

Beta Maturity Science Review For NOAA-20 (EDR) **Imagery**

Presented by **Don Hillger**

Date: 2018-01-25

- Imagery Cal/Val Team Members
- Product Requirements
- Findings/Issues for Beta Imagery
- Documentations (Science Maturity Check List)
- Conclusions
- Path Forward

Imagery Cal/Val Team Members

Name	Organization	Major Task
Don Hillger	NESDIS/StAR	Imagery Product Lead
Tom Kopp	Aerospace	Imagery Cal/Val Lead
Curtis Seaman	CIRA	Imagery/DNB expert
Steven Miller	CIRA	DNB/Imagery expert
Jorel Torres	CIRA	JPSS Liaison / trainer
William Straka III	CIMSS/SSEC	Imagery/DNB expert
Steve Finley	CIRA	IT/data expert
Rosalie Marley	GST	Imagery JAM

VIIRS Environmental Data Record

VIIRS Band	Central Wavelength (μm)	Bandwidth (μm)	Wavelength Range (μm)	Band Explanation	Spatial Resolution (m) @ nadir
M1	0.412	0.02	0.402 - 0.422	Visible	750 m
M2	0.445	0.018	0.436 - 0.454		
M3	0.488	0.02	0.478 - 0.488		
M4	0.555	0.02	0.545 - 0.565		
M5	0.672	0.02	0.662 - 0.682		
M6	0.746	0.015	0.739 - 0.754	Near IR	
M7	0.865	0.039	0.846 - 0.885	Shortwave IR	
M8	1.240	0.020	1.23 - 1.25		
M9	1.378	0.015	1.371 - 1.386		
M10	1.61	0.06	1.58 - 1.64		
M11	2.25	0.05	2.23 - 2.28	Medium-wave IR	
M12	3.7	0.18	3.61 - 3.79		
M13	4.05	0.155	3.97 - 4.13		
M14	8.55	0.3	8.4 - 8.7	Longwave IR	
M15	10.763	1.0	10.26 - 11.26		
M16	12.013	0.95	11.54 - 12.49		
DNB / NCC	0.7	0.4	0.5 - 0.9	Visible	750 m across full scan
I1	0.64	0.08	0.6 - 0.68	Visible	375 m
I2	0.865	0.039	0.85 - 0.88	Near IR	
I3	1.61	0.06	1.58 - 1.64	Shortwave IR	
I4	3.74	0.38	3.55 - 3.93	Medium-wave IR	
I5	11.45	1.9	10.5 - 12.4	Longwave IR	

M-bands highlighted in pale yellow are available as EDRs, in addition to SDRs.

True-color component bands are highlighted in red, green, and blue.

Product Requirements from JPSS L1RD

Attribute	Threshold	Objective
1. The Imagery EDR shall be delivered under all weather conditions, including any rain rate		
a. Horizontal Spatial Resolution for visible and IR Imagery bands		
1. Nadir	0.4 km	0.1 km
2. Edge of Swath	0.8 km	0.1 km
3. Night-time visual, Nadir	2.6 km	0.65 km
b. Horizontal Spatial Resolution for moderate resolution bands		
1. Nadir	0.8 km	NS
2. Edge of Swath	1.6 km	NS
c. Mapping Uncertainty		
1. Nadir	1 km	NS
2. Edge of Swath	3 km	0.5 km
3. Night-time visual, Nadir	TBS	1 km
d. Refresh for Visible and IR bands	At least 90% coverage of the globe every 12 hours	NS

The **Imagery** product consists of:

- **Visible/IR radiances/reflectances** remapped to the **Ground Track Mercator (GTM)** grid, eliminating overlapping pixels and bowtie deletions.
 - I-band and M-band Imagery
- **NCC Imagery** that is a **pseudo-albedo** derived from the DNB, creating an image product that removes large contrasts in DNB from day to night across the terminator.
- VIIRS Imagery products as a **Key Performance Parameter (KPP)** reads as follows:

VIIRS Imagery EDR for (8) bands I1, I3, I4, I5, M14, M15, M16, and DNB for latitudes greater than 60°N in the Alaskan region (I3 and DNB bands added post SNPP launch)

- There are **no (quantitative) requirements** that address the quality of the Imagery products.
- The **user** decides if the quality of the Imagery is acceptable, therefore **including the users is a key consideration** (although end users have not been involved at this Beta level)

JPSS/GOES-R Data Product Validation Maturity Stages – COMMON DEFINITIONS (Nominal Mission)

1. Beta

- Product is minimally validated, and may still contain significant identified and unidentified errors.
- Information/data from validation efforts can be used to make initial qualitative or very limited quantitative assessments regarding product fitness-for-purpose.
- Documentation of product performance and identified product performance anomalies, including recommended remediation strategies, exists.

2. Provisional

- Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from selected locations, time periods, or field campaign efforts.
- Product analyses are sufficient for qualitative, and limited quantitative, determination of product fitness-for-purpose.
- Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists.
- Product is recommended for potential operational use (user decision) and in scientific publications after consulting product status documents.

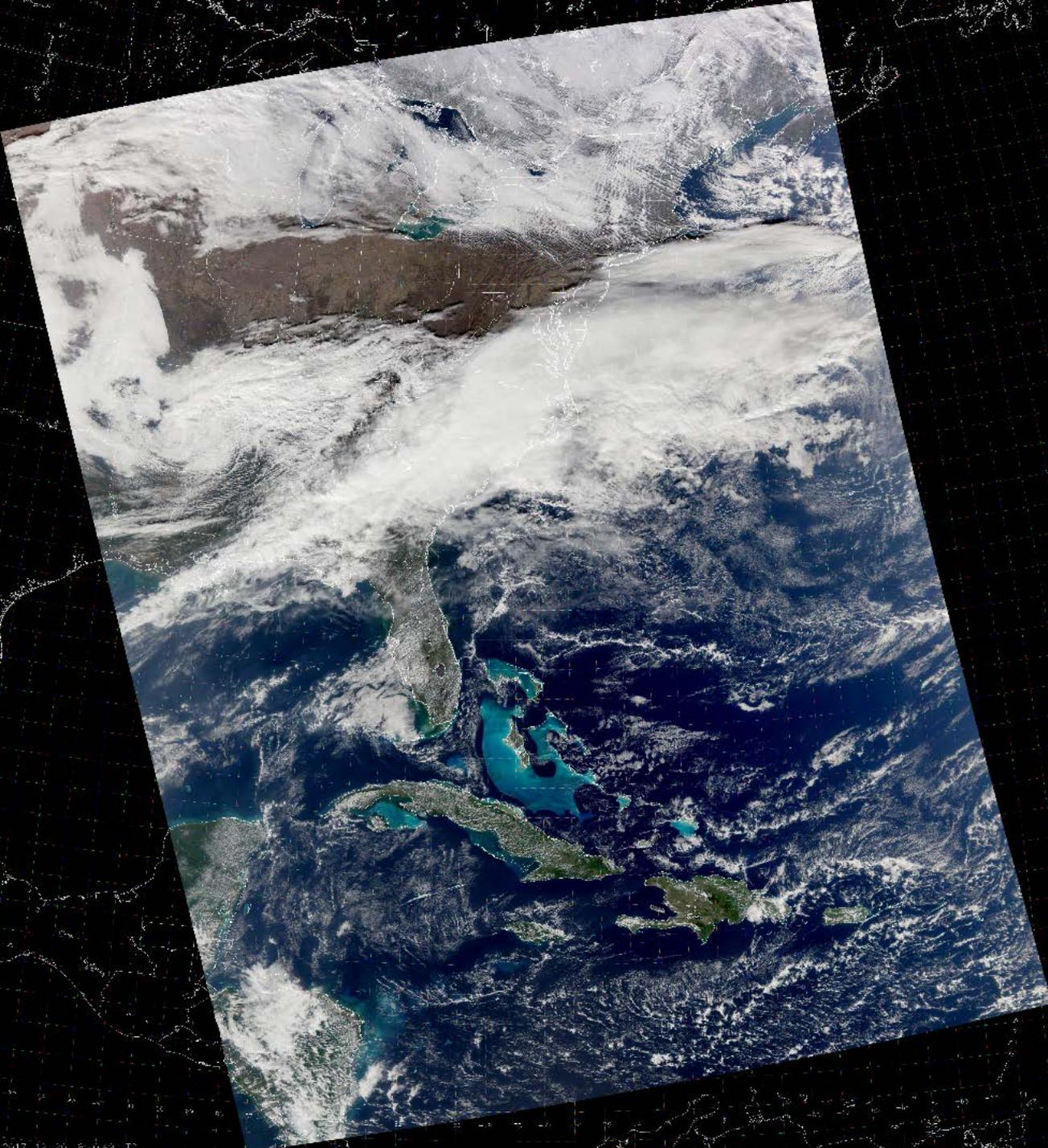
3. Validated

- Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).
- Comprehensive documentation of product performance exists that includes all known product anomalies and their recommended remediation strategies for a full range of retrieval conditions and severity level.
- Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.
- Product is ready for operational use based on documented validation findings and user feedback.
- Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

