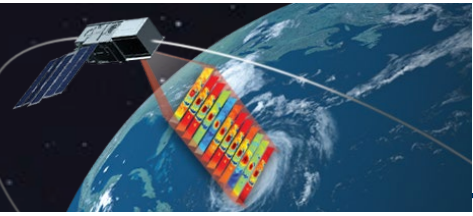


TROPICS Pathfinder & Data Update

Vince Leslie

8 July 2021

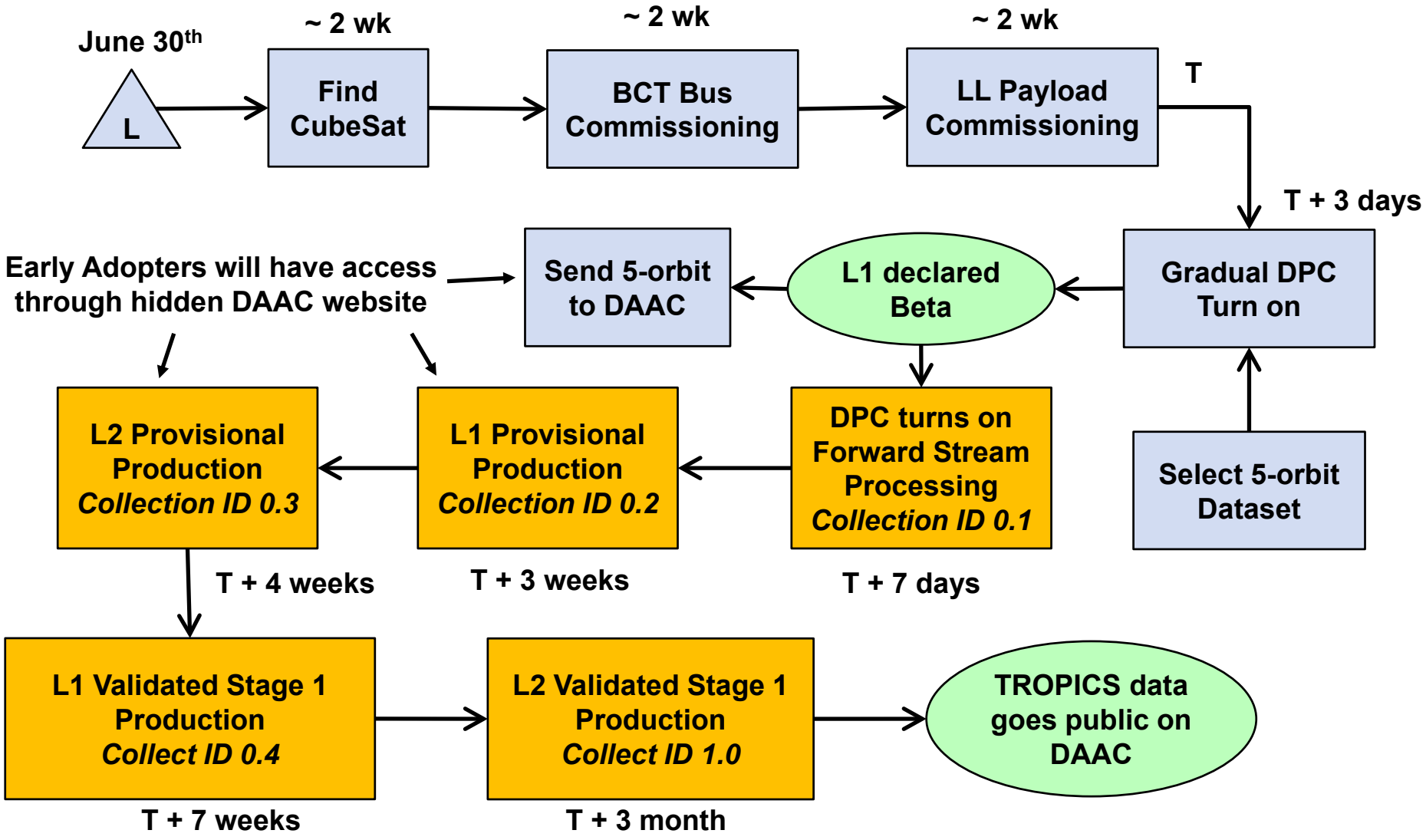
LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

This material is based upon work supported by the National Aeronautics and Space Administration under Air Force Contract No. FA8702-15-D-0001. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration .

Outline

- Pathfinder update and timeline
- Accessing data at GES-DISC
- Communicating status
- Data release summary
- Documentation update

