



SATELLITE OPERATIONS

TCORF/IHC Conference 2023 Miami FL
NOAA/NESDIS Update (GOES-18/NOAA-21/Non NOAA satellites)

Wednesday, March 8, 2023

Joe Fiore Joseph.Fiore@noaa.gov

**Enterprise User Services Coordinator
Satellite Products and Services Division
NOAA / NESDIS / OSPO**

Slide support and creation:

**Steve Superczynski, Matt Seybold, Tom Feroli, Elizabeth Kline, Jessica Levine,
Jason Taylor, Dave Donahue, Shuang Qiu, Zhao Cheng**



Outline

- User Services Update
- GOES Constellation Status
- GOES-18 (GOES-WEST) Plans & Schedule
- GOES-17 Drift and Storage Location
- NOAA-21 Update and Status
- NOAA-20 SNPP
- Non-NOAA Satellites Update
 - Himawari Update
 - EUMETSAT update
 - Jason 3



User Services Update

- Jason Taylor SPB Branch Deputy
—jason.taylor@noaa.gov
 - Joseph Fiore SPSP Enterprise User Services Coordinator
—joseph.fiore@noaa.gov
 - Stephen Superczynski- GOES-R User Services Coordinator
—stephen.superczynski@noaa.gov
 - Jessica levine - SPSP International User Services Coordinator
—jessica.levine@noaa.gov
- SPSP.Userservices@noaa.gov



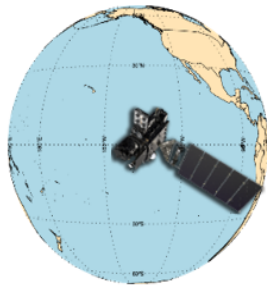
GOES Constellation Status



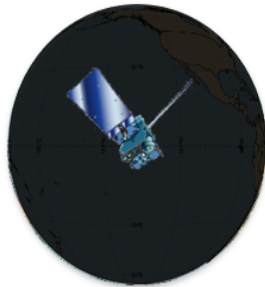


GOES Constellation

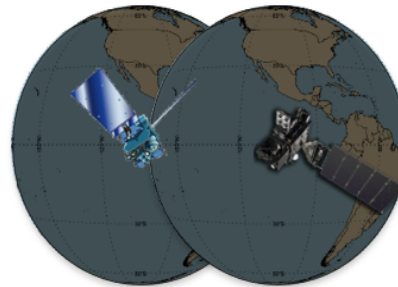
GOES-West
GOES-18
137.0°W



Storage
GOES-15
128°W



Co-Standby Standby
GOES-14 GOES-17
108.2°W 104.7°W



GOES-East
GOES-16
75.2°W



- Above locations and constellation roles are effective February 10, 2023
- Note the Standby role is filled jointly by GOES-17 and GOES-14 (for the warm periods of GOES-17 ABI loop heat pipe anomaly)
 - Field users leveraging smaller antennas (~5m) will not be able to simultaneously downlink GOES-17 GRB and GOES-14 GVAR due to interference because GRB will dominate the signal
- Note the Standby role locations are slightly different from the precedent location of 105°W
- Checkout of GOES-17 spacecraft, instrument, and product generation occurs February 10 – March 14, 2023
- GOES-15 property transfer to U.S. Air Force (USSF) is in progress and drift to USSF location will commence NST March, 2023





GOES- 17 GOES-14 Status



GOES-17 and GOES-14 Status

- GOES-17 Drifted to 104.7 W on 2/10/2023
- Pre-storage checkout of GOES-17 currently in progress to test Storage slot configuration. Testing will conclude on 3/13/2023 and GOES-17 will then be placed into standby mode on 3/14/2023.
- GOES-14 Drifted to 108.2 W on 2/3/2023
- Note the Standby role is filled jointly by GOES-17 and GOES-14 (for the warm periods of GOES-17 ABI loop heat pipe anomaly).

