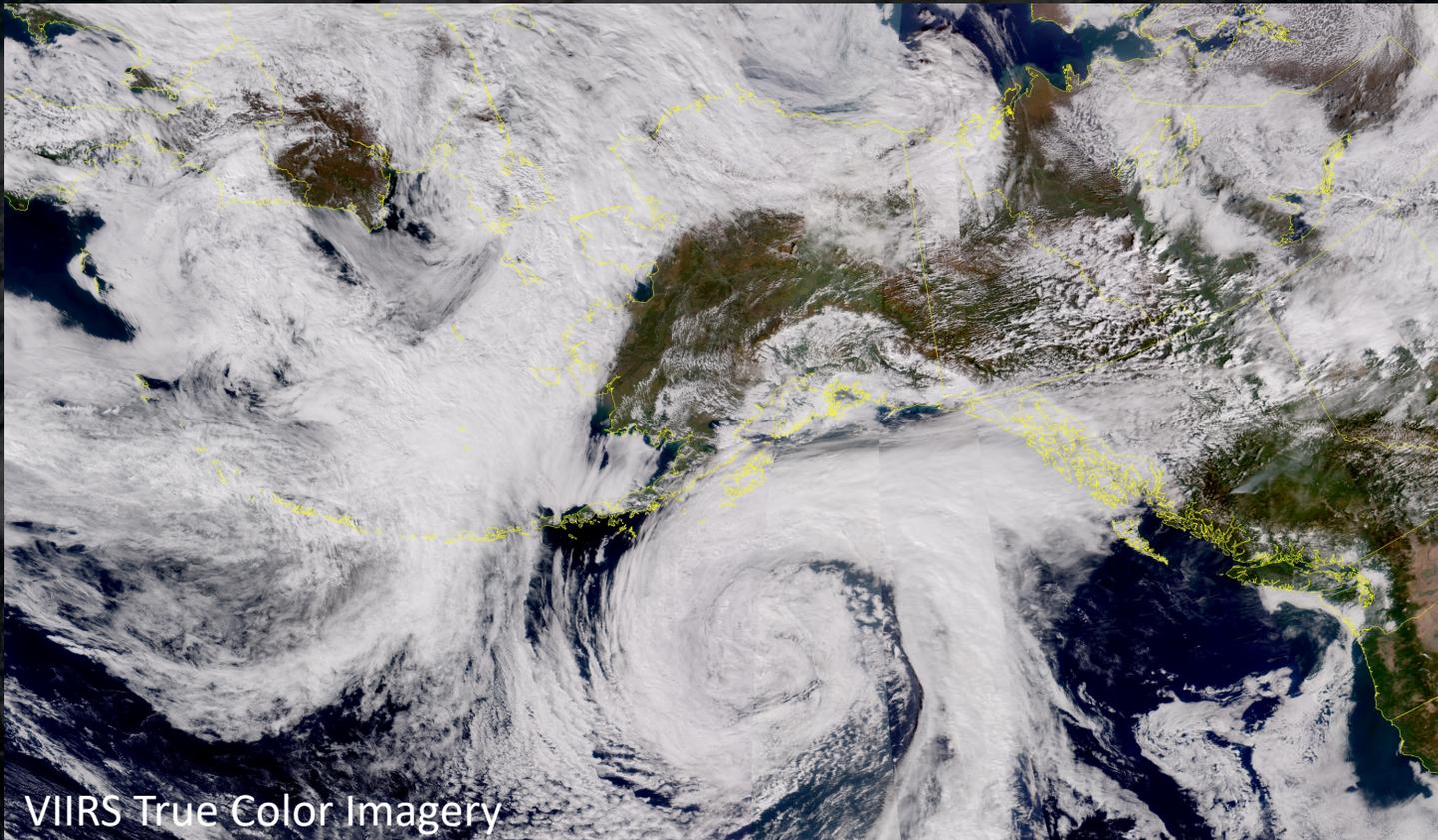
A satellite image of Earth showing the Arctic region, with Alaska and parts of Canada and Russia visible. The image is dark and serves as a background for the text.

# New Satellite Imagery for Sea Spray, Blowing Snow, and Water Vapor Detection in Alaska

**Bill Line**

NESDIS/StAR, Fort Collins, CO

- Sea Spray detection over AK using ABI and VIIRS
- Blowing Snow detection over AK using ABI and VIIRS
- Water Vapor Imagery for AK from JPSS CrIS IR Sounder



# Freezing Spray

- Accumulation of freezing water droplets on a vessel due to:
  - (1) size of a vessel, relative to the wavelength of ocean waves, (2) bearings of a vessel, relative to the prevailing wind, (3) ambient wind speed (18+ knots), (4) air temperature (<-1.7C), (5) sea temperature (<7C), and (6) geometry of a given vessel
- Hazard to vessels in the high altitudes
- NWS relevance
  - Coastal Waters Forecast, Heavy Freezing Spray Warning, DSS
  - Rarely verified
- Sea Spray signature in ABI and VIIRS Imagery
  - White caps and sea spray aerosols can be detected in otherwise clear sky conditions
    - with the right enhancements
    - multispectral imagery products that combine VIS/NIR/SWIR/MWIR channels
- Sea Spray RGB available in NWS AK AWIPS (VIIRS and ABI) and on CIRA SLIDER webpage
  - Training: [https://rammb2.cira.colostate.edu/training/visit/quick\\_reference/#tab17](https://rammb2.cira.colostate.edu/training/visit/quick_reference/#tab17)



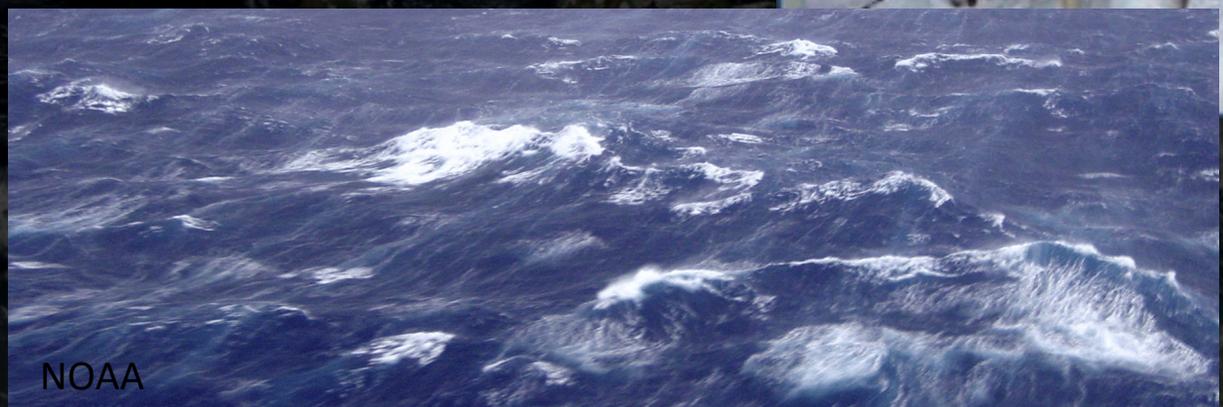
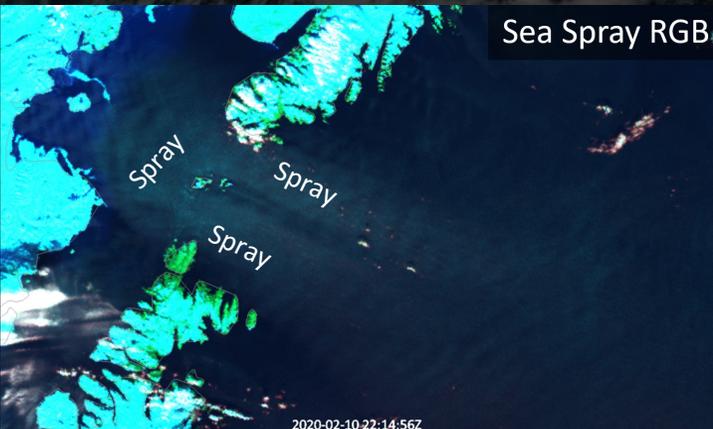
NOAA

## ABI Sea Spray RGB (0.5 km – 2km)

Red: 3.9 – 10.3  
 Green: 0.87  
 Blue: 0.64

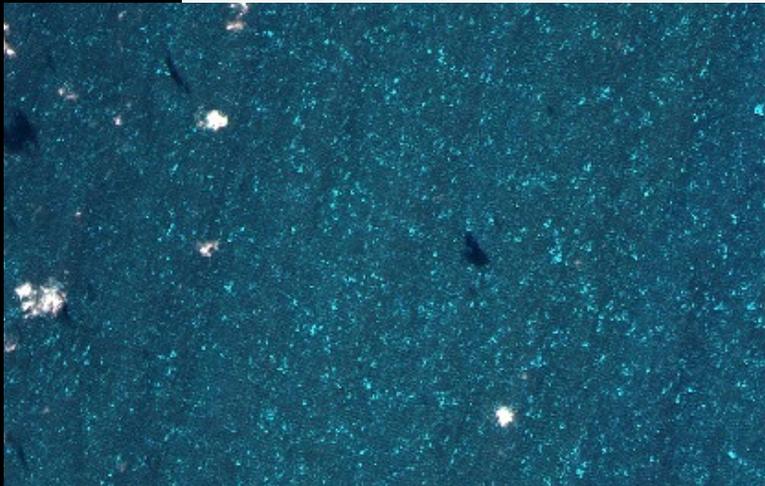
## VIIRS Sea Spray RGB (375-m I-bands)

Red: 3.7 – 11.45  
 Green: 0.86  
 Blue: 0.64

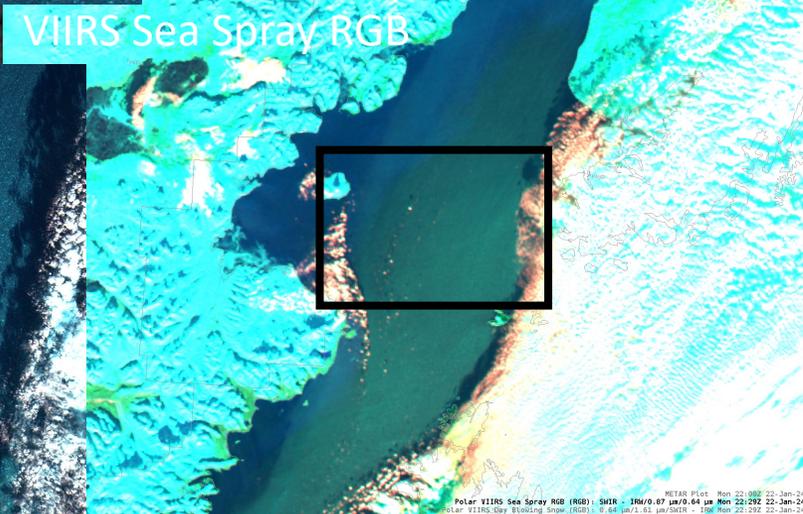
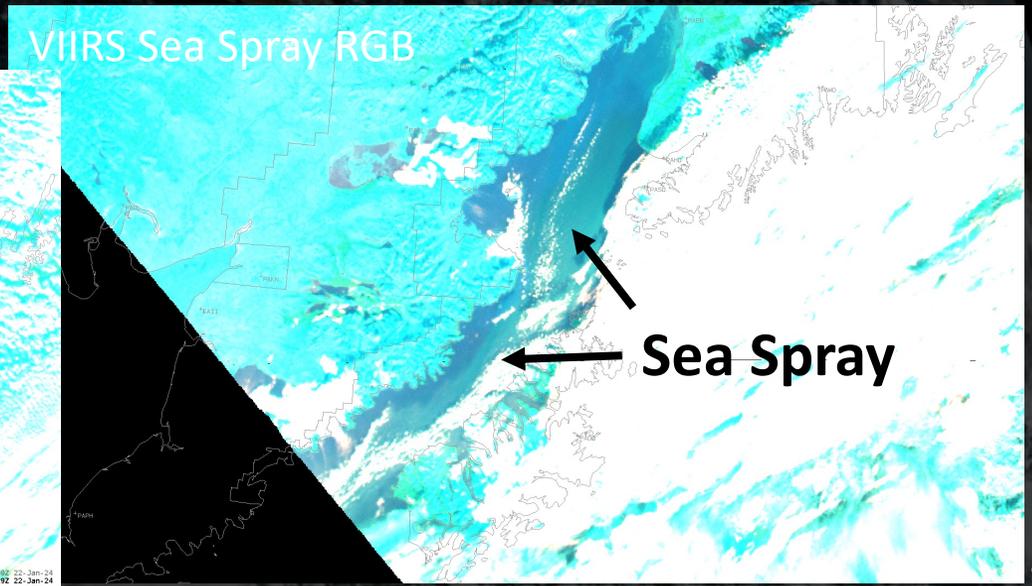
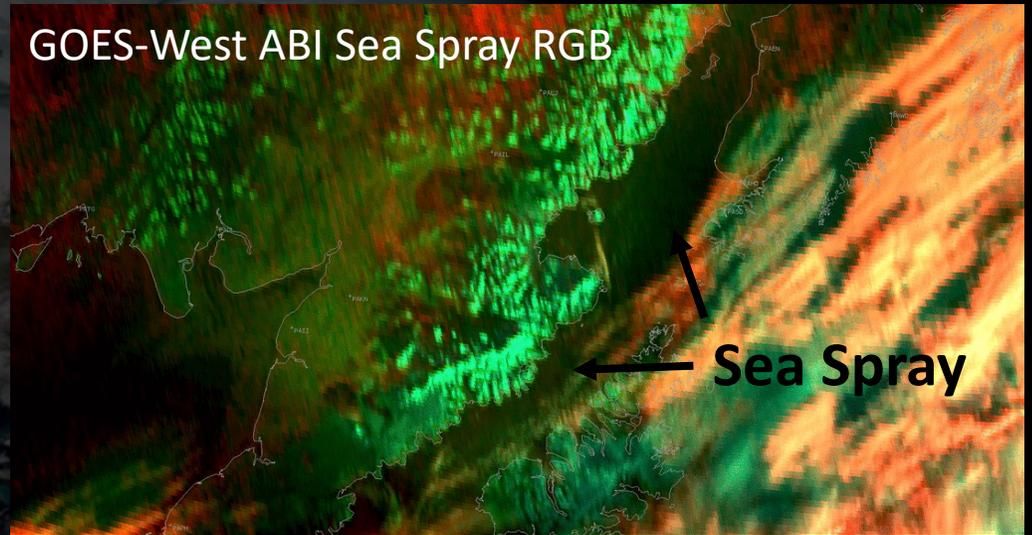


