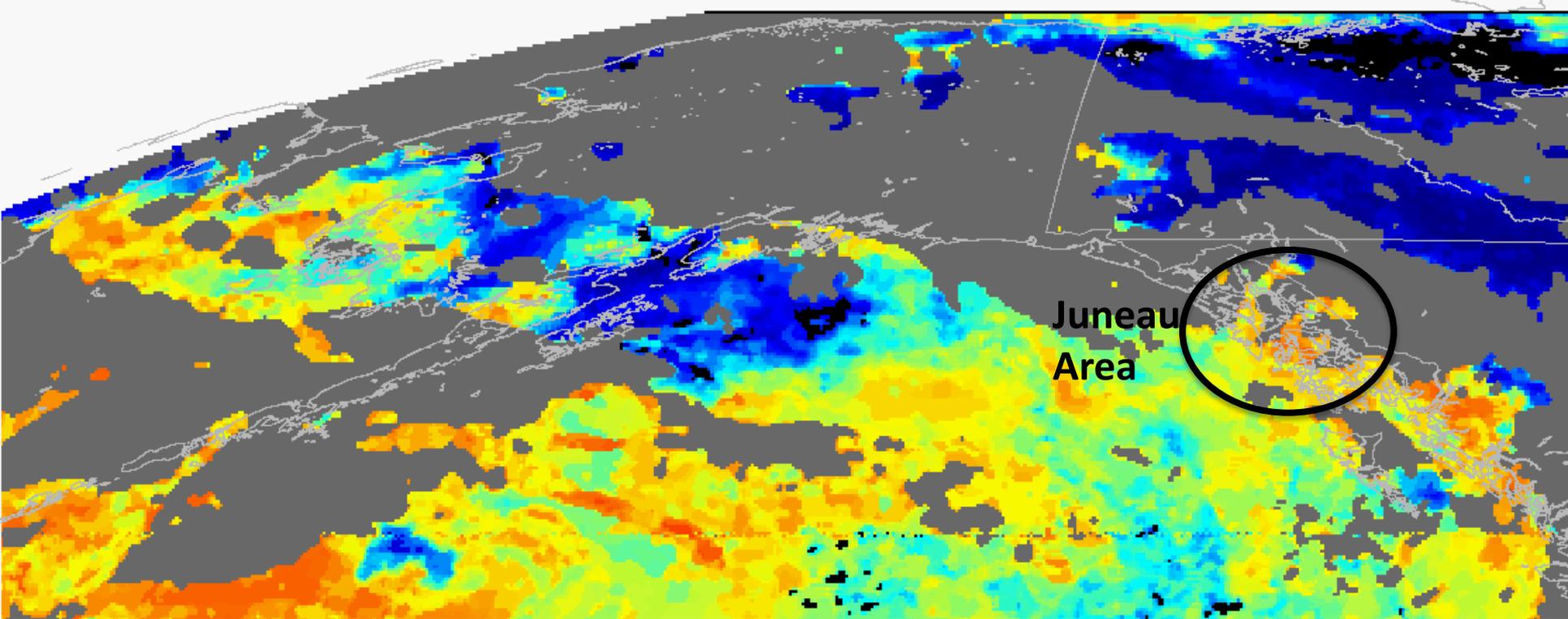
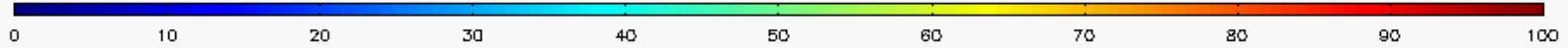


# Aborted Landing!

## July 26, 00:46 UTC

GEOCAT\_v0.80

GOES-11 2011-07-26 00:46:00  
GOES-R IFR Fog Probability [%]





Marco Fulle - [www.stromboli.net](http://www.stromboli.net)

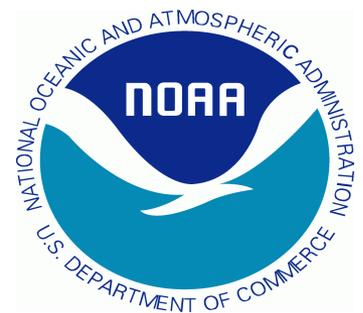


# The GOES-R AWG Fog/Low Cloud, Cloud Type, and Volcanic Ash Products

**Mike Pavolonis (NOAA/NESDIS)**

Justin Sieglaff (UW-CIMSS)

Corey Calvert (UW-CIMSS)



# High Latitude Testbed

Product	Sensor	Format
Volcanic ash (height, mass loading, and effective radius)	MODIS	AWIPS
SO <sub>2</sub> (mask and loading)	MODIS	AWIPS
Fog/low cloud (MVFR probability, IFR probability, FLS depth)	MODIS	AWIPS
Cloud type	MODIS	AWIPS

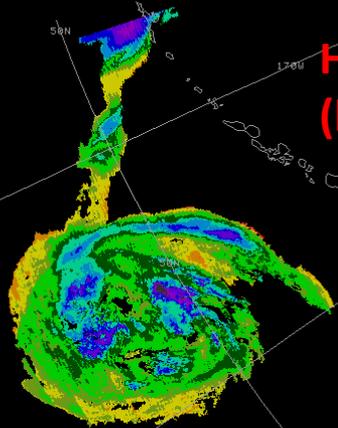
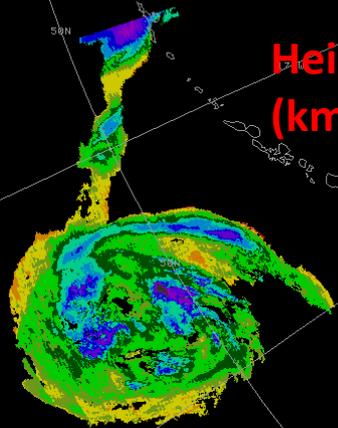
**All processing is currently being performed at UW-CIMSS. We would like to transition the processing to GINA in order to reduce latency.**



August 9, 2008 12:45 UTC

Height  
(km)

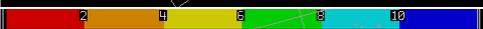
Height  
(kft)



Maximum cloud height ~ 43,000 feet ASL

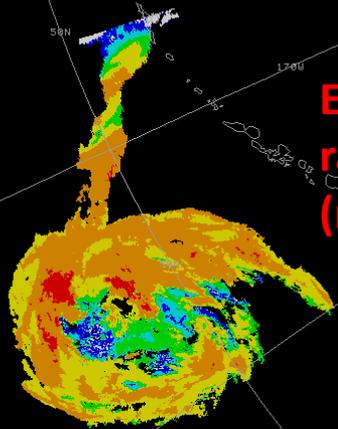
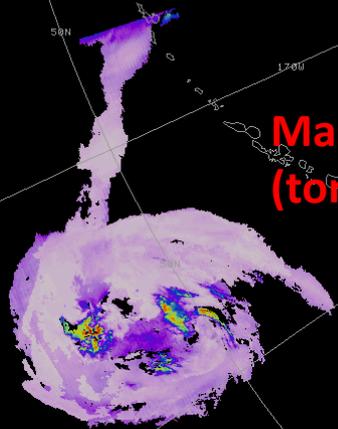
MODIS Ash Height 1km (km) Sat 12:45Z 09-Aug-08

MODIS Ash Height 1km (kft) Sat 12:45Z 09-Aug-08



Mass loading  
(ton / km<sup>2</sup>)

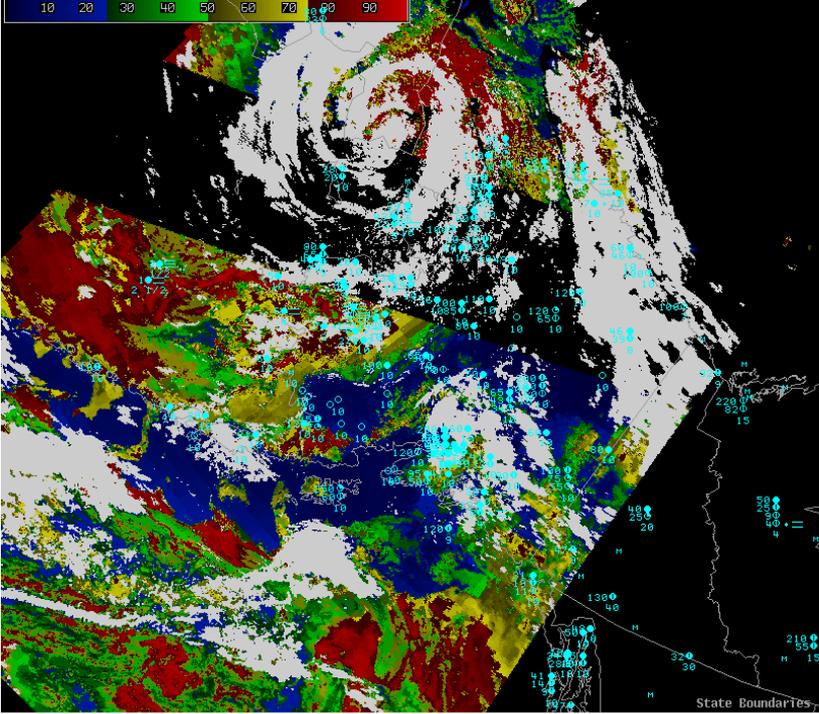
Effective  
radius  
(microns)



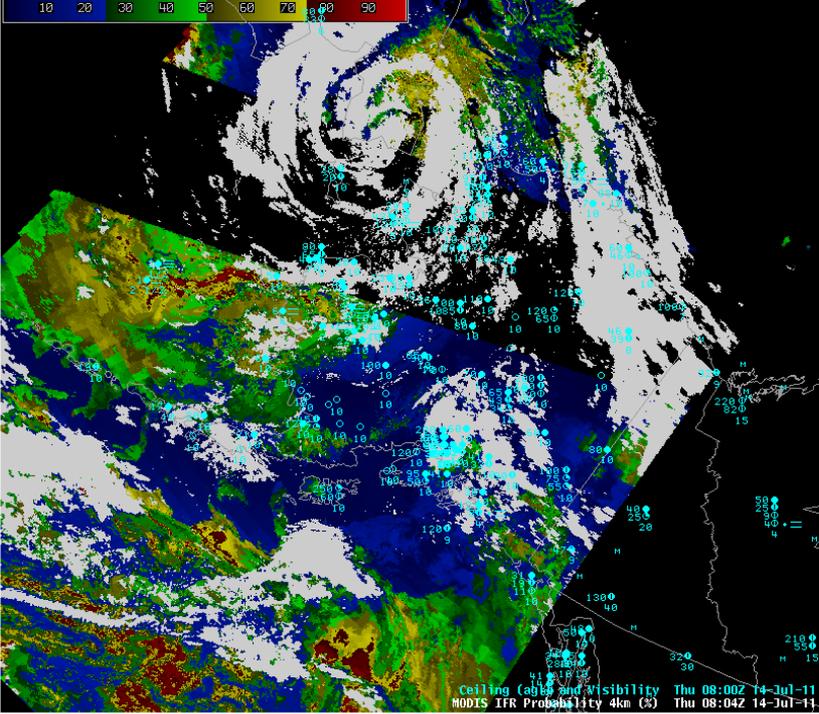
MODIS Ash Mass Loading 1km (tons/km2) Sat 12:45Z 09-Aug-08

