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Updates on NRL Near Real-Time Satellite Products

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TROPICS Applications Telecon, Feb 23, 2022

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Outline

1. Updates on the Navy's Geolocated Information Processing System (GeoIPS®)
2. Examples of TC Products
3. Plans for TROPICS Products
4. New NRL TC Webpage (demo)
5. Summary

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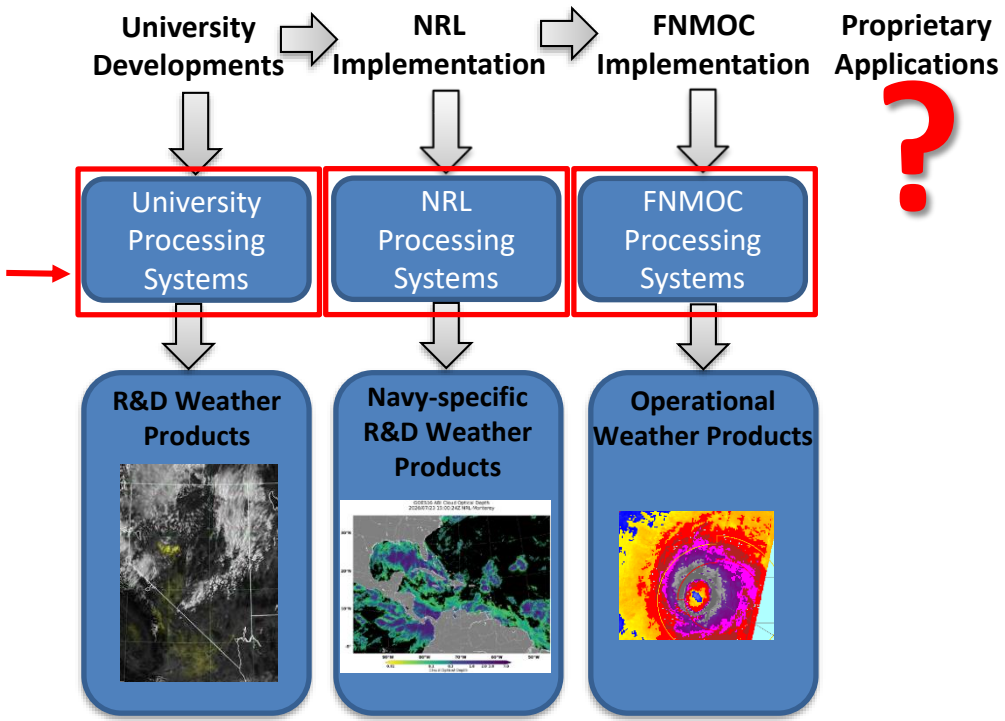
Problems

- **Current Navy weather processing systems rely on costly proprietary packages**
  - Large development times
- **No standardized processing system across weather community**
  - Inhibits efficient transfer of new ideas and capabilities between institutions
  - Inhibits efficient transitions of new functionality to operations
- **No method for seamless integration with proprietary applications**



No processing system capable of facilitating efficient transitions or handling proprietary applications

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Solution: GeoIPS®

(collaborative development efforts led by Mindy Surratt)

Common platform from Research and Development through Operations
- *Facilitate rapid transitions of new products*

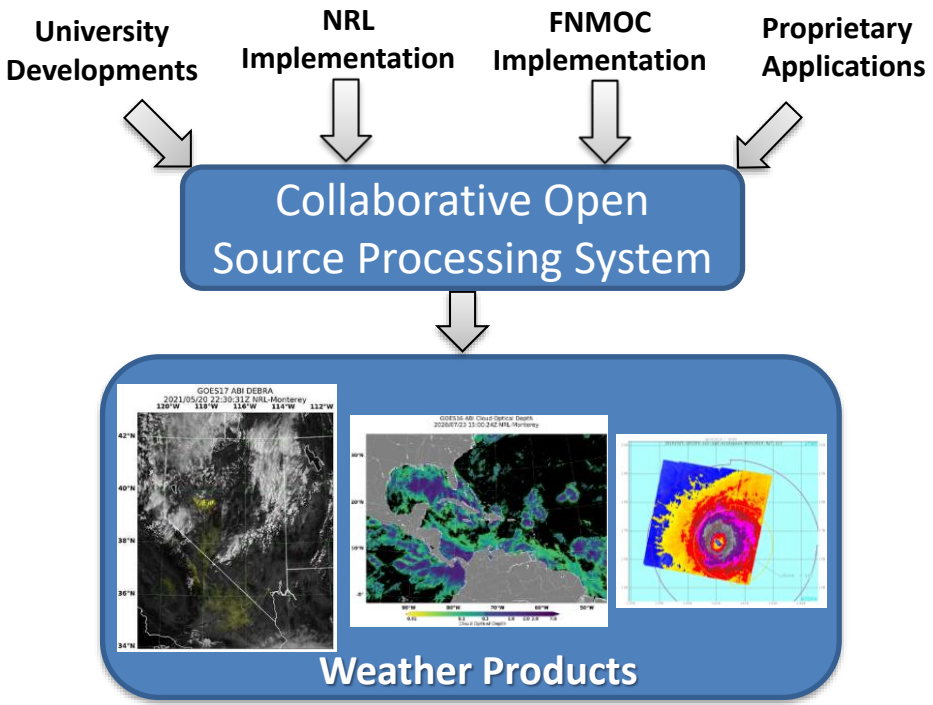
Easy to Use
- *Able to run without in-depth knowledge of the code*