NOAA

PKZ731-230430-

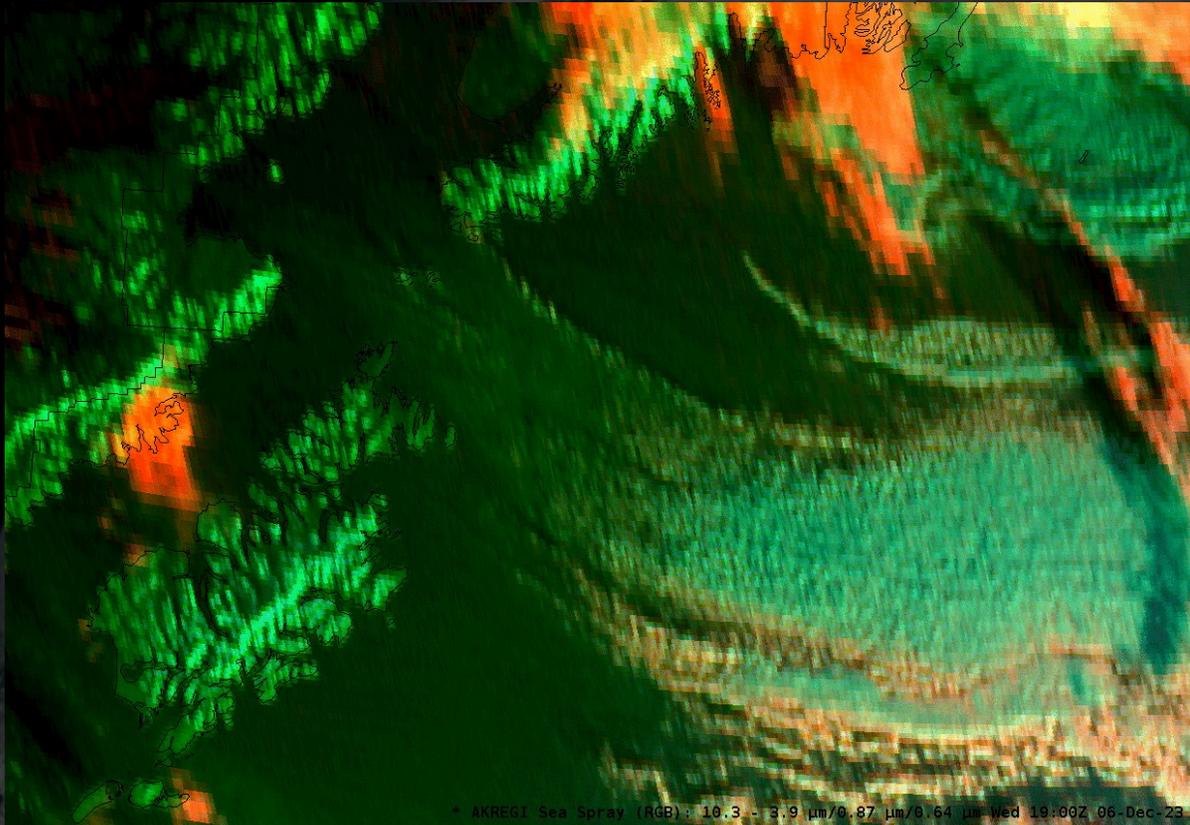


ESDAY...  
Freezing spray.  
. Freezing spray.

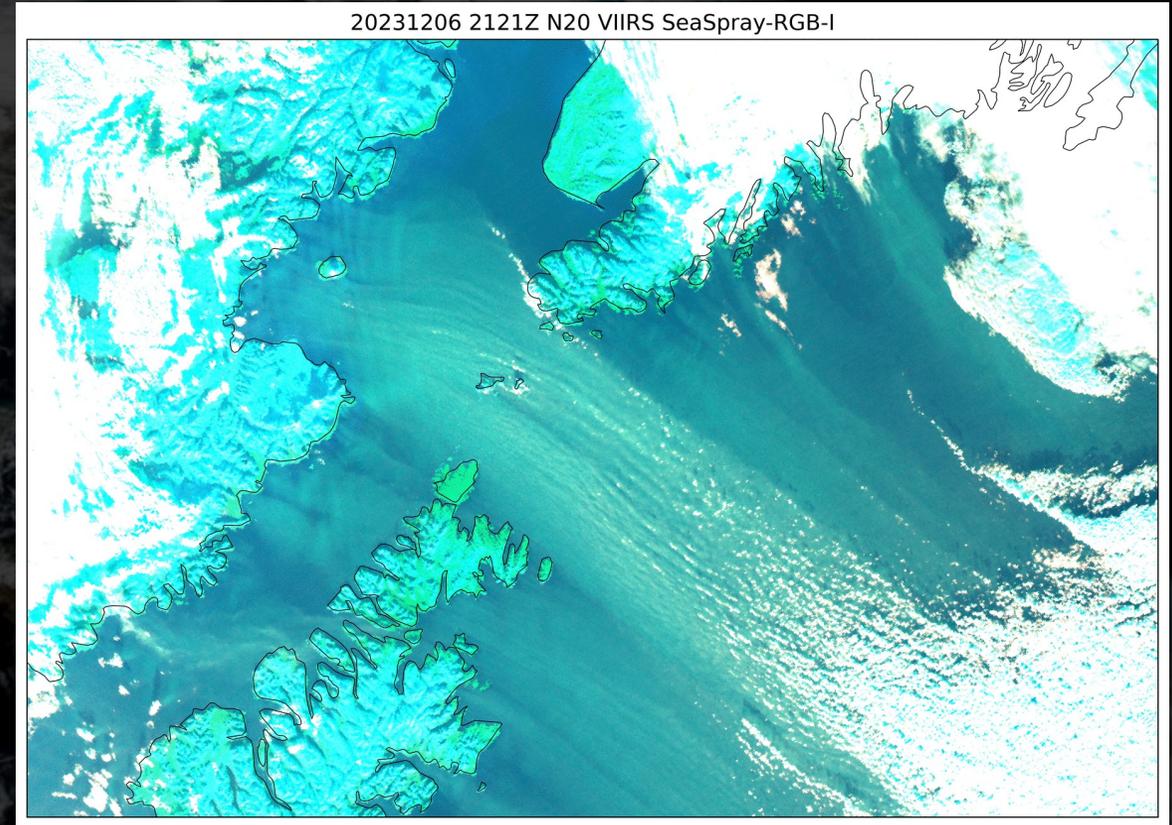


Polar VIIRS Sea Spray RGB (RGB) SMR - 106/0.87 Jan/20 04:18 Mon 22:08:22 Jan-24  
Polar VIIRS Day Bleeding Snow (RGB) 0.45 Jan/1 65 Jan/20 19:08 Mon 22:08:22 Jan-24

## GOES-West ABI Sea Spray RGB



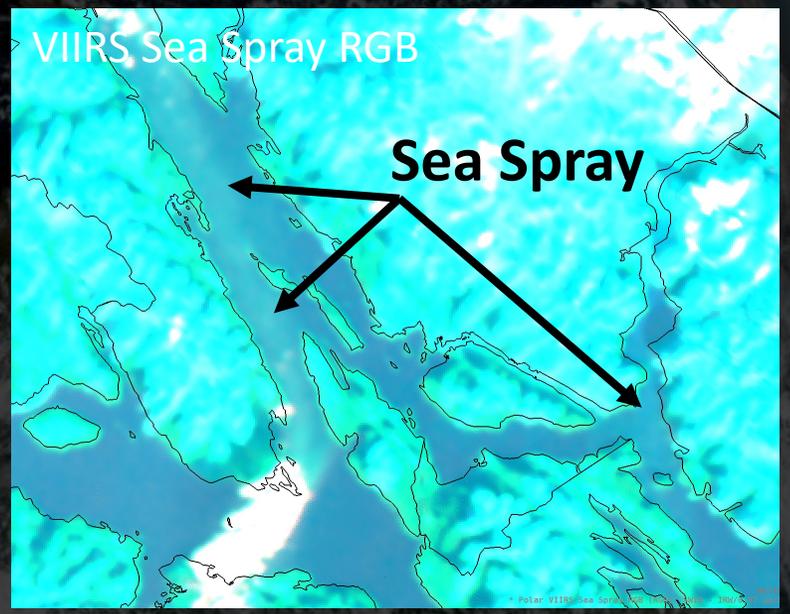
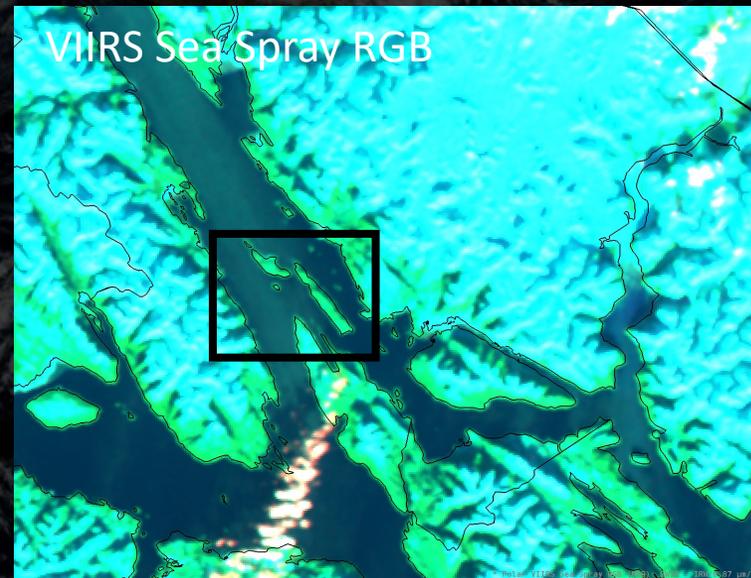
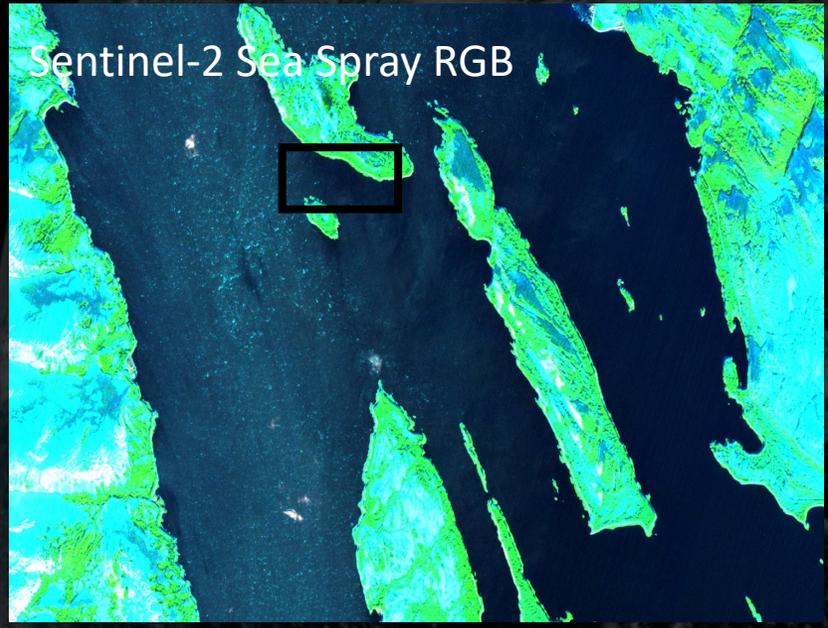
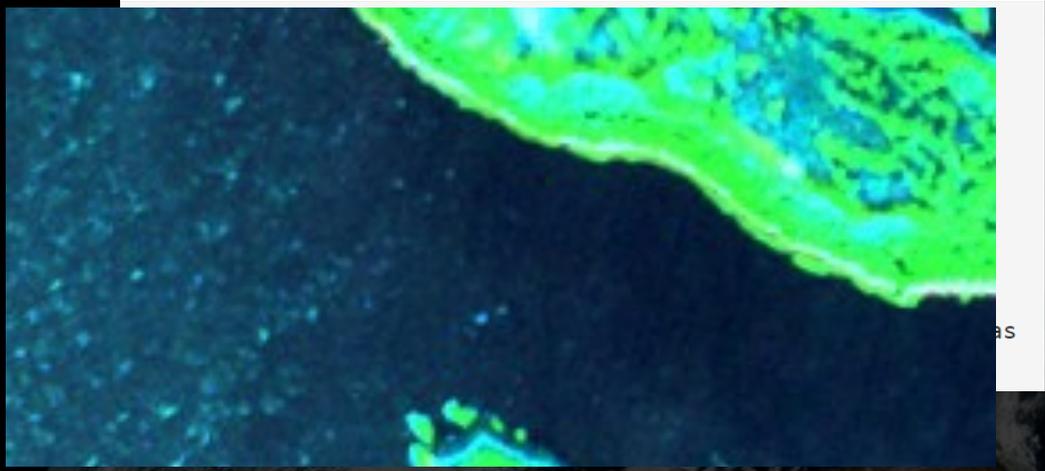
## VIIRS Sea Spray RGB



