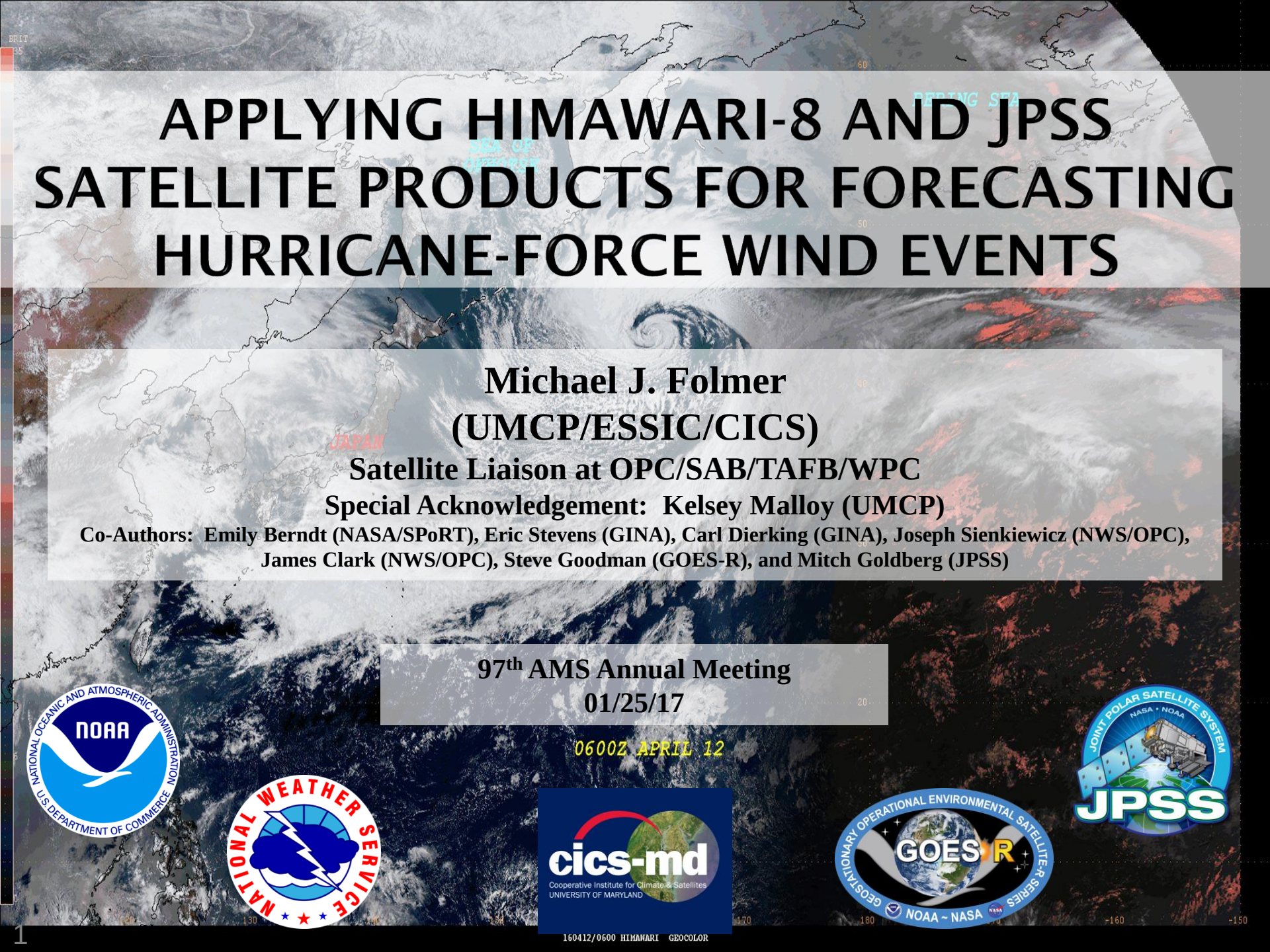
APPLYING HIMAWARI-8 AND JPSS SATELLITE PRODUCTS FOR FORECASTING HURRICANE-FORCE WIND EVENTS

Michael J. Folmer
(UMCP/ESSIC/CICS)
Satellite Liaison at OPC/SAB/TAFB/WPC

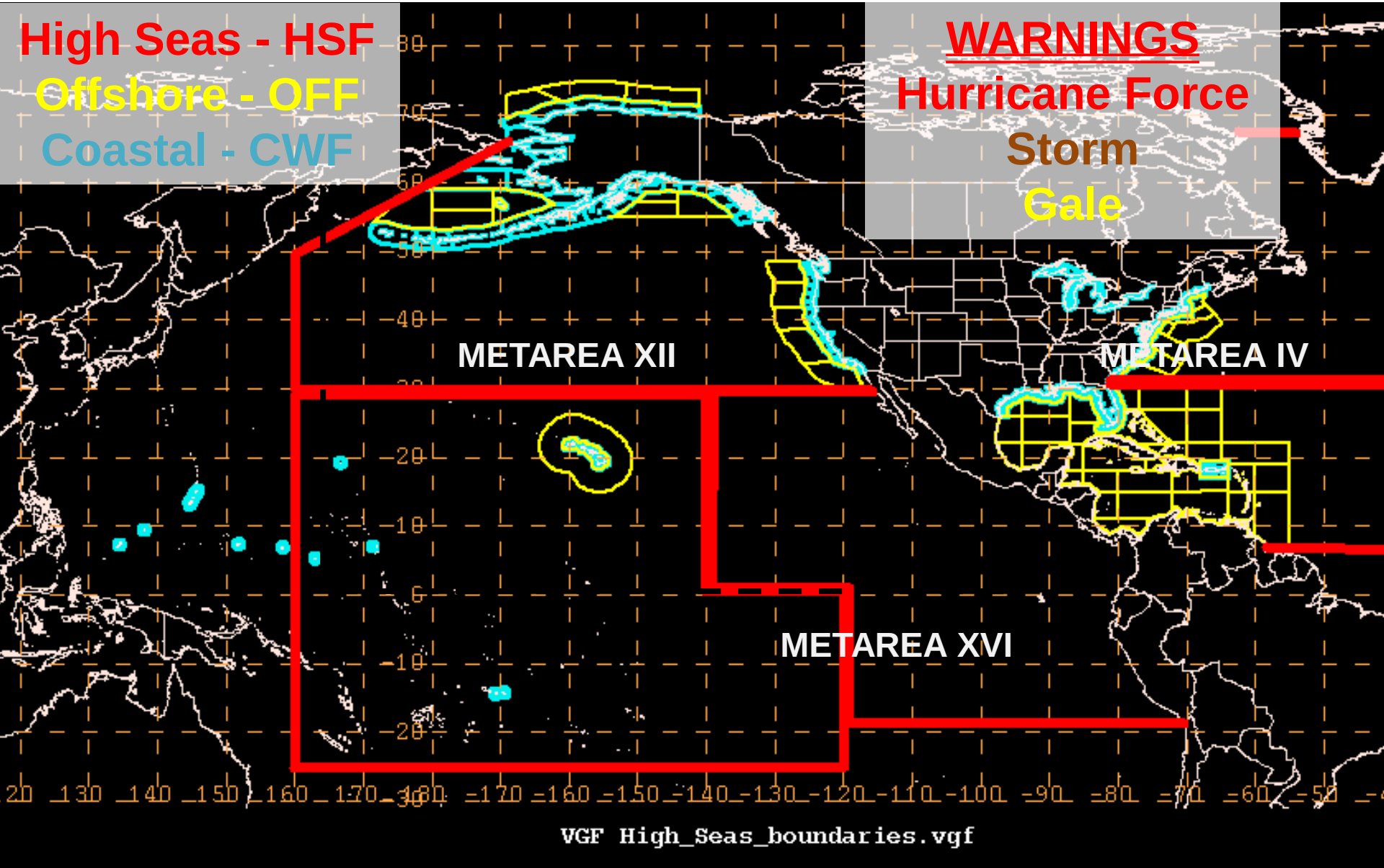
Special Acknowledgement: Kelsey Malloy (UMCP)

Co-Authors: Emily Berndt (NASA/SPoRT), Eric Stevens (GINA), Carl Dierking (GINA), Joseph Sienkiewicz (NWS/OPC), James Clark (NWS/OPC), Steve Goodman (GOES-R), and Mitch Goldberg (JPSS)