Findings/Issues at **Beta** Review

- VIIRS **M-bands** (all good) – vis/IR bands
- VIIRS **I-bands** Issues:
 - **I3 bad detector**
 - causing striping (CCR3742/ADR8560)
 - Imagery appears usable in spite of this striping
 - **I4 and I5 fill values**
 - blank images (CCR3742/ADR8559)
 - 88% of all granules are not usable (based on a 24 hour evaluation)
- VIIRS **DNB/NCC** issues:
 - **Extended DNB granule processing** by NCC
 - **Geolocation issues** (working with Geo Team)
 - **Stray light (VIIRS SDR Team)**
 - Not unlike striping on SNPP DNB
 - Expected to be addressed with DNB calibration in Feb 2018
 - **NOAA-20 vs. SNPP** (50 min separation)

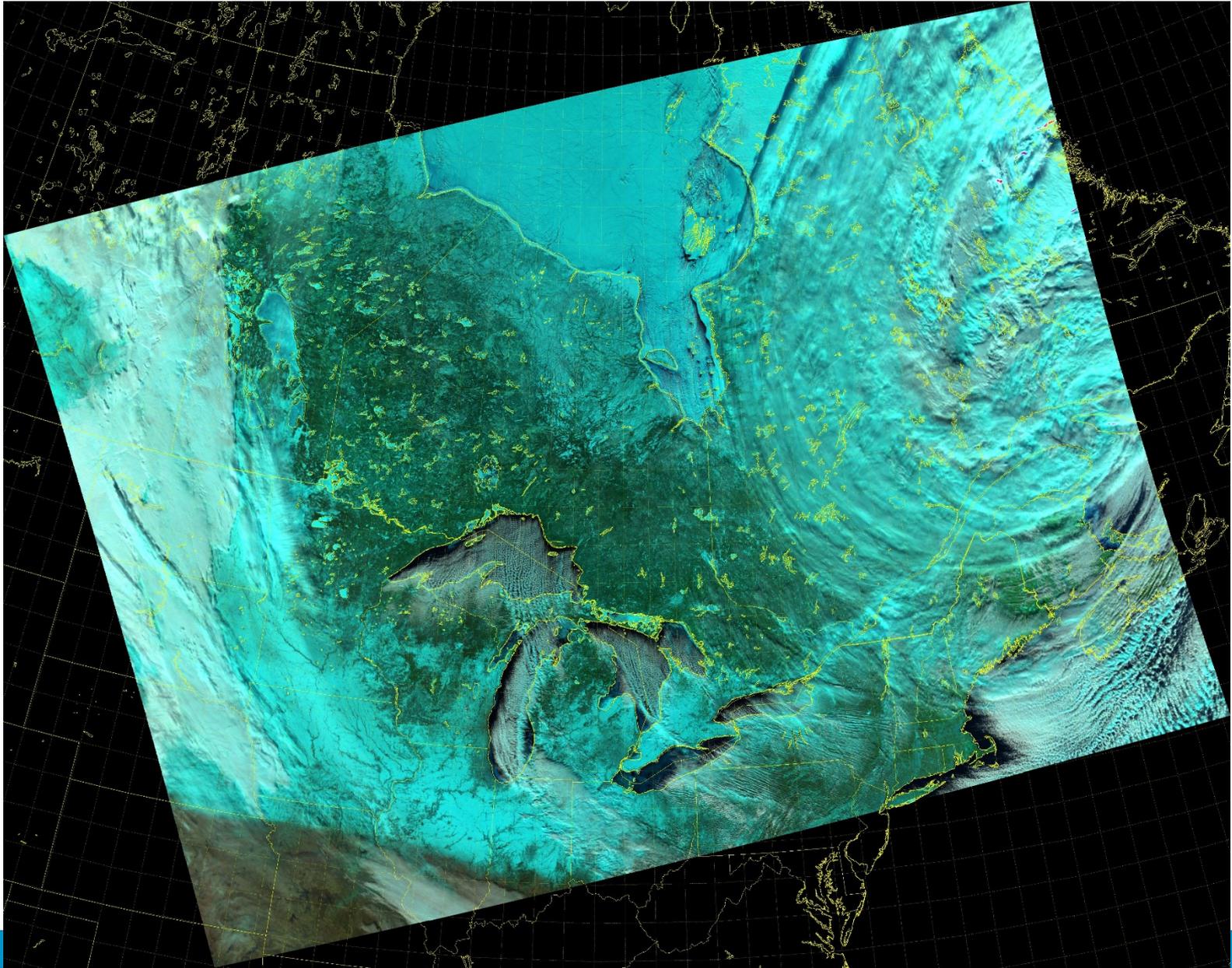
NOAA-20 **M-bands** visible/IR bands



VIIRS True Color
Eastern US
2017-12-20
(C. Seaman, CIRA)

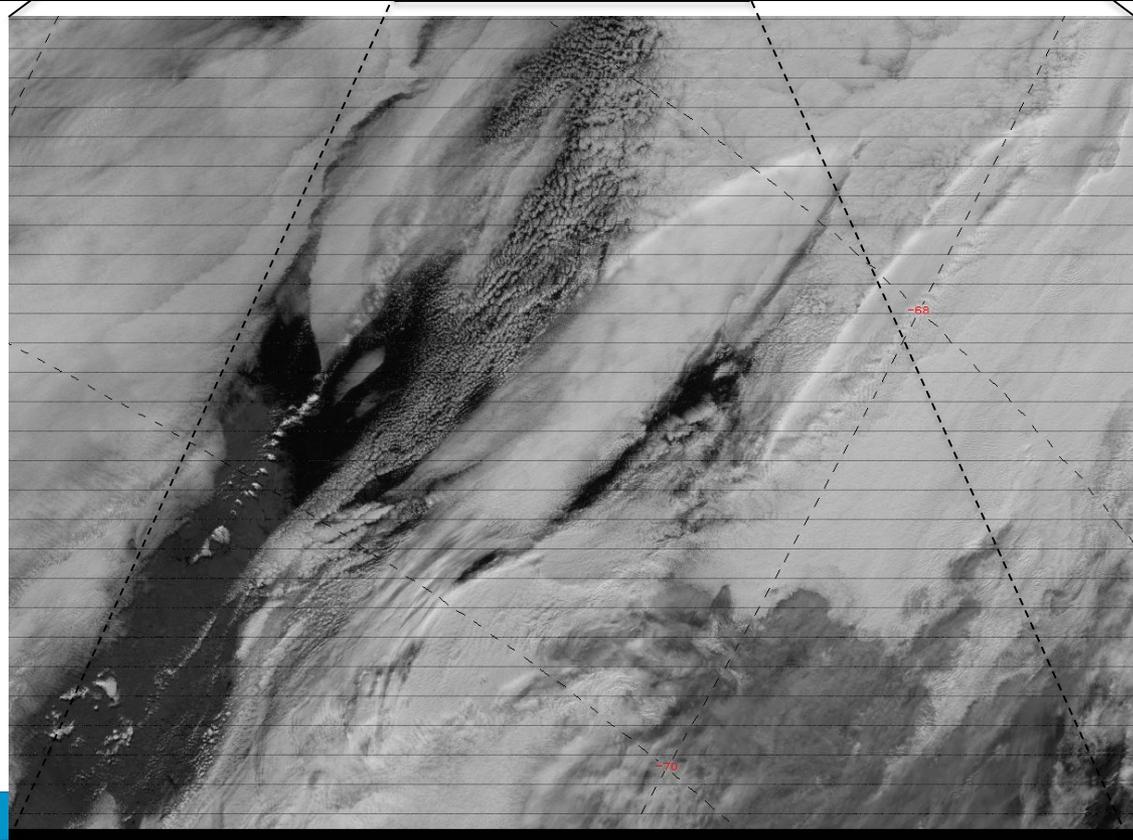
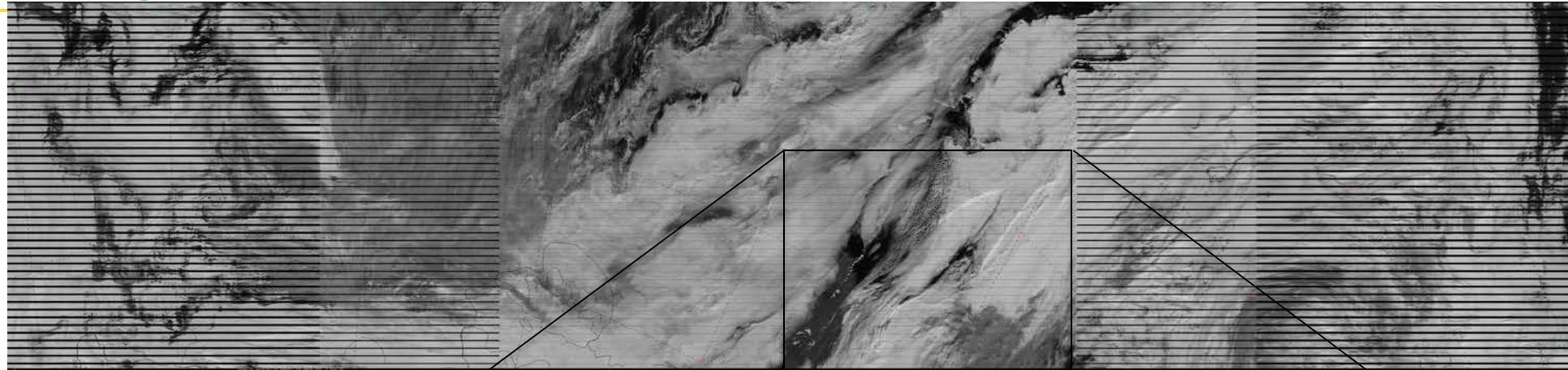
Natural-color RGB – Frozen North – 2018-01-05

