

NOAA

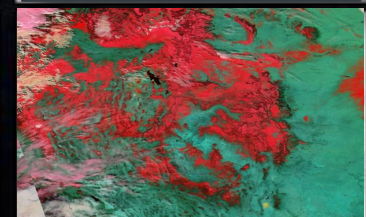
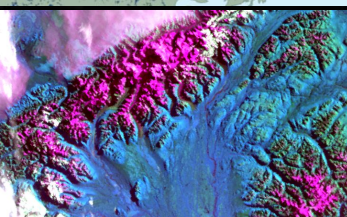
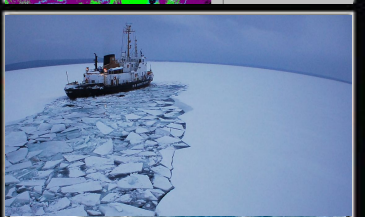
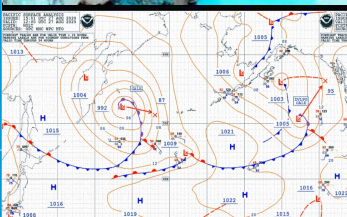
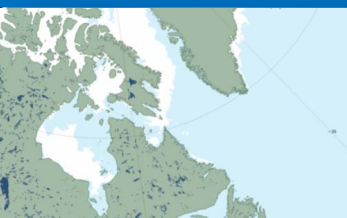
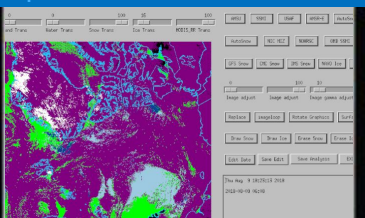
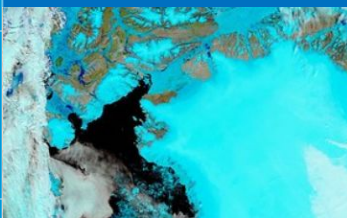
National
Weather
Service

VIIRS User Meeting – June 29-30, 2022

Operational Utility of VIIRS at the U.S. National Ice Center

Name: Walt Clark

Position: Snow and Ice Product Area Lead





U.S. National Ice Center

Mission and Organizational Alignment



The U.S. National Ice Center provides global to tactical scale ice and snow products, ice forecasting, and related environmental intelligence services for the United States government.



Tri agency organization composed of:

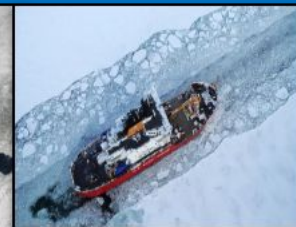


NOAA component:
NWS Ocean Prediction Center Ice Services Branch

Navy component:
Fleet Weather Center Norfolk, Naval Ice Center



USCG component:
Office of Waterways and Ocean Policy, Mobility and Ice Operations Division





Areas of Ice Product Responsibility



N. Hemisphere: Daily gridded snow *and* ice, daily vector ice analysis, 48hr ice edge forecast

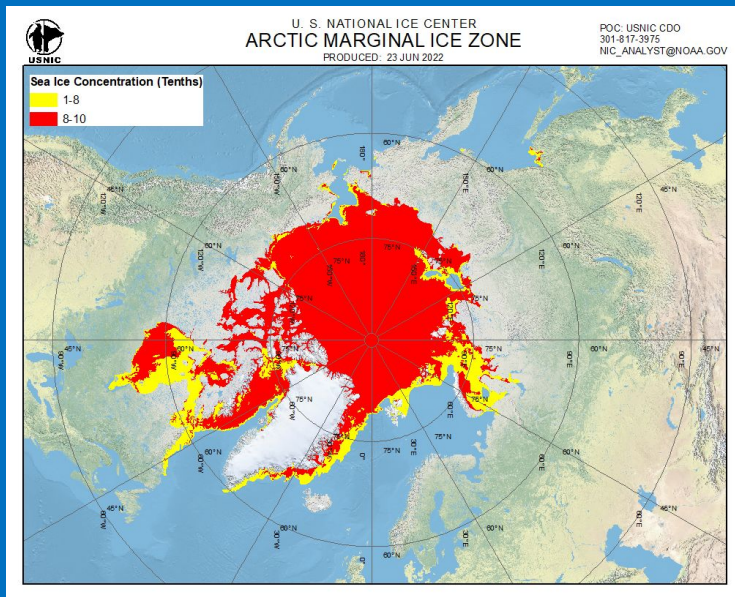
Antarctica: Routine vector ice analyses, iceberg ID/tracking