Non-Proprietary
- *Main code base open-source*

Data Fusion
- *Able to combine multiple datasets into a single product*

Generalized
- *The majority of the code is the same for all datasets*

Extendable
- *Addition of new data types, products, and output formats is straightforward*
  - *Incorporate proprietary data sets and algorithms*



Generalized processing system for combining geo-located datasets into unique products

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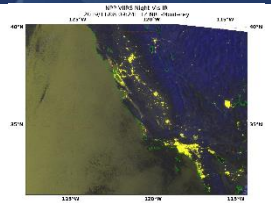
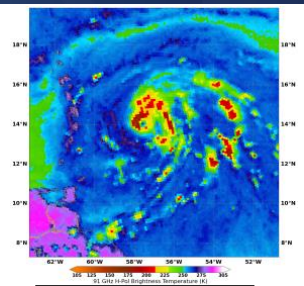
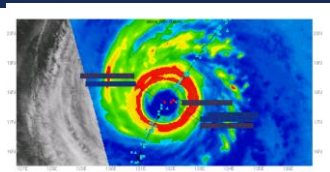
GeoIPS® Capabilities



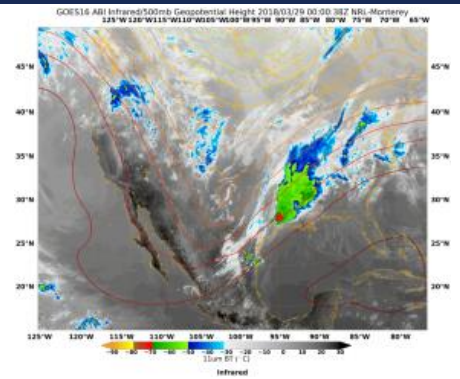
Environmental Characterization Imagery



TC Imagery



Quantitative Imagery



Data Fusion Products

Digital Satellite Products

GeoIPS®

Geospatial Data
Satellite, Numerical Model, etc.

Further Development

Transition and Open Source

Research Partners (e.g. university)

Operational Partners

Feedback

Leverage research and operational partners

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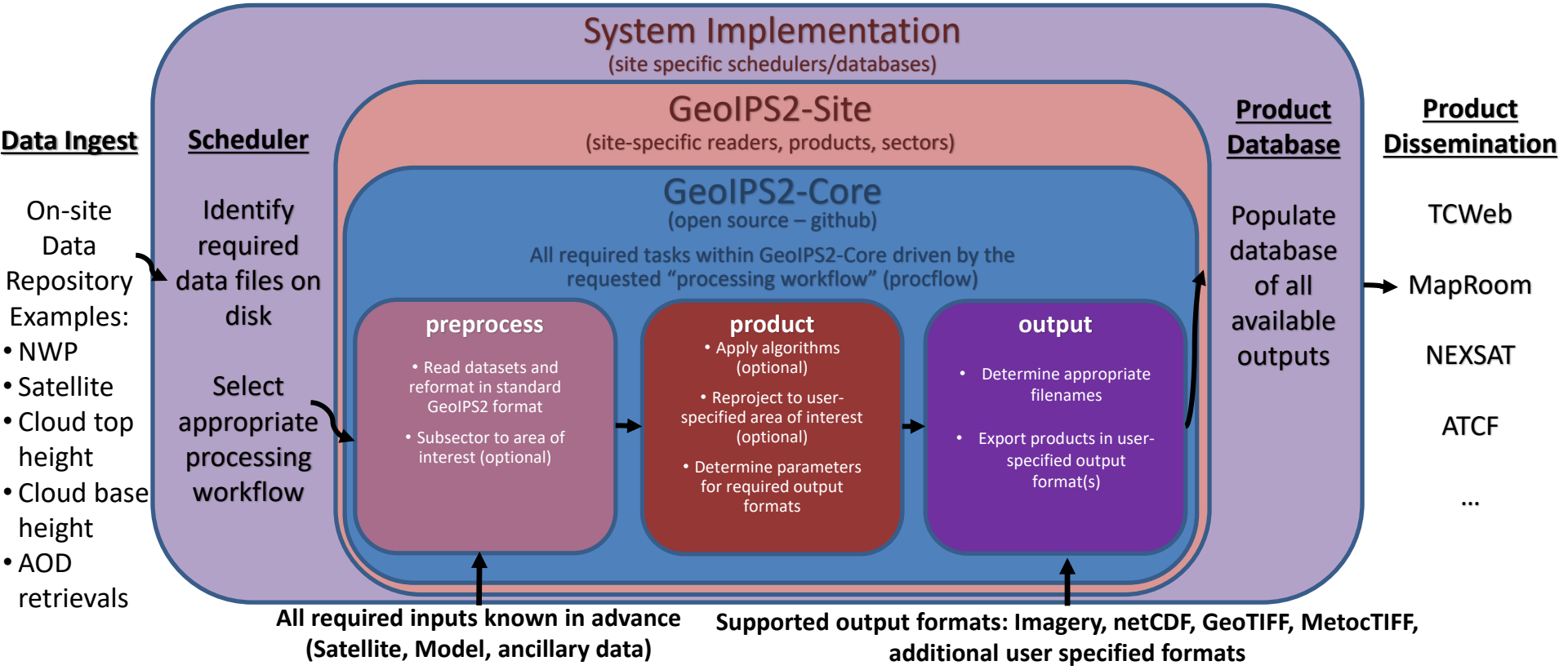
GeoIPS® Structure Overview