MODIS Ash Mass Eff Radius 1km (um) Sat 12:45Z 09-Aug-08

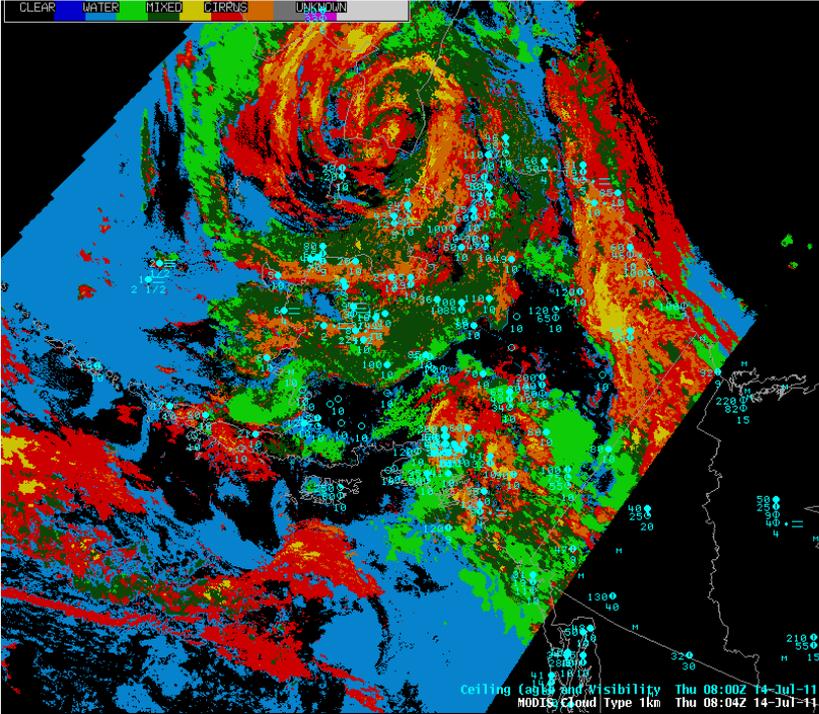
**MVFR Probability**



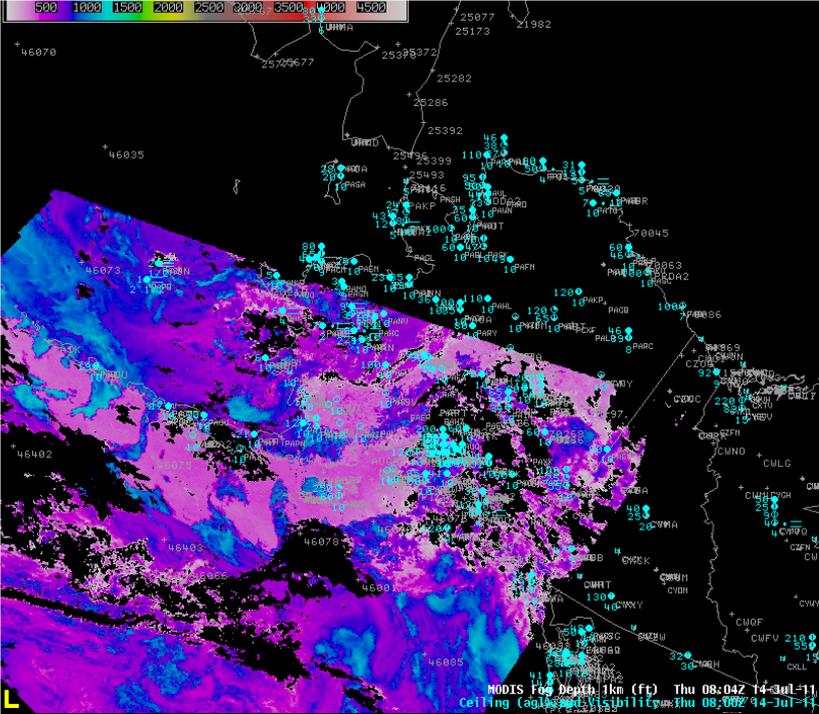
**IFR Probability**



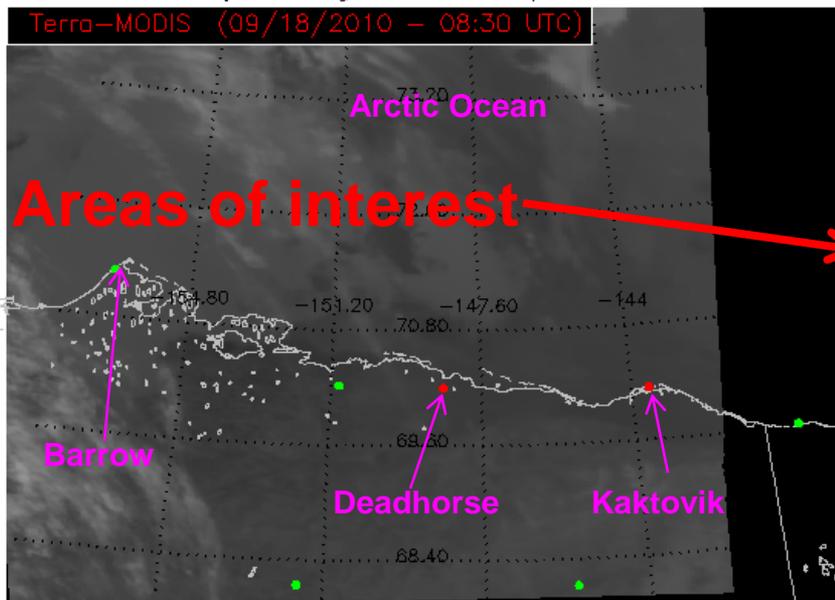
**Cloud Type**



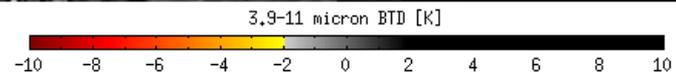
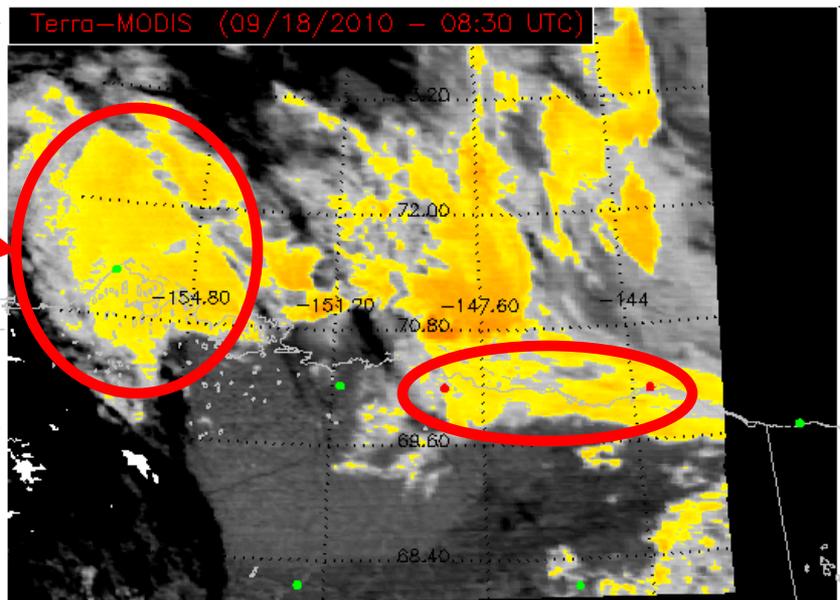
**FLS Depth**



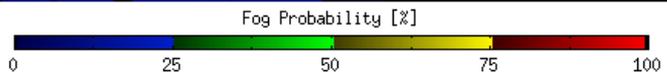
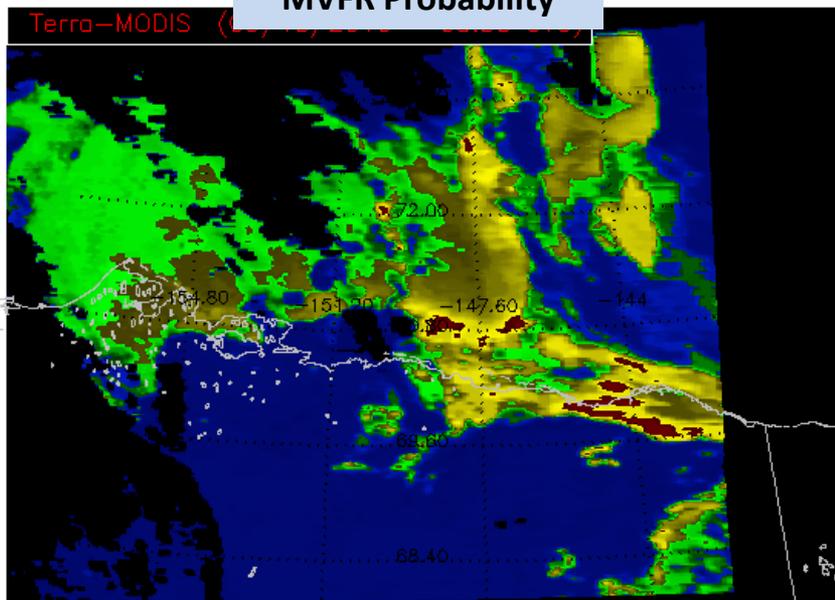
11 $\mu$ m Brightness Temperature



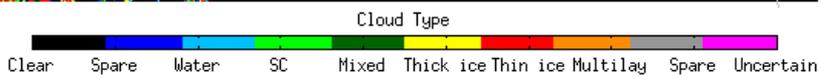
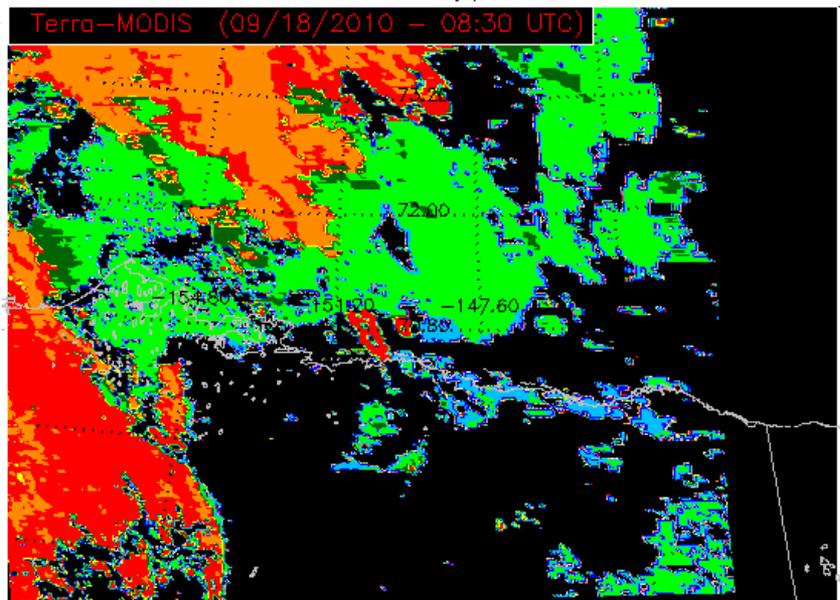
3.9-11 micron BTD