Nominal Pathfinder Timeline



T = Payload commissioning ends

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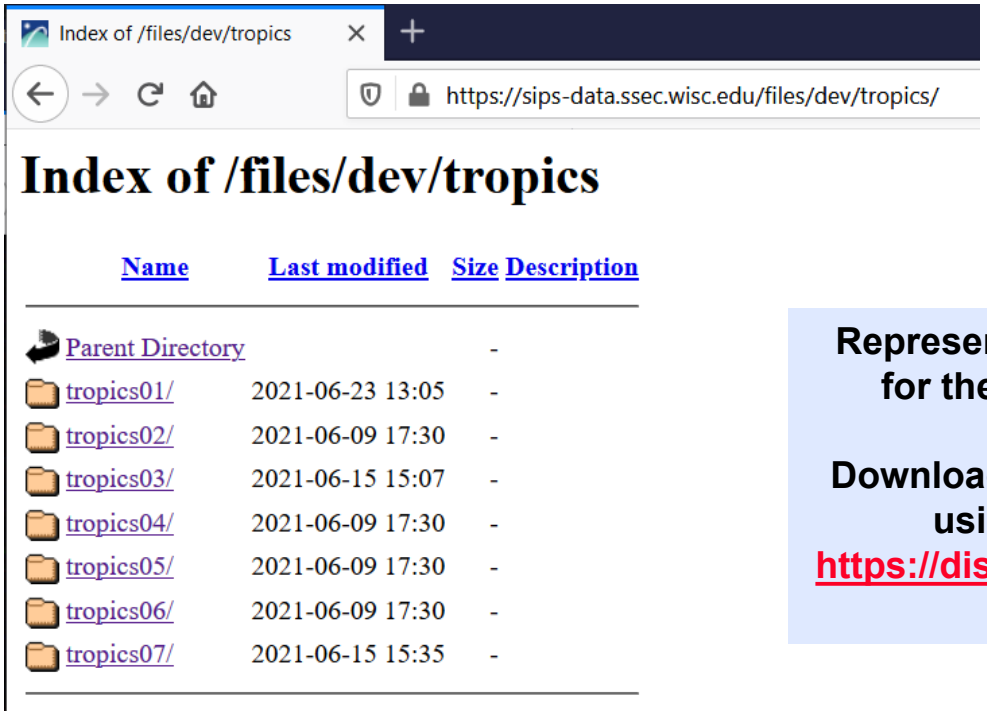
Early Adopters Data Access

Early Adopters will be give a hidden GES-DISC url to access the beta 5-orbit and provisional DPC forward-stream data products



Representative web interface for the hidden DAAC url

Downloads can be automated using curl or wget
https://disc.gsfc.nasa.gov/data-access

Early Adopters will transition to public GES-DISC at validated stage 1 data maturity

Public Data Access

After going public when data reaches validated stage 1, the main GES-DISC search will be enabled

EARTHDATA Find a DAAC

GES DISC Data Collections TROPICS01ANTTL1A_0.1 Feedback Help Login

Atmospheric Composition, *Water & Energy Cycles* and *Climate Variability*

My Dashboard

MERRA-2 reprocessed September 2020 data

Back to search results

Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats

TROPICS Pathfinder L1a Antenna Temperatures (Radiance) V0.1 (TROPICS01ANTTL1A)

View Full-size Image

The "Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats" (TROPICS) mission has a goal of providing nearly all-weather observations of three-dimensional temperature and humidity, as well as cloud ice and precipitation horizontal structure, at high temporal resolution to conduct high-value science investigations of tropical cyclones. The mission comprises a constellation of six identical Space Vehicles (SVs) conforming to the 3U form factor and hosting a passive microwave spectrometer payload. This dataset is produced from the Pathfinder satellite, a single 3U small satellite, which has launched previous to the constellation, on a sun-synchronous orbital plane.

Each SV hosts an identical high-performance spectrometer named the TROPICS Millimeter-wave Sounder (TMS) that will provide temperature profiles using seven channels near the 118.75-GHz oxygen absorption line, water vapor profiles using three channels near the 183-GHz water vapor absorption line, imagery in a single channel near 90 GHz for precipitation measurements (when combined with higher resolution water vapor channels), and a single channel near 205 GHz that is more sensitive to cloud-sized ice particles.

This dataset is from the Pathfinder satellite, as the Beta version of the Level 1a geolocated antenna temperatures (radiance) in units of kelvins that are timestamped to UTC and are reported at native spatial resolutions. Each TROPICS netCDF file contains a granule of data with 81 spots and approximately 2880 scans, where a granule is defined as an orbit's worth of data. ...less

Data Access

Online Archive

Earthdata Search

OPENDAP

Product Summary | Data Citation | Documentation

ALGORITHM THEORETICAL BASIS DOCUMENT (ATBD): TROPICS L1 Radiance ATBD

USER'S GUIDE: TROPICS User Guide

PROJECT HOME PAGE: TROPICS Mission Page

For further information or assistance click 'Feedback' (upper right) or email the Help Desk at: gsfc-dl-help-disc@mail.nasa.gov