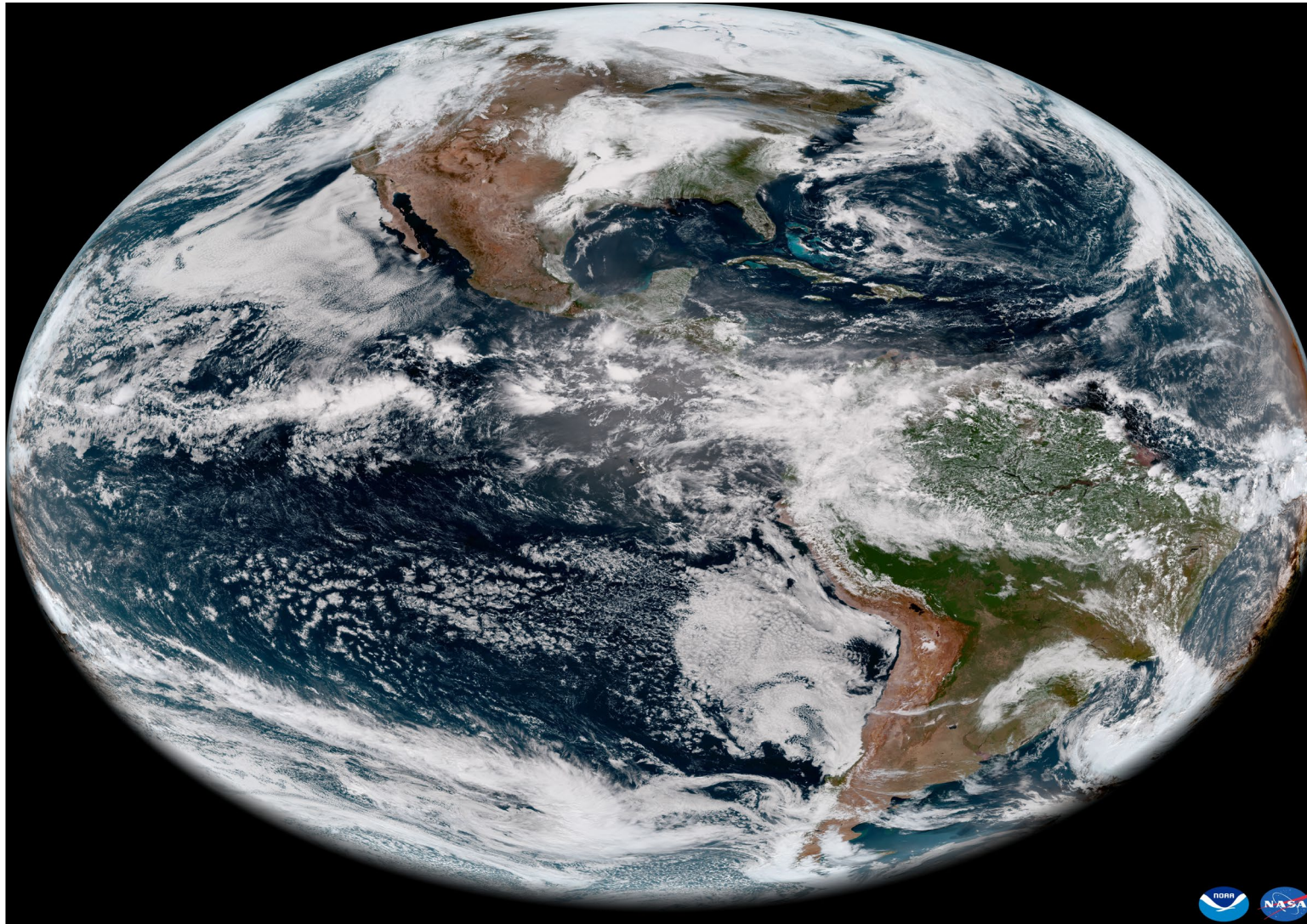


GOES-WEST(18)/U Updates





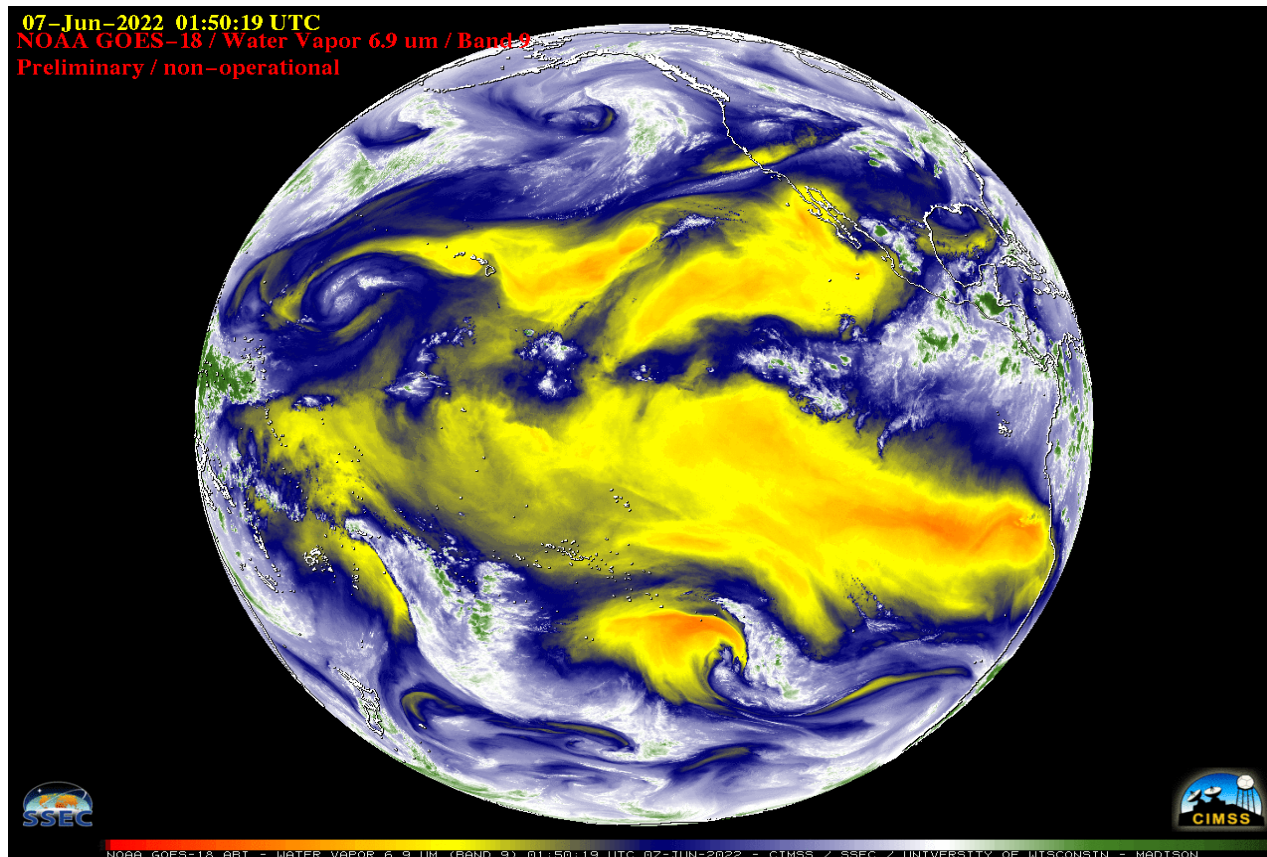
GOES-18 GeoColor Full Disk 5/05/2022





GOES-18 Water Vapor 6.9um (Band 9)

6/22/2022

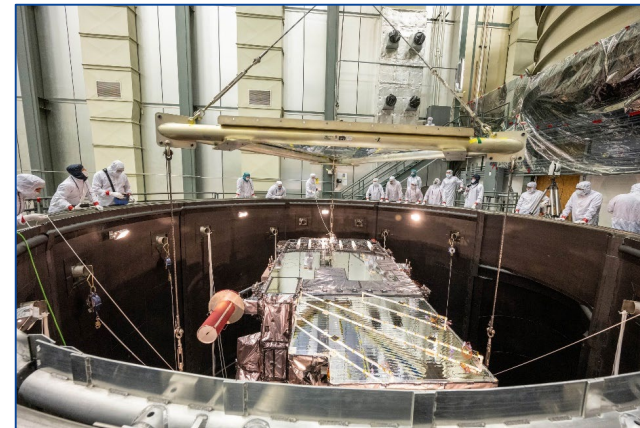




GOES-18 (WEST) and GOES-U Status

GOES-18

- **GOES-18 was declared the GOES-West operational satellite on January 4, 2023**
- Performance has been very good and in family with GOES-16 on orbit performance
- Periods of higher noise in the ABI Band 7 (3.9 μm) imagery can sometimes be seen over uniformly cold scenes presenting as vertical bands, earning it the name “Barcode Artifact”
- Unlike the Loop Heat Pipe anomaly on GOES-17, the Barcode Artifact is limited and has no impact on the usability of the ABI instrument data

