



June 2022 CSPP Users' Group Meeting, Madison WI

# NOAA Algorithm Scientific Software Integration and System Transition Team (ASSISTT) Collaboration with CSPP Geo on L2 Product Software

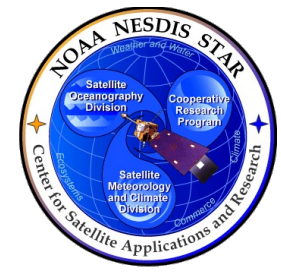
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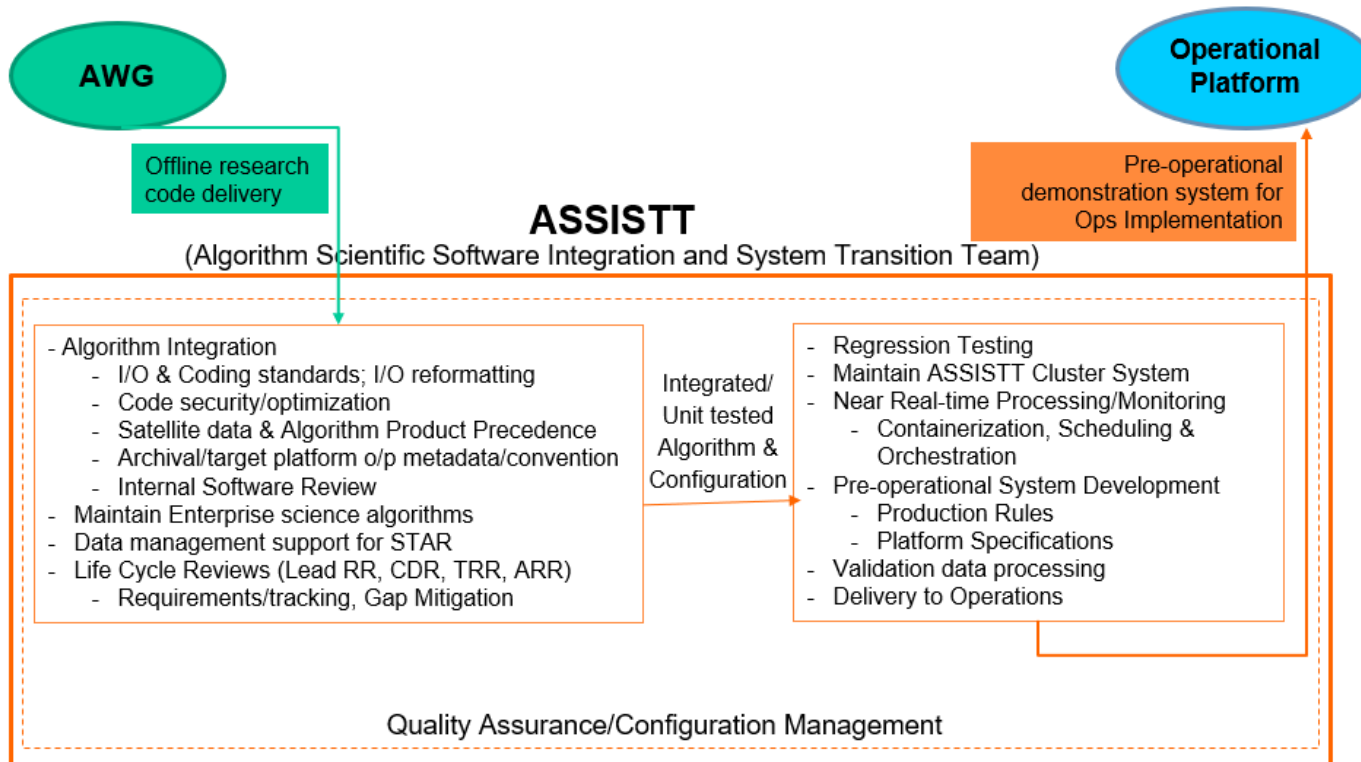
# Outline

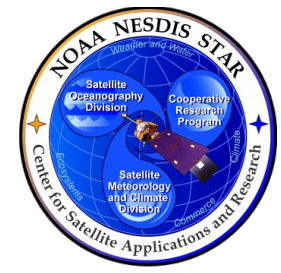
- **Introduction**
  - » Overview of ASSISTT's role in the R2O process
- **Framework v2.0 software overview/highlights**
- **Collaboration between ASSISTT and CSPP Geo**
  - » Most recent and upcoming deliveries
    - New features, modifications to L2 products
- **Summary/future directions**



# Introduction - ASSISTT R20

- The **NOAA STAR** Algorithm Scientific Software Integration and System Transition Team (**ASSISTT**) facilitates and support transition of satellite remote sensing algorithms from research to operations.





