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GINA Provides Millions of Maps a Year

The Geographic Information Network of Alaska sends a map to a user's screen every second, around the clock, using high tech imagery created by a team of talented people.

Last year GINA responded to 120 million map service requests and provided real-time information to the National Weather Service, the Alaska Fire Service, the state of Alaska and many other federal and local organizations. The images help with weather forecasts, sea ice surveillance, volcanic ash plume detection, wildfires and more.

"We've developed a solid niche serving maps, both real-time satellite imagery and base maps," said Tom Heinrichs, GINA director. "It started small but has steadily grown to a service used daily by hundreds of people."

GINA was established in 2001 by a University of Alaska presidential initiative and is now part of the Geophysical Institute at UAF. GINA has 19 employees and a $2.5 million operating budget, mostly from grants.

For much of GINA's work, they capture raw satellite data from an antenna atop the Akasofu Building on the UAF campus. They also use satellite downlinks from the Fairbanks Command and Data Acquisition Station owned by NOAA, north of Fairbanks.

"FCDAS is arguably the busiest and most capable satellite tracking station in the world," Heinrichs said. "It receives more data than the rest of the entire NASA ground receiving network combined."

Timeliness is key to GINA's customers, especially the National Weather Service, said Eric Stevens, GINA's science liaison. The weather service is one of GINA's largest customers, and up-to-date information is vital for them.

"It protects lives and property," Stevens said.

Providing real-time data is one part of a three-faceted service structure, Heinrichs said. GINA also develops large-scale maps and is finishing up a five-year project creating the most accurate map of Alaska to date.

Processing and distributing large volumes of satellite data also builds expertise in data management and is the third area of GINA's services, Heinrichs said. GINA is a repository for data from taxpayer-funded research projects. GINA analysts organize, document and clean up data, then look for ways to make it useful to other people.

courtesy of GINA

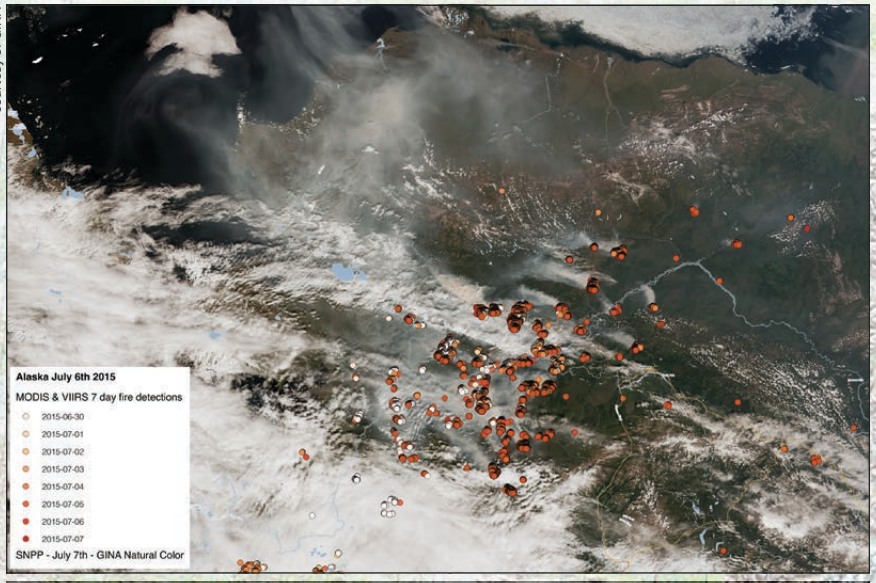
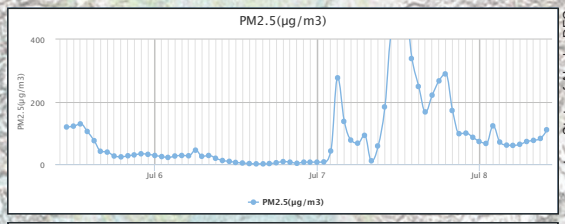
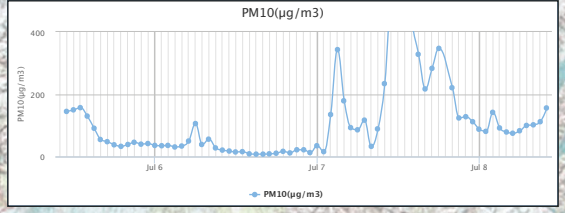