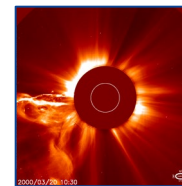


Lowering GOES-T into the thermal vacuum chamber

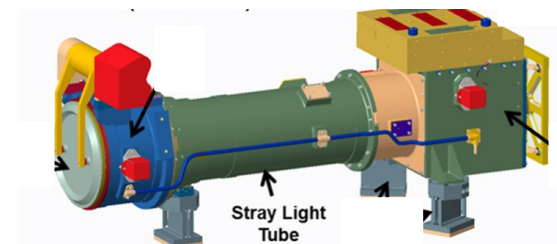
GOES-U

- Completed Thermal Vacuum (TVAC) testing on Nov. 4, 2022
- Launch Vehicle Preliminary Design Review held Nov. 7, 2022.
- Launch planned for Spring 2024

Coronal Mass Ejection



CCOR Concept





GOES-WEST Transition Plan

Date	GOES-17		GOES-18	
	Location	Activity	Location	Activity
11/16-1/3	137.3°W	GOES-West Operations <ul style="list-style-type: none"> GOES-17 Nominal Distribution 	137.0°W	GOES-18 product maturation continues <ul style="list-style-type: none"> Post Launch Product Test (PLPT) ends Jan 3, 2023
1/4	137.3°W	GOES-17 end of West Service <ul style="list-style-type: none"> Drop GOES-17 GRB Uplink Stop GOES-17 auxiliary comm services <ul style="list-style-type: none"> HRIT, EMWIN, DCS, SAR 	137.0°W	GOES-18 Declared operational GOES-West <ul style="list-style-type: none"> Start GOES-18 GRB uplink / nominal distribution <ul style="list-style-type: none"> 10min GRB outage for transition (1 ABI timeline) 1800-1810 UTC Start GOES-18 auxiliary comm services <ul style="list-style-type: none"> HRIT, EMWIN, DCS, SAR 1810-1830 UTC
1/10	Leaving 137.3°W	GOES-17 Drift Start to 104.7W <ul style="list-style-type: none"> Configure payload instruments for drift Handover to nominal database CMD uplink from ORTTC to CDAS 	137.0°W	GOES-WEST Operations <ul style="list-style-type: none"> CMD Uplink from CDAS to ORTTC Handover to collocated database
1/10-13	Leaving 137.3°W	Use ATS for LTR EWSK for 6 start burns over 3 days	137.0°W	No Change
1/15	~134°W	No Change	137.0°W	<ul style="list-style-type: none"> CMD uplink returned to CDAS (nominal) Handover to nominal database
1/19-21	~128°W	COMM Mitigation with GOES-15 <ul style="list-style-type: none"> Juggle GOES-17 & GOES-15 CDAS CMD Uplink 	137.0°W	No Change
2/11-13	104.7°W	GOES-17 drift stop at 104.7° <ul style="list-style-type: none"> Use ATS for LTR EWSK for 6 stop burns over 3 days 	137.0°W	No Change
2/14	104.7°W	GOES-17 checkout at 104.7°W	137.0°W	No Change
2/26	104.7°W	GOES-17 Eclipse Season Start	137.0°W	GOES-18 Eclipse Season Start
3/14	104.7°W	GOES-17 Storage Mode Entry	137.0°W	No Change
May 2024	104.7°W	GOES-17 First Annual Checkout	137.0°W	No Change



GOES- 18 (WEST) Product Status



GOES-18 L1b Science Product Validation Schedule

ABI L1b Product	Beta	Provisional	Full
Radiances	5/11/2022	7/28/2022	FY23 Q4
GLM L2 Product			
Lightning: Events, Groups, Flashes	9/16/2022	10/31/2022	FY24 Q1
SEISS L1b Products			
Energetic Heavy Ions	8/1/2022	11/15/2022	FY23
Magnetospheric e ⁻ /p ⁺ : Low Energy	8/1/2022	11/29/2022	FY23
Magnetospheric e ⁻ /p ⁺ : High Energy	8/1/2022	10/11/2022	FY23
Solar & Galactic Protons	8/1/2022	9/13/2022	FY23
EXIS L1b Products			
Solar Flux: EUV	7/18/2022	11/17/2022	FY23
Solar Flux: X-ray Irradiance	7/18/2022	11/17/2022	FY23
SUVI L1b Product			
Solar EUV Imagery	8/1/2022	11/22/2022	FY23
GMAG L1b Product			
Geomagnetic Field	7/11/2022	9/16/2022	FY23



