NASA LaRC satellite products and tools for ACTIVATE

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ACTIVATE Science Team Meeting, Nov 7-8 2022

*The **Sat**ellite **C**l**O**ud and **R**adiation Property retrieval **S**ystem

Products

GOES-16 ABI satellite sensor

- Satellite imagery
  - Visible, infrared, water vapor channel (6.2 µm) multi-channel RGB images and animations
- Satellite cloud retrievals
  - Cloud mask and phase (clear, liquid, and ice), cloud top temperature and height (and pressure), base height (and pressure).
  - Cloud optical depth, particle effective size (ice and liquid), water path (ice and liquid), and cloud droplet number concentration
  - Radiative fluxes, aircraft icing potential (of supercooled liquid water).
  - 2-km pixel resolution (nadir) produced every 20 min.

- **CERES MODIS retrievals**
  - 1˚x1˚ daytime cloud retrievals and MERRA-2 reanalysis data archived in the ACTIVATE repository
  - Dataset was used to describe synoptic-scale processes over the ACTIVATE domain (Painemal et al., 2022 JGR).

https://satcorps.larc.nasa.gov

NASA LANGLEY CLOUD AND RADIATION RESEARCH

User Warning, Please read !

Cloud and Radiation Group

References

CERES Algorithms

Satellite Calibration:

Langley Satellite Calibration

Viewers/Tools:

New!! OT Climatology Datasets

SCIAMACHY SBAF

IASI SBAF

Spectral Response Function

Contrail Forecast

NOAA AVHRR Viewer

MODIS Viewer

Mid-Atlantic NEXRAD

ARM-SGP NEXRAD

Angles Viewer

Plot RAP Sounding

Satellite Overpass Predictor

Gridded VISST Products

GEO-TISA

AVHRR-CDR

New!! US Aircraft Icing

Supported Programs:

ASR Atmospheric System Research

Field Experiments:

New!! CPEX-AW / CV

New!! HIWC-2022

New!! ACCLIP

New!! ARM-TRACE

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Satellite Imagery And Cloud Products Page

The Satellite ClOud and Radiation Property retrieval System (SatCORPS) is a comprehensive set of algorithms designed to retrieve cloud information from operational and research meteorological satellite imager data. The SatCORPS algorithms have been adapted to utilize imagery from polar-orbiting, geostationary, and precessing-orbit satellites using dedicated satellite intercalibration and spectral correction efforts. This website provides real-time access to cloud retrieval information. This information, in addition to being available in real-time and near-real-time for dedicated and part-time users, expands the frontiers of knowledge and understanding by providing critical data for research in various disciplines. These datasets are available to the American public in the form of both imagery and data-mining-ready binary files. The generation and distribution of these datasets are supported by the NASA CERES and various NASA ROSES programs, as well as the Department of Energy ARM and ASR Programs.

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You can also use our New Home Page

Satellite Imagery and Cloud Product Viewers: Select a domain from the table below to access the satellite channel imagery and cloud products.
Cloud products are derived with VISST/SIST algorithm.
Blue Cell: Real-time domain White Cell: Discontinued/historical domain

FULL-DISK CLOUD PRODUCTS (Real Time)				
GOES-WEST	GOES-EAST	METEOSAT	MET-8	HIMAWARI-8
Merged Global Geostationary Gridded Cloud Products				
GOES-17	GOES-16	INSAT	FY2	MTSAT

CLOUD PRODUCTS				
GOES WEST	GOES EAST	METEOSAT	Misc Domains	AVHRR/MODIS
North America (RR)		AMF-Azores	Indian Peninsula (INSAT-3D)	ARM-SGP
MERGED CONUS		HIWC-Cayenne	MTSAT	Alaska (Direct Broadcast)
ARM-SGP	ARM-SGP	WEST EUROPE	MANUS	Alaska (Relay)
Alaska/NPacific	ARM TRACER	EUROPE	HIWC	ARM-NSA
Alaska/NPacific G1		ARM-NIAMEY	GOES-9	COVE

Real-time and Historical Satellite Imagery Loops: The links from the table below provide access to the real-time (blue cells) and historical image loops for various satellites.

SATELLITE IMAGERY				
N. America GOES-W	N. America GOES-E	Mid-Atlantic US	Southeast US	CONUS
E. Pacific GOES-E	SGP 1KM VIS GOES-E	TWP DARWIN MTSAT	TWP DARWIN FY2C	TWP DARWIN MTSAT & FY2C
CALWater-2/ACAPEX	Florida		GMS-5 TWP	PACS EPIC
Mid-West US (SGP)	Northeast US			
	Pacific/West			

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+ Science Directorate
+ SatCORPS Home

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Cloud Products
+ Large GOES-16 (2021-22)
+ Small GOES-16 (2021-22)
+ GOES-16 (2019)

Satellite Imagery
+ Large GOES-16 (2021-22)
+ Small GOES-16 (2021-22)
+ GOES-16 (2019)

Viewers / Tools
+ Legacy Satellite Predictor

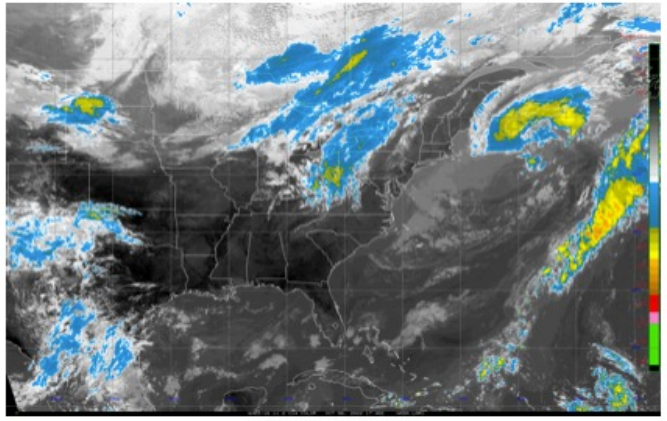
Related Datasets
+ NAAMES

Flight Track Overlay
+ All Planes
+ All Planes (2022)
+ All Planes (2021)
+ All Planes (2020)
+ B200 (All Years)
+ B200 (2021)
+ B200 (2020)
+ Falcon (All Years)
+ Falcon (2021)
+ Falcon (2020)

