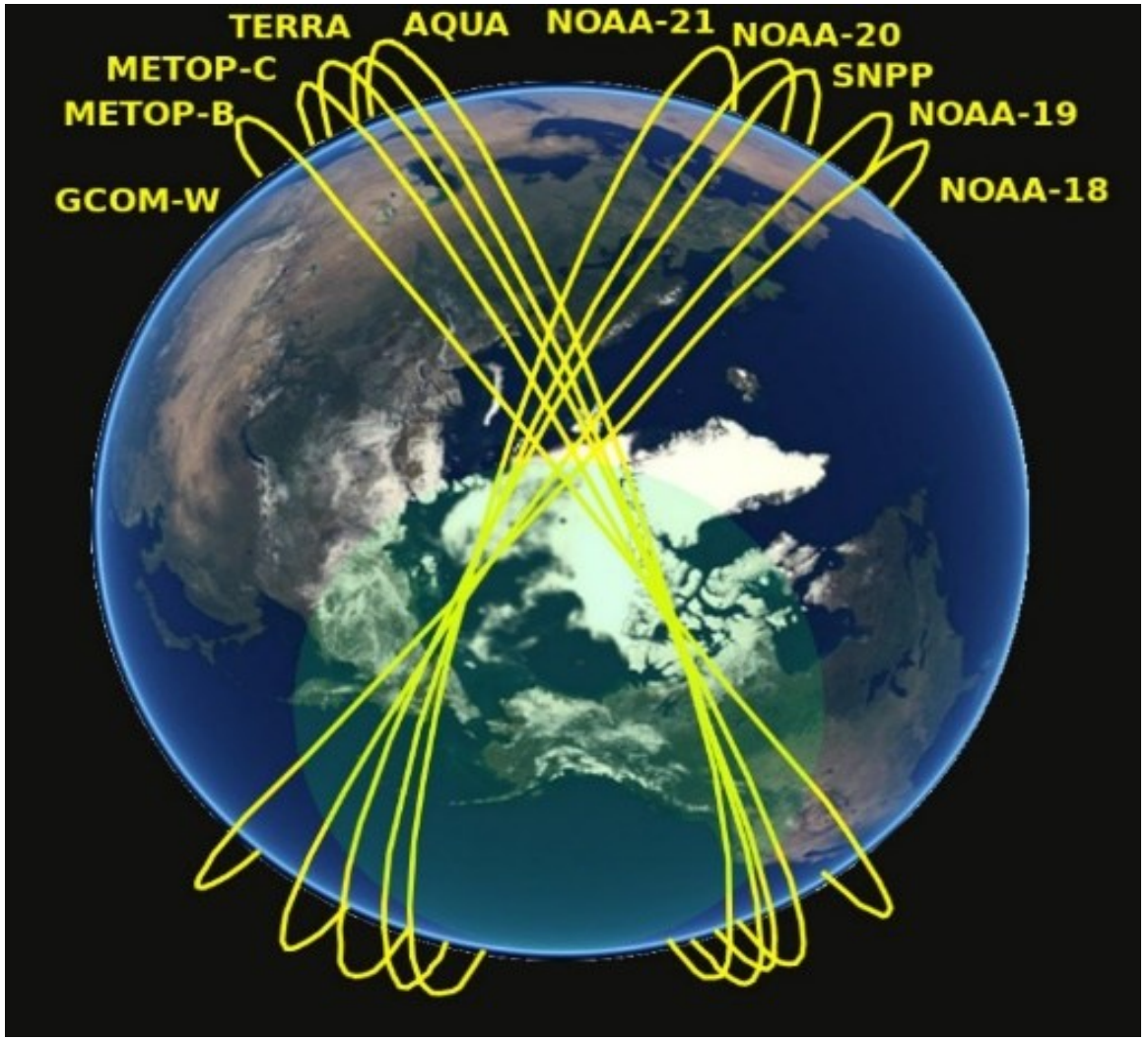
GINA: Serving Near-Real Time Satellite Imagery and Building Geospatial Collaboration

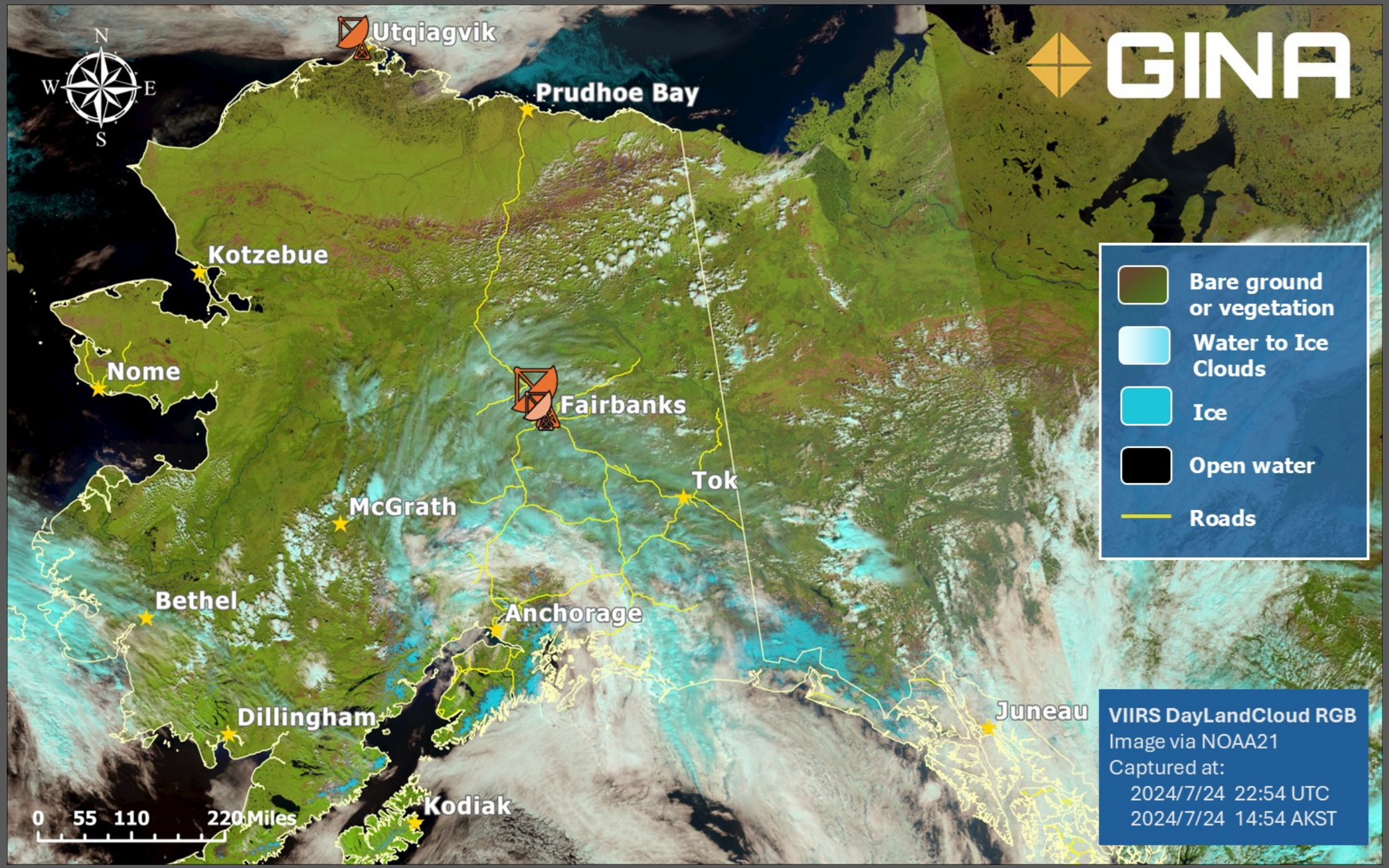
Owen Larson
Geographic Information Network of Alaska

GINA Provides Near Real-Time Direct Broadcast products from Low Earth Orbiting (LEO) Satellites

Some of the many key sources:

- Visible Infrared Imaging Radiometer Suite (VIIRS), NOAA/NASA Joint Polar Satellite System (JPSS) satellites
- Microwave Integrated Retrieval System (MiRS), drawing from sensors on multiple satellites




GINA
N
W
E
S
Utqiagvik
Prudhoe Bay
Kotzebue
Nome
Fairbanks
Tok
McGrath
Bethel
Anchorage
Dillingham
Juneau
Kodiak
Bare ground or vegetation
Water to Ice Clouds
Ice
Open water
Roads
0 55 110 220 Miles
VIIRS DayLandCloud RGB
Image via NOAA21
Captured at:
2024/7/24 22:54 UTC
2024/7/24 14:54 AKST

Importance of Direct Broadcast in Alaska

- Immediate downlink of sensor data, fastest product delivery for short-fused hazards (~15 min)
- Delivery adapted to user needs
- Close relationship with local users

The JPSS 2/3/4 RF Interfaces, as shown in Figure SC-GND-92,

a. Ground System to Spacecraft S-Band Uplink
b. Space Network to Spacecraft S-Band SAF
c. Spacecraft to Ground System S-Band Downlink
d. Spacecraft to Space Network S-Band SAR
e. Spacecraft to Ground System Ka-Band SMD Downlink
f. Spacecraft to Space Network Ka-Band SAR
g. Spacecraft to DBS X-Band HRD Downlink

