

Joint Polar Satellite System

NOAA's Next-Generation Polar Orbiting
Environmental Satellite System

JPSS Data Products and Aviation Initiative

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Special Thanks to Andy Heidinger!



GLOBAL DATA.
LOCAL WEATHER.



Agenda

- Aviation Initiative
- Users/Partners
- JPSS Cloud Products Demonstration
- Path Forward
- Summary



JPSS Proving Ground Initiatives

- What is an initiative? An interagency group of developers, service area providers, and stakeholders that frequently interact in a structured forum to address challenges in NOAA and partner service areas.
- Initiative activities
 - Products/capabilities are evaluated to ensure their optimal use in these focus areas.
 - Based on user feedback, changes to these capabilities are considered to increase their effectiveness
 - Actions to transition these capabilities to user operations are identified and implemented
- Why are initiatives successful?
 - Well defined objectives established and specific actions worked
 - Stakeholders are actively participating with engagement of the user advocate.
 - Products and capabilities are evaluated in operational environments
 - Monthly and bi-monthly meetings ensure proposed improvements can be worked on and then implemented quickly



Proving Ground Initiatives

- River Ice and Flooding
- Fire and Smoke (Aerosols)
- Sounding Applications
- NWP Impact Studies and Critical Weather
- OCONUS/AWIPS (Imagery/Nowcasting)
- Ocean and Coastal
- Hydrology
- Cryosphere (Arctic)
- Land Data Assimilation
- Atmospheric Chemistry



Aviation Initiative Overview

- Focus on polar data needs for aviation users
- Alaska aviation users will be our initial focus
- Subject areas include clouds, icing, turbulence, Cold Air Aloft (CAA)
- New Volcanic Ash Initiative will work closely with Aviation Initiative due to similar objectives
- Began in June 2018



Aviation Initiative Goals

- Continue providing AK with JPSS/VIIRS cloud products
- Establish an Alaskan User for the cloud macrophysical (vertical structure) products included in the new Cloud Cover and Layers (CCL) formulation
- Build relationships for perhaps extending into other products where people expressed interest
- Investigating the value of the quantitative products
- Alaska region has expressed a renewed interest in JPSS / VIIRS cloud products
- Continue demonstrations based on interest and type of season
- Expand to international users
- Determine how polar data improve diagnosis and forecast of aviation hazards.



Data Users

United States Users	International Users
Alaska Aviation Weather Unit (AAWU)	Environment Canada
NWS Center Weather Service Units	Iceland Weather Service
Federal Aviation Administration Flight Service	German Weather Service
Private Pilots	Swiss Federal Institute of Technology in Zurich
NWS Forecast Offices	



Partners

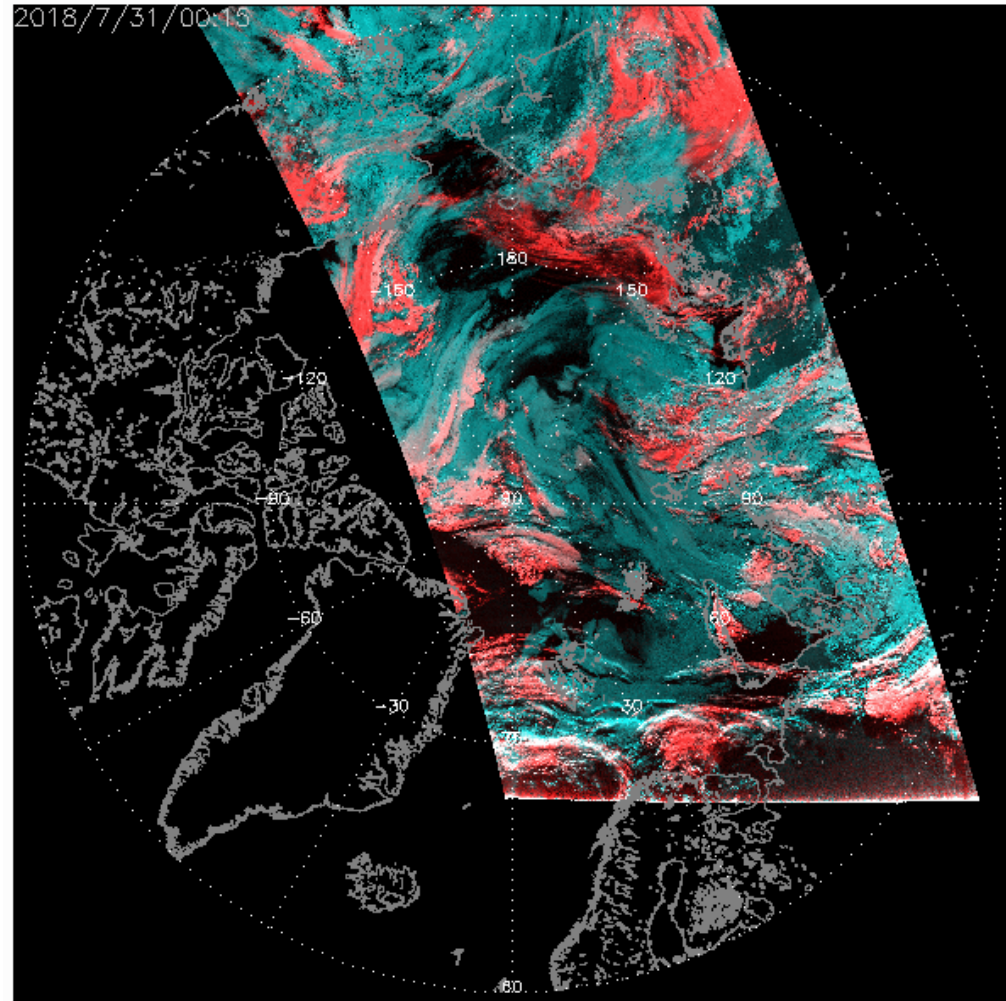
- CIMSS: Deliver CLAVR-x and algs to CSPP-LEO. Support GINA's processing and support cloud height and detection demo.
- CIRA: Work with CIMSS to ensure cloud base and CCL are functioning as planned. Support base and CCL in demo.
- CSPP: Generate JPSS data products from DB data stream.
- GINA: Implement new CSPP-LEO on their DB stream and run POLAR2GRID to inject products into AWIPS.
- JPSS Program: Oversight and coordination.
- Arctic Test Bed: Technical Expertise and Feedback Coordination

- Users expressed an interest in the cloud macrophysical products:
 - Cloud top altitude
 - Cloud base altitude
 - Cloud geometrical thickness
 - Cloud cover at flight levels
- Would like to provide these other aviation centric products
 - Supercooled water probability at cloud top
 - Supercooled water probability on flight levels