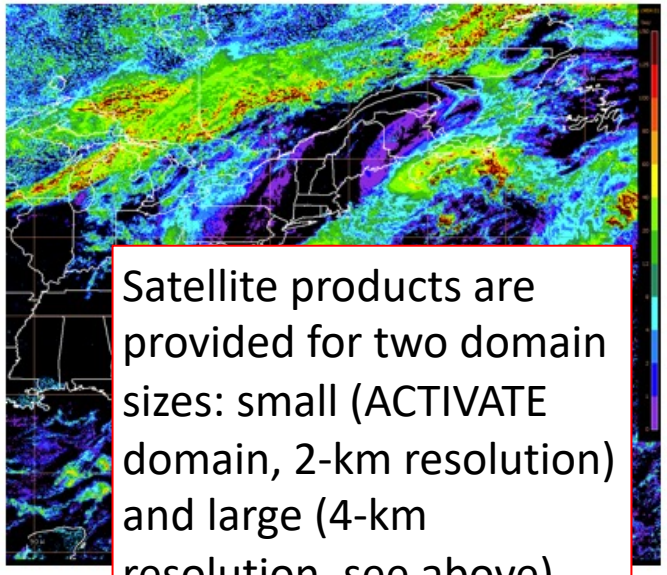
Datasets

Langley SATCORPS group support for Aerosol Cloud meTeorology Interactions oVer the western ATlantic Experiment (ACTIVATE)

Latest Imagery and Products for ACTIVATE Field Experiment



GOES-E Color-IR

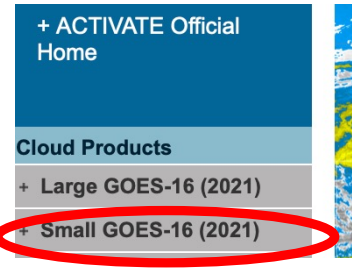


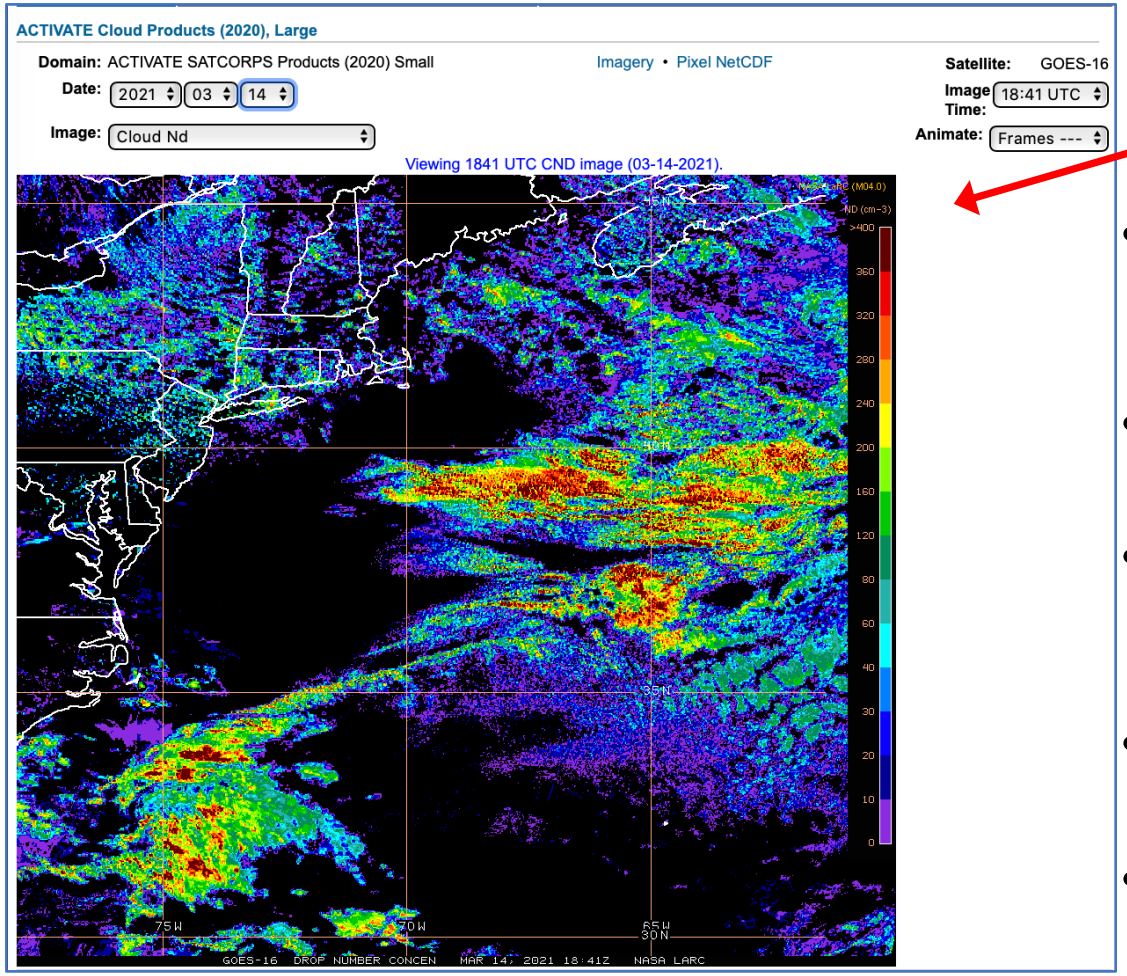
Satellite Imagery
+ 0.6µm Visible
+ 6.2µm WV
+ 11.2µm Infrared
+ 11.2µm Color IR
+ RGB
+ RGB-Night
+ 3.9-11µm BT

Cloud Products
+ Optical Depth
+ Phase
+ Nd
+ LWP
+ RGB
+ CTH (Kft-ASL)
+ Eff. Temp.

