Atmosphere SIPS Status Update

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special thanks to JMA for AHI data feed/support

Overview

- Atmosphere SIPS status and updates
- L1b calibration monitoring of MODIS/VIIRS/ABI/AHI
- Matchmaker python framework for development of multi-sensor validation and algorithm development
- Aerosol validation aircraft HSRL and using multi-sensor collocation

A-SIPS Processing and Science Team support

ST algorithm testing, integration and delivery

- A-SIPS provides a local test environment (sipssci2)
- Access to local data archive of L1 and L2 data products
- Each ST member has a dedicated SIPS team member to support algorithm testing, integration into the processing system, and delivery to DAAC
- A-SIPS software delivery system designed to ensure that every delivery is archived and tagged

Operational Processing responsibilities

- Standard products are created within 24 hours of observation
- Near Real Time products are created within 3 hours of observation
- Products are delivered to LAADS for public distribution
- NRT products are hosted at the A-SIPS (WI) but accessed through LANCE

Atmosphere Discipline Team Members (Product Creators)

Team Leads	ROSES-20 A.52 and A.33 Funded Proposals
Christina Hsu (NASA GSFC)	Extending Long-Term Aerosol Data Records from MODIS to VIIRS using e-Deep Blue Algorithm. (ROSES – 2020 A.52)
Robert Levy (NASA GSFC)	Upgrading the Dark Target aerosol data record for the 2020s and beyond. (ROSES – 2020 A.52)
Kerry Meyer (NASA GSFC)	The continuation and evolution of the CLDMSK and CLDPROP continuity cloud product suite. (ROSES – 2020 A.52)
Kerry Meyer (NASA GSFC)	Transitioning an existing near real-time MODIS cloud and above-cloud absorbing aerosol retrieval algorithm into a new MODIS/VIIRS continuity product. (ROSES – 2020 A.33)
Vincent Realmuto (NASA JPL)	TIR-Based Volcanic SO2 Science Products for MODIS and VIIRS. (ROSES – 2020 A.33)

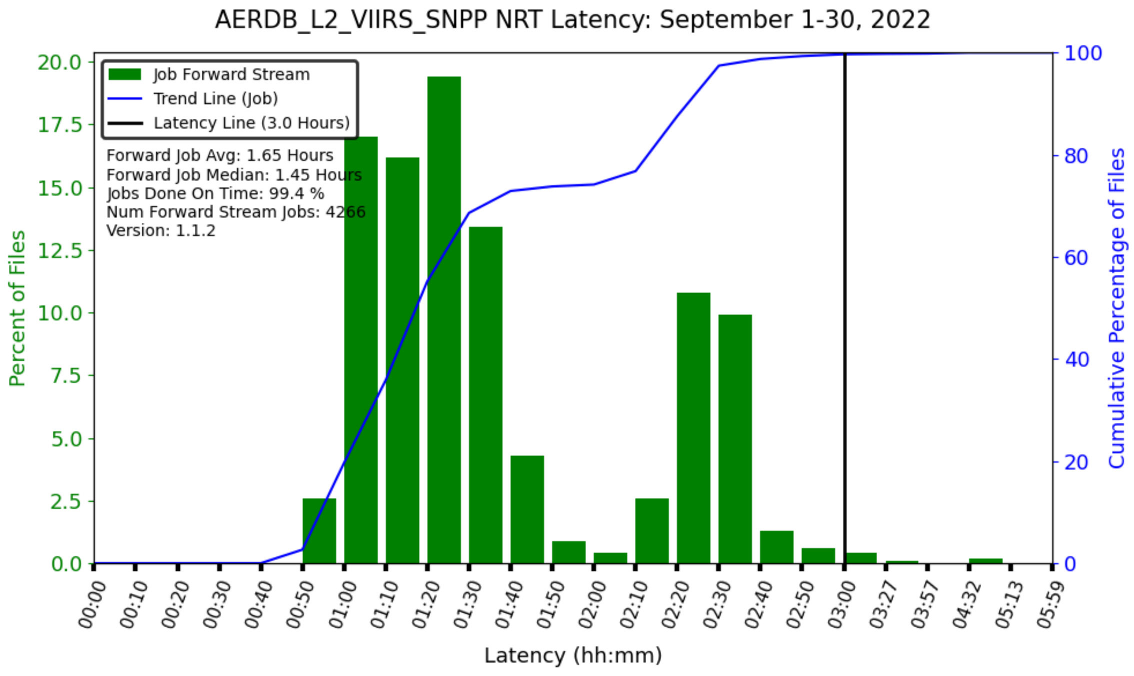
VIIRS/MODIS Atmosphere Level 2/3 Products from ASIPS (5/22)