(C. Seaman, CIRA)



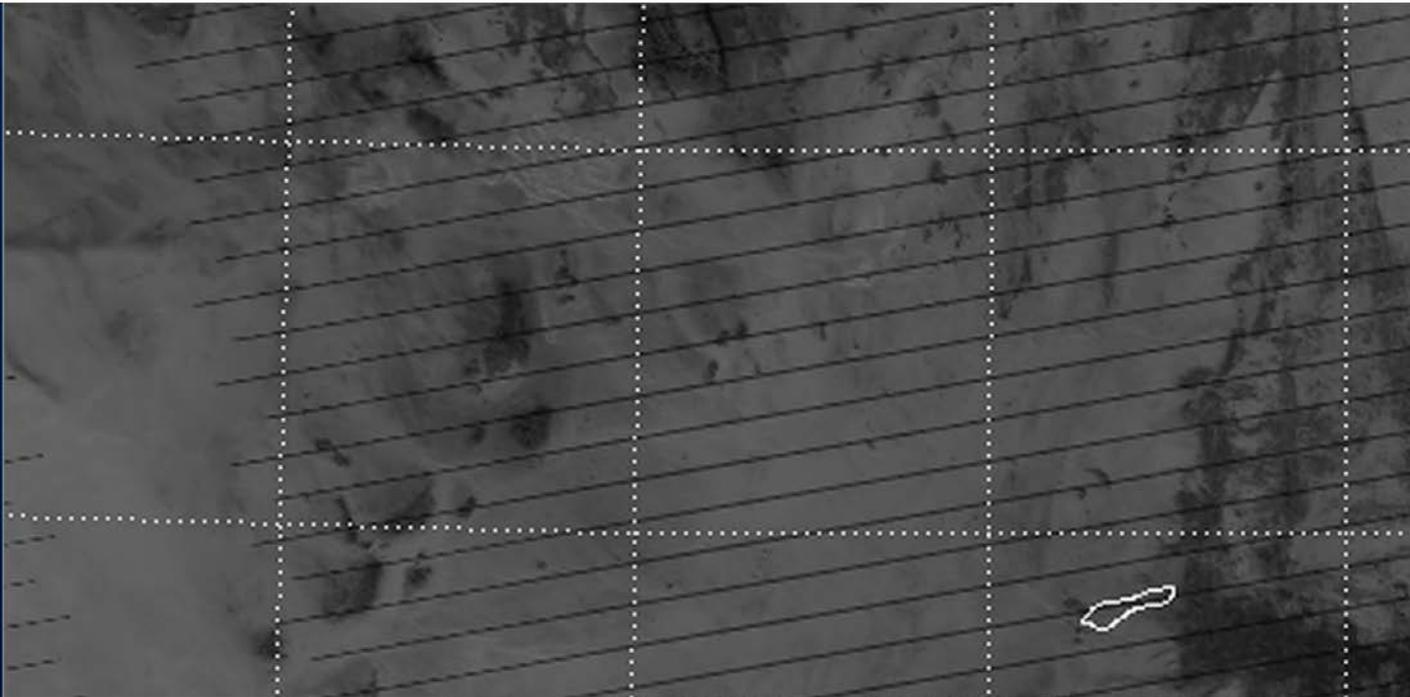
NOAA-20 I3 bad detector

I3 bad detector/stripping (granule projection)



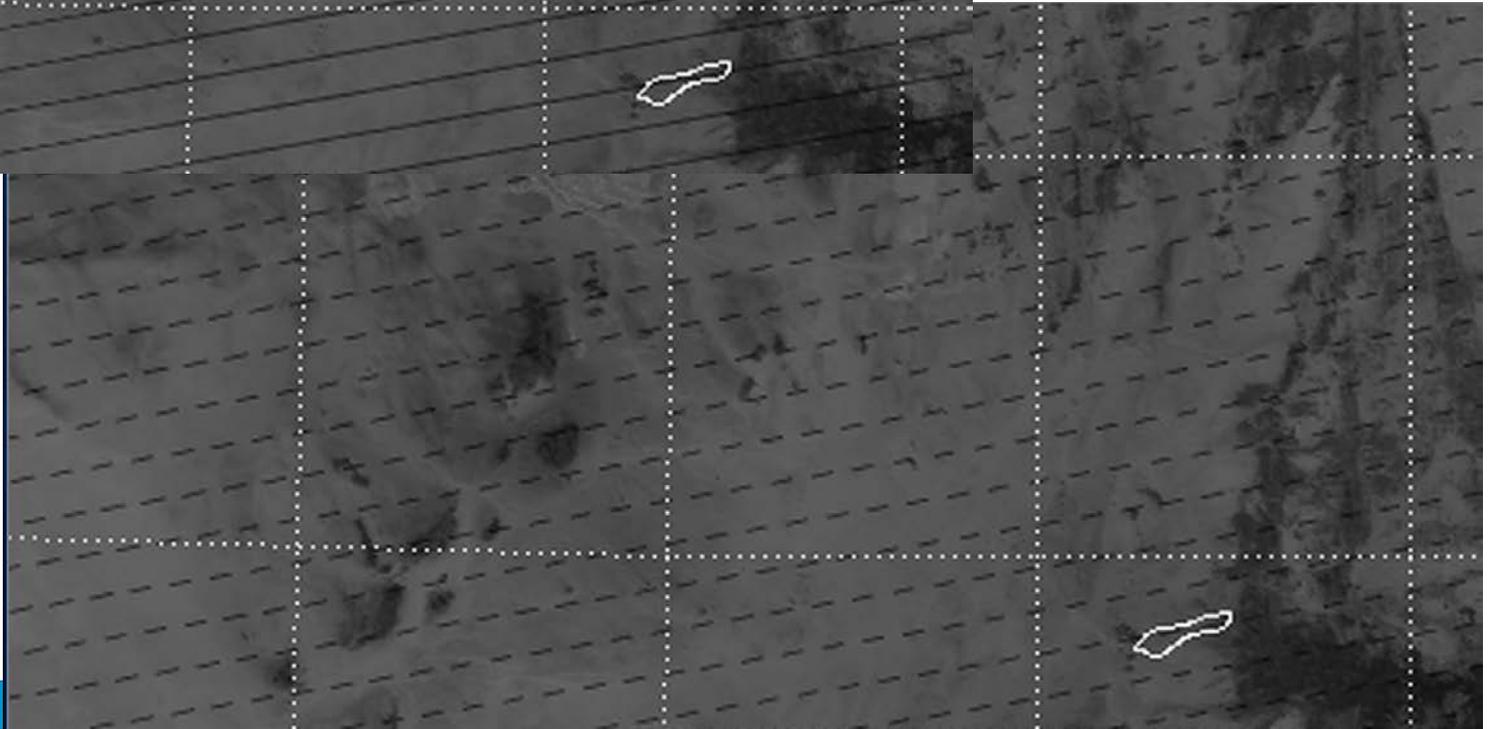
**blowup
from
above**

2018-01-22 – I3 bad detector/stripping (remapped over Sahara Desert)