photo by Dayne Broderson, GINA





courtesy State of Alaska DEC

***WILDFIRE**—Above is a map of Alaska's wildfires in early July of 2015, showing seven-day satellite fire detections atop a SNPP VIIRS image. The smoke launching in the July 6th image slammed into Fairbanks in an impressive way, as seen in the top, right photo taken July 7 from UAF's West Ridge. At right is preliminary data from the State of Alaska's DEC Division of Air Quality sensor in Fairbanks showing an extreme spike in particulate matter (smoke) that created a hazardous environment for those of us with lungs.*

background map courtesy USGS and http://earth.google.com

UAF UNIVERSITY OF ALASKA FAIRBANKS

TAKING DATA AND MAKING IT USEFUL

An image is the easiest way to look at data from a satellite, and it takes a team to put one together.

Satellites capture different wavelengths of light–from visible colors to infrared heat emissions–then transmit the information to Earth as a series of zeros and ones.

The Geographic Information Network of Alaska receives this signal from the satellite and then takes this raw digital data through a value-added processing chain, creating real-time satellite images, large-scale maps, distribution points and managed archival data.

"We figure out how to interpret and use the data, turn it into a useful product for people and make it available," said Will Fisher, lead developer with GINA. "We make the data discoverable and usable."

GINA manages about 100 terabytes of data–part of it processed in real time for customers, such as the National Weather Service, and part for archives. Fisher leads a group of four people who manage data storage and give technical assistance. Much of the data comes from mapping, research and operations support projects.

Fisher said his group first looks closely at the data they receive to understand how it is organized and what information the researcher documented regarding the data collection. Then they decide on the best format for distribution and add additional information, or metadata, that might make it more useable, such as an overview map.

Fisher described GINA's work as akin to building a robot. The skeletal frame of the digital map must be extremely accurate, so all the geographical details fit over the framework precisely.

GINA also provides training and help in ArcGIS, QGIS, GDAL, image processing and data management.

"Teaching people to use the technology and showing them our map services has been key to getting so much traction with the user community," said Tom Heinrichs, GINA's director. "Those 120 million map requests we

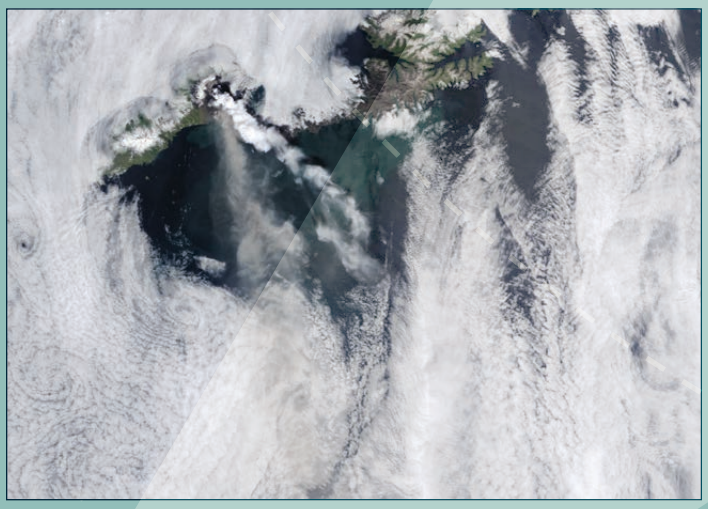
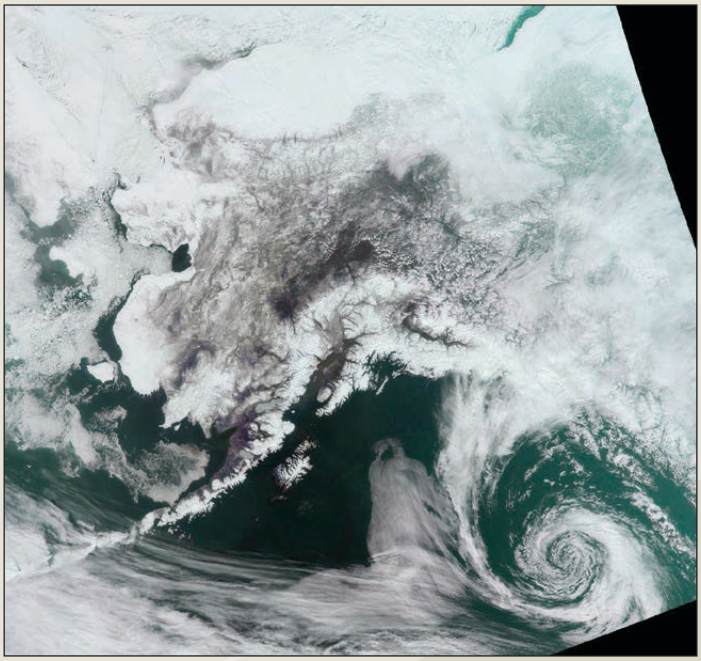