JPSS Data Products - Examples

Example VIIRS Cloud Products and Imagery Planned for the Alaska Cloud Demo

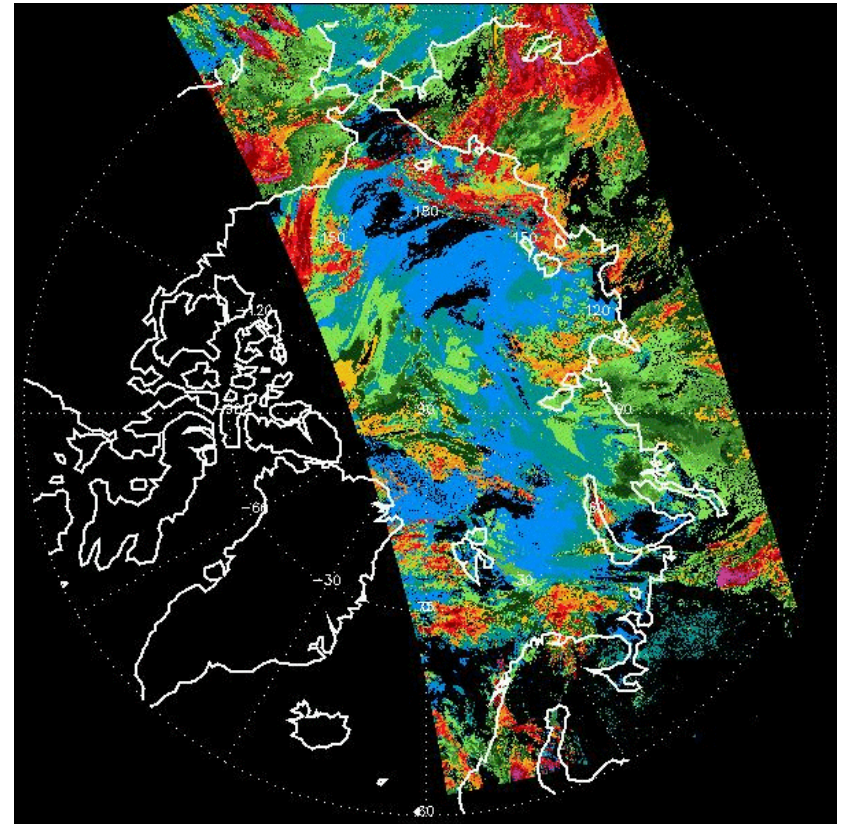
- This animation shows orbits of NOAA-20 and SNPP.
- The agreement in the calibration of the two sensors is apparent in continuity of the animation.
- The False Color RGB has the following recipe:
 - Red = 1.38 micron
 - Blue & Green = 1.6 micron
- It depicts high cloud in red and low cloud in blue. Snow, sea ice and open water are black.
- These images help visually verify the quantitative products provide in the demo.



JPSS Data Products - Examples

Example VIIRS Cloud Products and Imagery Planned for the Alaska Cloud Demo

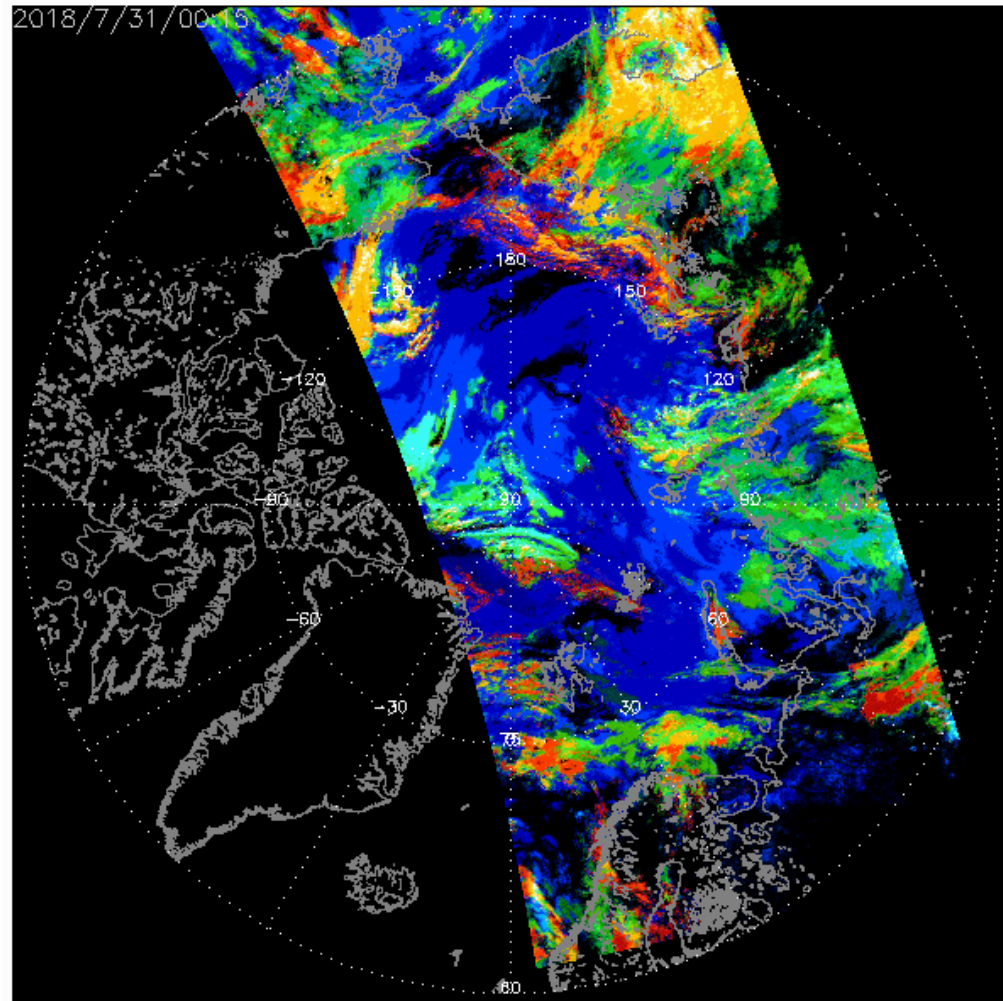
- One of the primary products of interest to the Aviation Community is the cloud-top altitude in kilo-feet.
- This animation shows NOAA-20 and SNPP together.
- The continuity of the values from image to image indicates good consistent algorithmic performance.
- This product will be provide to Alaska Forecasters via AWIPS.
- University of Alaska Fairbanks (UAF) Geographic Information Network of Alaska (GINA) uses the CSPP-LEO software to generate the products.
- Data shown here is from July 31, 2018.