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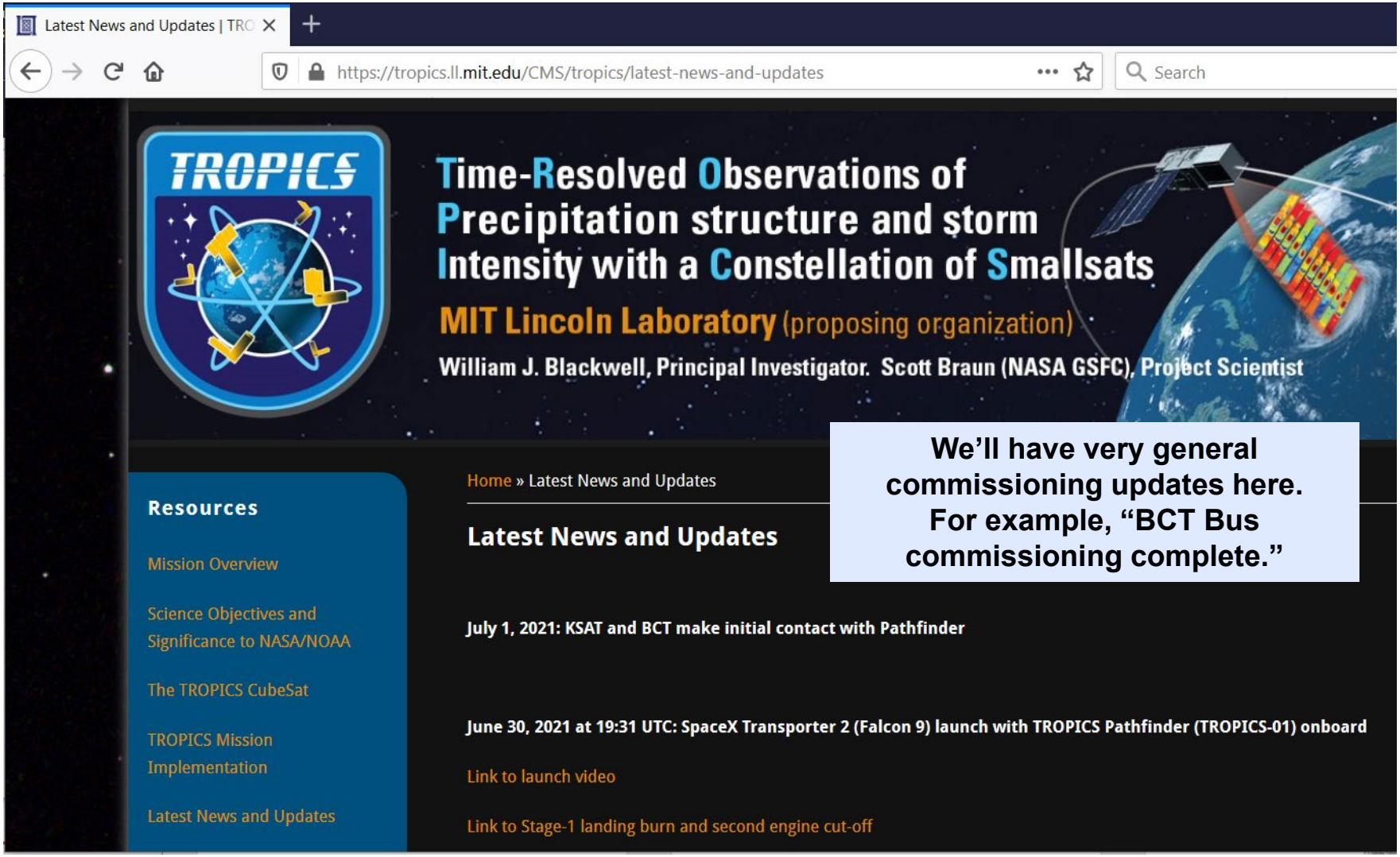
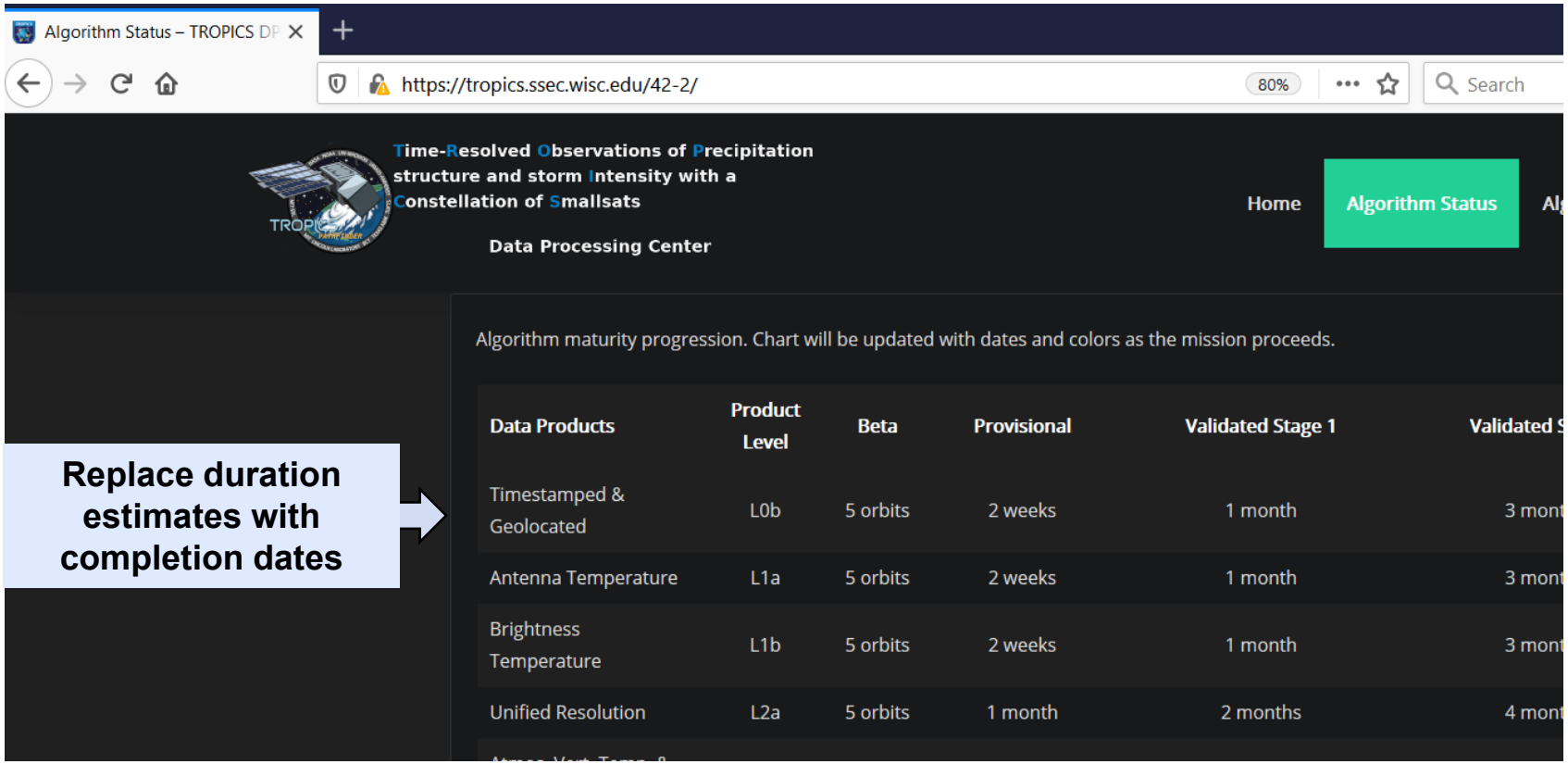
LL TROPICS Website



We'll have very general commissioning updates here. For example, "BCT Bus commissioning complete."