PKZ730-070115-  
West of Barren Islands Including Kamishak Bay-  
328 AM AKST Wed Dec 6 2023

...GALE WARNING TODAY...

.TODAY...NW wind 45 kt. Seas 13 ft. Freezing spray.  
.TONIGHT...W wind 25 kt becoming SW 15 kt after midnight. Seas 6 ft.



- Blowing snow poses a significant hazard to both air and ground transportation due to considerably and rapidly reduced visibility
- NWS relevance
  - Forecast grids, forecast discussions, blizzard warnings, aviation, DSS
- Blowing snow signal in ABI and VIIRS Imagery
  - Already accumulated snow that is lofted and blown by strong winds can be detected in otherwise clear sky conditions
    - with the right enhancements
    - multispectral products that combine VIS/NIR/SWIR/MWIR channels
- Blowing Snow RGB available in NWS AK AWIPS (VIIRS and ABI) and on CIRA SLIDER webpage
  - Training: coming soon



## ABI Blowing Snow RGB (0.5 km – 2km)

Red: 0.64  
Green: 1.6  
Blue: 3.9 – 10.3

## VIIRS Blowing Snow RGB (375-m I-bands)

Red: 0.64  
Green: 1.6  
Blue: 3.7 – 11.45

**Widespread Blowing Snow is Causing Blizzard Conditions in Open Areas**

weather.gov/f/g  
NWSGr andForks

Lofted Blowing Snow  
Visibility: 6+ Miles

...8 Minutes Later...  
Blowing Snow  
Visibility: 1/4 to 1/2 Mile

What Does This Mean?

- Blizzard conditions continue this afternoon, primarily in open areas, with occasional clearing between "streamers" of lofted blowing snow.
- Travel impacts are likely, with sharply reduced visibilities occurring suddenly.

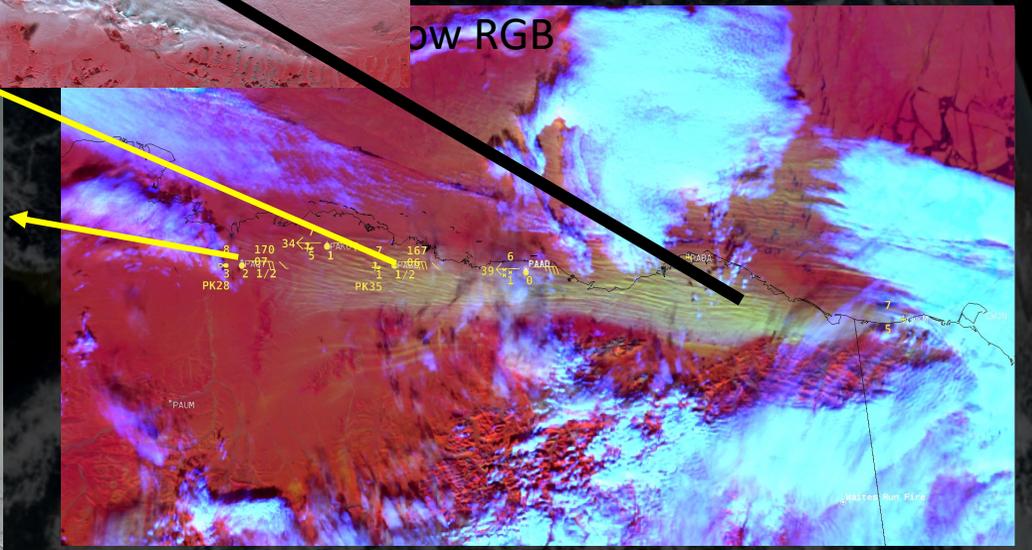
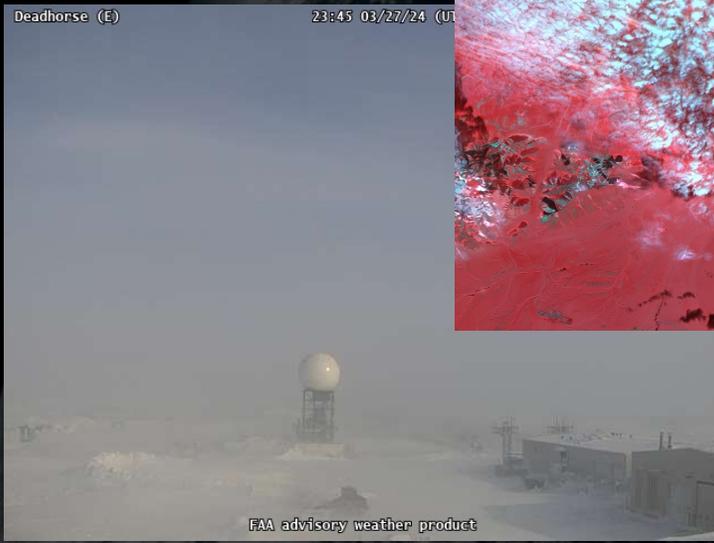
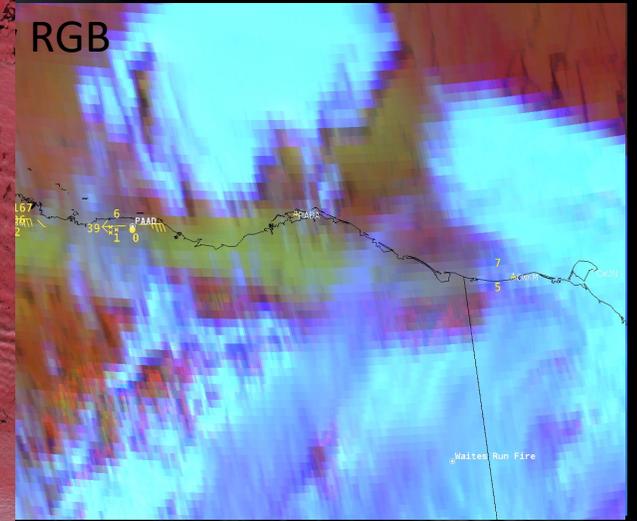
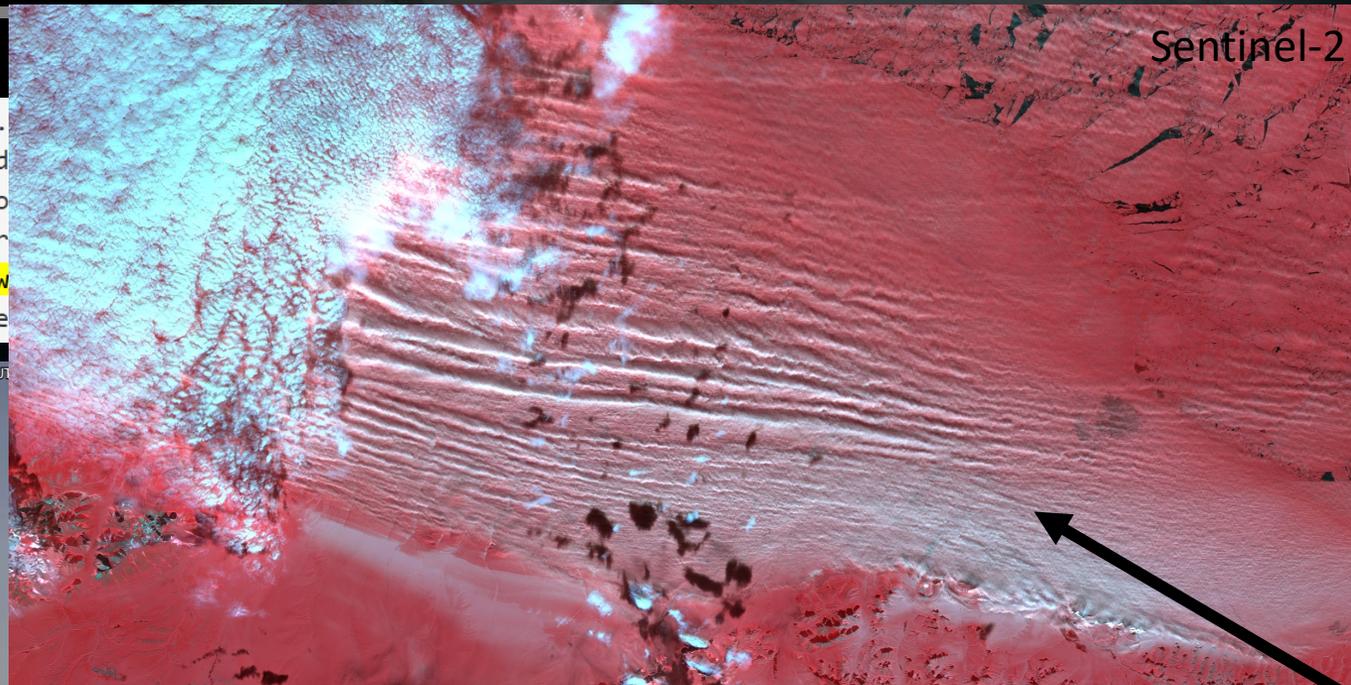
Published on: 01/18/2022 at 3:15PM