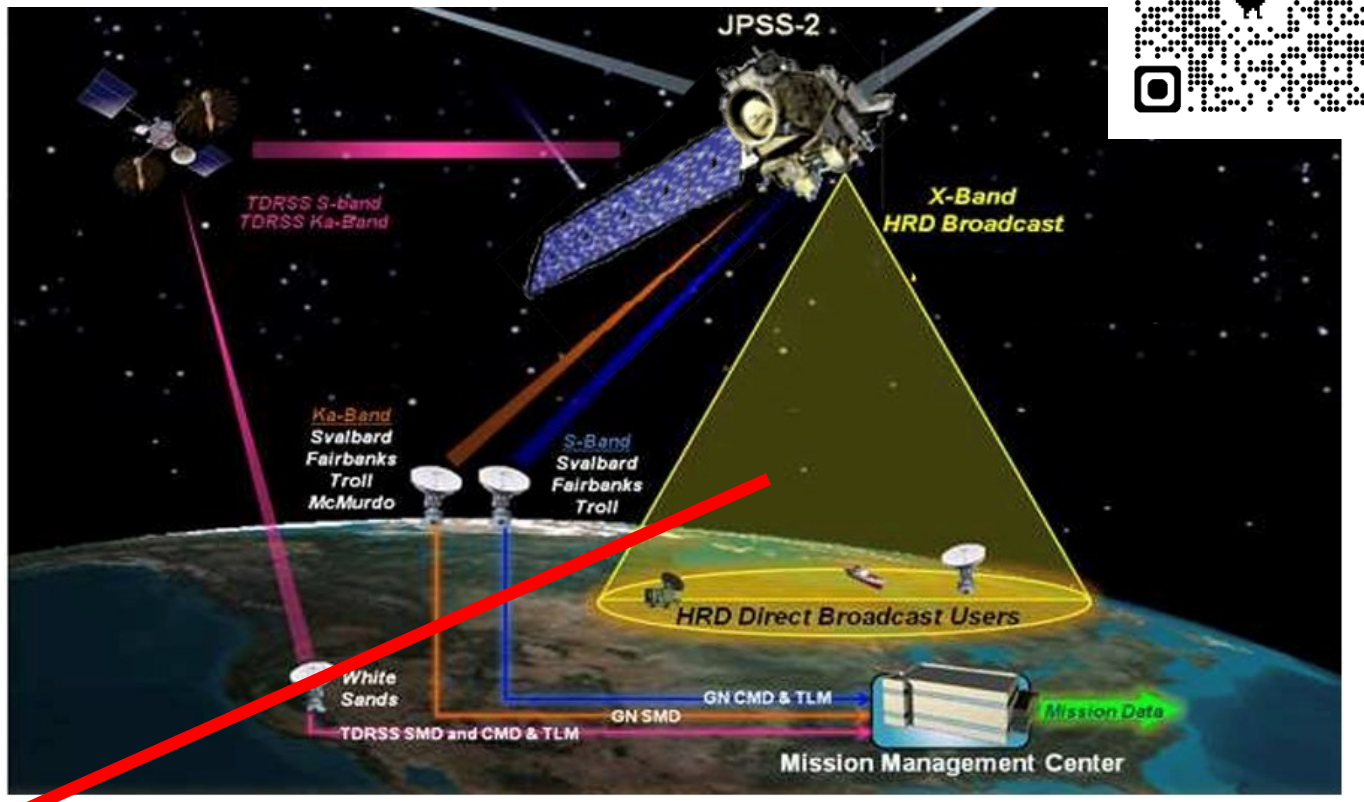


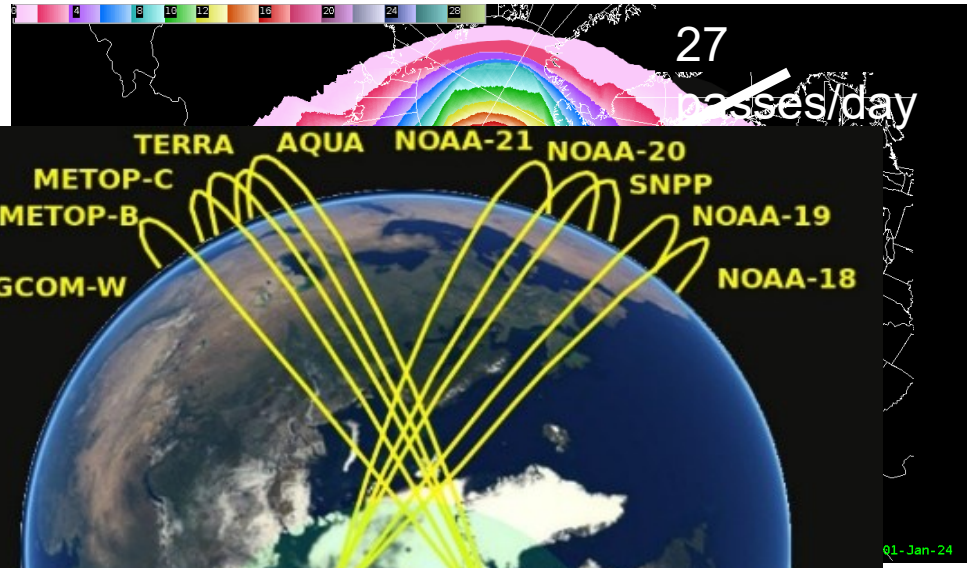
Figure SC-GND-92. SC to Ground System RF Links

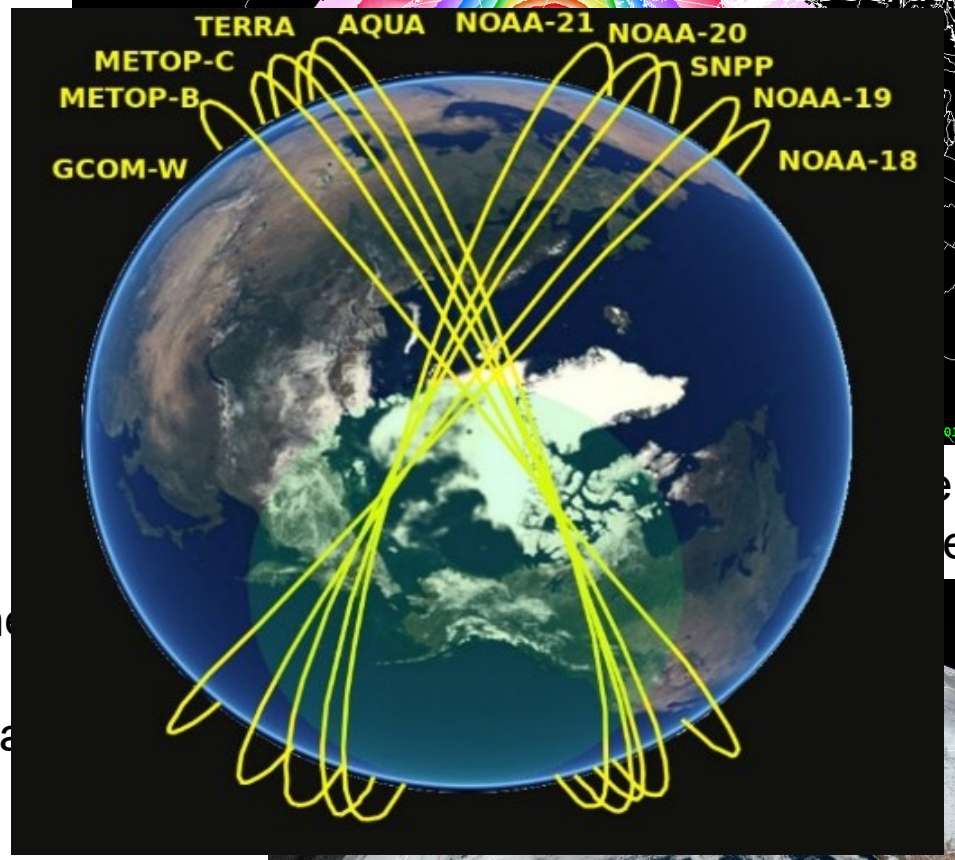
Importance of LEO Satellites in Alaska

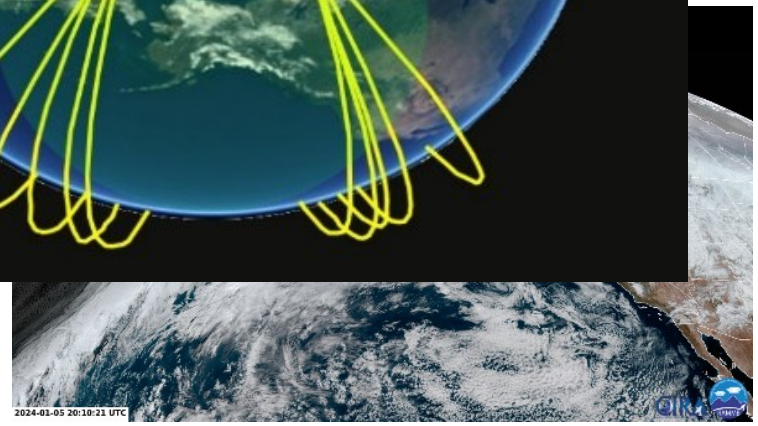
Polar orbit leads to many passes per day over Alaska.

Geostationary Satellites (i.e. GOES-18) have degraded resolution and parallax issues over Alaska.