Product Short Name	Product Description	ST Lead	DAAC Delivery
AERDB_L2_VIIRS_SNPP AERDB_D3_VIIRS_SNPP AERDB_M3_VIIRS_SNPP	Deep Blue Aerosol (day only) Standard and NRT	Christina Hsu (NASA GSFC)	LAADS (standard) LANCE (NRT)
AERDT_L2_VIIRS_SNPP	Dark Target Aerosol (day only) Standard and NRT	Robert Levy (NASA GSFC)	LAADS (standard) LANCE (NRT)
CLDMSK_L2_VIIRS_[SNPP|NOAA20]	Continuity Cloud Mask (day/night) Standard and NRT	Kerry Meyer (NASA GSFC)	LAADS (standard) LANCE (NRT)
CLDMSK_L2_MODIS_Aqua	Continuity Cloud Mask (day/night) Standard	Kerry Meyer (NASA GSFC)	LAADS
CLDPROP_L2_VIIRS_[SNPP|NOAA20] CLDPROP_D3_VIIRS_[SNPP|NOAA20] CLDPROP_M3_VIIRS_[SNPP|NOAA20]	Continuity Cloud Properties (day/night) Standard	Kerry Meyer (NASA GSFC)	LAADS
CLDPROP_L2_MODIS_Aqua CLDPROP_D3_MODIS_Aqua CLDPROP_M3_MODIS_Aqua	Continuity Cloud Properties (day/night) Standard	Kerry Meyer (NASA GSFC)	LAADS
FSNRAD_L2_VIIRS_CRIS_[SNPP|NOAA20] FSNRAD L2 subset SNPP|NOAA20	Fusion Radiances (day/night) Standard	Eva Borbas* (UW-Madison)	LAADS LaRC (CERES)
CLDCR_L2_VIIRS_SNPP	Cirrus Reflectance (day only) Standard	Bo-Cai Gao* (NRL)	LAADS

* Not funded under A.52 or A.33

Product Updates

- SNPP VIIRS Deep Blue L2/L3 v1.1 was released by LAADS in July 2021.
- SNPP VIIRS Deep Blue V2.0 processed for both VIIRS SNPP and NOAA-20 and being evaluated for public distribution
- Dark Target SNPP and NOAA-20 in testing expected delivery to LAADS November-December 2022
- Near Real Time:
  - Deep Blue v1.1 available through LANCE
  - DT for SNPP and JPSS-20 will be available once in production



Readiness for JPSS-2

- Ingesting JPSS-2 JCT3 VIIRS TVAC data as of May 11, 2022.
- Ready to ingest JPSS-2 VIIRS, CrIS, ATMS Level 0 data post-launch.
- Looking forward to JPSS-2 support in VIIRS Level 1 software.
- Supporting development and testing of CrIS Level 1 software for JPSS-2.
- JPSS-2 TVAC data will be ingested to support CrIS Level 1 team.
- No major issues or problems are anticipated in supporting JPSS-2.

SNPP, Aqua, and Terra Decommissioning

- All software versions delivered by ST are archived locally. Software versions used for operational products are delivered to LAADS.
- SNPP data ingest and product creation will continue as long as relevant calibration LUTs are available from VCST (and ST wants to continue production).
- Aqua decommissioning will mean end of record for MODIS continuity cloud products (cloud mask, infrared and optical cloud properties). However, data will be retained for reprocessing purposes.
- Terra decommissioning will have little impact on ASIPS activities.

A-SIPS GEO Processing Support (So far only clouds)

- NASA HQ provided one year of ASIPS support (Thanks!)
- 4 months of AHI full disk 10 minute 10/night cloud mask, IR, and optical property retrievals
- 4 months of GOES-16 and GOES-17 (full disk/10 min)
- Imagery generated for worldview with results viewable in the ASIPS worldview development site (https://sips.ssec.wisc.edu/worldview)
- Collocation and match files generated for ABI/AHI with VIIRS/MODIS/CALIPSO for both L1b and L2 products
- L1b intercalibration software processed using the GEO/LEO L1b files (*Remote Sens.* **2020**, *12*(24), 4096; https://doi.org/10.3390/rs12244096)
- **Multiple reprocessing of the ABI/AHI multi-month products with updated algorithm/calibration (1-month full disk ABI/AHI cloud products can be reprocessed in 3.6 hours)**
- ASIPS support has ended which limits our ability continue development and expand the data NASA GEO data record

L3 Development tool (YORI)

Workflow

- Yori is a software package developed by the A-SIPS that efficiently aggregate geophysical variables into a netcdf4 compliant L3 file
- It is designed to be run in an operational environment and will be used for the MODIS C7 Atmosphere L3 products
- Is being used as the new C7 MODIS Cloud and Aerosol L3 (MYD08)

Step 1:

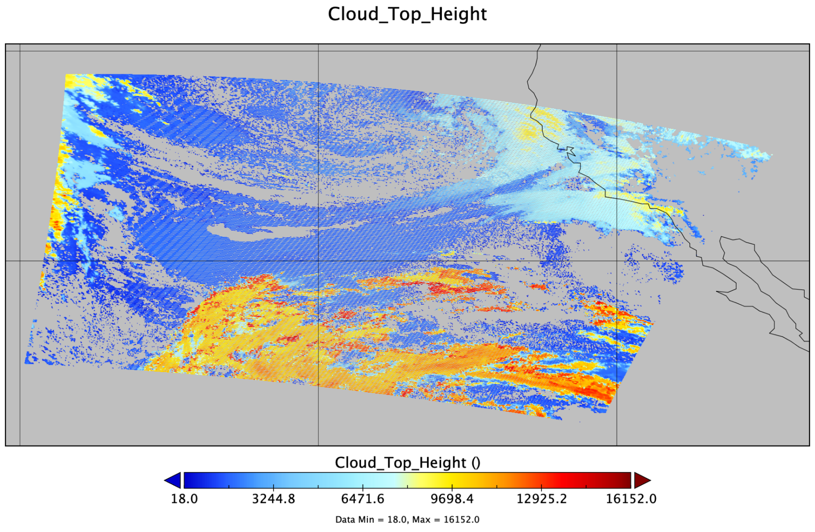
- The user prepares configuration and input files
- The configuration file contains instructions on how to grid data
- The input files allow the user to pre-process L2 variables