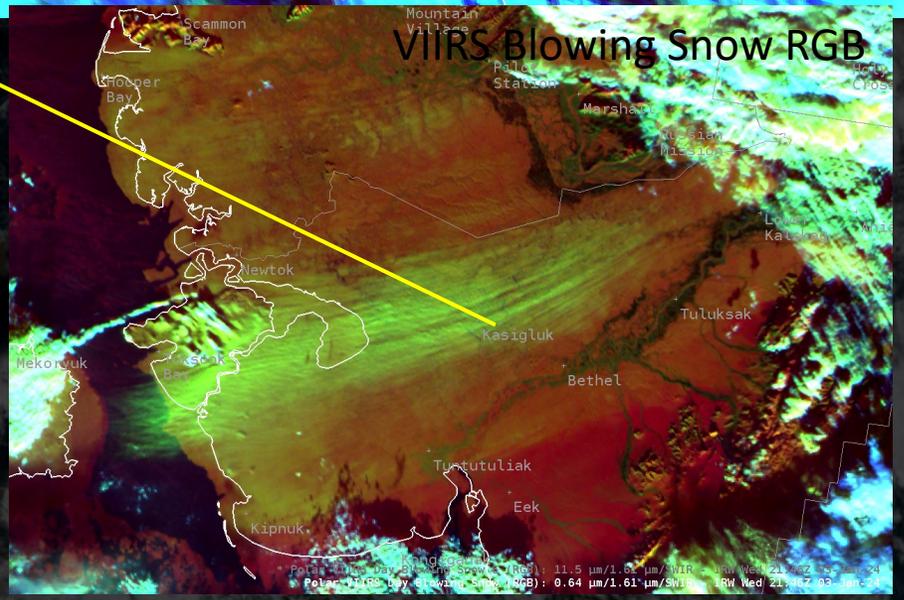
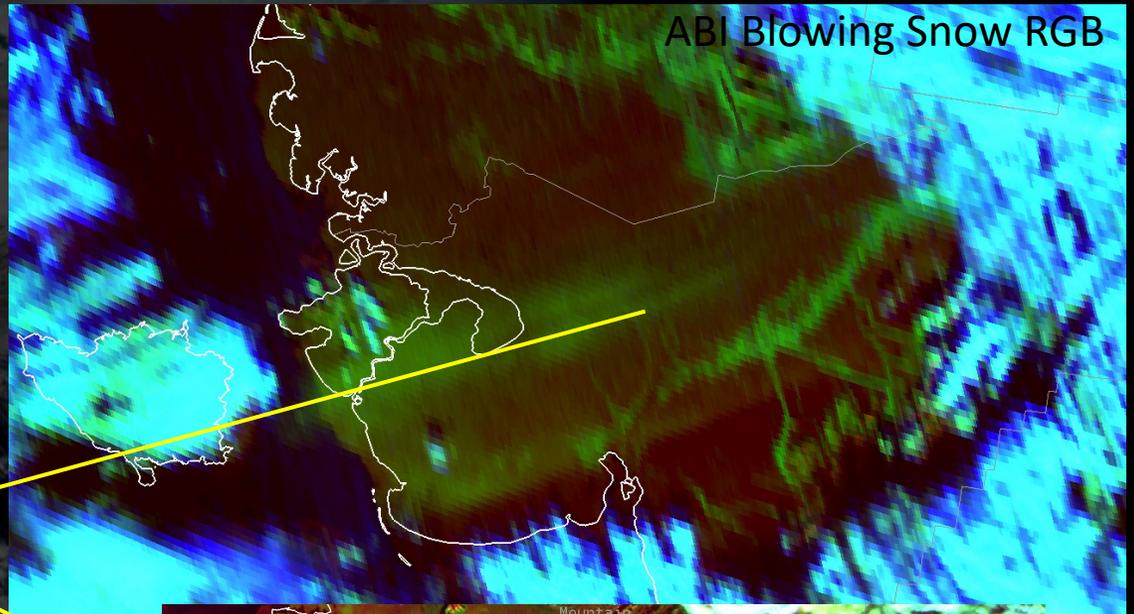
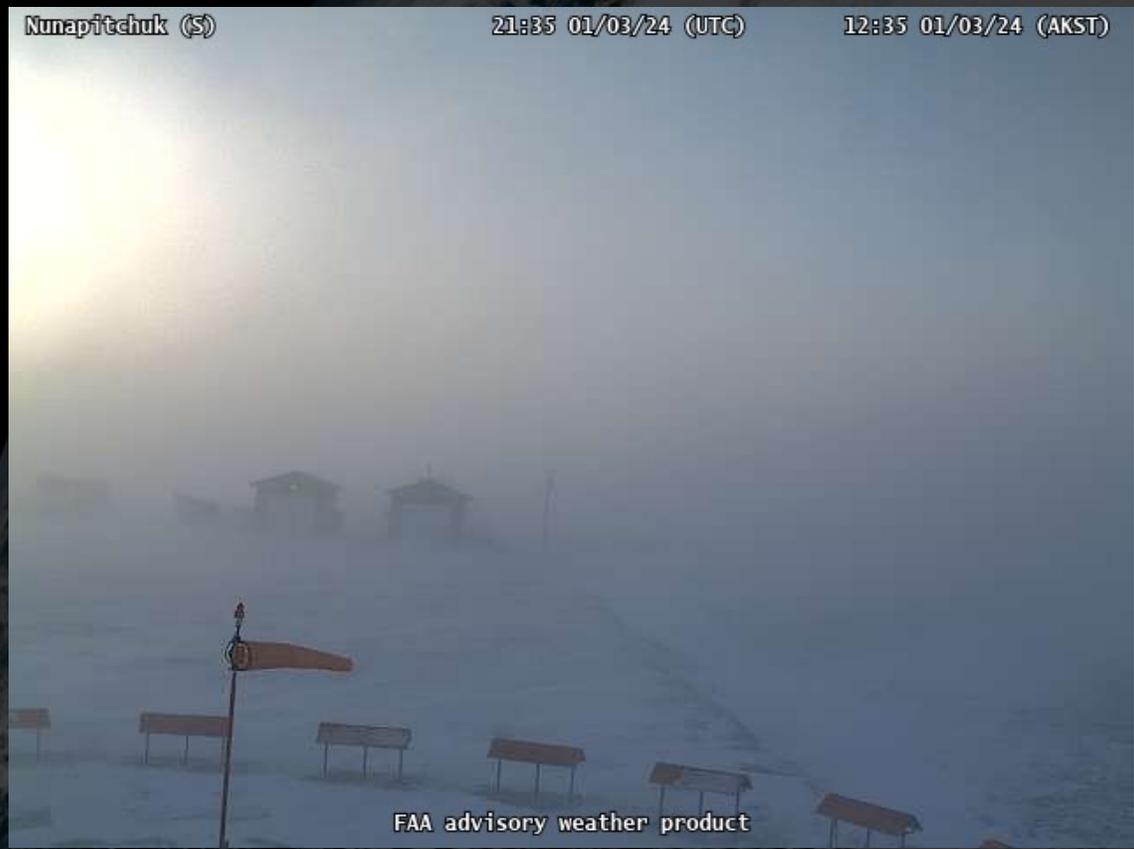


# 27 March 2024 northern Alaska Blowing Snow

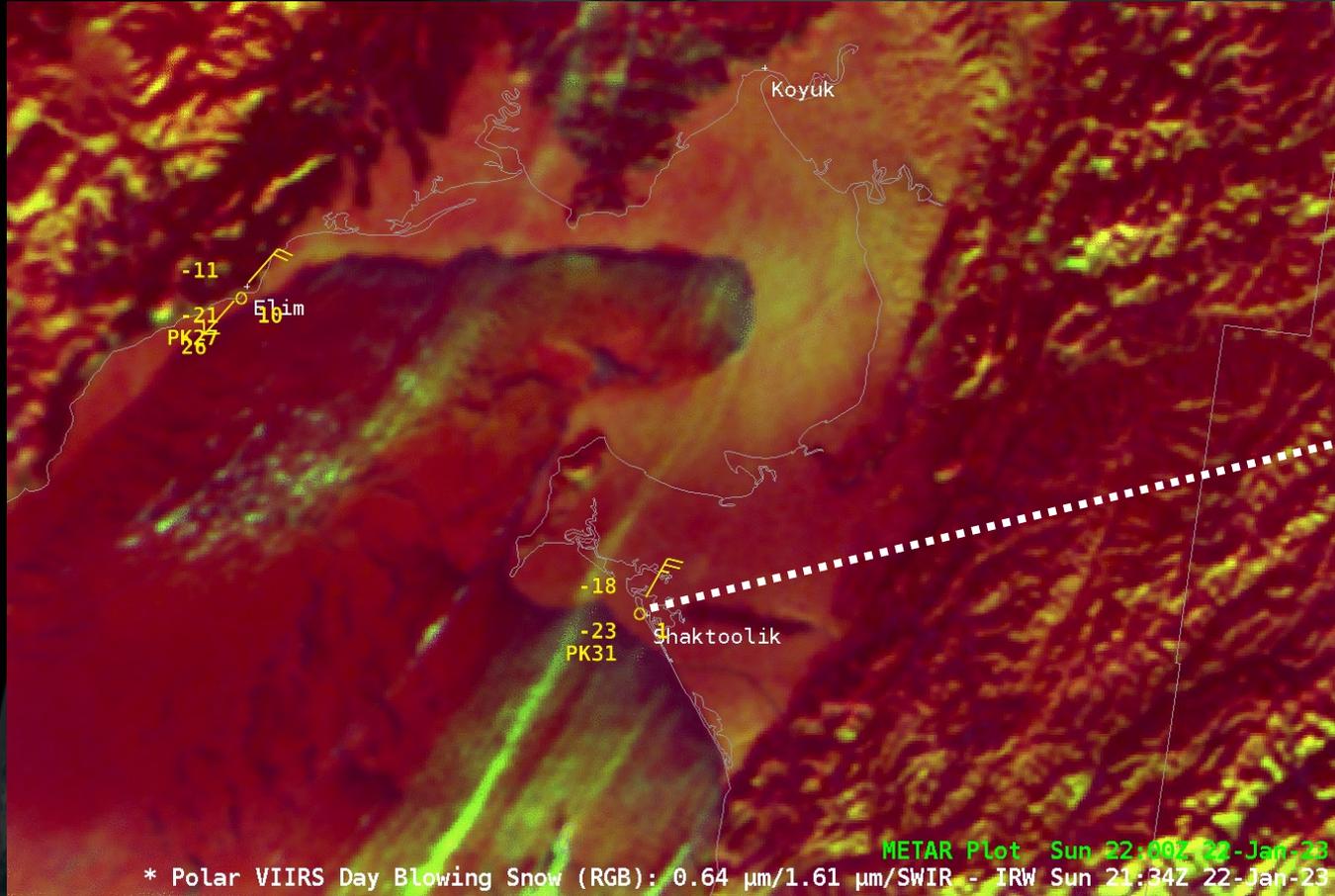


North Slope and Brooks Range..  
**Blowing snow** will diminish tod  
 Deadhorse west. East of Deadho  
 Barter Island, winds will incr  
 mph at times with **blowing snow**  
 into early tomorrow morning be





