

MIRS Microwave Products in Alaska

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Outline

- Brief overview of products provided by GINA to the National Weather Service in Alaska
- Review the Evaluation Project of the MIRS Sea Ice Concentration product with the Alaska Sea Ice Program (ASIP).

GINA Infrastructure Upgrades

Sandy Supplemental Objectives

- Mitigate the risk of a data gap between Suomi National Polar-orbiting Partnership (SNPP) and Joint Polar Satellite System-1 (JPSS-1)
- Deliver near real-time data (NRT) from JPSS satellites to the National Weather Service (NWS)
- Advance from best-effort downlink, processing, and distribution to 24/7 operations



GINA Direct Broadcast Infrastructure

	UAF (Big Dog)	FCDAS (Gilmore)	FCDAS (Barrow)
Antenna	3.6 m X-band	3.0 m X, L, S-band	3.0 m X, L, S-band
Sensors	SNPP MODIS	SNPP MODIS METOP	NOAA POES (15, 18, 19)
Processing	VIIRS MODIS AHVRR ATMS AMSU-A/MHS CrIS	VIIRS MODIS AHVRR ATMS AMSU-A/MHS CrIS	AHVRR AMSU-A/MHS

GINA Single Channel AWIPS Products

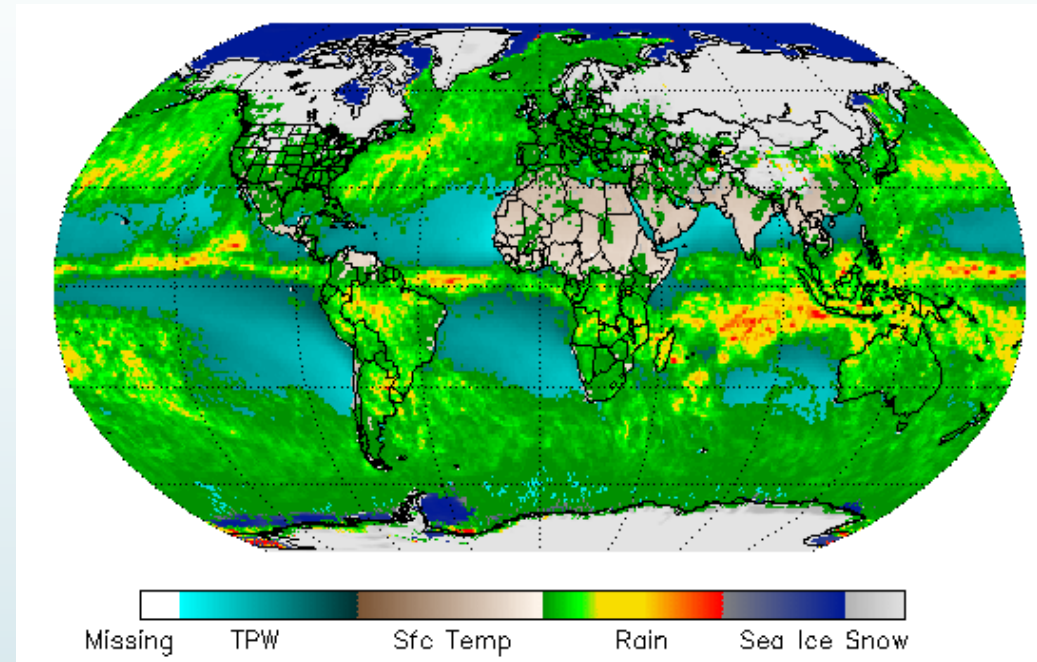
- **VIIRS: bands similar to GOES-R**
 - Plus DNB: Adaptive and Dynamic ERF
 - Plus 0.56 um Green Visible
 - No Water Vapor, Ozone, or CO2 Bands
- **MODIS Terra & Aqua: similar bands as VIIRS**
 - Plus 2 WV bands
 - No DNB or CO2 Bands
- **Corrected Reflectances: VIIRS & MODIS**
- **AVHRR: POES 15,18,19 & MetOp**
 - Bands 1 (.64um), 2 (.86um), 3a (1.6um), 3b (3.7um), 4 (10.8 um), 5 (12.0um)
 - Requested NOAA POES 3a & 3b switching be turned back on

Nickname	VIIRS	MODIS	CorRefl	AVHRR
Day Night Band	0.70 (DNB)			
Blue Band	0.49 (M3)	0.47 (3)	Y	
Green Band	0.56 (M4)	0.56 (4)	Y	
Red Band	0.64 (I1)	0.64 (1)	Y	0.64 (1)
Veggie Band	0.86 (I2)	0.86 (2)	Y	0.86 (2)
Cirrus Band	1.4 (M9)	1.4 (26)		
Snow-Ice Band	1.6 (I3)	1.6 (6)	Y	1.6 (3a)
Cloud Particle Size Band	2.3 (M11)	2.1 (7)		
Shortwave IR Window	3.7 (I4)	3.7 (20)		3.7 (3b)
Fire Band	4.0 (M13)	4.0 (23)		
Upper Lvl Trop WV Band				
Mid Lvl Trop WV Band		6.7 (27)		
Lower Lvl WV Band		7.3 (28)		
Cloud Top Phase Band	8.6 (M14)	8.5 (29)		
Ozone Band		9.7 (30)		
Clean IR Longwave Band	10.8 (M15)	11.0 (31)		10.8 (4)
IR Longwave Window	11.4 (I5)			
Dirty Longwave Window	12.0 (M16)	12.0 (32)		12.0 (5)

* Colors highlight sensor differences from GOES-R

Microwave Integrated Retrieval System (MIRS)

- Aims for BT consistency among platforms
- Generates surface and precipitation products from common algorithms using microwave BTs.
- Sensors: AMSU-A, MHS (NOAA POES, MetOp), ATMS (SNPP, JPSS), SSMIS (DMSP) and GMI (GPM)
- Products: BT, TPW, Rain rate, Snowfall rate, CLW, Ice Water Path, SWE, Snow cover, Sea Ice, Land Sfc Temp, Land Sfc Emissivity, Sfc Type, Temp Profile, Moisture Profile



<http://www.ospo.noaa.gov/Products/atmosphere/mirs/>



CSPP polar2grid version 2.1

MIRS support for Direct Broadcast



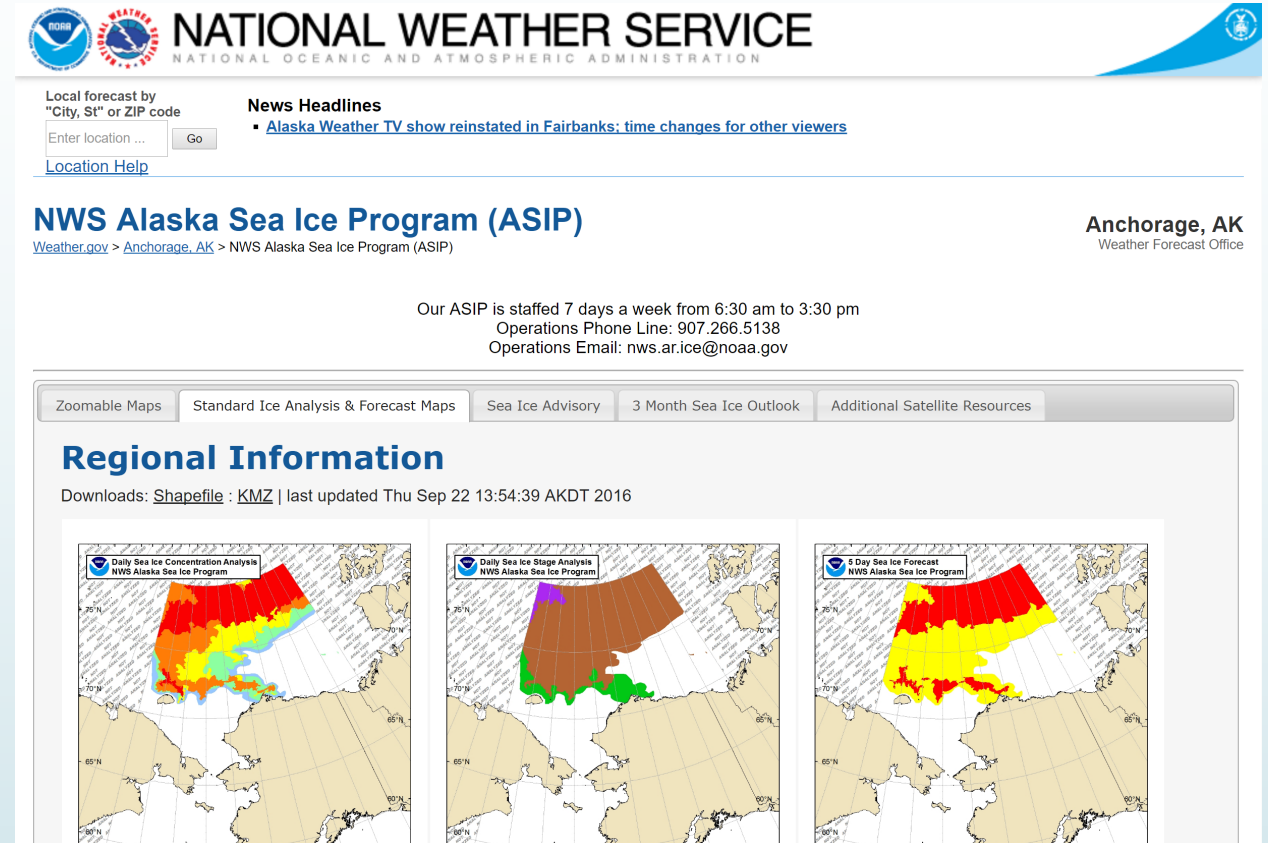
- Includes support for Microwave Integrated Retrieval System (MIRS)
- Direct Broadcast can significantly reduce latency and provide more data (avoid SBN limits)
- Supported satellites, sensors, and data include:
 - SUOMI NPP ATMS SDR (from CSPP)
 - NOAA-18 & 19 AMSU-A/MHS Level 1B (from AAPP)
 - Metop-A and Metop-B AMSU-A/MHS Level 1B (from AAPP)
- Current supported products are a subset of the full MIRS product line:
 - TPW, CLW, Rain rate, Sea Ice Concentration, SWE, Snow Cover