DPC Data Product Maturity Status Website

Using this public website to communicate the status of DPC data product maturity



Replace duration estimates with completion dates

https://tropics.ssec.wisc.edu

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Mission Data Release Plan

- Instrument Team remade HNR proxy dataset with latest filename and variable format (Release 5); will host on Applications website
- Early Adopters will have access to the beta five-orbit dataset to review data format
- Early Adopters will have access to provisional data stream from operational DPC/DAAC
- Early Adopters will have to use the DAAC hidden url for beta and provisional, and then transition to the normal GES-DISC access for validated
- The public will have access to the validated stage 1 data products through the normal GES-DISC landing page

Other Data Formats

- **GIBS/Worldview Status**
  - **DPC made sample GIBS files from old proxy data, and will soon repeat on the latest HNR release**
  - **Continued testing when the 5-orbit files are available**
  - **Target operational delivery to NASA Worldview starting when public can access data (internal testing on UWisc-M Worldview)**

- **BUFR Status**
  - **DPC will provide BUFR to NWP community**
  - **Presently developing on example files, and will also test on the 5-orbit dataset**
  - **DPC will initially provide radiances for a couple of channels in order for end users to review and provide feedback**

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L1 Radiance ATBD TOC

L1 ATBD and Data Products User Guide are under NASA Release Review.
When ready, GES-DISC will provide Early Adopters a web link to documents

Contents

TROPICS Data Users Guide TOC

Backup

GES-DISC Output Filenames

DAAC Short Name	Proposed changes
TROPICS0XANTTL1A	TROPICS03.ANTT.L1A.Orbit00119.V01-00.ST20190408-204530.ET20190408-222035.CT20210101-214129.nc
TROPICS0XBRTTL1B	TROPICS03.BRTT.L1B.Orbit00119.V01-00.ST20190408-204530.ET20190408-222035.CT20210101-214129.nc
TROPICS0XURADL2A	TROPICS01.URAD.L2A.Orbit00000.V01-00.ST20050806-052500.ET20050806-053458.CT20201028-170800.nc
TROPICS0XMIRSL2B	TROPICS01.MIRS.L2B.Orbit00000.V01-00.ST20050804-0545000.ET200508040554580.CT202011091628526.nc
TROPICS0XPRPSL2B	TROPICS01.PRPS.L2B.Orbit00000.V01-00.ST20050805-053500.ET20050805-054458.CT20200810-193035.nc
TROPICS0XTCIEL2B	TROPICS01.TCIE.L2B.Orbit00000.V01-00.OT20050804-011500.AL012019.CT20201001-121314.nc
TROPICS0XHISAL2B	TROPICS01.HISA.L2B.Orbit00000.V01-00.OT20050804-011500.AL012019.CT20201001-121314.nc

0X is SV ID that ranges from 01 to 07 (01 is Pathfinder)

Filename Convention

<mission_prefix><spacecraft_id>.<algorithm>.L<level>.Orbit<orbit>.V<version>.ST<start>.ET<end>.CT<creation>.nc

<mission_prefix><spacecraft_id>.<algorithm>.L<level>.Orbit<orbit>.V<version>.OT<overpass>.<ATCF id>.CT<creation>.nc

Filename part	Description
mission_prefix	TROPICS
spacecraft_id	Spacecraft ID from 01 to 07
algorithm	The algorithm or data product name (ANTT, BRTT, URAD, MIRS, PRPS, TCIE, & HISA)
level	The level identifier (1A, 1B, 2A, or 2B)
orbit	The orbit number with five digits
version	Algorithm version number XX-YY following XX.YY semantic versioning methodology with XX is the major version number and YY is the minor

Filename Convention

Filename part	Description
start	The data start time in YYYYMMDD-HHMMSS date/time format
end	The data end time in YYYYMMDD-HHMMSS date/time format
overpass	The overpass time in YYYYMMDD-HHMMSS date/time format
ATCF id	The ATCF ID taken from the ATCF -a/b deck files used to generate the product. The ATCF ID includes the basin abbreviation (AL, EP, CP, WP, IO, SH), the storm number, and the year. The storm number is always a 2-digit number between 01 and 49. For invests, the number is from 90 to 99. The year is in YYYY format.
creation	The file creation time in YYYYMMDD-HHMMSS date/time format

CRTM Coefficient Update

- NOAA/JCSDA delivered Pathfinder CRTM coefficients using the measured Spectral Response Functions
- NOAA implemented a new “fixed” cross-track polarization scheme
- NOAA is also working on scattering up to 206 GHz

Data Product Maturity

- TROPICS data products will loosely follow the NASA Science data maturity levels
- Beta: Products intended to enable users to gain familiarity with the parameters and the data formats.
- Provisional: Product was defined to facilitate data exploration and process studies that do not require rigorous validation. These data are partially validated and improvements are continuing; quality may not be optimal since validation and quality assurance are ongoing.
- Validated: Products are high quality data that have been fully validated and quality checked. These are publication quality data with well-defined uncertainties, but they are also subject to continuing validation, quality assurance, and further improvements in subsequent versions. There can be four stages of validated as the validation dataset grows large enough to be statistically significant in a variety of conditions