MVFR Probability

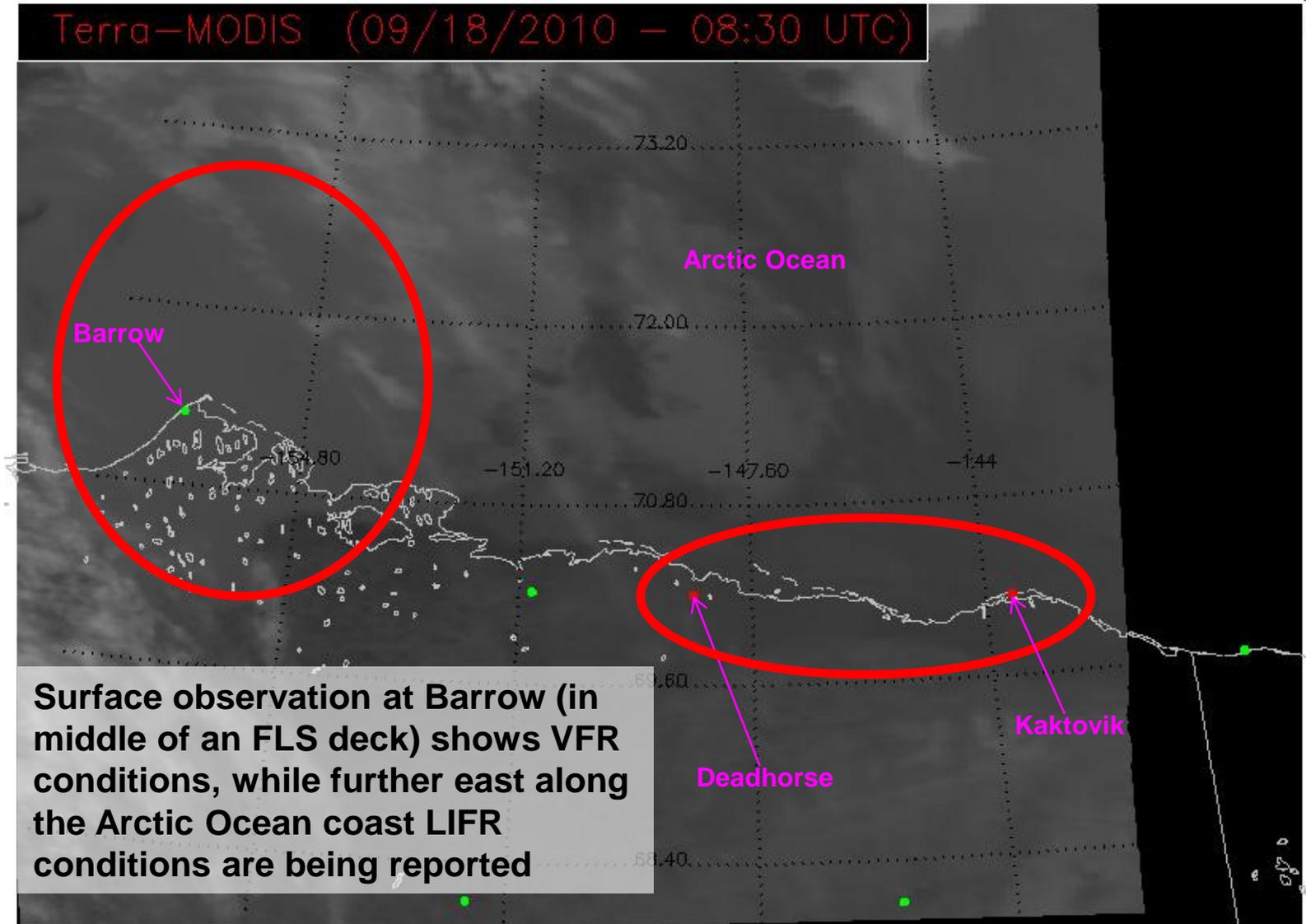


Cloud Type



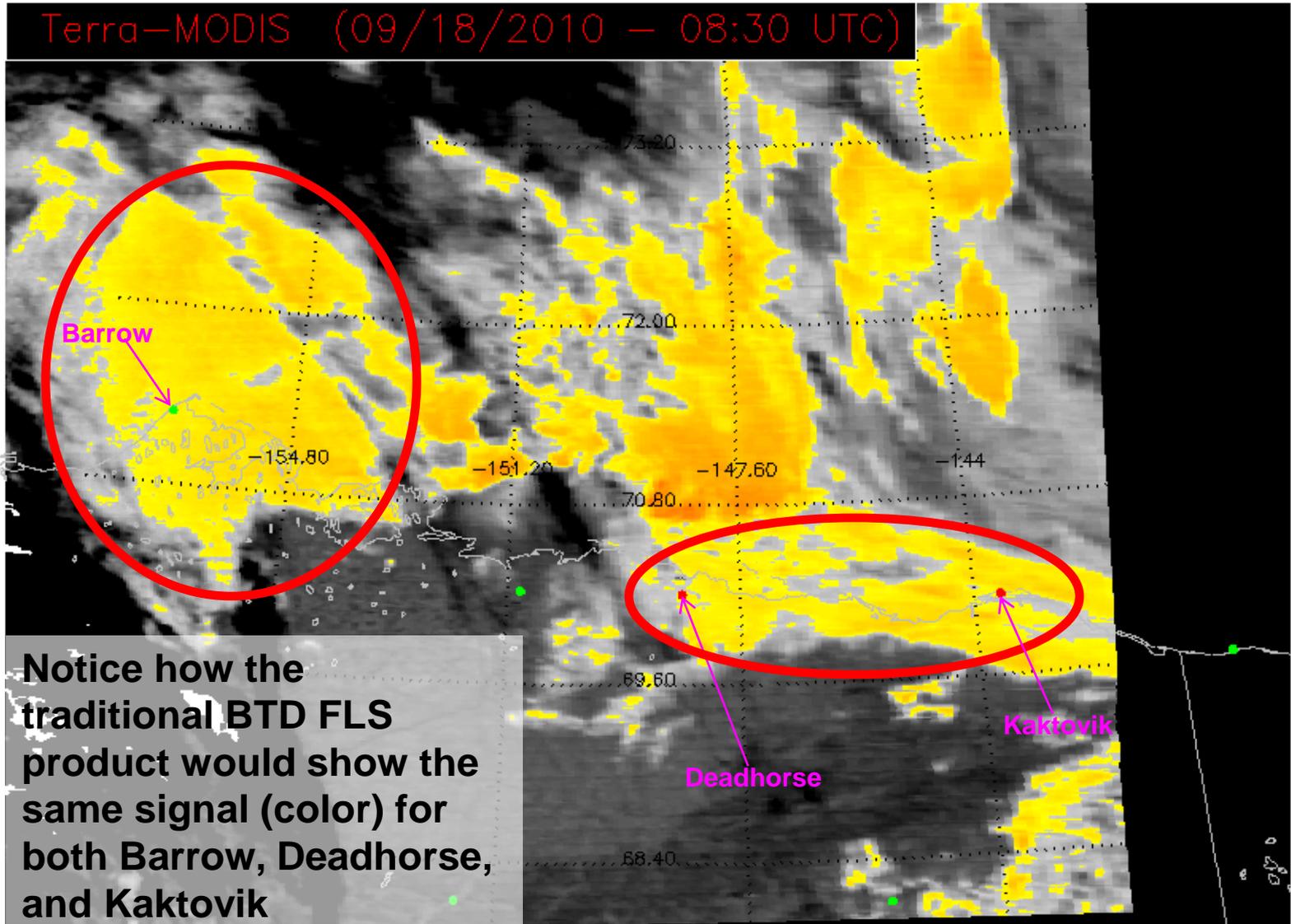
# 11 $\mu\text{m}$ Brightness Temperature

Terra-MODIS (09/18/2010 - 08:30 UTC)



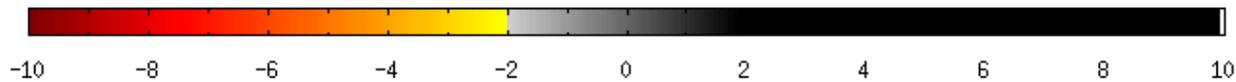
# 3.9–11 micron BTD

Terra-MODIS (09/18/2010 – 08:30 UTC)



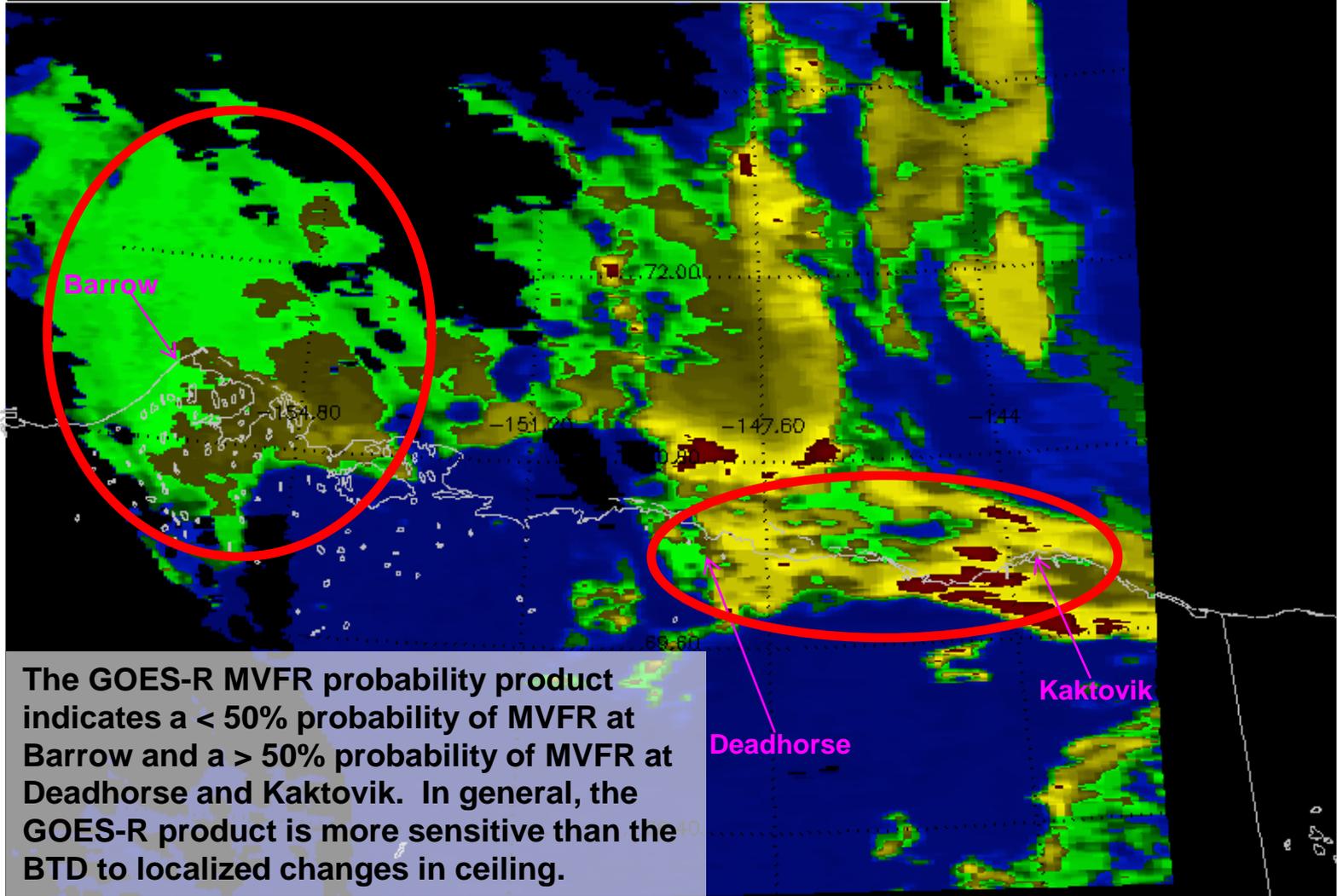
Notice how the traditional BTD FLS product would show the same signal (color) for both Barrow, Deadhorse, and Kaktovik

3,9-11 micron BTD [K]



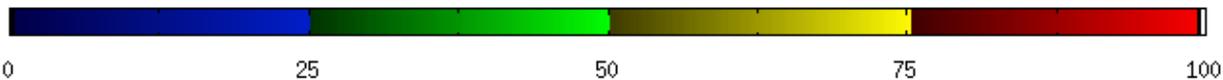
# MVFR Probability

Terra-MODIS (09/18/2010 - 08:30 UTC)