Community Satellite Processing Package


Home	Download	Applications	History	Credits	Forum
<p>The Community Satellite Processing Package (CSPP) supports the Direct Broadcast (DB) meteorological and environmental satellite community through the packaging and distribution of open source science software. CSPP supports DB users of both polar orbiting and geostationary satellite data processing and regional real-time applications through distribution of free open source software, and through training in local product applications. CSPP is funded through NOAA JPSS.</p> <p style="text-align: center;">Suomi National Polar-orbiting Partnership (NPP) Products</p> <p>CSPP software to support Suomi NPP:</p> <ul style="list-style-type: none"> VIIRS, ATMS and CrIS calibration and geolocation software (Raw Data Records (RDRs) to Sensor Data Records (SDRs)); Learn more ... VIIRS Environmental Data Records (EDRs), including a subset of Land, Ocean and Atmosphere Products; Learn more ... VIIRS, MODIS and AVHRR Imager reprojection software for the creation of GeoTIFFs and/or AWIPS NetCDF files; Learn more ... NOAA/NESDIS/STAR NOAA Unique CrIS/ATMS Processing System (NUCAPS) EDR Hyperspectral Sounding Retrieval Software; Learn more ... CrIS, AIRS and IASI University of Wisconsin dual regression single Field-of-View (FOV) Temperature, Moisture, Surface and Cloud Retrieval Environmental Data Record (EDR); Learn more ... S-NPP VIIRS, ATMS, CrIS and EOS Aqua and Terra HYDRA2 multispectral data analysis toolkit; Learn more ... <div style="border: 2px solid red; padding: 2px;"> NOAA/NESDIS/STAR Microwave Integrated Retrieval System (MIRS) supporting S-NPP ATMS, NOAA-18, 19 and Metop-A, B AMSU-A and MHS instruments; Learn more ... </div> VIIRS, MODIS and AVHRR (POES and Metop) Cloud and Land Surface Retrievals from CLAVR-x; Learn more ... International ATOVS Processing Package (IAPP) Retrieval Software, supporting POES and Metop HIRS, AMSU-A and MHS Instruments. Learn more ... 					<p>What's New</p> <ul style="list-style-type: none"> Polar2Grid Reprojection Software v2.1 IAPP ATOVS Retrieval Software v1.1 ACSP0 SST Retrieval Software v1.1.2_Patch Suomi-NPP SDR v2.2 for VIIRS, CrIS and ATMS Patch CLAVR-x Cloud Retrieval Software for VIIRS, MODIS and AVHRR v2.0 Suomi-NPP SDR v2.2 for VIIRS, CrIS and ATMS HYDRA2 Version 2.0 NUCAPS CrIS/ATMS EDR Retrieval Software v1.1


MIRS Sea Ice Concentration Evaluation Project

- Objective: Assess the value of passive microwave Sea Ice products for NWS [Alaska Sea Ice Program](#) (ASIP):
- ASIP desk provides highly detailed ice analyses for Alaskan stakeholders!
- Advantages:
 - Not impacted by cloud cover like visible and IR data.
 - Wider swath and coverage than SAR
- Disadvantage:
 - Lower resolution than other satellite data
 - MIRS > 50 km (some oversampling on ATMS)
 - AMSR2 ~ 18 km.



MIRS Sea Ice Concentration Evaluation Project

- The ASIP desk filled out a google form (ideally) at the end of the shift when passive microwave data was used.
- Primarily used MIRS from ATMS and AMSR2 data obtained from NASA worldview

 **NATIONAL WEATHER SERVICE**
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Local forecast by "City, St" or ZIP code
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News Headlines
▪ [Alaska Weather TV show reinstated in Fairbanks: time changes for other viewers](#)

NWS Alaska Sea Ice Program (ASIP)
[Weather.gov](#) > [Anchorage, AK](#) > NWS Alaska Sea Ice Program (ASIP)

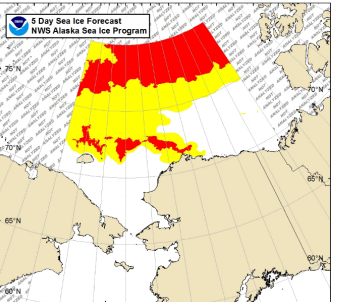
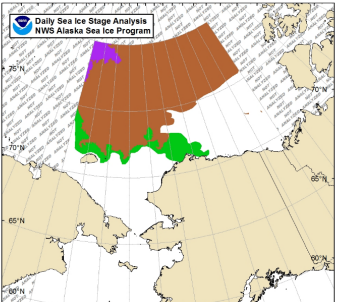
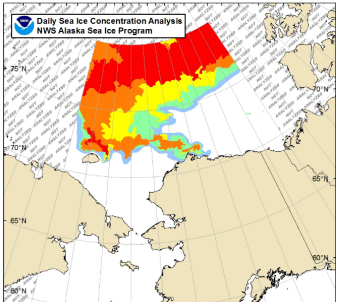
Anchorage, AK
Weather Forecast Office

Our ASIP is staffed 7 days a week from 6:30 am to 3:30 pm
Operations Phone Line: 907.266.5138
Operations Email: nws.ar.ice@noaa.gov

Zoomable Maps Standard Ice Analysis & Forecast Maps Sea Ice Advisory 3 Month Sea Ice Outlook Additional Satellite Resources