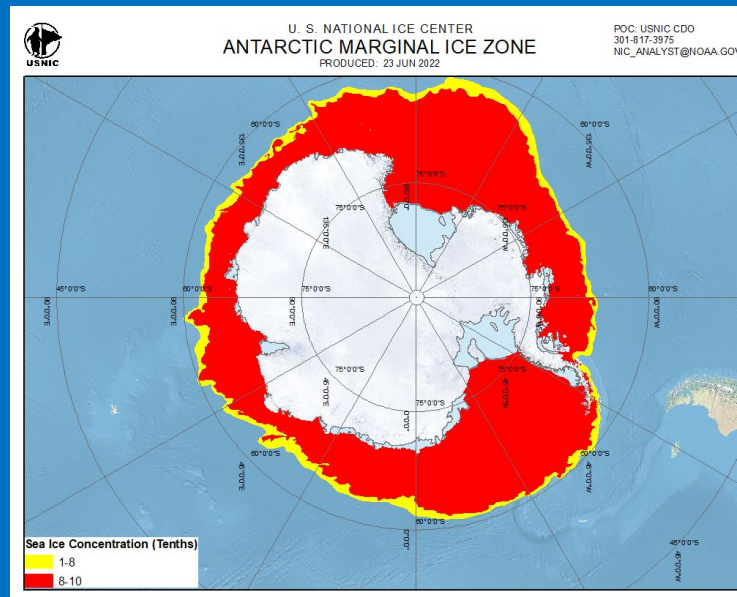
Routine Products

Core Daily Products:

- Marginal Ice Zone (MIZ): Baseline analysis of ice edge and pack ice (>8/10ths ice)
- 48hr forecast of the ice edge
- Disseminated through DOD networks and used by DOD, USCG, and commercial mariners in strategic decision-making



Daily northern hemisphere MIZ analysis valid June 23, 2022. Yellow areas indicate ice of <80% concentration. Red shading indicates ice concentrations >80%

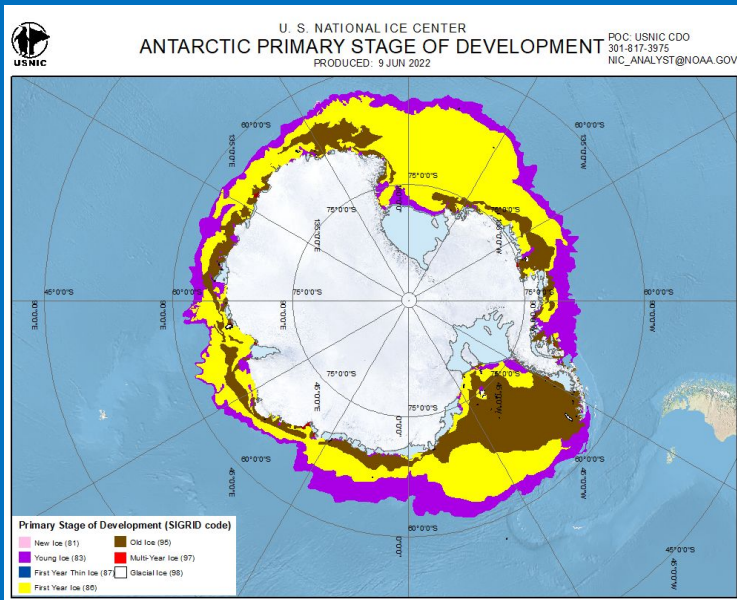


Daily southern hemisphere MIZ analysis valid June 23, 2022. Yellow areas indicate ice of <80% concentration. Red shading indicates ice concentrations >80%