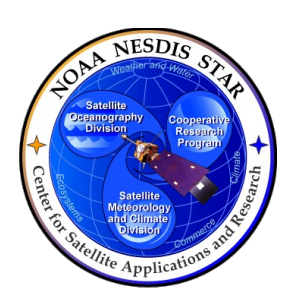
# Software to Support ASSISTT R2O

- The ASSISTT integration team developed NOAA STAR Algorithm Services Framework (**ASF**) v2.0, which is a single software framework with common interfaces for running and managing the precedence of large sets of enterprise algorithms.
- Multi-mission and Enterprise Research-To-Operations (R2O) support requires the ASF infrastructure to be versatile, feature-rich, and easily extensible.

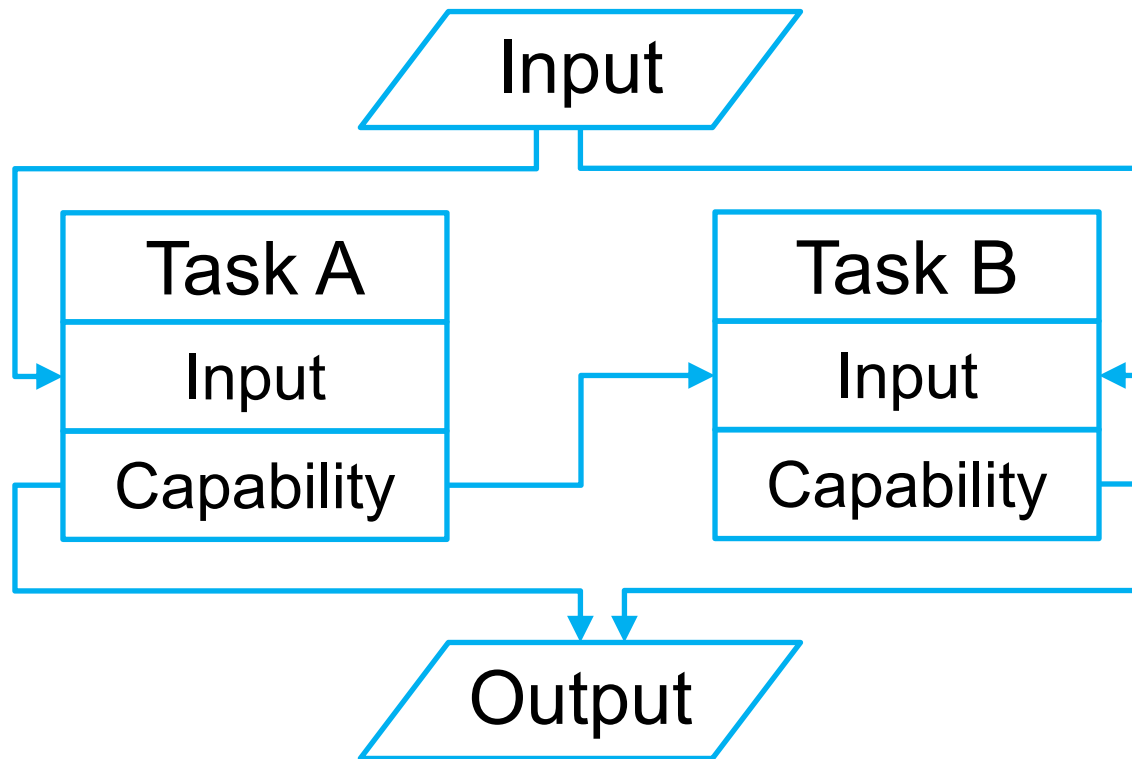


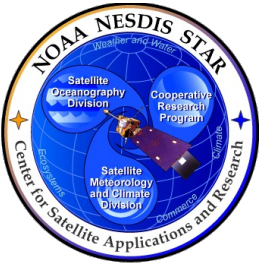
# ASF System Overview

- **Integration API:** Supports a multi-language (native Fortran, C/C++, Python) integration environment.
- **Configuration System:** All algorithm parameters, inputs, capabilities, and dependencies are defined within XML files in a flexible and user-friendly way
  - » The ASF parses the XML files to construct algorithm execution graphs for varying configurations (multi-satellite, temporal, etc)
- **Algorithm execution scheduling:** Based on the configuration, the ASF Task Scheduler will schedule and execute algorithms in order of precedence, ensuring all downstream products have the inputs they need available, either in the data cache or netCDF files.