JPSS Data Products - Examples

Example VIIRS Cloud Products and Imagery Planned for the Alaska Cloud Demo

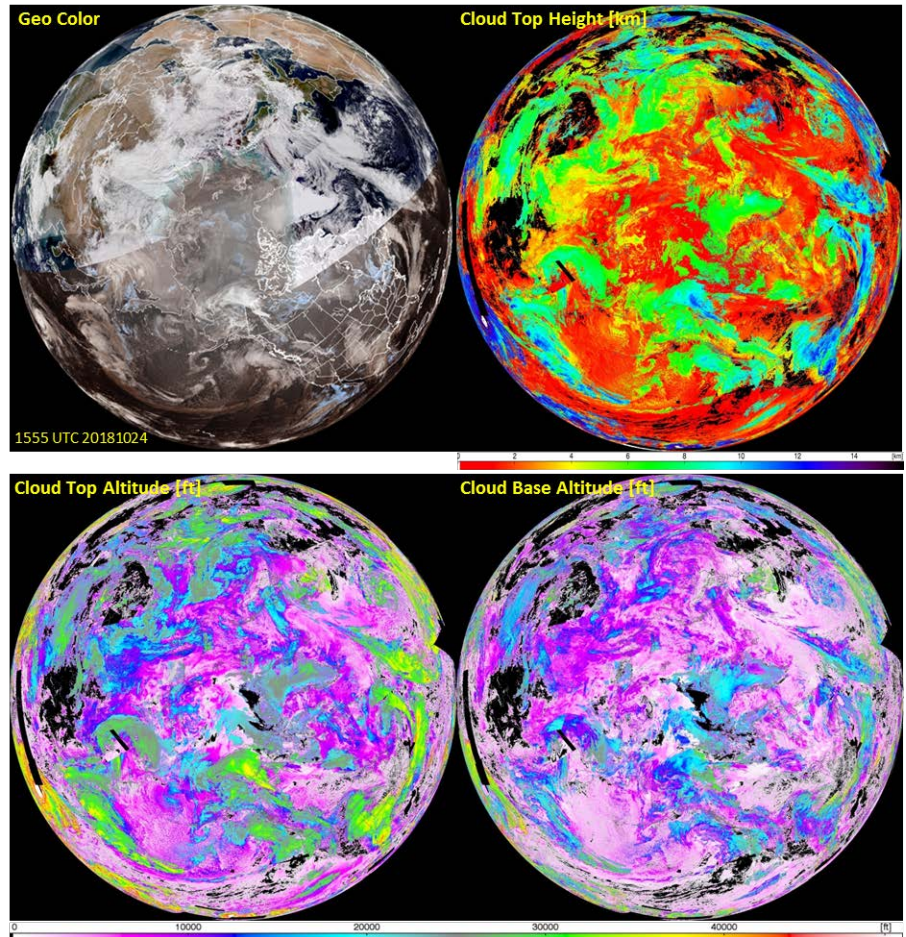
- Another quantity of interest to the Aviation Community is the vertical distribution of cloud at various flight levels.
- We generate cloud cover in 5 layers defined by common flight levels.
- In addition, we take these 5 layer values and construct a false color image.
- Layer 1 is the highest and layer 5 is lowest.
- The false color image recipe is:
 - Red = weighted mixture of layers 1&2
 - Green = weighted mixture of layers 2,3,4
 - Blue = weighted mixture of layers 4&5.
- Different layer combinations product the multiple colors seen. (For example, yellow = high + mid cloud)
- This image is intended to provide a quick look to forecastors.
- Data shown here is from July 31, 2018.



JPSS Data Products - Examples

CIRA's Polar Slider

- All VIIRS imagery available at <http://rammb-slider.cira.colostate.edu> (Satellite "JPSS")
- Sample **Cloud Top Height** and **Cloud Top/Base Altitudes** products over the Northern Hemisphere (public release scheduled in Nov 2018)