TROPICS Data Maturity Matrix

Data Products	Level	Beta	Provisional	Validated Stage 1	Validated Stage 2
Timestamped & Geolocated	L0b	5 orbits	2 weeks	1 month	3 months
Antenna Temperature	L1a	5 orbits	2 weeks	1 month	3 months
Brightness Temperature	L1b	5 orbits	2 weeks	1 month	3 months
Unified Resolution	L2a	5 orbits	1 month	2 months	4 months
Atmos. Vert. Temp. & Moisture Prof.	L2b	5 orbits	1 month	3 months	5 months
Instant. Surf. Rain Rate	L2b	1 week	2 months	6 months	12 months
TCIE TC Intensity (MSLP & MSWS)	L2b	3 months (~12 TC)	6 months (full 2021 NATL season)	18 months (after 2022 NATL season)	30 months (after 2023 NATL season)
HISA TC Intensity (MSLP & MSWS)	L2b				

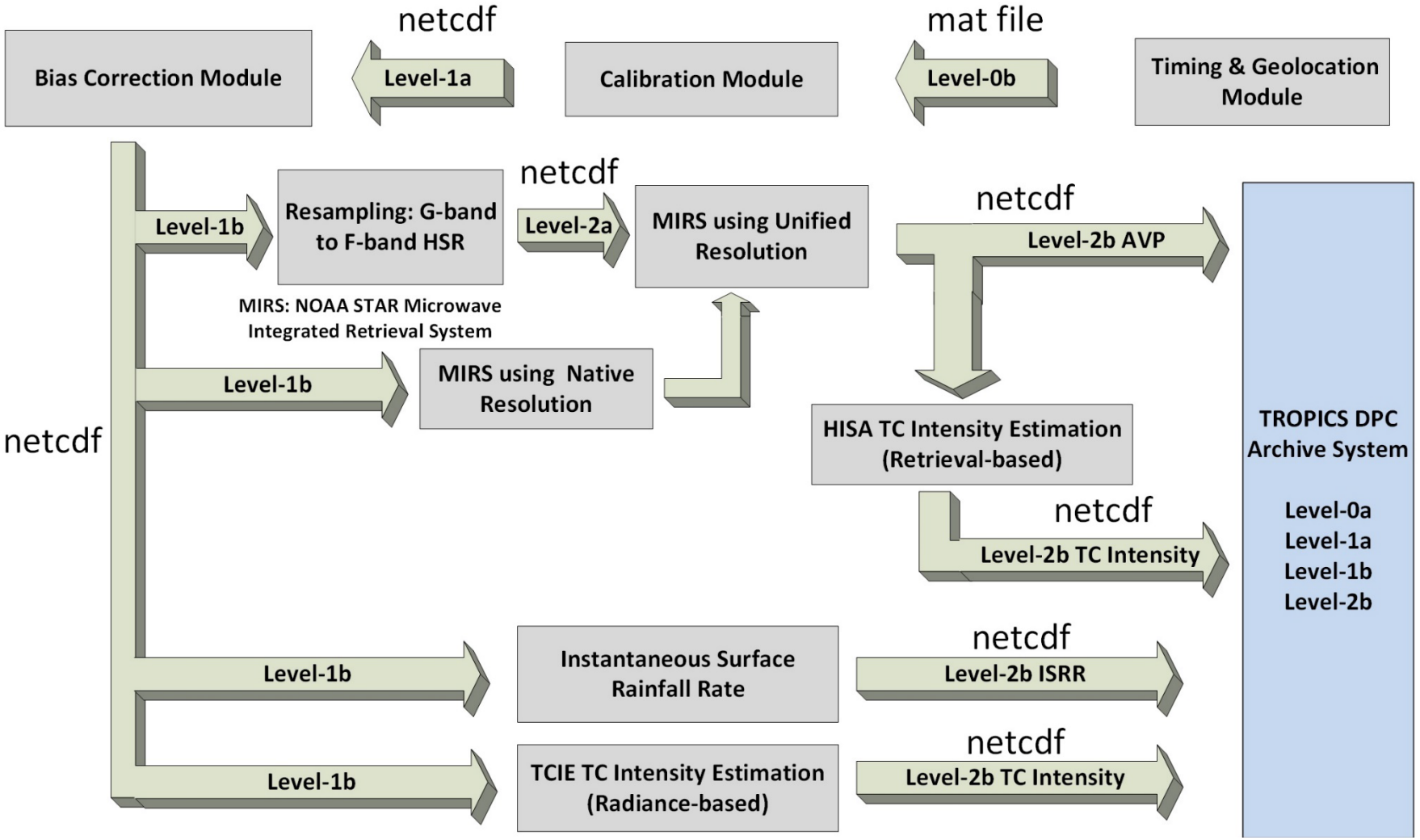
Limited access to Early Adopters

DAAC public release

TROPICS Data Products

Data Product Level Designation	Data Product Description	Team Member (Org.)
Level 0	raw CCSDS payload and telemetry from space vehicles	Shawn Donnelly (LL)
Level 1a	Timestamped, geolocated, calibrated antenna temperature	Vince Leslie (LL)
Level 1b	Timestamped, geolocated, calibrated brightness temperature with bias removed	Vince Leslie (LL)
Level 2a	Spatially resampled (i.e., collocated) G-band brightness temperature (to F-band resolution)	Ralf Bennartz (UWisc-Madison/Vanderbilt)
Level 2b MIRS "AVP"	Atmospheric Vertical Temperature Profile [Kelvin]	Tom Greenwald (UWisc-Madison) & Ralf Bennartz
	Atmospheric Vertical Moisture Profile [g/kg]	Tom Greenwald & Ralf Bennartz
PRPS/GPROF	Instantaneous Surface Rain Rate [mm/hr]	Toshihisa Matsui & Chris Kidd
TCIE & HISA	TC Intensity: Minimum Sea-Level Pressure [mb]	A) Derrick Herndon & Chris Velden (UWisc-Madison) B) Galina Chirokova (CSU/CIRA) & Mark DeMaria (NHC)
	TC Intensity: Maximum Sustained Wind [m/s]	A) Derrick Herndon & Chris Velden B) Galina Chirokova & Mark DeMaria