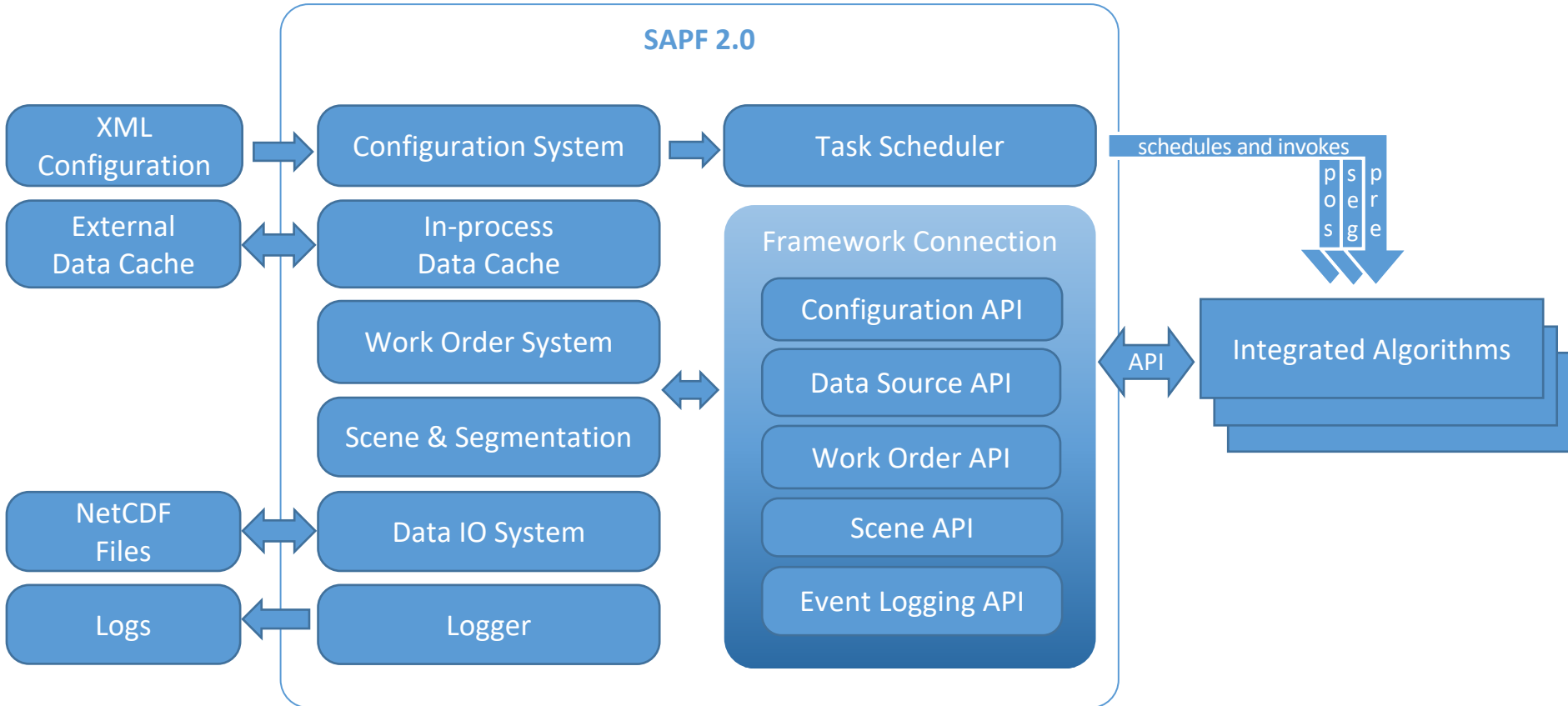


# Task Scheduling and Execution





# ASF 2.0 System Components





# CSPP Geo DAP Preparation by ASSISTT

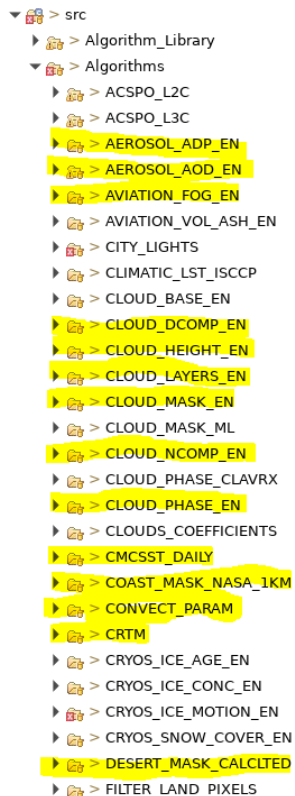
- CSPP Geo DAPs are delivered as a subset of the ASF
- During the transition to operations lifecycle, ASSISTT helps to verify and validate the algorithm updates
  - » Initial validation performed between the integration and science team
    - More in-depth validation performed between the ASSISTT Framework output and the operational platform for much larger sets of data during lifecycle reviews.