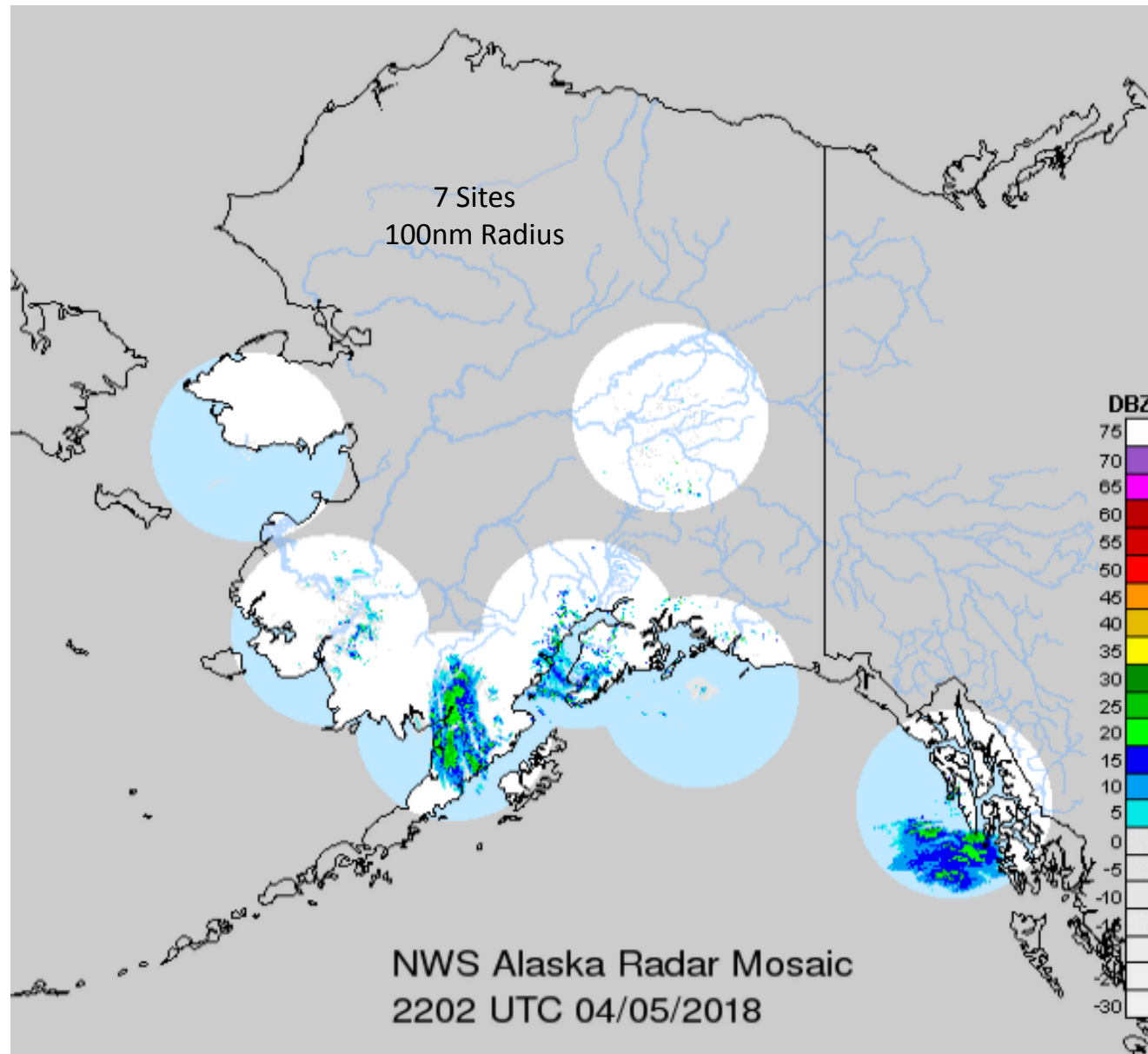




JPSS Cloud Products Demonstration

- Why do aviation weather forecasters want products like these?
 - There is limited weather information in Alaska. There are only 7 radar in the entire state with mostly of them partially blocked by mountains so satellite data products are essential. There are only 190 METARs with many remote areas with no data for hundreds of miles.
- What do they tell the forecasters and/or pilots about the pre-flight conditions?
 - For RGB it shows it tell pilots and forecasters what conditions will be in enroute. They can alter their level at which they fly. For Visual Flight Rule pilots it may ground them entirely. Forecasters can issue watches for an entire area and flight levels based on this product. This is helpful do to the flight levels.
- Does it help forecasters make decisions somehow about if they will fly or where there will fly?
 - Based on the type of aircraft and pilot rating, the product could be used in different ways.
 - For example, a Visual Flight Rule aircraft they would use the cloud base to determine which areas to avoid. In flight planning a pilot may cancel a flight or take an alternate route.
 - For Instrument Flight Rule pilots, cloud type heights may indicate potentially convective or turbulent areas. An alternate route may be chosen base on this information.

NEXRAD Weather Radar





JPSS Cloud Products Demonstration

- More and more users asking to join and participate
- JPSS Cloud Products Soft Demonstration has begun
 - Real time integration of product or display changes based on users feedback.
 - Feedback from soft demo starting to come in.
- Training has been given to the users directly from the experts that developed the products





Path Forward

- Start JPSS Cloud product demonstration in mid-Nov
- Determine utility of JPSS Cloud Products
- Document any feedback on JPSS Cloud Products
- Modify algorithms based on feedback
- Determine potential for uses of other areas in JPSS Product Suite.
- Plan additional JPSS Cloud Product demonstrations to cover additional seasons



Data Access and Resources

- Stored Mission Data (SMD) access
 - Product Distribution and Access (PDA): Designed for near real-time users. Access is managed/controlled by NESDIS/Office of Satellite Products and Operations;
 - Comprehensive Large Array-data Stewardship System (CLASS): Designed non real-time users. <https://www.avl.class.noaa.gov>
 - Global Telecommunications System (GTS): currently includes CrIS SDR and ATMS TDR
 - GEONEcast-Americas: Currently includes VIIRS DNB, I band Imagery, Blended TPW, Active Fires, MiRS, NUCAPS

- High Rate Data (HRD) / Direct Broadcast access
 - Available to users with antennas. Software available: <http://cimss.ssec.wisc.edu/cspp/>

- Algorithm maturity information and documentation: <https://www.star.nesdis.noaa.gov/jps/AlgorithmMaturity.php>



Summary

- Builds on user interaction from the JPSS Arctic Summit
- The Alaskan Cloud Products Demo builds on the successful JPSS Arctic Summit
- First phase of Cloud Products demo will focus on cloud vertical structure for aviation users in Alaska
- JPSS Cloud products already in the hands of the users as part of the soft demo
- International aviation community could benefit, especially in the high latitudes, from JPSS products
- Want to get involved? Tell us what your needs are!

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Thank you!

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Backup Slides

JPSS PGRR Background Definitions

- **Proving Ground**

- Demonstration and utilization of data products by the end-user operational unit, such as a NWS Weather Forecast Office or Modeling Center.
- Promote outreach and coordination of new products with the end users, incorporating their feedback for product improvements

- **Risk Reduction**

- Development of new research and applications to maximize the benefits of JPSS satellite data
 - Example - use of Day Night Band for improved fog and low visibility products at night, benefiting transportation industry.
- Encourages fusion of data/information from multiple satellite, models and in-situ data
- Primary work is done at the algorithm and application developer's institution.
- Address potential risk in algorithms and data products by testing alternative algorithms.

PGRR Proving Ground Initiatives Responding to User Feedback

- The River Ice and Flooding Initiative was the first attempt at this new partnership and it was established in response to Galena AK flooding in May 2013.
- The Initiative included River Ice and River Flooding Project teams, direct broadcast SMEs, and National Weather Service River Forecast Center forecasters.
- The success of River Ice and Flooding Initiative led to creation of other initiatives that guided the 2014 PGRR CFP.
- Initiatives have proven to be critical forums where JPSS personnel, product developers, and users interact. The effort is to evaluate current and future JPSS Capabilities in operational environments to determine which of these capabilities should be transitioned to operations.