97th AMS Annual Meeting
01/25/17



NOAA/NWS Marine Responsibility

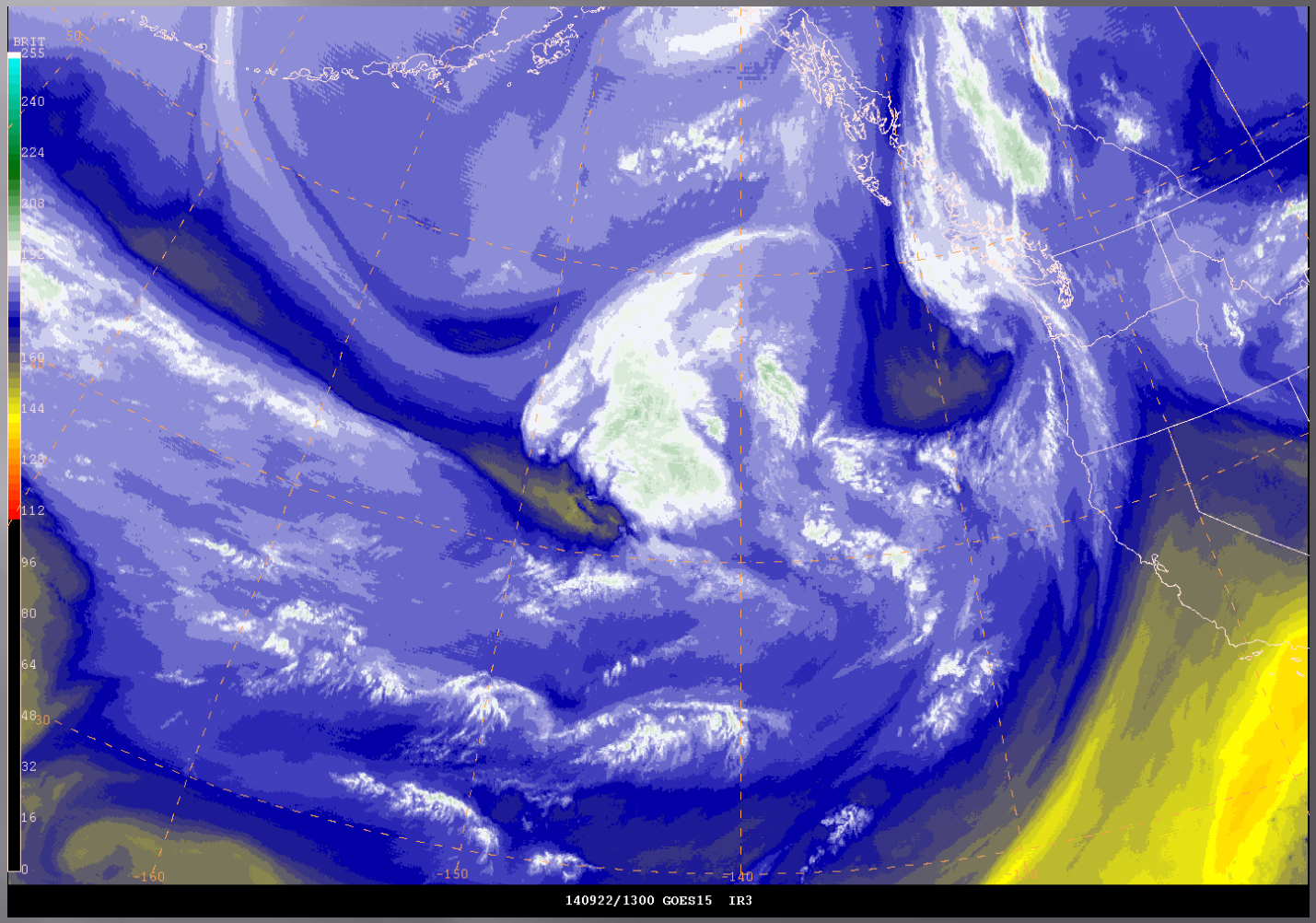


Motivation

- The Ocean Prediction Center (OPC) and Alaska Region have large, data sparse domains.
- New satellites (Himawari-8 and GOES-16) are or will be integrated into current forecast operations.
- New polar products such as Hyperspectral Infrared Soundings are being introduced to forecasters to better assess the synoptic to mesoscale environments.
  - AIRS
  - IASI
  - CrIS/ATMS processed through the NOAA Unique Combined Atmospheric Processing System (NUCAPS),
- This project seeks to improve forecaster identification of the onset of a hurricane-force wind event as it relates to OPC high seas and Alaska Region nearshore forecast responsibilities.

OPC Decision Process

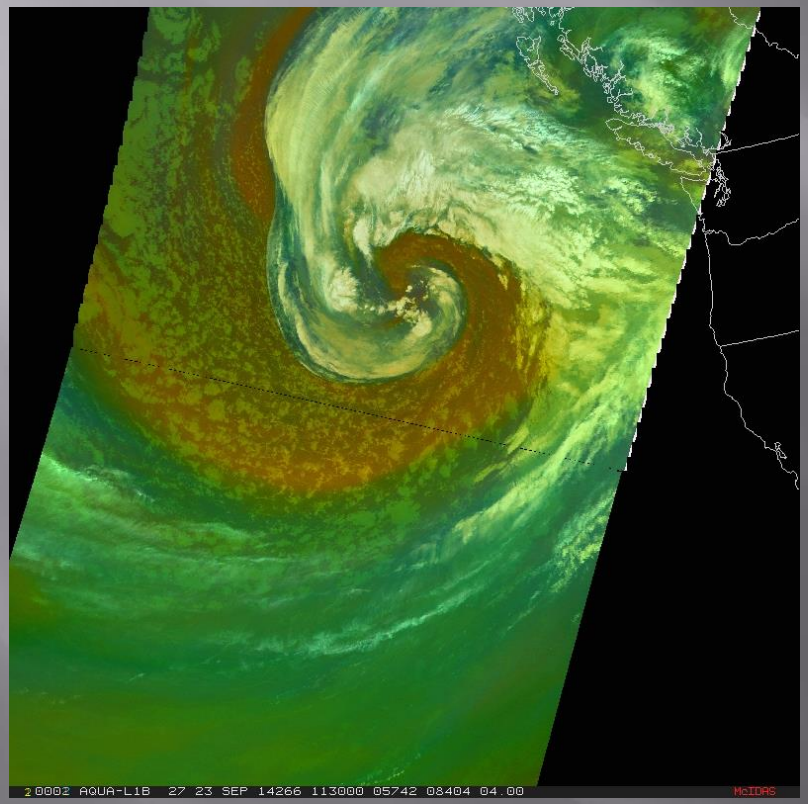
GOES-15 WV: Hurricane-Force Low on 09/23/14



OPC Decision Process

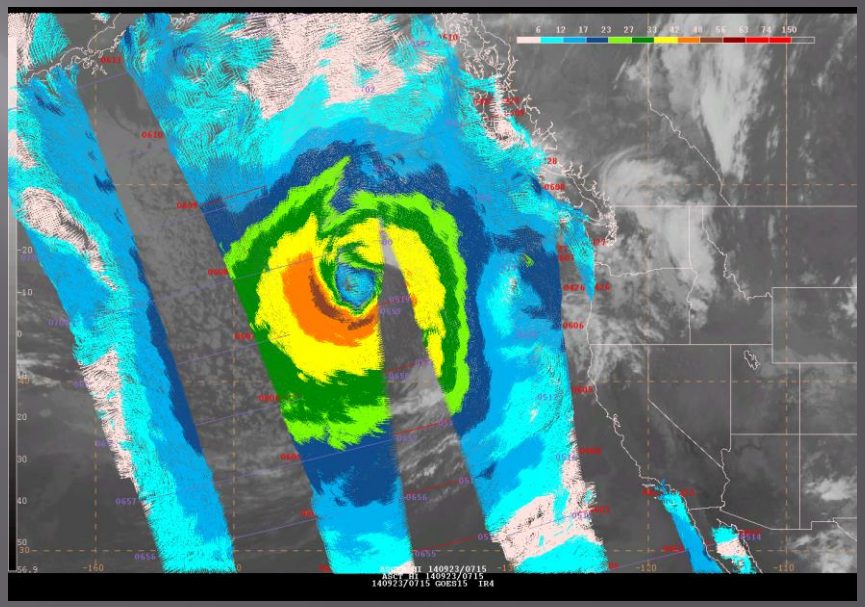
Hurricane-Force Low 1130 UTC on 09/23/14