TROPICS Data Products Flowchart

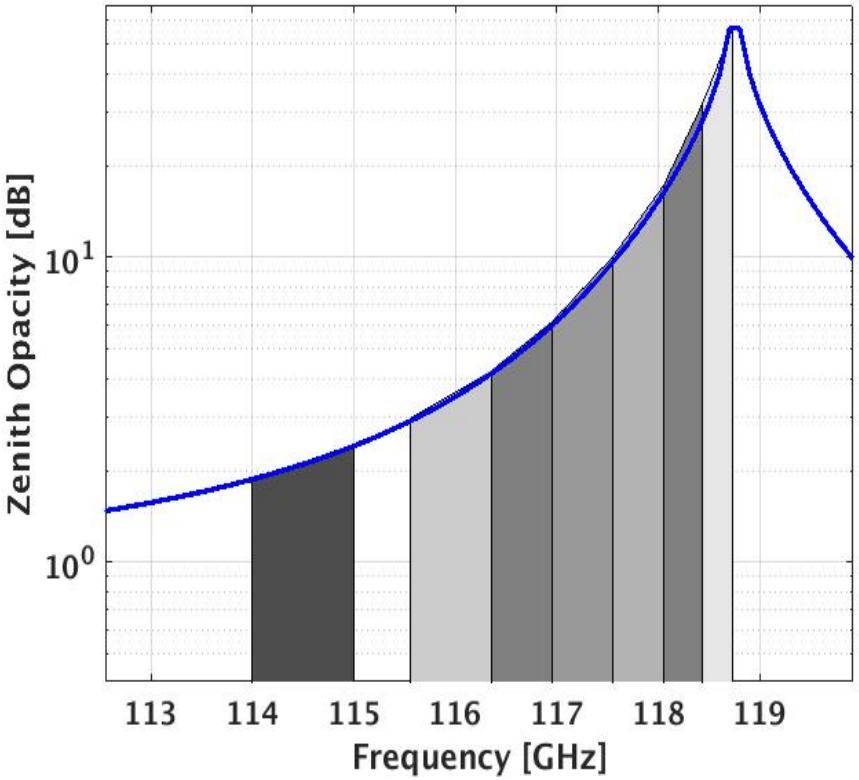


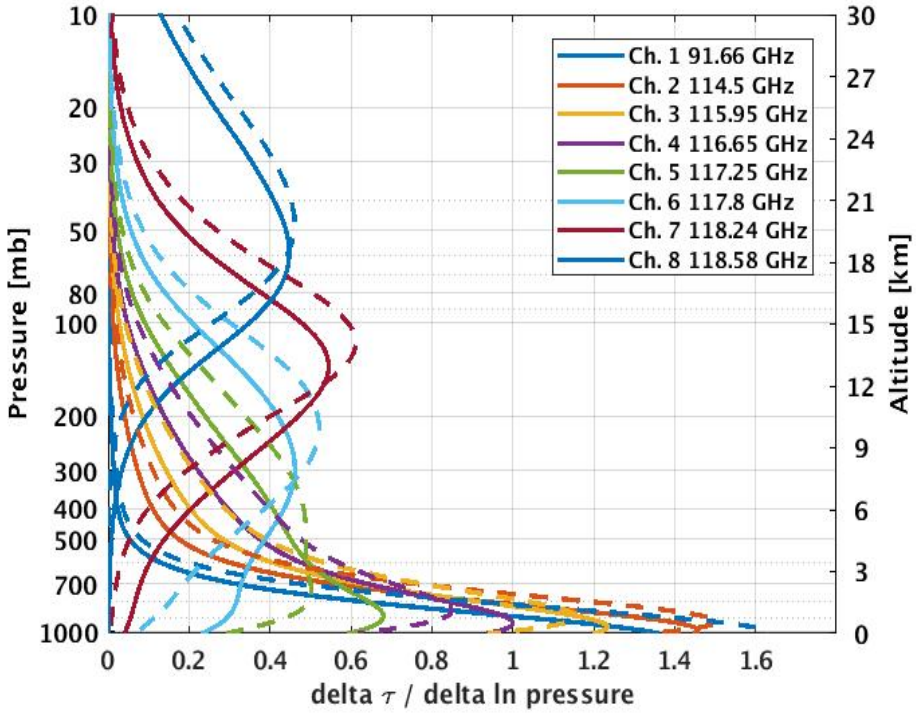
TROPICS Channel Set

TROPICS Chan.	Center Freq. (GHz)	Bandwidth (GHz)	RF Span (GHz)	Beamwidth (degrees) Down/Cross	Nadir Footprint Geometric Mean (km)*	Expected NEdT (K)
1	91.656 ± 1.4	1.000	89.756-90.756, 92.556-93.556	3.0/3.17	29.6	0.67
2	114.50	1.000	114.00-115.00	2.4/2.62	24.1	1.03
3	115.95	0.800	115.55-116.35	2.4/2.62	24.1	0.90
4	116.65	0.600	116.35-116.95	2.4/2.62	24.1	1.12
5	117.25	0.600	116.95-117.55	2.4/2.62	24.1	1.03
6	117.80	0.500	117.55-118.05	2.4/2.62	24.1	1.03
7	118.24	0.380	118.05-118.43	2.4/2.62	24.1	1.12
8	118.58	0.300	118.43-118.73	2.4/2.62	24.1	1.12
9	184.41	2.000	183.41-185.41	1.5/1.87	16.1	0.78
10	186.51	2.000	185.51-187.51	1.5/1.87	16.1	0.78
11	190.31	2.000	189.31-191.31	1.5/1.87	16.1	0.71
12	204.8	2.000	203.8-205.8	1.45/1.83	15.6	0.78