PGRR Initiatives List

Blue – Most Recent from 2017 PGRR CFP



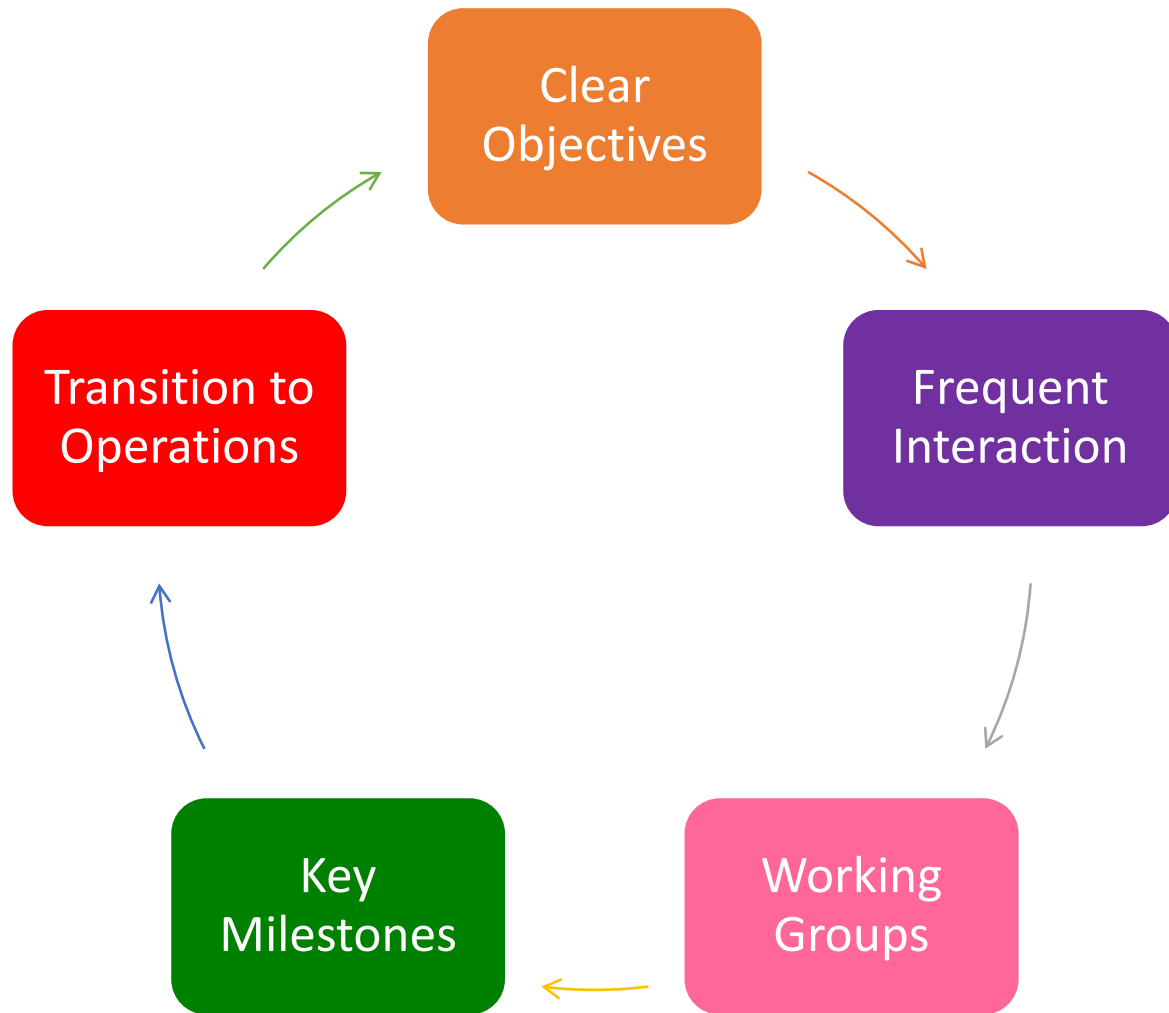
PGRR Initiatives

Initiative	Start Date
River Ice and Flooding	November 2013
Fire and Smoke	May 2014
Sounding Applications NOAA Unique CrIS/ATMS Processing System (NUCAPS)	July 2014
Hydrology	July 2015
Ocean and Coastal	March 2016
Severe Weather/NWP/Data Assimilation	March 2016
Arctic Initiative	June 2016
Hurricanes and Tropical Storms Initiative	June 2018
Aviation Initiative	June 2018
Training Initiative	June 2018
Volcano Initiative	June 2018

PGRR Initiatives Partners

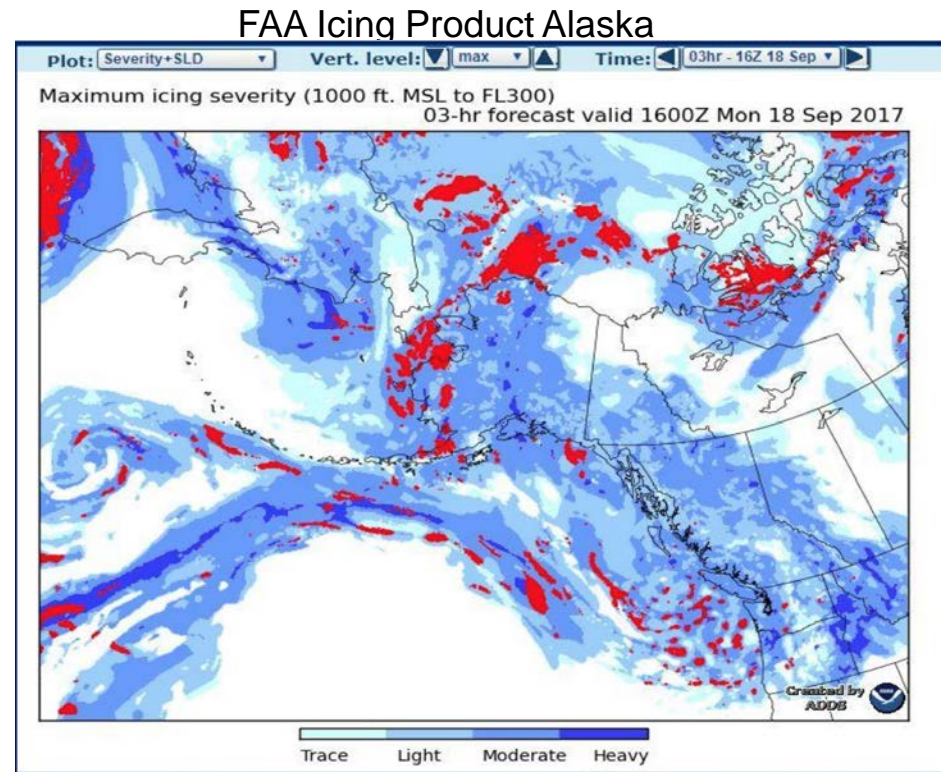


PGRR Proving Ground Initiatives Best Practices



Role of JPSS Cloud Products in Aviation

- AAWU is evaluating the FAA IPA.
- In CONUS, NCAR's CIP is a dominant source of Icing Information to the NOAA Aviation community.
- Is it relevant to the AAWU?
- CIP uses an NCAR cloud-top temperature but no other satellite products. (Not NOAA or NASA LaRC)
- Should our goal be to integrate with the IPA and the CIP?
- Should JPSS try to present its satellite products in a similar format?