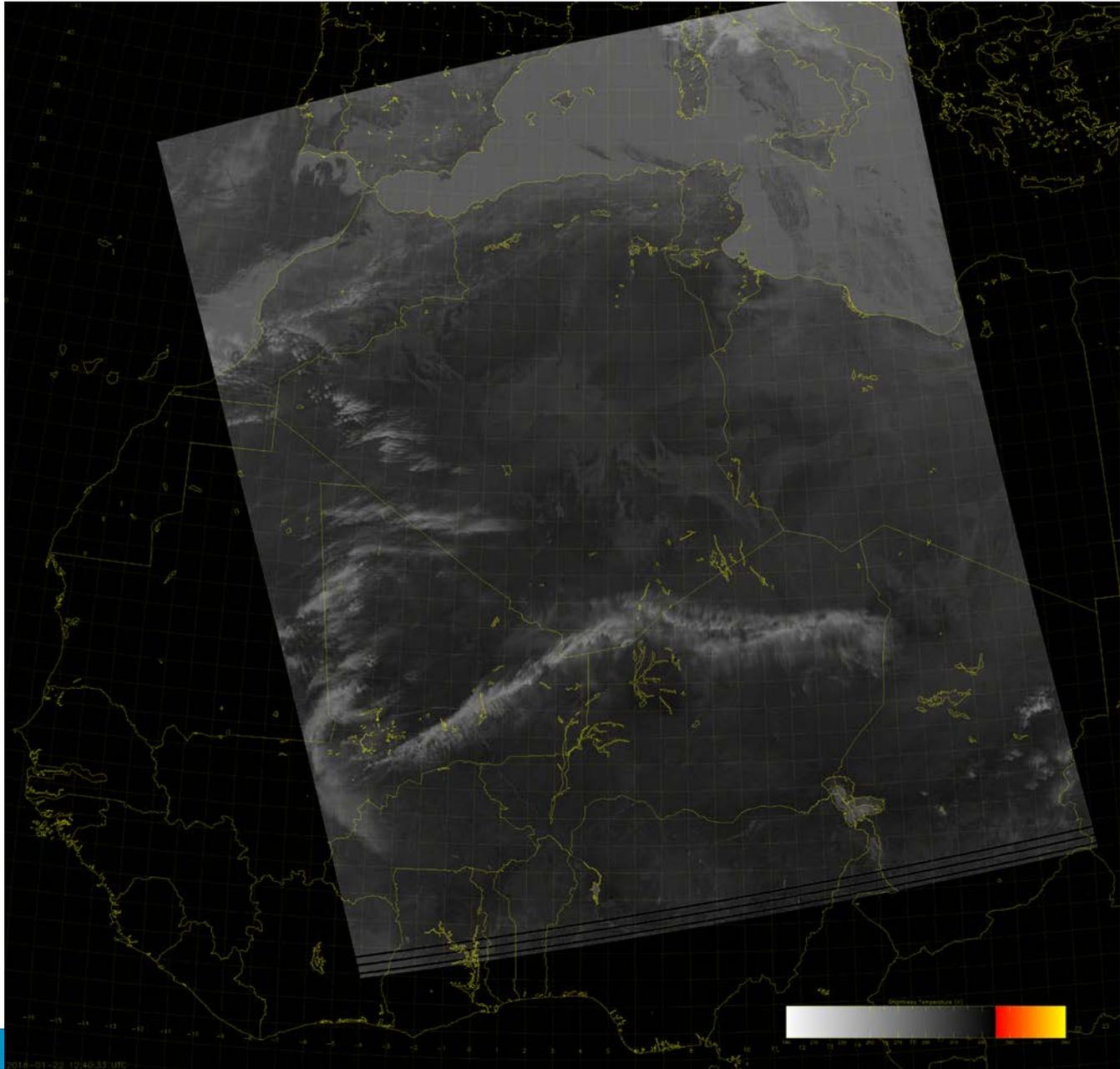


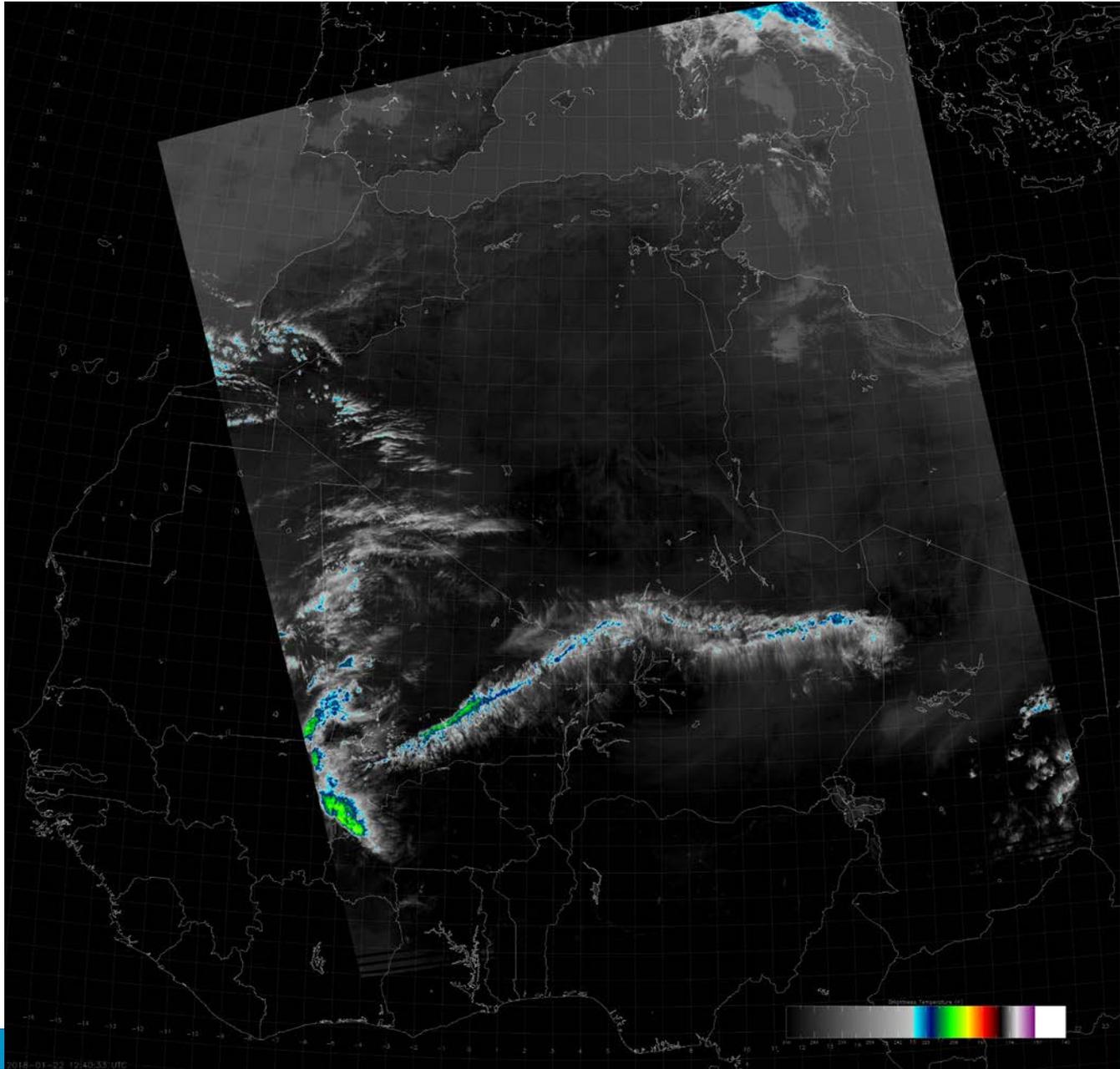
**SDR
I3**

**EDR
I3**

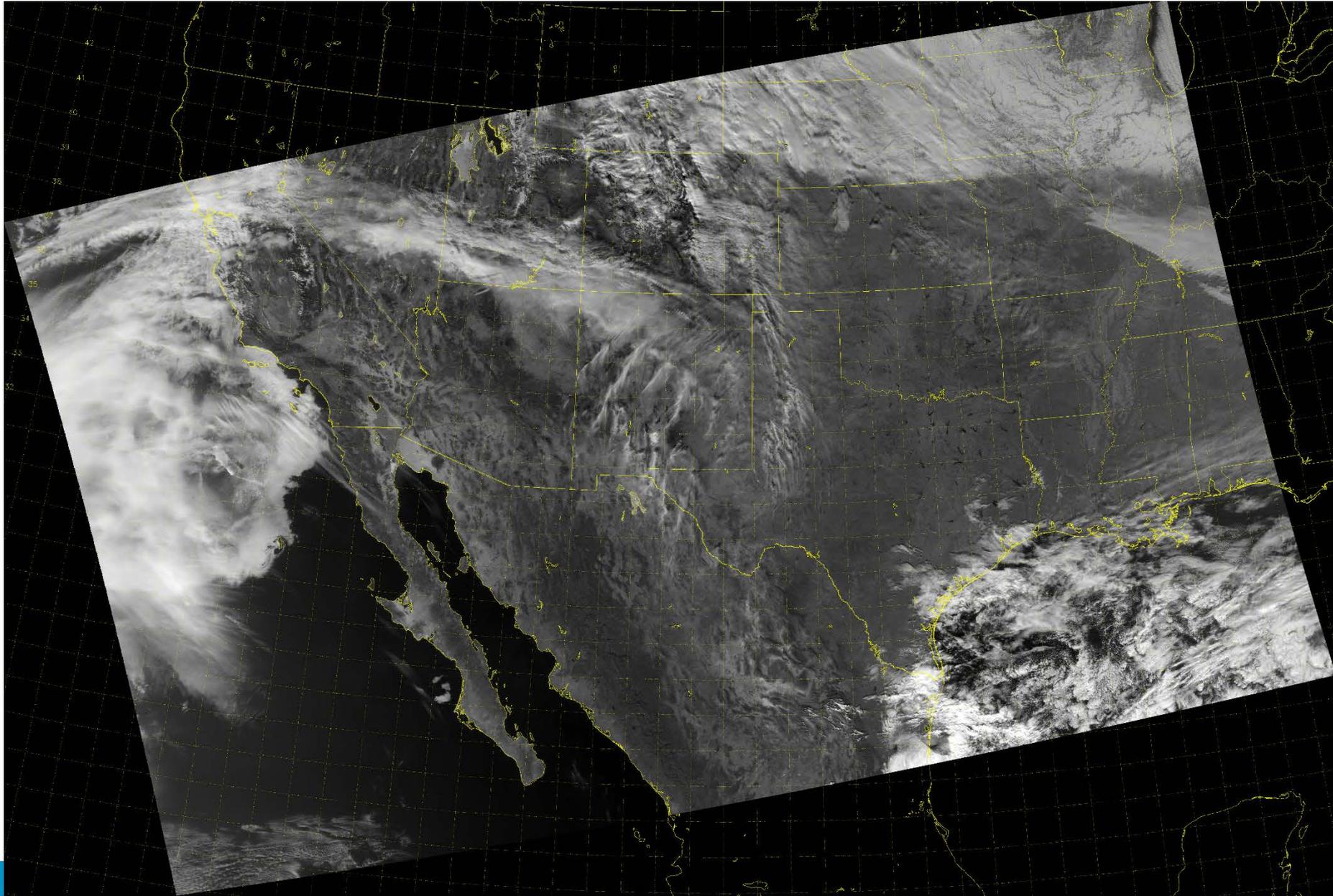


I4 and I5 missing/fill values (occasional valid data)