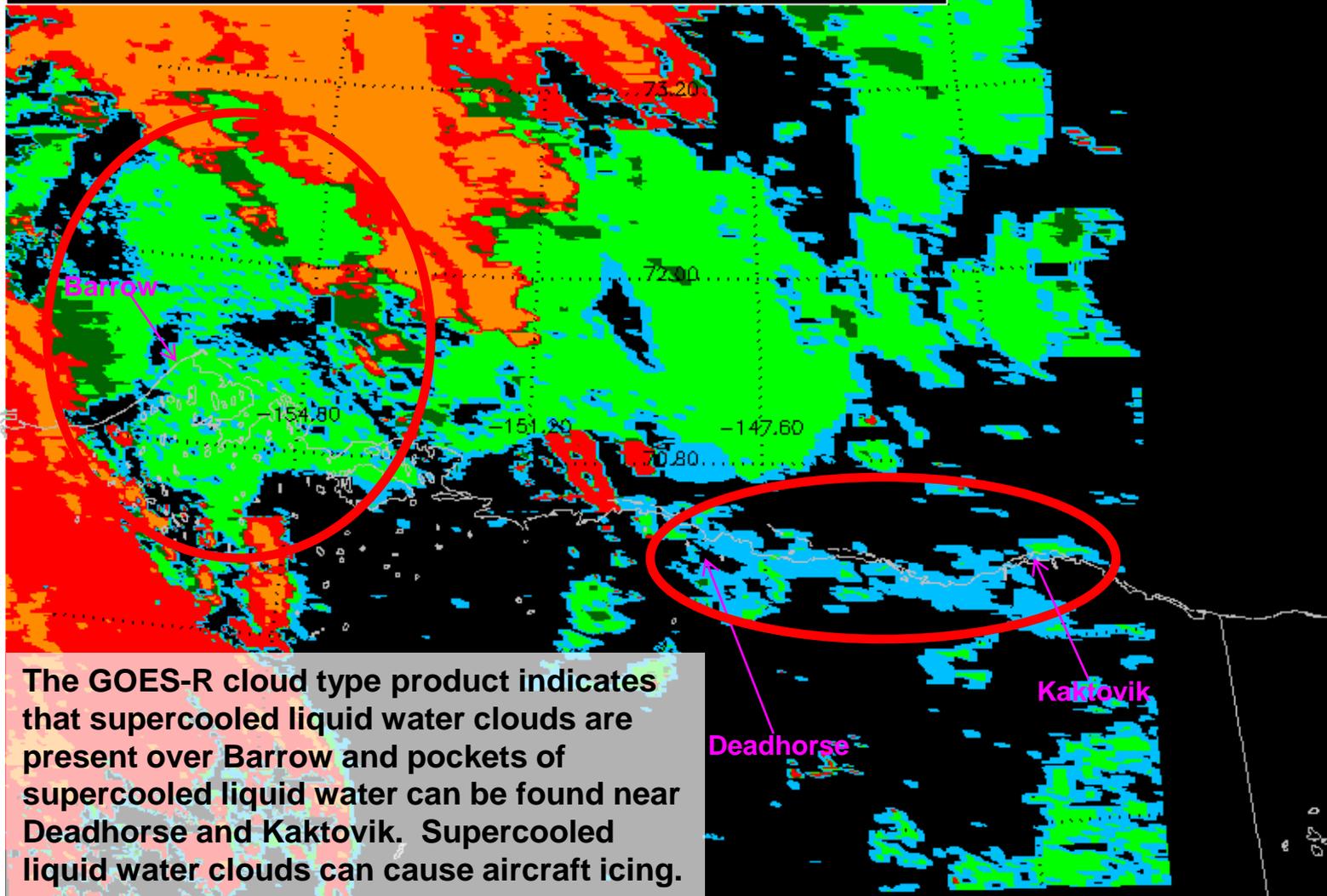
The GOES-R MVFR probability product indicates a < 50% probability of MVFR at Barrow and a > 50% probability of MVFR at Deadhorse and Kaktovik. In general, the GOES-R product is more sensitive than the BTD to localized changes in ceiling.

Fog Probability [%]



# Cloud Type

Terra-MODIS (09/18/2010 - 08:30 UTC)

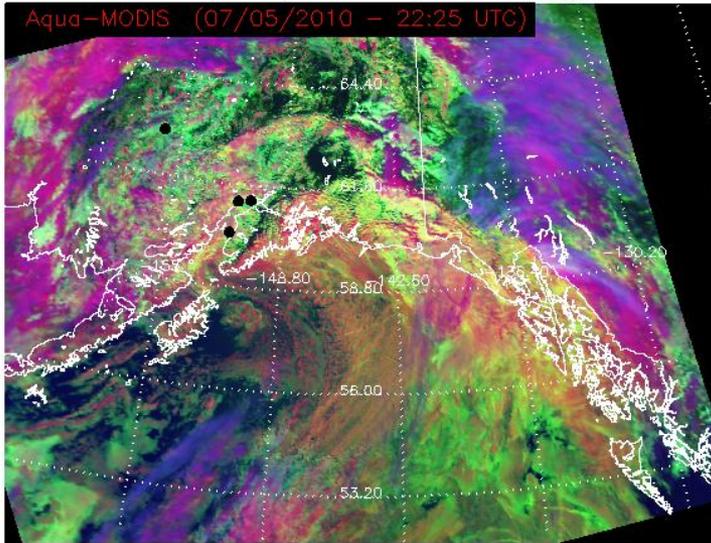


Cloud Type

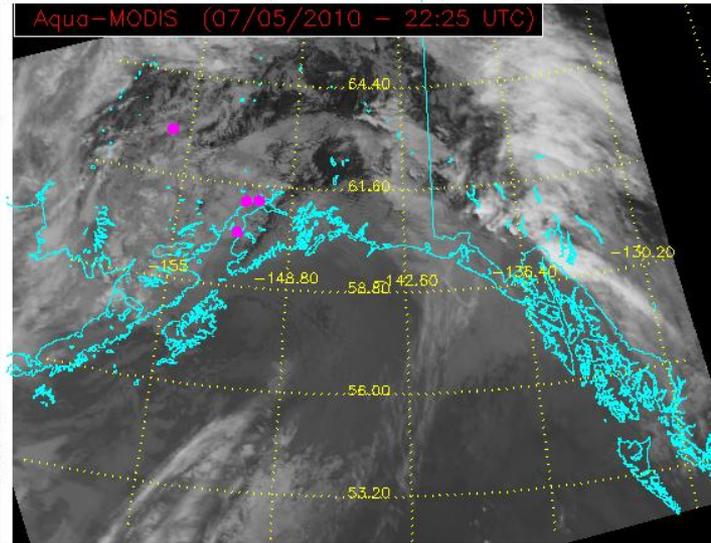


# Aqua-MODIS (July 05, 2010, 22:25 UTC)

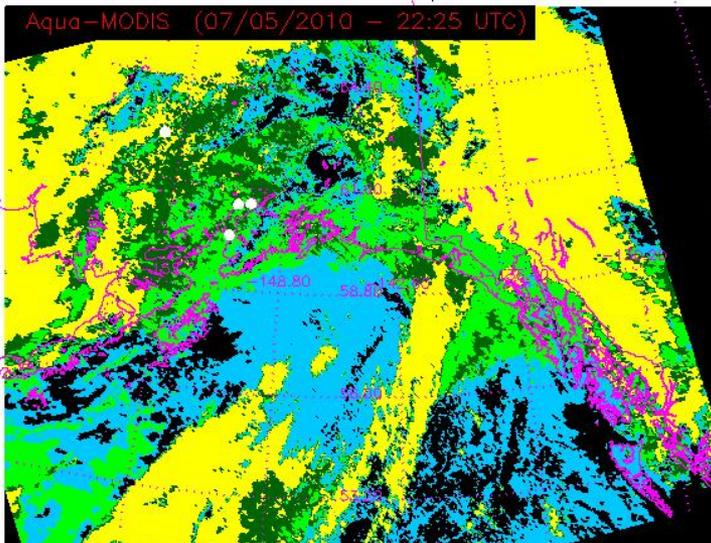
RGB (0.65 $\mu\text{m}$ , 3.75 $\mu\text{m}$ , 11 $\mu\text{m}$ )



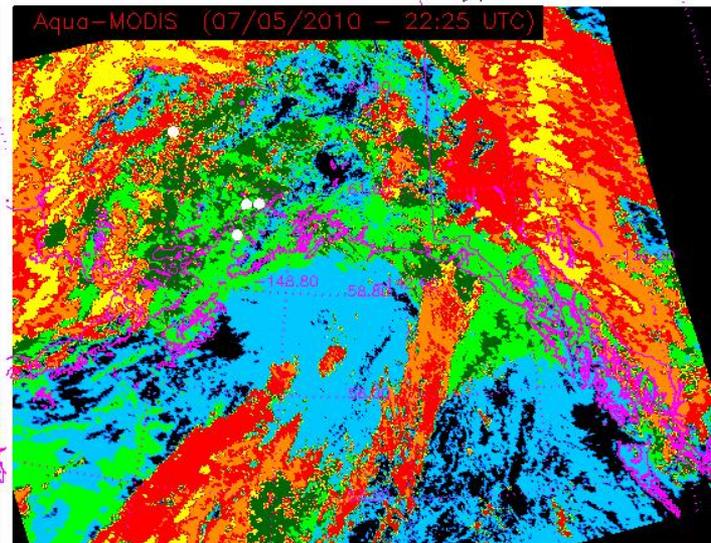
11 $\mu\text{m}$  Brightness Temperature [K]



GOES-R Cloud Top Phase



GOES-R Cloud Type



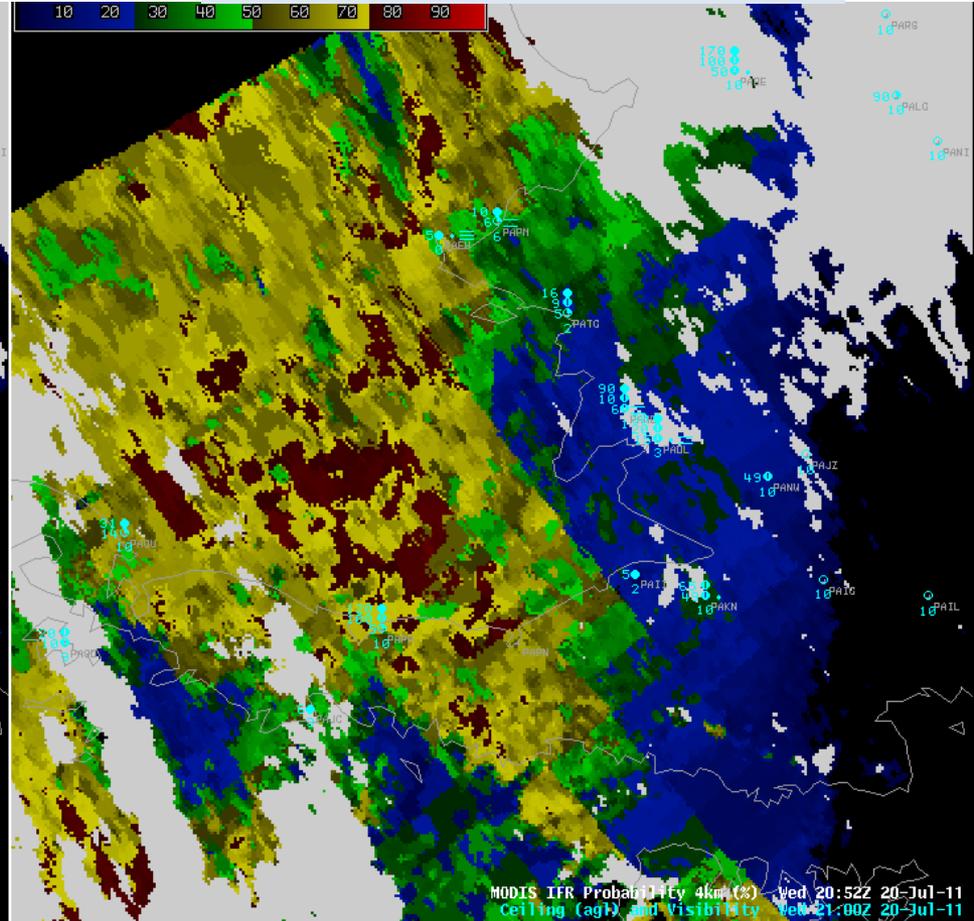
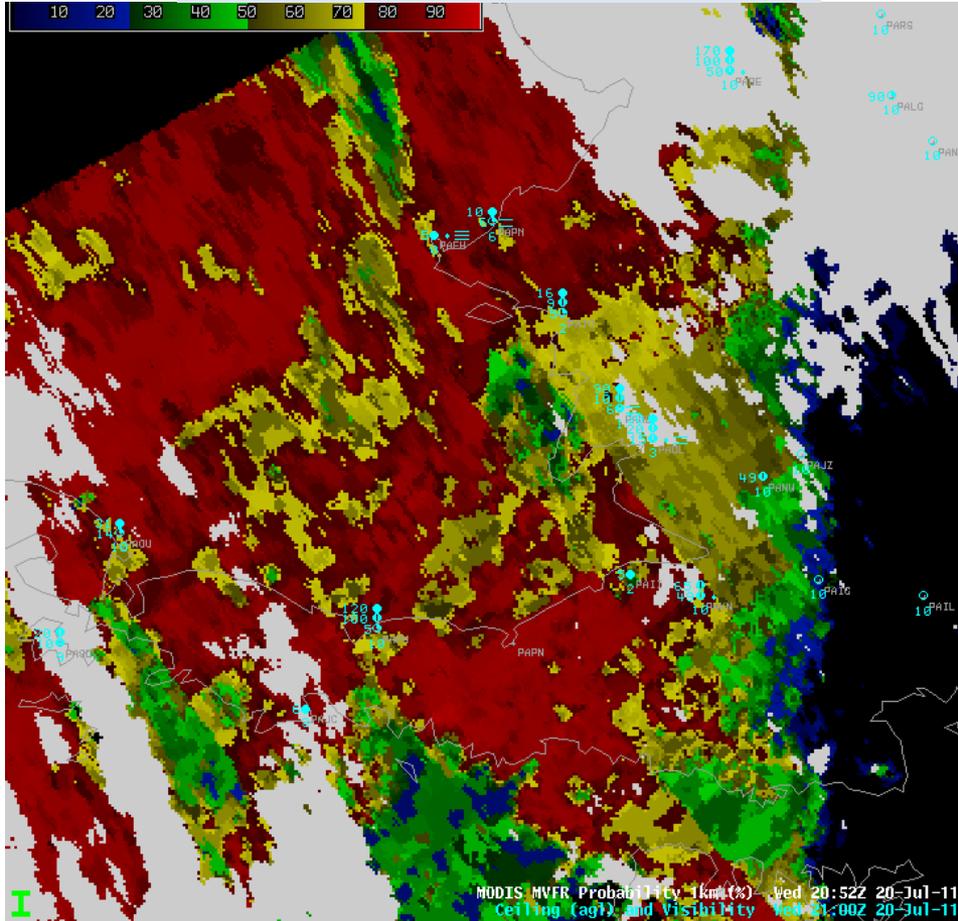
Clear Liquid Supercooled Mixed Ice Uncertain