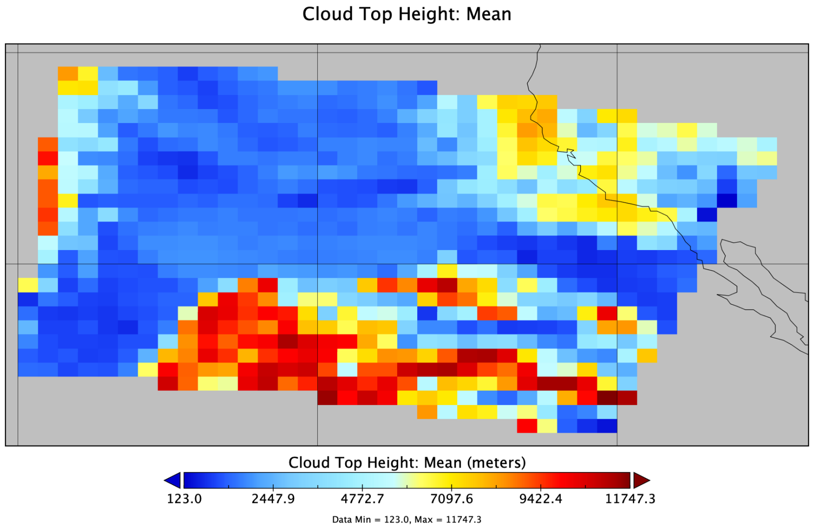
Step 2:

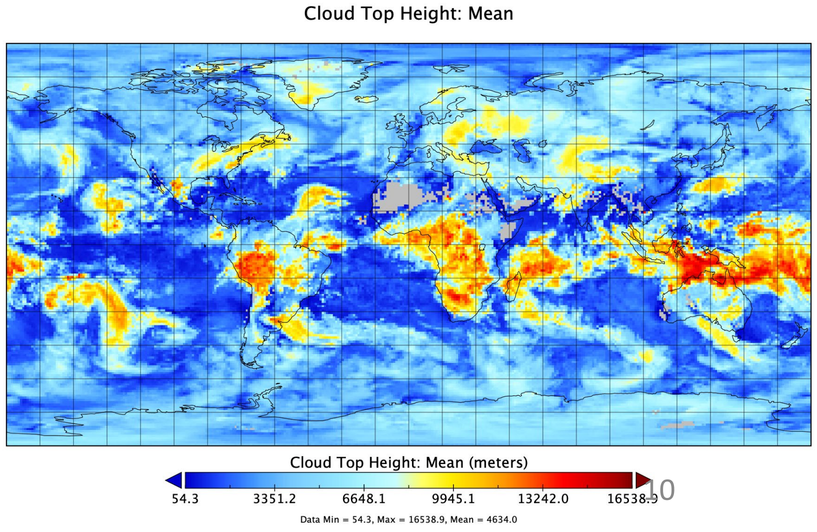
- `yori-grid` reads inputs and produces a gridded granule according to user's instructions provided in the configuration file

Step 3:

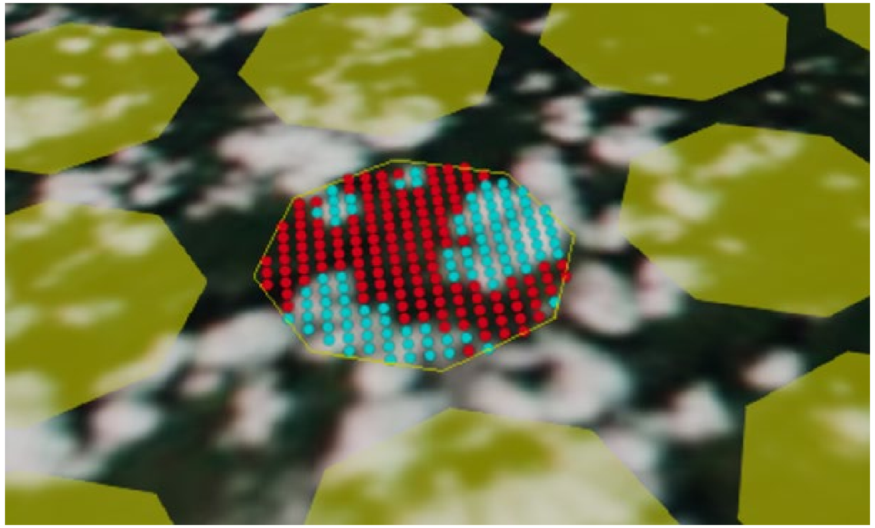
- `yori-aggr` aggregates multiple gridded granules (from *Step 2*) into Level-3 products