photo courtesy Fairbanks Daily News-Miner

MONITORING, MODELING *– Above, satellite remote sensing plays a critical role in monitoring volcanoes and responding to eruptions. GINA produced this MODIS image of Okmok Volcano erupting on July 13, 2008. At right, GINA worked with NSF EPSCoR to produce the augmented-reality sandbox, which uses a computer, Kinect 3D camera and a digital projector to allow users to create topography models by shaping sand, which is then augmented in real time by an elevation color map, topographic contour lines and simulated water. Here, David Kroto of the Tyonek Native Corporation sculpts a waterway in the sand at a mapping conference.*



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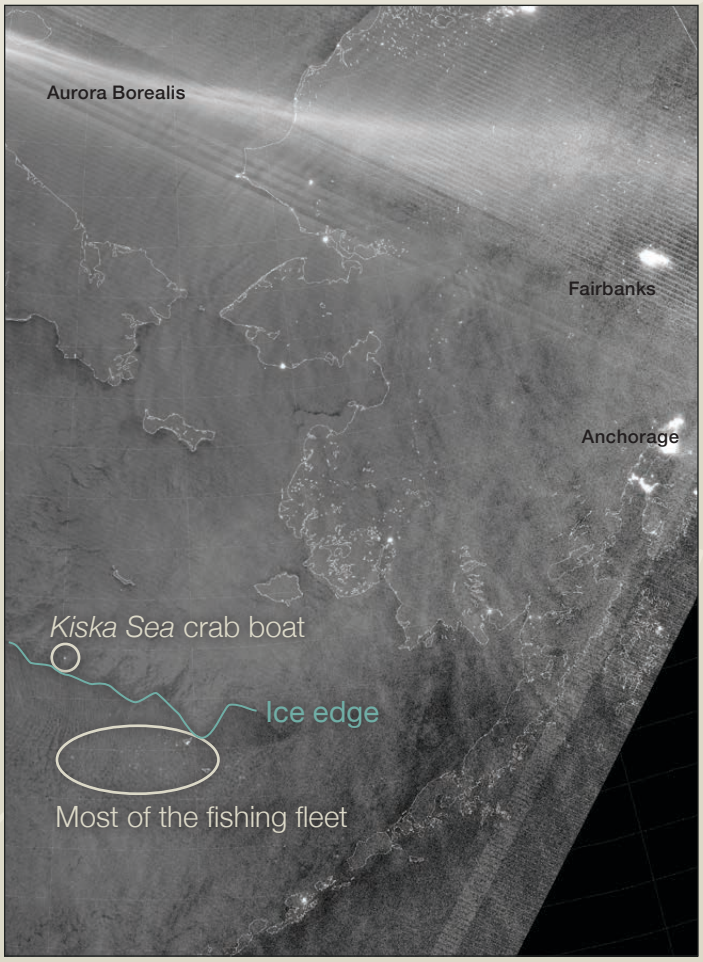

courtesy of GINA

IMAGING *– Above is an image from the first Suomi NPP pass captured by GINA on April 26, 2012, after upgrading the GINA BigDog direction reception system to be capable of supporting the newly launched Suomi-NPP satellite. The image shows an extratropical cyclone in the Gulf of Alaska. The National Weather Service uses Suomi NPP data to forecast weather, map sea ice and assess hydrologic events. At right is a VIIRS DNB image from the Suomi NPP satellite captured by GINA and provided to the Alaska NWS Sea Ice desk and used to support the safe return of a crab fishing boat, the* Kiska Sea, *when it became stranded in sea ice.*

served last year didn't materialize from thin air."