Clear Spare Liquid Supercooled Mixed Thick Ice Thin Ice Multi-layered

- Icing reports are denoted by the filled circles.
- All pilot reported occurrences of aircraft icing are coincident with supercooled liquid water or mixed phase clouds.

MVFR Probability

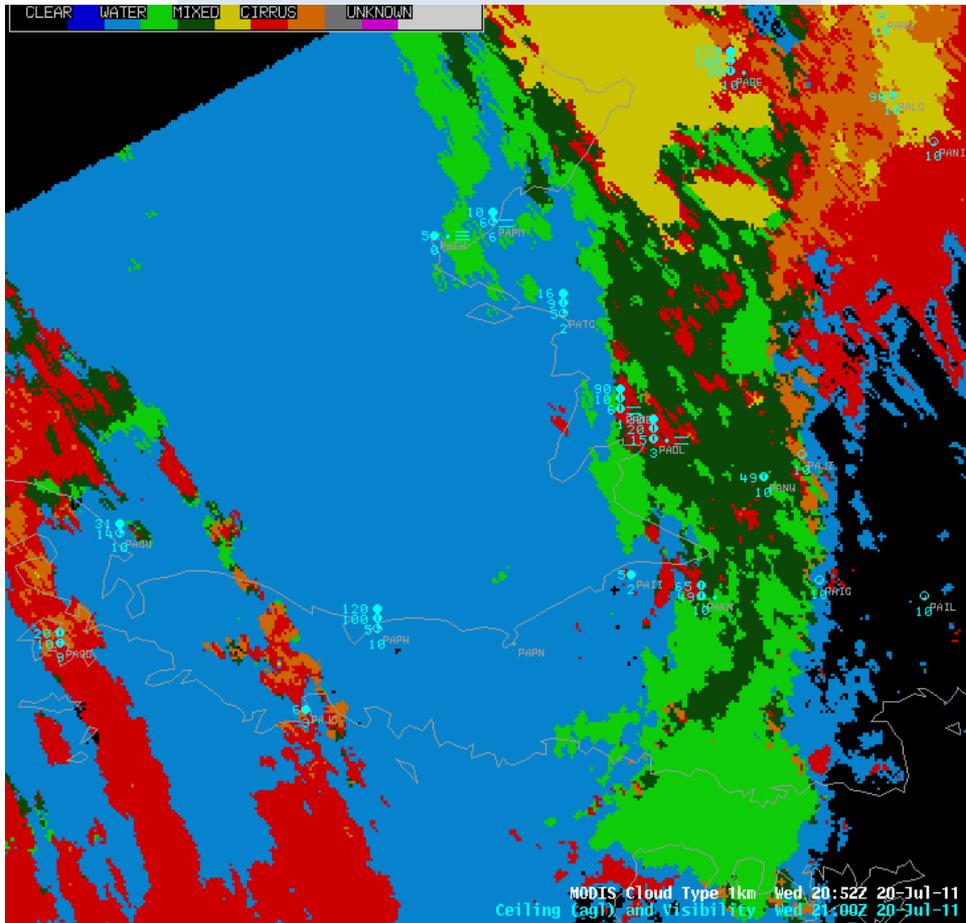
IFR Probability



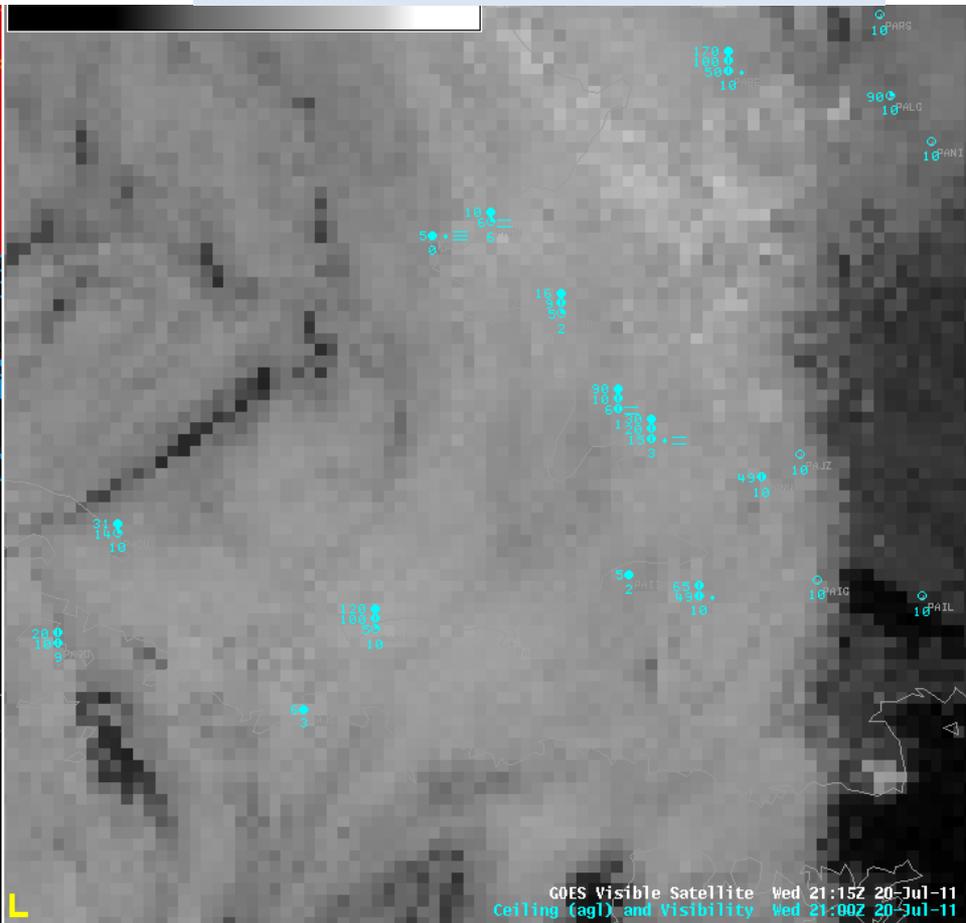
*Location of higher MVFR and IFR probability agree well with surface observations of ceiling*

July 20, 2011 (20:52 UTC)

## Cloud Type



## GOES Visible Image

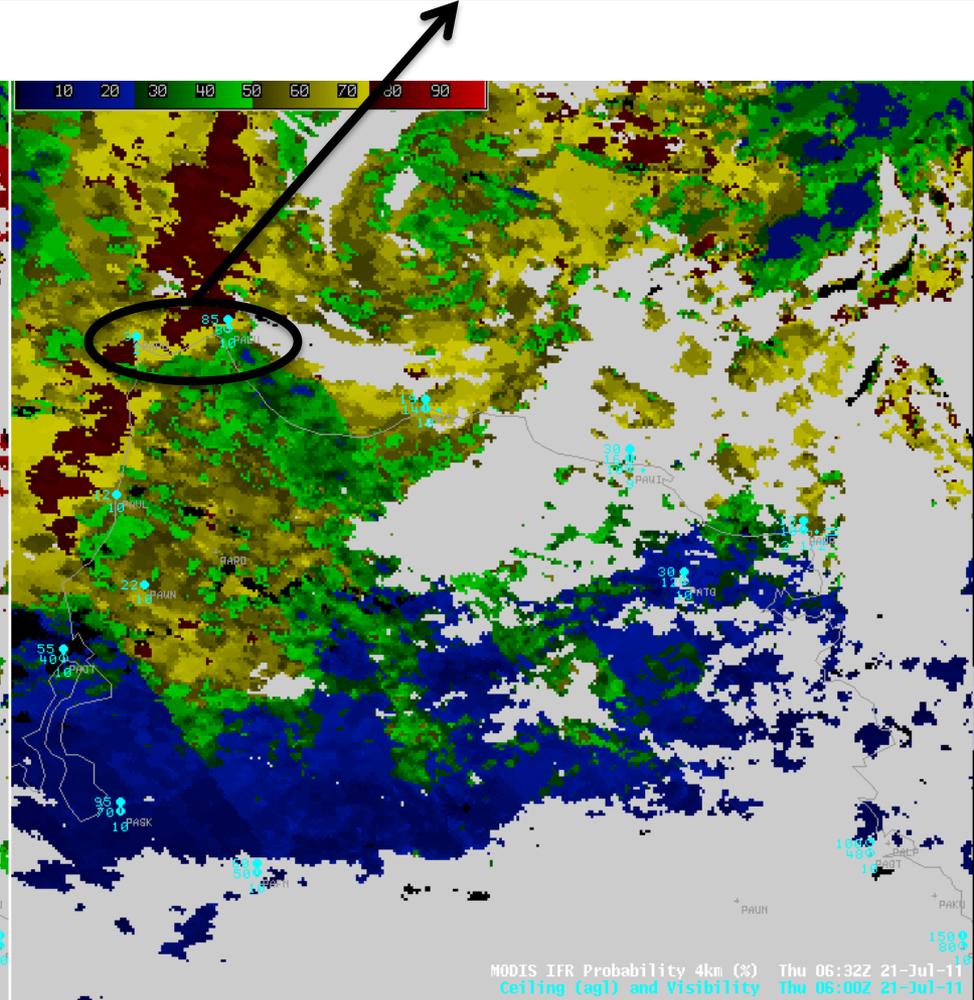
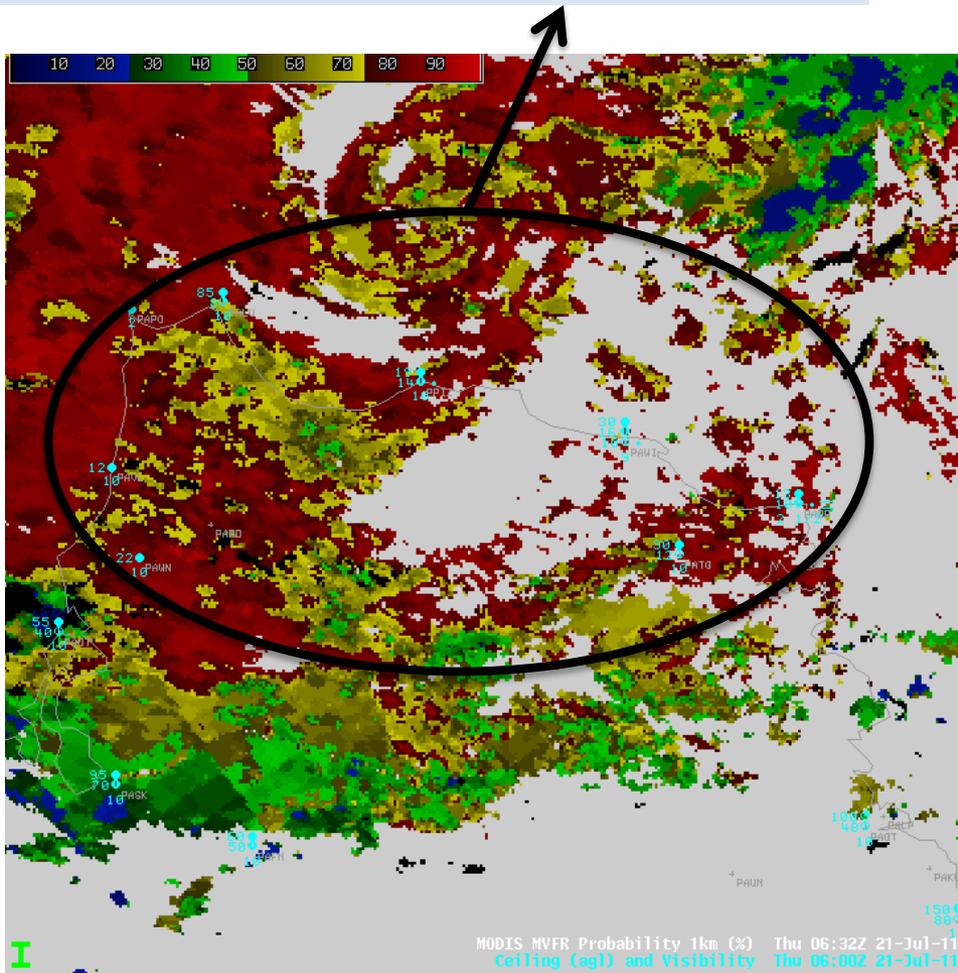