Collocation tools: Collopak



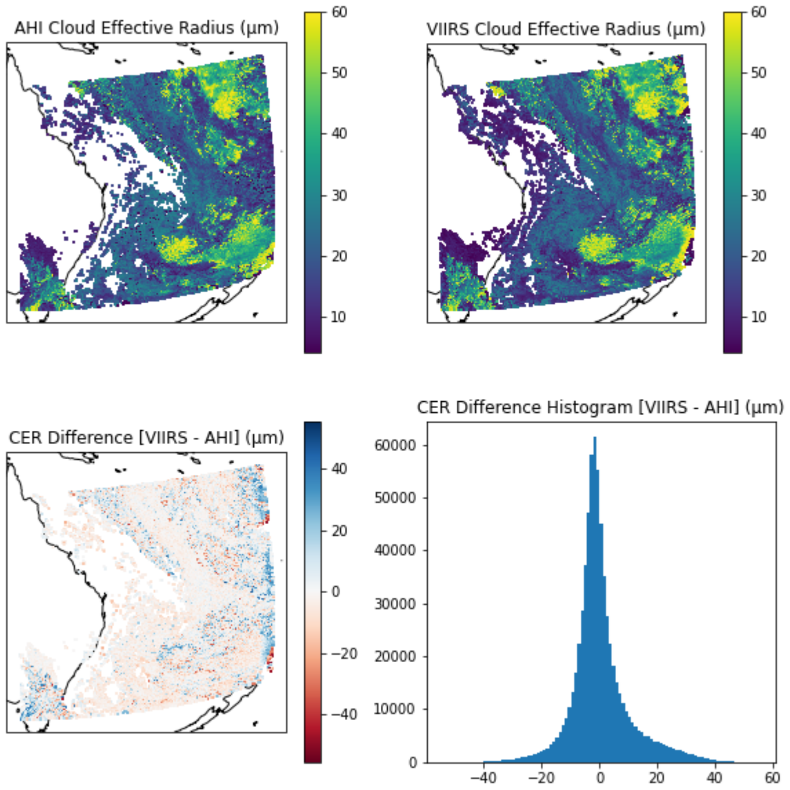
- Physical collocation utilities for various sensor combinations
  - Each collocation program use geolocation data from the “primary” (larger-footprint) and “secondary” sensors to compute coincident observations
  - Output is a NetCDF file containing array indexes that identify observations that overlap spatially
- Collopak also includes TLE-based orbital navigation tools (the programs that power the SIPS “OrbNav” API)
- Available on sipssci2, or for download
  - `/mnt/software/support/collopak`
  - https://www.ssec.wisc.edu/~gregq/collopak/

Primary / Master \ Secondary / Follower	AVHRR	CALIOP	CLOUDSAT	Fixed Grid GEO	MODIS	POLDER	VIIRS
AIRS		*	*	*	*		
AMSR-E			*	*	*		
CLOUDSAT		*			*		*
CrIS		*		*			*
Fixed Grid GEO		*	*		*		*
HIRS	*	*					
IASI	*			*	*		
MODIS		*				*	*
VIIRS		*					

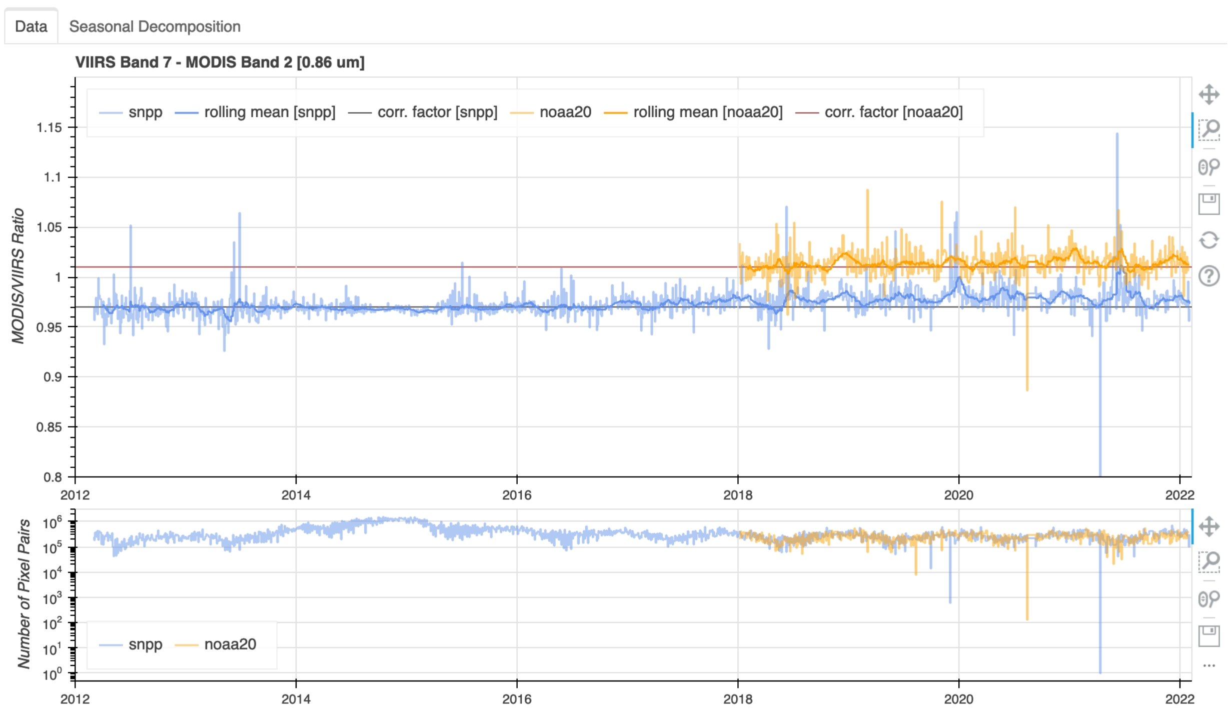
Collocation tools: Matchmaker

```
[outputs.ahi_Cloud_Effective_Radius]
source = "ahi_l2_cldprop/geophysical_data/Cloud_Effective_Radius"

[outputs.viirs_Cloud_Effective_Radius]
source = "viirs_l2_cldprop/geophysical_data/Cloud_Effective_Radius"
aggregation = "mean"

[outputs.viirs_Cloud_Effective_Radius_sdev]
source = "viirs_l2_cldprop/geophysical_data/Cloud_Effective_Radius"
aggregation = "std"
```