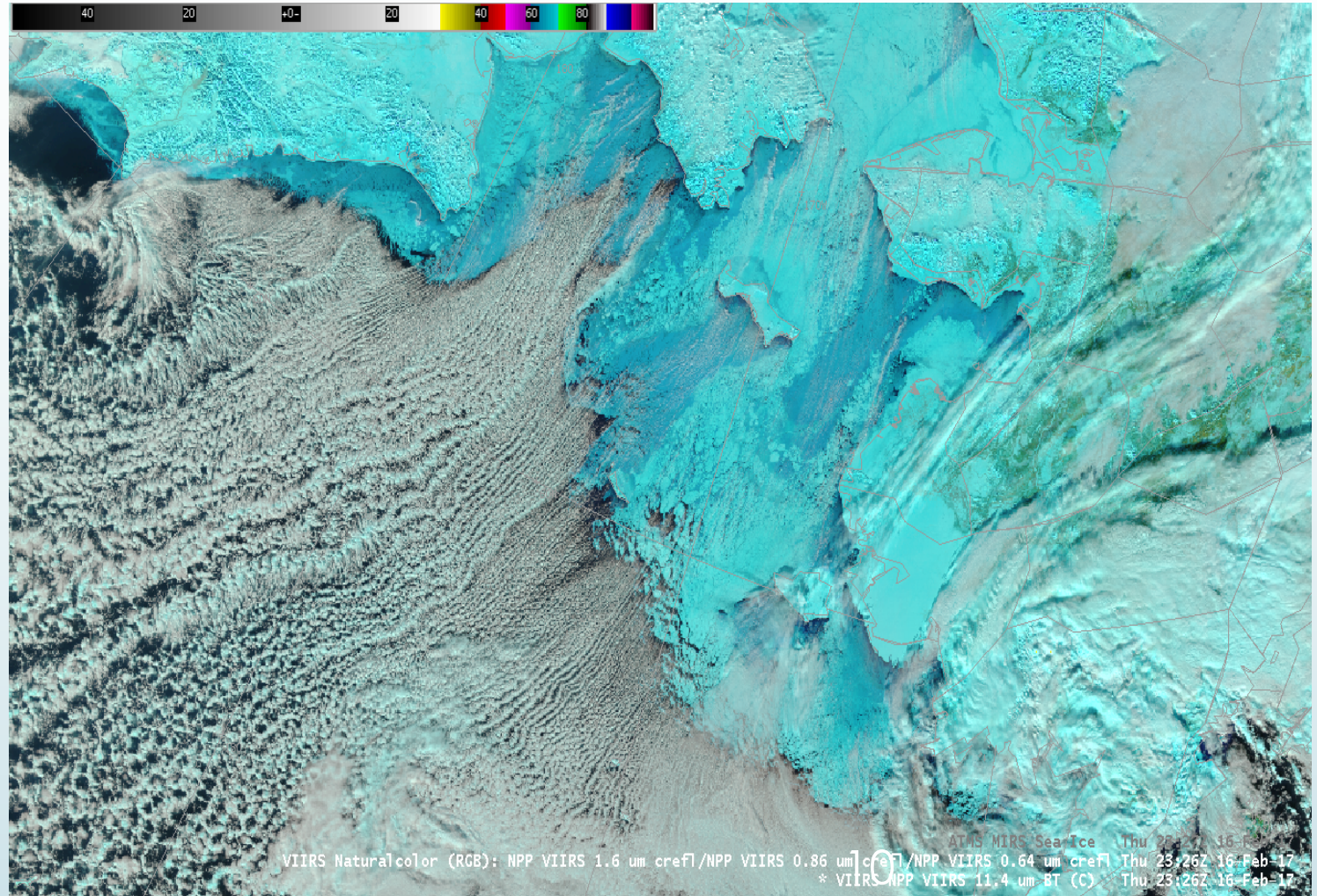
Regional Information

Downloads: [Shapefile](#) : [KMZ](#) | last updated Thu Sep 22 13:54:39 AKDT 2016



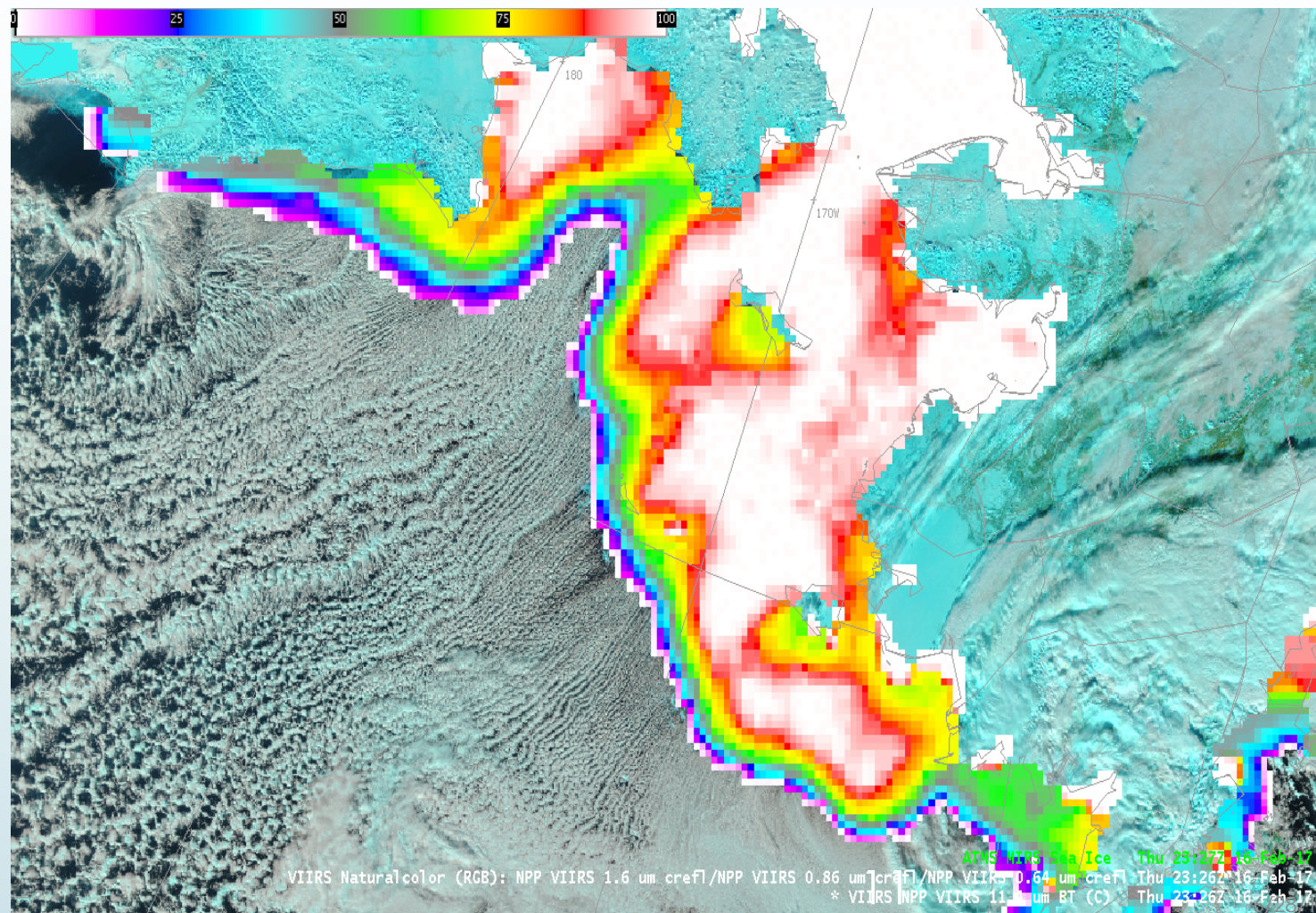
MIRS Sea Ice Concentration

- Defined as the area of sea ice relative to the total at a given point in the ocean.
- Different from the AMSR2 product derived from the “NASA Team 2” algorithm.

