Wildland Fire Map Services from Near Real-Time Satellite Imagery

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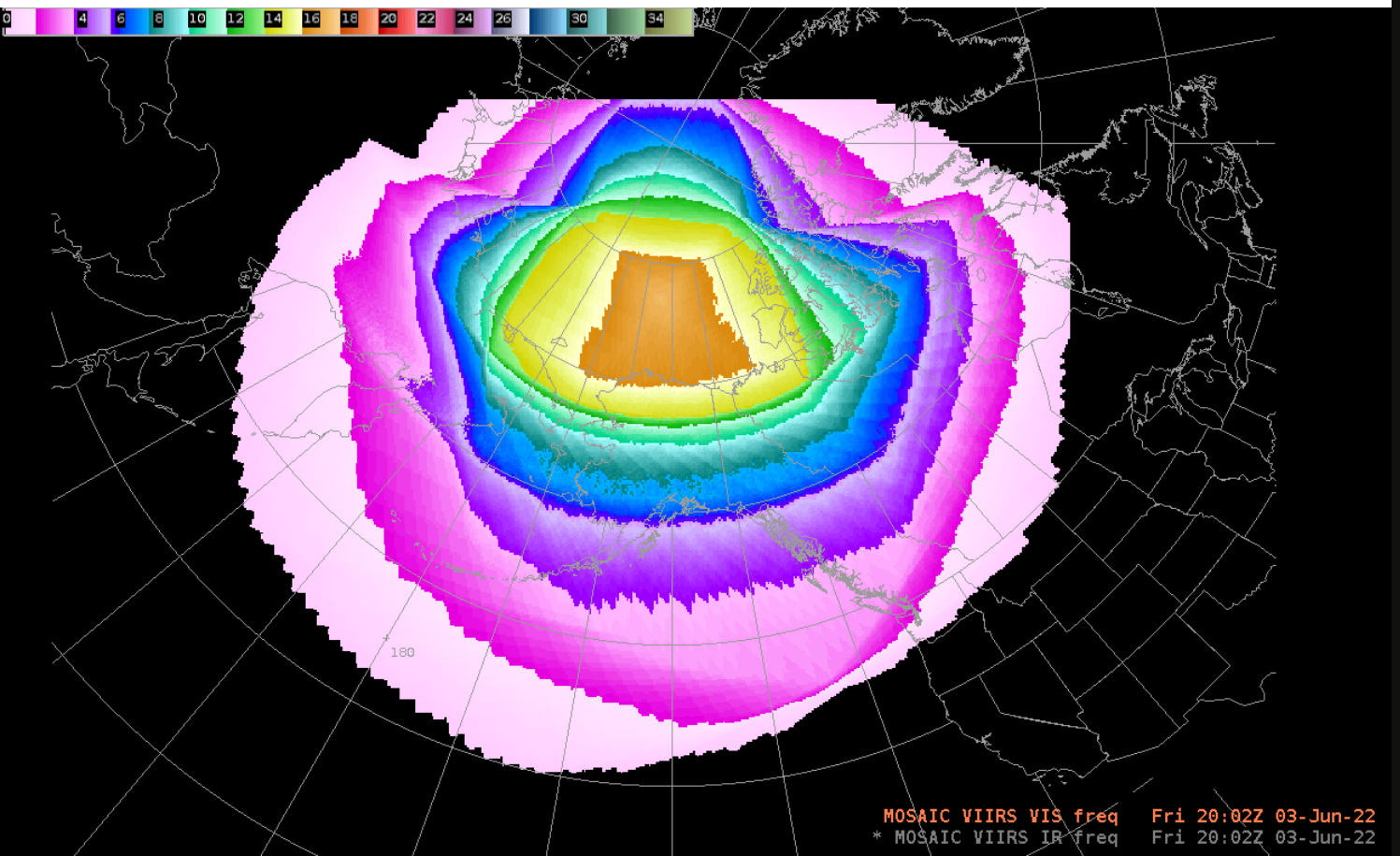
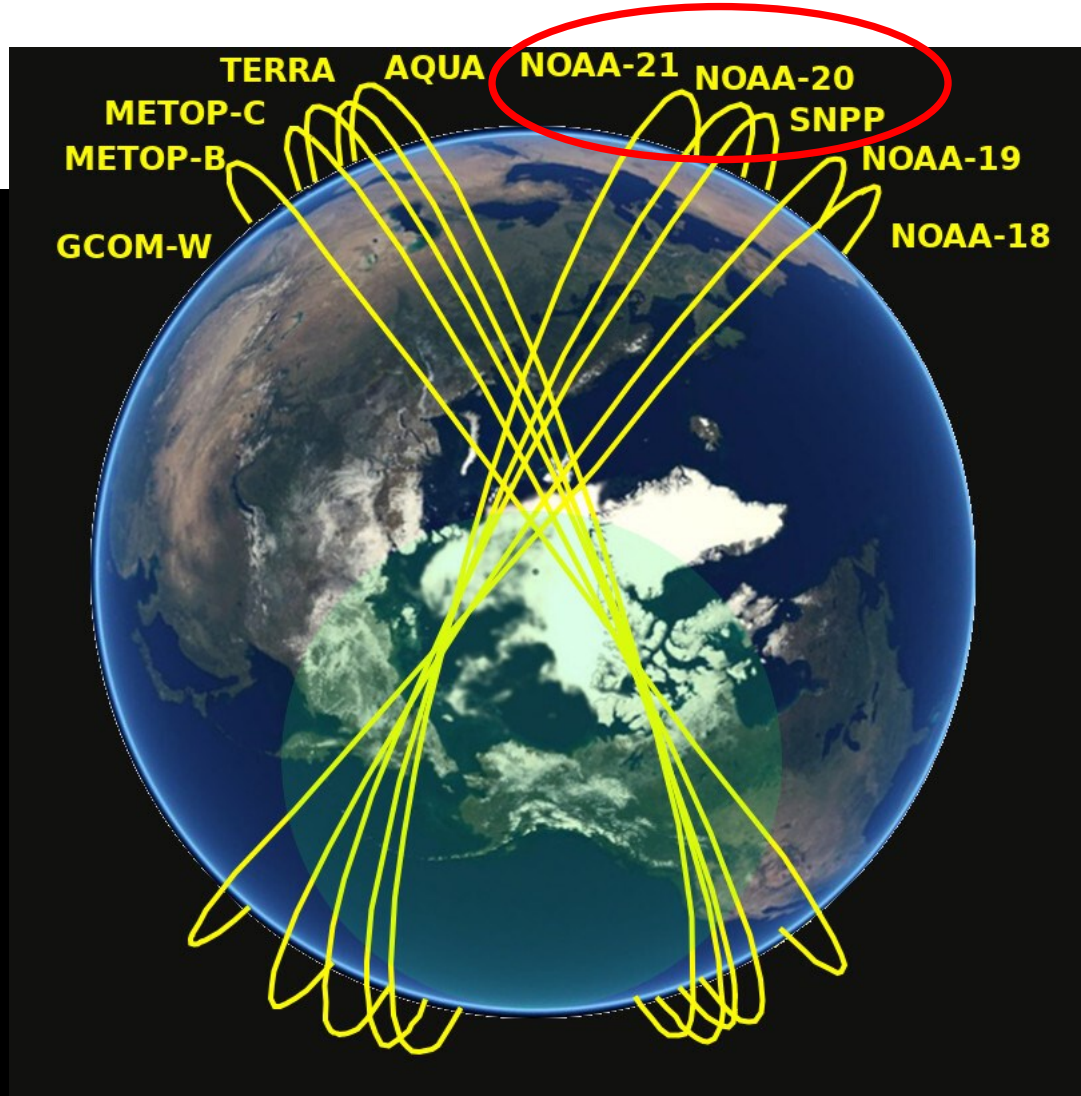
Geographic Information Network of Alaska
www.gina.alaska.edu