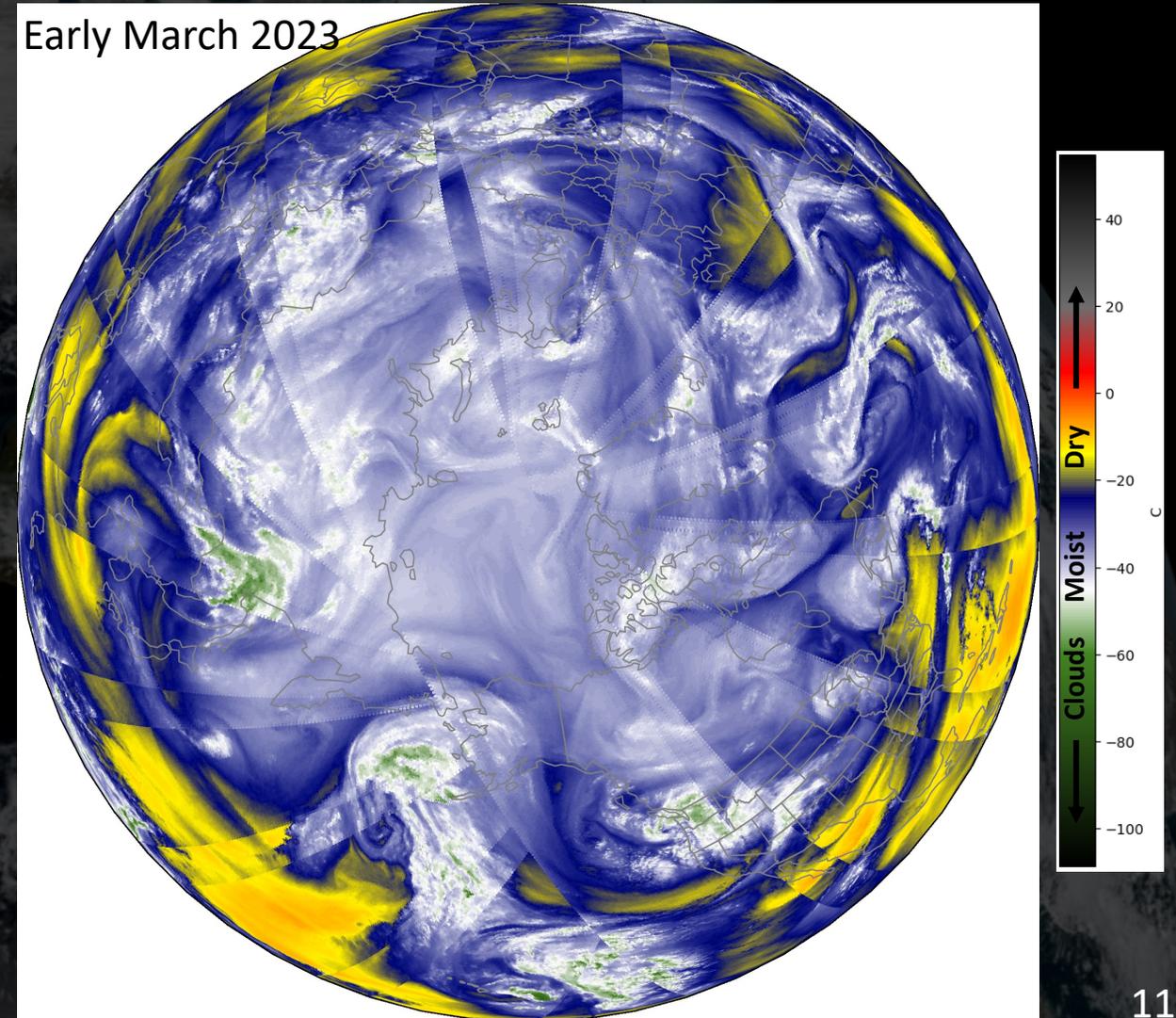
## VIIRS Blowing Snow RGB



- WV imagery helps forecasters detect and track large scale meteorological features
- JPSS VIIRS Imager lacks WV and Ozone bands, and GEO imagery is not available over the poles
- JPSS CrIS IR Sounder senses at a high spectral resolution
- This Project: Create imagery from CrIS to fill spectral gaps present in VIIRS for the high latitudes
- CrIS Imagery available on CIRA SLIDER webpage, coming to AWIPS soon
- More info/training: <https://rammb2.cira.colostate.edu/research/cris-imagery/>

NOAA-20/21 CrIS MLWV (ABI Ch09)

Early March 2023

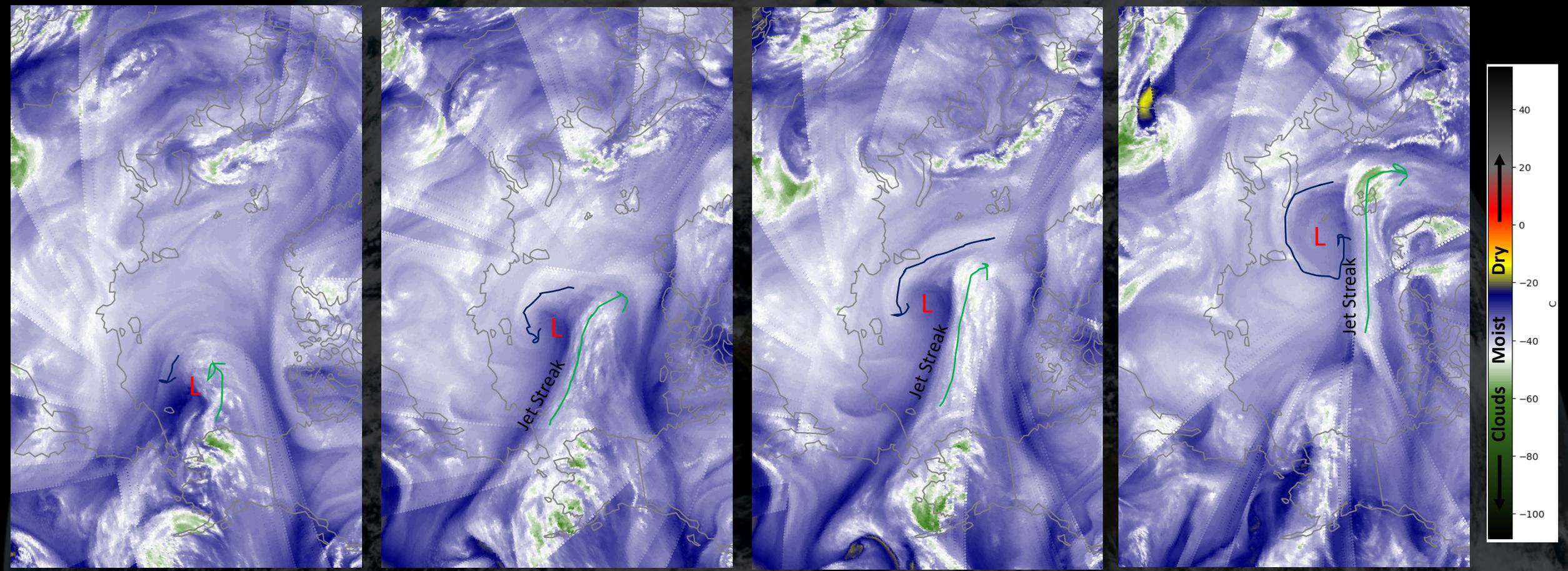


| ABI #   | Name              | ABI CWL (um)   | ABI Range (um)   | CrIS Range Used (1/cm) |
|---------|-------------------|----------------|------------------|------------------------|
| 8       | UL water vapor    | 6.19           | 5.79 - 6.59      | 1517.5 - 1726.875      |
| 9       | ML water vapor    | 6.93           | 6.72 - 7.14      | 1400.625 - 1487.5      |
| 10      | LL water vapor    | 7.34           | 7.24 - 7.43      | 1346.25 - 1380.625     |
| 12      | Ozone             | 9.61           | 9.42 - 9.80      | 1020.625 - 1061.25     |
| 13      | LWIR Window       | 10.33          | 10.18 - 10.48    | 954.375 - 981.875      |
| 14      | LWIR Window       | 11.21          | 10.82 - 11.60    | 861.875 - 923.75       |
| 15      | LWIR Dirty Window | 12.29          | 11.83 - 12.75    | 784.375 - 845          |
| 16      | CO2               | 13.28          | 12.99 - 13.56    | 737.5 - 769.375        |
| VIIRS # | Name              | VIIRS CWL (um) | VIIRS Range (um) | CrIS Range Used (1/cm) |
| M15     | CWLWIR            | 10.76          | 10.26 - 11.26    | 888.125 - 974.375      |

| RGB Name         | Red     | Green   | Blue |
|------------------|---------|---------|------|
| Airmass RGB      | B8 - B9 | B12-B13 | -B8  |
| Modified SO2 RGB | B9-B10  | B15-B13 | B13  |

= Not Available with VIIRS

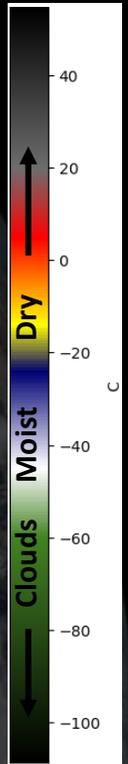
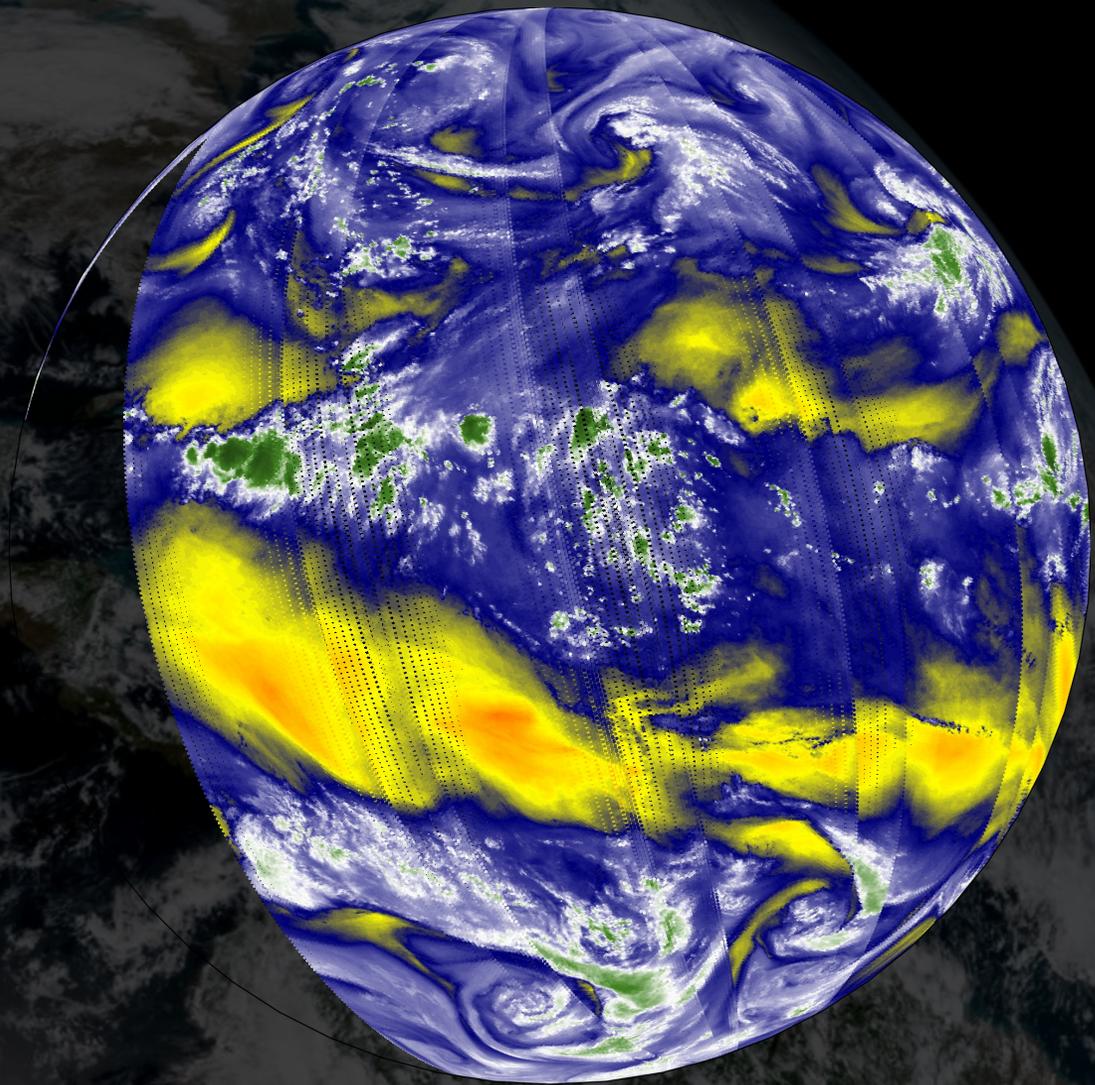
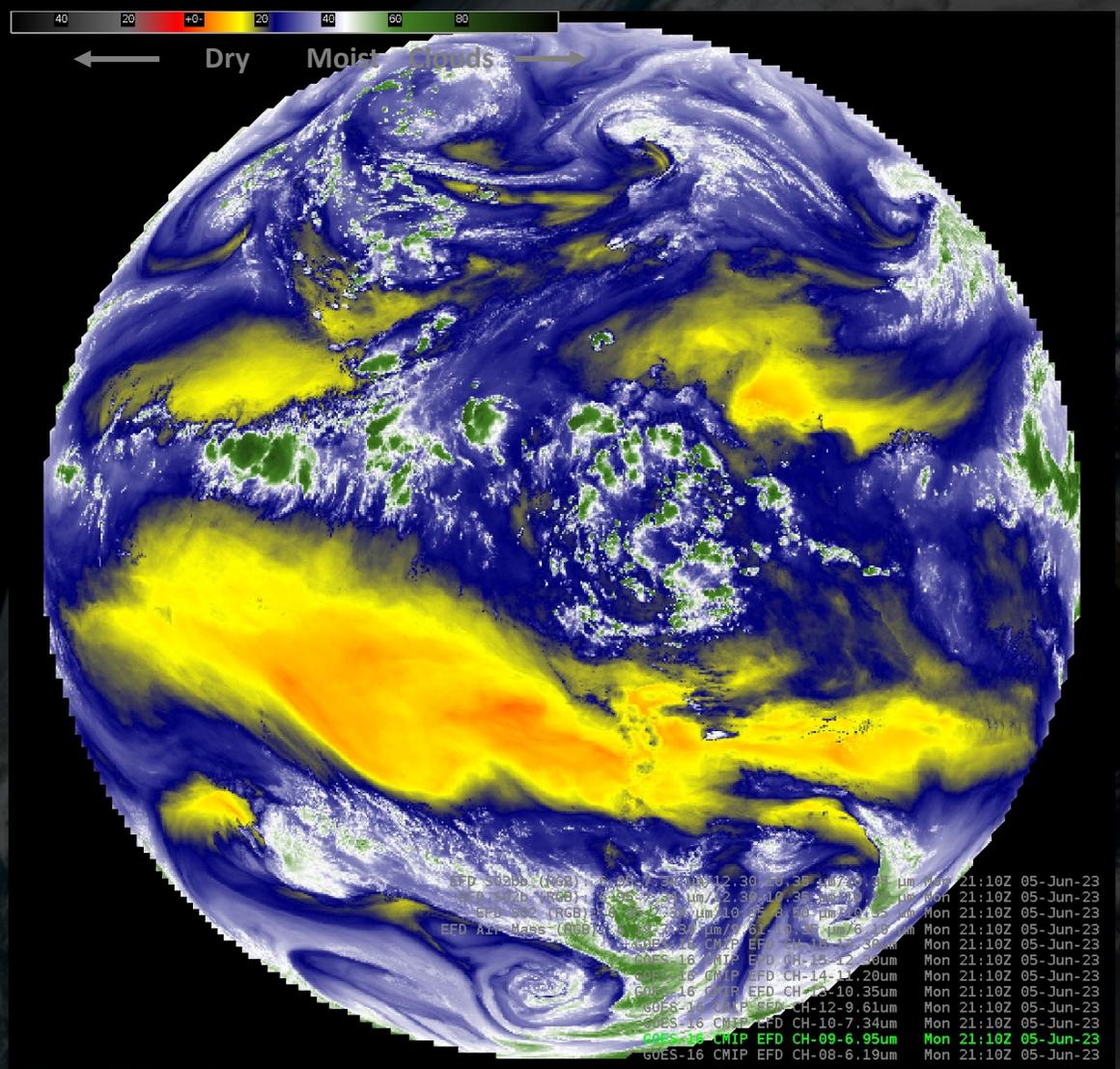
NOAA-20/21 CrIS MLWV (ABI Ch09)