WJ, Blackwell, Braun, S, Bennartz, R, et al. An overview of the TROPICS NASA Earth Venture Mission. *Q J R Meteorol Soc*. 2018; 144 (Suppl. 1): 16– 26. https://doi.org/10.1002/qj.3290

TROPICS W/F-band Temperature Weighting Functions

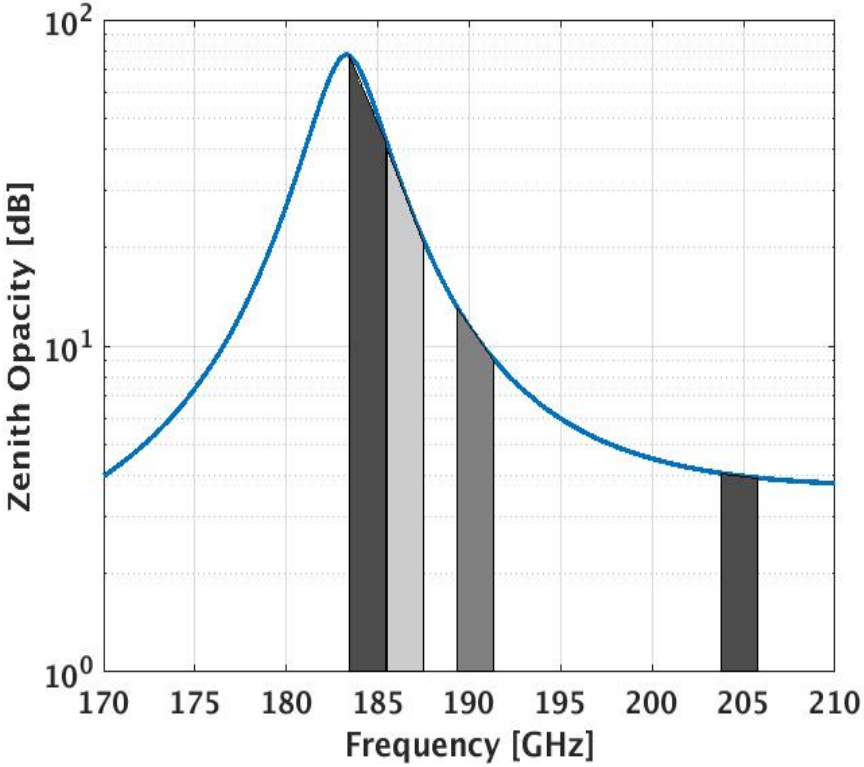




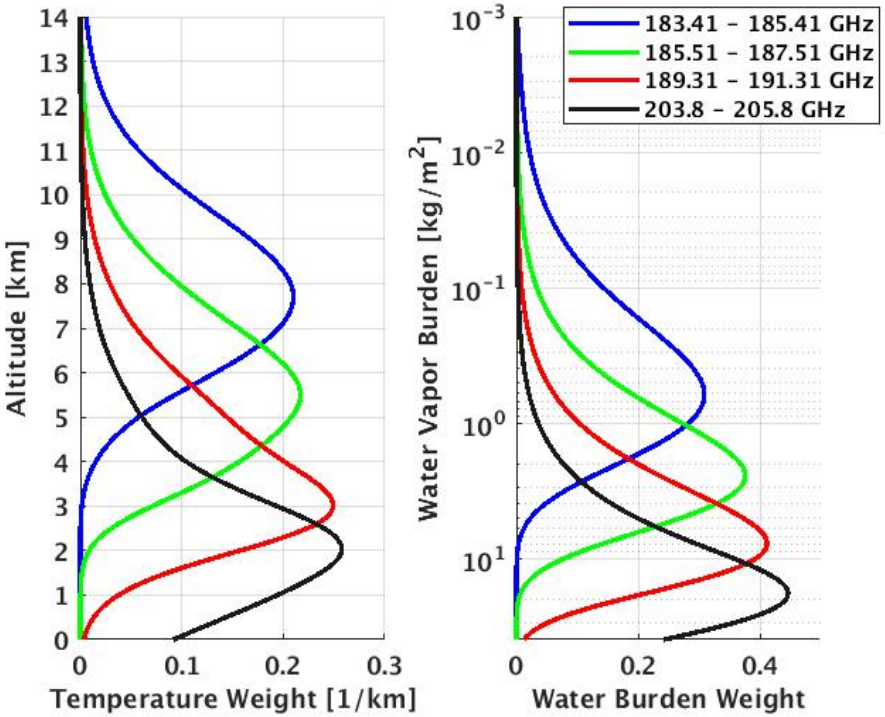
Solid are nadir and dashed are 50°
US 1976 Tropical Standard Atmosphere