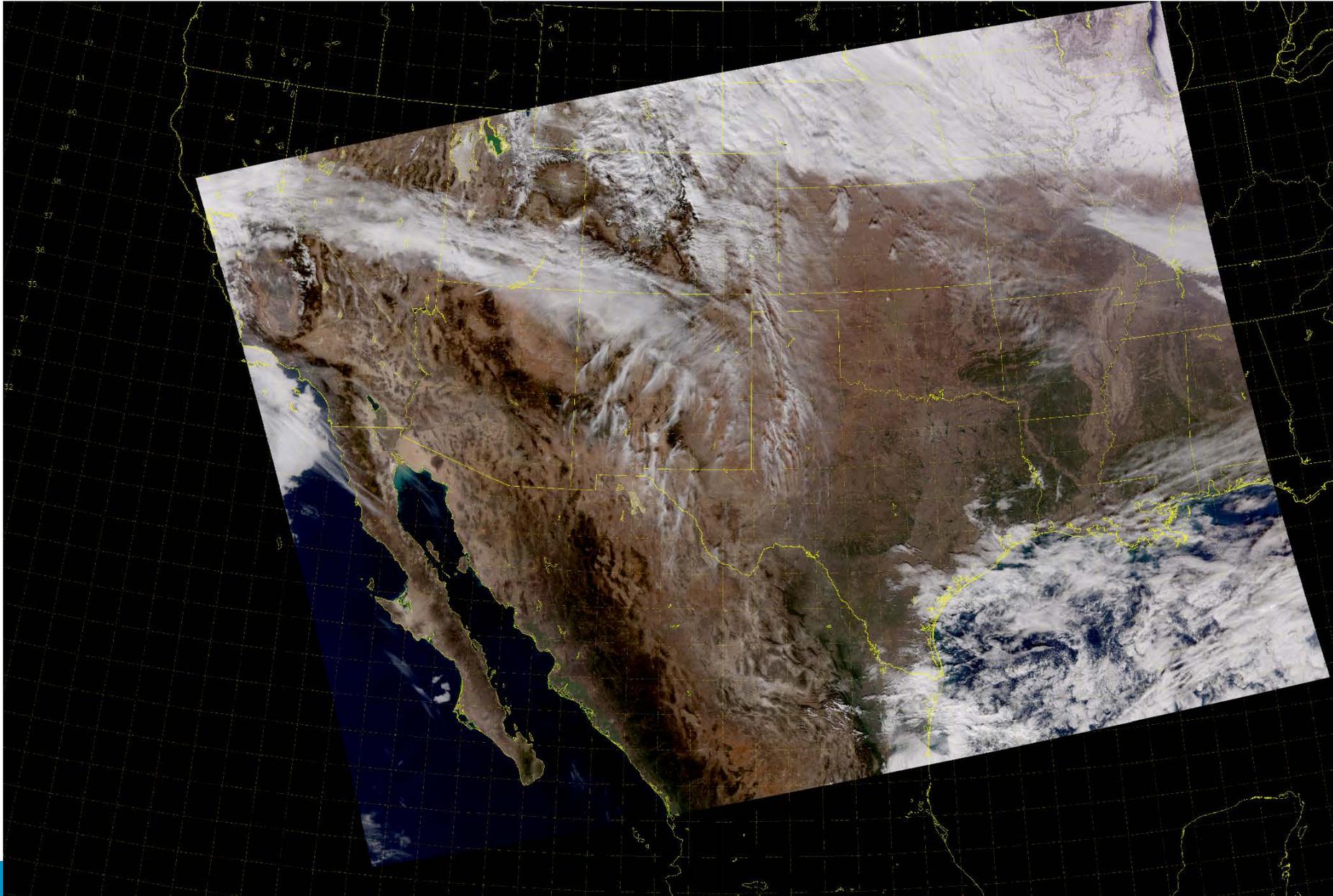


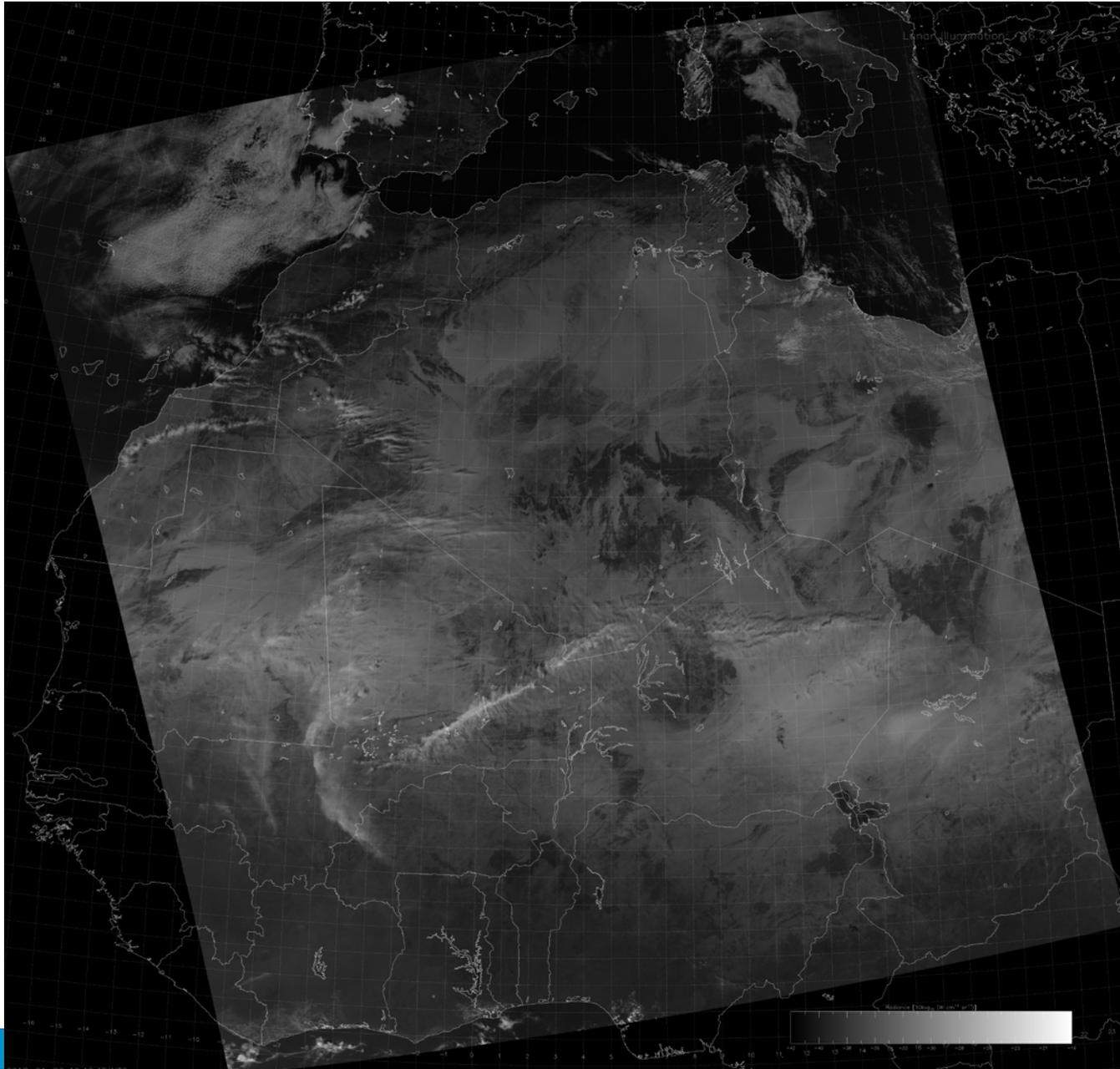
NOAA-20 **DNB** extended granule