Polar Orbiting Satellites

Up to 27 daily VIIRS passes over northern Alaska

Limited applications in Alaska for geostationary satellites

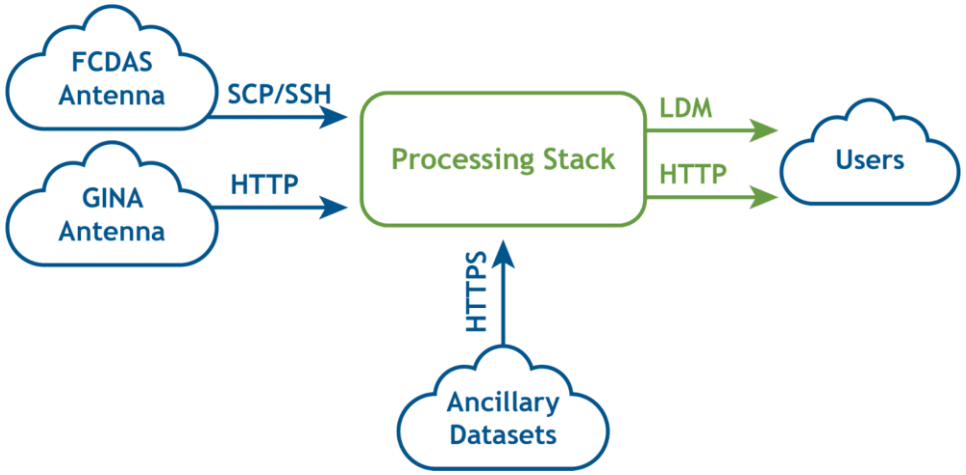




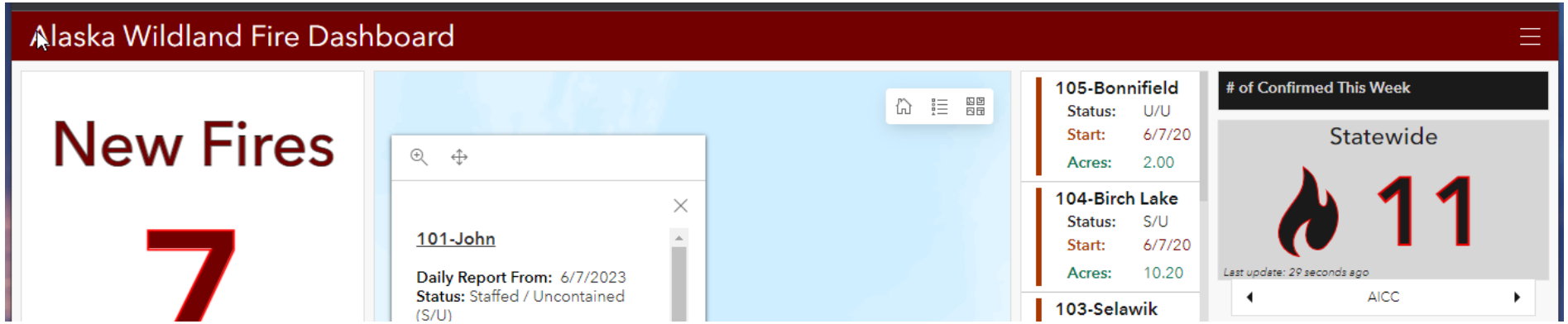
GINA Operations

Near real-time processing stacks in Alaska delivering products within minutes of an overpass.

AWS used for processing AFS Products



Alaska Fire Service Decision Support Systems

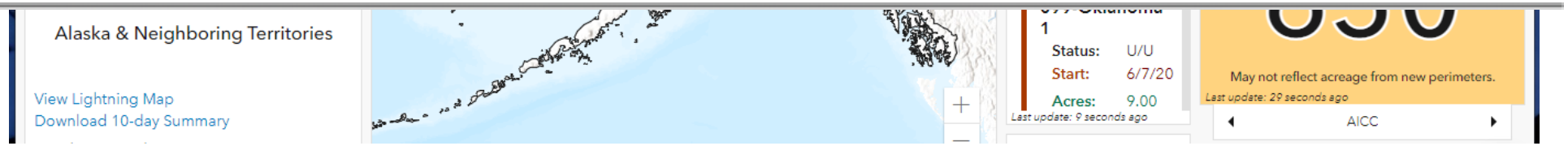


Daily Report From: 06/07

200.0 Acreage On 06/07

P9EP	Lat:	**67 03.1233**	Status: **S/U**	Acres:	**200.0**	Option:	**Modified**
331101	Lon:	**151 48.0717**	Personnel: **12**	Start Date:	**06/07**	Area:	**TAD**
PDP9EP	Owner:	**State**	Unit:	**AKDNS-AK Dept. Natural Resources**			
101	Name:	**John**				Cause:	**Lightning**

Fire observed via satellite remote sensing. Civilian later reported smoke near Bettles. Upon arrival, the fire was reported to be approximately 40 acres, 70 percent active with creeping and running fire behavior and flame lengths of 1 to 4 feet. Fire was burning in a mix of spruce and tundra with sparse hardwoods. Twelve Smokejumpers were deployed and later requested two firebosses and an air attack platform. Fire was wind and terrain driven spreading to 200 acres. With the help of the air tankers and significant precipitation, the fire was knocked down dramatically. Firefighters continued fire suppression efforts through the operational period.



https://www.arcgis.com/apps/dashboards/a23a625f4d18412ea13cffeefcbe7f5e

6/2/2022
Hog Butte Fire
Nowitna
National Wildlife
Refuge
Lake Minchumina
Kantishna
Denali National
Preserve
Telida
Denali National
Park
Denali State
Park
GINA

VIIRS Imagery Collection

https://arcg.is/1vGKmW

Training Materials

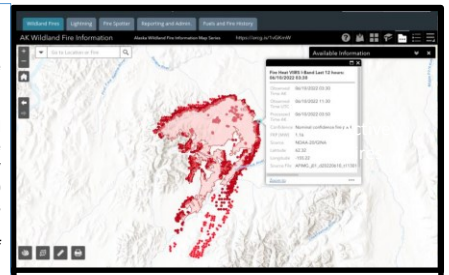
https://gina.alaska.edu/training-resources/

VIIRS Active Fires (VAF) Algorithm

Quick Guide

Why is VIIRS Active Fires Important?