MODIS AIR MASS RGB



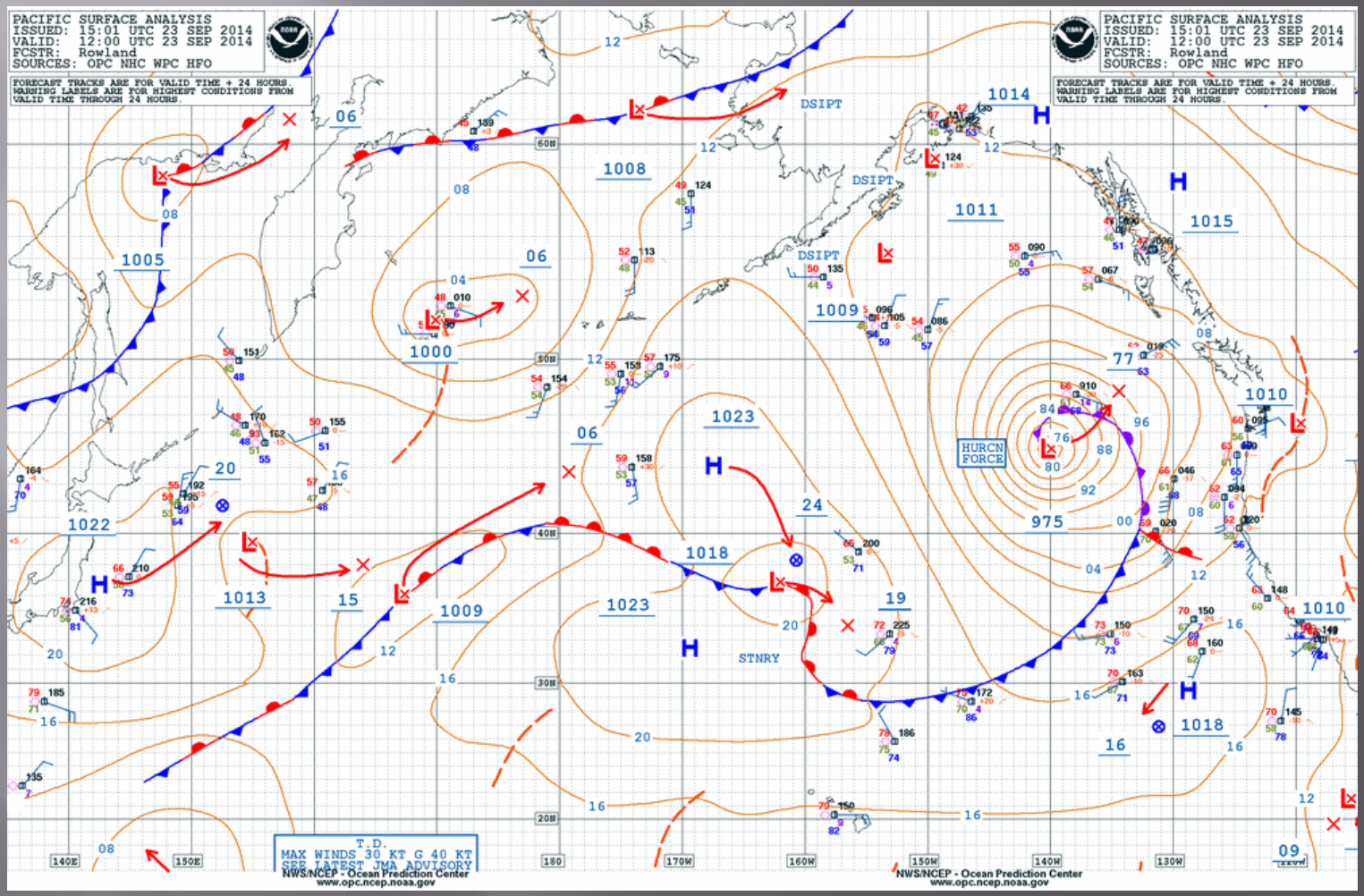
Courtesy of NASA SPoRT

ASCAT WINDS ON
GOES-15 INFRARED



OPC Surface Analysis

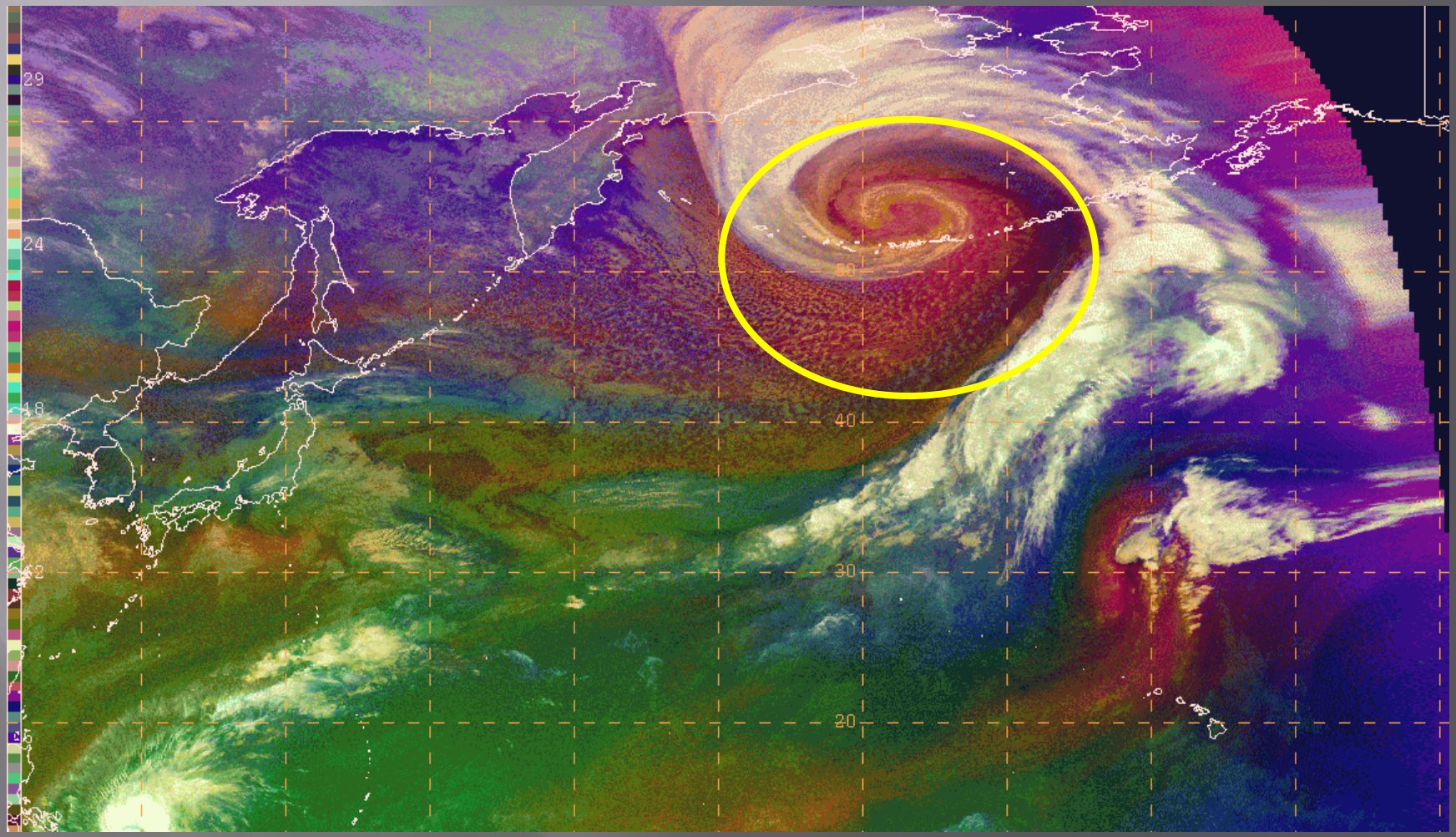
Hurricane-Force Low valid at 1200 UTC on 09/23/14