GOES-16 ABI Band 09

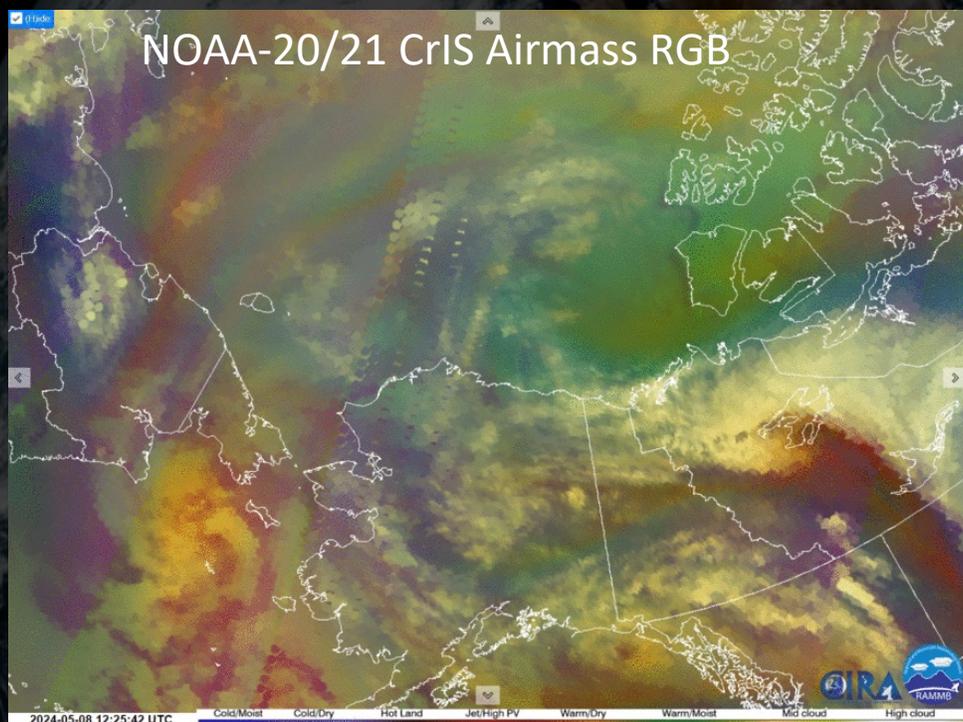
6.95 um - MLWV

NOAA-20/21 CrIS

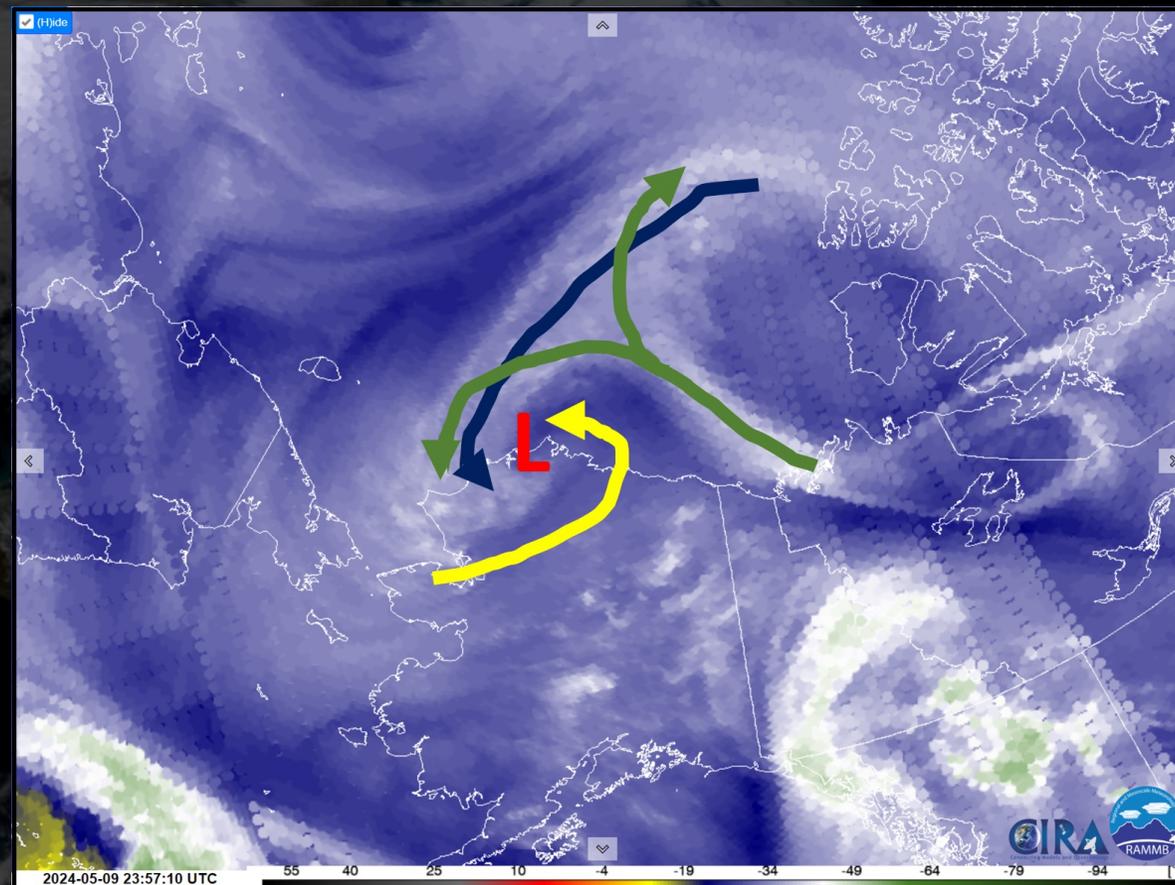


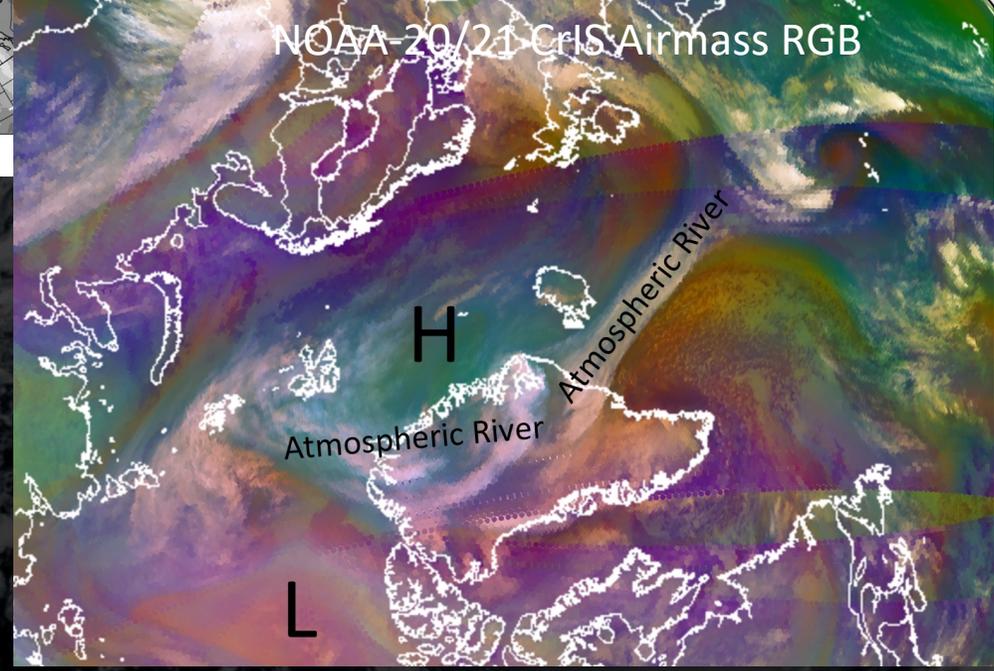
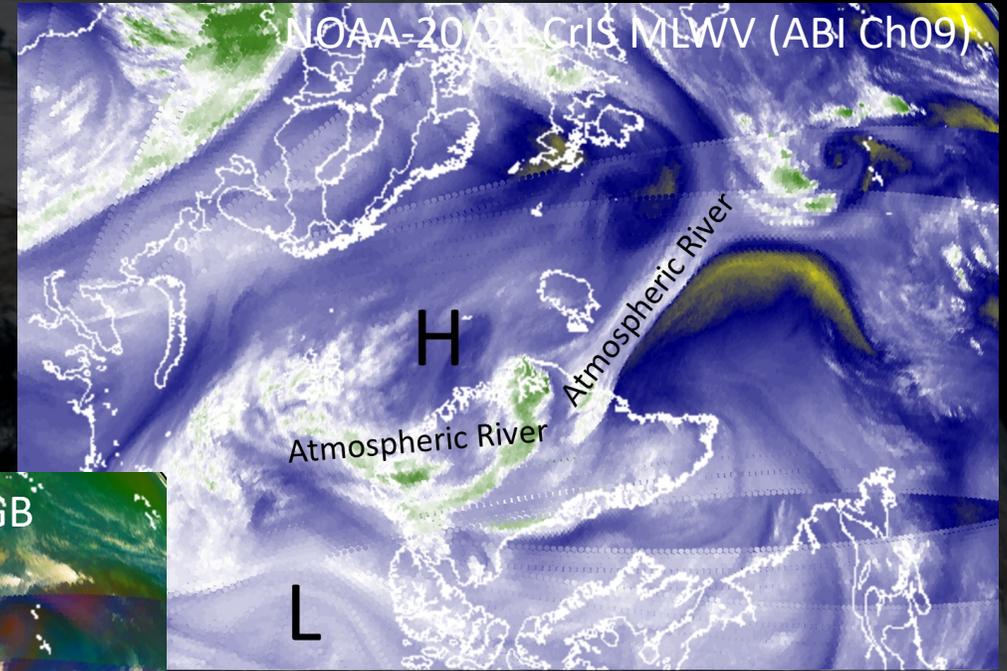
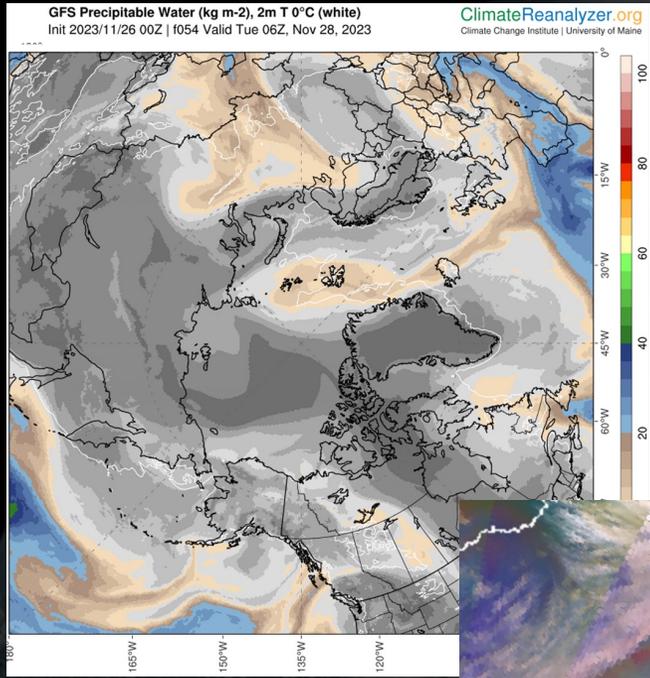