- Prior to preparing a new DAP, we work with the CSPP Geo team to identify what capabilities, modifications, or fixes are required for the next delivery





# CSPP Geo DAP Preparation by ASSISTT

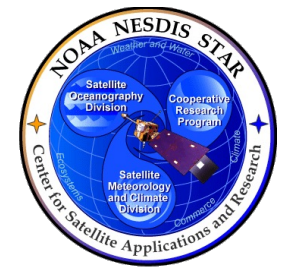
- Once we have all requested algorithms and changes, ASSISTT begins preparing the CSPP Geo DAP by first creating a subset of the FW code.



CSPP Geo FW Subset

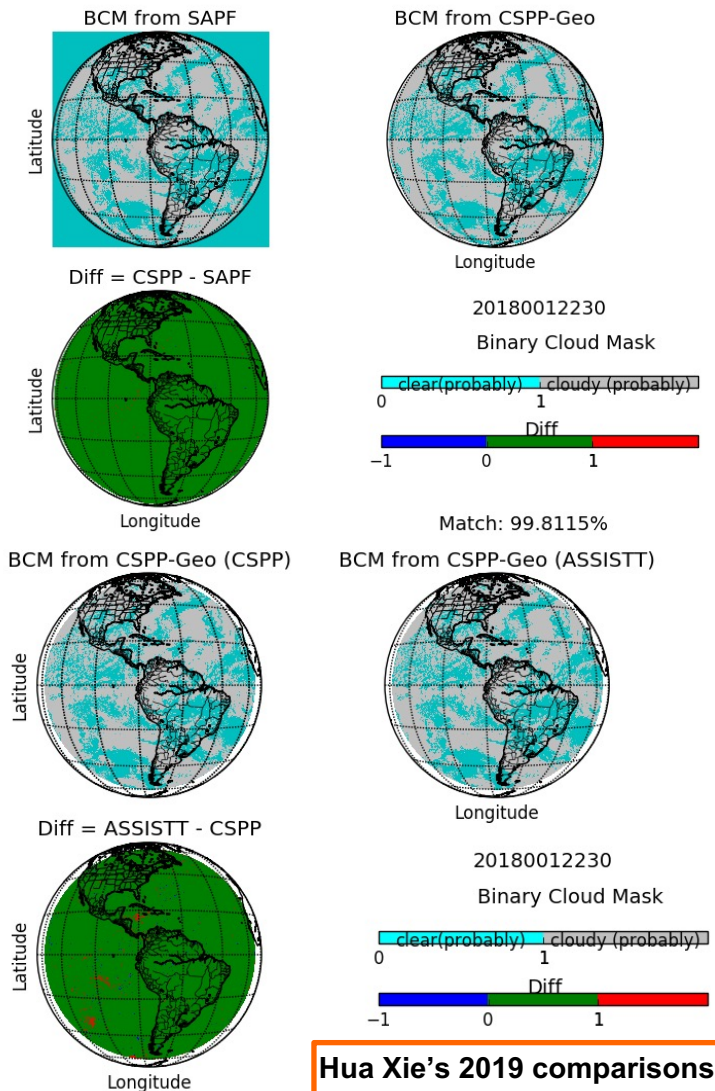
Wrap static executable in Python scripts, create test cases

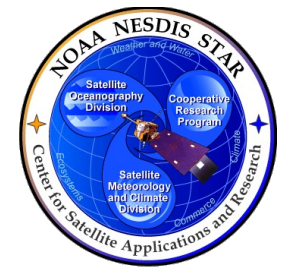
Deliver DAP (inc. source code, test cases, and documentation) to CSPP Geo