GOES-18 L2+ Science Product Validation Schedule

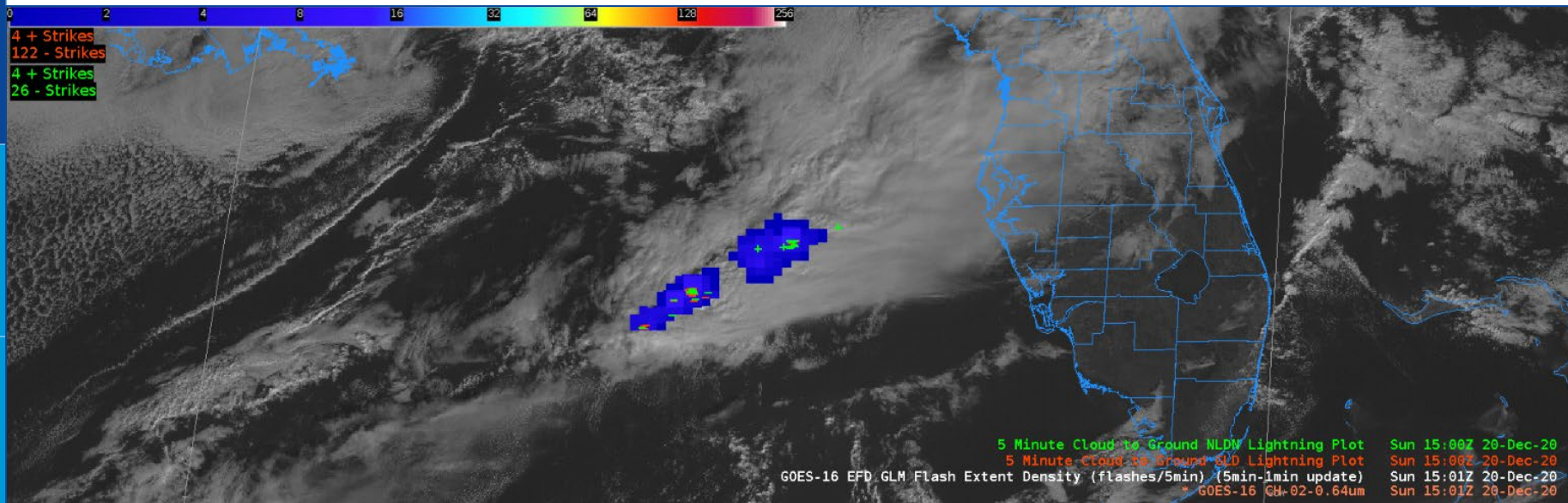
L2+ Products	Beta	Prov	Full
Cloud and Moisture Imagery (CMI) and Sectorized CMI (KPP)	5/11/2022	7/28/2022	FY24
Aerosol Detection (Smoke & Dust)	5/11/2022	11/9/2022	
Aerosol Optical Depth	5/11/2022	11/9/2022	
Clear Sky Mask ^E	5/11/2022	9/28/2022	
Cloud Cover Layers	N/A	3/7/2023	
Cloud Optical Depth	5/11/2022	11/21/2022	
Cloud Particle Size Distribution	5/11/2022	11/21/2022	
Cloud Top Height	5/11/2022	9/28/2022	
Cloud Top Phase ^E	5/11/2022	9/28/2022	
Cloud Top Pressure	5/11/2022	9/28/2022	
Cloud Top Temperature	5/11/2022	9/28/2022	
Derived Motion Winds	5/11/2022	9/28/2022	
Derived Stability Indices	5/11/2022	10/12/2022	
Downward S/W Radiation: Surface	5/11/2022	11/9/2022	

L2+ Products	Beta	Prov	Full
Fire/Hot Spot Characterization	5/11/2022	10/12/2022	FY24
Ice Age & Thickness	5/11/2022	12/29/2022	
Ice Concentration & Extent ^E	5/11/2022	12/29/2022	
Ice Motion	N/A	3/7/2023	
Land Surface Albedo ^E	5/11/2022	11/9/2022	
Land Surface Reflectance ^E	5/11/2022	11/9/2022	
Land Surface Temperature ^E	5/11/2022	11/9/2022	
Legacy Vertical Moisture Profile	5/11/2022	10/12/2022	
Legacy Vertical Temperature Profile	5/11/2022	10/12/2022	
Rainfall Rate/QPE	5/11/2022	11/9/2022	
Reflected S/W Radiation: TOA	5/11/2022	11/9/2022	
Sea Surface Temperature	5/11/2022	11/21/2022	
Snow Cover	N/A	12/9/2022	
Total Precipitable Water	5/11/2022	10/12/2022	

GLM FED Status



- GLM Flash Extent Density will be produced in the GOES-R Ground System and will flow to NWS via the AWIPS interface
- Delivery of the GLM gridded products arrived as part of the DO.11 software package in late 2022, and data will begin flowing to NWS on March 6, 2023 1800 UTC