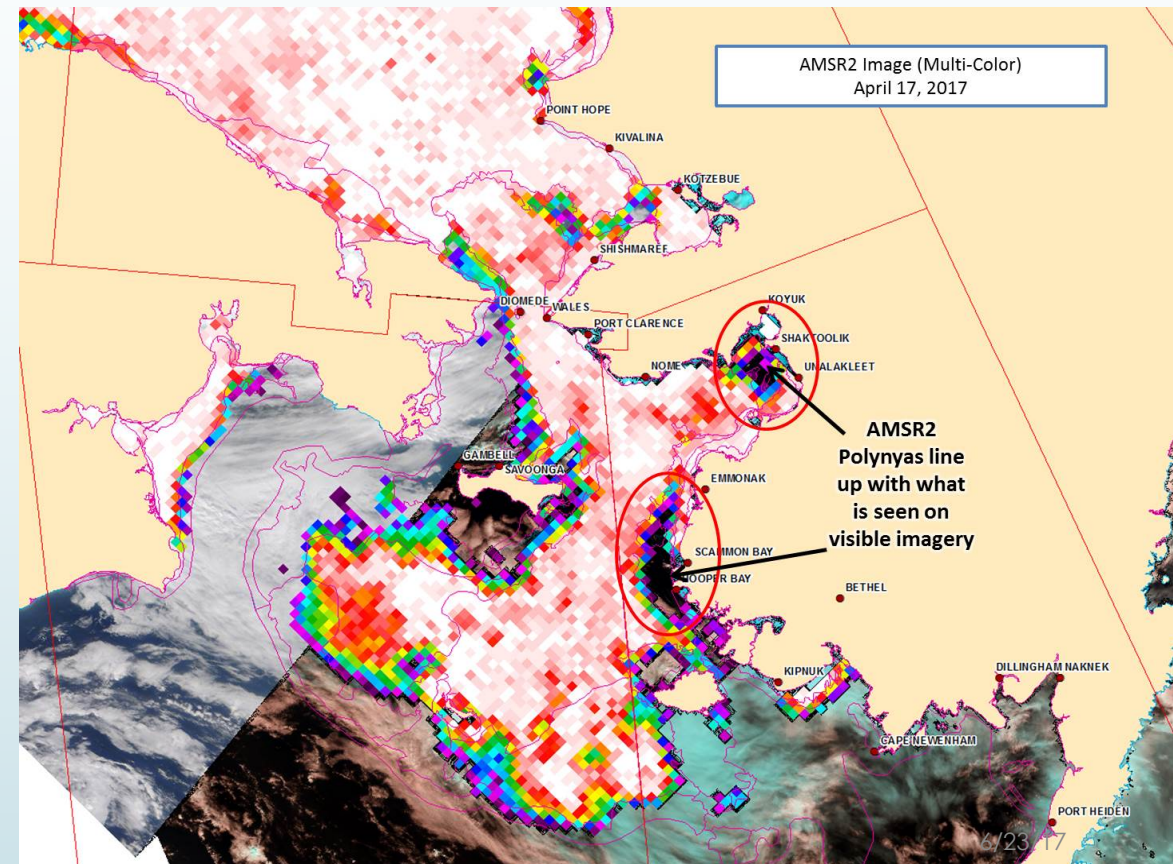
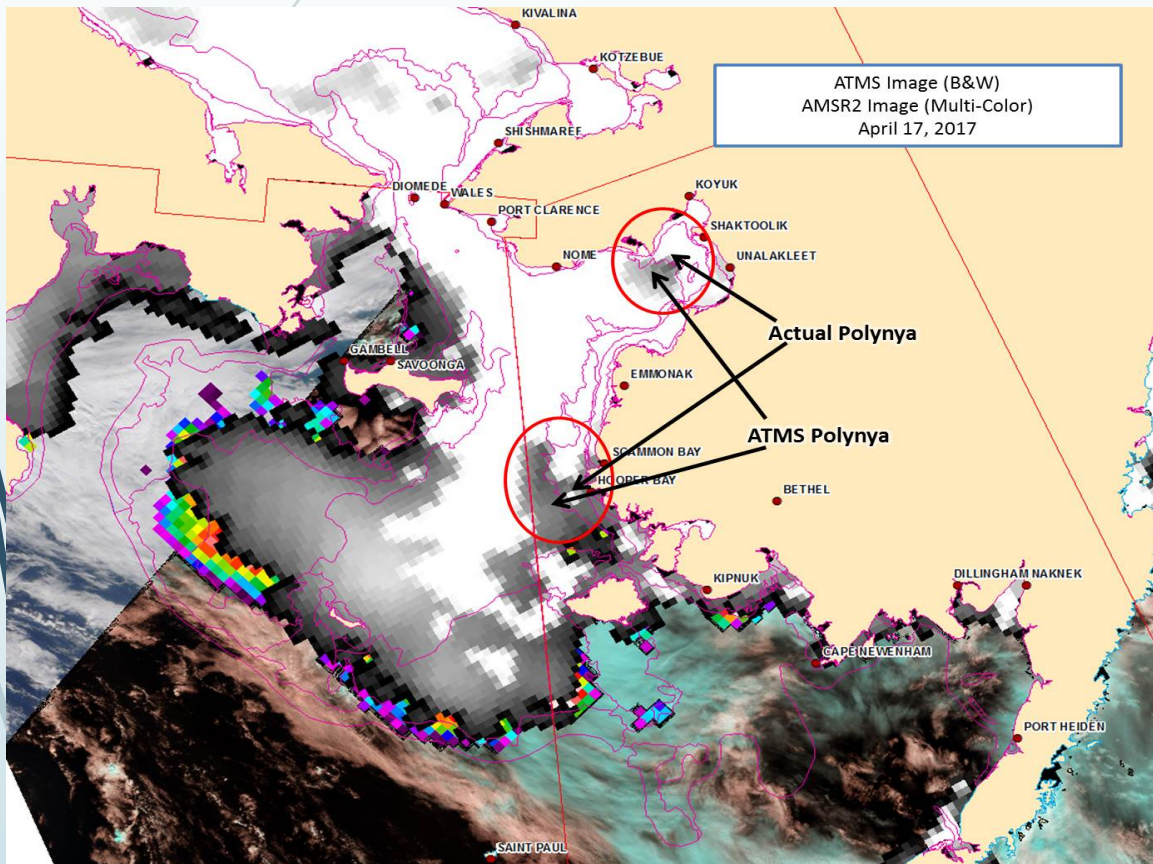


MIRS Sea Ice Concentration

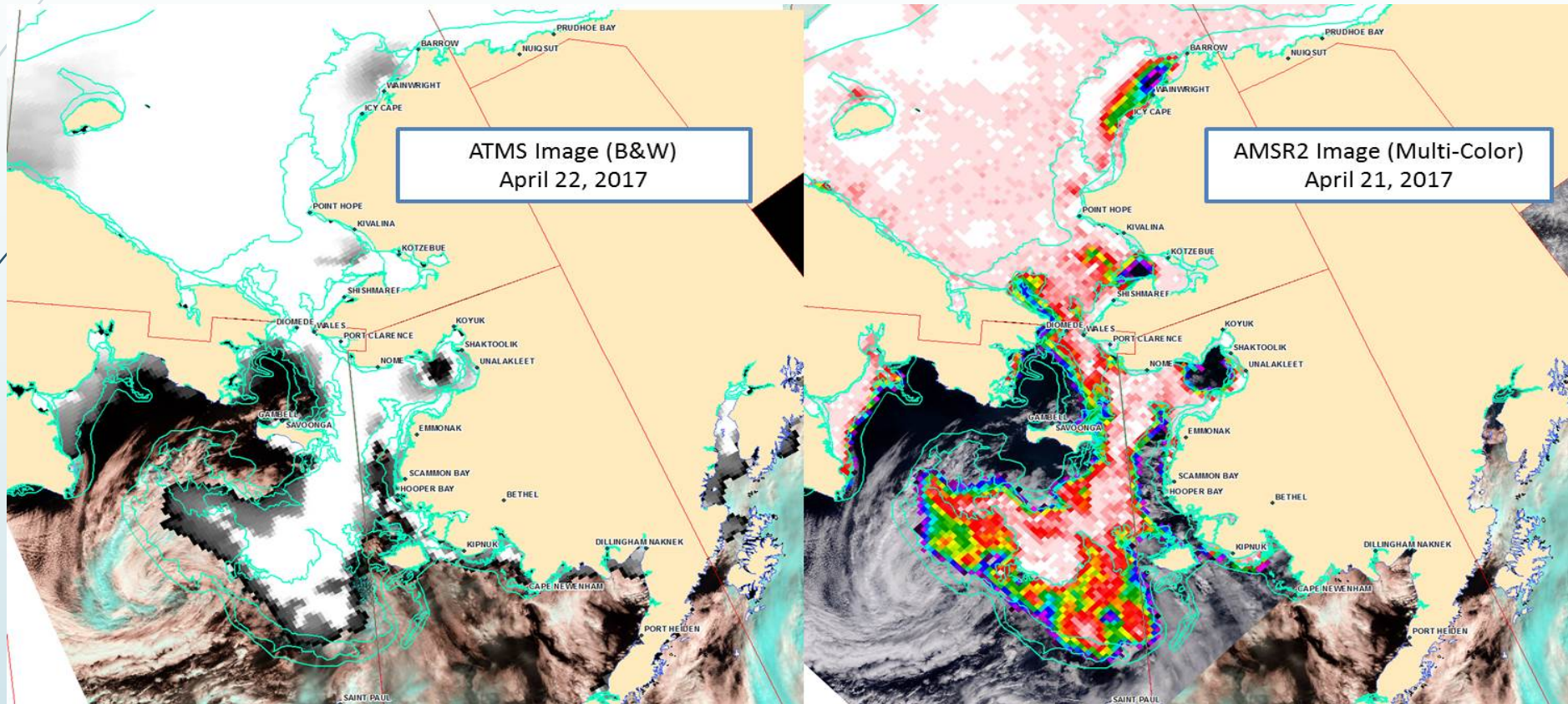
- Defined as the area of sea ice relative to the total at a given point in the ocean.
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ATMS vs AMSR2 Sea Ice Concentration Comparison – 17 Apr 2017