Current Collaborations

GeoIPS® development efforts funded by the Office of Naval Research

NRL Maintains collaborative open source code base and Navy-specific functionality

Operational Transition Partners

- National Hurricane Center (NHC)
- Fleet Numerical Meteorology and Oceanography Center (FNMOC)

Current and future Navy users of GeoIPS® products:

- Joint Typhoon Warning Center (JTWC)
- Fleet Weather Centers (San Diego and Norfolk)
- Strike Group Oceanography Team (SGOT)
- 7th Fleet, Navy Oceanography ASW Detachment (NOAD)-Kadena
- Naval Oceanography Antisubmarine Warfare Center (NOAC) in Yokosuka, Japan

Research Partners

- University of Wisconsin Cooperative Institute for Meteorological Satellite Studies (CIMSS)
- Colorado State University Cooperative Institute for Research in the Atmosphere (CIRA)

Leverage research and operational partners

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Next Steps

Lessons Learned:

- Modularity / streamlined integration of external plugins is important! (ie, proprietary applications)
- Backwards compatible development is important!
- Thorough testing and continuous integration / continuous development capabilities are important! (Make sure you don't break what's already there)

Future work:

- Develop streamlined open source release cycle – rapid integration of capabilities outside of DoD
- Share open source GeoIPS infrastructure with international collaborators
- Direct GeoIPS® integration of machine learning infrastructures

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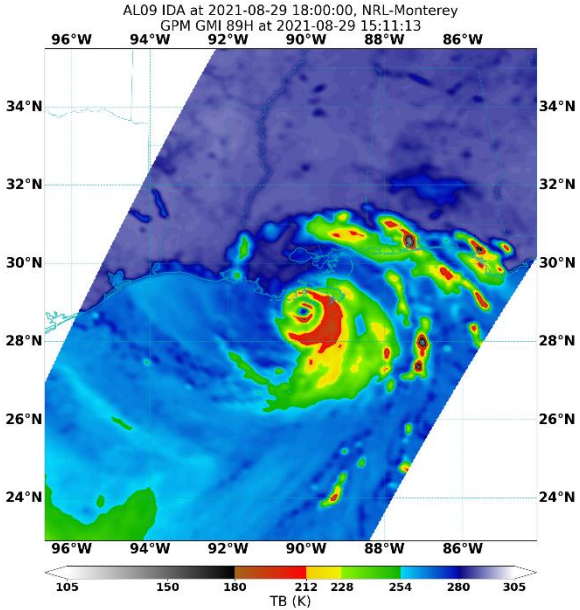
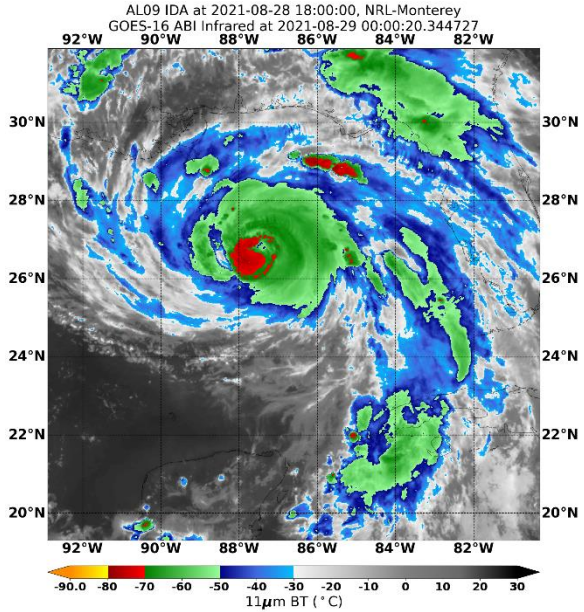
Examples of NRL TC Products