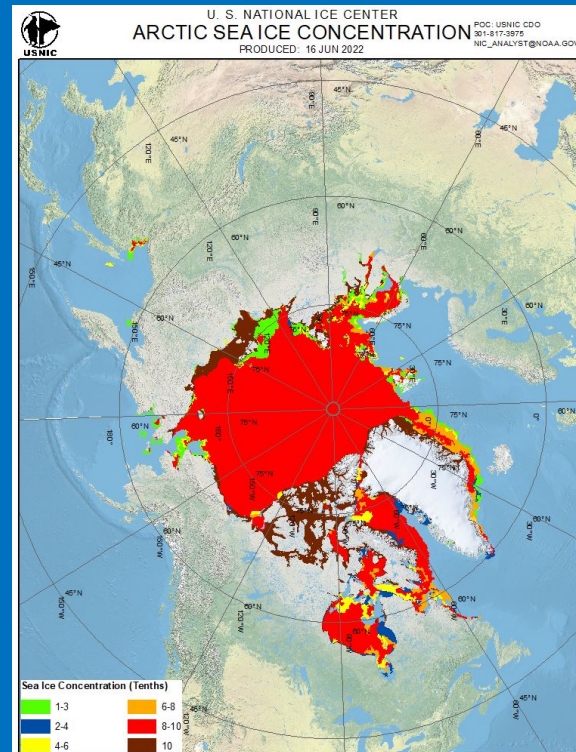
Routine Products

Bi-weekly detailed ice characterization:

- Delineates not only total concentrations of ice, but also details the stage of development (thickness) as well as other characteristics such as land-fastened ice
- Serves as a knowledge backbone for incoming tailored decision support requests



Biweekly southern hemisphere ice analysis visualized by primary stage of development (thickest ice present). Brown = older/thicker ice, magenta = much younger, thinner ice, yellow = medium age ice.

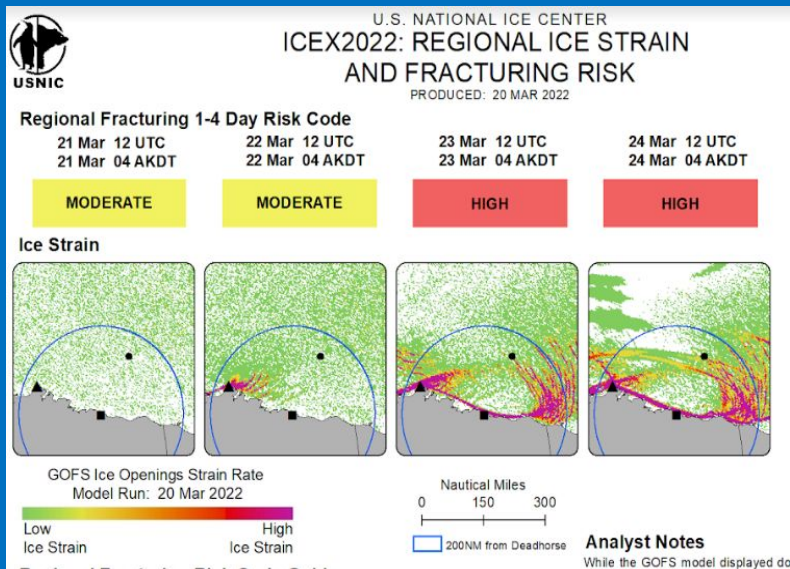


Biweekly northern hemisphere detailed ice analysis symbolized by concentration with greens and blues representing a few tenths of ice concentration and browns representing 10/10ths.