TROPICS

TROPICS G-band Weighting Functions

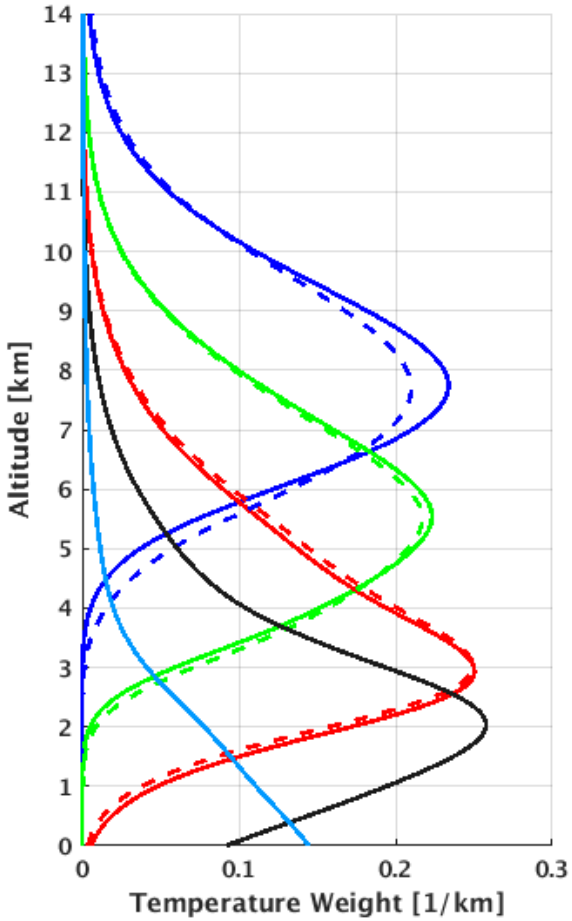


TROPICS

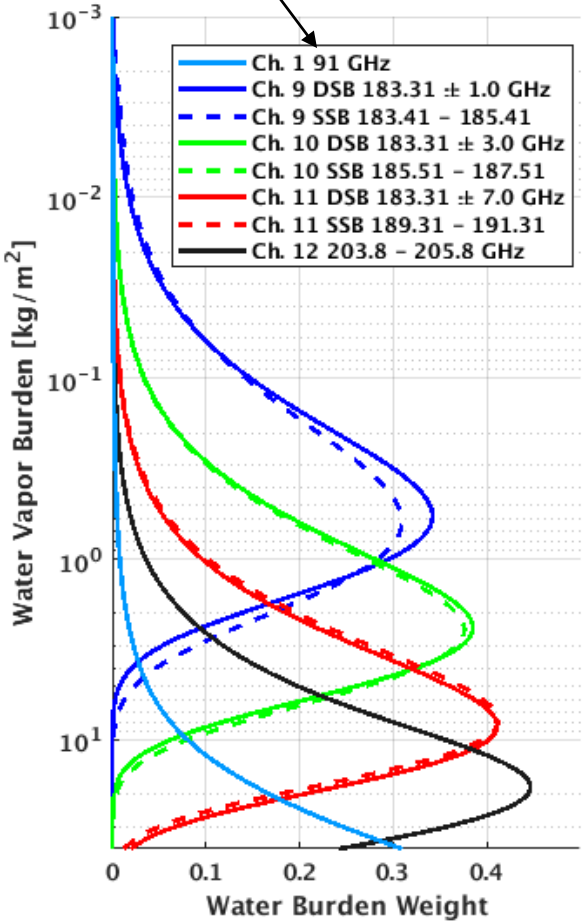


Nadir angle
US 1976 Tropical Standard Atmosphere

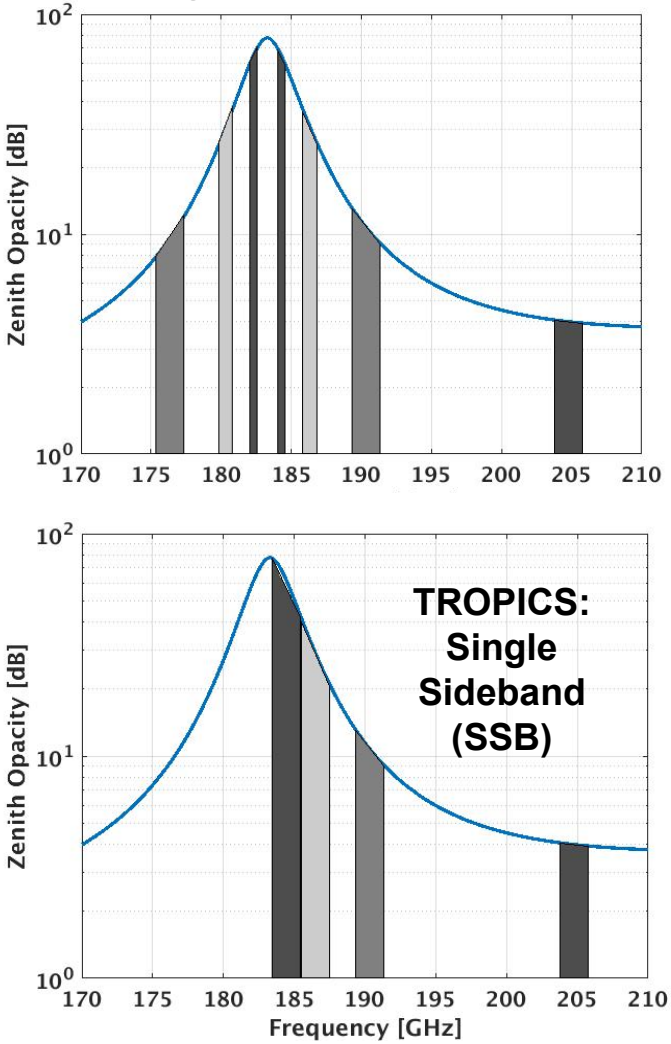
G-band: Converting to Heritage Sensors



Mapping between TROPICS and Heritage



Heritage: Double Sideband (DSB)



US Standard Tropical 1976

TROPICS Scan Profile

Characteristic	Units	Value
Rotation Period	Sec.	2
Maximum Earth View Sector Angle	Degrees	± 60
Scan Type	N/A	Constant velocity (scanning during integration)
Integration time	Seconds	1/120
Number of Earth View Sector Measurements	N/A	81 per scan (one at nadir) at 1.5 deg. separation
Altitude	Km	500-600