AL09 Ida

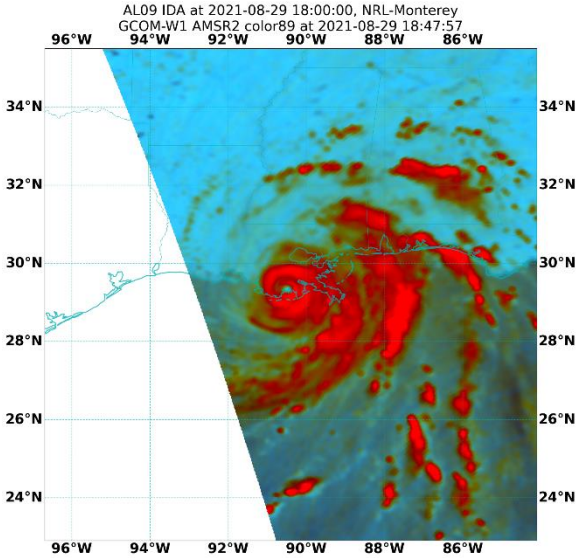
GMI 89H



GOES-16 ABI IR



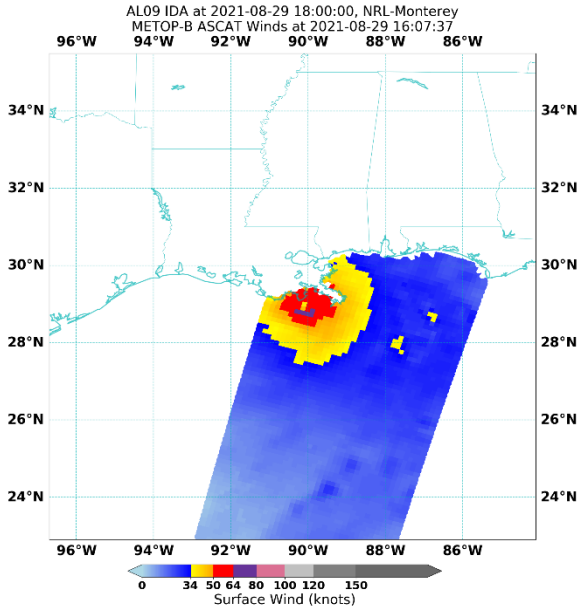
AMSR2 Color89



Examples of NRL TC Products

AL09 Ida

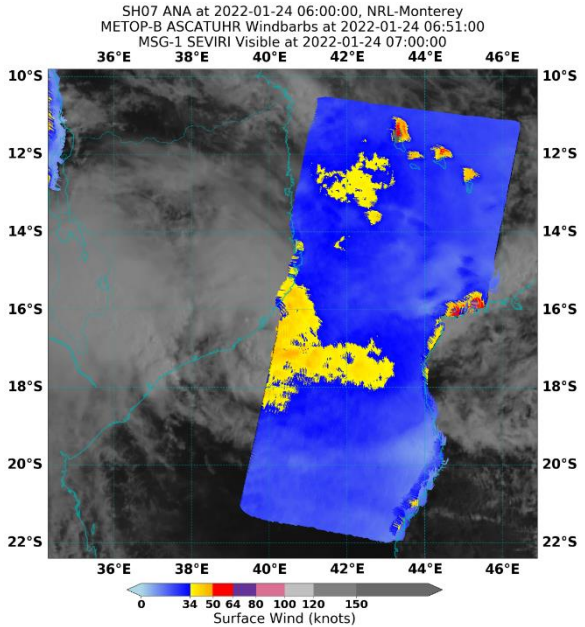
Metop-B ASCAT WindSpeed



12.5km

SH07 ANA

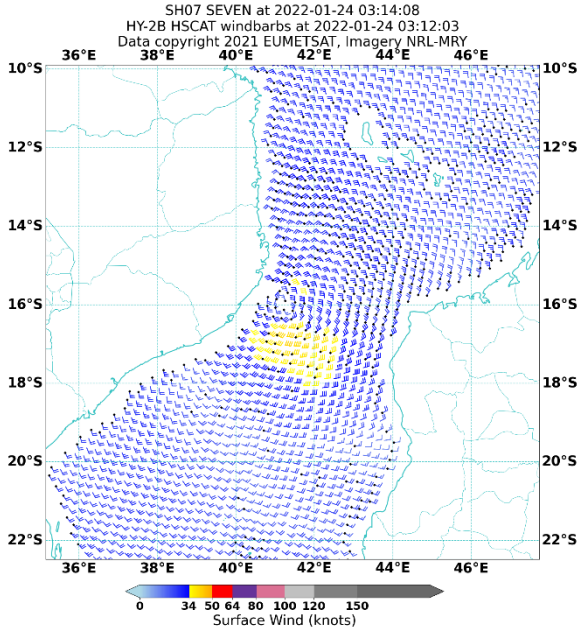
Metop-B ASCAT UHR Windbarbs



Ultrahigh Resolution (UHR), 4km

SH07 Seven

HY-2B HSCAT Windbarbs



Ku-band scatterometer (HSCAT), 50km

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Plans for TROPICS TC Products

1. Image products (91GHz)
2. Mtif products for ATCF
3. Precipitation products
4. Temperature and moisture profiling products
5. Vmax products
6. Better uncertainty estimation and data selection algorithms to maximize TROPICS information for numerical weather prediction