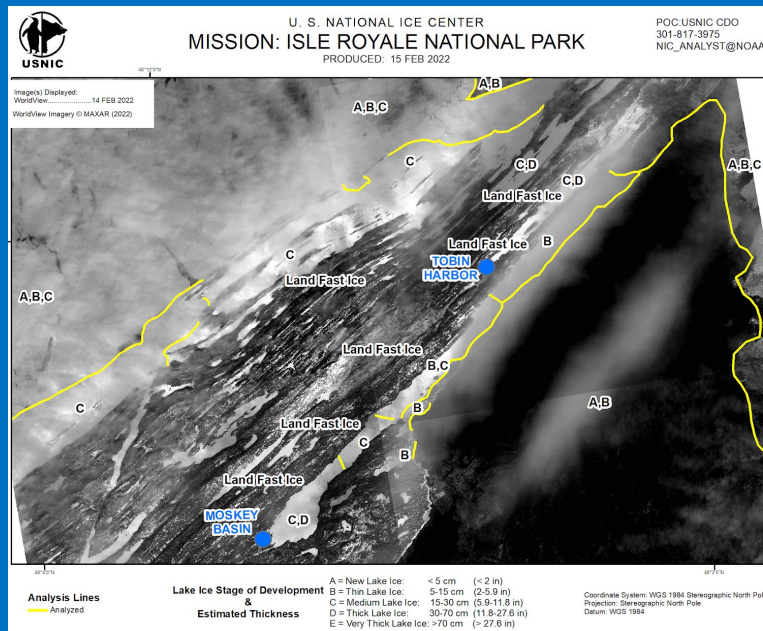


Decision Support Services (DSS)

USNIC rises to meet a variety of challenges various U.S. gov't agencies face navigating and operating within polar regions



The every-other-year Ice Exercises (ICEX) is a significant DOD undertaking to conduct various exercises and science on an ice floe north of Alaska. USNIC support begins before deployment with subseasonal forecasts and ID'ing of suitable floes. Analyses, imagery, and forecasts (except of ice fracturing risk forecast pictured) are issued throughout the operation.



February 15, 2022: USNIC contributed to unified briefings in support of a Nat'l Park Service winter wildlife study of Isle Royale Nat'l Park. High resolution analysis was provided depicting the ice edge, ice concentrations, ice stage, and land-fastened ice.



Center Operations and Production Flow

Observation: Remote and In Situ Sensing



Satellites

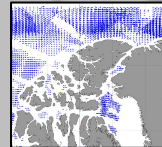
Buoys

Deployed Personnel

Surface Observations

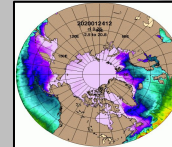
Radar

Computing/IT



Extract Data from Satellite Imagery

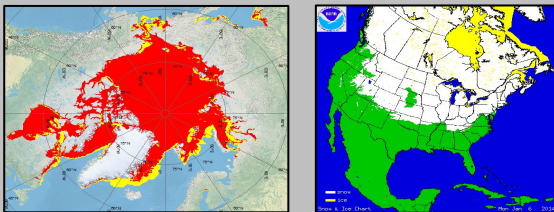
Modeling



Nowcasting and Forecasting

- Reliance on remotely sensed observations combined with in situ measurements and model data