Limited Radar, ground observation sites relative to Lower 48







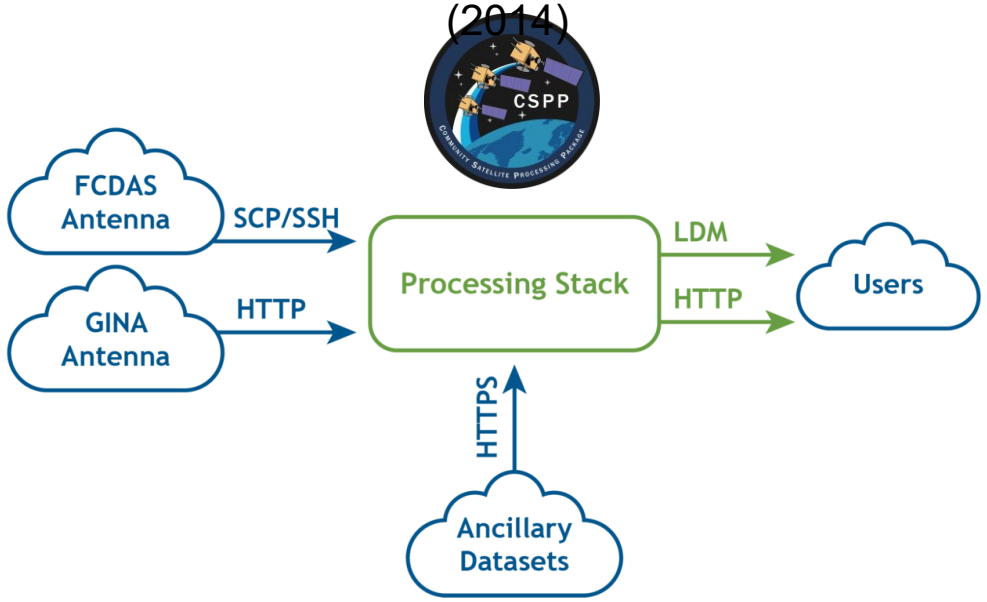
Near Real-Time Processing at GINA

GINA operates 3 antennas and a local processing stack to deliver products within **5 – 25 minutes** of an overpass.

GINA's 3 Antennas: UAF-5 (2024), Big Dog (2001), Sandy Dog (2014)

GINA works with local users and product developers to:

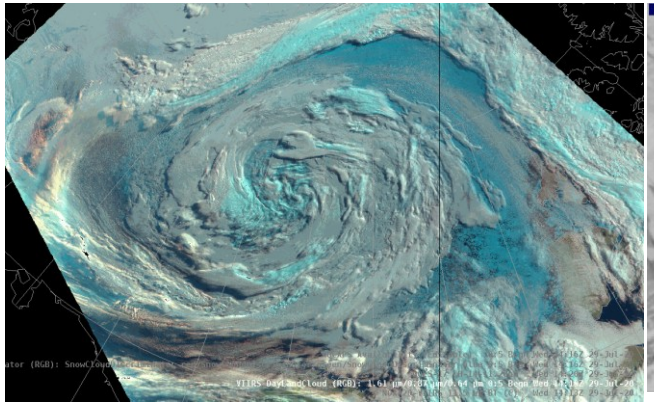
- Deliver products in useful formats
- Develop and share training materials
- Assess satellite products and provide feedback



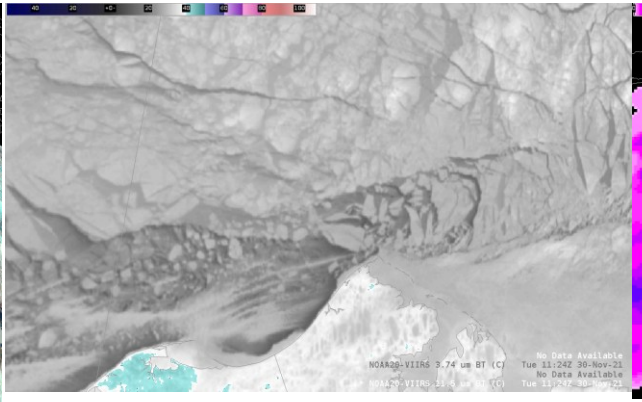
GINA processing stack utilizes the Community Satellite Processing Package (CSPP) software developed by Cooperative Institute for Meteorological Satellite Studies (CIMSS)

Many, many organizations are involved in the production and use of GINA direct broadcast products.

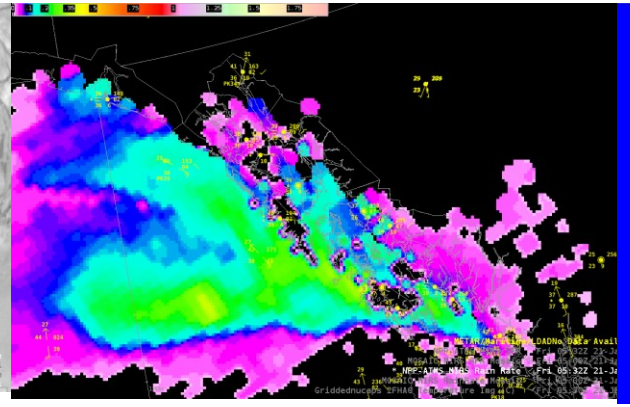
GINA Satellite Products are used for:



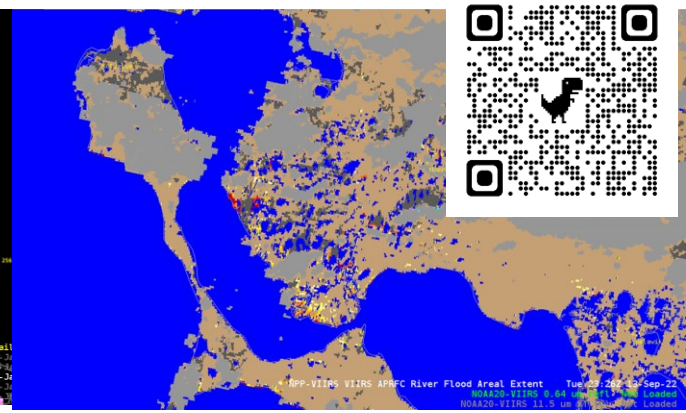
Daily Weather Forecasts



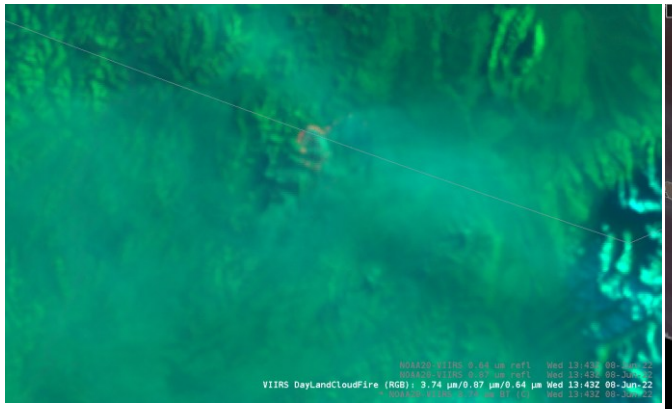
Sea Ice Motion



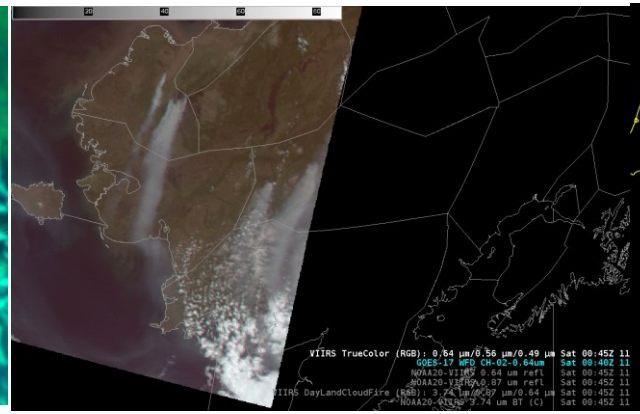
Heavy Precipitation



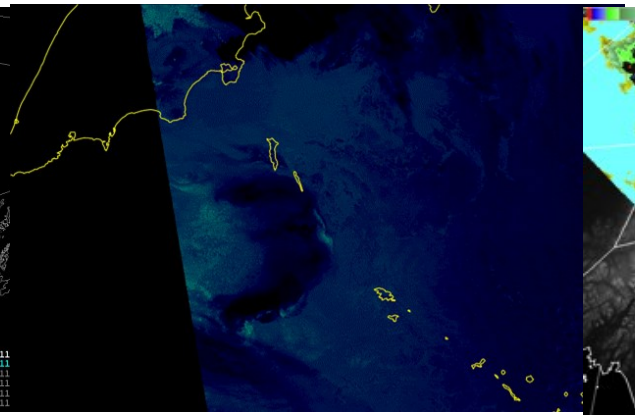
River Flooding



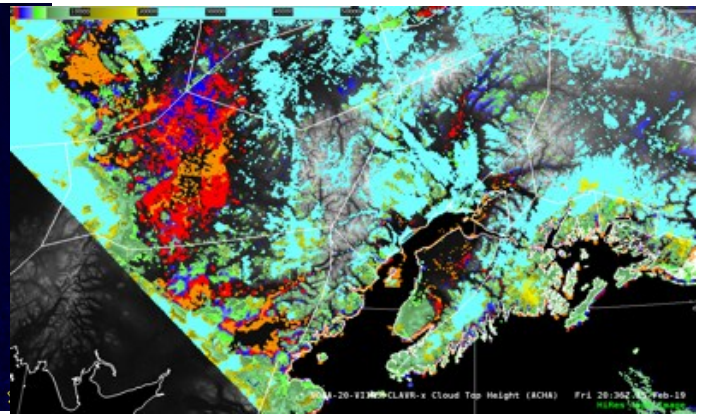
Wildland Fire Detections & Extent



Smoke & Air Quality



Volcanic Emissions

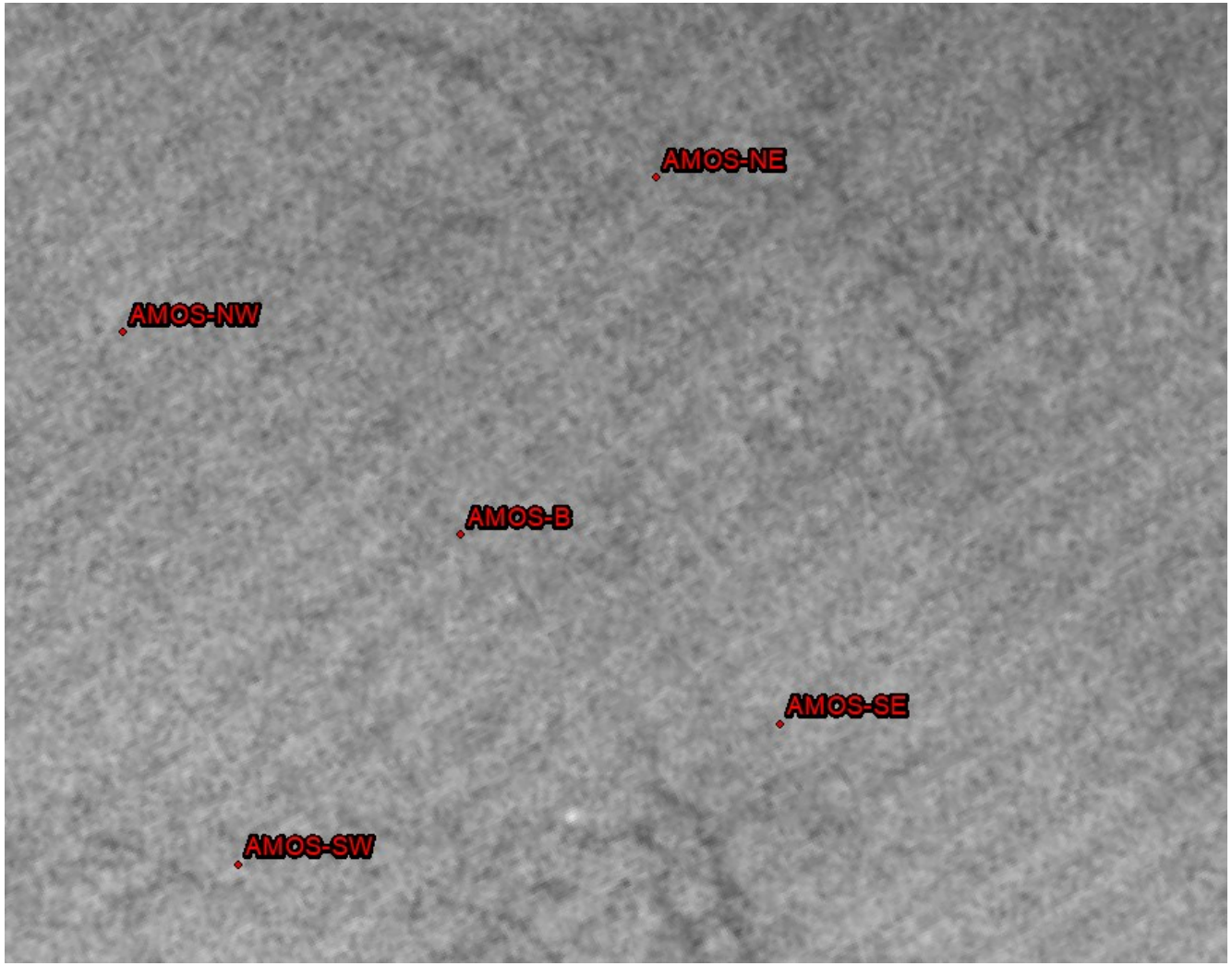


Aviation Advisories (Clouds)

Sea Ice Navigation

Research Vessel R/V Sikuliaq

- 261-foot oceanographic research ship operated by UAF School of Fisheries and Ocean Sciences
- Onboard: Science Systems Engineer
  - Utilizes DB satellite data for weather briefing & ice navigation
  - Provides feedback on product effectiveness