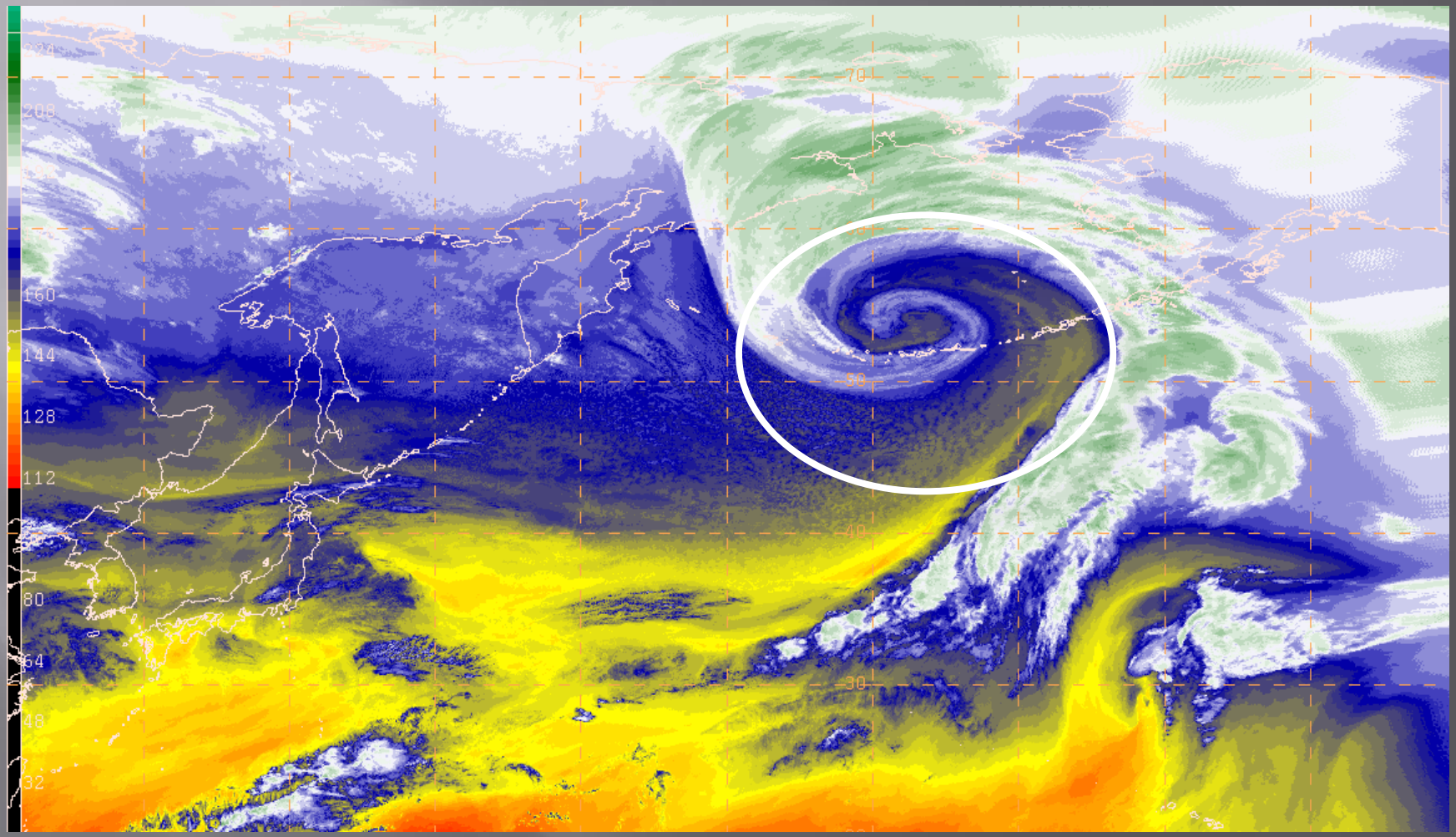
MPS PG Collaboration with AK Region

- First case study is the Adak Island, AK (Aleutian Islands) extreme wind event in mid-December 2015.
  - Winds sustained around 87 mph with a gust to 122 mph
  - Central pressure: 924 mb
- Mallory Cato (SLU) compared NUCAPS, AHI WV bands, Air Mass RGB, and Ozone products to identify the precursors to this extreme event.
- Other storms will be added using the OPC Story map (50 hurricane-force NPAC systems in the 2015-2016 winter).

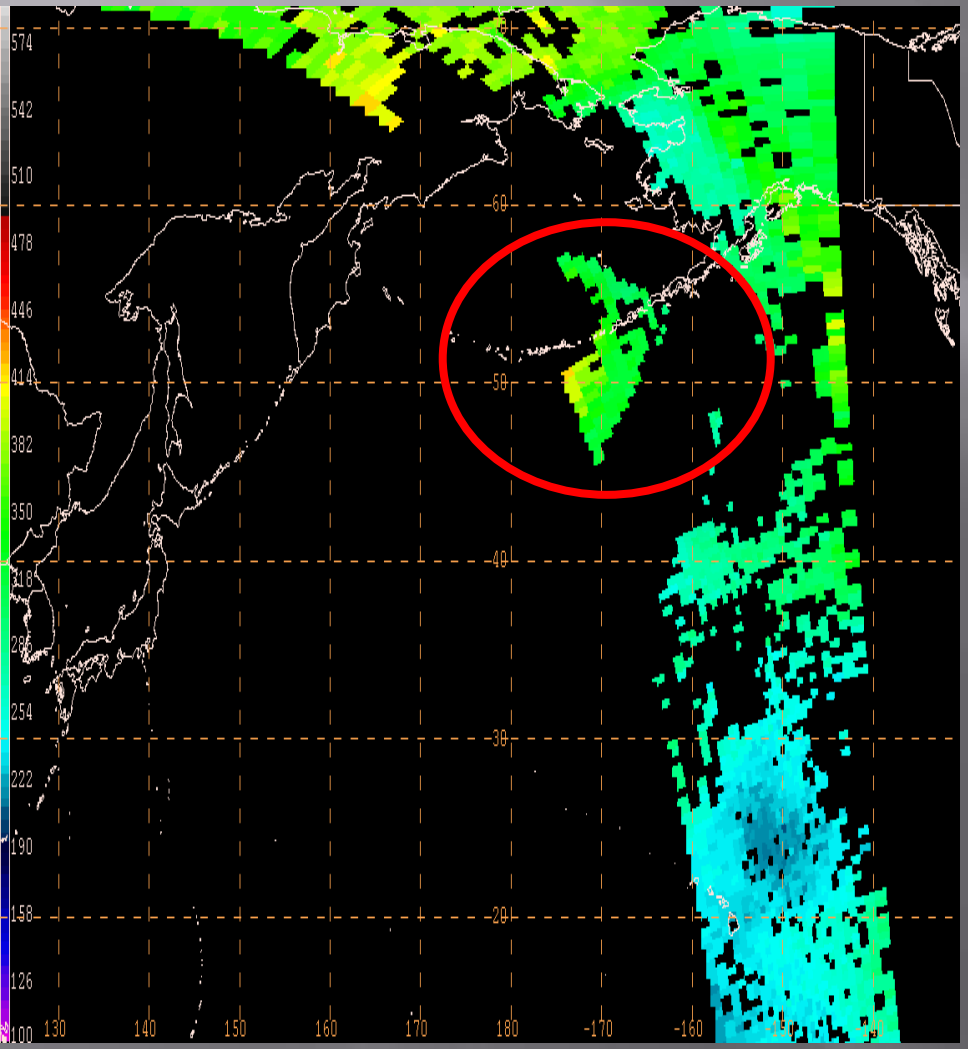
Warm Core Seclusion
Dec 13 06Z Himawari Airmass