TROPICS Chan.	Center Freq. (GHz)	Bandwidth (GHz)	RF Span (GHz)	Beamwidth (degrees) Down/Cross	Nadir Footprint Geometric Mean (km)*	Measured NEdT (K)
1	91.656 ± 1.4	1.000	89.756-90.756, 92.556-93.556	3.0/3.17	29.6	0.66
2	114.50	1.000	114.00-115.00	2.4/2.62	24.1	0.96
3	115.95	0.800	115.55-116.35	2.4/2.62	24.1	0.82
4	116.65	0.600	116.35-116.95	2.4/2.62	24.1	0.86
5	117.25	0.600	116.95-117.55	2.4/2.62	24.1	0.79
6	117.80	0.500	117.55-118.05	2.4/2.62	24.1	0.81
7	118.24	0.380	118.05-118.43	2.4/2.62	24.1	0.90
8	118.58	0.300	118.43-118.73	2.4/2.62	24.1	1.03
9	184.41	2.000	183.41-185.41	1.5/1.87	16.9	0.58
10	186.51	2.000	185.51-187.51	1.5/1.87	16.9	0.55
11	190.31	2.000	189.31-191.31	1.5/1.87	16.9	0.53
12	204.8	2.000	203.8-205.8	1.35/1.76	15.2	0.52

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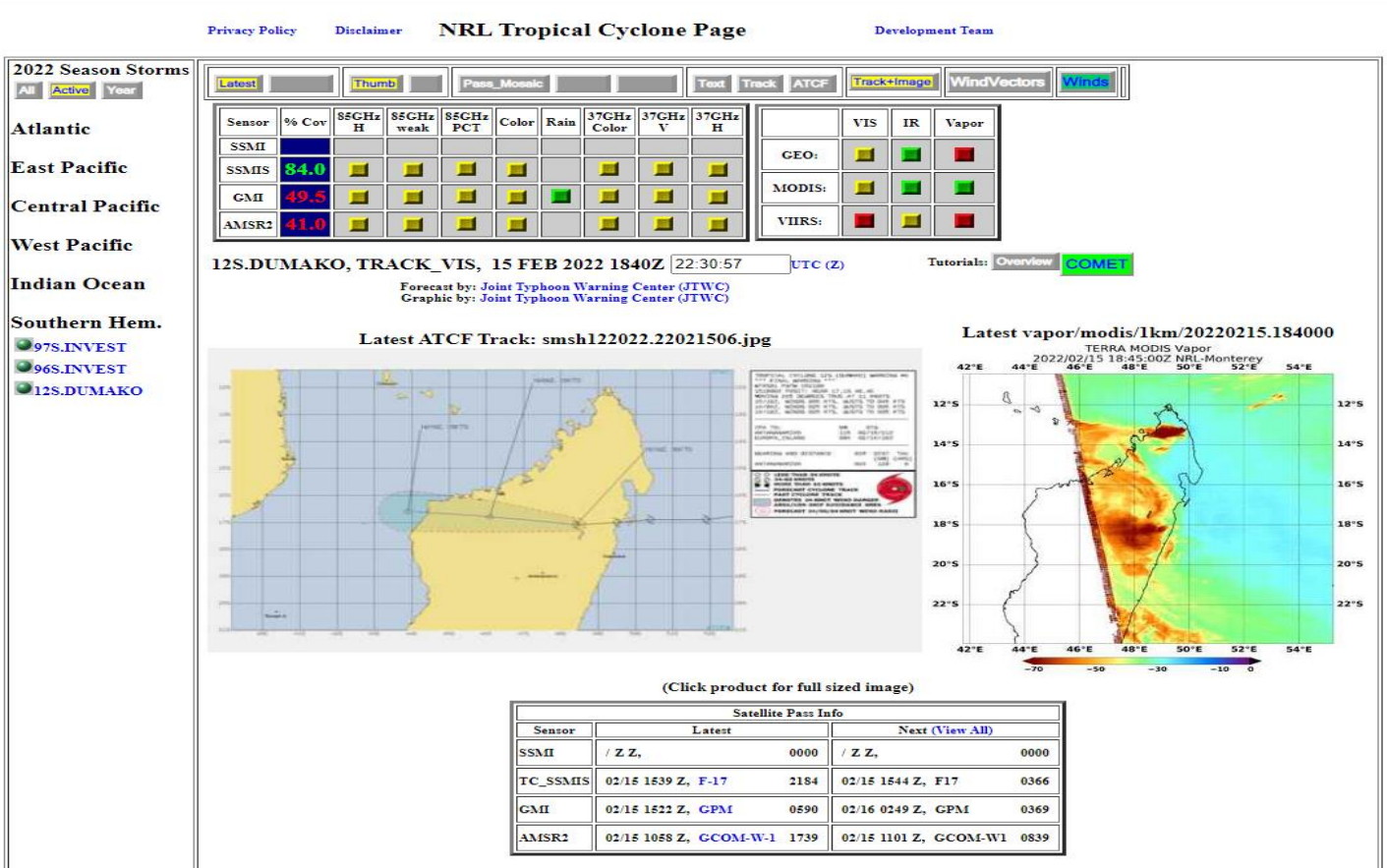
Classic NRL Tropical Cyclone Webpage