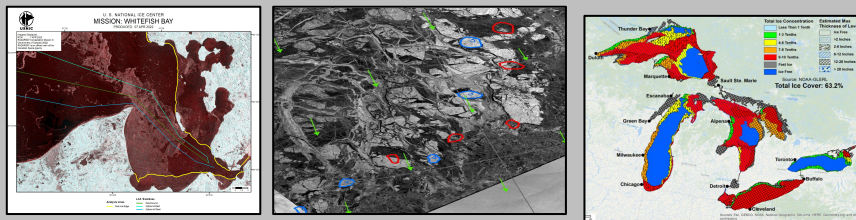
Characterization



Sea Ice Extent, Concentration, and Thickness

Gridded Snow and Ice Charts

Tailoring and Integration of Products & Services



Ice Navigation and Avoidance

Environmental Intelligence

Operations Planning

- Strategic to tactical scale support

USNIC IT: Dual Production Systems

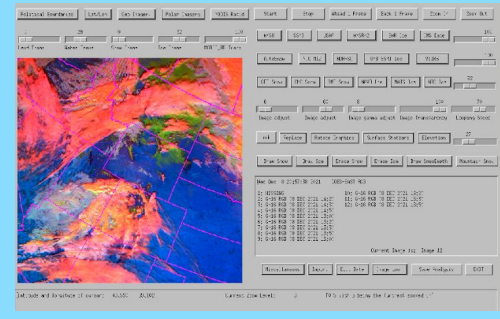
SIPAS



Sea Ice Prediction and Analysis System

- Uses ESRI ArcMap software as a back-bone
- Shared database architecture allows analysis to be split among staff
- Collection of custom plug-ins facilitate easy imagery import, editing functionality, and product creation

IMS



Interactive Multisensor Snow and Ice Mapping System

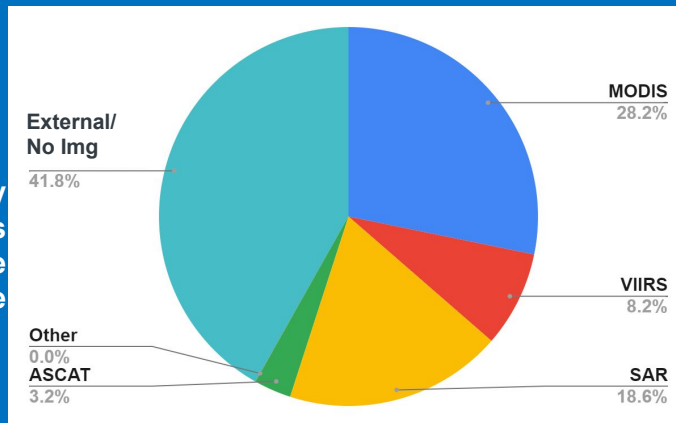
- Fully custom end-to-end linux-based application
- Imagery collection tailored for rapid ice/snow delineation
- System tailored for creation of gridded products

VIIRS Within SIPAS

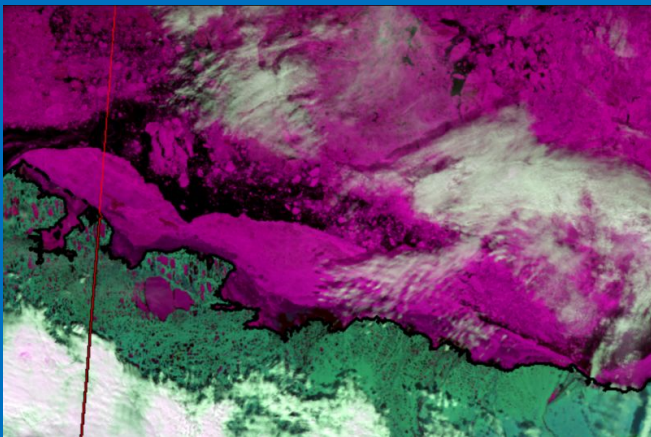
Individual scenes of the following available:

- I1, I2, I3 RGB composite
- Individual I1, I2, I3, and I5 bands
- Individual DNB

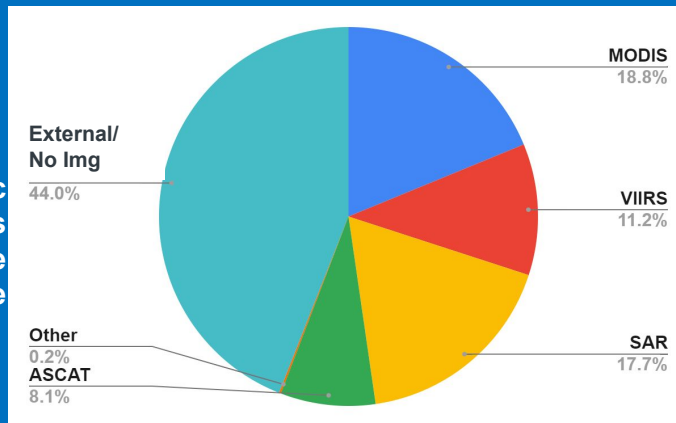
2021 Arctic Weekly Ice Lines Drawn by Image Visible



VIIRS I1, I2, I3 RGB imagery within the ArcMap and SIPAS system.