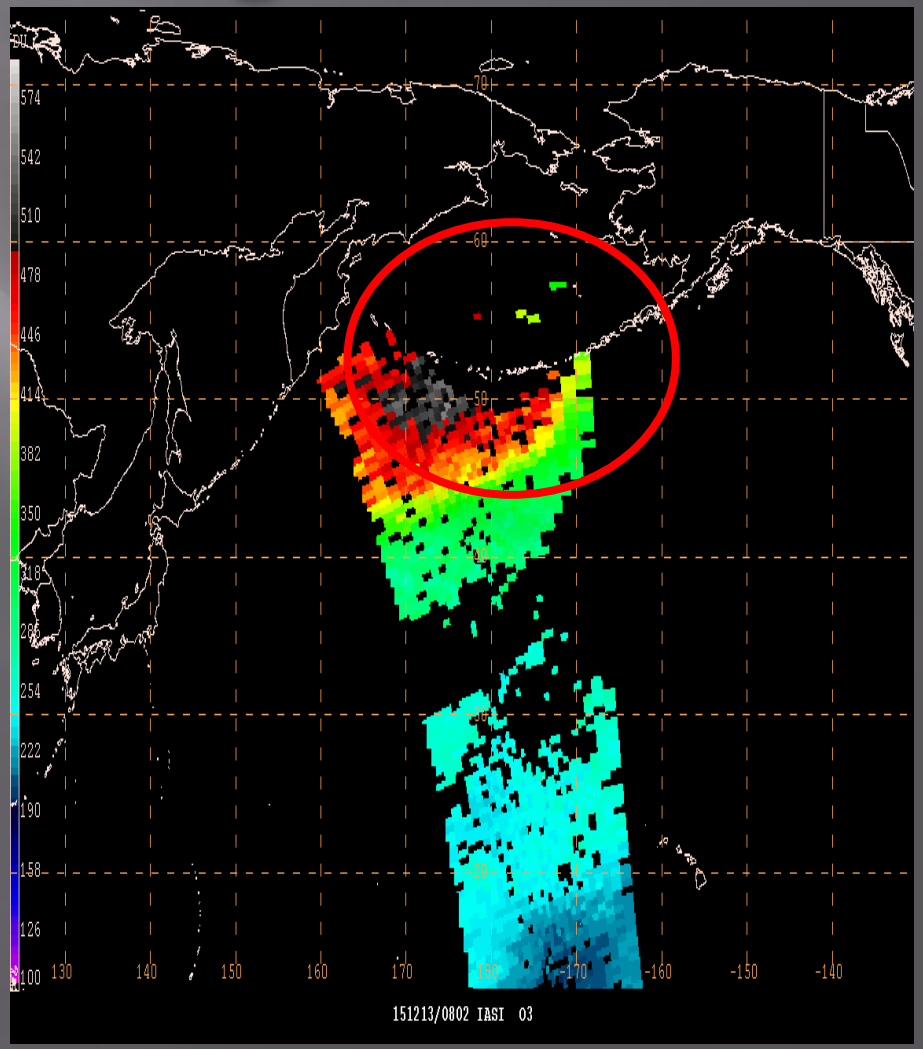


Himawari 7.3µm WV-Low-Level
Dec 13 06Z

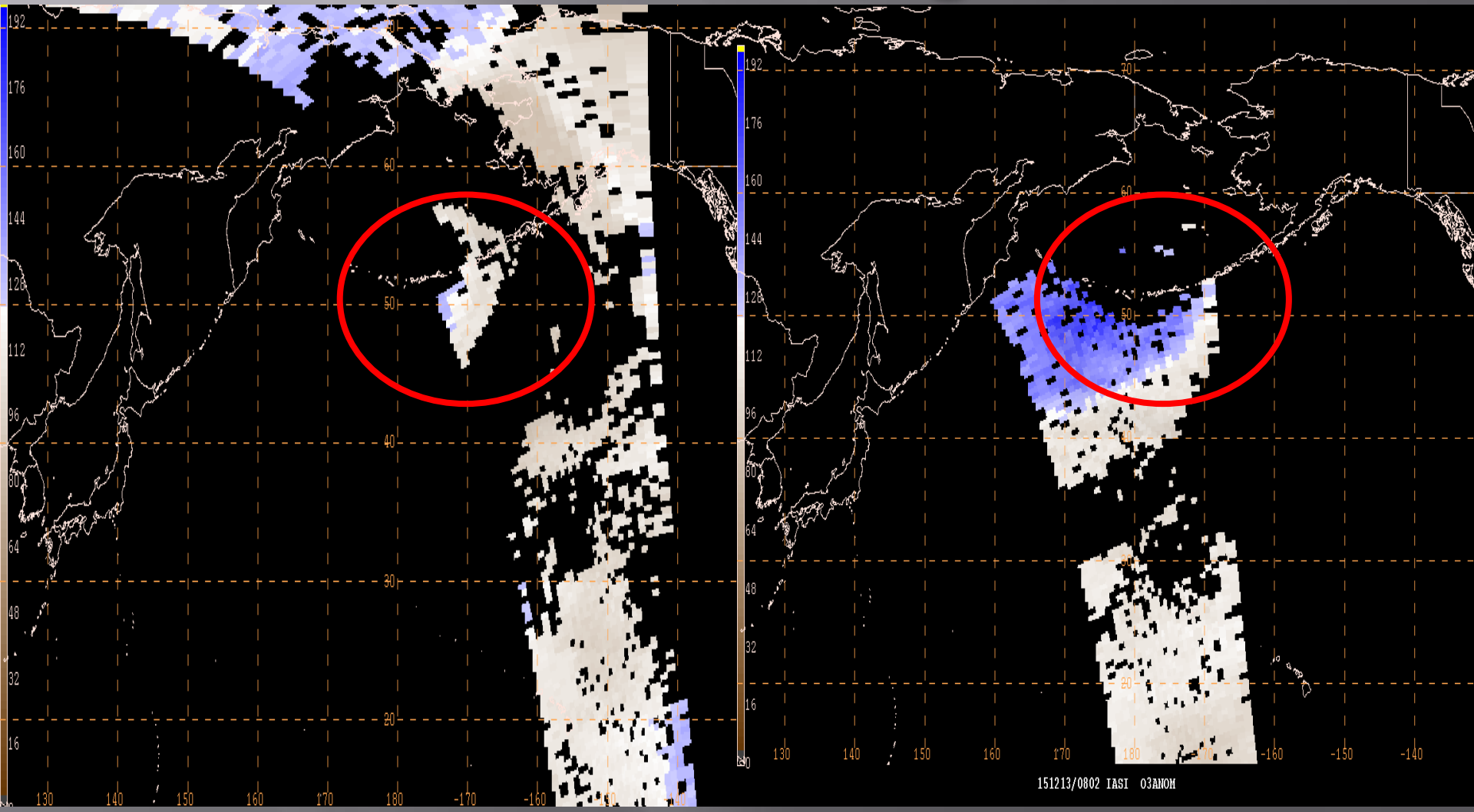


IASI Total Column Ozone Dec 13 0702Z (left) and 0802Z (right)





IASI Ozone Anomaly Dec 13 0702Z (left) and 0802Z (right)



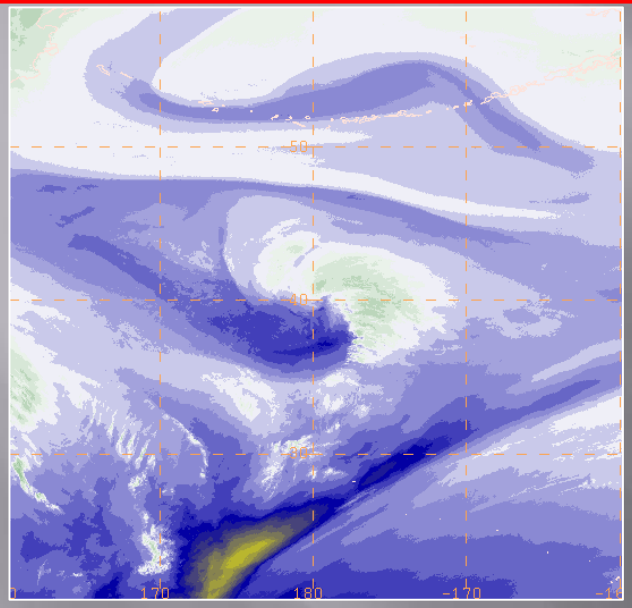
Research Question
From: Kelsey Malloy's Senior Thesis

How can integrating satellite data imagery and derived products help forecasters improve prognosis of rapid cyclogenesis and hurricane-force wind events?