North Slope and Brooks Range...  
A round of snow this morning for the western North Slope as a surface low tracks west across the North Slope. This same low was responsible for overnight snowfall along the central and eastern Arctic Coast and is expected to move off shore tonight. North winds 15 to 20 mph are expected west of this low with no blowing or drifting snow concerns. Winds elsewhere are expected to remain



## NOAA-20/21 CrIS MLWV (ABI Ch09)



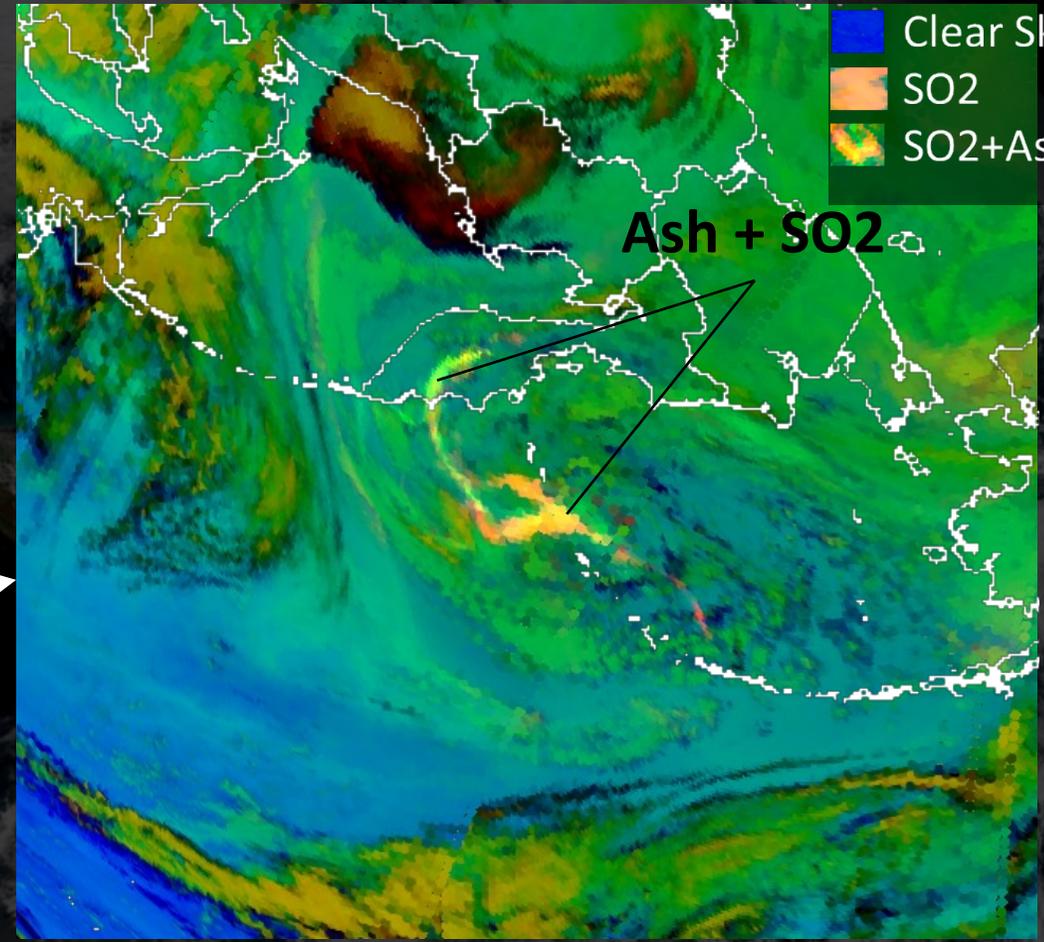
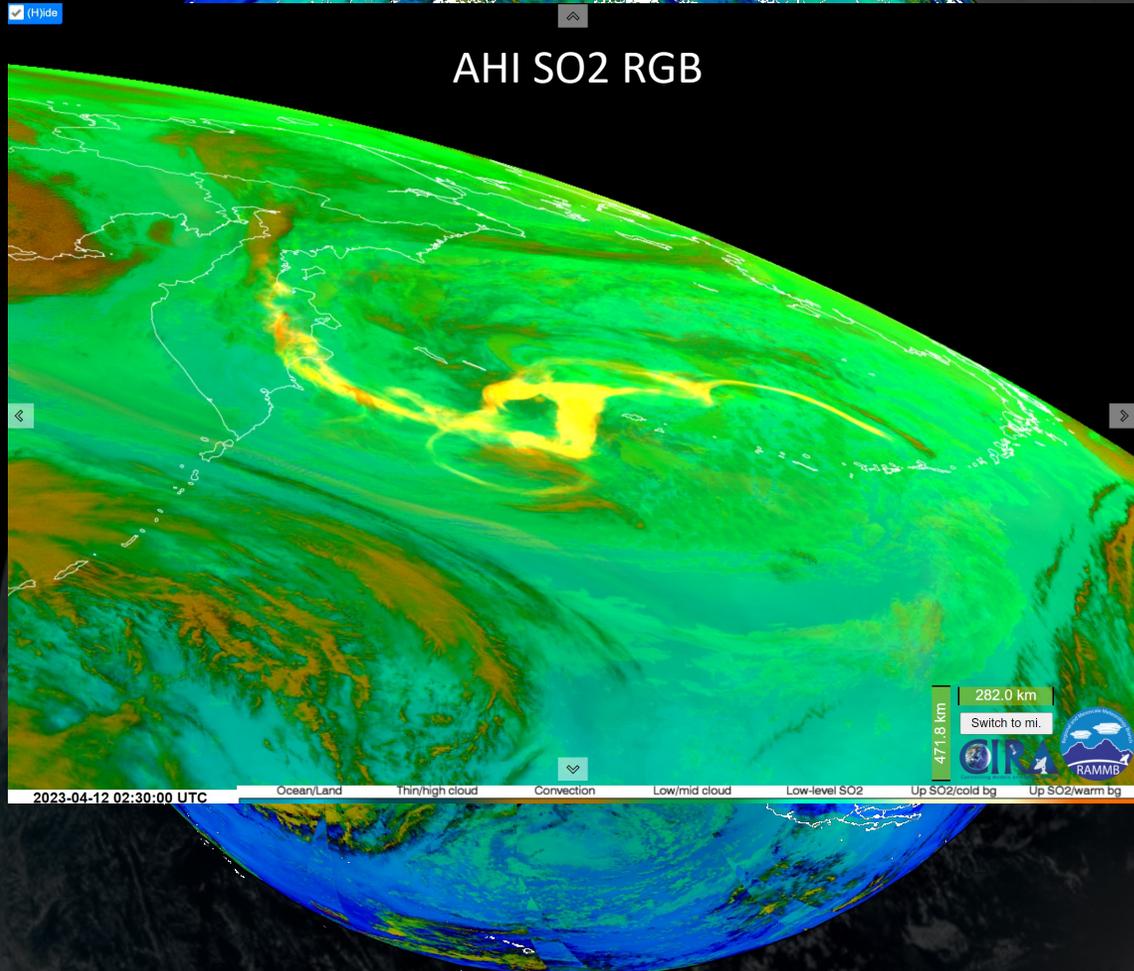


CrIS SO2/Ash RGB  
0243 UTC 12 April 2023

- Low Cloud
- High/Thick Cloud
- High/Thin Cloud
- Clear Sky
- SO2
- SO2+Ash

AHI SO2 RGB

Ash + SO2

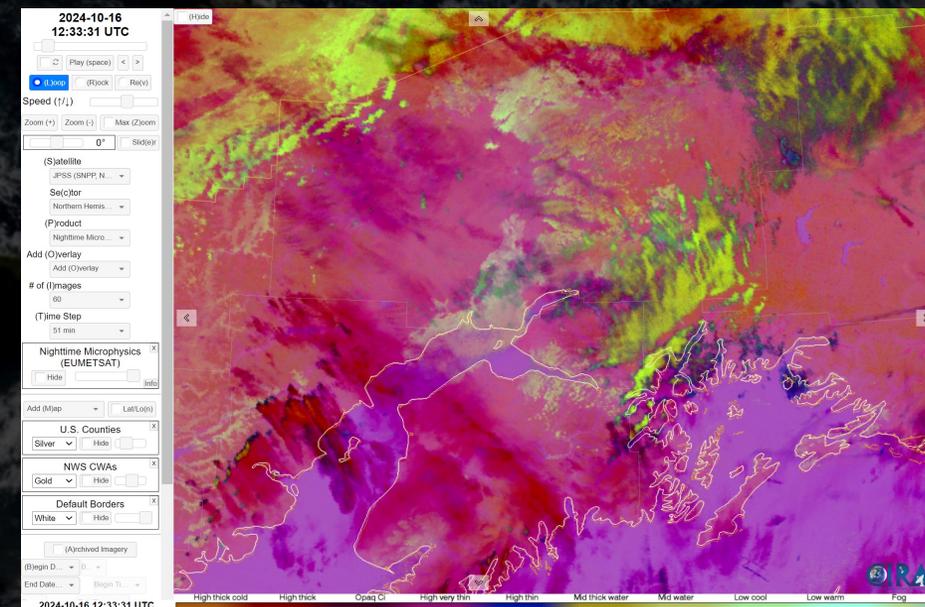
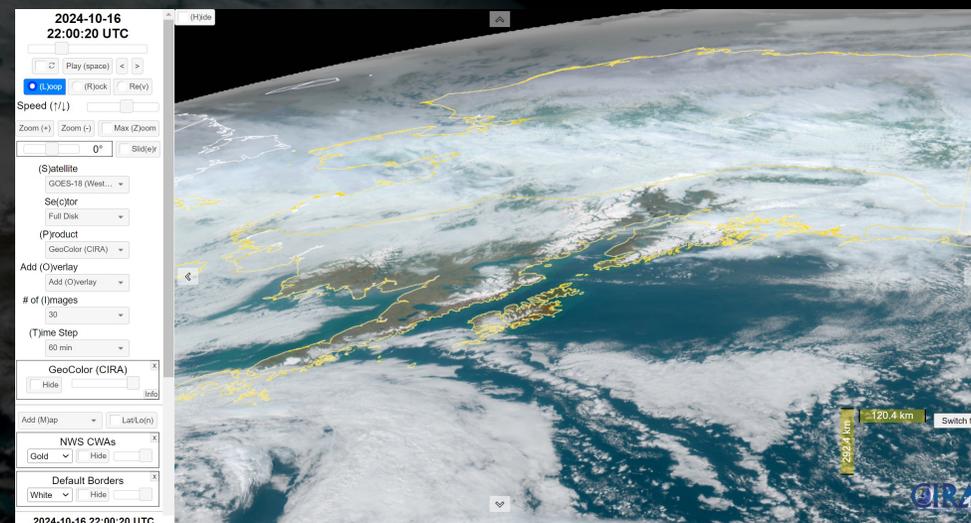