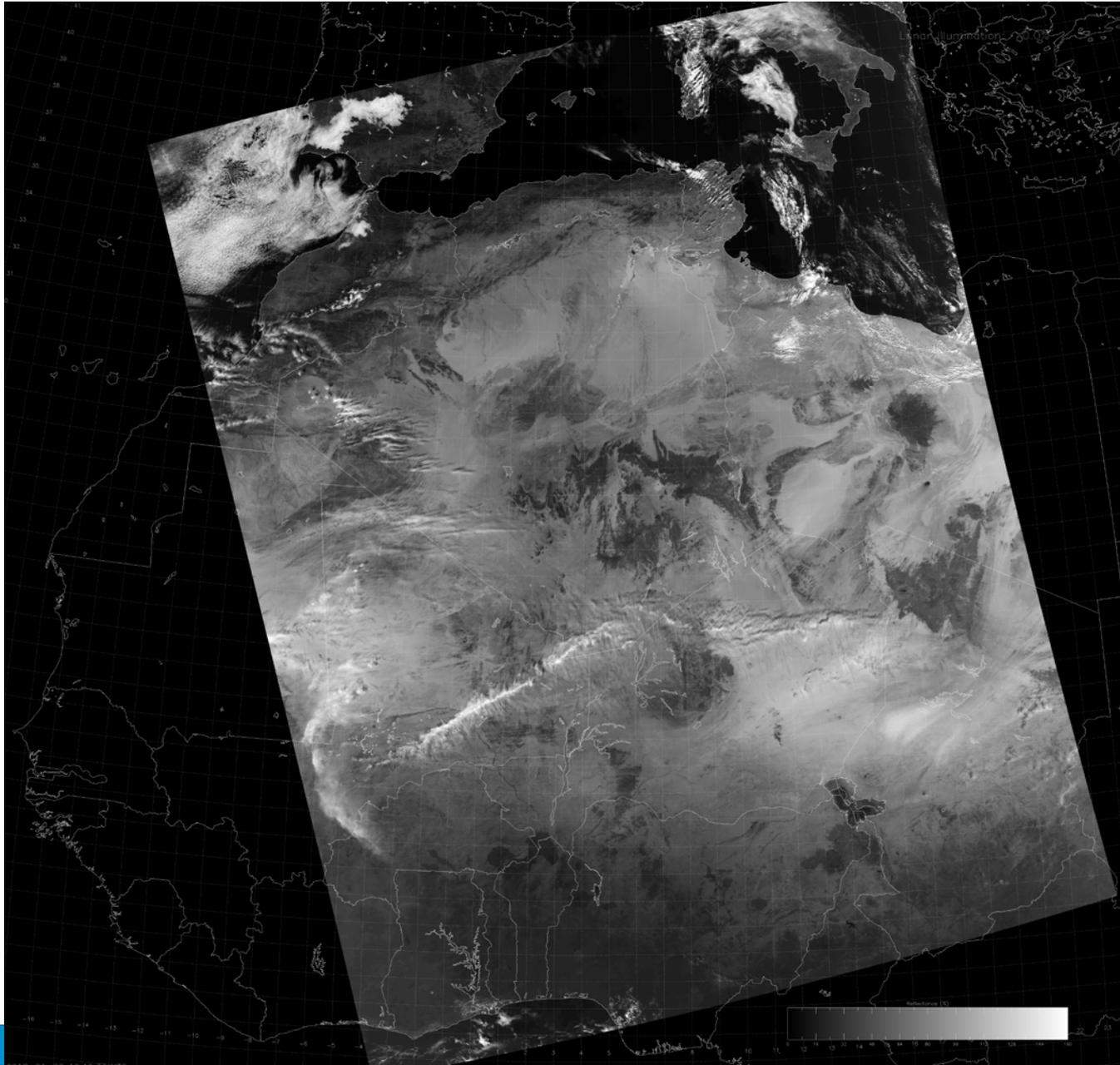


True-color RGB – SW USA – 2018-01-05

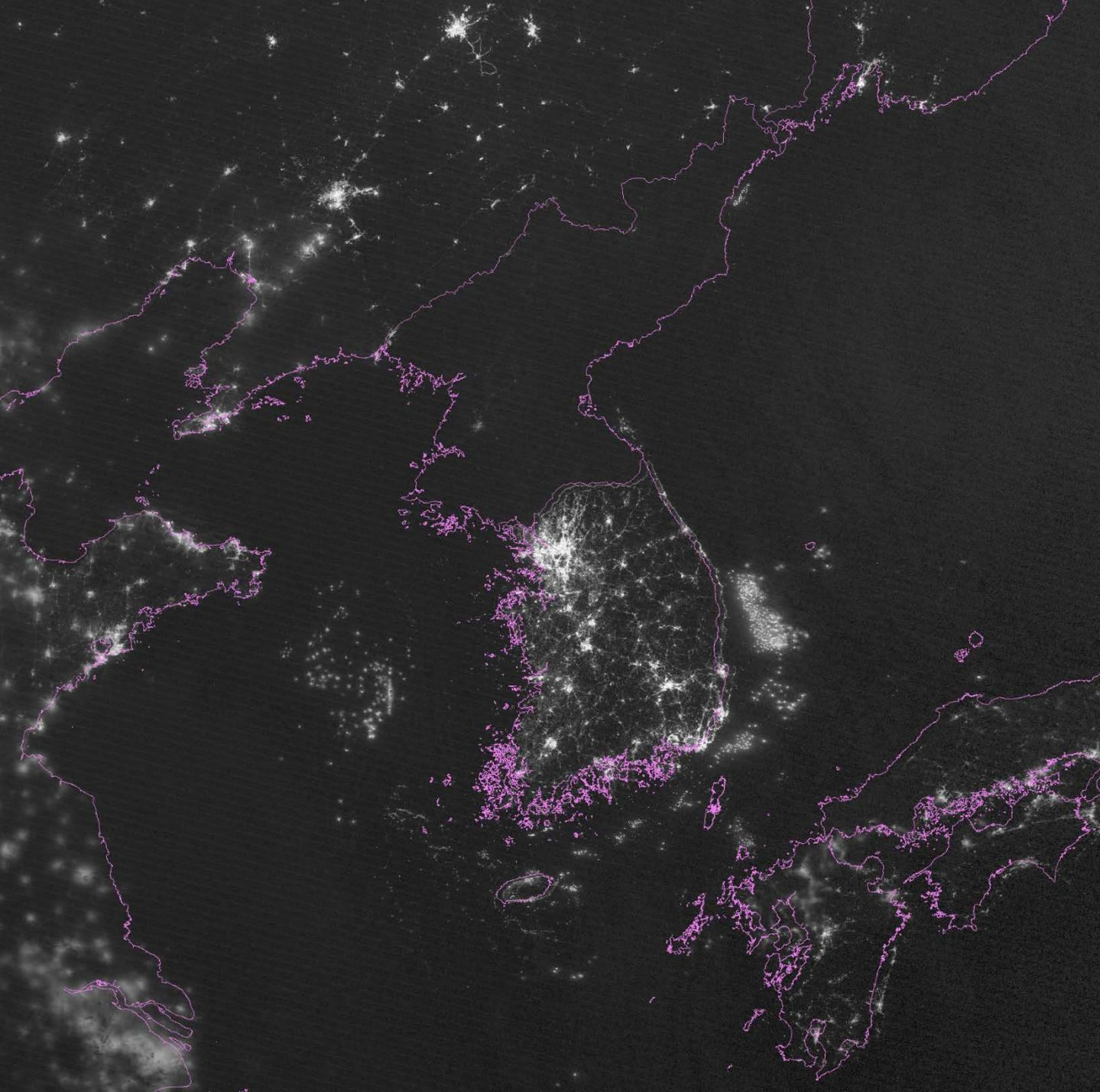
(C. Seaman, CIRA)