# After Delivery Validation

- After the DAP has been implemented by CSPP Geo, ASSISTT runs the FW and CSPP beta package on our Linux machines as well as our cluster in a docker container
- Comparisons are conducted between the CSPP Team and ASSISTT's results (Framework and CSPP)
  - » Any flagged differences are examined
    - If it is determined to be an implementation issue, a fix is worked on and provided by ASSISTT (e.g. via git cherry-pick)
    - If implemented correctly, the only differences should be caused by differences in the run environment (e.g. machine noise)





# CSPP Geo - Currently supported Products

Clouds

- Enterprise Cloud Mask
- Enterprise Cloud Height
- Enterprise Cloud Phase
- Enterprise DCOMP/NCOMP

Aerosols

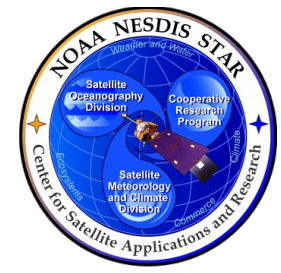
- Aerosol Detection (ADP): Smoke & Dust
- Aerosol Optical Depth (AOD)

Land Surface  
Temperature (skin)

Fog/Low Stratus

Winds

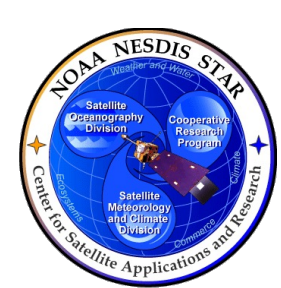
Ancillary algorithms: SAT\_ABI,  
NWP\_GFS, CRTM, static masks  
etc.