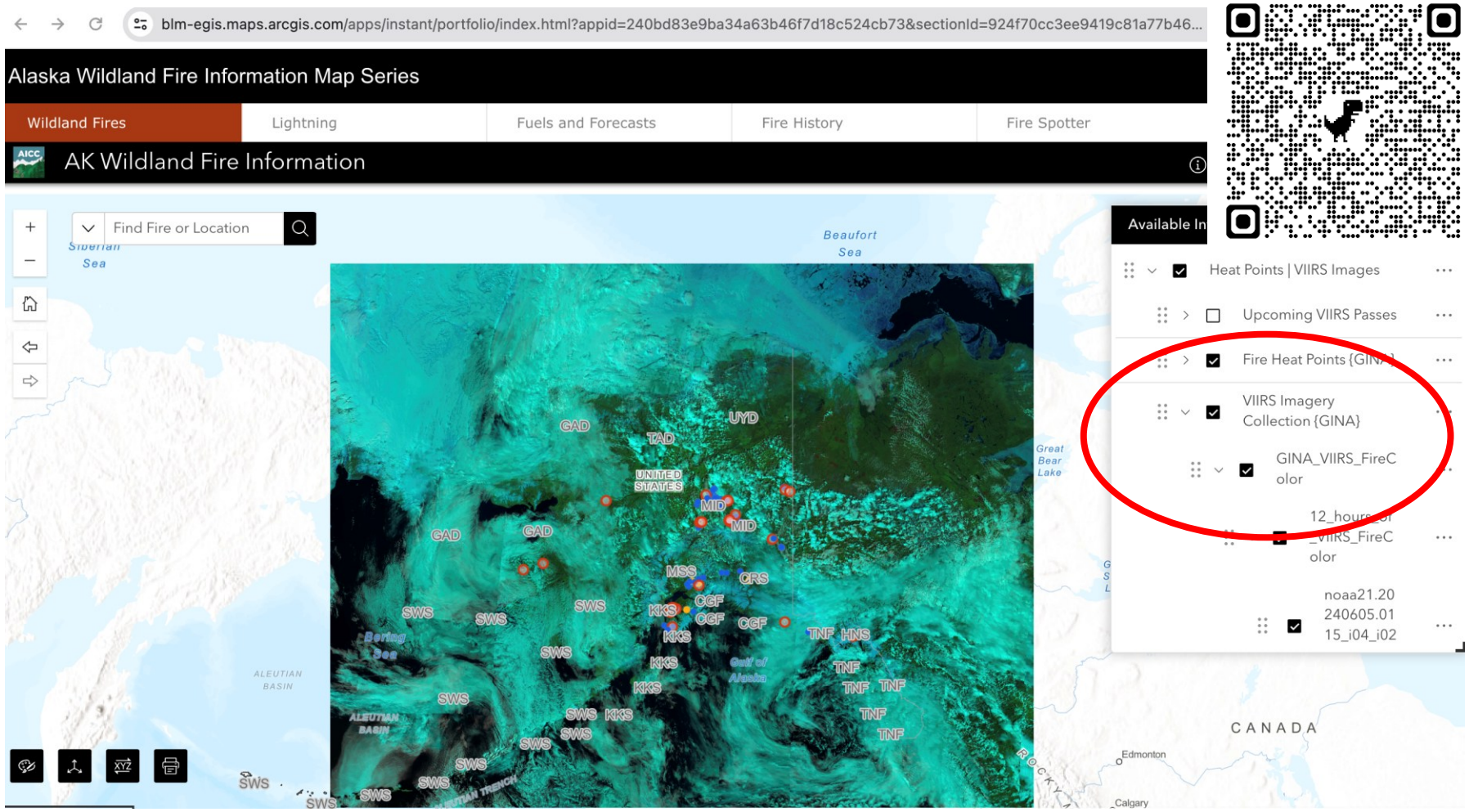
Wildfire Detection

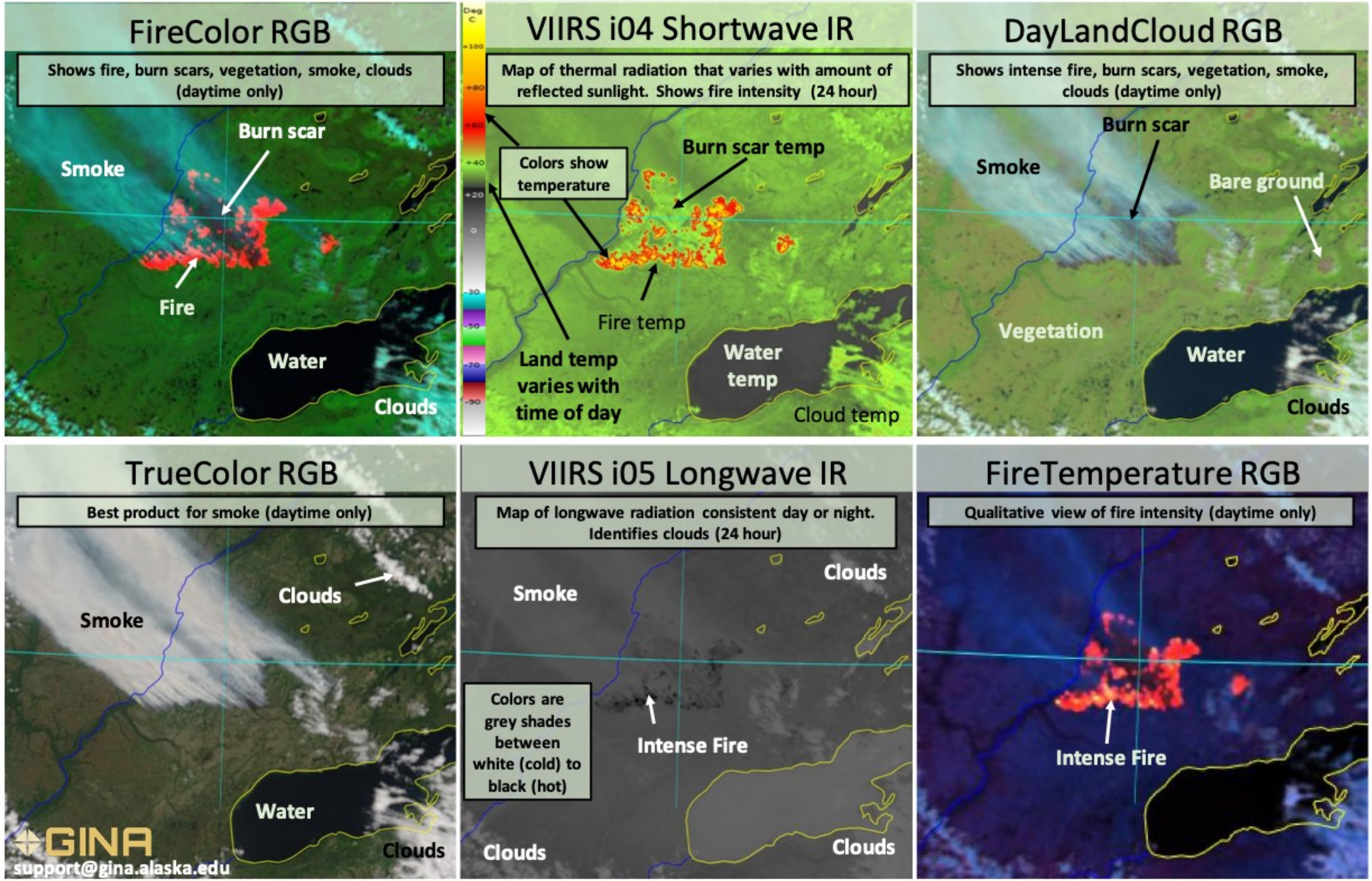
MacKenzie River Fire

Wildfire Detection

GINA produces ArcGIS Rest Services for the Alaska Fire Service.

- VIIRS Active Fire Detections
- VIIRS Fire Imagery




FireColor RGB
Shows fire, burn scars, vegetation, smoke, clouds (daytime only)
Burn scar
Smoke
Fire
Water
Clouds
VIIRS i04 Shortwave IR
Map of thermal radiation that varies with amount of reflected sunlight. Shows fire intensity (24 hour)
Deg C
+100
+80
+60
+40
+20
0
-30
-50
-70
-90
Colors show temperature
Burn scar temp
Fire temp
Land temp varies with time of day
Water temp
Cloud temp
DayLandCloud RGB
Shows intense fire, burn scars, vegetation, smoke, clouds (daytime only)
Burn scar
Smoke
Bare ground
Vegetation
Water
Clouds
TrueColor RGB
Best product for smoke (daytime only)
Clouds
Smoke
Water
Clouds
GINA
support@gina.alaska.edu
VIIRS i05 Longwave IR
Map of longwave radiation consistent day or night. Identifies clouds (24 hour)
Clouds
Smoke
Colors are grey shades between white (cold) to black (hot)
Intense Fire
Clouds
Clouds
FireTemperature RGB
Qualitative view of fire intensity (daytime only)
Intense Fire

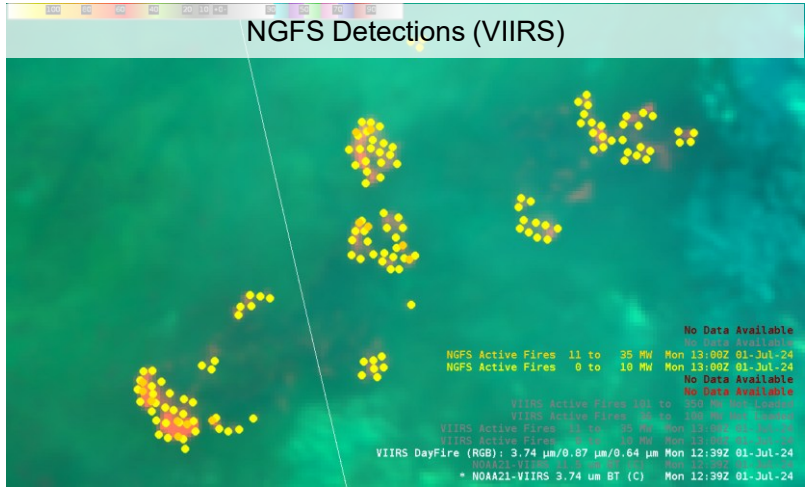
Wildfire Detection

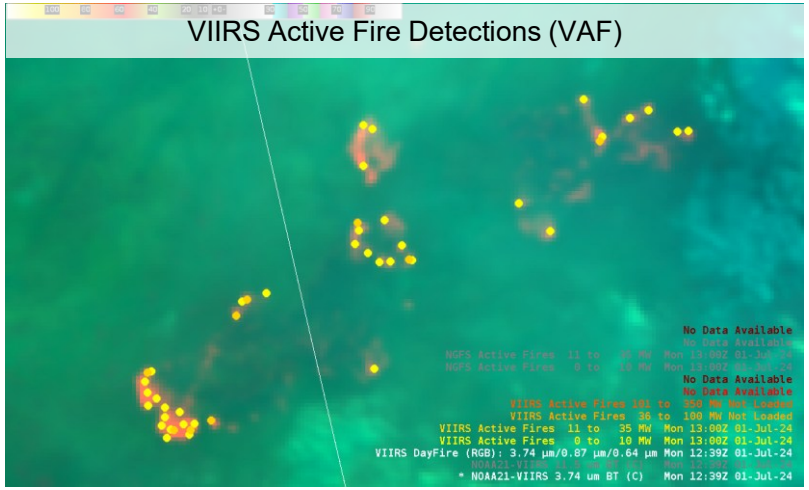
Next Generation Fire System (NGFS)

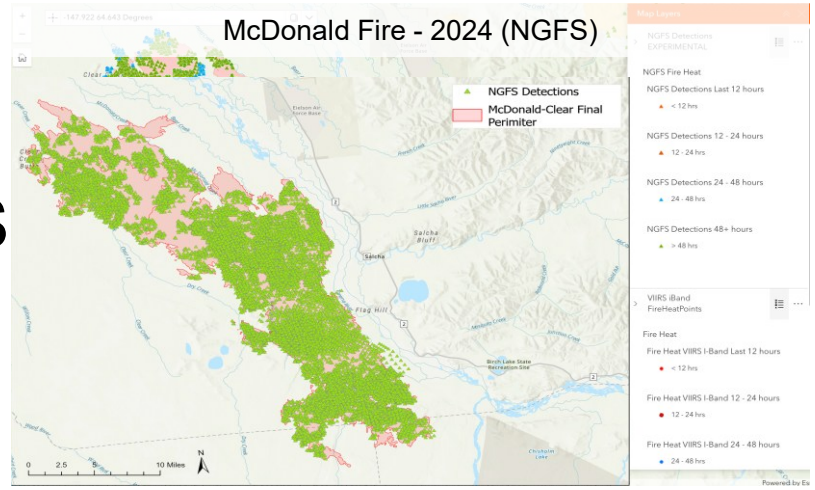
NGFS algorithm can detect thermal anomalies under clouds and smoke at a higher rate.

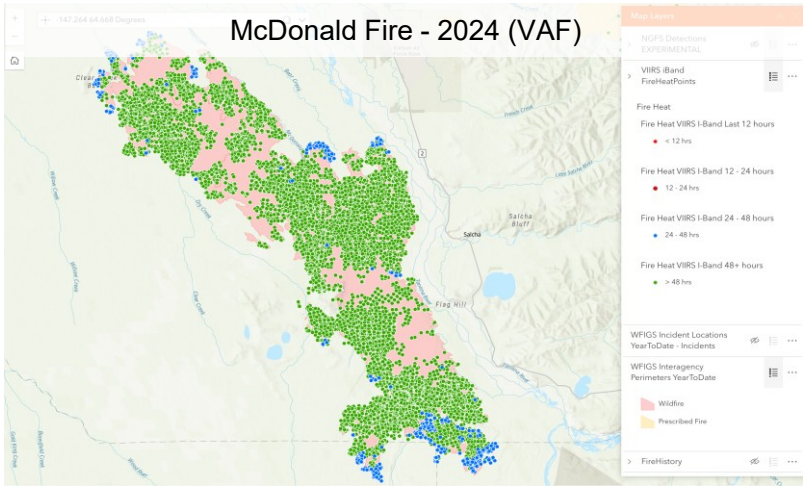
GINA is deploying prototype NGFS ArcGIS Rest Services in 2025.