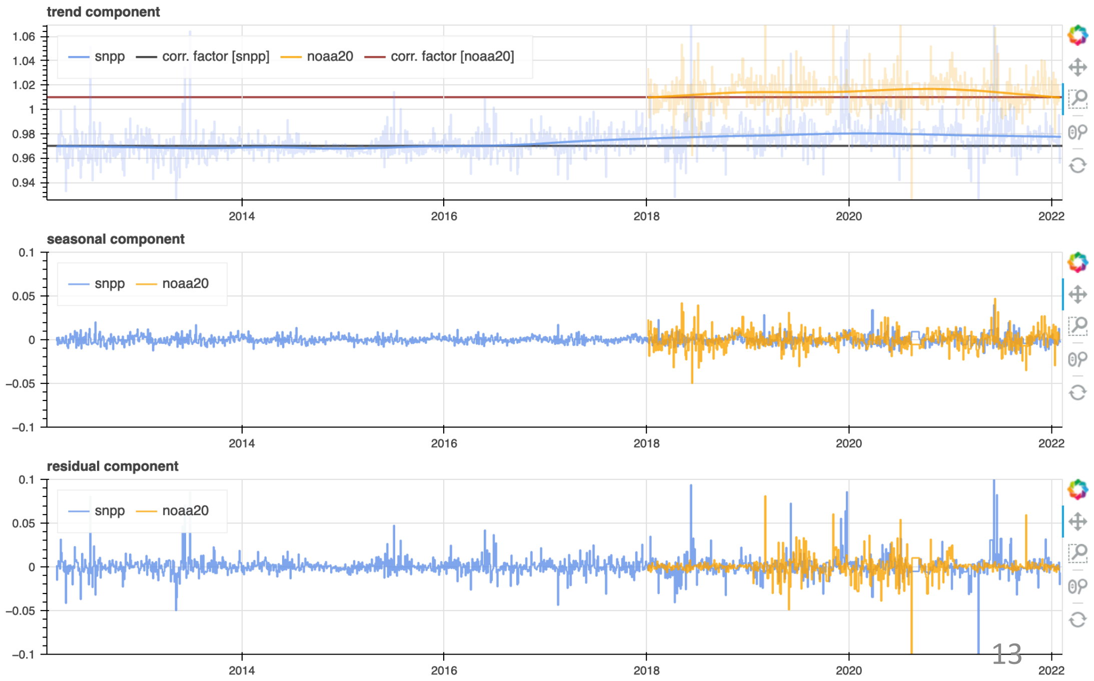
- New project in development to simplify creation of multi-sensor “match files” that contain side-by-side data from multiple sensors
- Goals
  - Better science team control over match file contents
  - Unified code base for correct & efficient application of collocation array indexes
  - Accumulation of reusable configuration and code for common matchup needs (e.g. CALIOP)
- Similar approach to Yori: a configuration file drives the construction of the match file
- Many simple use cases can be handled just by setting desired output variables in configuration
- More complex uses possible by either pre-processing sensor data (like the “pre-yori” step for L3) or via a Python plug-in system for custom processing
- Future goal: Make the framework available to broader community (ie open source)



Level 1 QA: VIIRS Band Monitoring



- Intercalibration product (K. Meyer) between Aqua MODIS and VIIRS sensors in forward stream production allows for RSB monitoring
- Web app enables interactive analysis of product
  - results updated in real-time

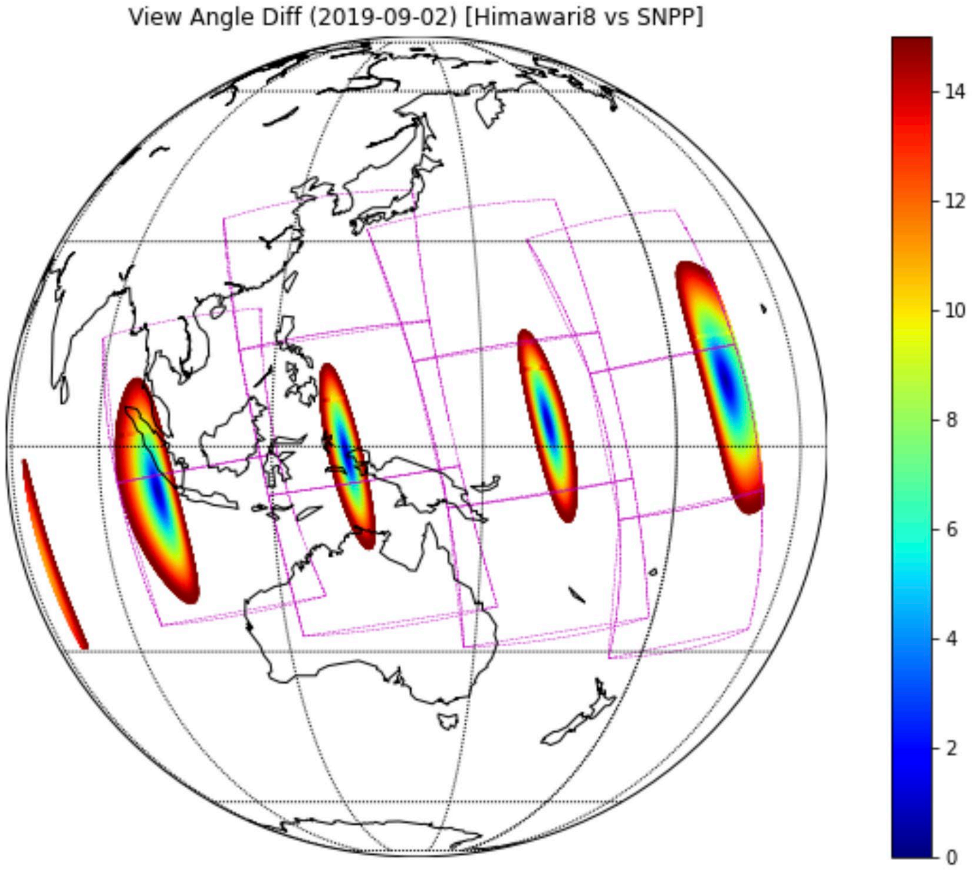


- Seasonal decomposition applied to
- Production stream monitored for significant outliers and trending
- Similar approach using Cris-VIIRS brightness temperature differences to monitor TEB calibration