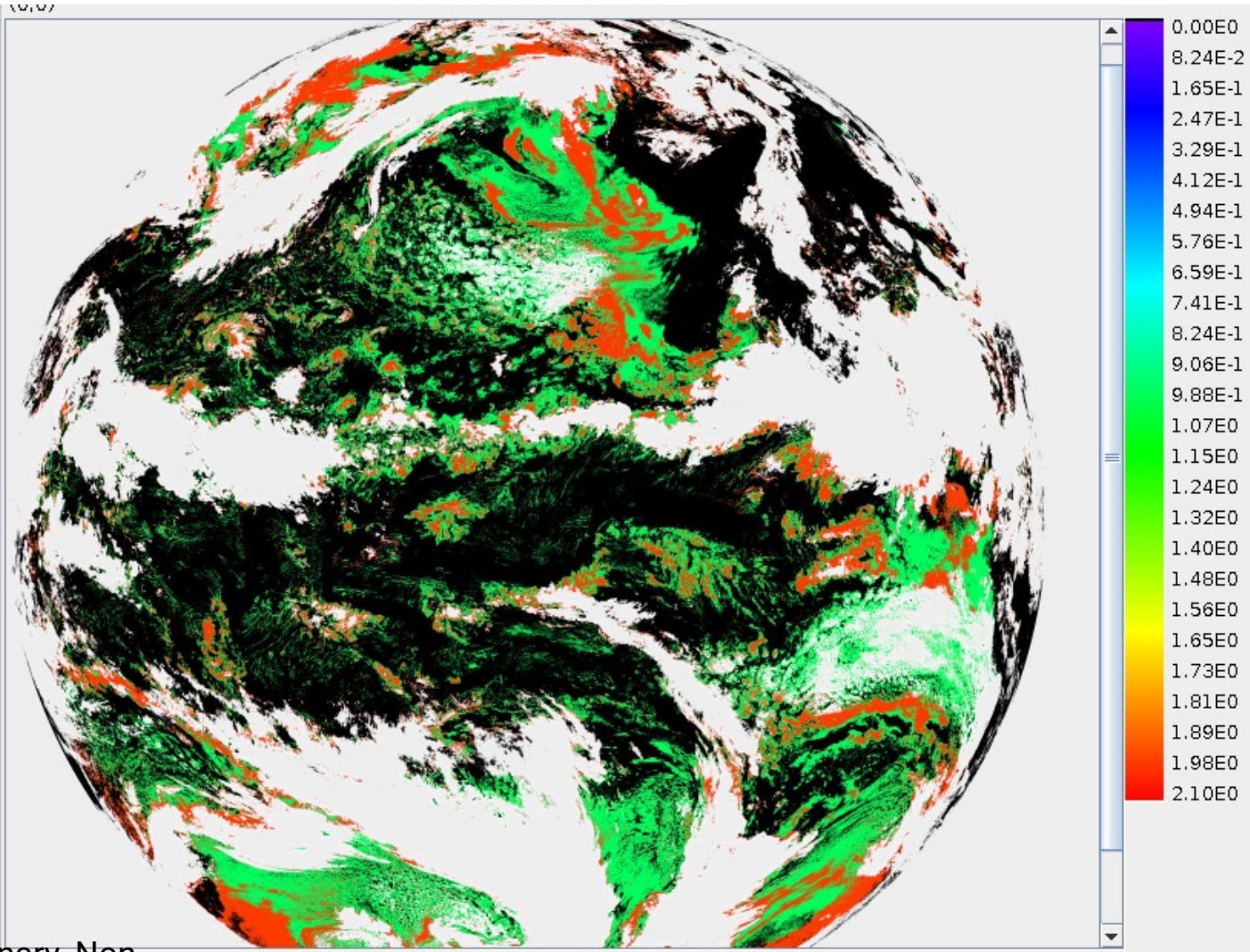
# CSPP Geo v3 – New Capabilities

- Latest CSPP Geo DAP delivered from ASSISTT in May 2022
- New feature highlights:
  - » Updated the existing algorithms to the latest science version
  - » Add GOES-17 support for DCOMP, NCOMP, LST, AOD, ADP, FLS
  - » GOES-18 processing support for all products
  - » New algorithms
    - Sounding
    - Cloud Cover Layers (no cloud base height dependency)
    - To be delivered July 2022 – enterprise rainfall rate
  - » Support for more PUG-format-friendly output
    - Latitude/Longitude removed from all products
    - Gridding coordinates/projection information added to all products
    - Thinned versions of CMI produced by SAT\_ABI reader



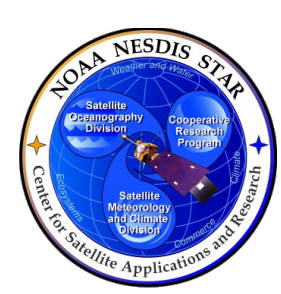


# GOES-18 Cloud Cover Layers - 6/21/2022 01:00Z



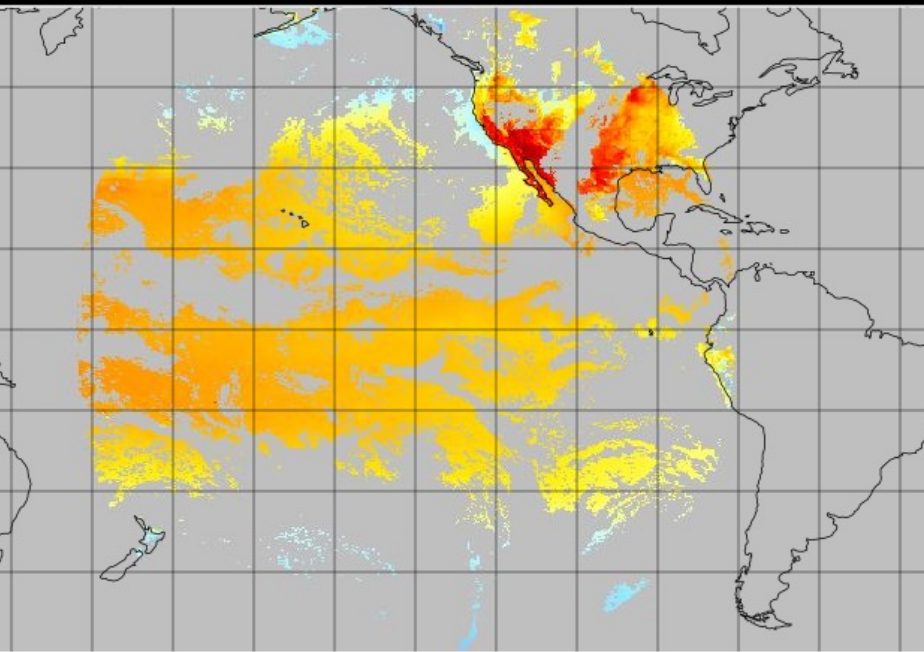
0.00E0  
8.24E-2  
1.65E-1  
2.47E-1  
3.29E-1  
4.12E-1  
4.94E-1  
5.76E-1  
6.59E-1  
7.41E-1  
8.24E-1  
9.06E-1  
9.88E-1  
1.07E0  
1.15E0  
1.24E0  
1.32E0  
1.40E0  
1.48E0  
1.56E0  
1.65E0  
1.73E0  
1.81E0  
1.89E0  
1.98E0  
2.10E0