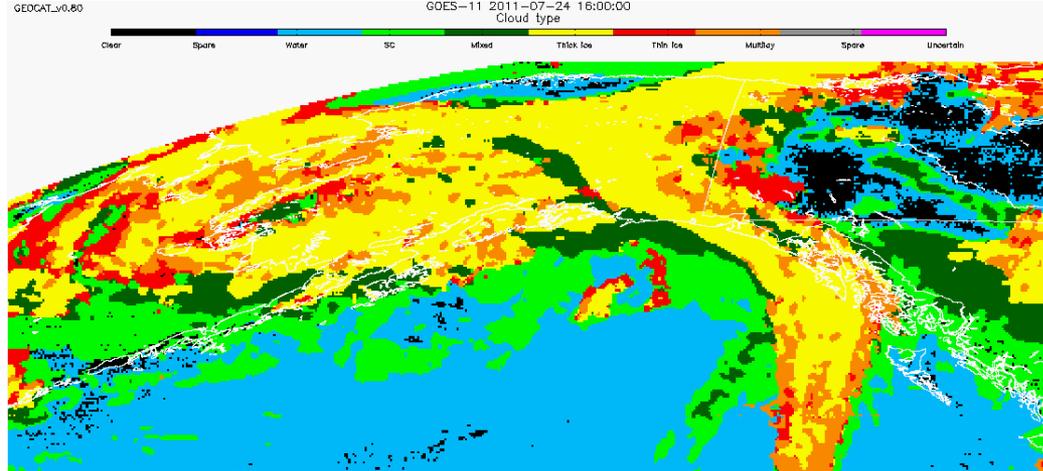
*It is difficult to infer MVFR and IFR conditions (away from surface observations) just using GOES visible imagery.*

July 20, 2011 (06:32 UTC)

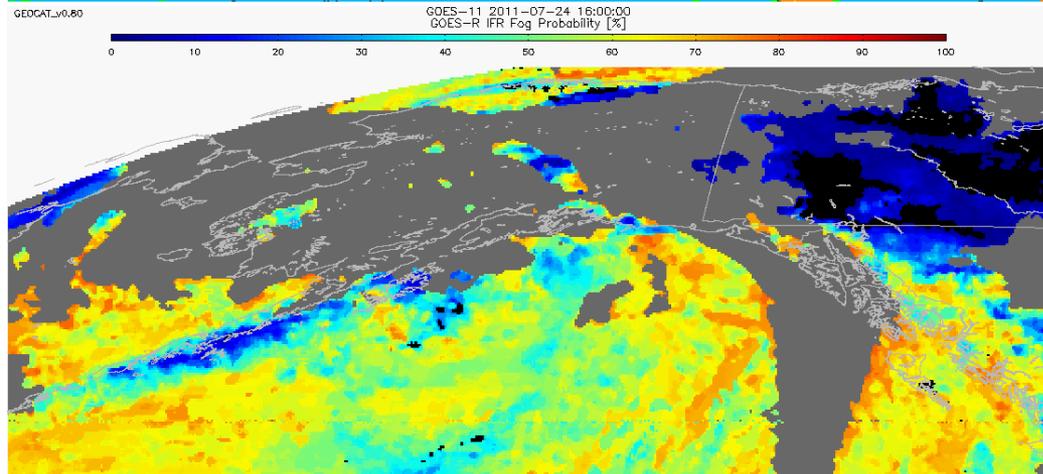
The MVFR probabilities are 80-100% near surface observations of MVFR or lower ceilings, while the MVFR probability is < 50% near surface observations of VFR ceilings.

The only 2 observations of IFR ceilings are co-located with IFR probabilities of 70-80%, while all other surface are co-located with with IFR probabilities of < 55%

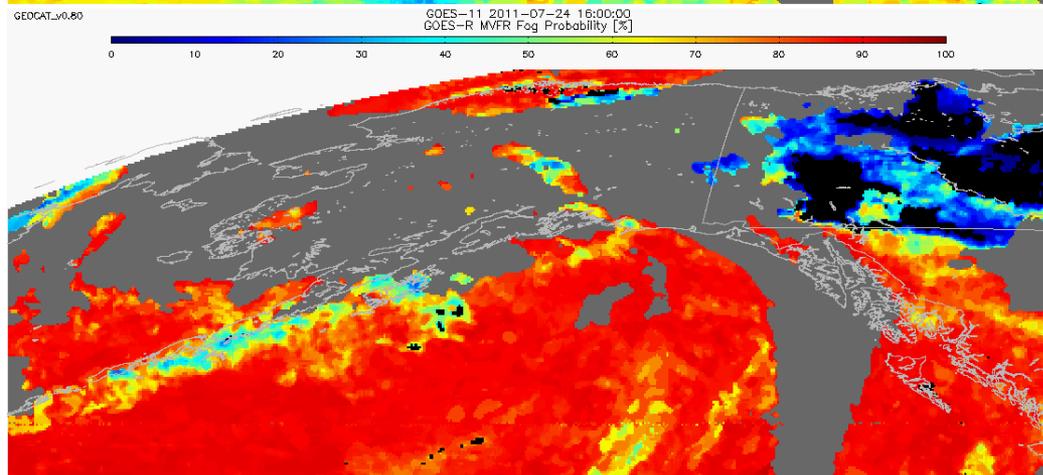




**Cloud Type**



**IFR Probability**



**MVFR Probability**

If interested, the GOES-R fog/low cloud and cloud type products are also available from GOES (albeit with a slightly reduced accuracy compared to MODIS).

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

# Pacific Testbed

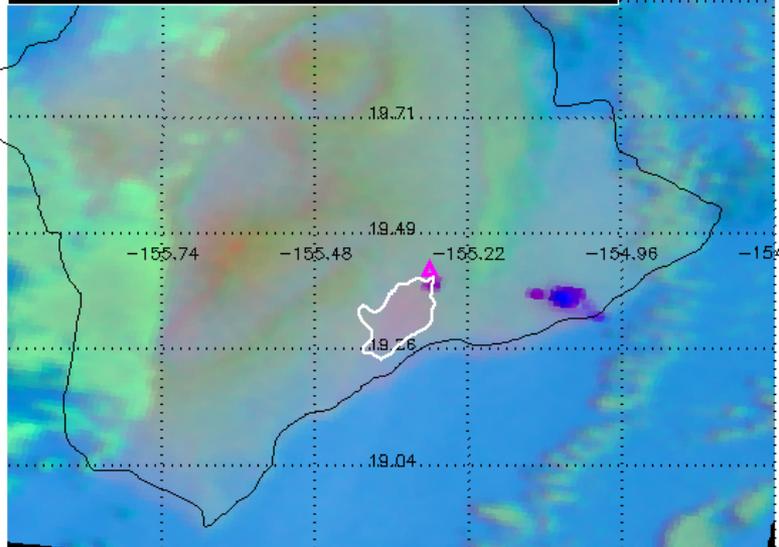
Product	Sensor	Format
Volcanic ash (height, mass loading, and effective radius)	MODIS*	AWIPS
SO <sub>2</sub> (detection and loading)	MODIS*	AWIPS

**The Pacific testbed has not started yet. Eventually GOES Imager volcanic ash products can be made available (if desired).**

*\*Need to gain access to near real-time MODIS data over Pacific Region*

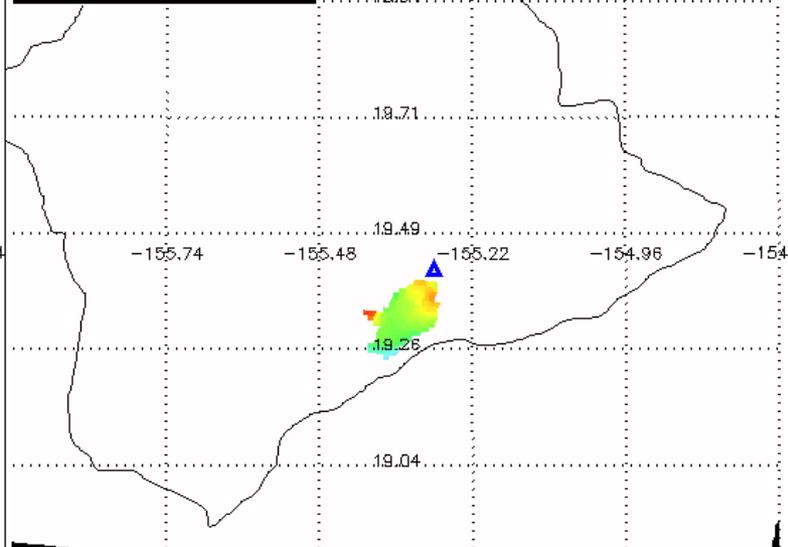
RGB (12-11 $\mu\text{m}$ , 11-3.75 $\mu\text{m}$ , 11 $\mu\text{m}$ )

NOAA-15 AVHRR (06/12/2010 - 14:51 UTC)