Satellite products are provided for two domain sizes: small (ACTIVATE domain, 2-km resolution) and large (4-km resolution, see above)

Visualization tool for “small” domain





Cloud droplet number concentration

- Retrievals and images are available every 20-min for deployment periods.
- For other periods, data are produced every 30-min
- GOES-16 data matched with aircraft tracks will be made available.
- Netcdf files can be downloaded from the ACTIVATE repository:
- https://www-air.larc.nasa.gov/missions/activate/index.html, under the “Satellite” link

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https://satcorps.larc.nasa.gov

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Datasets
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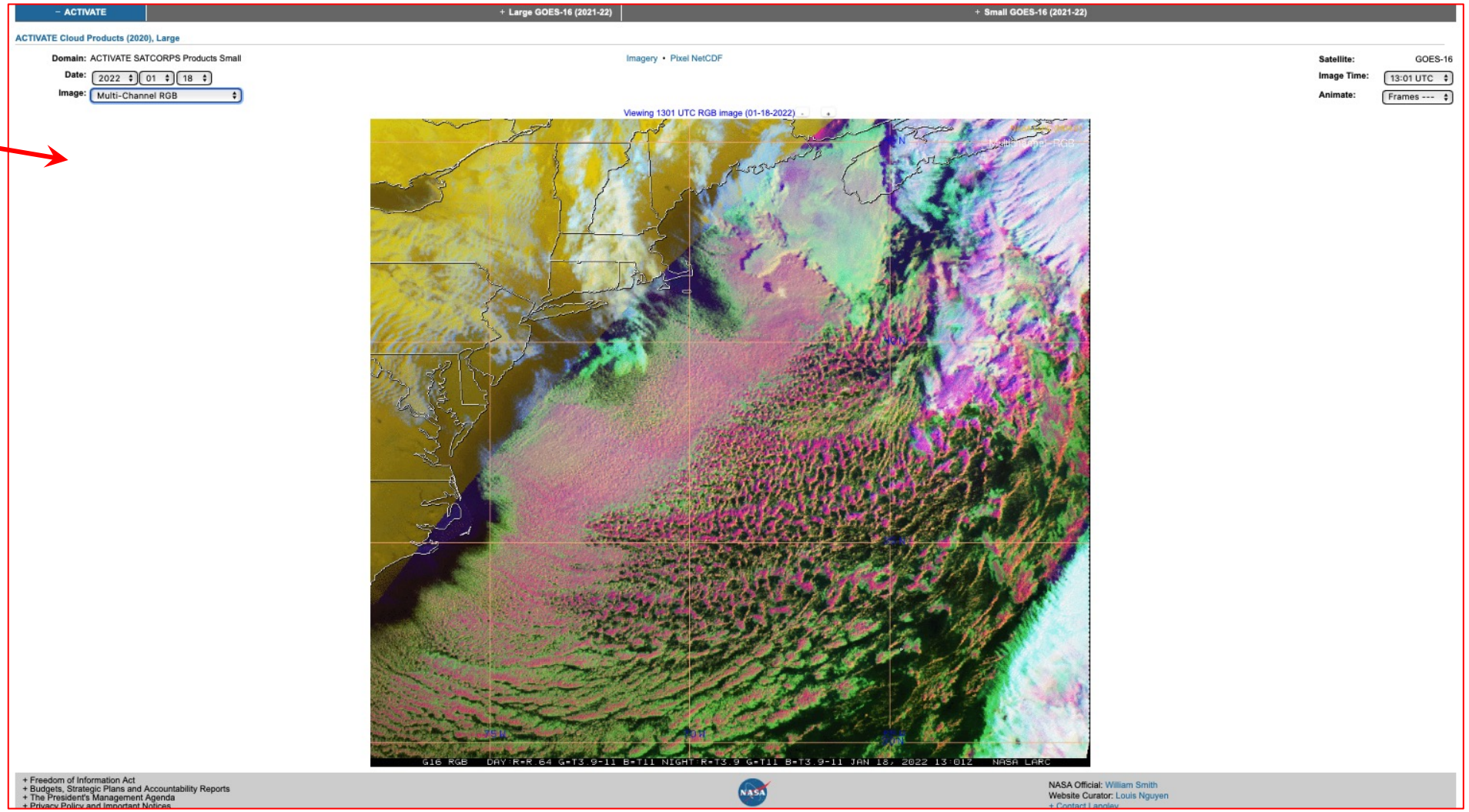
+ Small GOES-16 KML