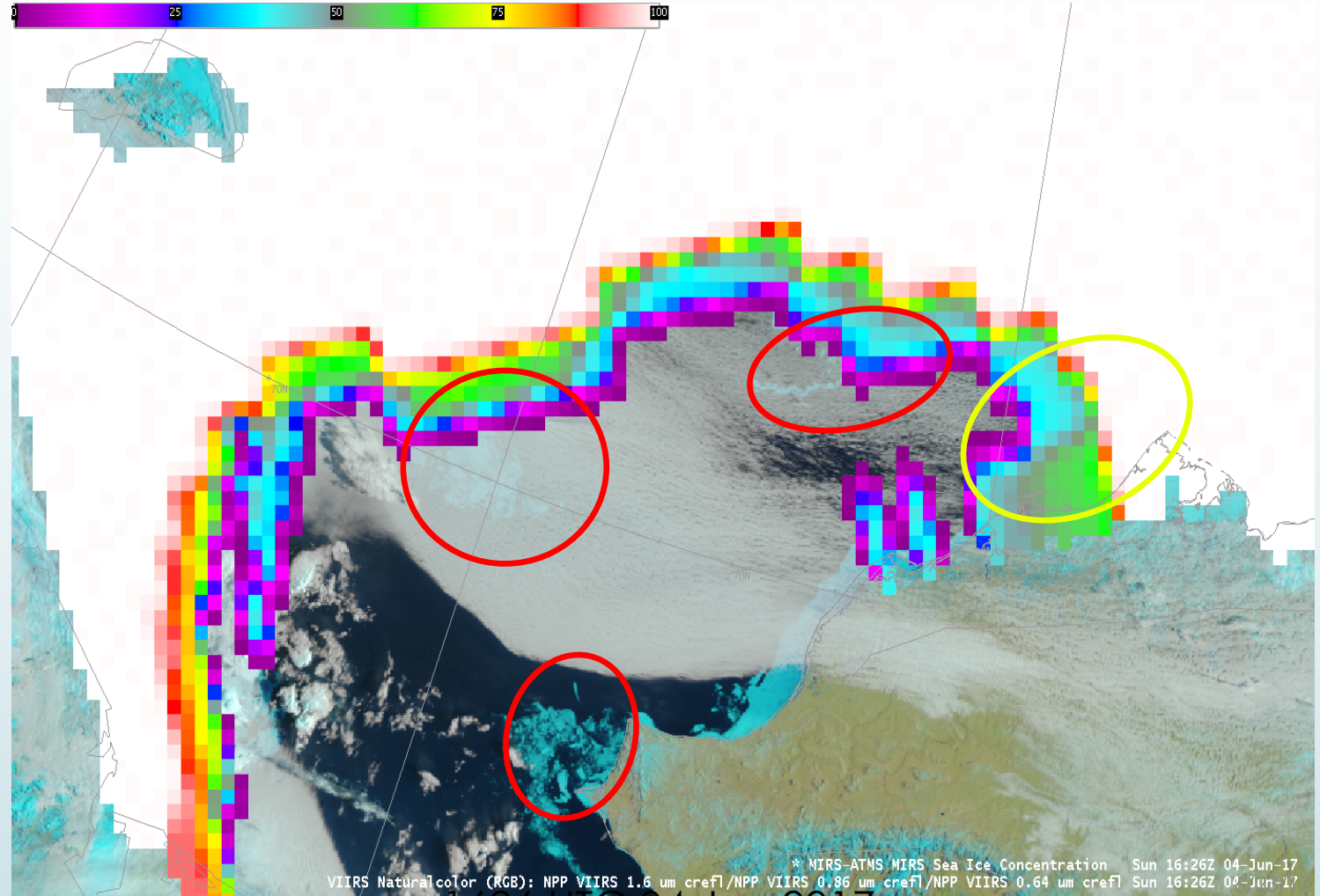


ATMS vs AMSR2 Sea Ice Concentration Comparison – 22 Apr 2017



MIRS Sea Ice Concentration Product

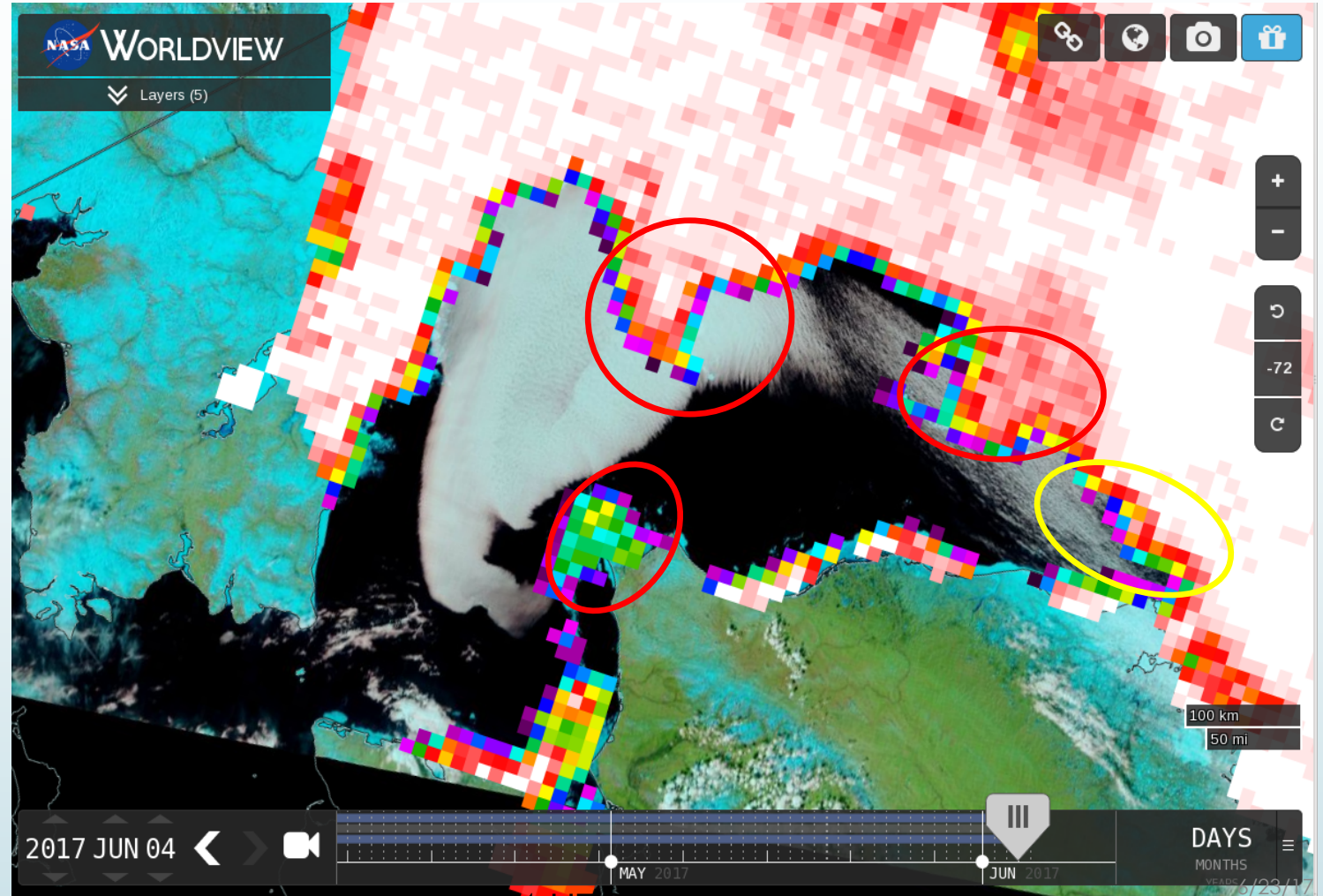
- VIIRS NaturalColor RGB
 - Sea Ice visible through thin clouds
 - Circles mark problem areas
- MIRS Sea Ice Concentration Product
 - Underdone in areas with partial coverage (red circle)
 - Overdone arctic coast (expected)