Ash Loading

Total Mass: 0.44 kton

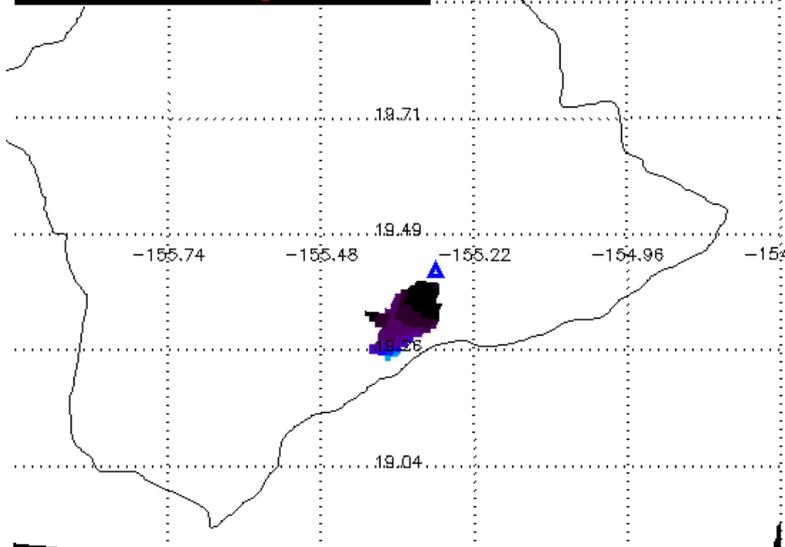


Ash Concentration [ton/km<sup>2</sup>]



Ash Height

Maximum Ash Height: 4.88 km

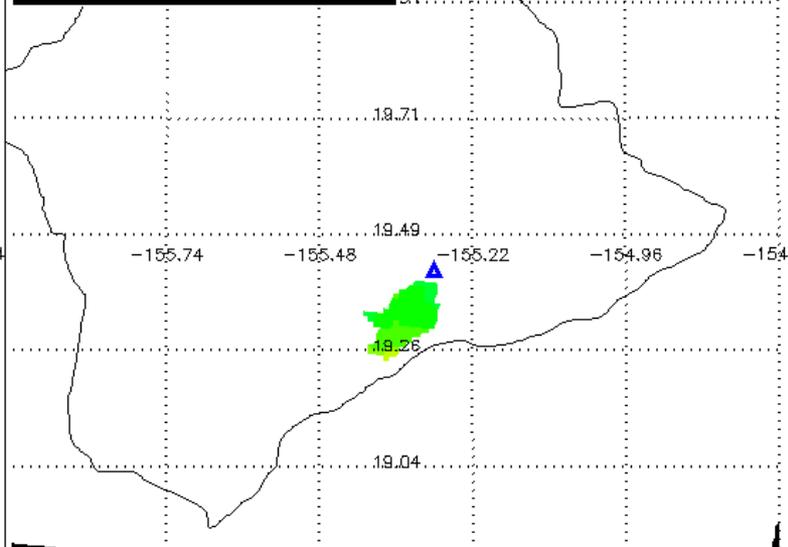


Ash Height [km]



Ash Effective Radius

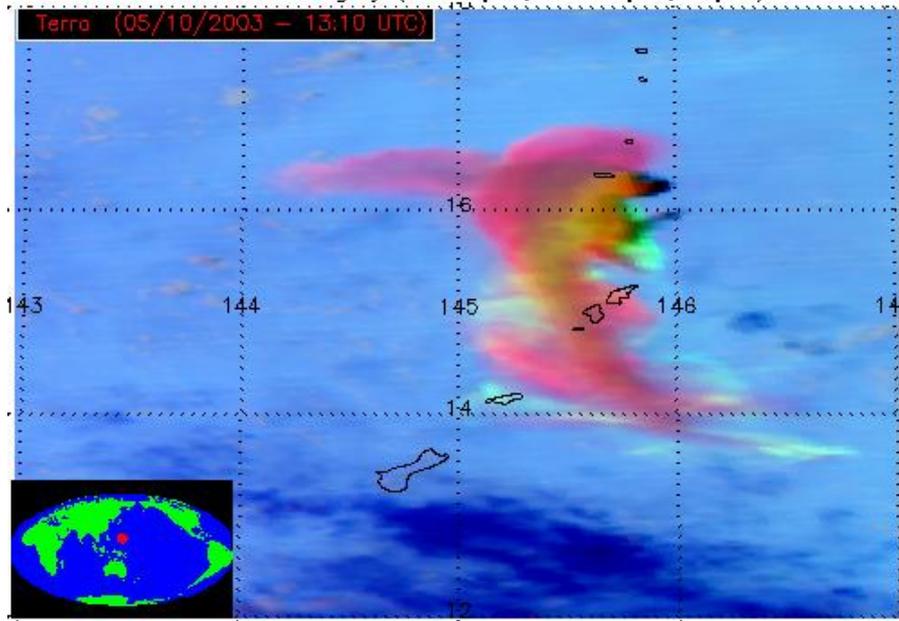
Mean Ash Reff: 4.82 micron



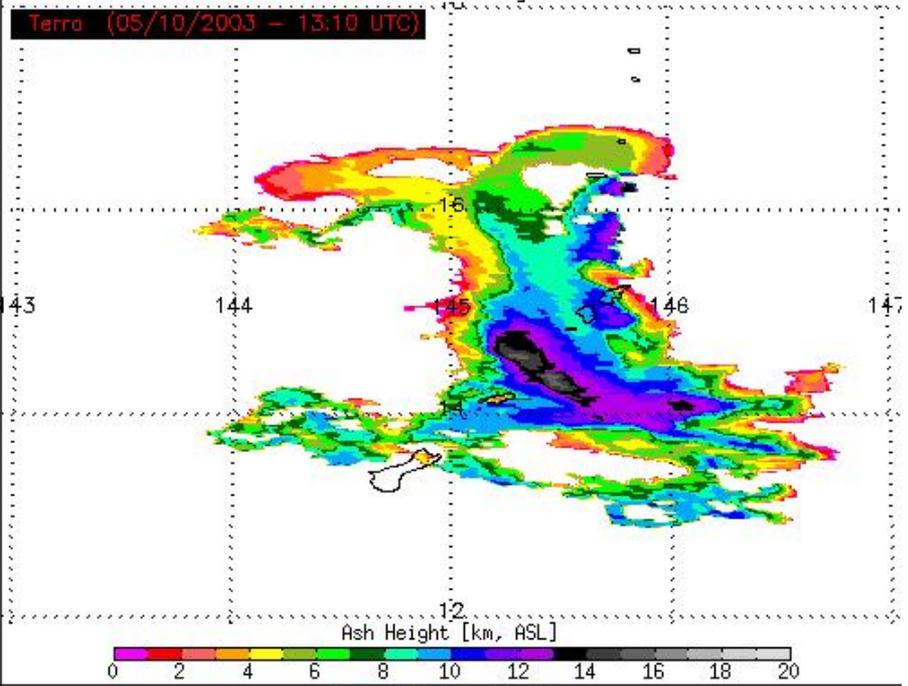
Ash Effective Radius [ $\mu\text{m}$ ]



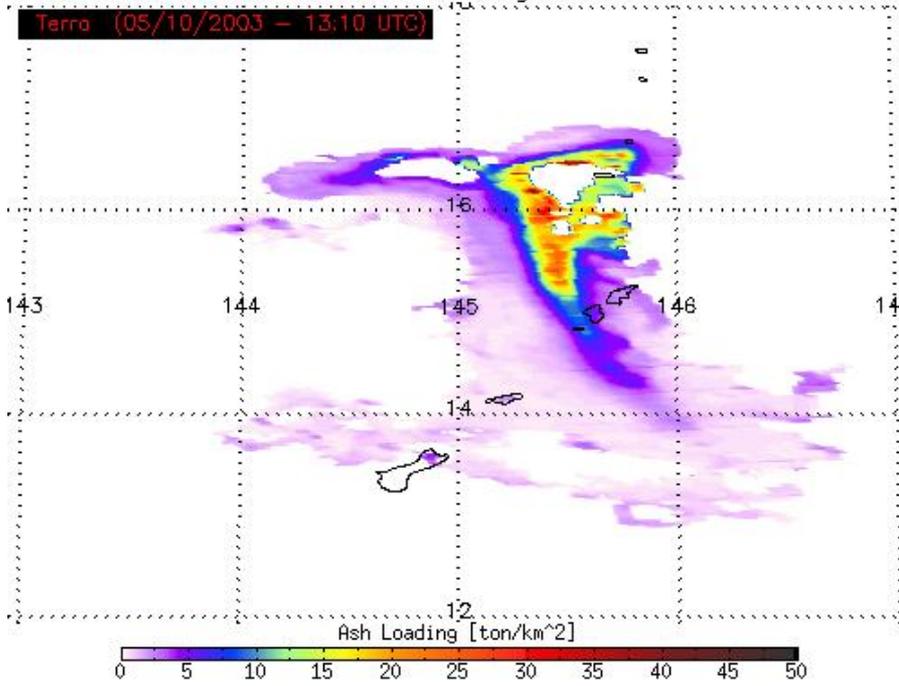
False Color Imagery (12-11 $\mu$ m, 11-8.5 $\mu$ m, 11 $\mu$ m)