This is a product that is straightforward to make from JPSS suite. Is there value in a JPSS SLD product / image?

NWS Aviation Initiative Users

Alaska Aviation Weather Unit (AAWU)
National Weather Service Forecast Offices
National Weather Service Center Weather Service Units



NWS Alaska Region Overview



National Weather Service Alaska Region Facilities

▲ In Anchorage:

- Alaska Aviation Weather Unit
- Anchorage Volcanic Ash Advisory Center
- Anchorage Center Weather Service Unit
- Weather Forecast Office
- River Forecast Center

★ Weather Forecast Offices

● Weather Service Offices

T National Tsunami Warning Center

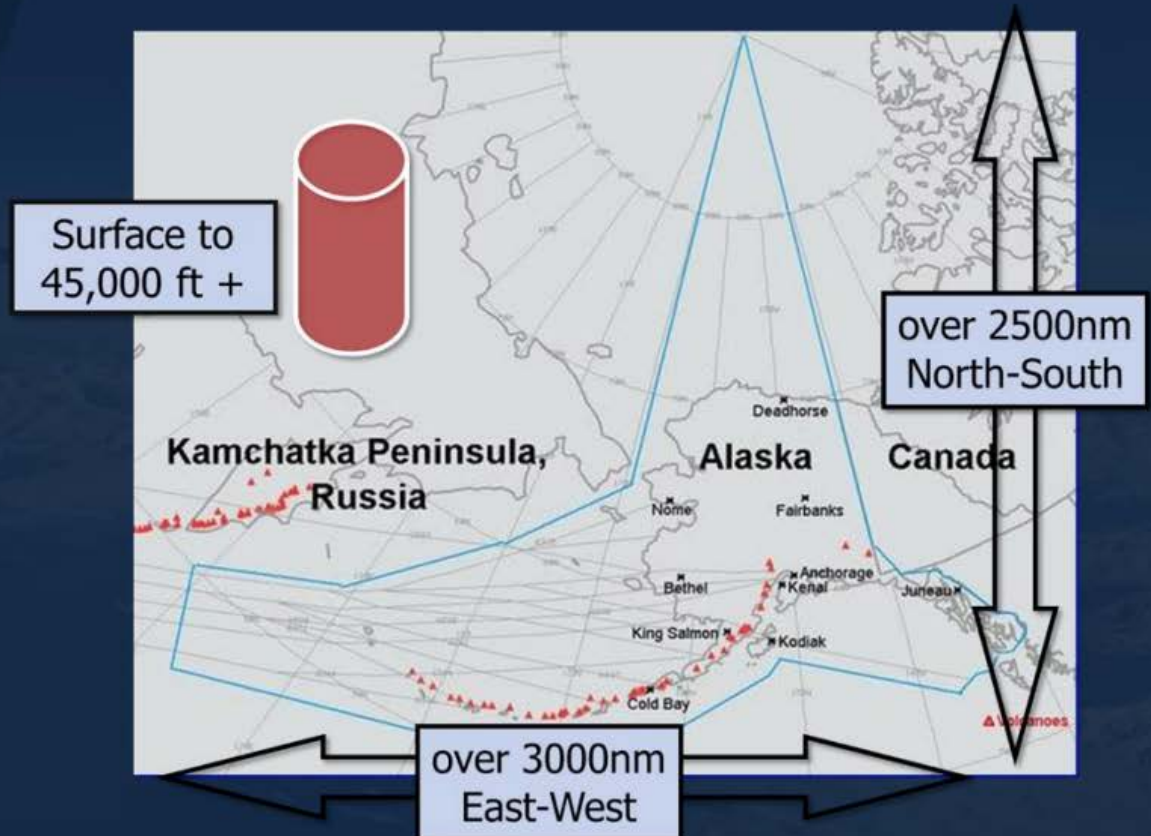


Alaska Aviation Weather Unit (AAWU)



Alaska Aviation Weather Unit (AAWU)

- Forecasts for over 2.4 million sq. miles of airspace
 - Graphics, Area Forecasts, AIRMETs, and SIGMETs
 - Flight Category, Icing, Turbulence, Convection, Surface Analyses, and Volcanic Ash
- Need for a strong internal collaborative forecast process
- Close partnerships with FAA, industry, and formal associations to help guide services



AAWU Forecast Responsibility



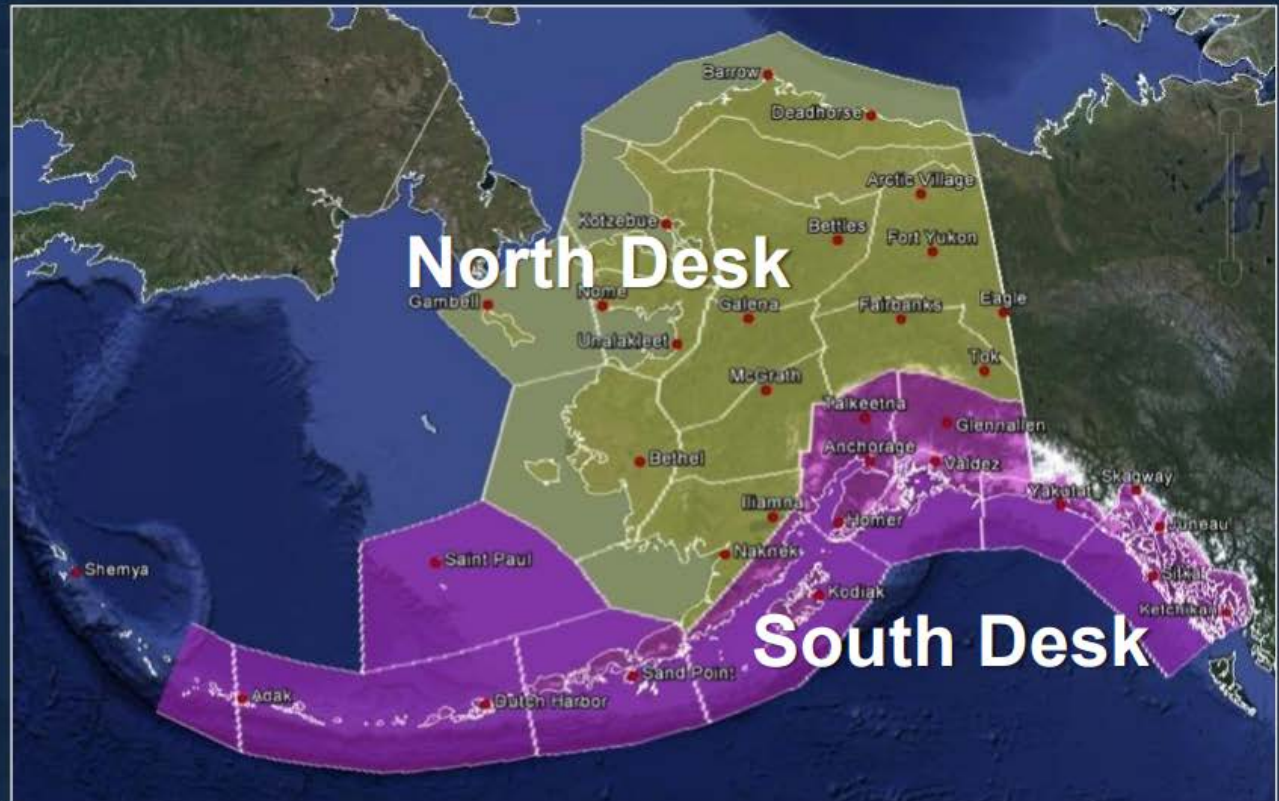
Alaska Aviation Weather Unit (AAWU)