The VAF algorithm provides critical information on significant thermal anomalies across the globe in high detail. It is within software that can be used as a background monitoring utility, continually examining satellite data for potential fires or heat points. VAF output includes fire location, confidence value, and intensity information such as Fire Radiative Power (FRP) which can assist fire response decisions such as the allocation of resources for mitigation efforts. Product information can be used as the basis of an alert system for new fires, or as a monitoring tool for evaluating the distribution, intensity, and evolution of existing fires.



ESRI ArcGIS plot of VIIRS VAF fire detections and the analyzed perimeter for the Tatlawiksuk fire in Alaska at 1900 UTC 10 Jun 2022. Red dots outlined in white are < 12 hrs old and black are 12-24 hrs.

VIIRS Active Fire algorithm and specifications

Algorithm	Wavelengths Used	Resolution	Coverage Frequency	Latency
The VIIRS Active Fire algorithm uses a combination of fixed and contextual tests to detect active fires and thermal anomalies both day and night. Detection criteria are based on 3.74 µm shortwave IR data refined with 11.5 µm longwave data. Three reflectance bands filter for high solar radiation during the day. Criteria is also refined by cloud and water classification schemes.	3.74 µm (I4 band) 11.5 µm (i5 band) 0.64 µm (I01 band) 0.86 µm (I02 band) 1.61 µm (i03 band) 4.05 µm (m13 band)	375 m 375 m 375 m 375 m 375 m 750 m	Varies with latitude from 2 VIIRS satellites (SNPP and NOAA-20). Alaska interior: 10-14 passes/day CONUS: 3-4 passes/day	Less than 30 min from Direct Broadcast sources

Impact on Operations

24-Hour Fire Detection: automated monitoring to identify and locate fire point sources day or night.
Remote Coverage: satellite observations detect fires where no other observations are available.
Frequent Coverage over High Latitudes: Polar satellites pass more often over Alaska & Canada.
High Spatial-Resolution: 375 meters.
Fire Radiative Power (FRP): Higher values equate to higher fire intensity and/or larger fires.
Additional features: identifies industrial burns, gas flares and volcano eruptions.
Persistent Anomalies: identifies common sources of non-wildfire heat sources, such as solar farms, volcanos, etc.

Limitations

Obscuration: clouds, smoke, and terrain may obscure or lower fire intensity values.
Missed Detections: fires too small or smoldering in duff.
False Alarms (day): reflected solar radiation from hot or bright surfaces that are not persistent anomalies. Missed cloud classifications.
False Alarms (night): reflected solar energy from cloud tops near the terminator. Hot smoke plumes.
Temporal Frequency: polar orbiting satellites have less frequent coverage over CONUS than geostationary satellites.