RGB image



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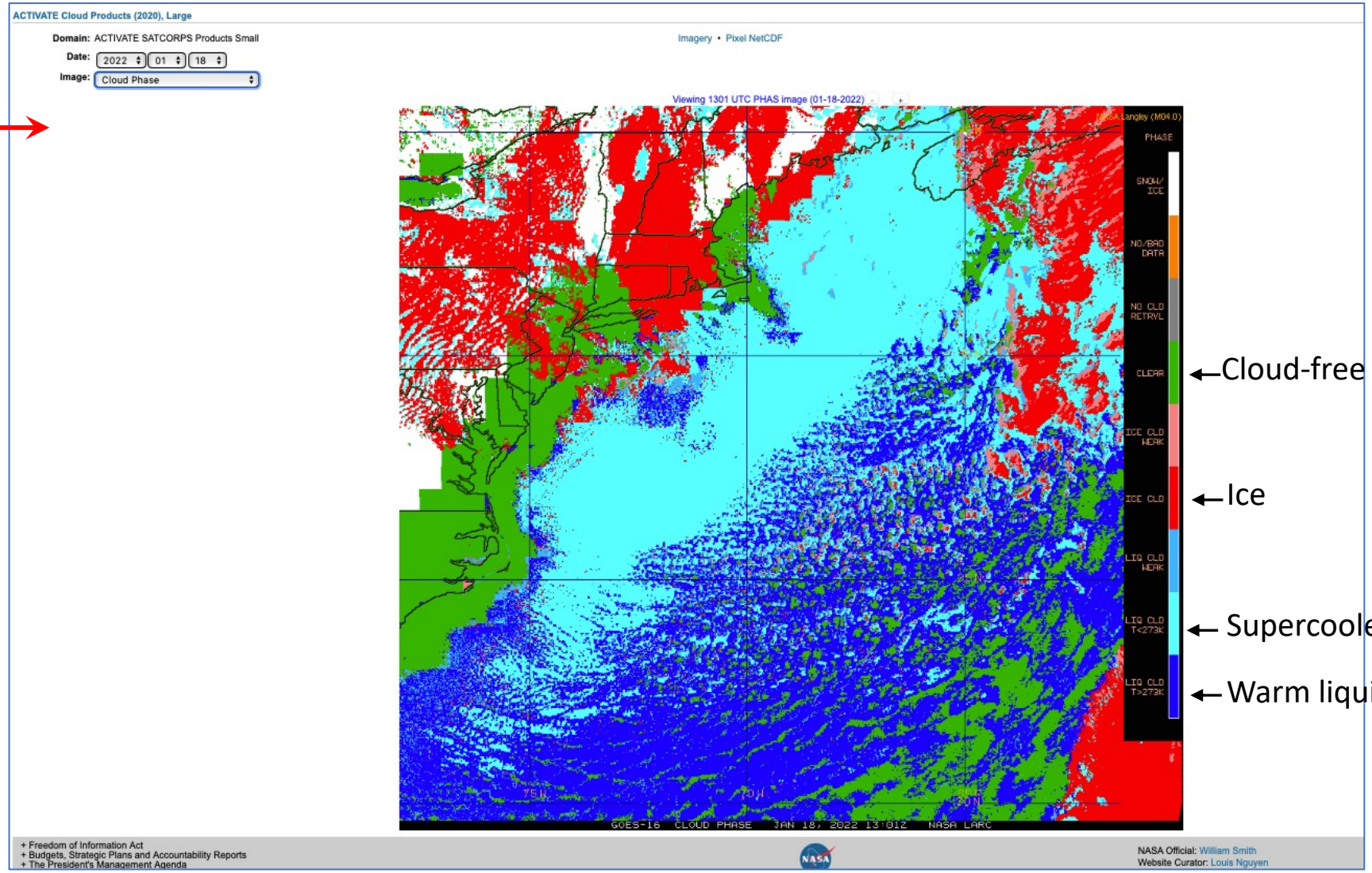
Cloud phase