North Desk:

- 12 Area Forecasts
- Freezing Levels
- Icing
- Convection
- Flight Category

South Desk:

- 13 Area Forecasts
- Surface wind
- Low-level Turbulence
- High-level Turbulence
- Surface Analysis





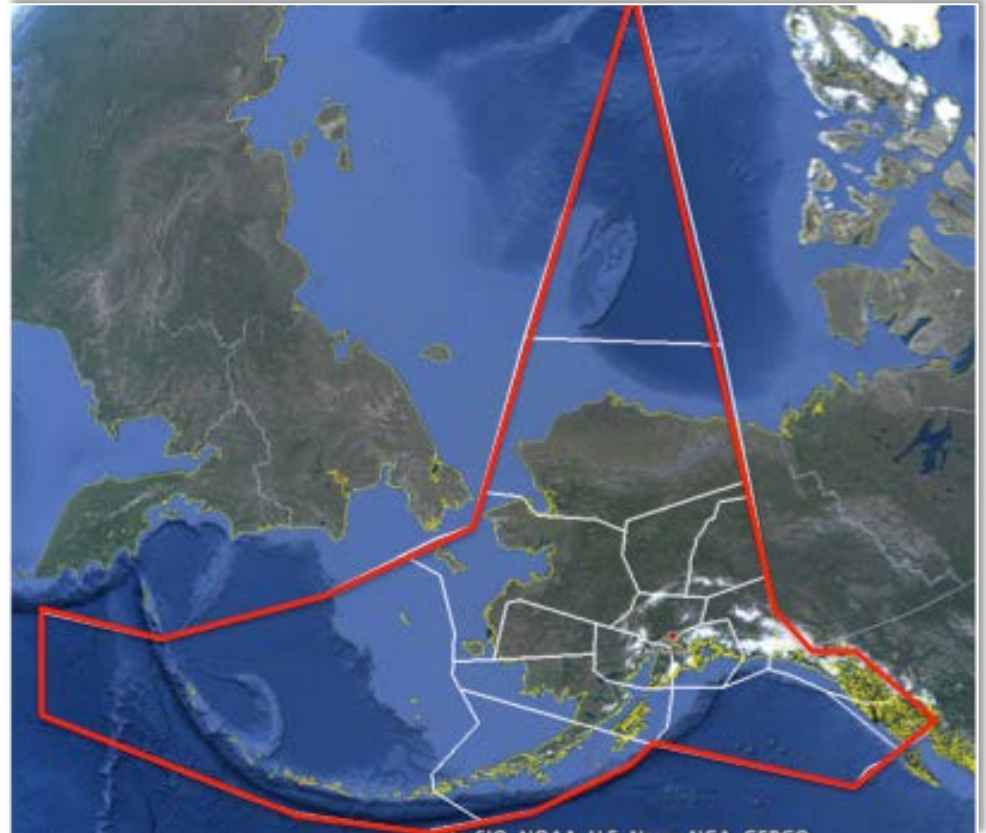
Anchorage Center Weather Service Unit





ZAN CWSU Area of Responsibility

- ZAN Flight Information Region covers 2.4 million square miles
 - = Approximately the area covered by 13 of the 20 Lower 48 CWSUs
- Borders Russian, Japanese, Canadian, and U.S. (Oakland) FIRs



Federal Aviation Administration

Flight Service Duties

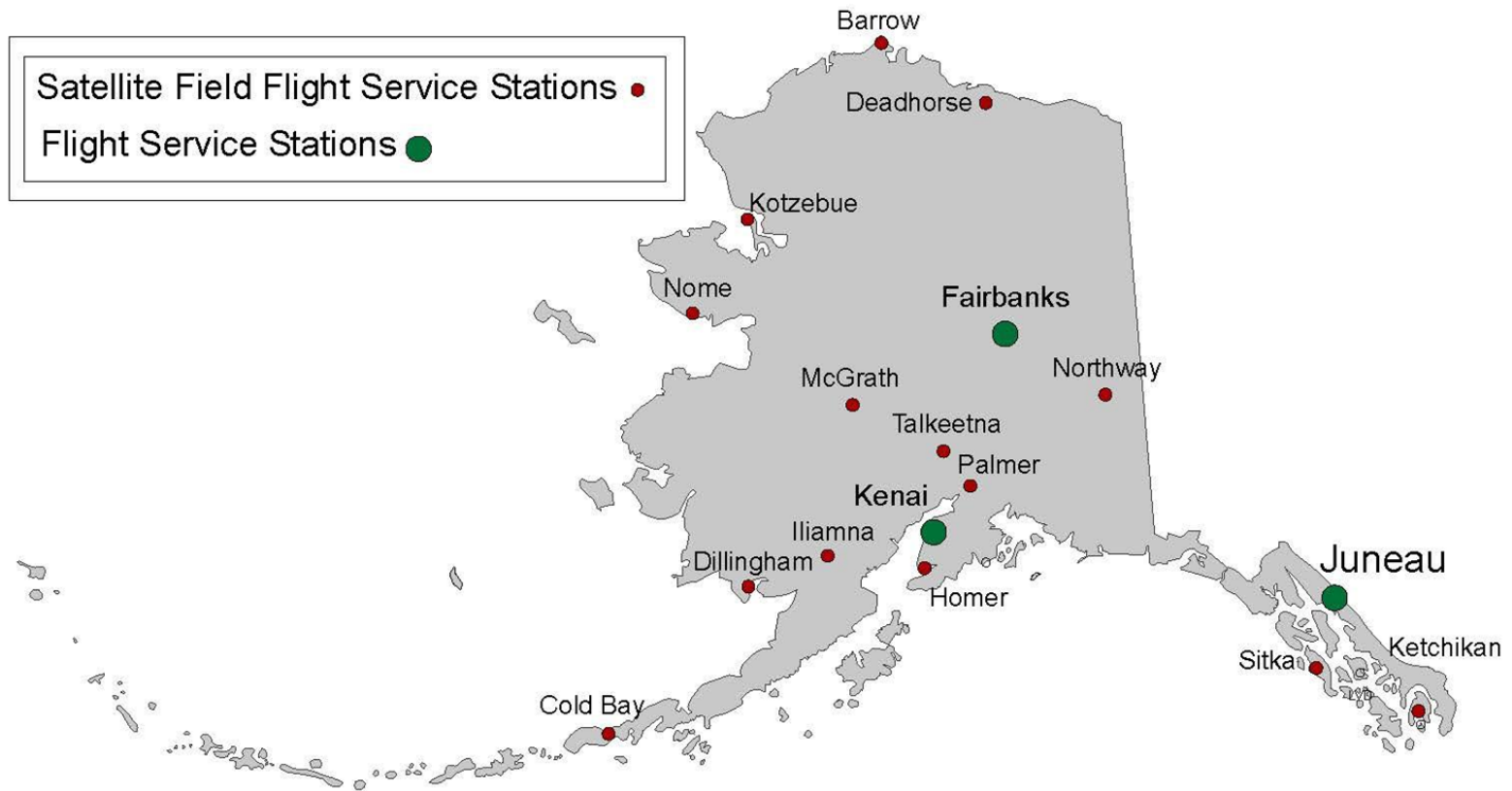
- Weather briefing
- Flight Planning
- Emergency Services
- Search And Rescue
- Notices To Airmen (NOTAM)