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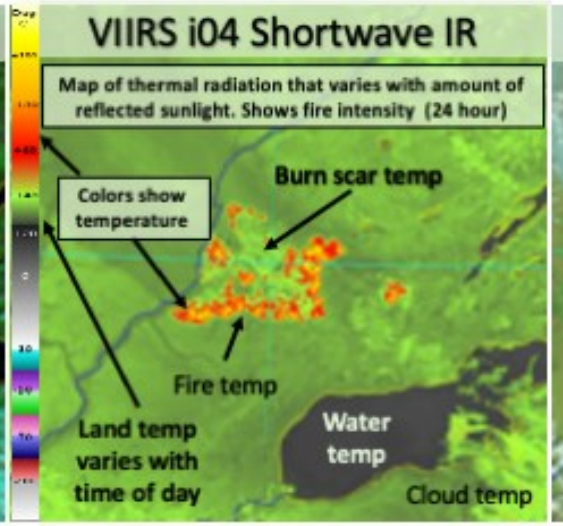
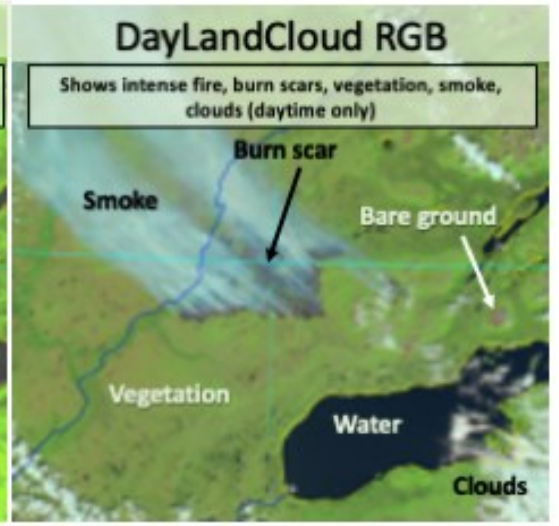
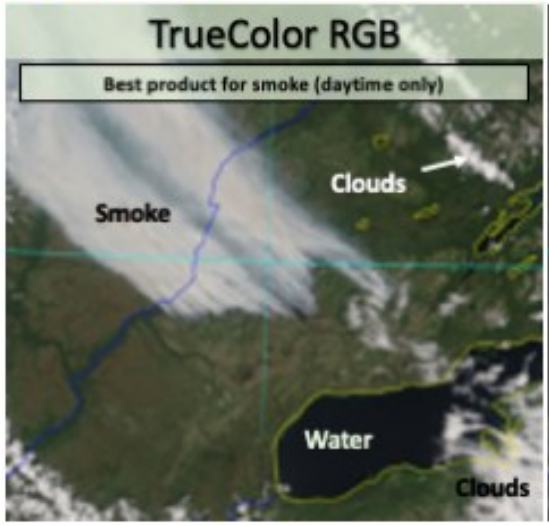
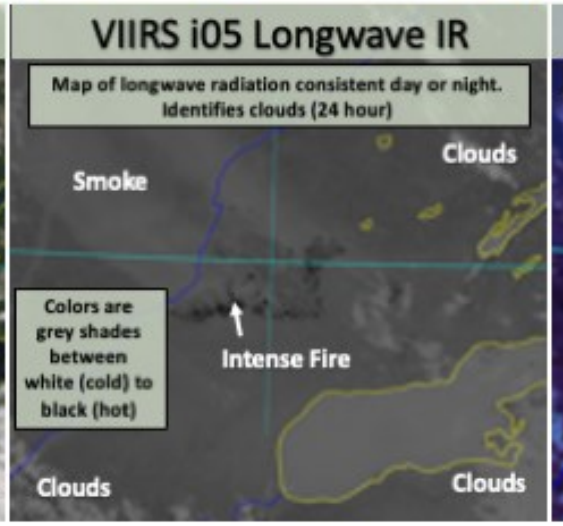
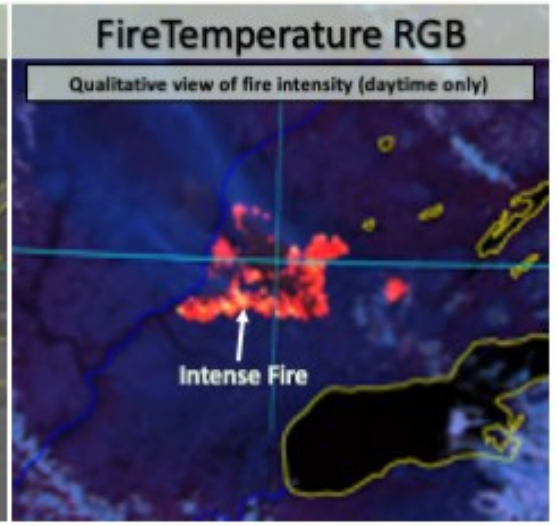