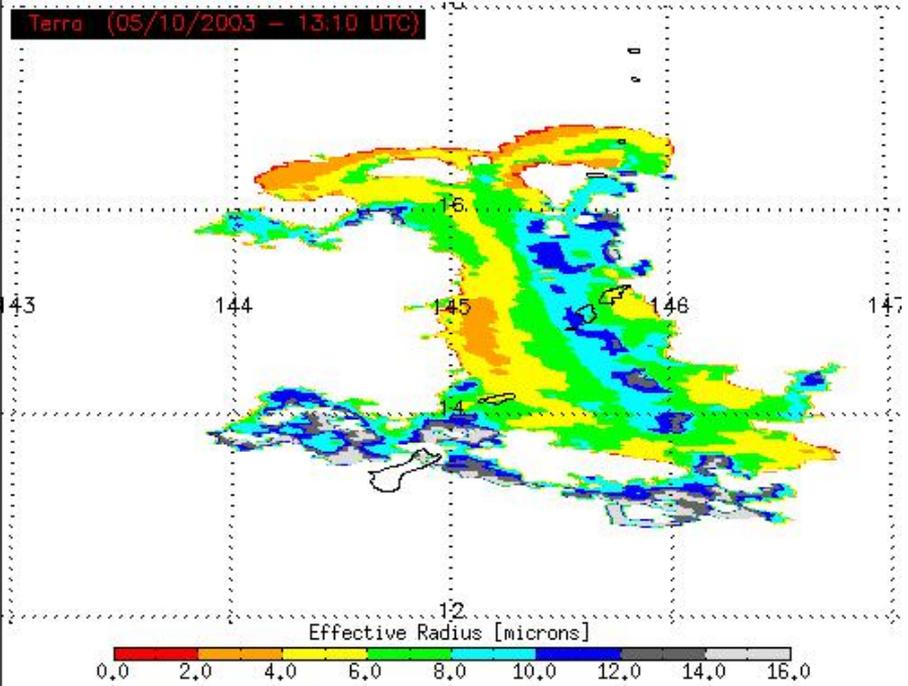
Ash Cloud Height



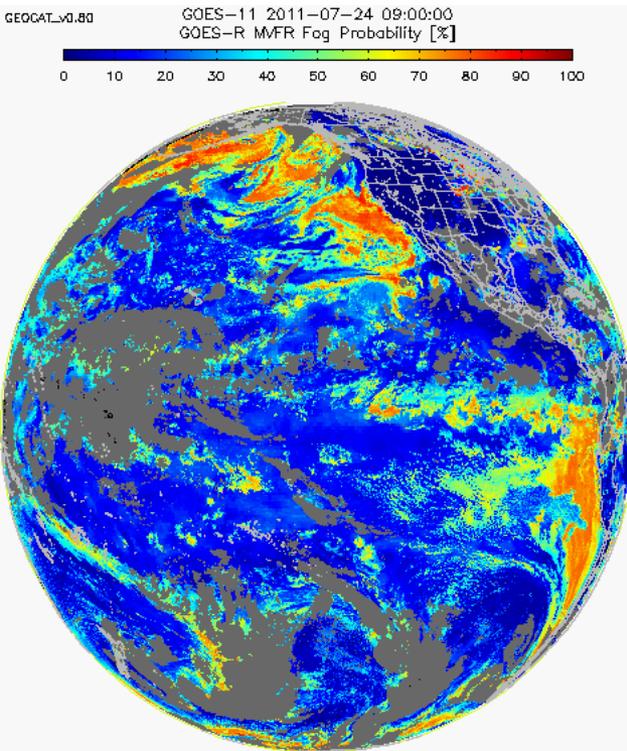
Ash Loading



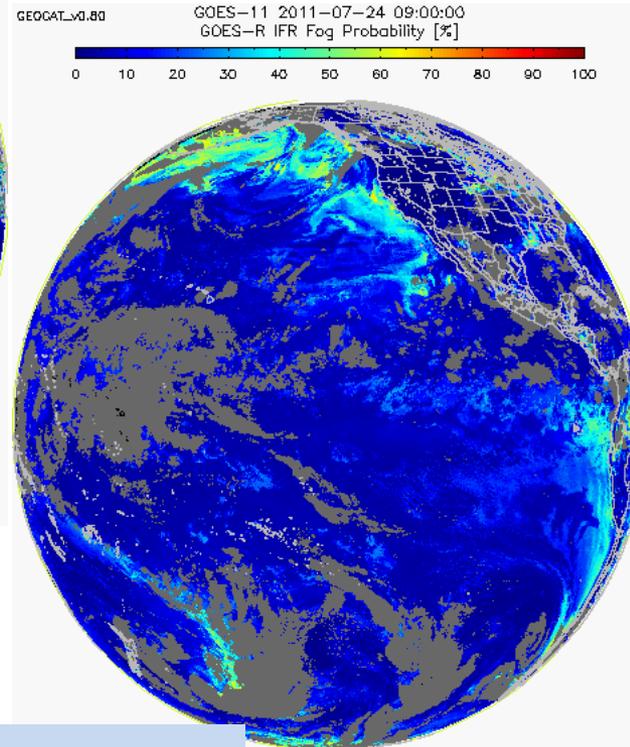
Ash Effective Radius



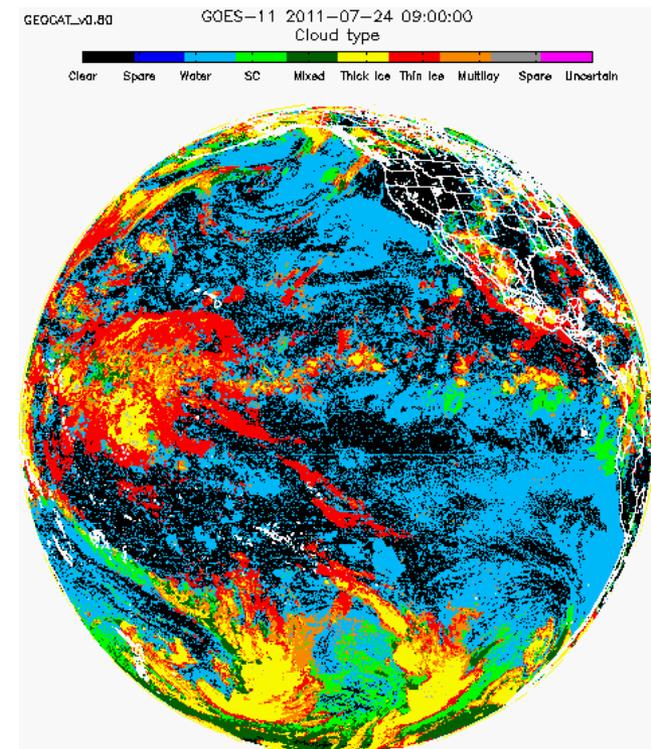
## MVFR Probability



## IFR Probability



## Cloud Type



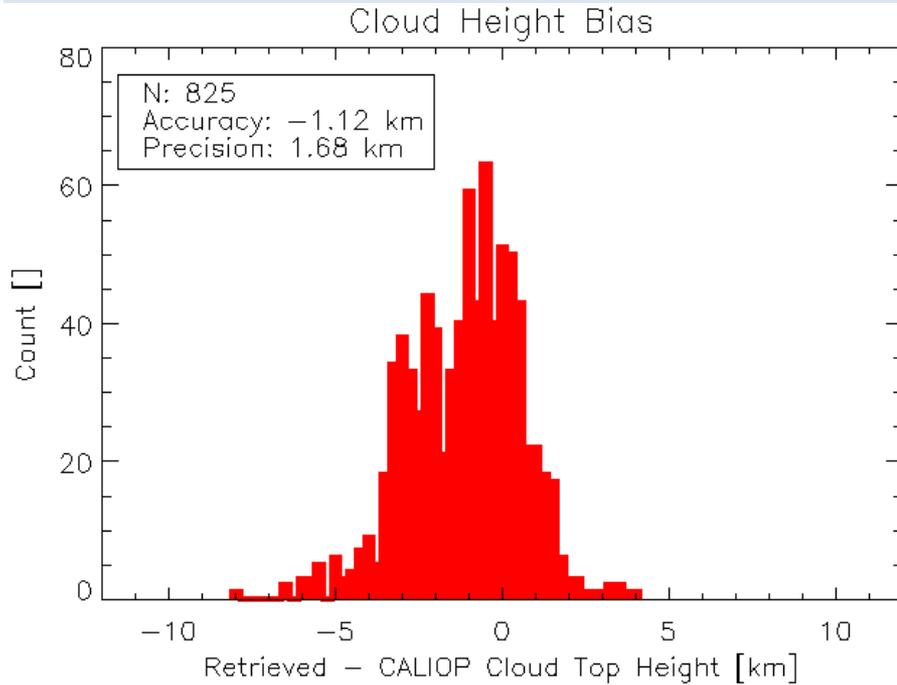
**GOES FLS and cloud type products for Pacific Region are also available, if interested**

# Near-Term Improvements



- **A high resolution (1 km) terrain map will be used to help detect areas where terrain rises into elevated liquid cloud layers thus creating localized MVFR/IFR conditions and to improve MVFR and IFR characterization in smaller-scale valleys.**
- **Additional blending of satellite and NWP will be used to create “all weather” MVFR and IFR probability products (e.g. mitigate overlapping cloud limitation)**
- **Incorporate auto-alert quality probabilistic ash detection algorithm (being developed under GOES-R3)**
- **Probabilistic SO<sub>2</sub> detection**

# Eyjafjallajökull Only (SEVIRI)

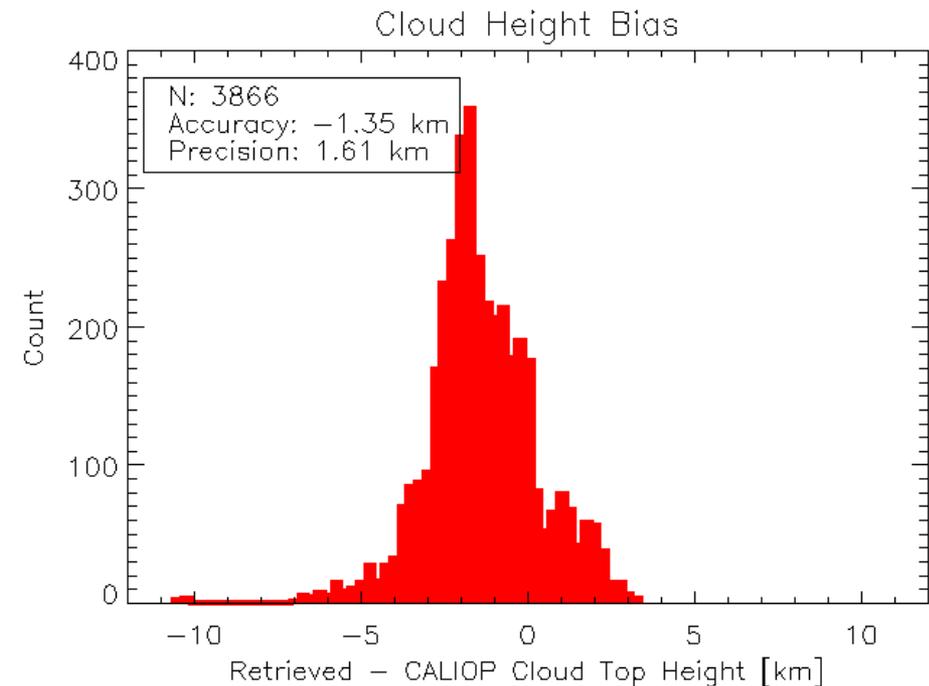


*Nearly all of these observations are of the distal volcanic ash cloud*

• Comparisons to CALIOP indicate that the ash cloud top height estimates are biased low, as expected.

• Infrared retrievals performed at large view angles have a smaller bias

# All Other Cases (MODIS)



# Cloud Type Validation

## Cloud Phase Accuracy

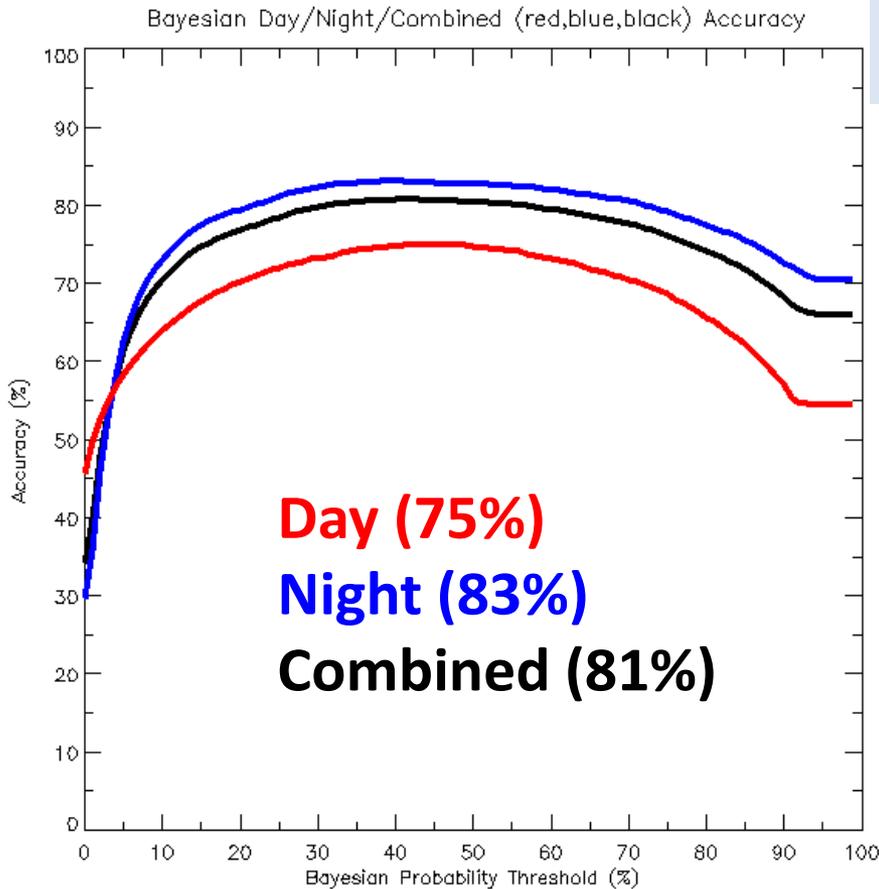
Category	CALIPSO Count	ABI Phase Count	Percent Agree	Percent Disagree
Liquid Water/ Supercooled water	49,642	44,915	90.48%	9.52%
Potentially Mixed Phase	21,434 (not included in total)	?	?%	?%
Ice Phase	45,607	38,693	84.84%	15.16%
Total	95,249	83,608	87.78%	12.22%

## Cloud Type Accuracy

Category	CALIPSO Count	ABI Phase Count	Percent Agree	Percent Disagree
Liquid Water/ Supercooled water	49,642	44,915	90.48%	9.52%
Potentially Mixed Phase	21,434 (not included in total)	?	?%	?%
Optically Thick Ice	5763	4975	86.33%	13.67%
Optically Thin Ice	15,689	9183	58.53%	41.47%
Multilayered Ice	24,155	9570	39.62%	60.38%
Total	95,249	68,643	72.07%	27.93%

# FLS Validation

## Surface Observation Validation



•Objective comparison against surface observations of ceiling and LIDAR measurements of ceiling indicate that the maximum accuracy of the MVFR detection is 81 and 90%, respectively.

## LIDAR Validation