GOES-18 Preliminary, Non-Operational Data



# GOES-18 Sounding - 6/21/2022 01:00Z

Skin Temperature

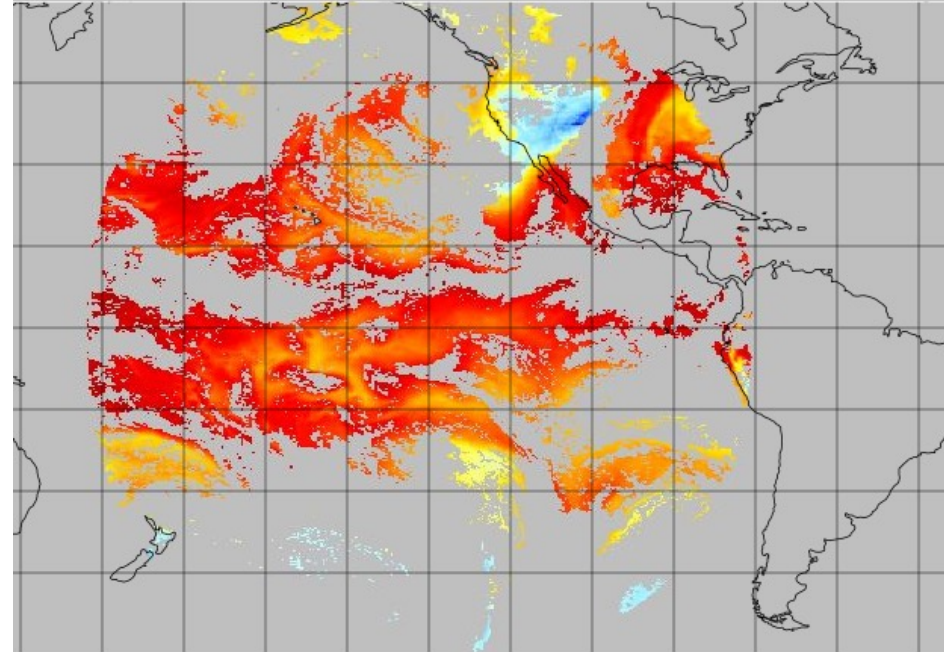


Skin Temperature (Kelvin)



Data Min = 258.9, Max = 323.0

Total Precipitable Water



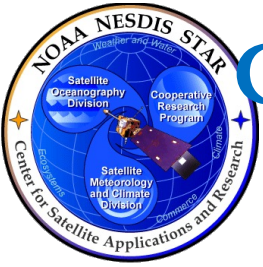
Total Precipitable Water (cm)