L1b Inter-Calibration using Collocated Angle Matched VIIRS/AHI Observations

(GEO)/VIIRS Inter-Calibration:
- VIIRS and AHI FOV are physically collocated
- The viewing geometry is angle matched to 1 degree
- Filtered for optically thick, homogeneous liquid water clouds over ocean
- Methodology accounts for the channel spectral response differences(REF)

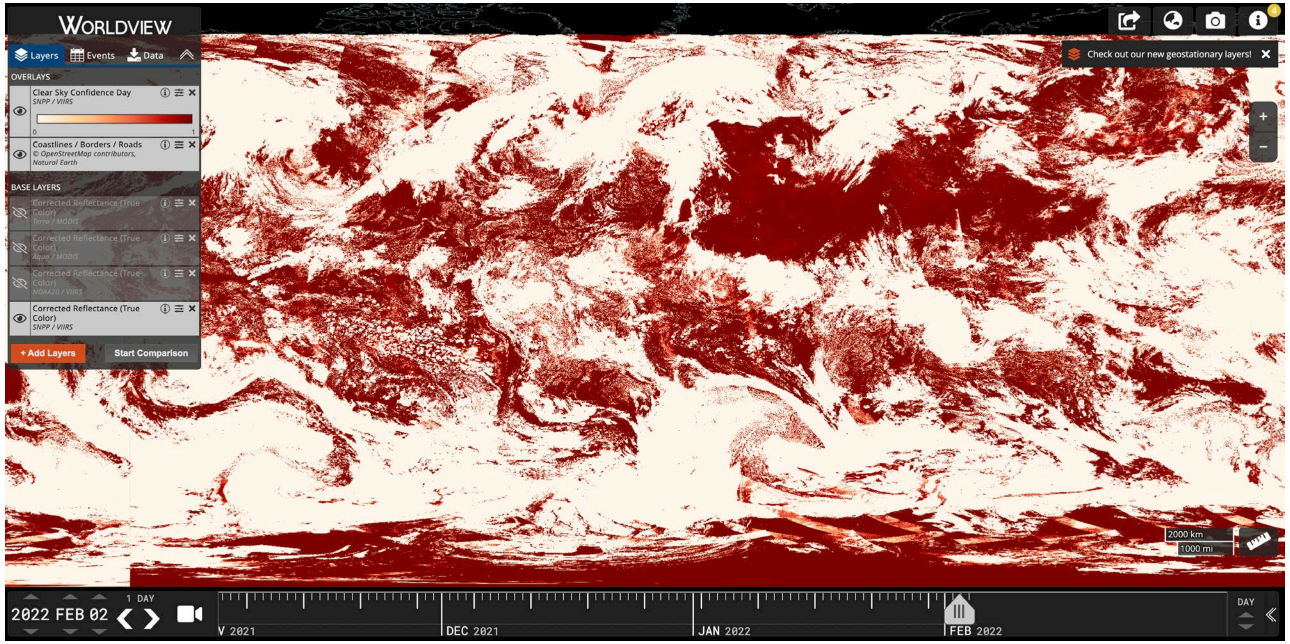
Channel	Ratio (VIIRS/AHI)	Ratio (VIIRS/GOES-16)
0.65	2% (1.02)	-3% (0.97)
0.86	4% (1.04)	1% (1.01)
1.61	4% (1.04)	0% (1.00)
2.26	9% (1.09)	3% (1.03)



Meyer, K.; Platnick, S.; Holz, R.; Dutcher, S.; Quinn, G.; Nagle, F. Derivation of Shortwave Radiometric Adjustments for SNPP and NOAA-20 VIIRS for the NASA MODIS-VIIRS Continuity Cloud Products. *Remote Sens.* **2020**, *12*, 4096. https://doi.org/10.3390/rs12244096

Internal worldview support for Algorithm development and field campaigns

- https://sips.ssec.wisc.edu/worldview/
- Ability to create test days for dev versions of products
- Can create unique colormaps with a requested max and min
- Can create multiple layers for different bands
- Not as many restrictions on the number of layers as the public worldview instance has