# CIRA SLIDER



- <https://rammb-slider.cira.colostate.edu>
- General
  - Zoomable, change timestep, overlay boundaries, overlay imagery, compare imagery, draw/text overlay
  - Full Resolution imagery and products
  - ~7 week archive
- GOES-East and – West (plus other geostationary satellites)
  - Full Disk, CONUS, Mesoscale sectors
  - Native satellite projection
  - All 16 single bands, plus traditional and new Multispectral Imagery products, GLM data, and Cloud Products
- JPSS (VIIRS and CrIS)
  - Northern Hemisphere, Southern Hemisphere, CONUS sectors
  - All 22 VIIRS single bands, plus traditional and new Multispectral Imagery products and Cloud Products
  - CONUS Sector also includes remapped ABI Imagery
- SLIDER Archive
  - <https://slider-archive.cira.colostate.edu/>

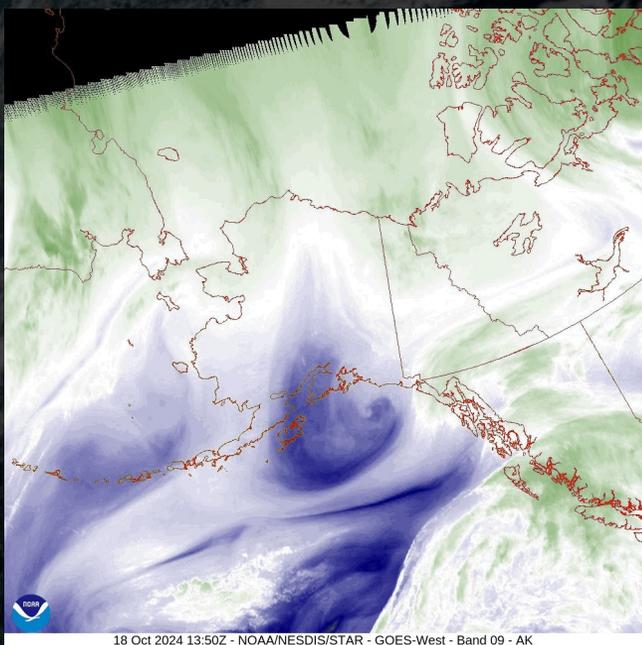


• <https://www.star.nesdis.noaa.gov/goes/>

## • General

- GOES-East and GOES West Imagery
- Static FD/CONUS, Regional, WFO Sectors
- All 16 bands plus popular RGBs
- Pre-made GIFs
- Easy to embed on webpages
- Full Resolution imagery and products
- 10 day archive

Alaska Sector

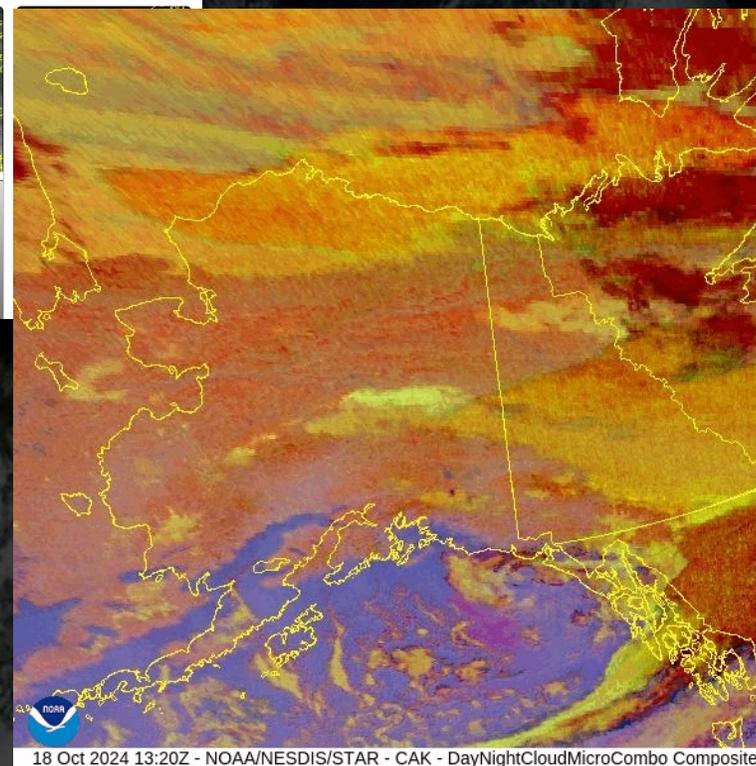


GOES-West - Sector view: Central Alaska  
Images updated every 10 minutes.

Auto-refresh

|   |   |   |   |  |
|---|---|---|---|--|
| <p><b>GeoColor</b><br/>True Color daytime multispectral IR at night<br/>18 Oct 2024 - 21:30 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 72 KB)</li> <li>• 600 x 600 px, (JPG, 224 KB)</li> <li>• 1200 x 1200 px, (JPG, 702 KB)</li> <li>• 2400 x 2400 px, (JPG, 2.3 MB)</li> </ul> </li> <li>• Animated GIF, (GIF, 11.18 MB)</li> <li>• Product documentation</li> </ul> | <p><b>AirMass RGB</b><br/>RGB based on data from IR &amp; water vapor<br/>18 Oct 2024 - 21:40 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 75 KB)</li> <li>• 600 x 600 px, (JPG, 221 KB)</li> <li>• 1200 x 1200 px, (JPG, 682 KB)</li> <li>• 2400 x 2400 px, (JPG, 2.02 MB)</li> </ul> </li> <li>• Animated GIF, (GIF, 9.28 MB)</li> <li>• Product documentation</li> </ul> | <p><b>Sandwich RGB</b><br/>Blend combines IR band 13 with visual band 3<br/>18 Oct 2024 - 21:30 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 108 KB)</li> <li>• 600 x 600 px, (JPG, 340 KB)</li> <li>• 1200 x 1200 px, (JPG, 1.05 MB)</li> <li>• 2400 x 2400 px, (JPG, 3.3 MB)</li> </ul> </li> <li>• Animated GIF, (GIF, 11.34 MB)</li> <li>• Product documentation</li> </ul> | <p><b>Day Night Cloud Micro Combo RGB</b><br/>Day: show cloud-top phase, Night: distinguish clouds / fog<br/>18 Oct 2024 - 21:40 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 84 KB)</li> <li>• 600 x 600 px, (JPG, 260 KB)</li> <li>• 1200 x 1200 px, (JPG, 805 KB)</li> <li>• 2400 x 2400 px, (JPG, 2.66 MB)</li> </ul> </li> <li>• Animated GIF, (GIF, 11.04 MB)</li> <li>• Product documentation</li> </ul> | <p><b>Fire Temperature</b><br/>RGB used to highlight fires<br/>18 Oct 2024 - 21:40 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 80 KB)</li> <li>• 600 x 600 px, (JPG, 233 KB)</li> <li>• 1200 x 1200 px, (JPG, 666 KB)</li> <li>• 2400 x 2400 px, (JPG, 2.07 MB)</li> </ul> </li> <li>• Animated GIF, (GIF, 3.99 MB)</li> <li>• Product documentation</li> </ul> |
| <p><b>Dust RGB</b><br/>RGB for identifying tropospheric dust<br/>18 Oct 2024 - 21:40 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 81 KB)</li> <li>• 600 x 600 px, (JPG, 251 KB)</li> <li>• 1200 x 1200 px, (JPG, 784 KB)</li> <li>• 2400 x 2400 px, (JPG, 2.53 MB)</li> </ul> </li> <li>• Product documentation</li> </ul>  | <p><b>Band 1</b><br/>0.47 <math>\mu\text{m}</math><br/>Blue - Visible<br/>18 Oct 2024 - 21:40 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 65 KB)</li> <li>• 600 x 600 px, (JPG, 181 KB)</li> <li>• 1200 x 1200 px, (JPG, 511 KB)</li> <li>• 2400 x 2400 px, (JPG, 1.65 MB)</li> </ul> </li> <li>• Product documentation</li> </ul>   | <p><b>Band 2</b><br/>0.64 <math>\mu\text{m}</math><br/>Red - Visible<br/>18 Oct 2024 - 21:40 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 79 KB)</li> <li>• 600 x 600 px, (JPG, 232 KB)</li> <li>• 1200 x 1200 px, (JPG, 697 KB)</li> <li>• 2400 x 2400 px, (JPG, 2.29 MB)</li> </ul> </li> <li>• Animated GIF, (GIF, 5.98 MB)</li> <li>• Product documentation</li> </ul>      | <p><b>Band 3</b><br/>0.86 <math>\mu\text{m}</math><br/>Veggie - Near IR<br/>18 Oct 2024 - 21:40 UTC</p> <ul style="list-style-type: none"> <li>• Animation loops</li> <li>• Download images           <ul style="list-style-type: none"> <li>• 300 x 300 px, (JPG, 81 KB)</li> <li>• 600 x 600 px, (JPG, 241 KB)</li> <li>• 1200 x 1200 px, (JPG, 716 KB)</li> <li>• 2400 x 2400 px, (JPG, 2.36 MB)</li> </ul> </li> <li>• Product documentation</li> </ul>   |  |

Central Alaska Sector

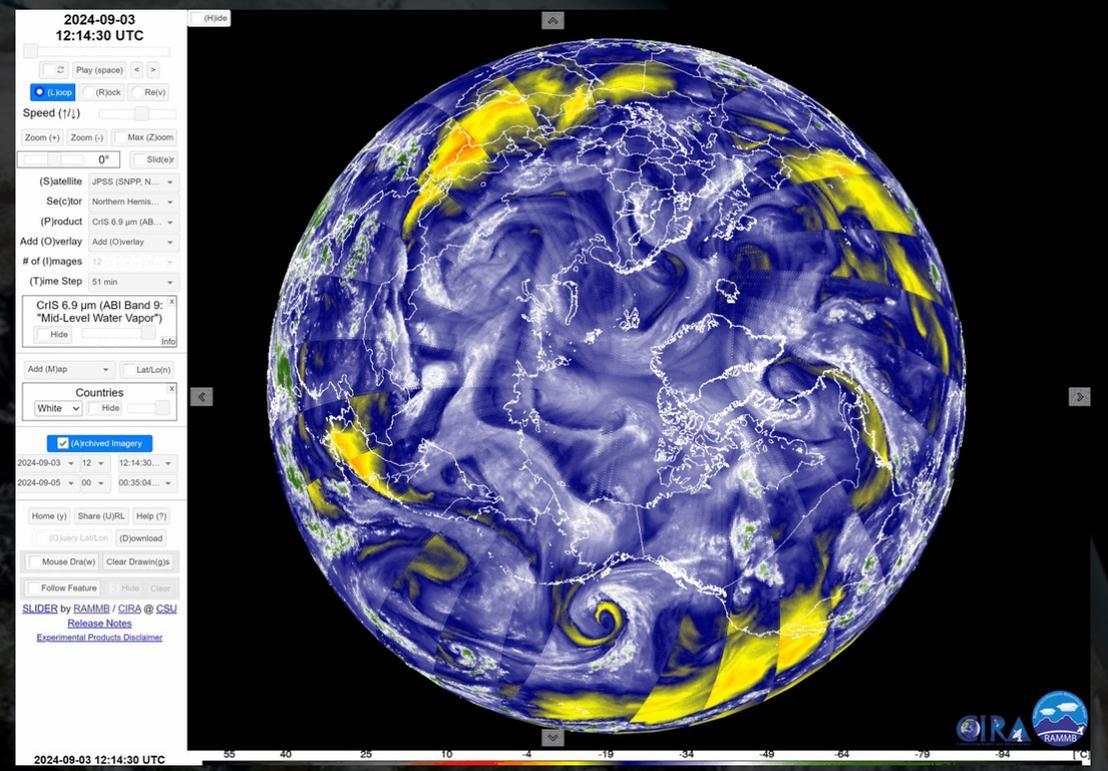




# Thank you!



- Sea Spray RGB, Blowing Snow RGB, and CrIS Water Vapor Imagery all recently available to AK users
- This imagery, and much more, available online at the CIRA SLIDER webpage
  - <https://rammb-slider.cira.colostate.edu/>
  - Satellite = JPSS, Sector = Northern Hemisphere
- Happy to collaborate with Alaska users to find imagery-based solutions to forecast challenges



bill.line@noaa.gov  
@bill\_line

Many more examples: [www.satelliteliaisonblog.com](http://www.satelliteliaisonblog.com)