←Cloud-free

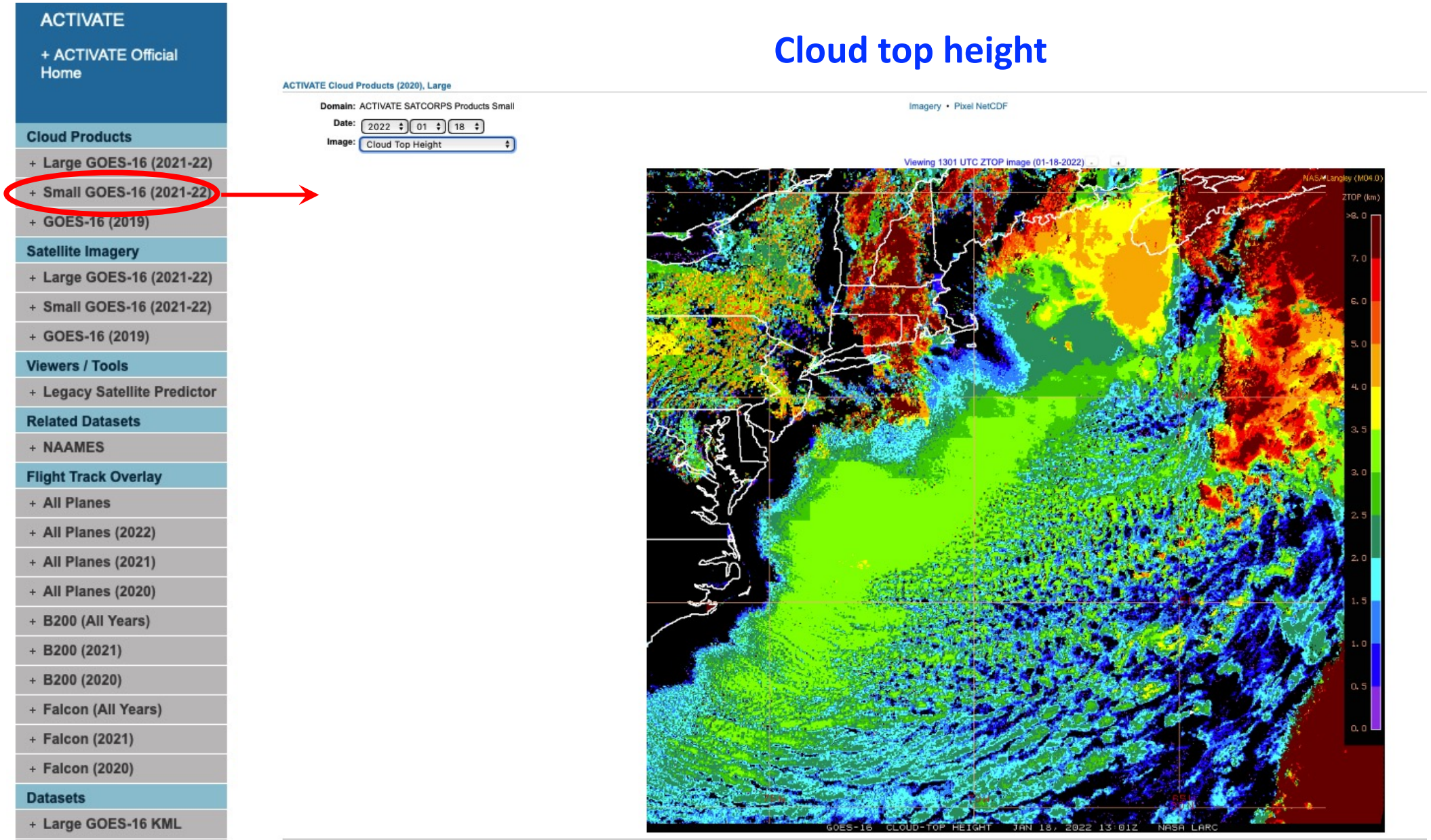
←Ice

← Supercooled liquid

←Warm liquid

https://satcorps.larc.nasa.gov

Cloud top height



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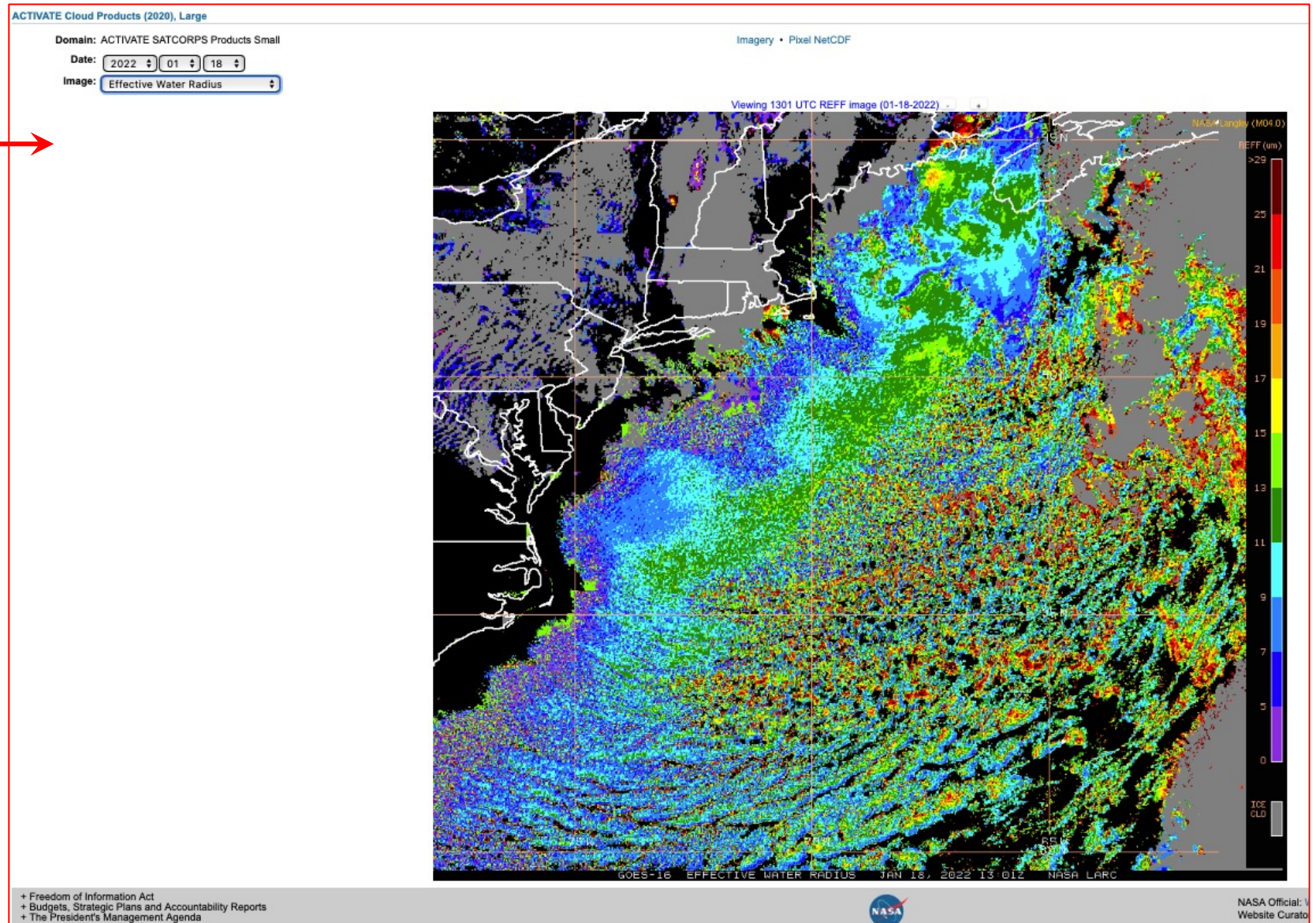
Cloud droplet effective radius



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Cloud droplet number concentration