http://www.nrlmry.navy.mil/TC.html

The Classic NRL TC webpage has been running for over 20 years. It will be replaced by a modernized new NRL TC webpage in the near future.

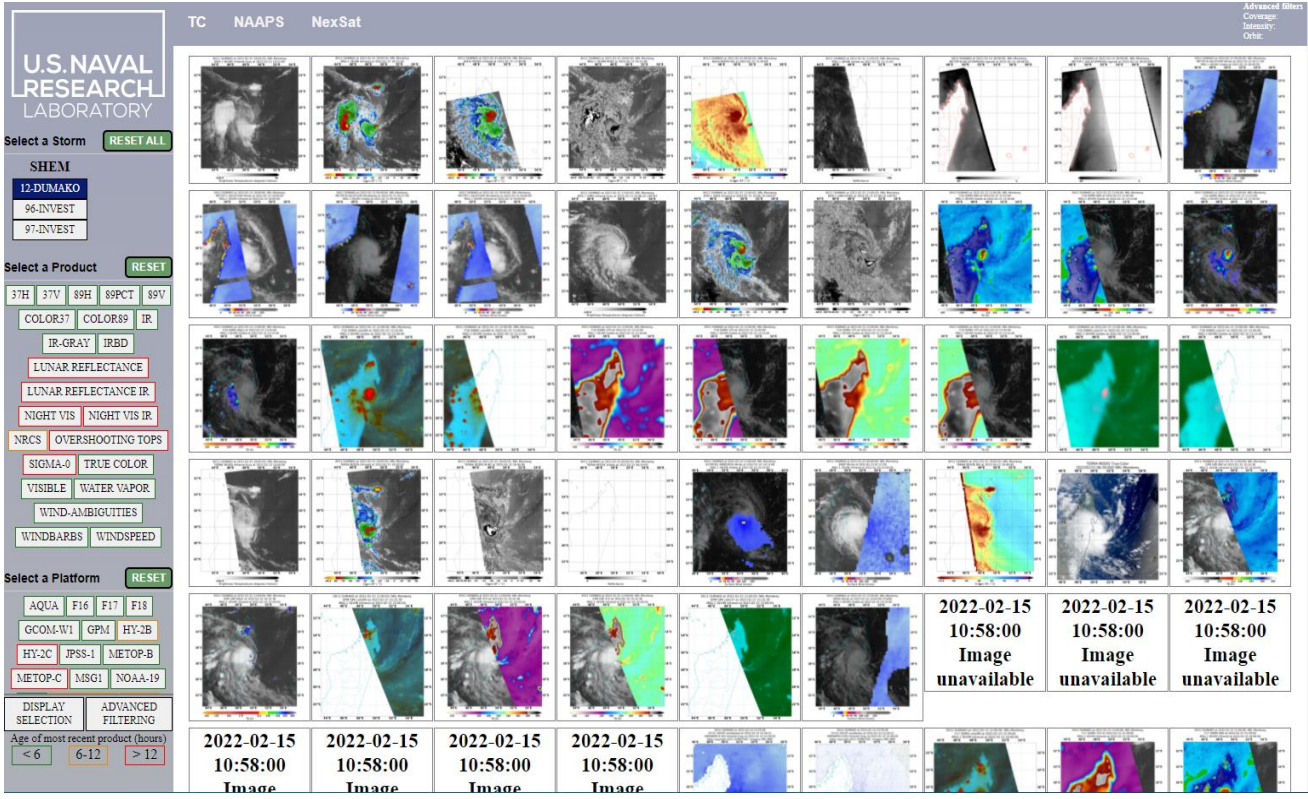


New NRL TC Webpage (demo)