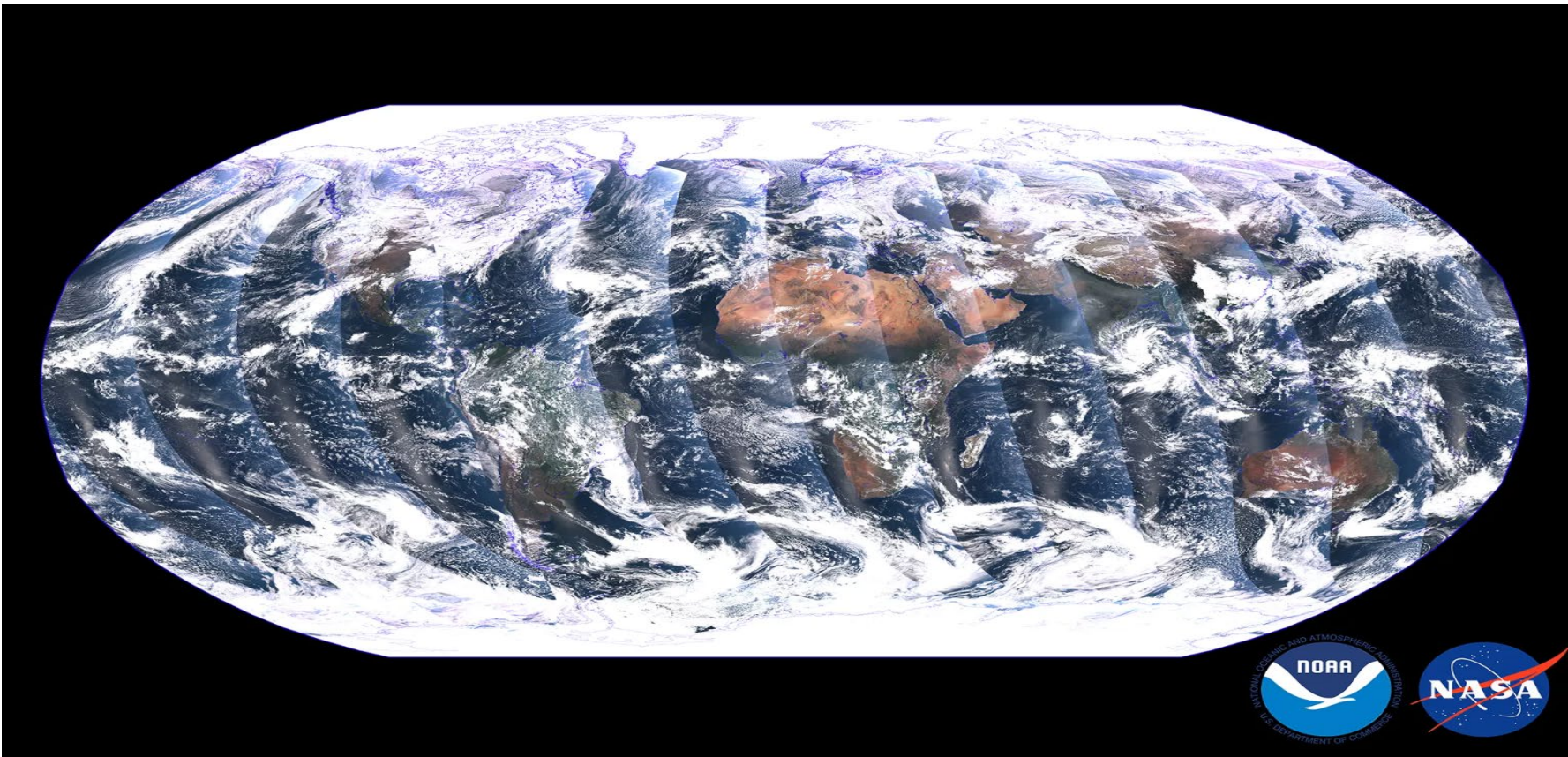


NOAA-21 Status



NOAA-21 1st light Image

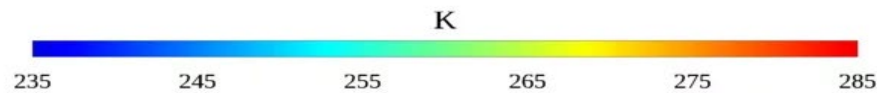
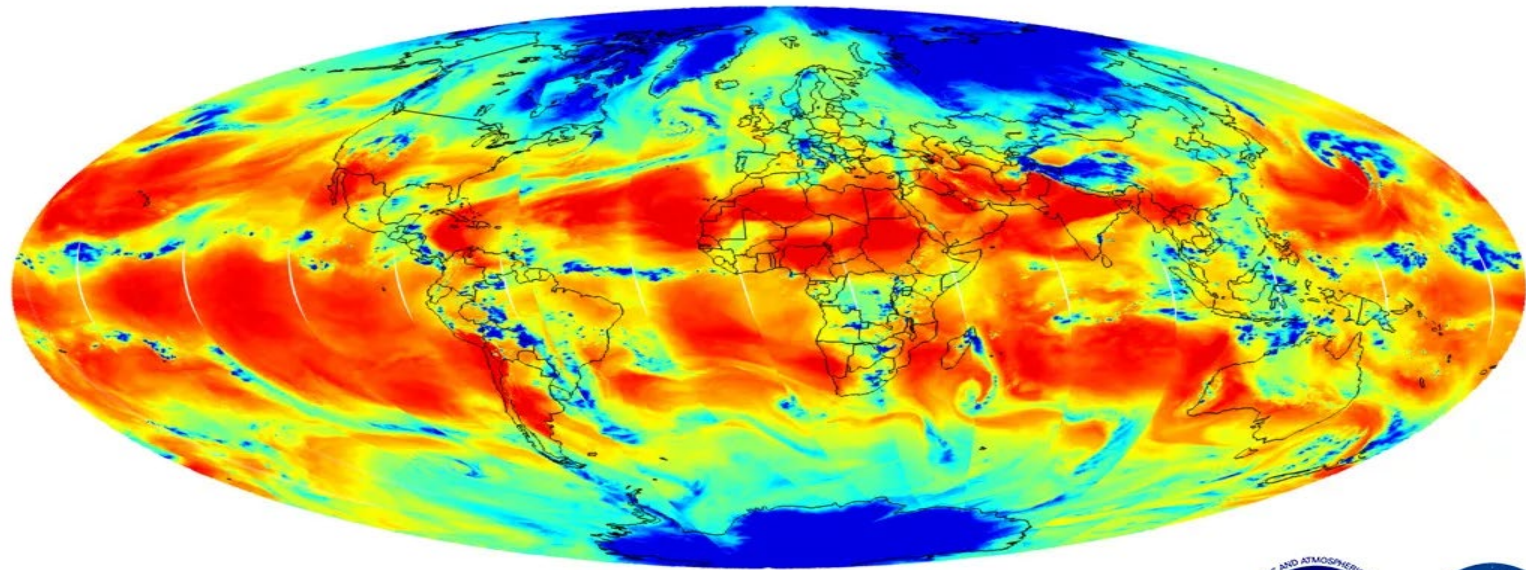
Nov 22, 2022





NOAA-21 1st light Image

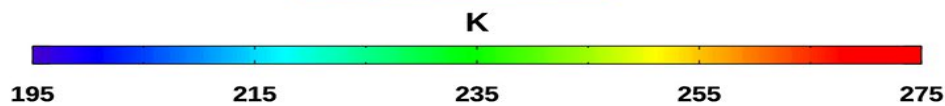
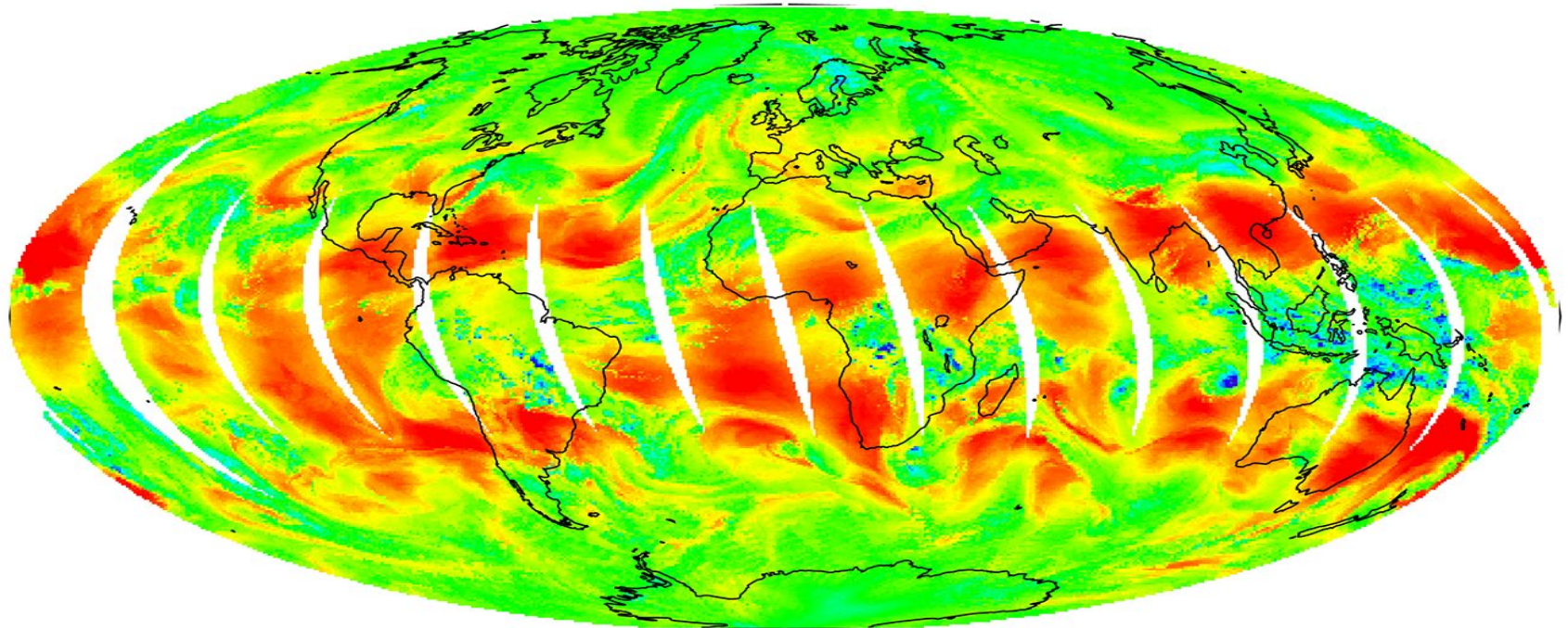
NOAA-21 ATMS Sensor Brightness Temperature
Ch.18 183.311 ± 7.0 GHz QH-POL
22 Nov 2022