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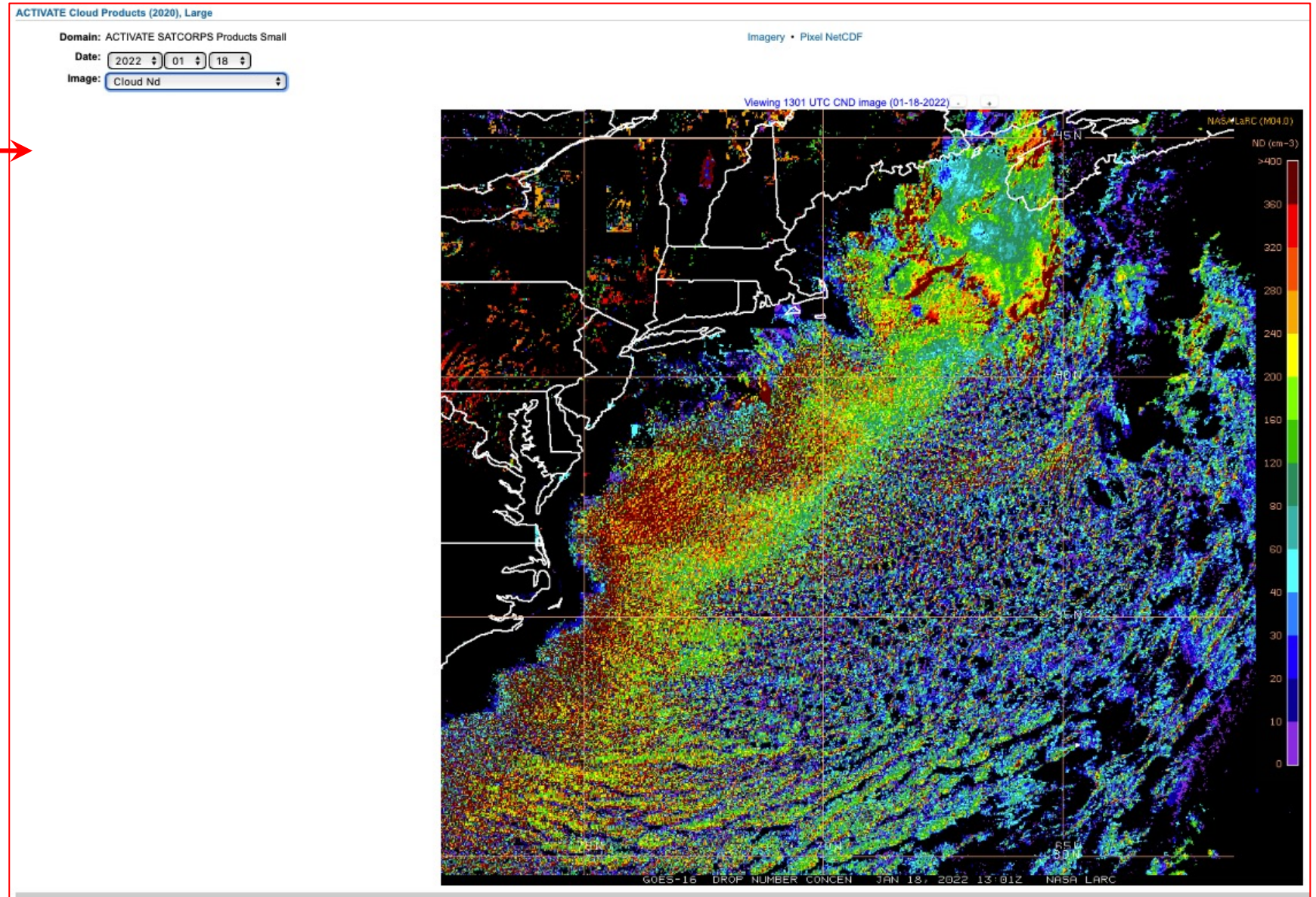


Preliminary assessment of GOES-16 cloud droplet effective radius and number concentration (N_d)

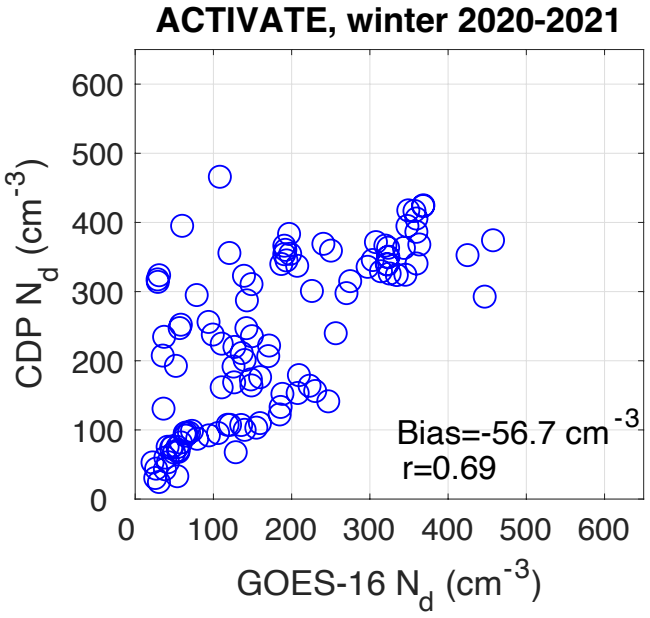
Cloud optical depth

$$N_d = \Gamma_{\text{appr}}^{1/2} \frac{10^{1/2}}{4\pi\rho_w^{1/2}} \frac{\tau^{1/2}}{k\, r_e^{5/2}}$$