NGFS Version 3.3.8 deployed at GINA for assessment in Alaska

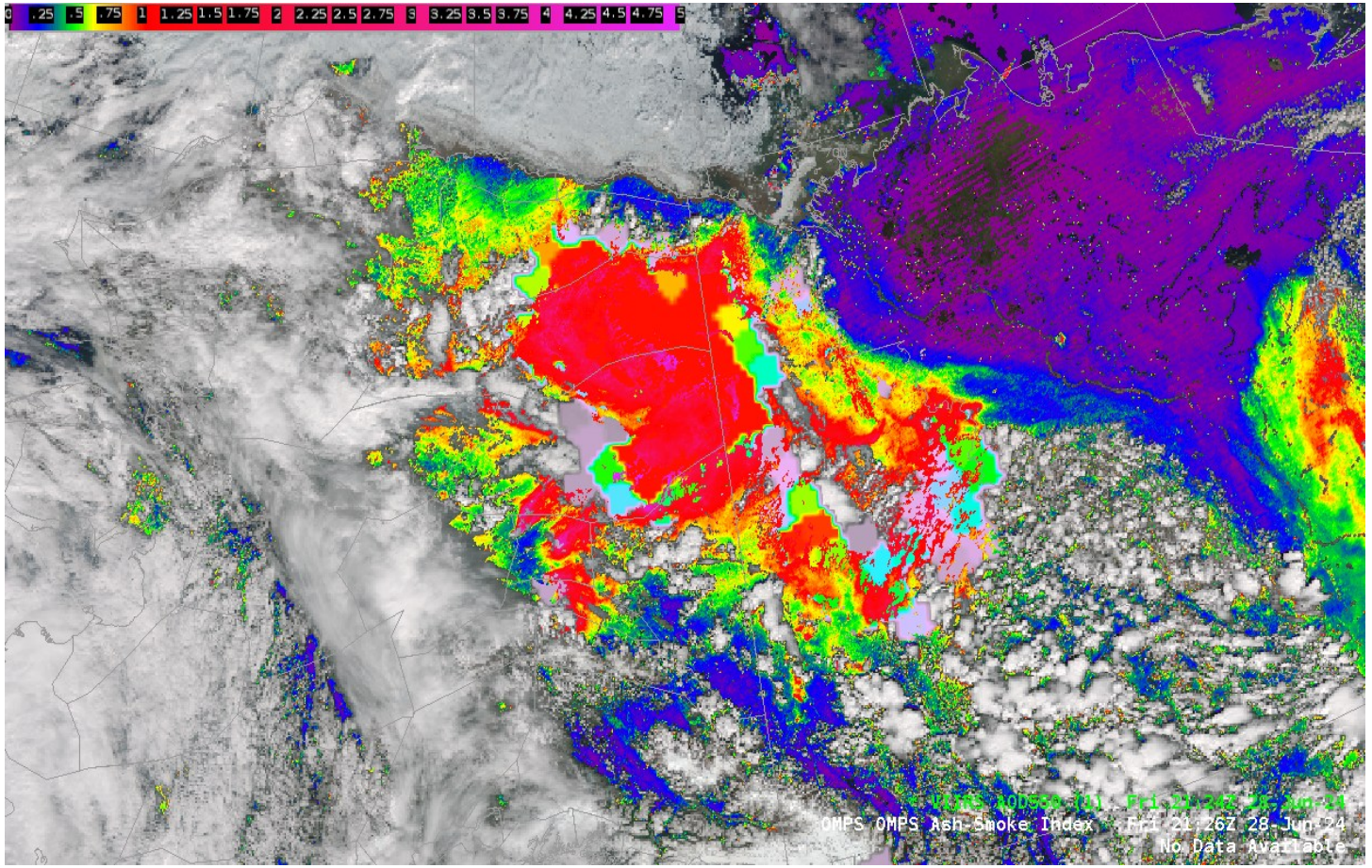








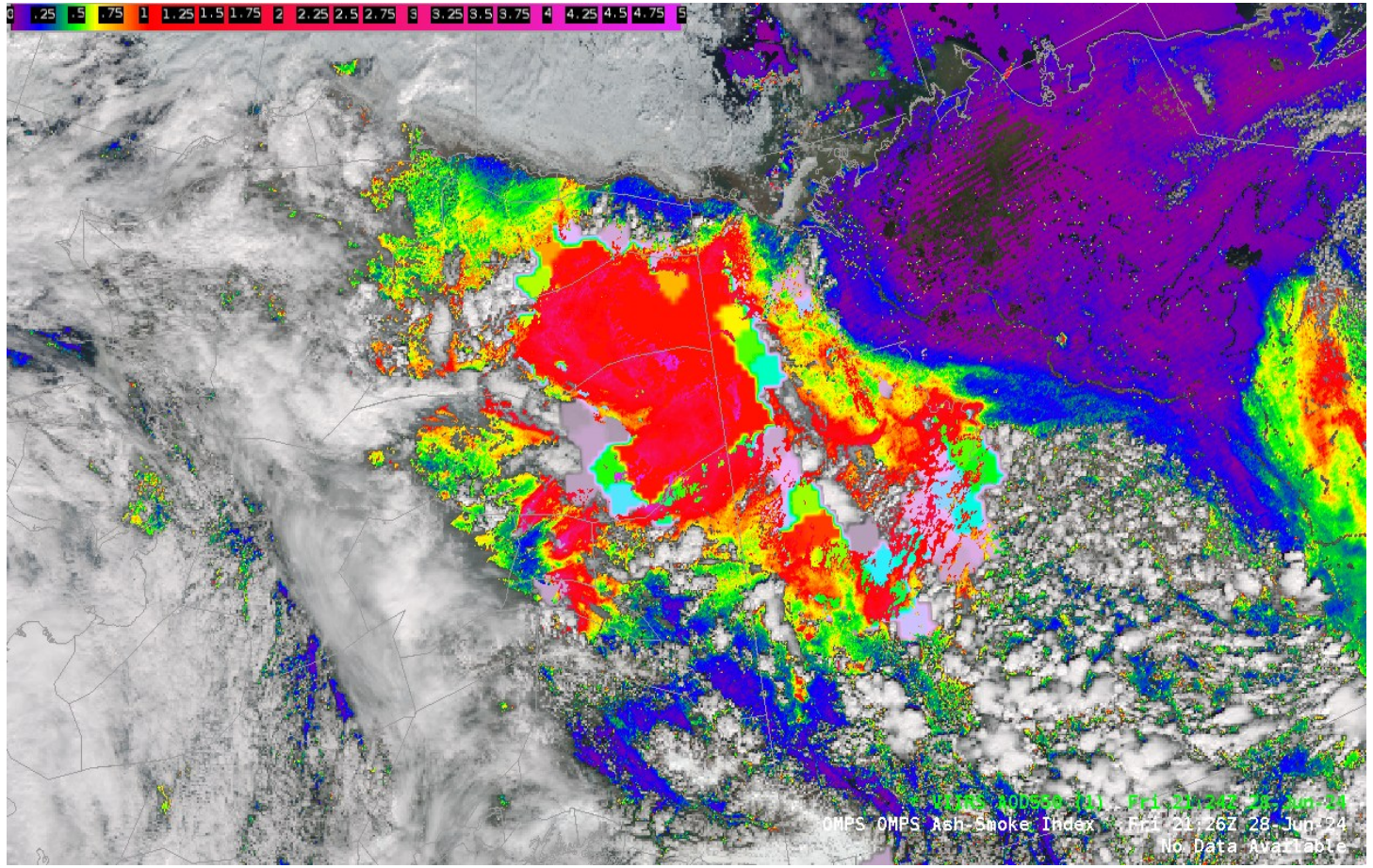
Air Quality



OMPS Aerosol Index

Air Quality

Dr. Jinqui Mao (UAF) leading development of 2.5 PM Analysis tool using blend of VIIRS/OMPS input and in situ observatic



OMPS Aerosol Index

ACS ES&T Air

pubs.acs.org/estair Article

Observational Constraints on the Aerosol Optical Depth–Surface $PM_{2.5}$ Relationship during Alaskan Wildfire Seasons

Published as part of ACS ES&T Air virtual special issue "Wildland Fires: Emissions, Chemistry, Contamination, Climate, and Human Health".

Tianlang Zhao,* Jingqiu Mao,* Pawan Gupta, Huanxin Zhang, and Jun Wang

Cite This: ACS EST Air 2024, 1, 1164–1176 Read Online

Volcanic Emissions

VIIRS Ash Index

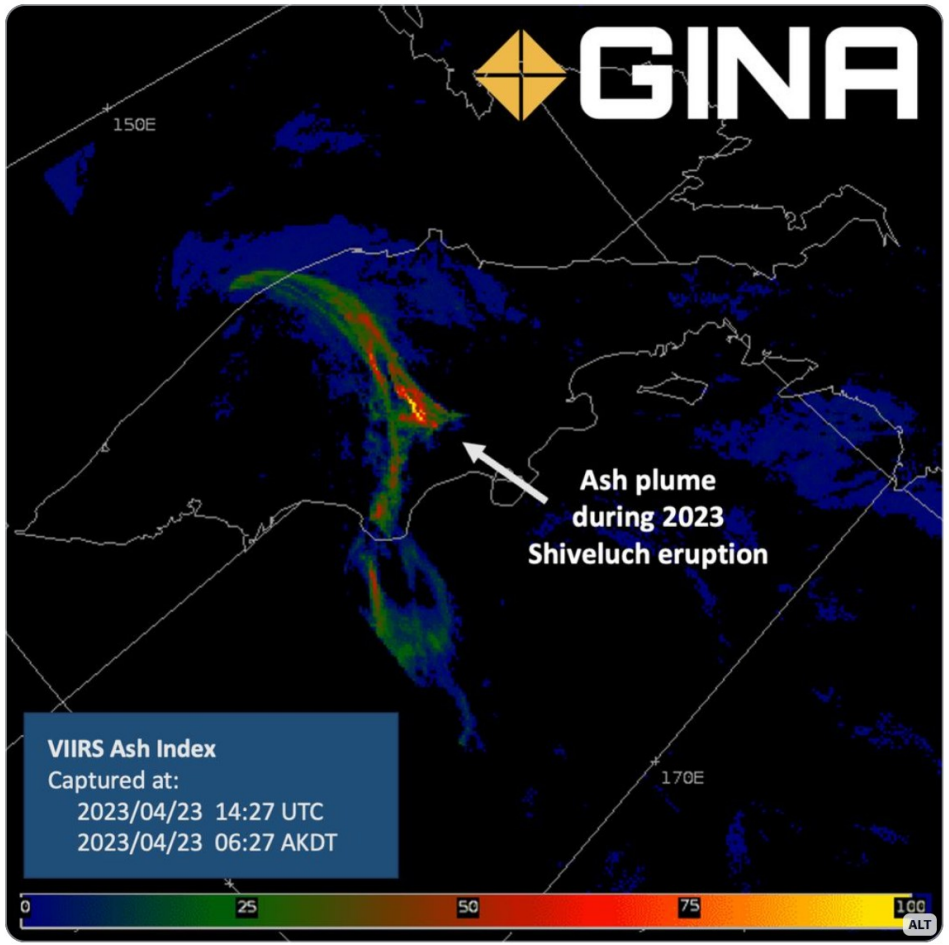
OMPS Ash-Smoke Index

VIIRS Ash RGB

UAF GINA
@alaskagina.bsky.social

+ Follow

With a potential eruption of Mount #Spurr, let's highlight the GINA products used to monitor volcanoes by detecting Ash and SO2. Ash is a big concern since it can cause aircraft engines to quit. To help forecasters find it, GINA has the VIIRS Ash Index, OMPS Ash-Smoke Index & VIIRS Ash RGB. #akwx