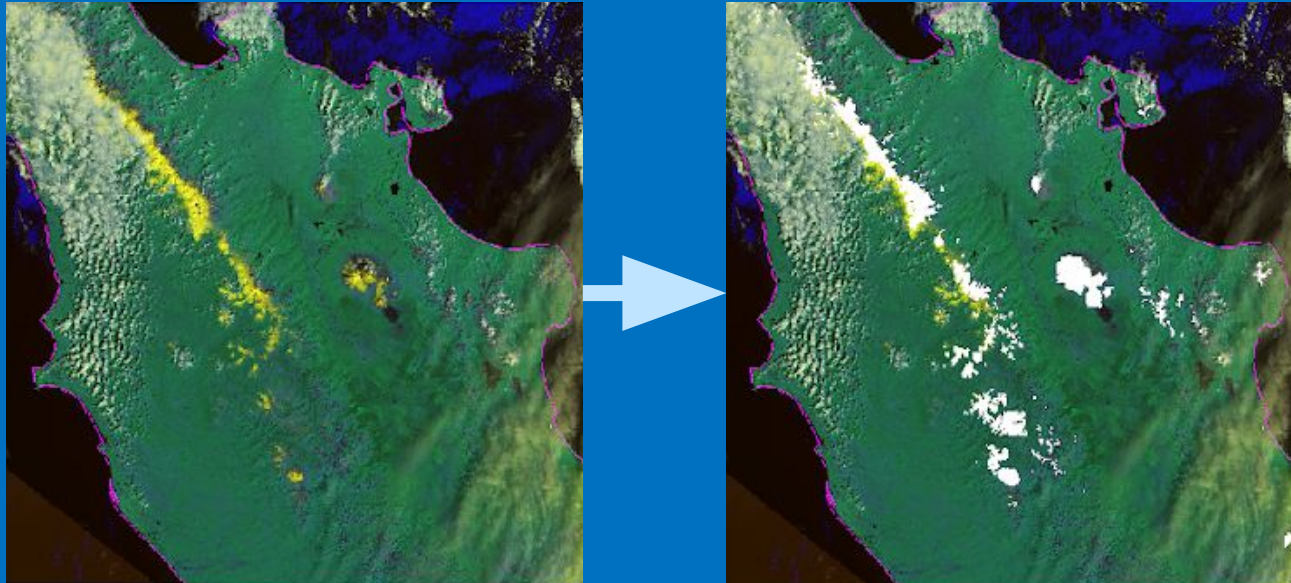
2021 Antarctic Weekly Ice Lines Drawn by Image Visible



VIIRS Within IMS

Products available to operations:

- 3x a day updating RGB (I1, I2, and I3) composite of all recent imagery (most heavily used)
- 3x a day updating image composite of recent I5 infrared bands
- 3x a day updating composites of recent NCC imagery
- 3x a day derived VIIRS based snow and ice detection algorithm



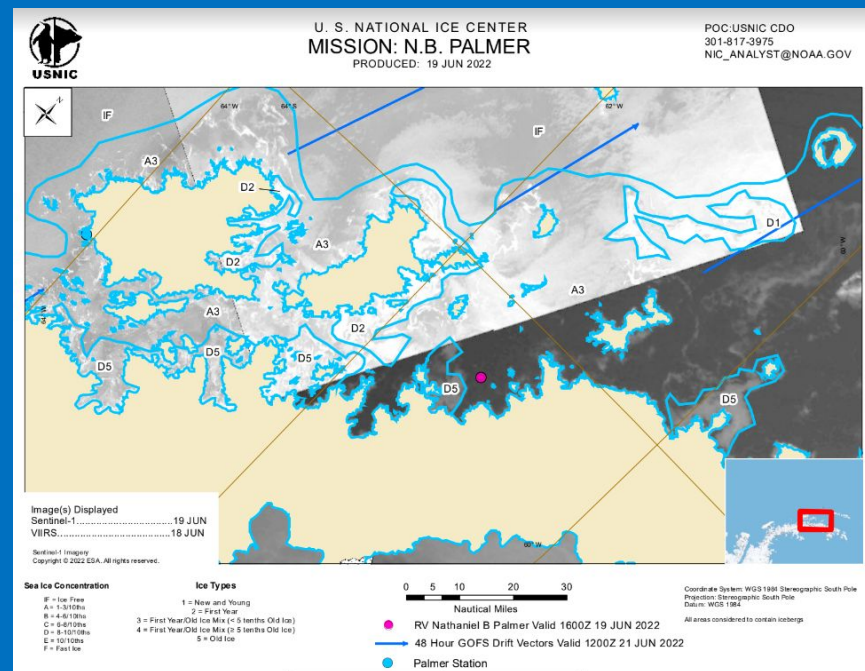
Before and post analysis screenshots of VIIRS use in IMS.