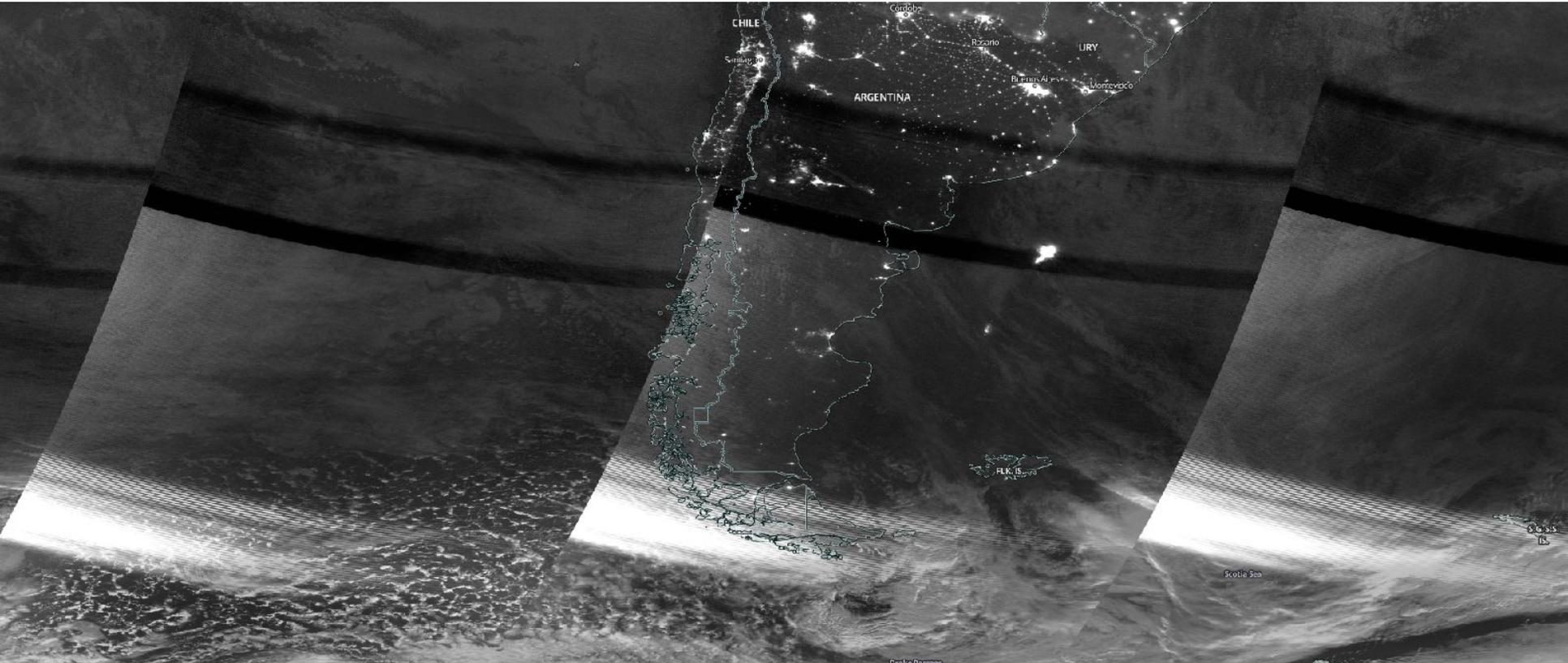
NOAA-20 DNB geolocation offset



**Korea (N/S)
and fishing
boats
2017-12-13
(S. Miller, CIRA)**

**Slight
navigation
offset**

NOAA-20 DNB stray light



This striping will also appear in the NCC product!

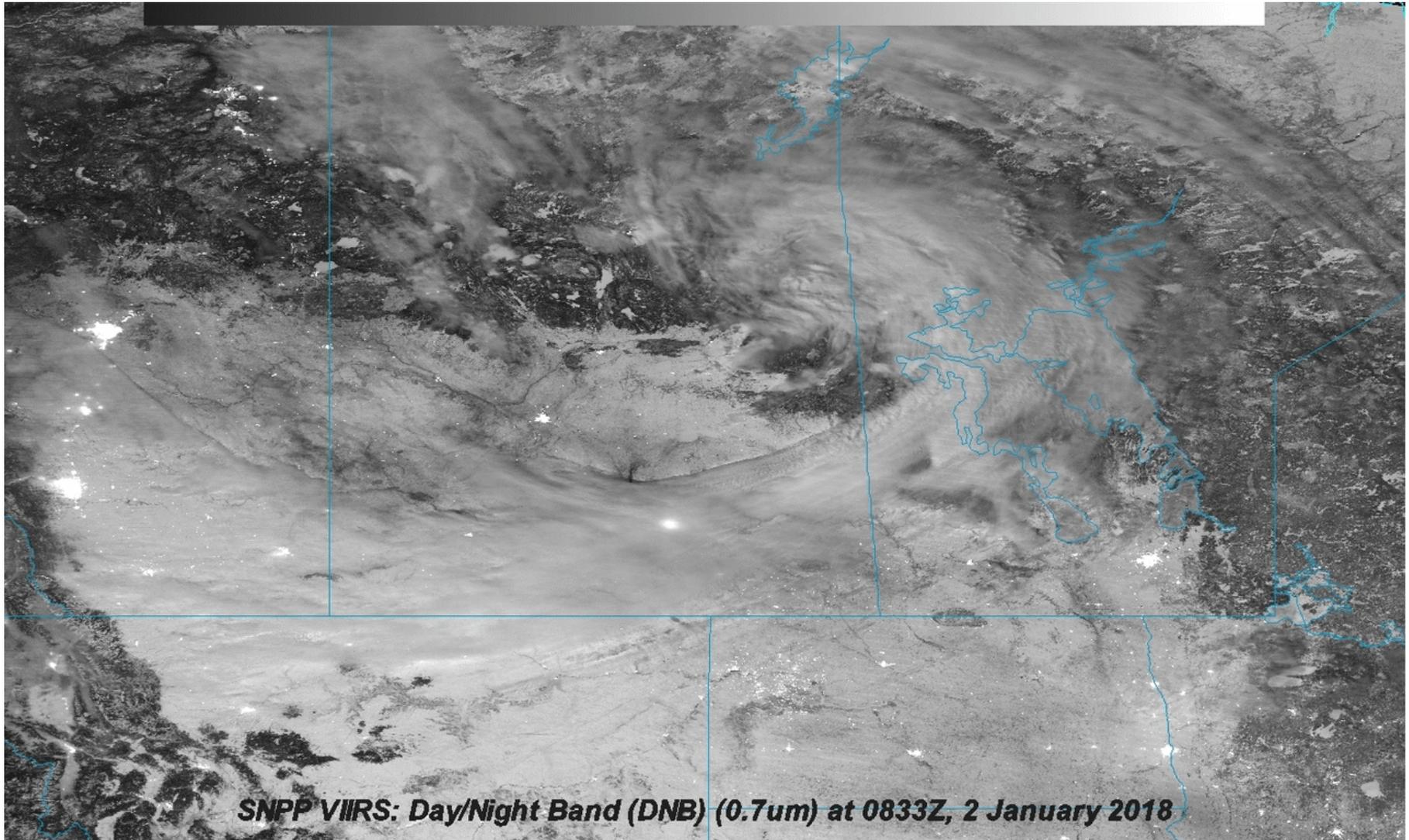
Day-Night-Band **First Light** CONUS – 2017-12-14

(S. Miller, CIRA, for NOAA **Facebook**)



SNPP and NOAA-20 DNB comparisons (@ ~50 minutes separation)

Animation of VIIRS DNB between SNPP and NOAA-20/JPSS-1 (J. Torres, CIRA)