1626 UTC 04 Jun 2017

AMSR2 Sea Ice Concentration Product

- MODIS NaturalColor RGB (NASA Worldview)
 - Circles show same areas with partial sea ice coverage
- AMSR2 Sea Ice Concentration shows much better description of ice edge and coverage.
- Even does well near coastlines



2304 UTC 04 Jun 2017

Conclusions from Sea Ice Evaluation

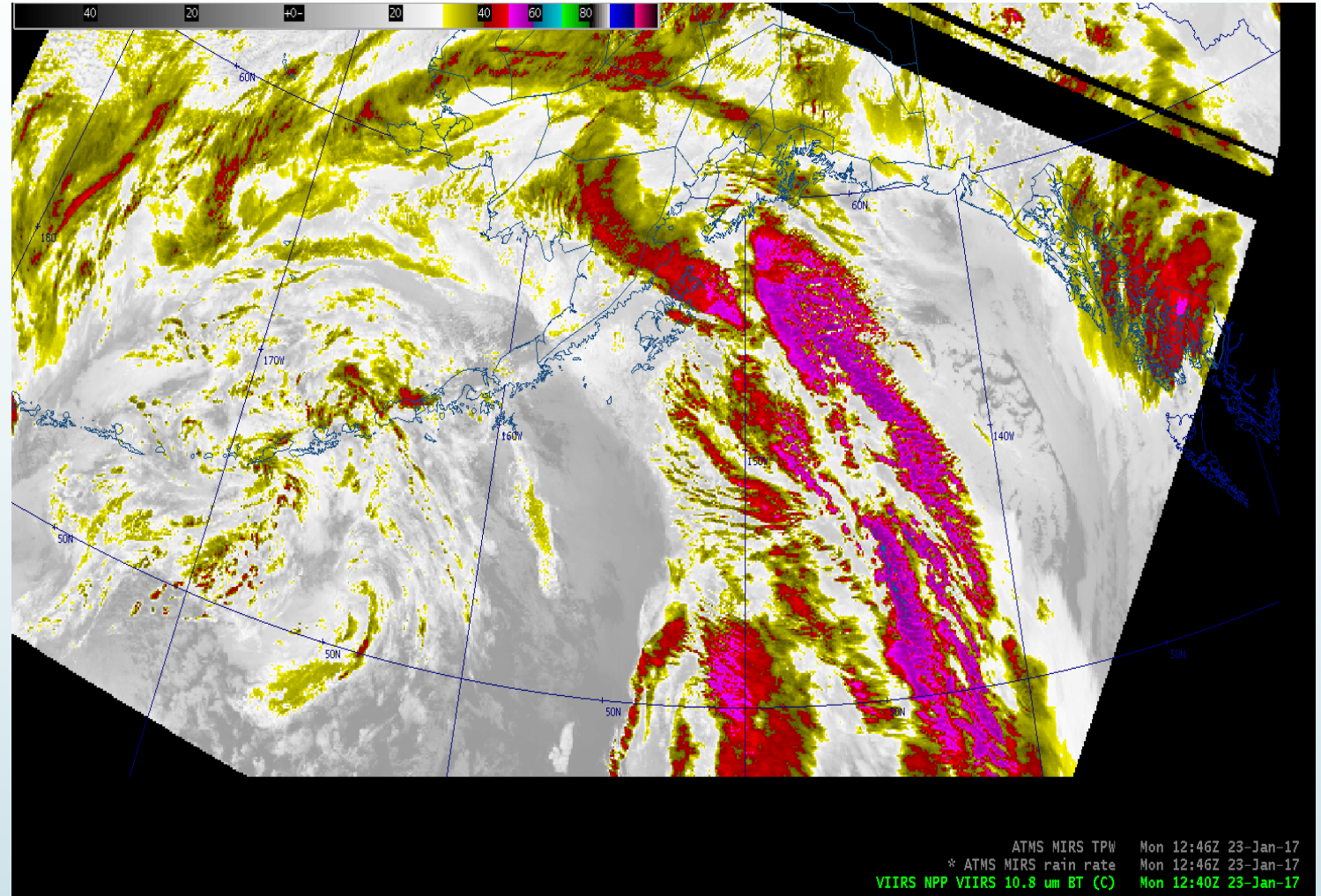
- The Evaluation Project confirmed the value of a passive Microwave Sea Ice concentration product, however resolution is important.
- MIRS Sea Ice product (ATMS, AMSUA-MHS) is less useful than AMSR2 because of significantly lower resolutions.
- Unclear how MIRS algorithm compares with NASA Team 2 due to significant resolution differences.
- ASIP desk is going to continue to use AMSR2 from NASA Worldview
- MIRS support for AMSR2 could be very useful

Conclusions from Sea Ice Evaluation

▀ Next Step?

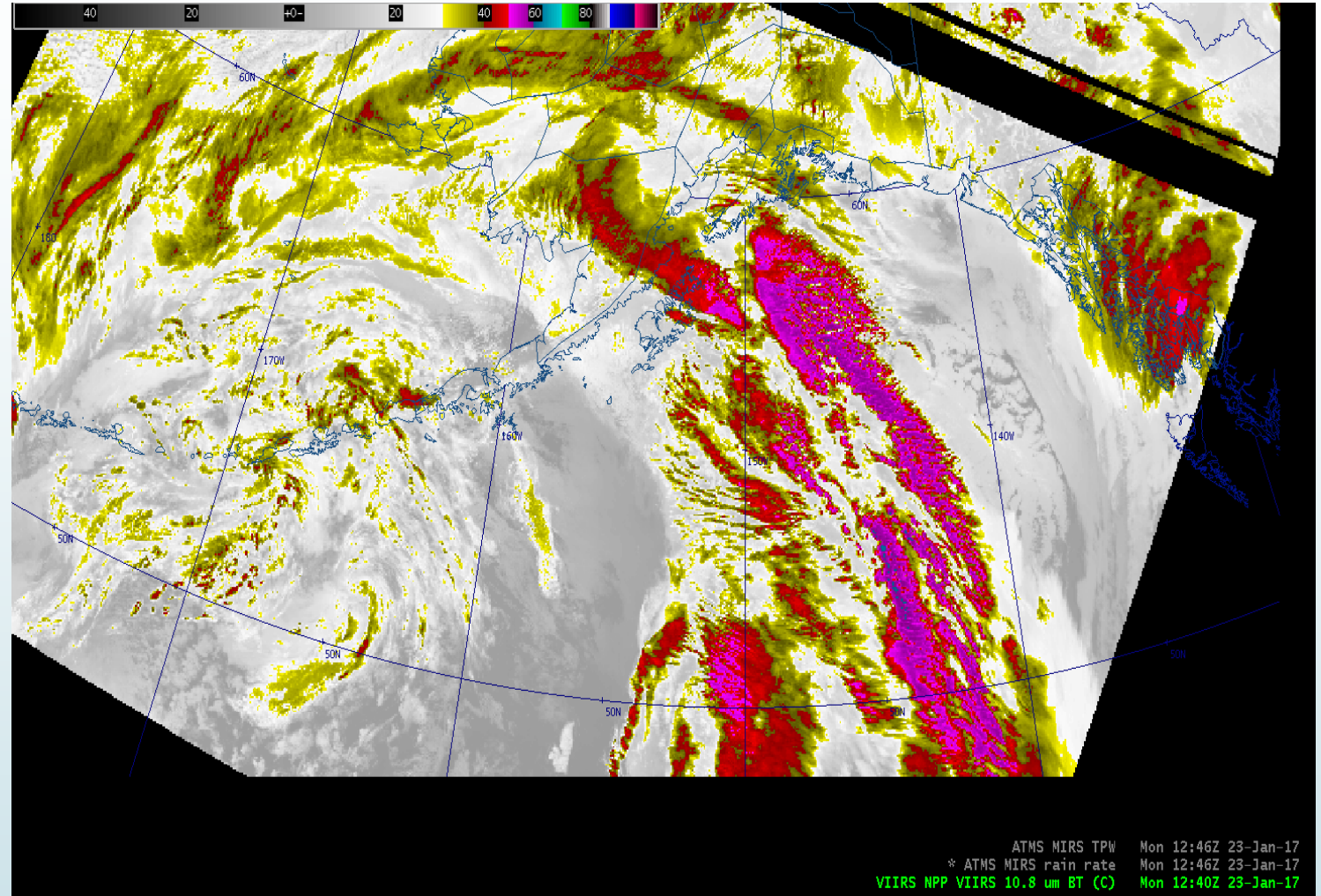
MIRS Total Precipitable Water (TPW)

- Defined as the vertically integrated water vapor in a column extending from the surface to the top of the atmosphere.
- Reported as the depth of water in a column (mm or in).