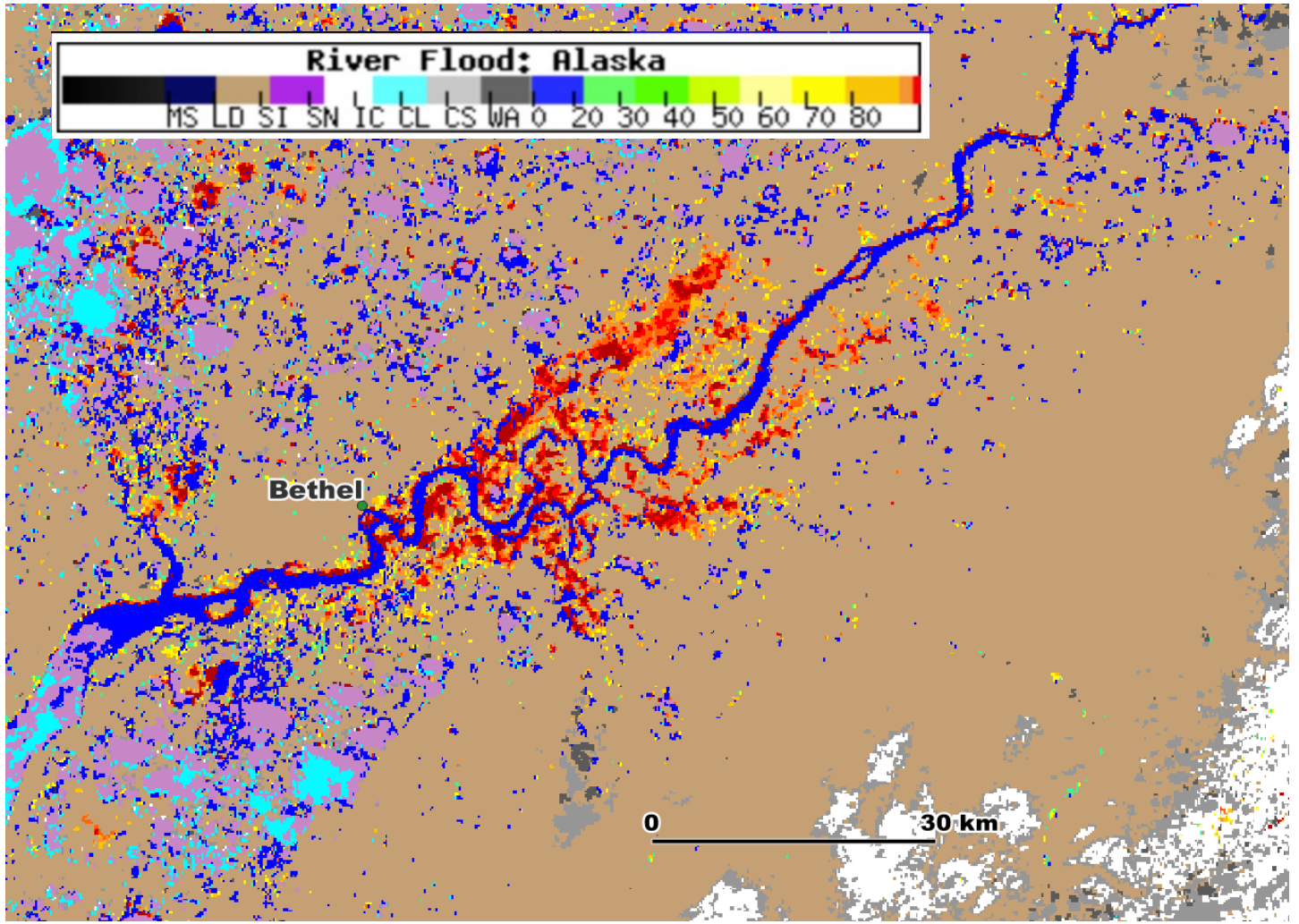


March 24, 2025 at 12:30 PM · Everybody can reply

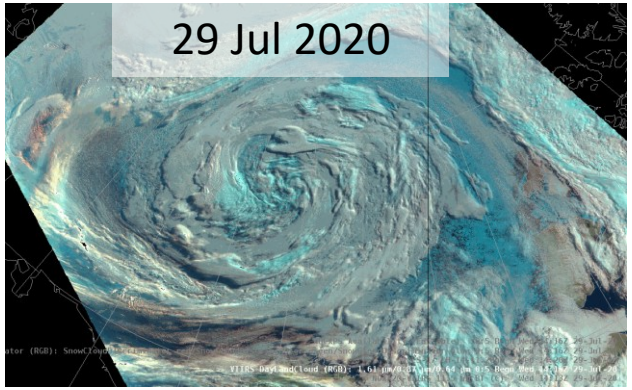
Riverflood Monitoring

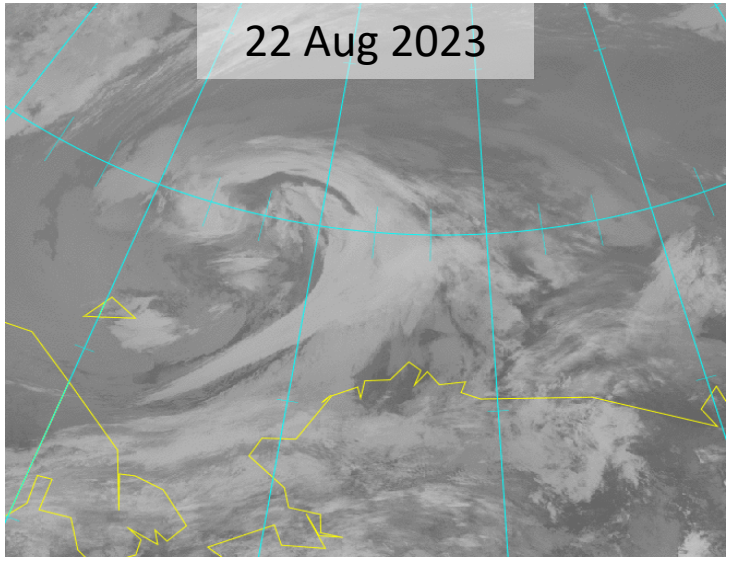
VIIRS Flood Detection Algorithm

Developed by Sanmei Li (George Mason University)

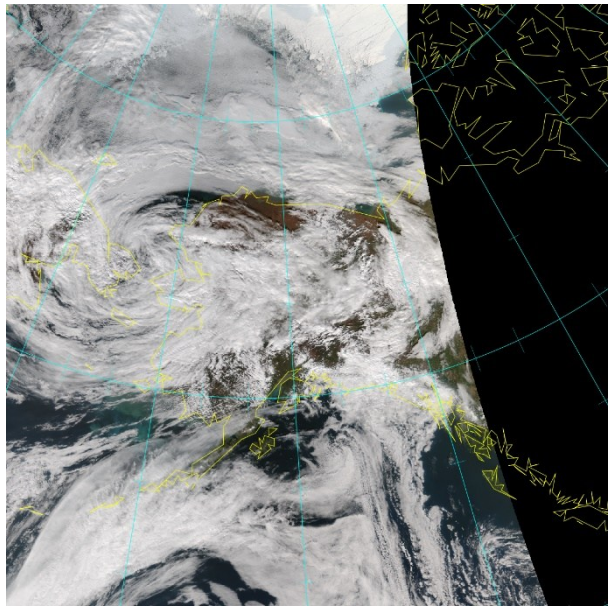


High Latitude Ocean Storms

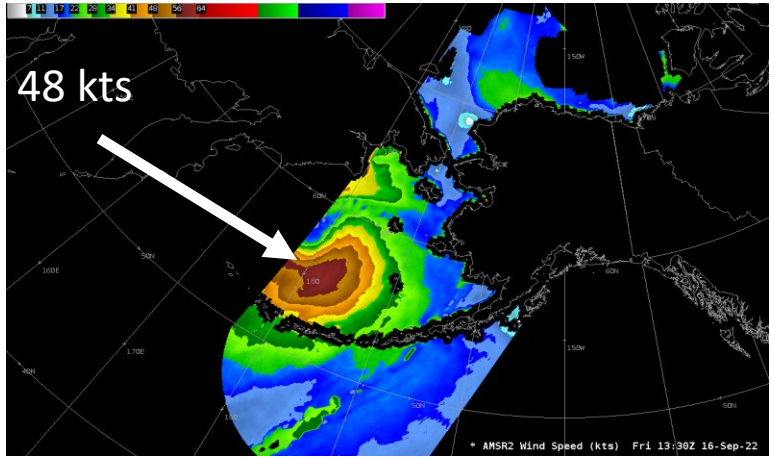




"The recent storm is not a rarity in Utqiagvik and the Arctic. The coast there has been rapidly eroding putting in danger houses, roads and cultural sites." Anchorage Daily News Aug 2023