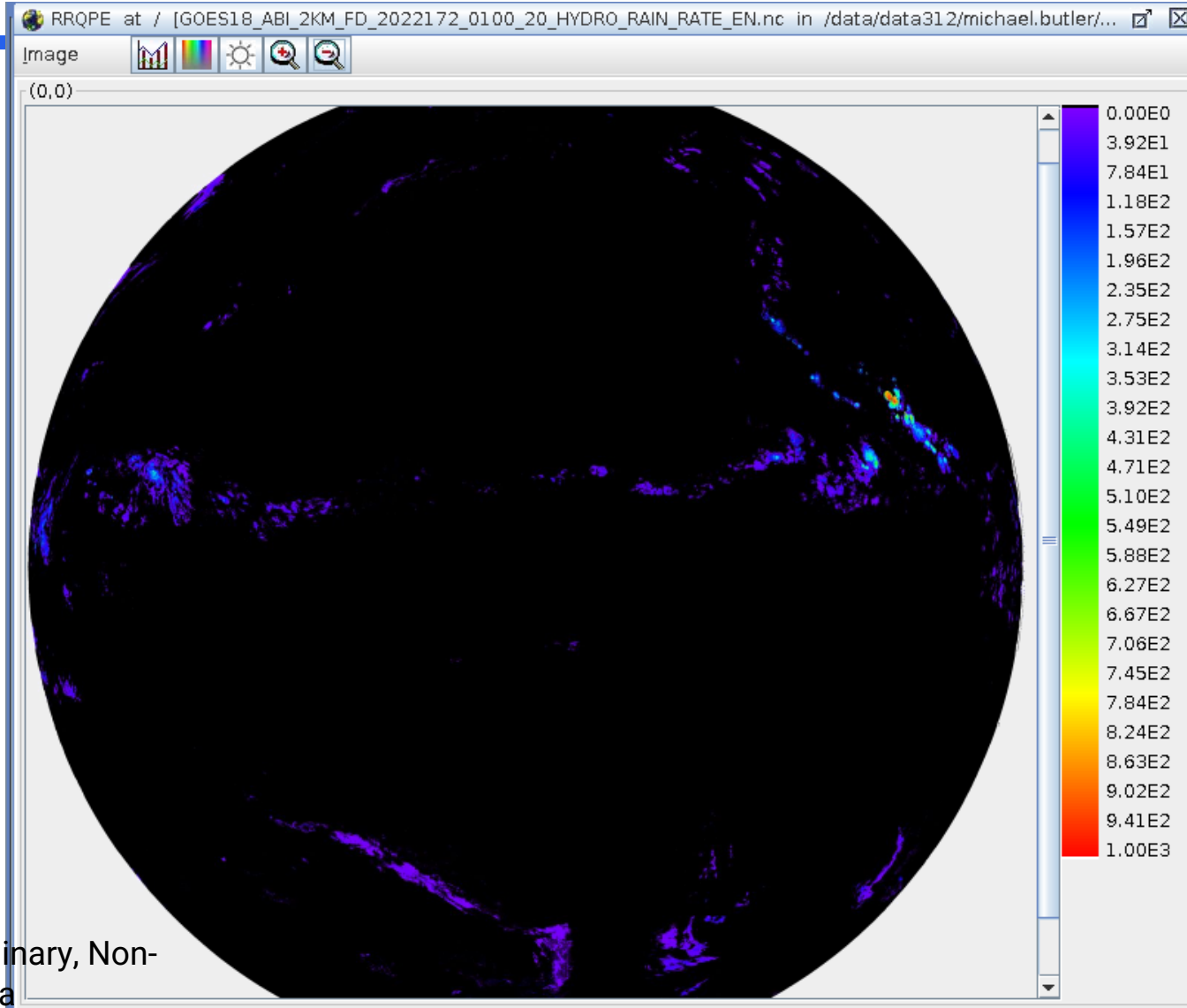
Data Min = 0.2, Max = 6.5

GOES-18 Preliminary, Non-Operational Data





# GOES-18 Rainrate (RRQPE) - 6/21/2022 01:00Z



GOES-18 Preliminary, Non-Operational Data



# CSPP Geo v3 DAP Performance

- **CSPP Geo v3**

- » ~23 minutes total to generate the GOES-18 Full Disk output for the 13 supported CSPP Geo algorithms, plus CMI and navigation file using **the standard NDE/NCCF format**
  - **6.8 Gb** total
- » ~22 minutes total to generate the GOES-18 Full Disk output for the 13 supported CSPP Geo algorithms, plus CMI and navigation file using the **delivered output format in the CSPP Geo v3 DAP**
  - **5.6 Gb** total (ignoring the 1km, 500m resolution CMI and navigation files)
- » Minor impact on I/O time, but ~18% decrease in file size just by removing the latitude/longitude variables from the L2 products and trimming the CMI.





# Remaining CSPP Geo v3 updates

- Rain rate was not included in the initial delivery while issues in the offline training algorithm scripting were worked out.
  - » ASSISTT will deliver a patch in July 2022 containing the offline and main processing algorithm in the Framework.
- GOES-18 LUT updates – deliver if/when necessary. Many algorithm teams are using G16 LUTs/thresholds now, to be possibly reevaluated once GOES-18 becomes the operational satellite
  - » Enterprise Cloud Phase thresholds were received and shared
  - » New G18 LUT for AOD will be shared with CSPP Geo/GOES-R Ground System soon



# Future Directions for ASF v2.0

- The long term goal for ASSISTT is to move away from large single software framework like ASF v2.0 toward a more stand-alone approach
  - » Helps support cloud service-based processing
  - » Will help AWG teams to collaborate more closely with ASSISTT during the integration process (CI/CD)
- The orchestration system to enable this is still a long-term work in progress. The details of how this will impact future deliveries to the GS and CSPP Geo remain TBD.



# Summary

- The STAR Algorithm Services Framework v2.0 software has enabled ASSISTT and CSPP Geo to collaborate smoothly on large packages of delivered algorithms
  - » Support for more streamlined outputs added
  - » New algorithms added, bringing CSPP Geo up to date with respect to the GOES-R Ground System
- Moving from Framework to standalone algorithms run on the cloud – in the long term, we will need to determine how this will impact our CSPP Geo deliveries – more to come as this transition develops.