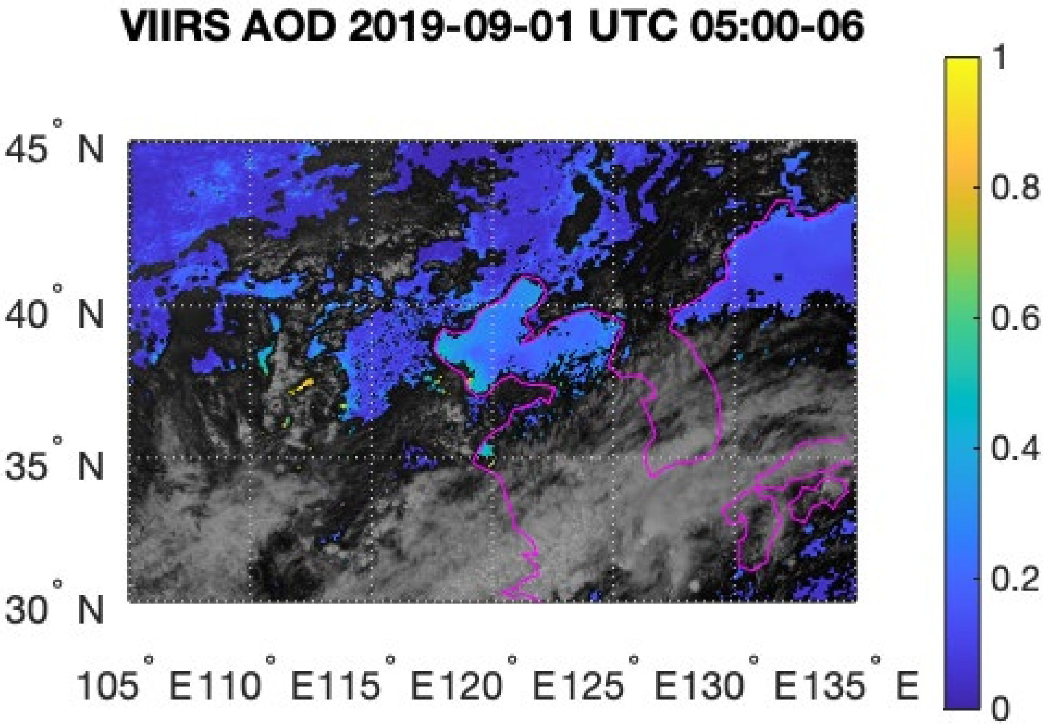


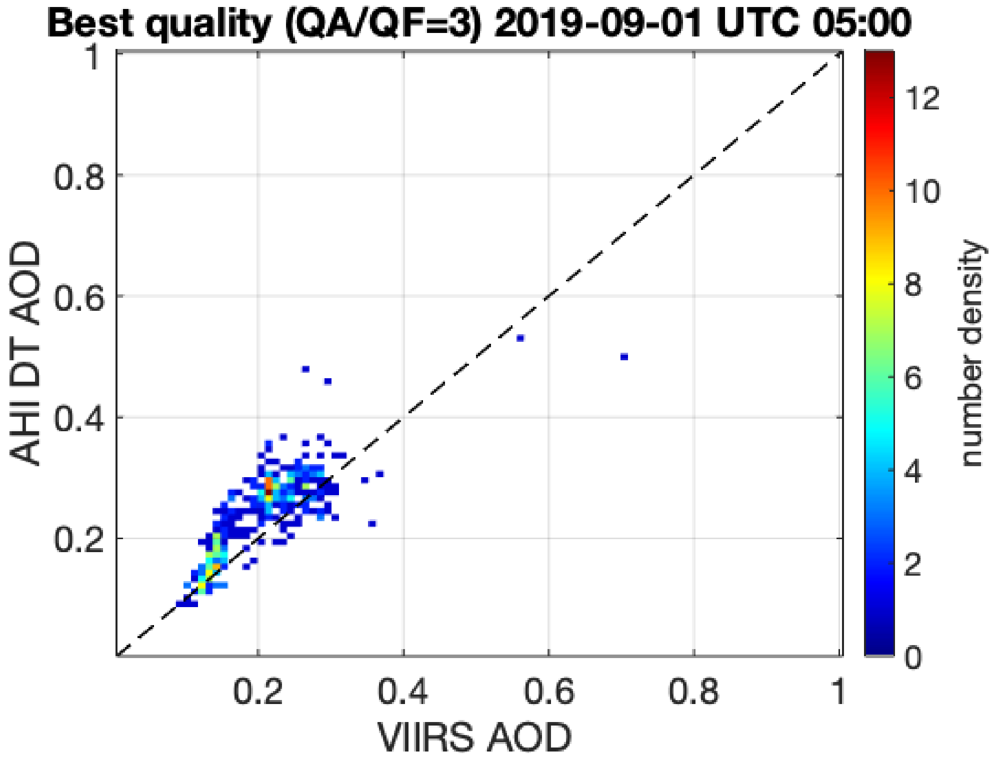
Worldview for validation and field support

- An internal version of worldview is used for both product validation and field experiment support
- Used for the NASA CAMP2Ex field campaign flight planning and post mission science
- ONR provided support for CPEX-AW (geoworldview.ssec.wisc.)
- Custom imagery was developed including aircraft flight tracks and products
- ONR MURI GEO retrieval processed in NRT for CPEX-AW

