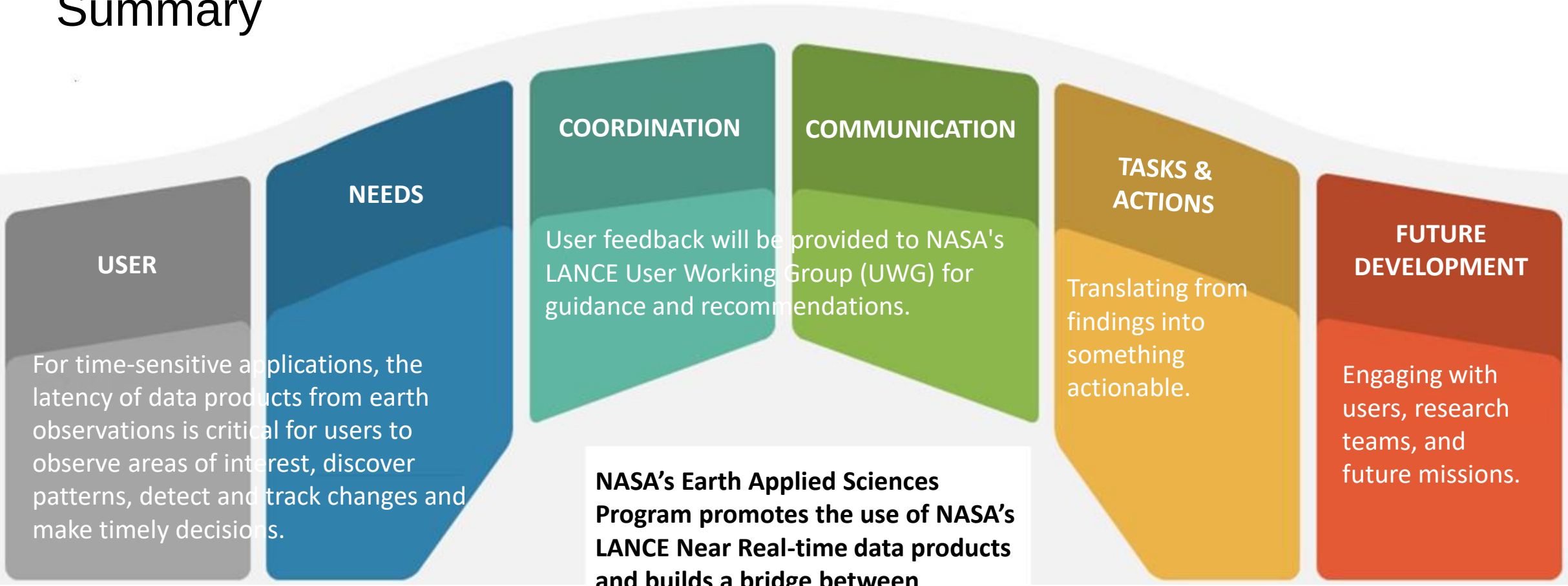
Tropospheric Emissions: Monitoring of Pollution (TEMPO)|| Launched in April 2023

Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats (TROPICS)|| Launched in May 2023

NASA-ISRO SAR Mission (NISAR) || Launch in January 2024

Plankton, Aerosol, Cloud, ocean Ecosystem (PACE)|| Launch in 2024

Summary



NASA's Earth Applied Sciences Program promotes the use of NASA's LANCE Near Real-time data products and builds a bridge between application users and research teams.

Current Situation

IDENTIFY & DEFINE THE GAP

IDEAL Near Real-time Data Products, Tools and Platforms

Thank you!

Many thanks to co-authors!

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