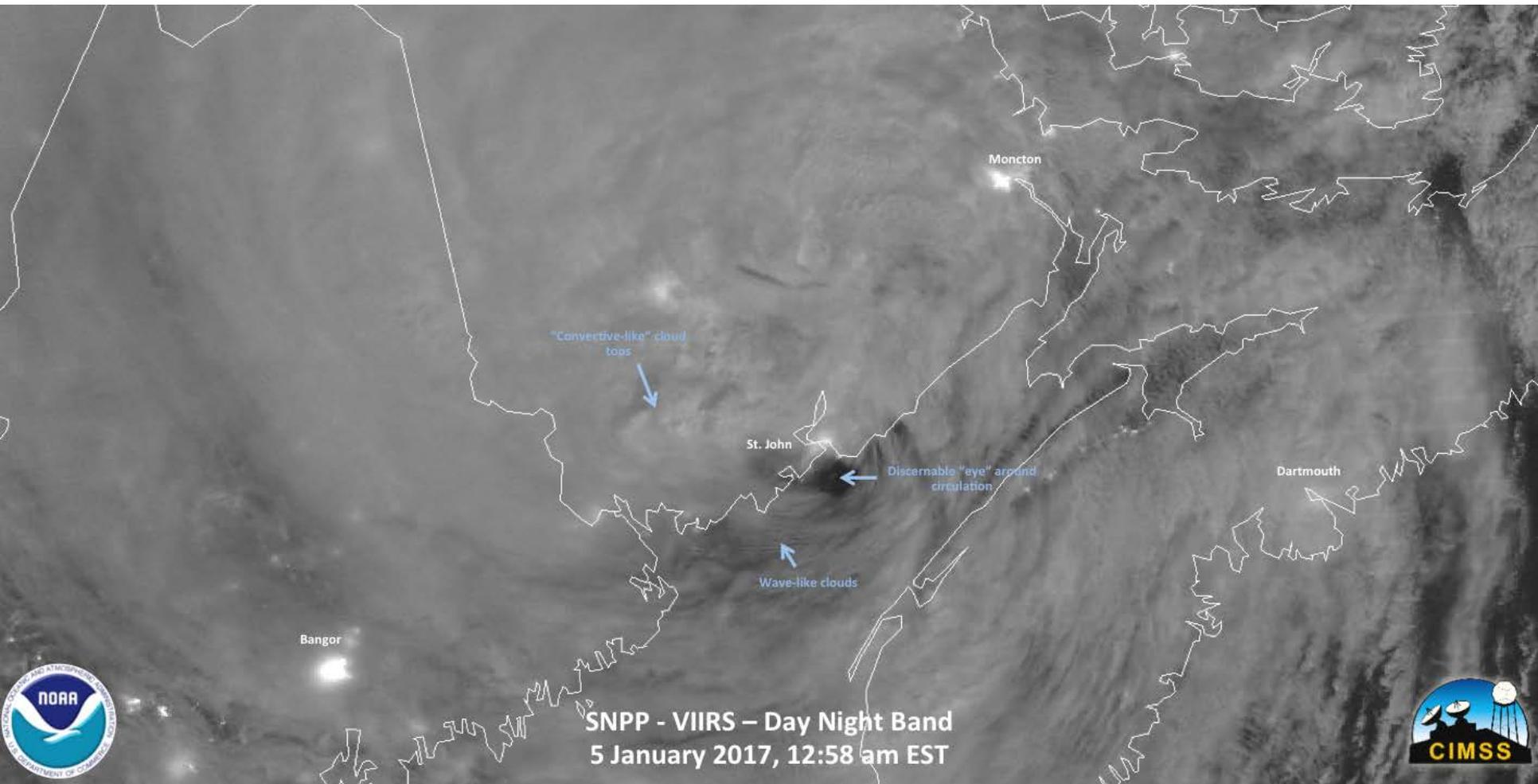


SNPP DNB

East Cost “bomb” off St. John NB

2018-01-05 0558 UTC

(W. Straka, CIMSS/SSEC)

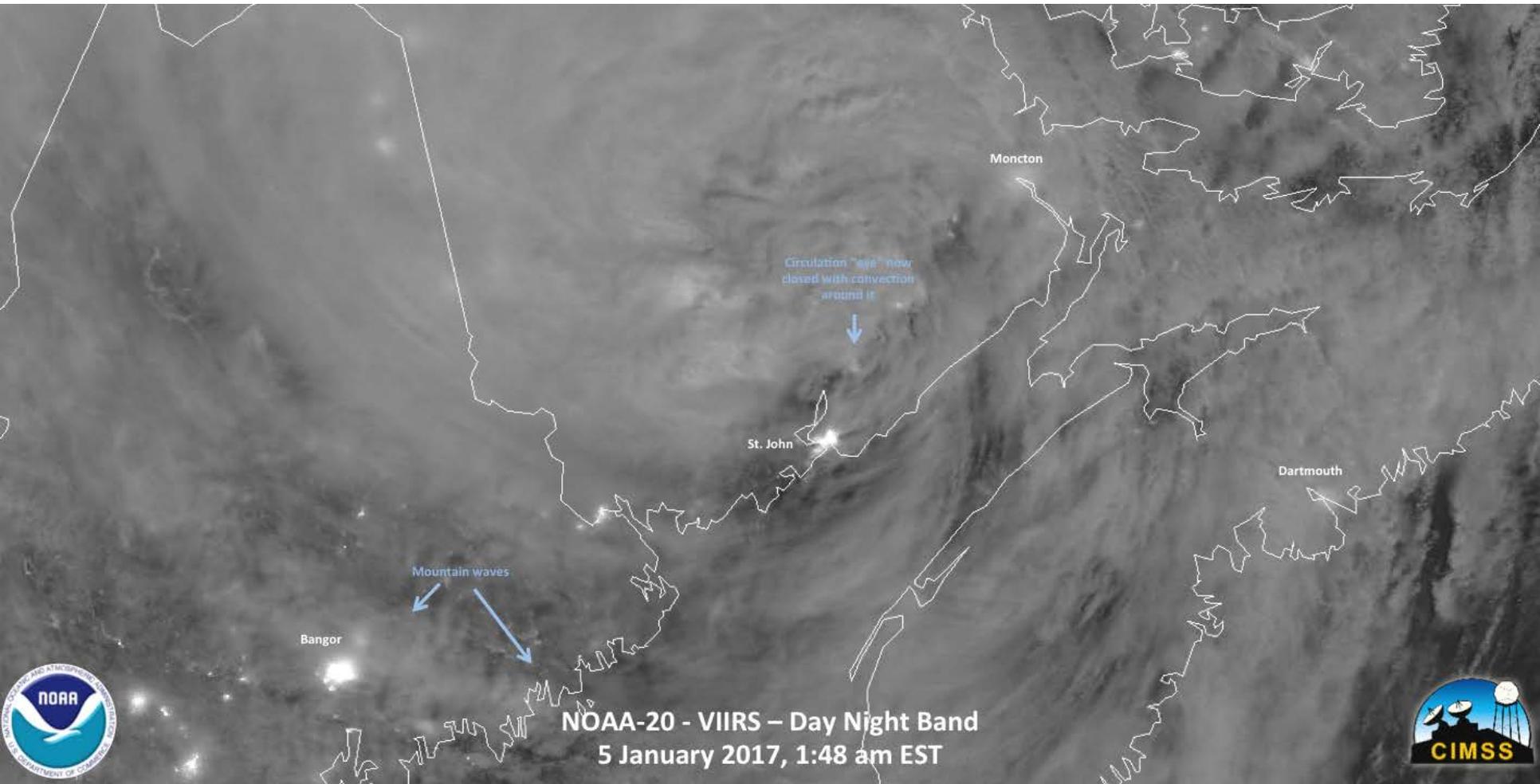


NOAA-20 DNB

East Cost “bomb” off St. John NB

2018-01-05 0648 UTC

(W. Straka, CIMSS/SSEC)







Documents (Check List)

Science Maturity Check List	Yes ?
ReadMe for Data Product Users	In development
Algorithm Theoretical Basis Document (ATBD)	Yes (SNPP)
Algorithm Calibration/Validation Plan	Yes (NOAA-20)
(External/Internal) Users Manual	Yes (SNPP)
System Maintenance Manual (for ESPC products)	
Peer Reviewed Publications (Demonstrates algorithm is independently reviewed)	Yes (SNPP)
Regular Validation Reports (at least annually) (Demonstrates long-term performance of the algorithm)	JPSS Annual Meeting presentations

- Cal/Val results summary:
 - Team recommends **Beta** maturity for **EDR Imagery** based on:
 - **Limited assessment of I4/I5 Imagery**
 - Expected LUT updates for **I3 striping and I4/I5 fill values**
 - Expected **DNB stray light corrections** in February 2018

- Planned improvements:
 - Planned LUT changes for **I3/I4/I5** and **DNB stray light**
- Future Cal/Val activities / milestones:
 - **Provisional** Maturity – Launch+90d – 16 Feb 2018
 - **Validated** Maturity – Launch+9m – August 2018