Cloud droplet effective radius

Adiabatic increase of water content with height

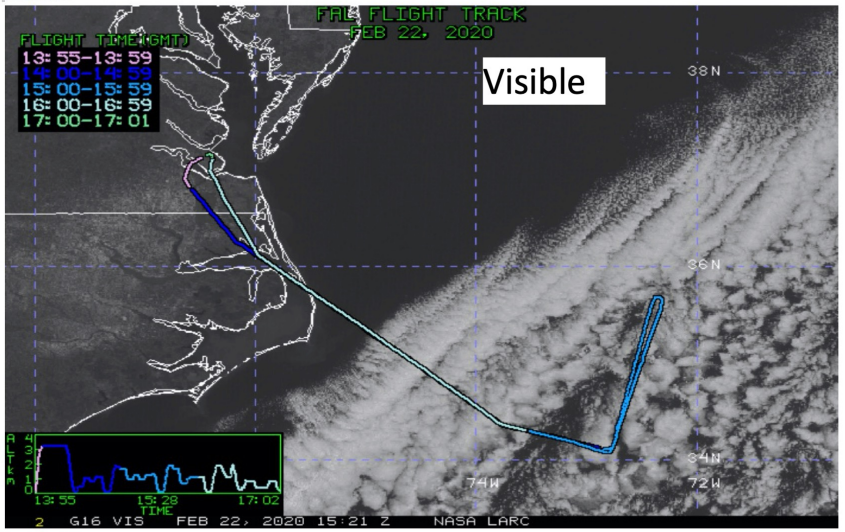
Parameter associated with the width of the droplet size distribution



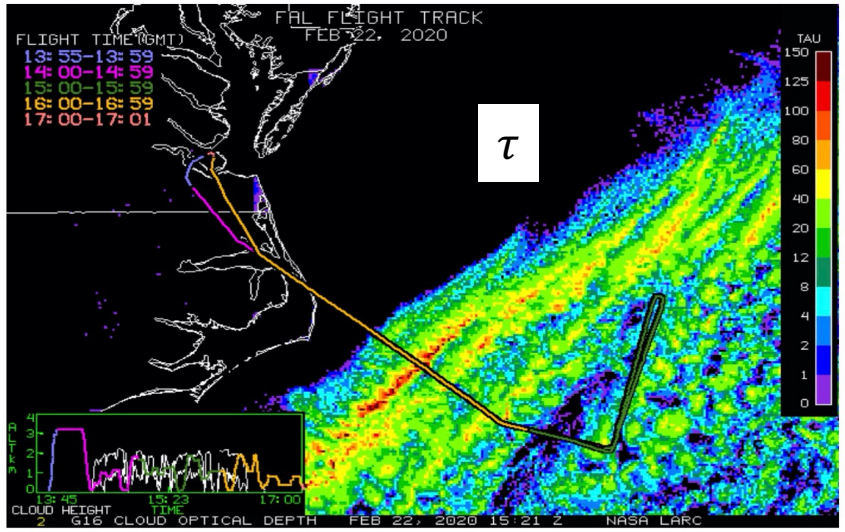
- Satellite N_d is derived using 2-km pixel-level data. 4x4 N_d pixels are averaged before comparing GOES with in-situ data.
- In-situ N_d (CDP and FCDP) are limited to samples with water content ≥0.03 g/m^3. In-situ data are temporally averaged (30-s window).
- GOES and in-situ N_d are matched within 10 min.

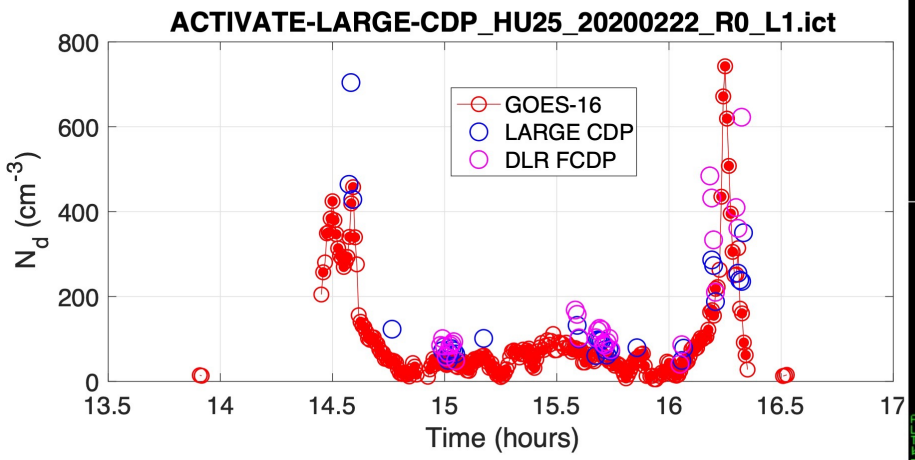
Examples: Postfrontal clouds and closed-cell Sc