New NRL TC webpage (demo): https://www.nrlmry.navy.mil/tcdemo/tc_web/active/

Main Features

1) User friendly interactive - dynamic TC webpage
2) Active/Archives/TCname
3) Product-based option
4) Platform-based option
5) Sensor-based option
6) Advanced filter (Geo/Polar; mini coverage; mini wind speed)
7) Color-based time products



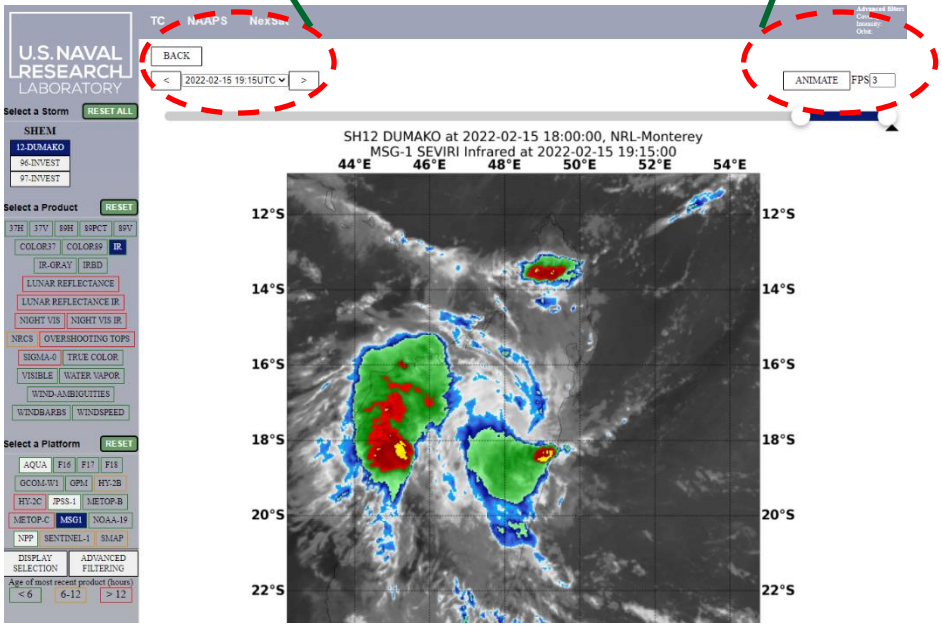
New NRL TC Webpage (cont.)