FAA Flight Service Briefing Tools

- Surface Charts
- Weather Prognostic Charts
- Satellite Imagery
- NEXRAD Radar
- Weather Cameras
- Pilot Reports

Alaska Flight Service Station Facilities

Alaska Flight Services



Private Pilots

- Tom George
 - FAA ratings and certificates: Commercial Pilot, Single Engine Land, Single Engine Sea, Multi Engine Land, Instrument Airplane. Also Flight Instructor, Airplane Single Engine
 - Over 4,300 hours flight time, almost exclusively in Alaska. Fly a single engine aircraft, VFR In the past have flown supercubs in off-field operations, today fly a Cessna 185 for business travel, and to collect aerial photography and other data. Mostly operate in Interior, north slope, south central parts of the state.
 - Work for the Aircraft Owners and Pilots Association, a national organization advocating on behalf of pilots and aircraft owners who fly for non-commercial purposes such as private business, government or recreational activities.

Private Pilots

- Adam White

- Has the following FAA ratings and certifications: Commercial Pilot

- Single Engine Land
- Single Engine Sea
- Multiengine Land
- Instrument Airplane
- Flight Instructor
- Airplane Single Engine
- Instrument Airplane
- Mechanic
- Airframe and Power plant

- I have 4500+ hours flight time in the past 28 years, 95% of it in Alaska. I primarily fly VFR, single engine, below 10K' and just about every flight involves off-airport operations. I fly floats and wheels in the summer season and skis and wheels in the winter with a Maule M7 and a Cessna 206. While I do fly IFR occasionally, the infrastructure in Alaska doesn't really support IFR operations in remote, off-airport situations. Most of my flights are in the Interior and Northwest Arctic regions of the Alaska. Because I fly in remote, off-airport situations I find it difficult to get an accurate and complete weather picture for flight planning.



NOAA Arctic Test Bed and Proving

Test Bed Background Specifics

- **Purpose**
 - Located at NWS Alaska Region HQ, Anchorage. Part of Environmental and Scientific Services Division (ESSD) & the NWS Science and Technology Integration (S&TI) Portfolio
 - Focus NWS Alaska Region development efforts to maximize service delivery effectiveness in Alaska
 - Facilitate and improve (R2O, O2R, and O2O) of new and improved products and services that fulfill current and emerging decision-support requirements
- **Capabilities:**
 - Integration with NWS forecast systems & data streams, and research data streams
 - Ability to simulate operations with archived data in AWIPS
 - Test generate new products or services in real-time or during simulation
- **Synergistic Opportunities**
 - Connecting the research community with NWS operations in Alaska
 - Potential to evaluate new datasets directly in operations or in a simulated environment
- **Expectations**
 - Model and data assimilation improvements to operational models for sea ice forecasting
 - Working with satellite partners to bring new capabilities to the Alaska Sea Ice Program and all of our forecast programs (Marine, Hydro, Aviation, Public, Fire Weather)
 - Evaluate and assimilate new forecast data, methods and procedures into operations

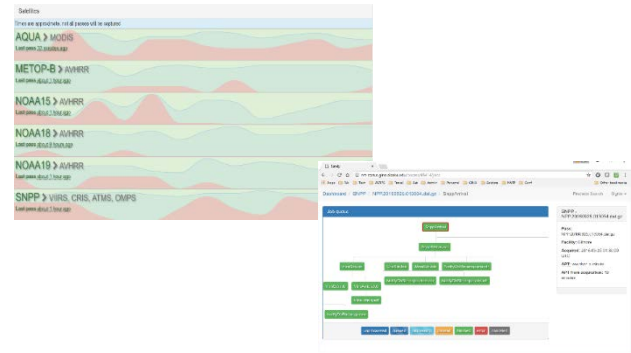
Geographic Information Network of Alaska (GINA)



University of Alaska Fairbanks



NESDIS/FCDAS
Gilmore Creek, AK



The Geographic Information Network of Alaska (GINA) located on the University of Alaska Fairbanks campus receives polar satellite data from several downlink resources via Direct Broadcast. Using redundant systems GINA is able to processes and deliver polar satellite data in Near Real Time (NRT) to the National Weather Service and other government agencies in Alaska.

Direct Broadcast satellite processing is made possible by CSPP software provided by CIMSS

<http://cimss.ssec.wisc.edu/cspp/>



Aviation Initiative Goals

- Establish an Alaskan User for the cloud macrophysical (vertical structure) products included in the new CCL formulation.
- Build relationships for perhaps extending into other products where people expressed interest:
- Develop a sense of the utility of JPSS products compared to the current AAWU product suite (IPA, CIP, FIP) from NCAR and FAA. Use feedback to motivate collaboration with those groups.