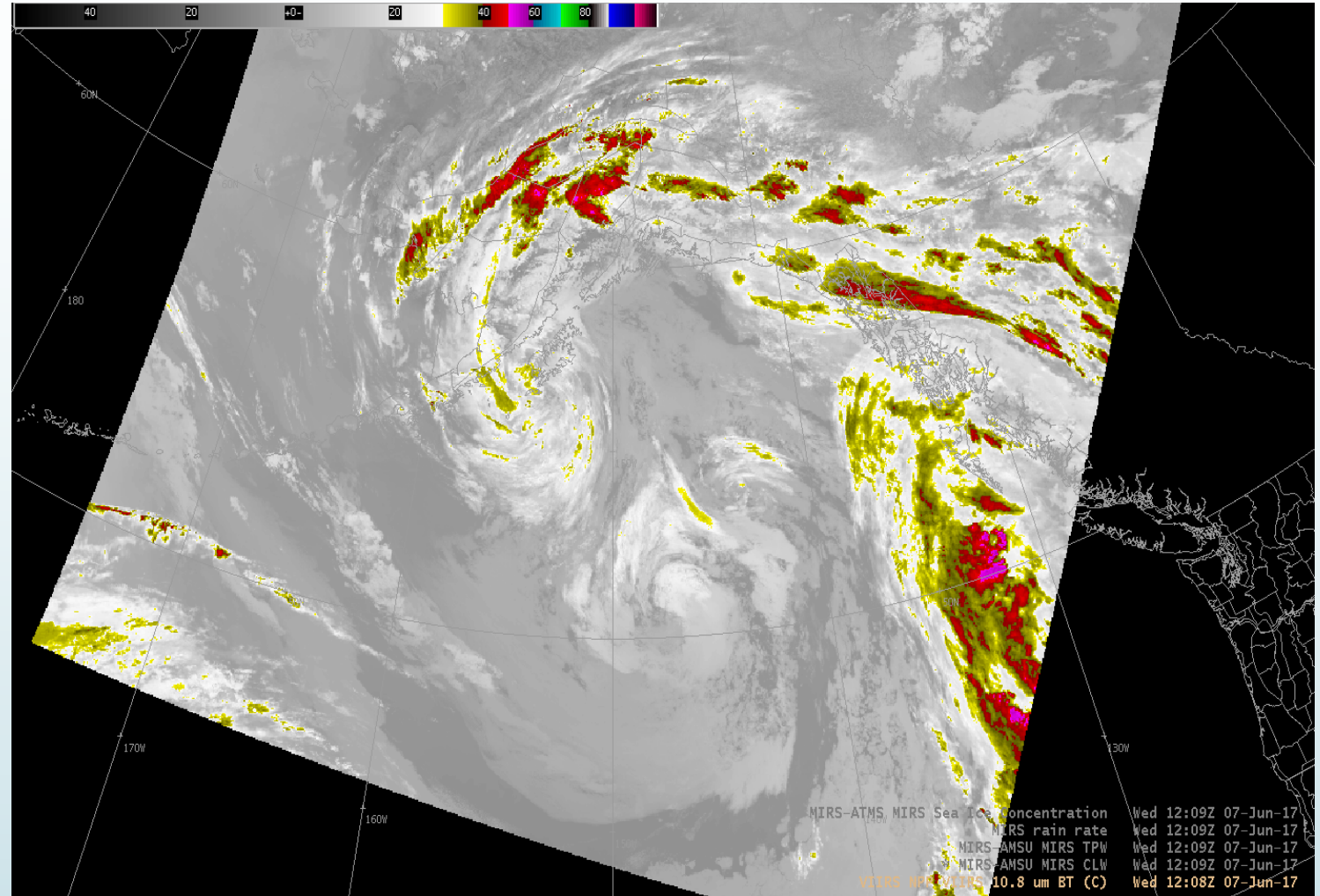
MIRS Rain Rate

- Measure of the intensity of rainfall.
- Reported as the depth of water in a column per unit of time (usually in/hr).



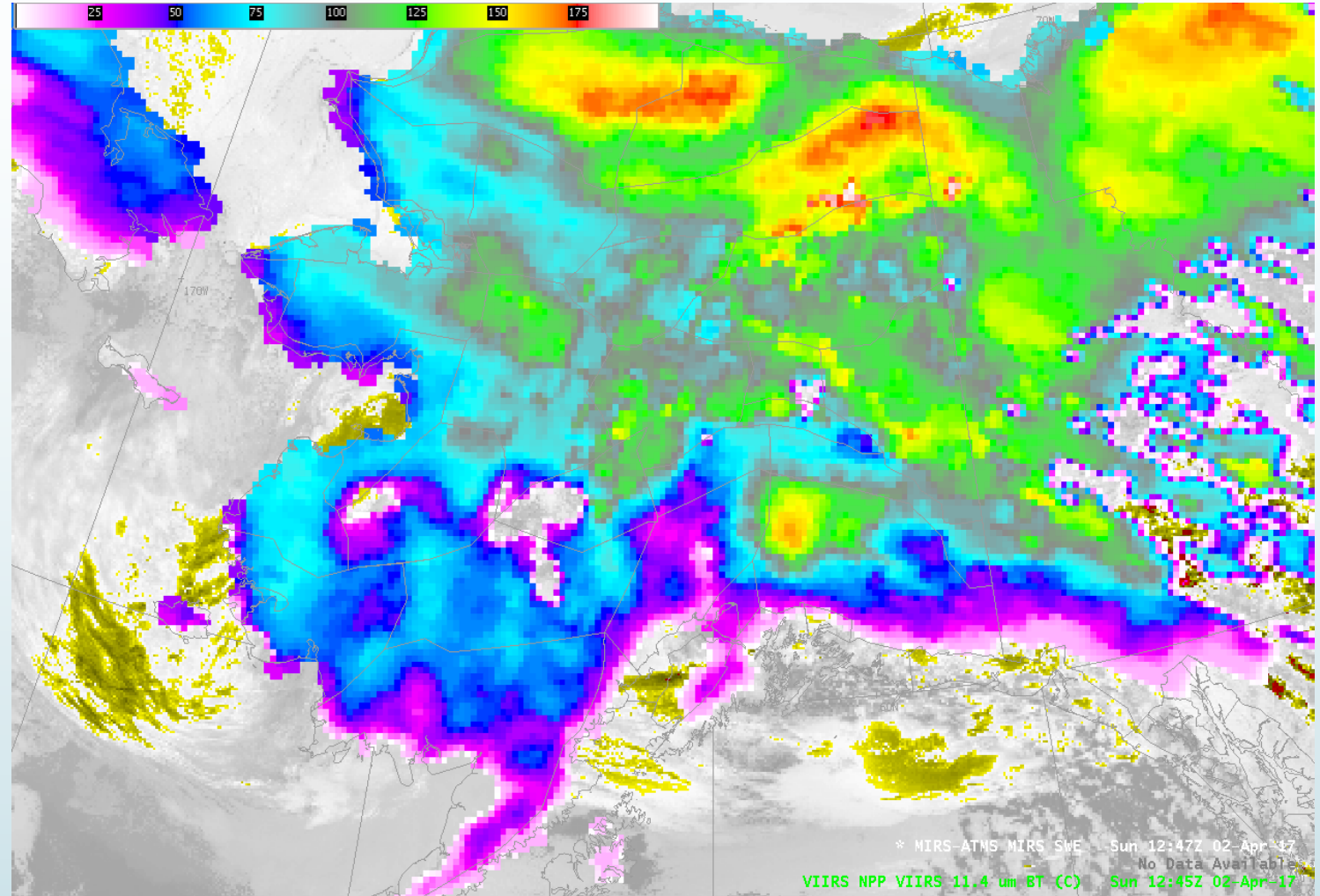
MIRS Cloud Liquid Water (CLW)

- Measure of the total liquid water contained in a cloud in a vertical column of atmosphere.
- Reported as the depth of water in a column
- Does NOT include solid water (snow, ice).