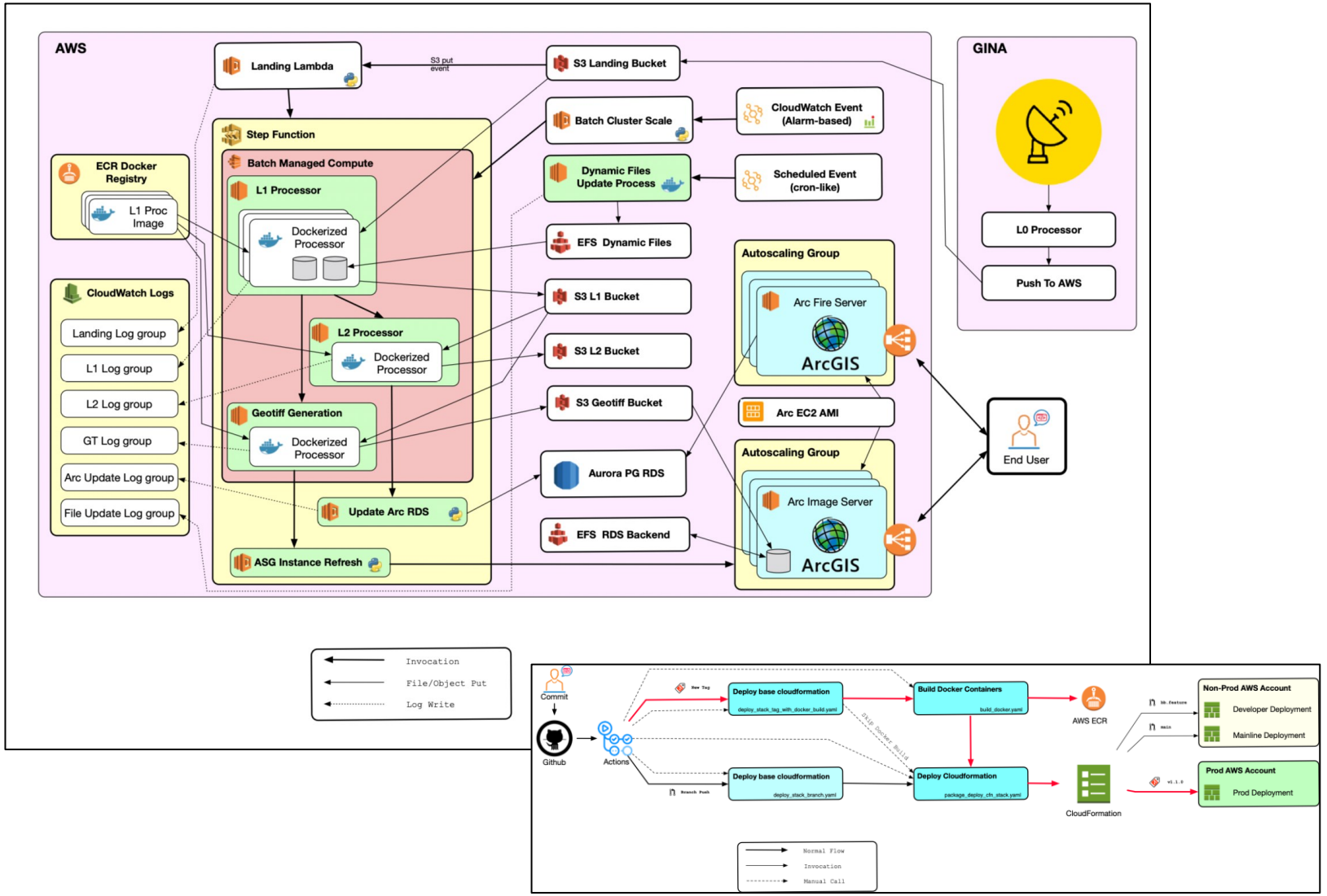


Fire Detections in AWS

Increased uptime, lower latency

Allows additional resources during times of high demand

Built for flexibility and future updates