Merbok 2254 UTC 17 Sep 2022



AMSR2 Ocean Winds - 1330 UTC 16 Sep 2022

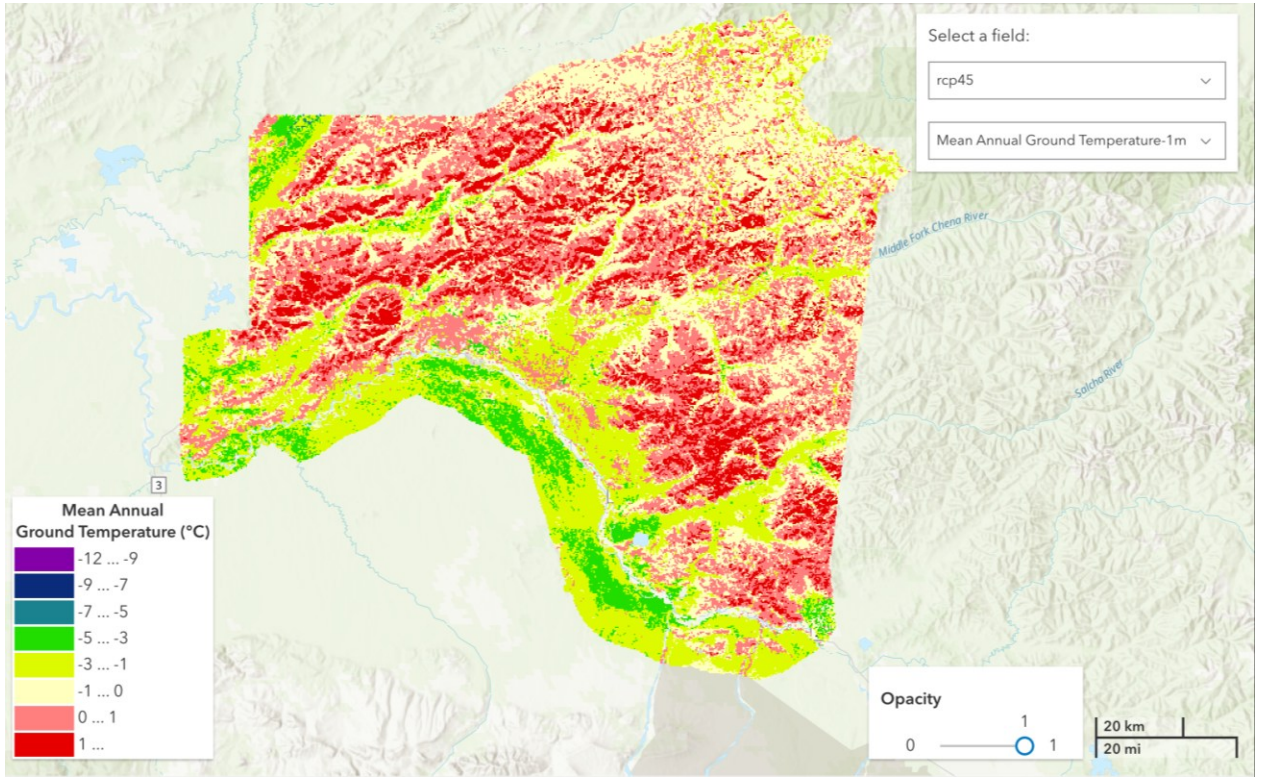
Building Collaboration across University of Alaska

GINA staff assist with:

- ArcGIS Server setup
- Mapping (PDFs, ArcGIS Online)
- Automated processing workflows
- Geospatial Analysis

UAF Geospatial Alliance

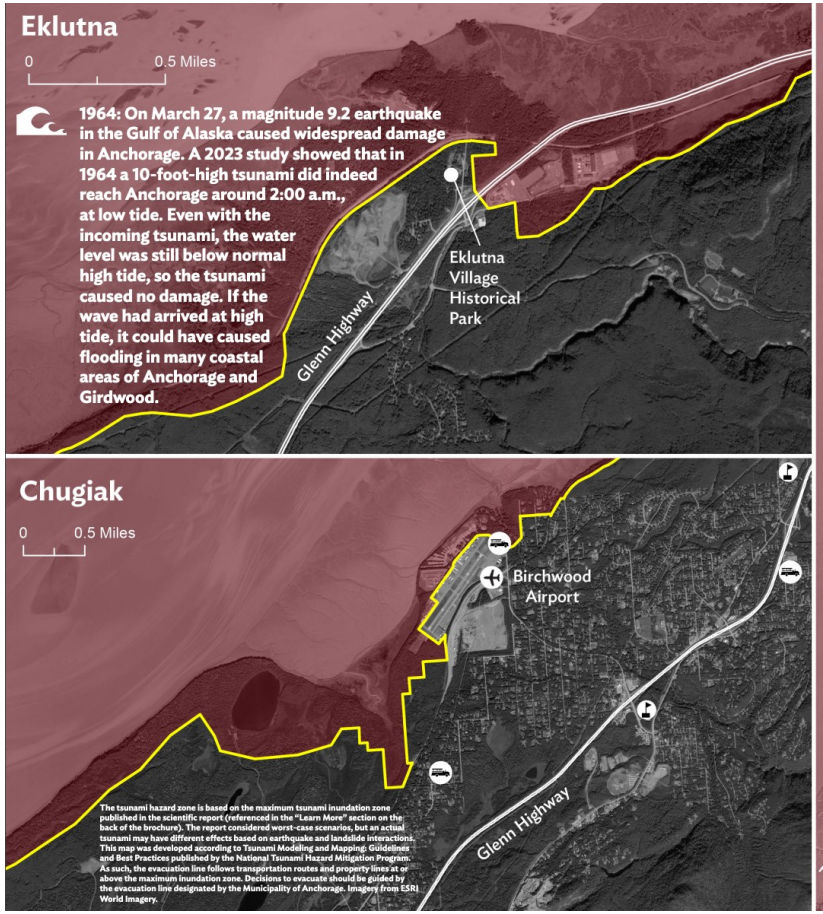
- Quarterly get togethers to learn about ongoing GIS work and network

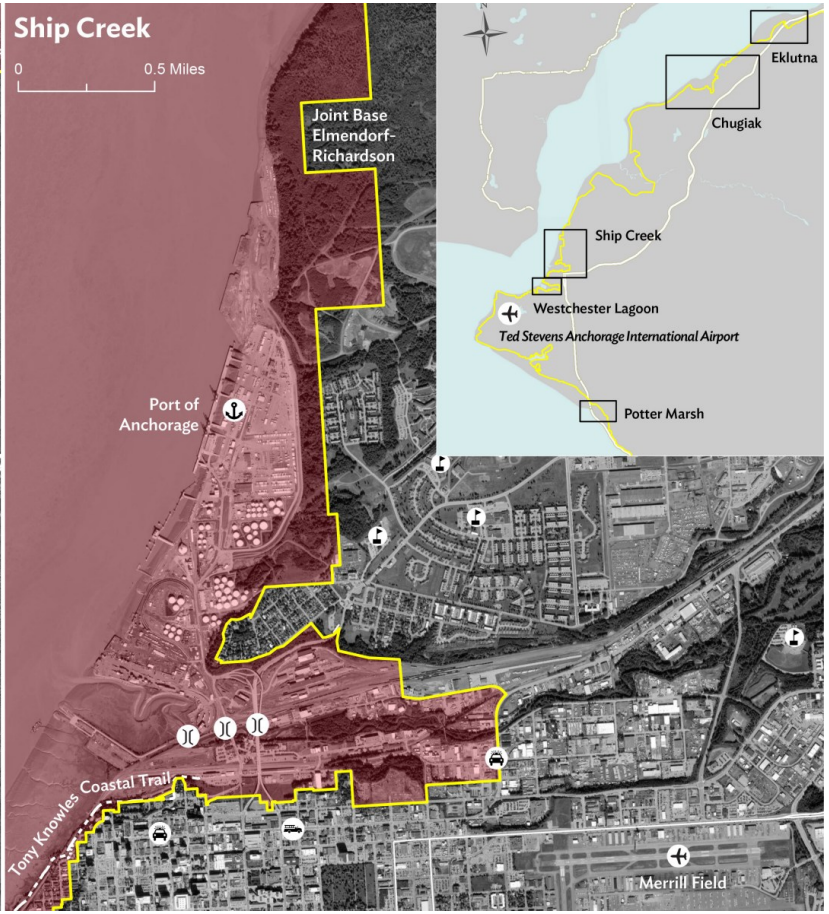


ArcGIS Image Service developed with Dr. Dmitry Nicolsky (UAF)

Tsunami Hazard Brochures

UNIVERSITY OF ALASKA FAIRBANKS
ALASKA EARTHQUAKE CENTER





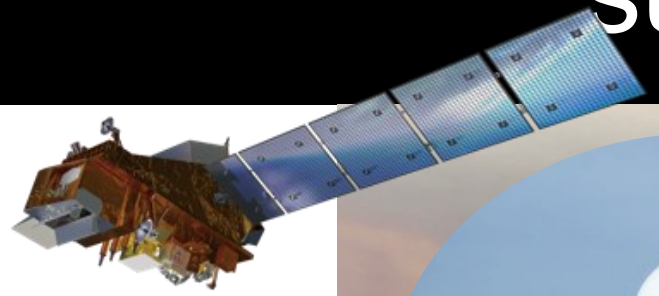
Collaboration beyond University of Alaska

Global **L**earning and **O**bservations to **B**enefit the **E**nvironment

NASA SnowEx

Global measurements from the Snow View Intensive Observing Period (IOP), 2025

Geographic Information Network of Alaska
support@gina.alaska.edu



Jen Delamere

Christi Buffington

Jay Cable

Carl Dierking

Hannah Chapman-Dutton

Hunter Barndt

Ben Stream

Grace Veenstra

Abigail Hass

Owen Larson

Email
ojlarson@alaska.edu

GINA Website