Left image represents only the VIIRS imagery in IMS while the right image shows the analysis conducted in this region (Kamchatka).

Imagery is weighed in consideration with other imagery types, in-situ, and occasionally model datasets to render a snow or ice decision.

Benefits of VIIRS to USNIC Operations

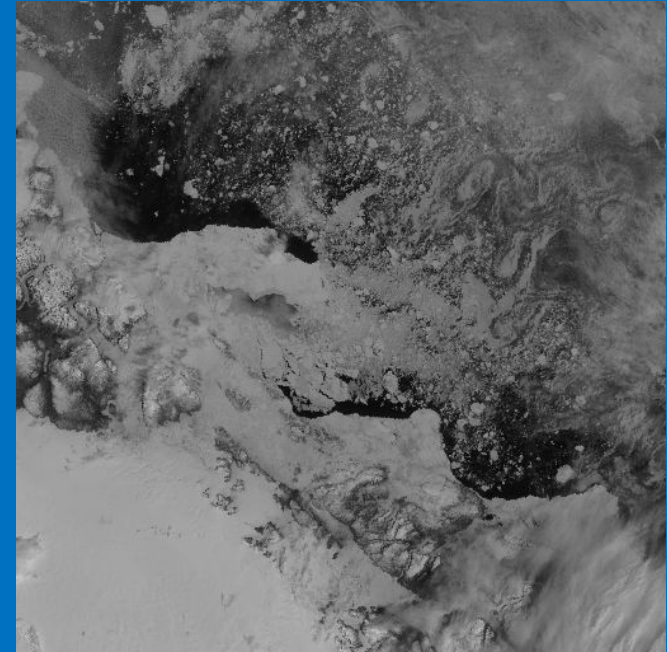
- Near seamless analysis compatibility with legacy MODIS observations.
- Balanced resolution to swath size greatly benefits general ice surveillance and can still be utilized for some higher resolution DSS (pictured).
- Useful selection of bands to assess ice in both the infrared and across the optical spectrum.
- Multiple sensors improves revisit time, image geometry over an AOI, and feature discrimination.



Both Sentinel SAR and VIIRS are utilized in this DSS product to the NSF's primary Antarctic vessel, *Nathaniel B. Palmer*.

VIIRS Challenges/Opportunities

- MODIS Retirement: VIIRS will soon become the USNIC's 2nd most sought after sensor type.
- Frequency/Amount of Observations: 3 sensors?
- Optimizing products for both IT capabilities and analyst needs.
 - Granule swath height.
- Inherent limitations of Optical/IR Imagery: Clouds, polar night, resolution.
 - Seeking the right applications for VIIRS to shine.
- Obtaining high enough quality derived products to augment analyst time.
 - Overcoming the R2O gap to see application.
- Maintaining data portals that are 1) low latency 2) high reliability and 3) easily accessible.



VIIRS 1km Imagery within the USNIC IMS application



Thanks! Questions?

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USNIC Website
<https://usicecenter.gov>

 @usnatice
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VIIRS RGB of Great Bear Lake in
Canada within the USNIC
ArcMap/SIPAS framework, June
26, 2022