Most people love maps, and science outreach can painlessly be embedded in maps, Heinrichs said. GINA's virtual sandbox, a real sandbox with a projector that draws topography, as well as rainstorms, on the sand, has been a big hit with all ages. When users move the sand around, the topographic lines and the pools of "water" change accordingly. Another tool is a computer game called What Where, in which players look at a piece of a familiar landscape and try to guess where and what it is.

"The sandbox was the biggest draw on the American Geophysical Union exhibitor floor last year," said Greg Wirth, the lead developer for the sandbox. "At kids' events like the UAF Science Potpourri, we are mobbed."

In addition to data management, GINA leads several very large-scale map projects – some of the largest in the U.S. Maps used to be produced from aerial photographs and with teams of surveyors who walked the land, measuring angles and distances. Building on that past work, combined with satellite data, sophisticated airborne imagers, lidar and GPS surveying, the new maps GINA helps create provide much more information, such as coastal erosion, permafrost and vegetation changes and glacier shrinkage.

GINA is finishing a five-year project updating a map of Alaska. It will be the most accurate and detailed map of Alaska ever made.

"This is the first new statewide map in decades," Heinrichs said. "It is a tremendous project, and GINA is proud to execute the project on behalf of our state and partners."

Recently, GINA received a $1.7 million grant from the National Oceanic and Atmospheric Administration to upgrade their real-time data collection abilities for the National Weather Service. The award adds a new antenna to existing satellite systems at the Fairbanks Command and Data Acquisition Station. New, more powerful satellite data processors will also be installed at UAF and NOAA facilities.

"This is a great story of collaboration between the university and the federal government, leading to an economical system that will provide better weather services to Alaskans," Heinrichs said.

GEOPHYSICAL INSTITUTE
University of Alaska Fairbanks
903 Koyukuk Drive
P.O. Box 757320
Fairbanks, AK 99775-7320

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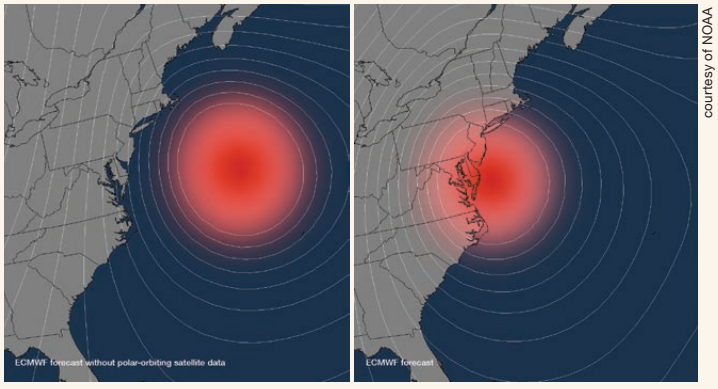
NOAA Funding Extends GINA's Capabilities

Weather tracking from Alaska of polar orbiting satellites was vital in the days before Hurricane Sandy made landfall, said Tom Heinrichs, the director of GINA. Sandy was a complex storm system close to 1,000 miles in diameter that impacted 24 states, killed 285 people and caused billions in damage.

The weather information gave people in New Jersey and New York some advance notice of the danger, resulting in many lives saved, according to a NOAA report. However, more advance notice would have helped emergency responders take action earlier and perhaps save more lives.

After Sandy, Congress passed the Sandy Supplemental Appropriations Act in 2013. The act covers Sandy recovery efforts and calls for improving response and recovery capability for future weather events. Under this umbrella, GINA received $1.7 million from NOAA to improve satellite data capture and processing.

GINA oversaw installation of a new satellite dish this spring at the Fairbanks Command and Data Acquisition Station, owned by NOAA. "We've been working closely with the NOAA satellite operators and the Alaska NWS for nearly two decades. This project is an extension of that long and successful collaboration," Heinrichs said.



courtesy of NOAA

IMPROVING FORECASTS– *Without polar orbiting satellite data, NOAA forecasts of severe storms such as Hurricane Sandy could be hundreds of miles in error. For example, weather models without polar orbiting satellite data showed Hurricane Sandy remaining at sea (left). Weather models with polar orbiting satellite data accurately predicted Sandy's landfall location within 30 miles, five days before its occurrence (right). The accuracy and speed of receiving and processing data locally allows forecasters to help save lives.*