NOAA-21 1st light Image

NOAA-21 CrIS Sensor Brightness Temperature, 1596 cm⁻¹
12 Feb 2023 Day Time





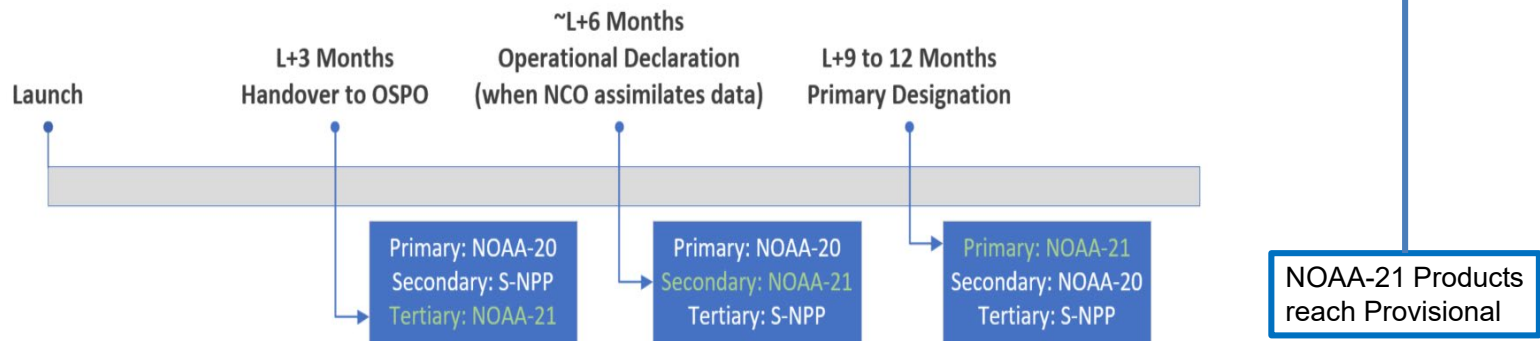
Notional NOAA-21 Schedule

November 10, 2022
January 2024

~ March 2023

May – July 2023

July – October 2023



An important note is that NOAA-21 remains in a Post Launch Testing (PLT) phase and it is not yet in operational service.

After handover, OSPO assumes the responsibility for NOAA-21 mission operations.

NOAA-21 will be tertiary satellite with best-effort support until operational declaration.

Distribution of Imagery/data per the schedule above will be delayed ~ 6 weeks due to the Ka transmitter issue.

Update on NOAA-21 KA Band Transmitter Issue



- NOAA-21 Ka-transmitter anomaly occurred on December 16, 2022. No Stored Mission Data (SMD) from NOAA-21 were downlinked through Ka band.
- X-Band High Rate Data (HRD) received over Svalbard were used to backfill SMD on a best-effort basis.
- On February 2, 2023, NOAA-21 Ka #2 transmitter was turned on. NOAA-21 data flow resumed since then.
- Distribution of Imagery/data per the schedule in the previous slide will be delayed ~ 6 weeks due to the Ka transmitter issue.



JPSS-2 (NOAA-21) Operations Status (slide from Polar Port)

Shuang Qiu

- NOAA-21 ATMS SDR BUFR and Passthrough PDA data flow resumed on 2/2/2023 after Ka #2 transmitter switched on
- NOAA-21 Post Launch Acceptance Review and Handover Readiness Review scheduled on March 29-30, 2023
- NOAA-21 CrIS SDR BUFR and VIIRS Imagery EDR:
 - currently available on NDE/PDA IT (beta on Feb. 23, 2023)
 - NCCF version will be available on PDA IT in March
 - PDA OPS can distribute KPPs publicly if provisional maturity reached



NOAA-21 Science Product Validation & Readiness for Operations (Mission Unique Products)

ATMS Level 1 Products	Beta	Provisional	Declares Ready for Operations	Validated
Temperature Data Record (TDR)*	Nov-30-2022	Dec-15-2022	Dec-15-2022	May-10-2023
Sensor Data Record (SDR)	Nov-30-2022	Dec-15-2022	Dec-15-2022	May-10-2023
CrIS Level 1 Product				
SDR*	Feb-23-2023	Apr-27-2023	Apr-27-2023	Sep-28-2023
VIIRS Level 1 Product				
VIIRS SDR	Feb-23-2022	Mar-30-2023	Mar-30-2023	Jul-13-2023
OMPS Level 1 Product				
Total Column and Nadir Profile SDRs	Feb-23-2023**	Apr-27-2023	Apr-27-2023	Dec-22-2023
VIIRS Level 2 Products(s)				
VIIRS Imagery*	Feb-23-023	Mar-30-2023	Mar-30-2023	Jul-13-2023