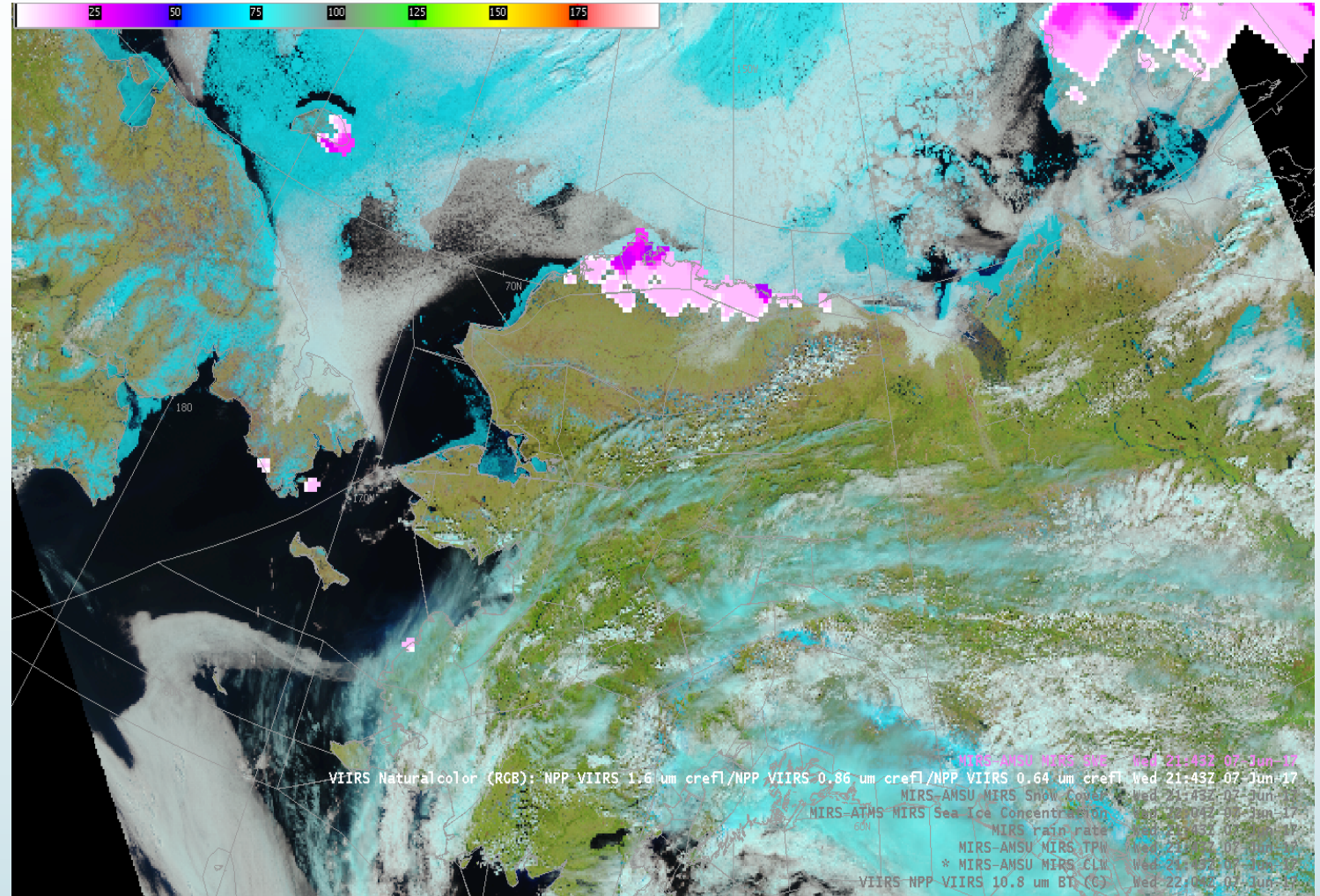
MIRS Snow Water Equivalent (SWE)

- Amount of water contained within the snowpack
- Reported as the depth of water in a column from melted snow at a given point.



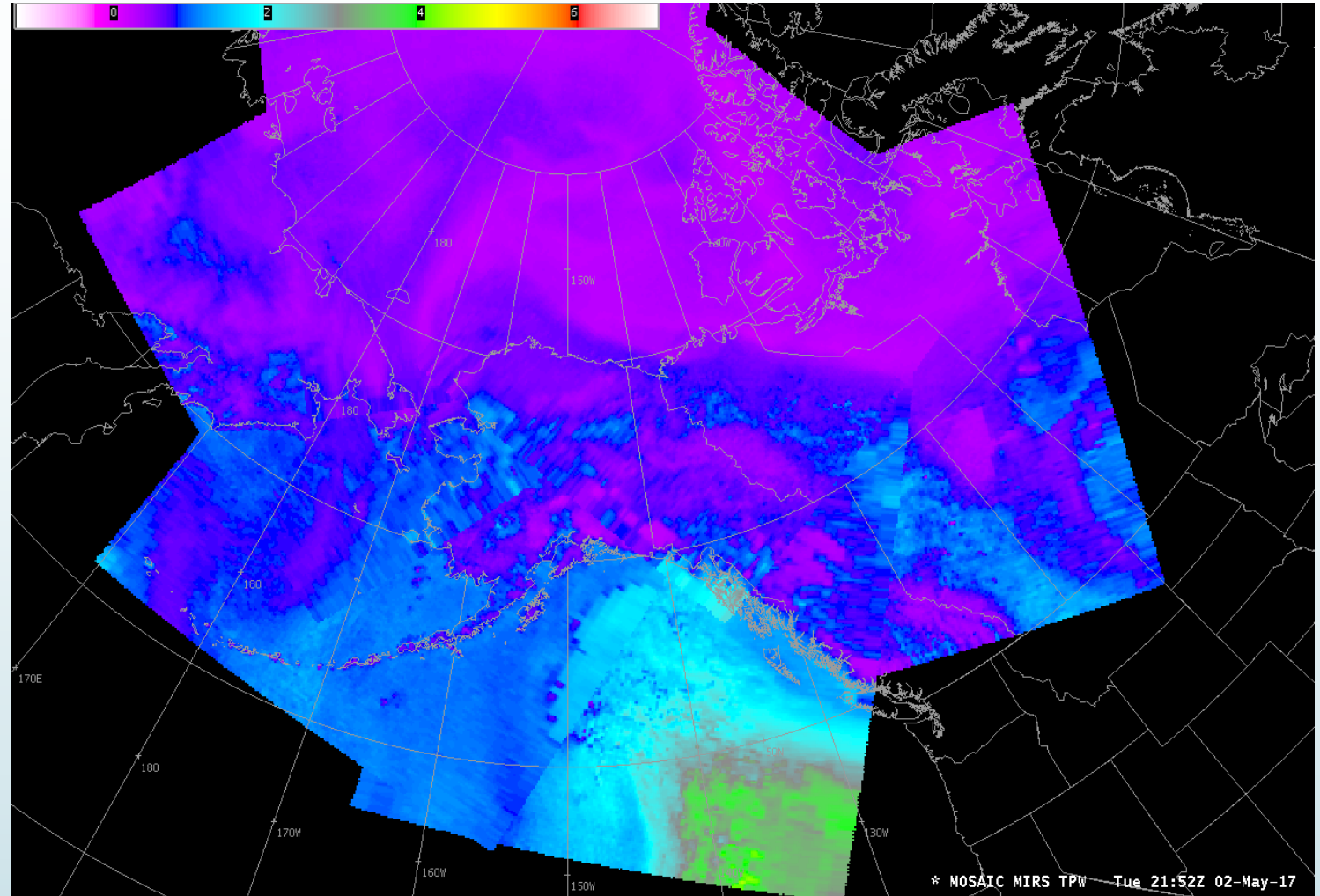
MIRS Snow Cover

- Binary (yes/no) for snow cover detected over land
- Same footprint as positive values of SWE.



Future Plans

- Mosaic compositing for MIRS products
- Additional product evaluations:
 - TPW and Rain Rates
 - SWE
- Move processing from experimental to operational production



Summary

- The new version of CSPP/polar2grid provides means to produce passive microwave products for AWIPS to the National Weather Service in Alaska from Direct Broadcast.
- There are currently six MIRS product being distributed to NWS (TPW, CLW, Rain Rate, SWE, Snow Cover, Sea Ice Concentration)
- An evaluation of microwave Sea Ice Concentration products for use by the Alaska Sea Ice Program found that the significant resolution advantage of AMSR2 led to better verification than the MIRS version.
- Evaluation projects will be planned for other microwave products.



Thank you. Questions?

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