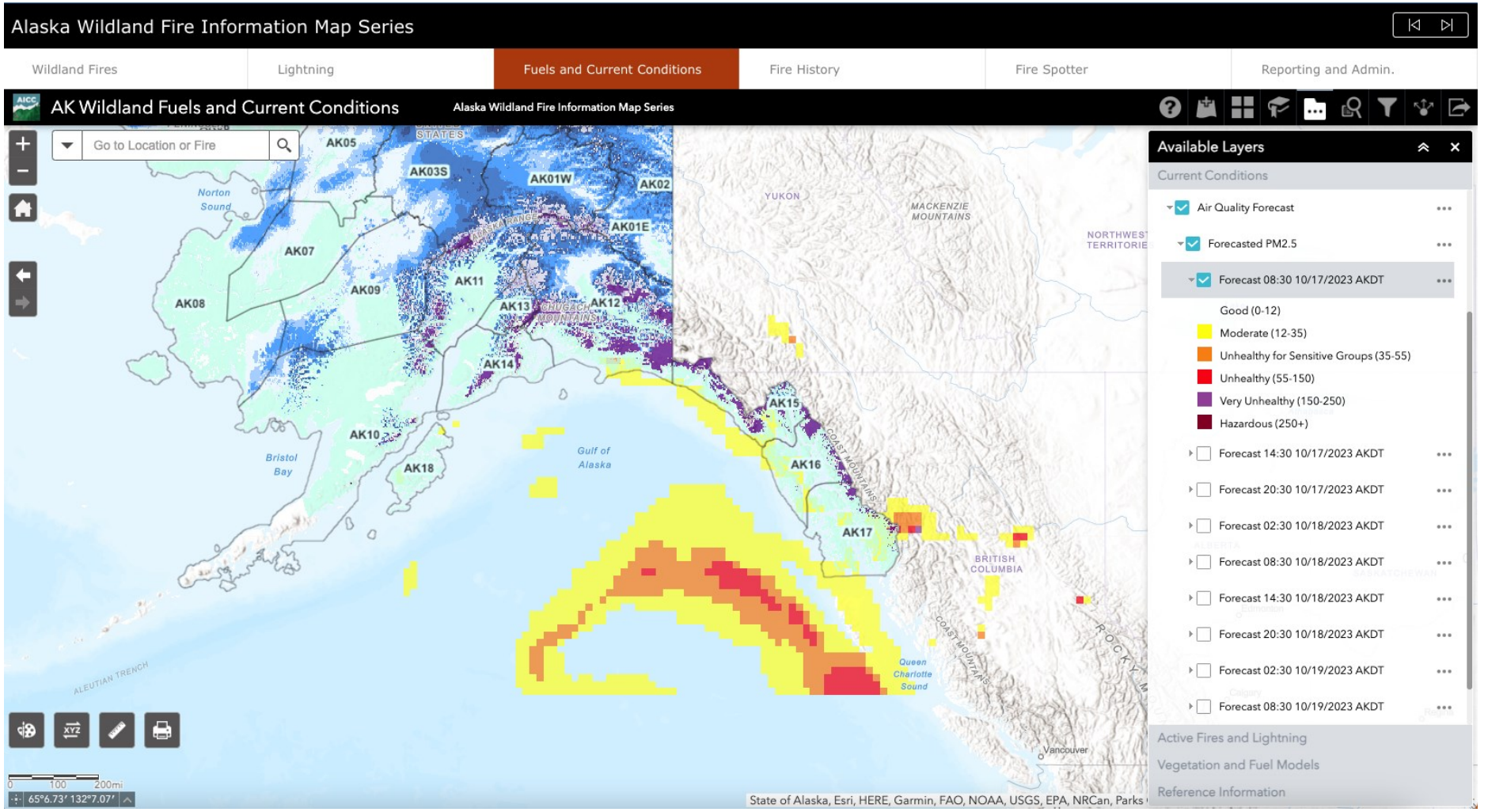


Air Quality Forecast Collaboration with Mao Lab

HAQAST Project: Air quality and health impacts of boreal fires: decision support and applied research supported by NASA satellite products