Validation Maturity Levels	Not Validated	Beta Maturity	Provisional Maturity	Validated Maturity
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Ready for Operations	Declares Ready for Operations
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*Key Performance Parameter (KPP)

Product quality documentation available: <https://www.star.nesdis.noaa.gov/jps/AlgorithmMaturity.php>

** Effective date pending on implementation of DR 10281



NOAA-21 Science Product Validation & Readiness for Operations (Enterprise Products)*

VIIRS Level 2 Products	Beta	Provisional	Declares Ready for Operations	Validated
Cloud Mask	Jun -2023	Oct-2023	Dec. 2023	Mar-2024
Cloud Property	Sep-2023			
Aerosol Optical Depth and Particle Size Parameter	Jun-2023	Nov-2023	Jan-2024	Jun-2024
Aerosol Detection	Aug-2023	Dec-2023	Feb-2024	Jun-2024
Volcanic Ash	Sep-2023	Oct-2023	Dec. 2023	Mar-2024
Ice Surface Temperature	Jul-2023	Oct-2023	Dec. 2023	Feb-2024
Sea Ice Concentration and Ice Thickness	Jul-2023	Oct-2023	Dec. 2023	Feb-2024
Snow Cover (Binary Map & Snow Cover Fraction)	Jul-2023	Oct-2023 Jan-2024	Dec. 2023	Jul-2024
Active Fire	Jul-2023	Oct-2023	Dec. 2023	Jul-2024
Land Surface Temperature	Jul-2023	Jan-2024	Mar-2024	Jan-2025
Land Surface Albedo	Jul-2023	Jan-2024	Mar-2024	Jul-2024
GST (Global Gridded Surface Type)	May-2024	Jul-2024	--	Sep-2024
Land Surface Reflectance	Jul-2023	Jan-2024	Mar-2024	Jan-2025

VIIRS Level 2 Products	Beta	Provisional	Declares Ready for Operations	Validated
Green Vegetation Fraction	Jul-2023	Jan-2024	Mar-2024	Jan-2025
Vegetation Index (VI)	Jul-2023	Jan-2024	Mar-2024	Jan-2025
Vegetation Health (VH)	Sep-2023	Mar-2024	Jun-2024	Apr-2025
Ocean Color	Nov-2023	Mar-2024	Jun-2024	Jul-2025
Sea Surface Temperature	May-2023	Aug-2023	Oct-2023	Aug-2024
VIIRS Polar Winds	Nov-2023	Jan-2024	Mar-2024	Mar-2024
VIIRS Flood Mapping	Jul-2023	Jan-2024	Mar-2024	Jan-2025
CRIS/ATMS Level 2 Products				
NUCAPS: AVTP, AVMP, OLR	Jun-2023	Dec-2023	Feb-2024	Mar-2024
NUCAPS: Ozone, Trace Gas (CO, CO2, CH4)	Jun-2023	Mar-2024	May-2024	Jun-2024
ATMS Level 2 Products				
MiRS Products	May-2023	Oct-2023	Dec-2023	Oct-2024
SnowFall Rate (SFR)	May-2023	Feb-2024	Apr-2024	May-2025
OMPS Level 2 Products				
Ozone EDR: NP	Mar-2023	May-2023	Jul-2023	Jan-2024
Ozone EDR: TC	Mar-2023	May-2023	Jul-2023	Jan-2024
Ozone LP (SDR&EDR)	Jun-2023	Jan-2024	Mar-2024	Sep-2024

Validation Maturity Levels

Not Validated

Beta Maturity

Provisional Maturity

Validated Maturity

Ready for Operations

Declares Ready for Operations

*These dates have been adjusted due to the recovery of N21 KATX.



Himawari Updates

Himawari Updates



- Himawari-8 is in standby mode at 140.65E as of December 13, 2022.
- Himawari-9 is operational at 140.75E.
- Himawari-9 imagery is currently available in AWS and AWIPS
 - The necessary code to create L2 SST, Cloud and Wind products in NCCF was not received in sufficient time to establish and test production prior to satellite swap
 - L2 SST, Cloud, Rain Rate and Wind product outage will continue until Spring 2023 (April - June est.)
- User Services will send an email update through the ESPC Notification system when these products come online

Satellite \ FY	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Himawari-8						Launch ▲				Operational											
						Manufacturing															
Himawari-9							Launch ▲														



NOAA'S Himawari-9 Data Access Options

- **PDA (operational distribution)**

- H9 L1B data and H9 L2 products* in netCDF and netCDF4

- **BDP-Big Data Program (non-operational distribution, general public access)**

- H9 L1B data (HSD format) and H9 L2 (netCDF4 format) products

- <https://noaa-himawari9.s3.amazonaws.com/index.html>

- **GEODIST Servers**

- McIDAS Products

- Imagery, GHE, TCFP, ADT, SST, GMGSI, ACI, eTRaP

- **Customized sectors (GIF files) supporting WFO Guam operations at OSPO web page****

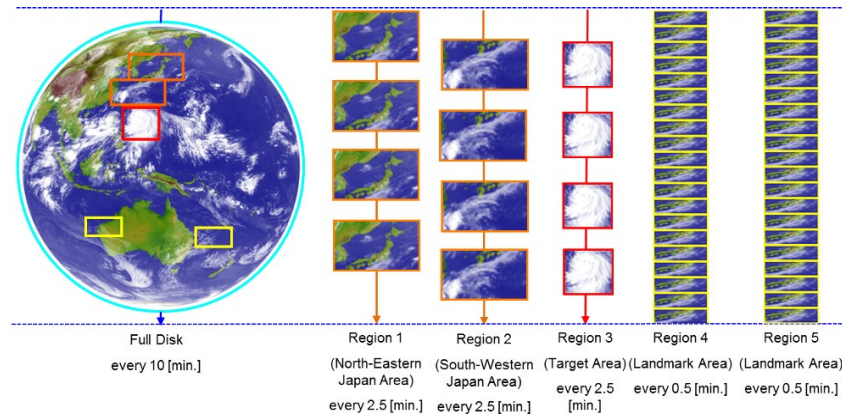
- <https://www.goes.noaa.gov/guam/index.html>

- * H-9 L2 SST, Cloud, Wind and Rain Rate products will not be available until Spring of 2023.