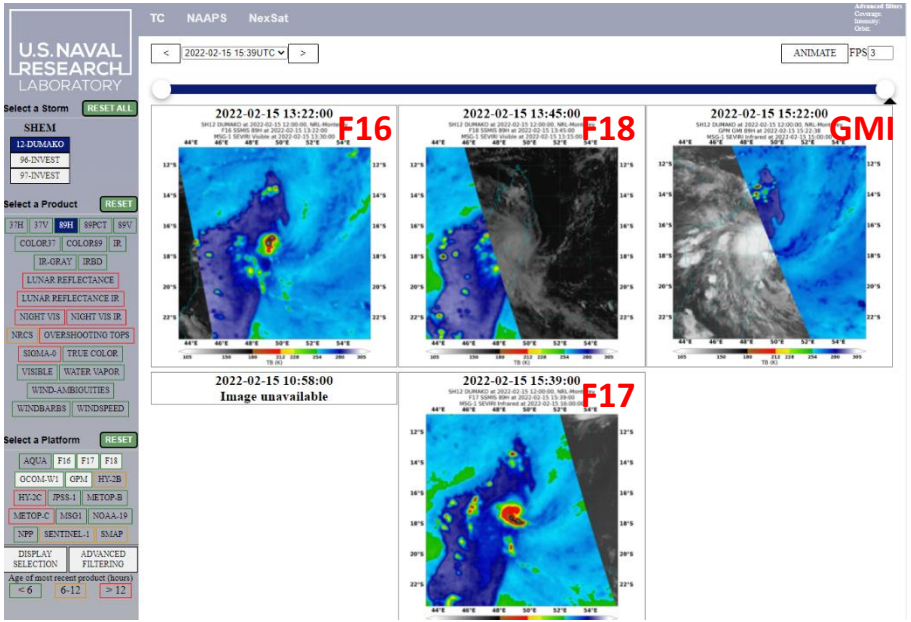
Back & Time selection

Animation & Frame Speed selection

Select one image

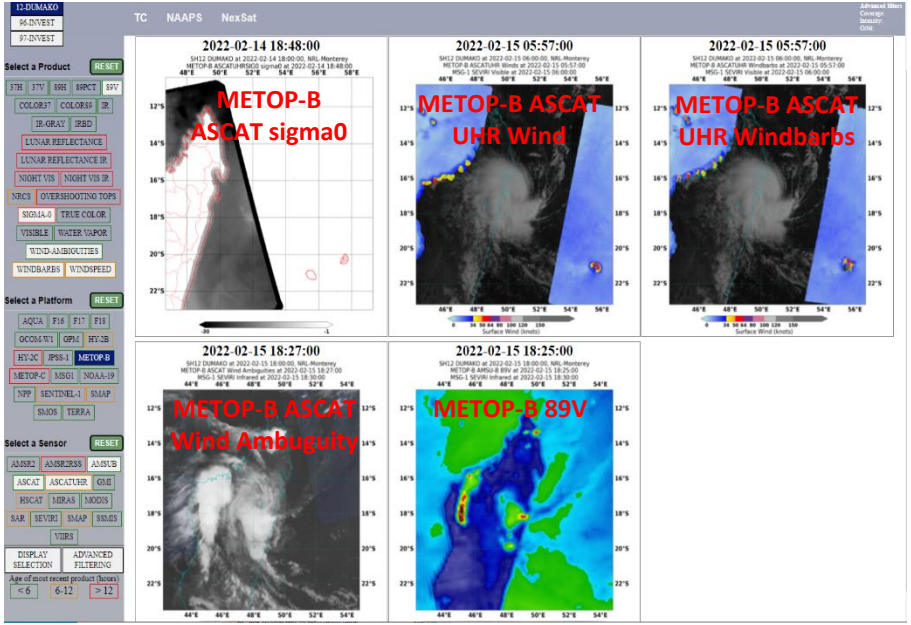
Select one product (i.e., 89H)



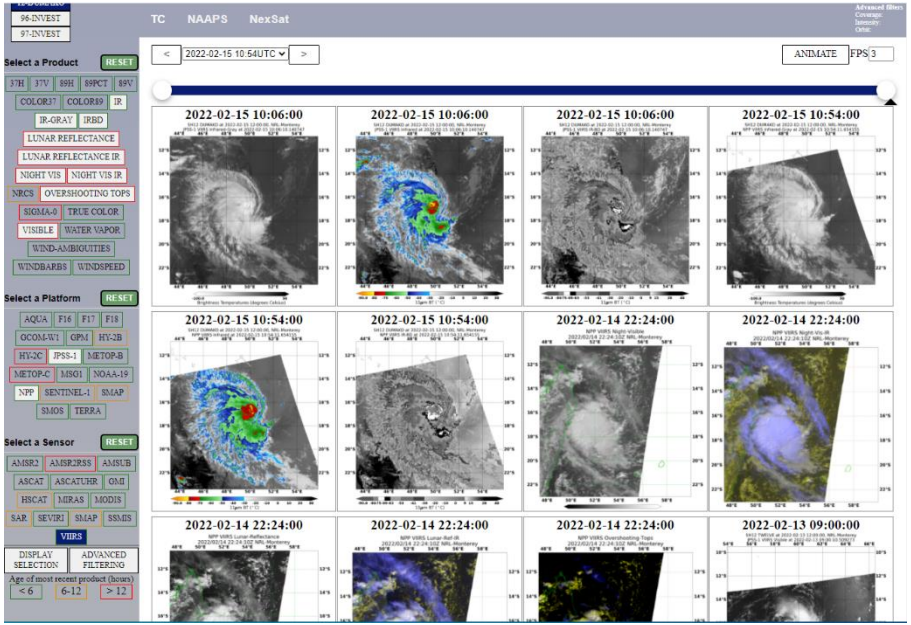


New NRL TC Webpage (cont.)

Select one platform (i.e., metop-b)



Select one sensor (i.e., VIIRS)



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Summary

- The open-sourced GeoIPS is successfully developed and implemented for the NRL operational and research applications. It is an actively ongoing project for continuous improvements and applications;
- GeoIPS is a result of the collaborative efforts by NRL and partners. The community contributions and applications to GeoIPS updates are welcome;
- All NRL TC products are now generated by GeoIPS. The TeraScan products is now an history for NRL TC products;
- The NRL TROPICS TC products should be available in the upcoming TC season;
- The new NRL TC webpage should be running at least in parallel mode in the 2022 TC season.