Geoworldview during CPEX-AW

AHI DT AOD collocated with VIIRS Deep Blue AOD

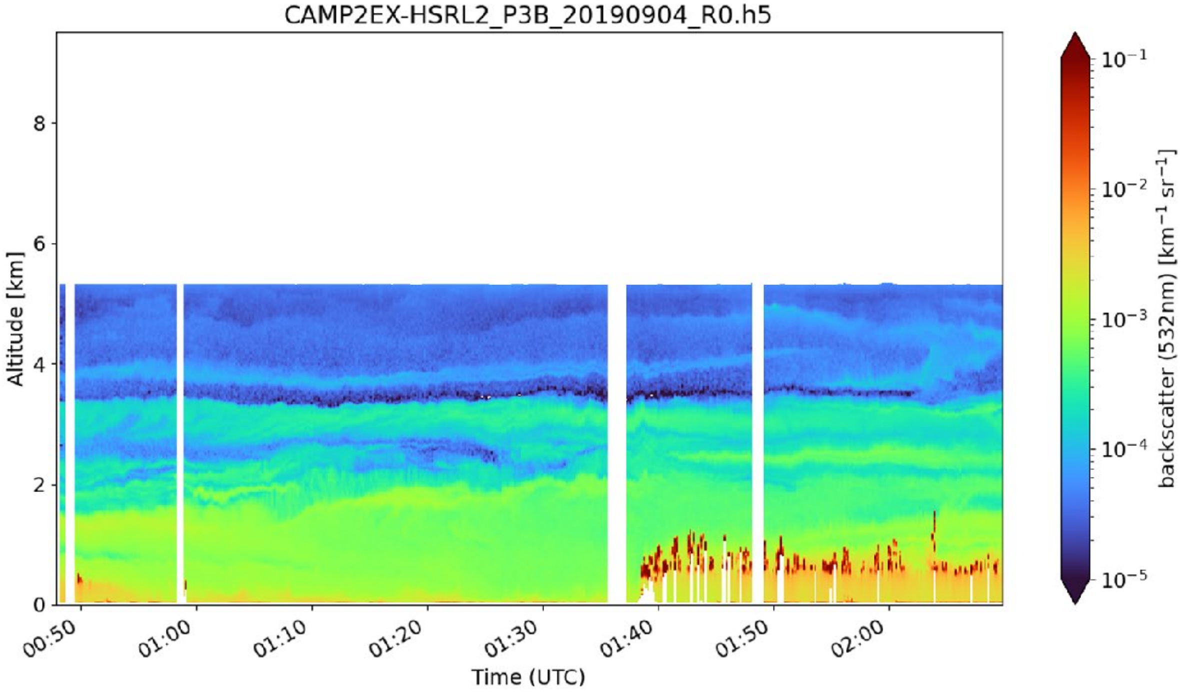


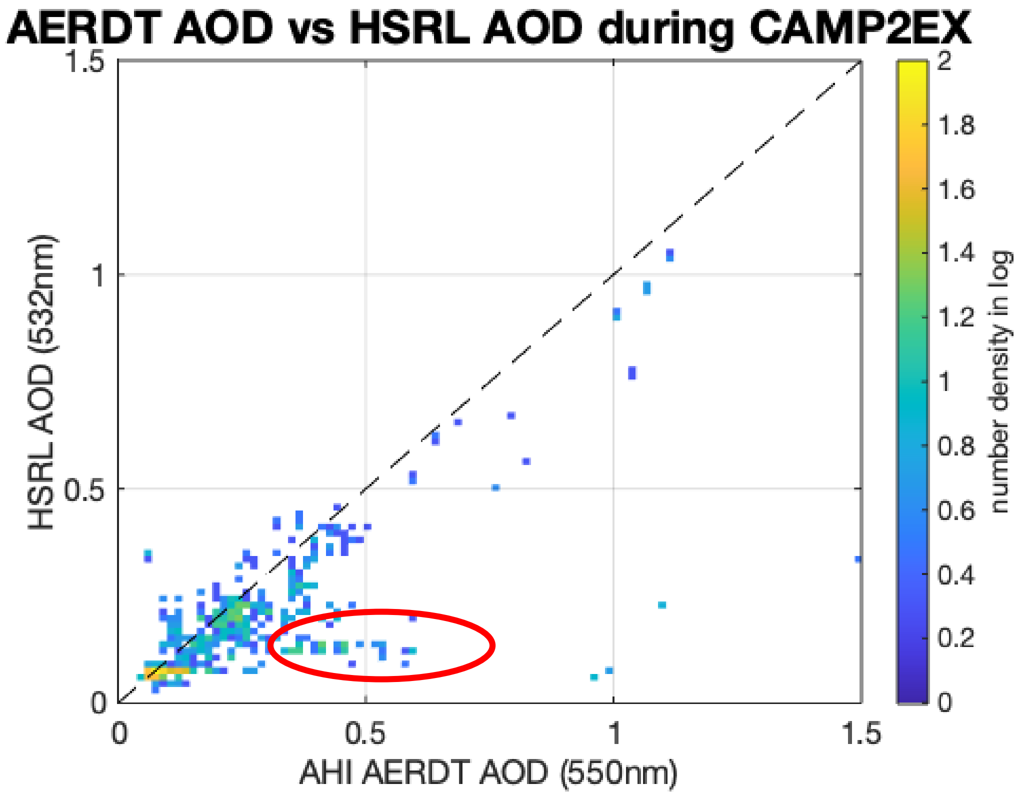


- The **Collopak** software was used to collocate AHI and VIIRS
- Using **Matchmaker**, a combined AHI/VIIRS aerosol match file was created with an example presented for a single granule
- The A-SIPS is processing system is designed to process the collocation and match software in support of long-term statistical inter-comparisons for PoR development and multi-instrument algorithm development

Collocation/Matchfiles (HSRL-2 AHI AOD Validation)

- Updated aircraft match-files which provide the AHI/VIIRS L1b and cloud/aerosol retrievals have been update to include the temporal information provided by AHI
- The files have been delivered to the Langley archive
- Example of AHI/P3-HSRL-2 validation of AOD using the match files





Preliminary: Exploring dust scattering models using collocated LEO/GEO/Aircraft observations

- MURI GEO AOD retrievals allows for flexible radiative transfer and aerosol habits selection
- HSRL-2/HALO HSRL measurements
- Ping Yang dust models
- MURI AOD retrieval
- Demonstrates new capabilities offered by the GEO combined with field campaign aircraft HSRL measurements
- To fully leverage temporal GEO capabilities new dust models are needed
- A spheroid was used in this example (ie ratio is 1/1, received in 2018 from Dr. Yang)
- Hope to collaborate with Dr. Yang's group on exploring new models …