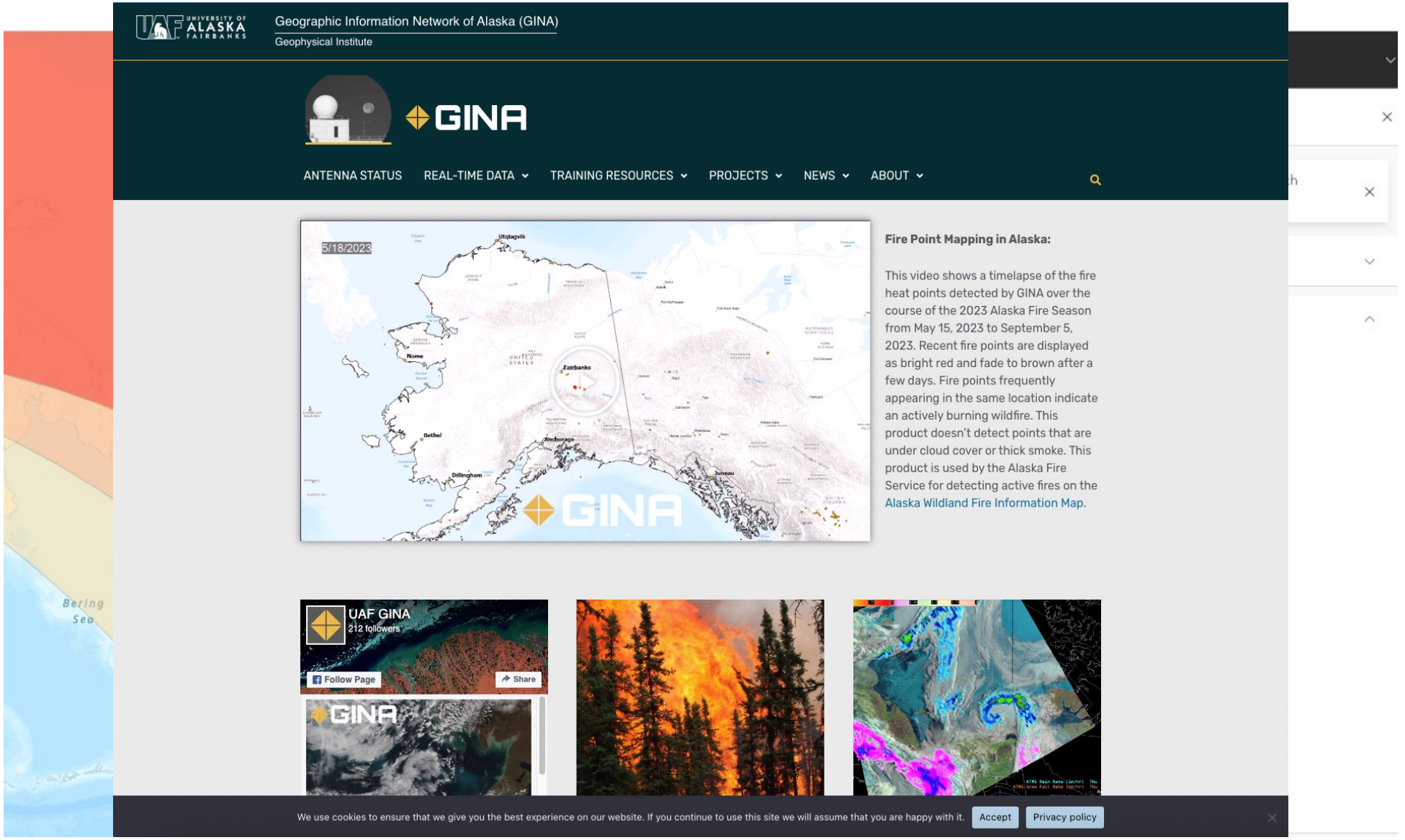
Research led by Dr. Jingqui Mao at UAF

NASA GEOS-FP model



https://arcg.is/1vGKmW

Additional Fire Product Visualizations



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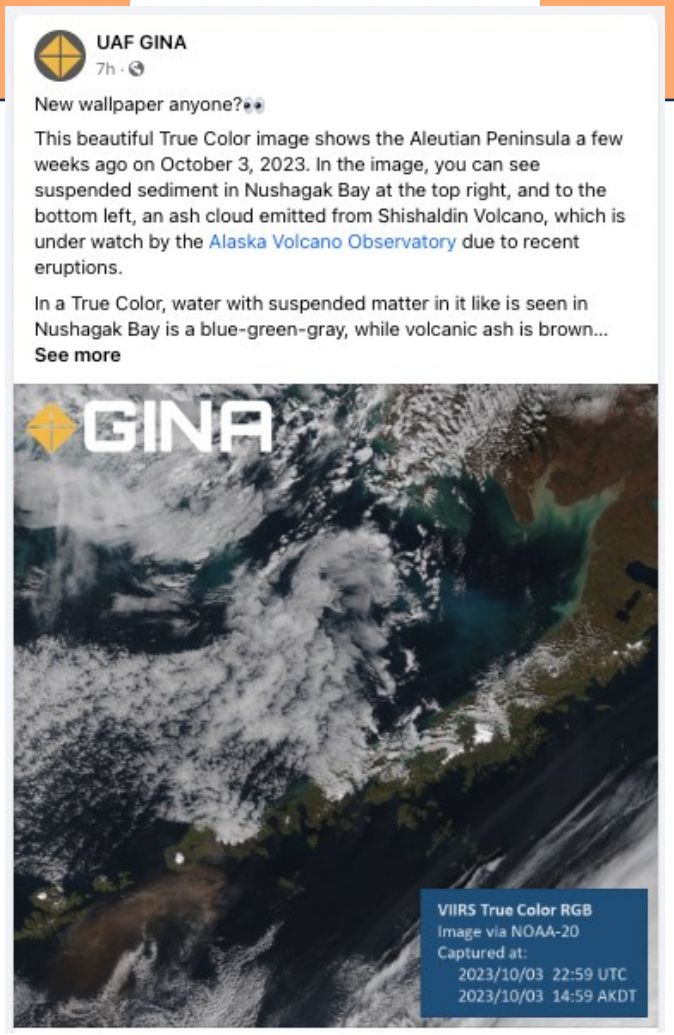

What's Next

- NOAA-21 Fire Heat Points in AWS system
- Improved Image Service Delivery
- NOAA/NESDIS Satellite Products for Wildland Fire Applications

  https://uaf-accap.org/event/wildfire-satellite-applications/