Visible

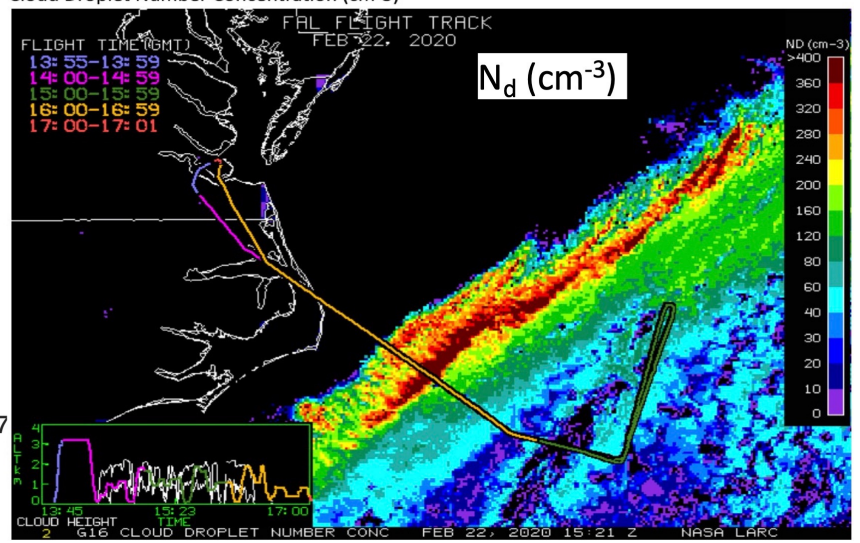


Cloud Optical Depth



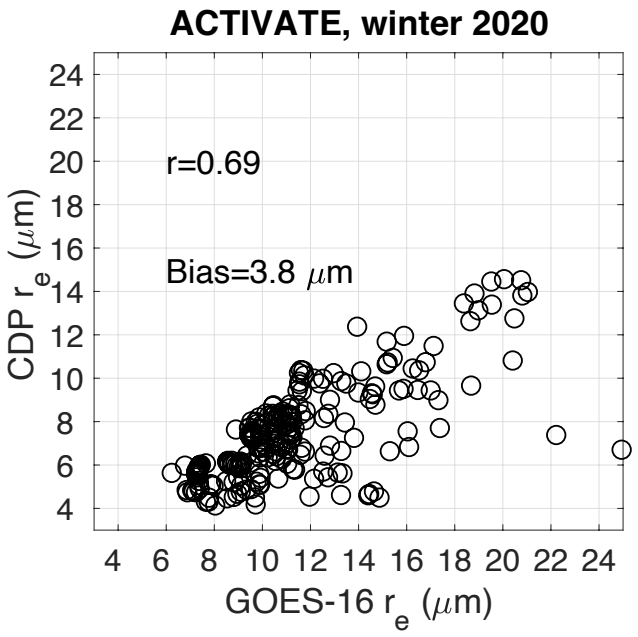


Cloud Droplet Number Concentration (cm-3)

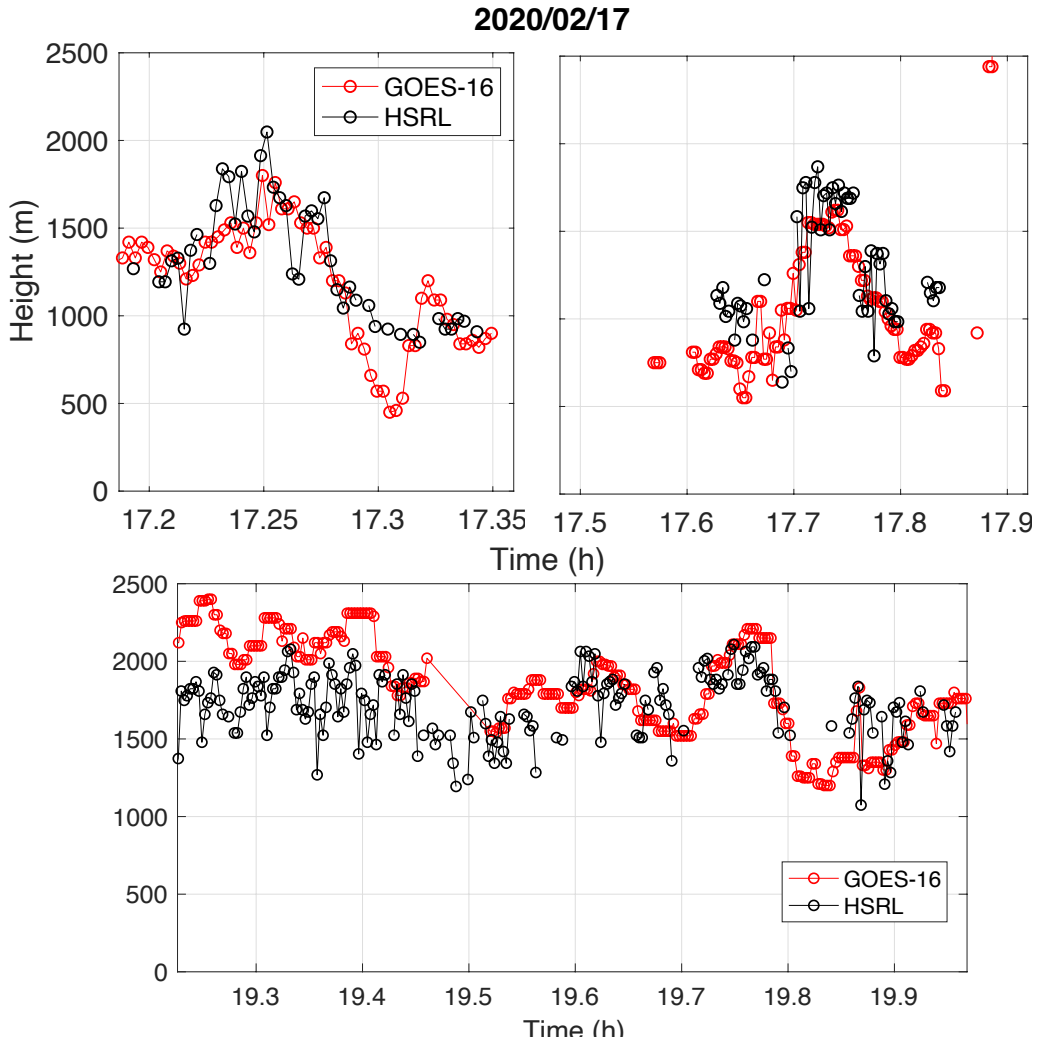


Preliminary assessments: cloud height and droplet effective radius

- **Cloud droplet effective radius**



- **Cloud top height**



- GOES effective radius overestimates the in-situ observation, consistent with previous studies.
- GOES cloud height consistent with the airborne HSRL
- Comparison against RSP retrievals is ongoing.

Final remarks

- GOES-16 retrievals are suitable for synoptic-scale, Lagrangian, and diurnal cycle studies, as well as for model evaluation.
- Pixel-level retrievals can be more uncertain in highly broken scenes. Screening methods can be devised for removing problematic data.
- Retrieval improvements are ongoing, aiming at reducing the retrieved droplet size.