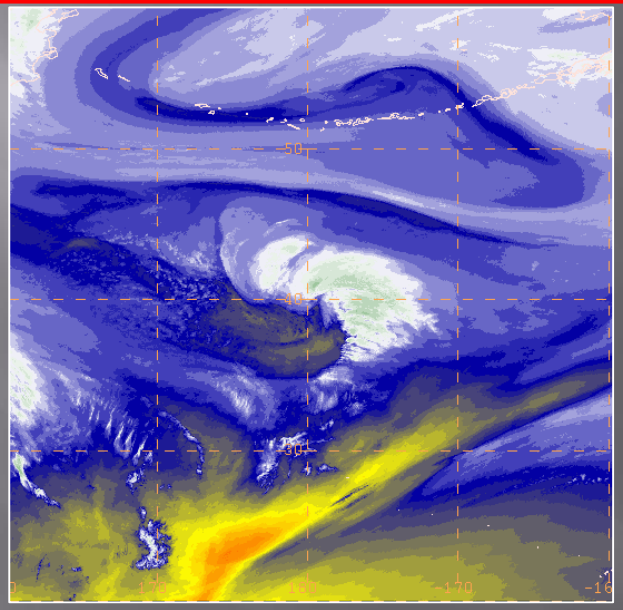
Phase I – Identifying stratospheric air intrusions

- Water Vapor – 6.2, 6.9, 7.3 μm channels
- Airmass RGB Product
- AIRS, IASI, NUCAPS total column ozone & ozone anomaly
- ASCAT (A/B) and AMSR wind data

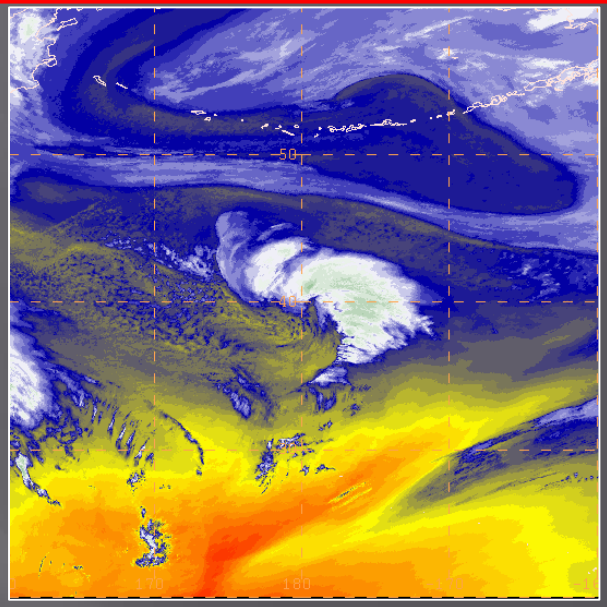
Himawari-8 Water Vapor



Upper-layer
- 6.2 µm channel
- Peak response at ~350 mb



Middle-layer
- 6.9 µm channel
- Peak response at ~450 mb



Lower-layer
- 7.3 µm channel
- Peak response at ~650 mb

Brightness Temp:

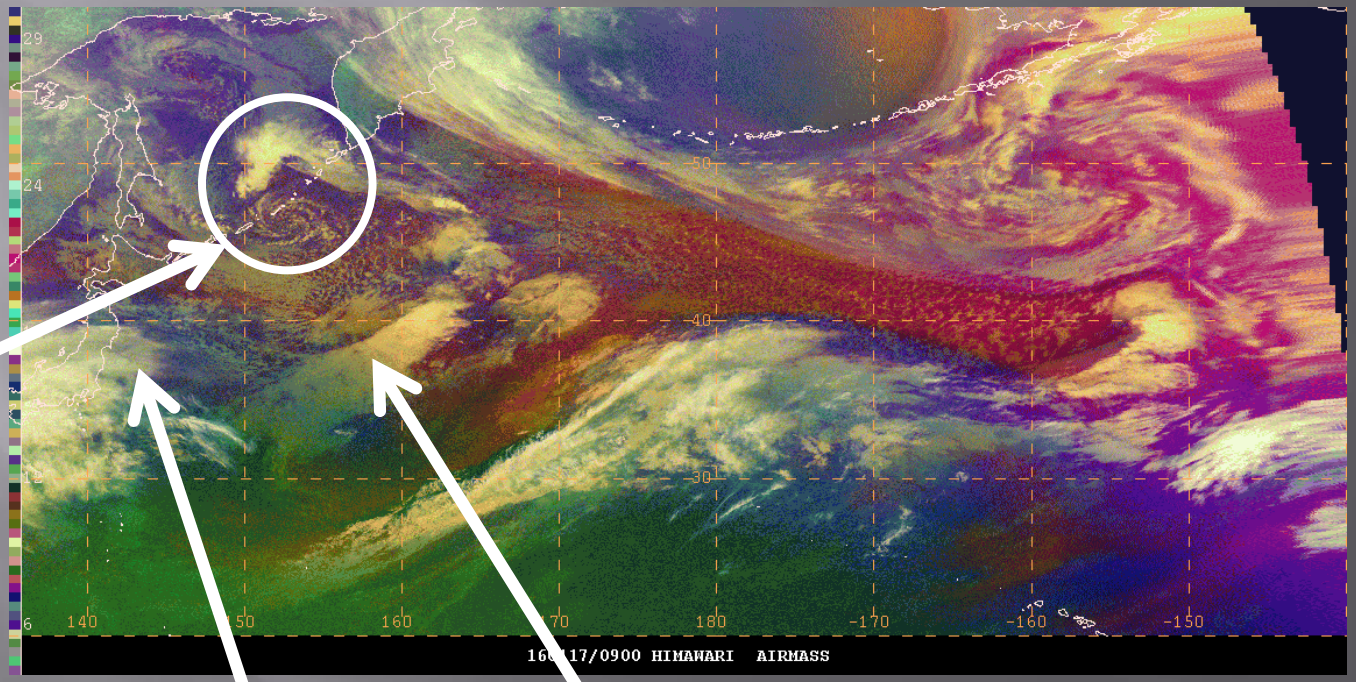
Cooler
"high moisture"

Warmer
"low moisture"