- ** OSPO is overhauling its webpages to be more organized and user friendly



Himawari Scanning Sectors including Floating 2.5 min Target Area (Region 3)



Only Full Disk and Target Area/Region 3 scans is processed at NOAA/NESDIS

- HimawariRequest is available to NOAA to remap the Target Area sector to an AOI with a 2.5 min refresh rate.
 - Includes full spatial and spectral resolution
- HimawariRequests were submitted from the NWS SDM for CY2022 through early December
 - All requests were for tropical cyclone/heavy rain monitoring
 - All three were approved by JMA



EUMETSAT Updates



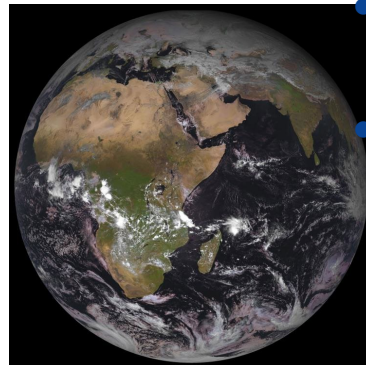


Meteosat Program Update

Current MSG Constellation

SATELLITE	LIFETIME	POSITION	SERVICES
Meteosat-11	15/07/2015 – Fuel lifetime is until 2033	0°	0° SEVIRI Image Data. Real-time Imagery.
Meteosat-10	05/07/2012– Fuel lifetime is until 2030	9.5° E	Rapid Scan Service. Real-time Imagery.
Meteosat-9	28/08/2002 – Fuel lifetime is until 2022	45.5° E	Primary IODC service started 6/1/22.
MTG-I1	Launched 12/13/2022	0°	Will replace Meteosat-10 at 0° in Q4 2023/Q1 2024.

Primary Imaging Operations



Meteosat Constellation Configuration Plans

- The relocation of Meteosat-10 to 0° and Meteosat-11 to 9.5°E, is currently planned for ~ March 2023. The swap duration will be in the order of 30+ days.
 - After the swap, Meteosat-11 will begin support of Rapid Scanning Service (RSS) at 9.5°E.
- MTG-I1 launched on December 13, 2022 from French Guiana.
- MTG-I1 will be assigned to Full Disk Scan Service (FDSS) when starting Prime operations at 0°, taking over the service from Meteosat-10 in Q1 2024.

Meteosat-9 FD Image



Meteosat Third Generation (MTG) Satellites

- **MTG-I1 (imager mission)**
 - Launched December 13, 2022
 - fully operational by Q1/CY2024 at 0 degrees replacing Meteosat-10
 - 16 spectral band imager (Flexible Combined Imager - FCI) and Lightning Imager (LI)
 - Temporal and spatial resolutions similar to GOES-R series
 - FCI - 10 minute FD scans and 2.5 minute scans over Europe
 - LI – 84% FD coverage every 10 minutes and 100% European coverage every 2.5 minutes
- **MTG-S1 (sounder mission)**
 - Projected launch date Q2/CY2024
 - fully operational by Q1/CY2025 at 0 degrees
 - First operational sounding satellite in geostationary orbit
 - InfraRed Sounder (IRS)
 - Two Spectral bands: MWIR (4.44–6.25 μm) and LWIR (8.26–14.70 μm)
 - Spatial resolution of 4 km x 4 km at nadir



Backup Slides



JASON 3 Updates

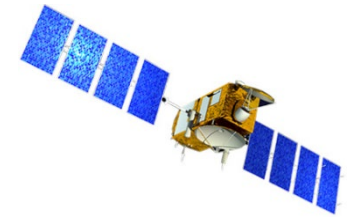


JASON-3

- Jason-3 and its follow-on mission Sentinel-6 are joint NOAA, NASA, CNES, and EUMETSAT satellites launched on January 17, 2016 and November 21, 2020, respectively.
- Jason-3 is in an interleaved orbit with Sentinel-6, providing maximum global spatial coverage.
- The Jason missions are designed to study ocean surface topography and provide near real-time sea surface height, ocean surface wind speed, and significant wave height measurements.
- Jason-3 and Sentinel-6 each utilize a two-frequency Poseidon radar altimeter operating at 13.575 GHz (Ku-band) and 5.3 GHz (Jason-3) and 5.41 GHz (Sentinel-6) (C-Band) and an Advanced Microwave Radiometer consisting of three separate channels at 18.7, 23.8 and 34 GHz



JASON-3 status



JASON-2 lessons learned:

- ✓ Patch EDAC_INVESTIGATION to monitor EDAC in RAM (currently on PMA): no recurrent error detected so far
- ✓ Gyro swap strategy to prevent JA2-like gyro anomalies: next swap (GYR3 ↔ GYR2) foreseen in March 2025
- ✓ PCE sections swap strategy to prevent JA2-like PCE anomalies: Next swap (S1 – S7 ↔ S2 – S8) foreseen in January 2025

After almost 7 years in orbit :

- Both half satellites available
 - all sub-systems **operational** with **nominal performances**
 - all **equipment is available**
-
- ✓ No limitation of **mission duration** involved

Electrical & Power



Thermal



Data handling – TT&C





Jason 3 Future Operations

- Ocean Surface Topography Science Team (OSTST) Recommendation: Jason-3/Sentinel-6MF Tandem phase
 - Given the societal importance of the sea level record and the need to understand and its long-term uncertainty, the OSTST recommends to the Jason-3 Project an additional tandem phase between Jason-3 and Sentinel-6 MF that lasts 12 cycles, after at least 2 years in the interleaved mission. The OSTST recognizes that the second tandem mission should have no operational impact on Sentinel-6MF.
- Right after the 2nd tandem phase, Jason-3 will be transferred to the “Jason-2 LRO”
 - Altitude 1309 km / geodetic mission
- As soon as the Jason-3 status becomes degraded (missing redundancy), Jason-3 will be transferred to a geodetic + graveyard orbit
 - Necessary due to French law on space operations.
 - Altitude 1282.9km
- At any time, in case of emergency, Jason-3 can be transferred to an emergency disposal orbit, 4km under the current orbit.