Winter Underdog: Early Features

17 Jan 0900 UTC

Airmass RGB



"old" vorticity

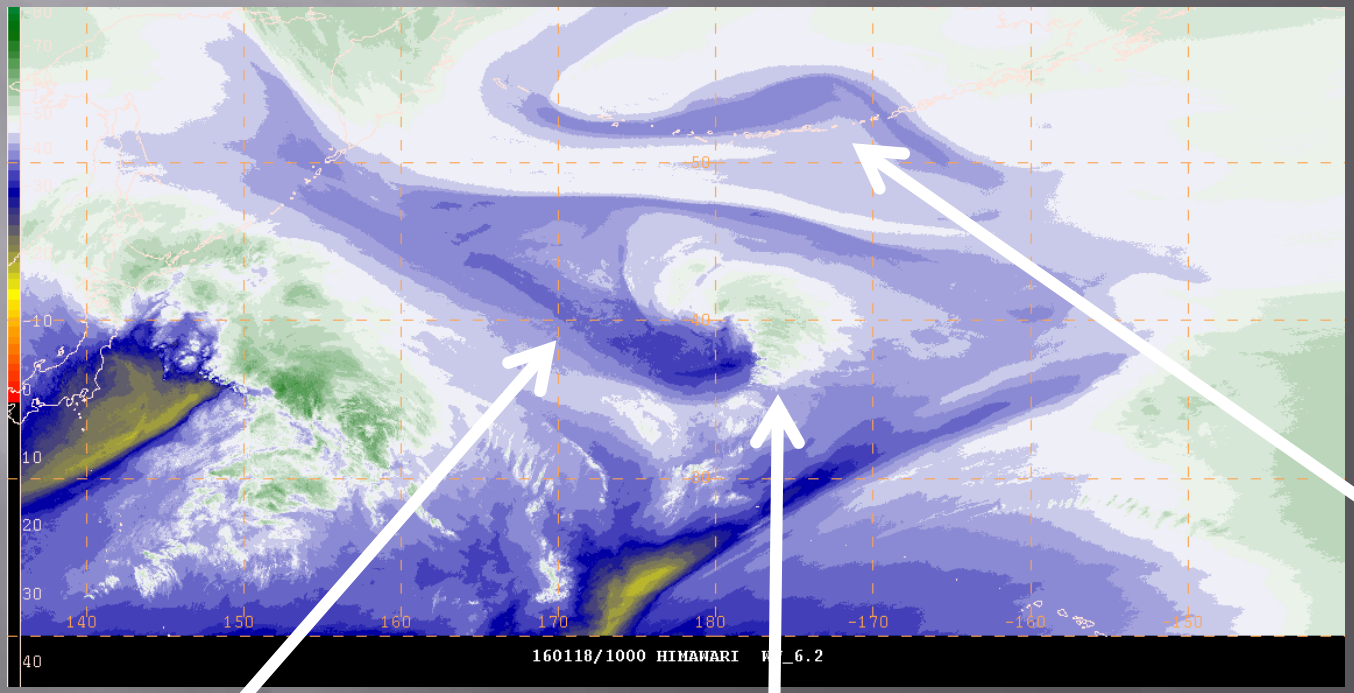
Latent heat energy from this system

Intrusion and cloud development begin

Winter Underdog: Rapid Development

18 Jan 1000 UTC

WV upper-level



Vortex lobe

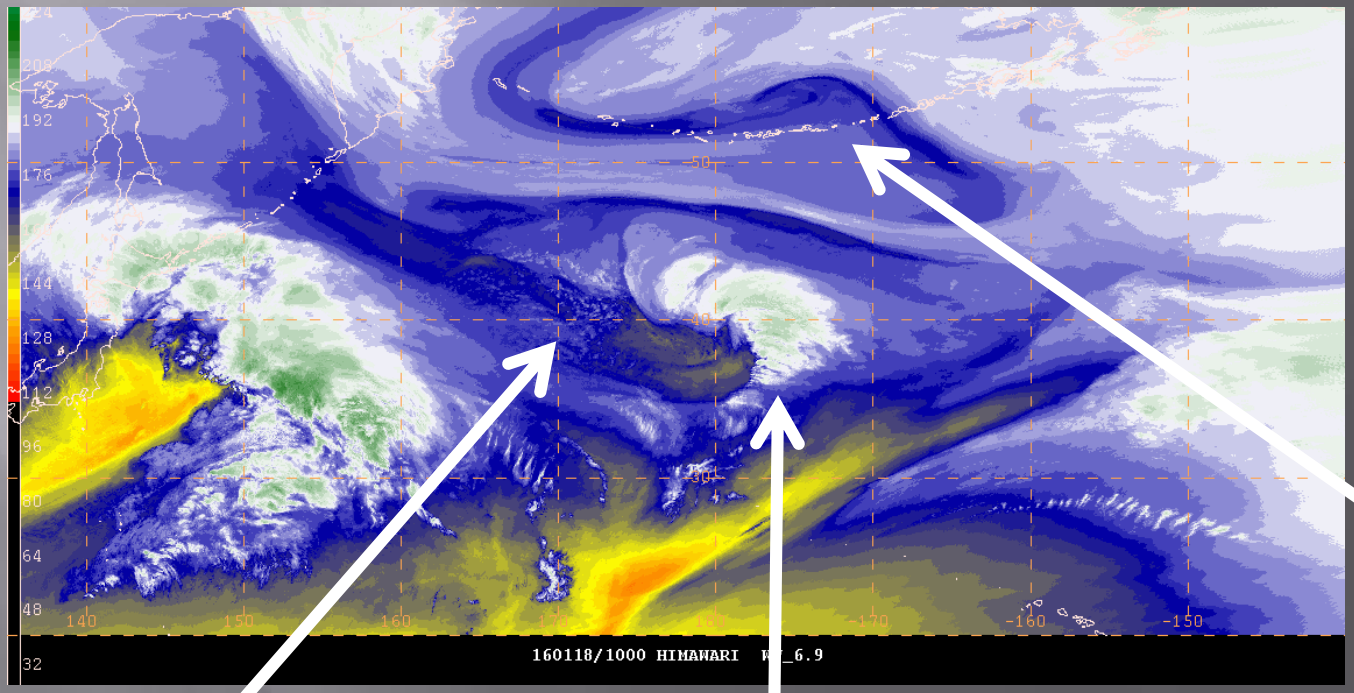
stream of dry air still feeding system

Comma cloud develops

Winter Underdog: Rapid Development

18 Jan 1000 UTC

WV middle-level



Vortex lobe

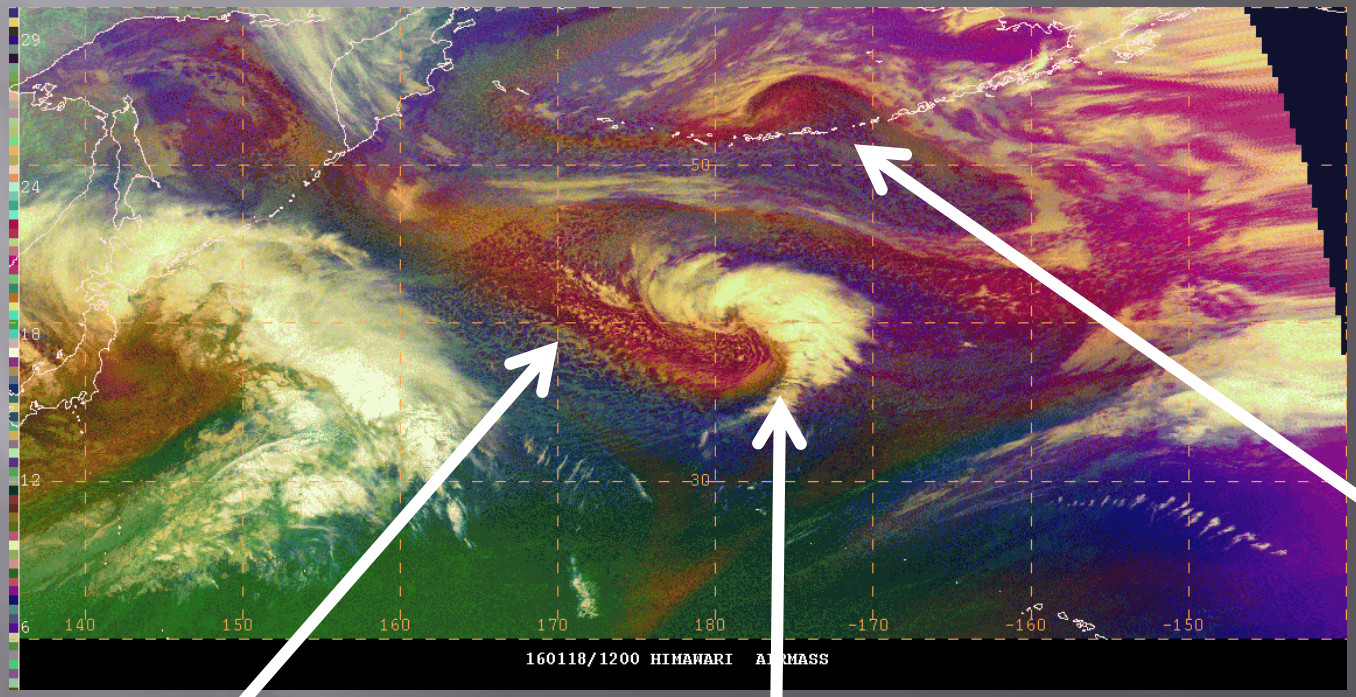
stream of dry air still feeding system

Comma cloud develops

Winter Underdog: Rapid Development

18 Jan 1200 UTC

Airmass RGB



Vortex lobe

stream of dry air still feeding system

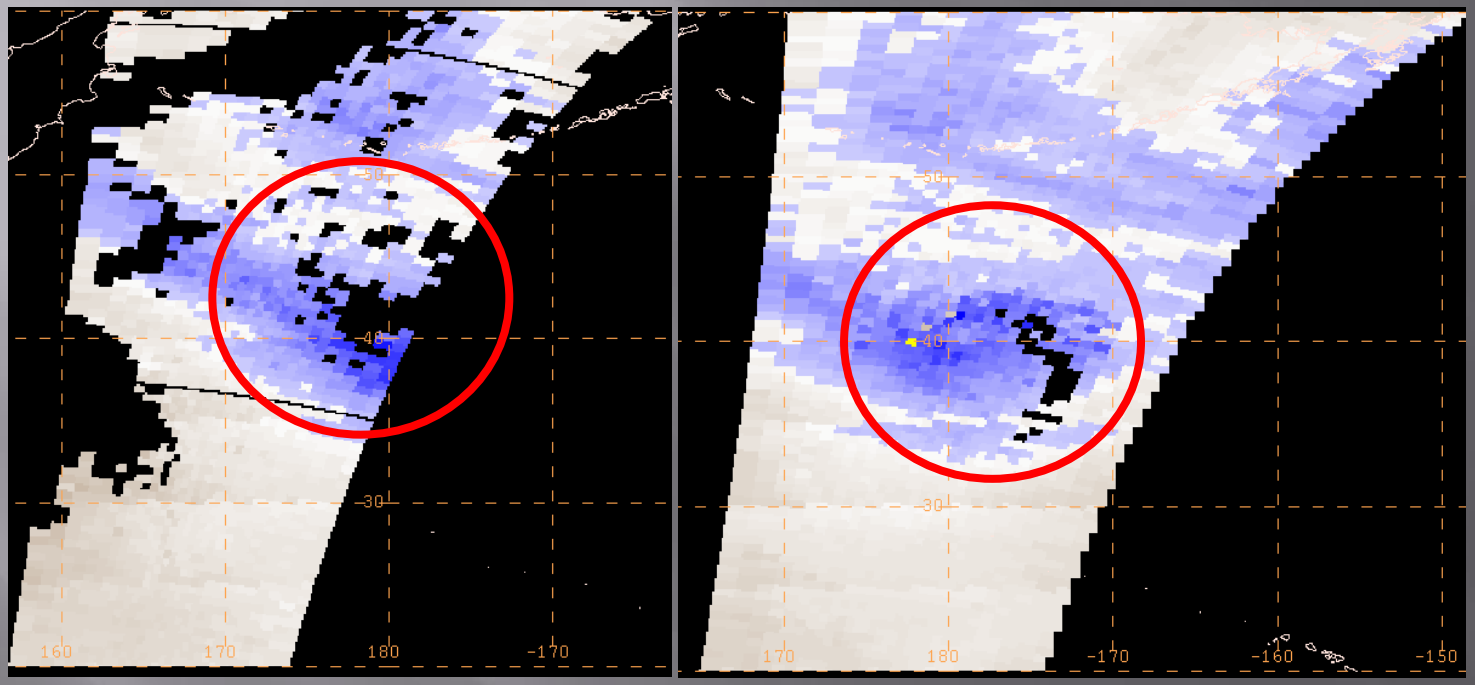
Comma cloud develops

Winter Underdog: Rapid Development

AIRS on 18 Jan 1400 UTC

NUCAPS on 18 Jan 1400 UTC

Ozone Anomaly (%)

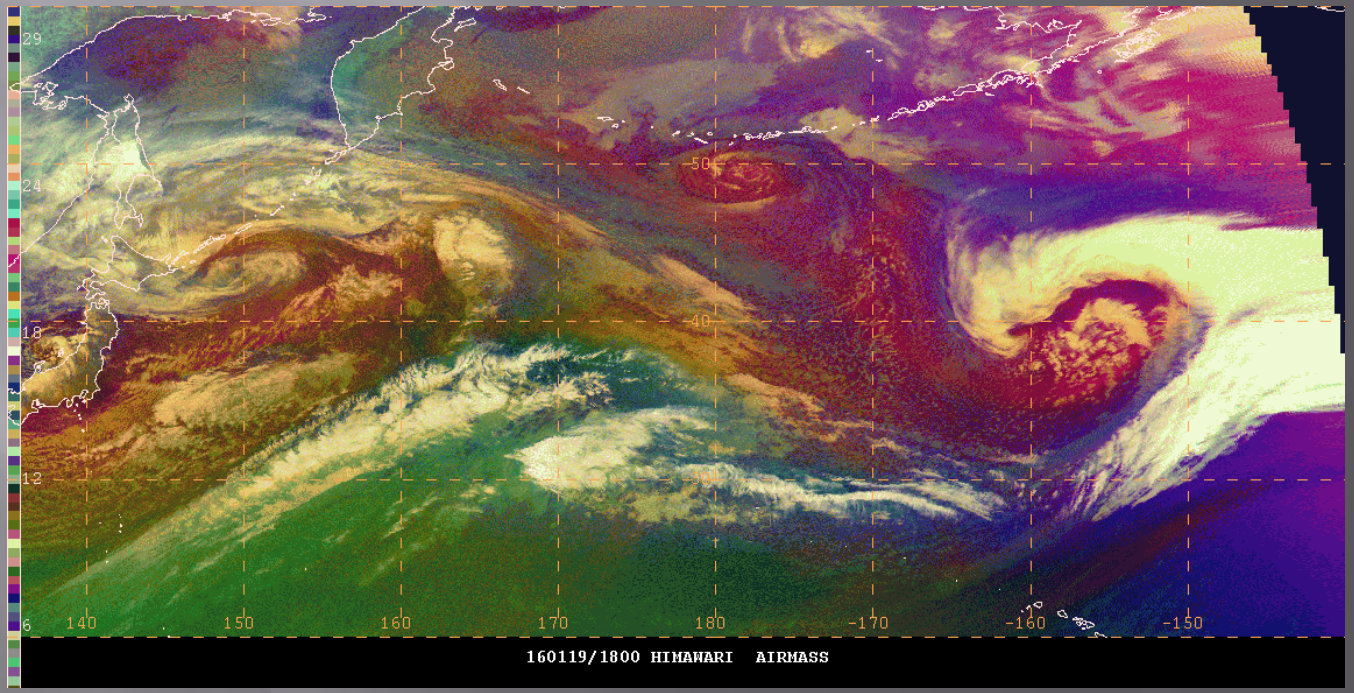


Condensed area of increased ozone

Winter Underdog: Peak Intensity

19 Jan 1800 UTC

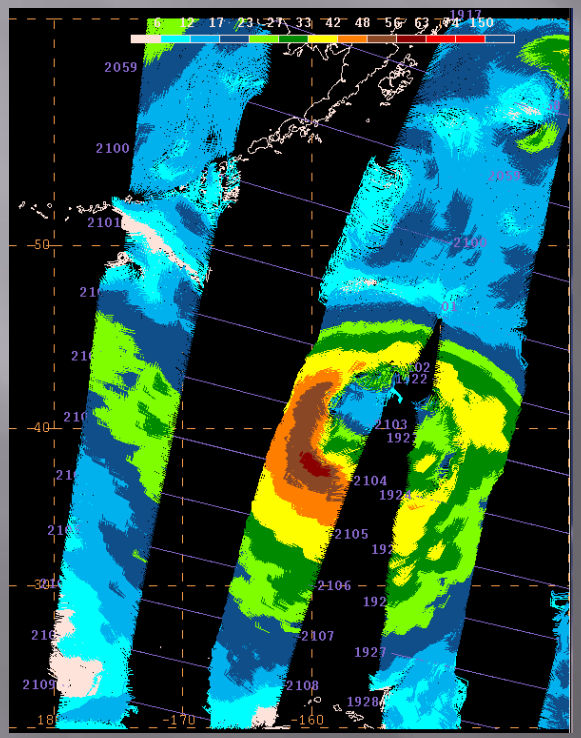
Airmass RGB



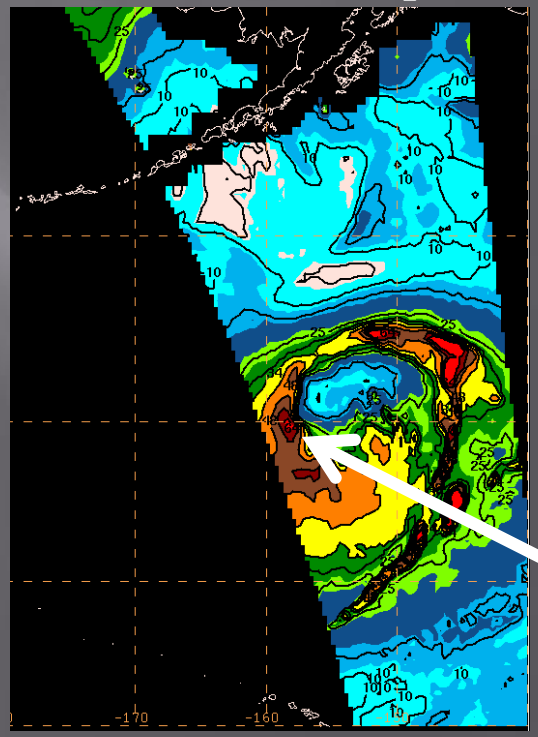
Winter Underdog: Peak Intensity

19 Jan 2100-2300 UTC

ASCAT B



AMSR Wind Speeds



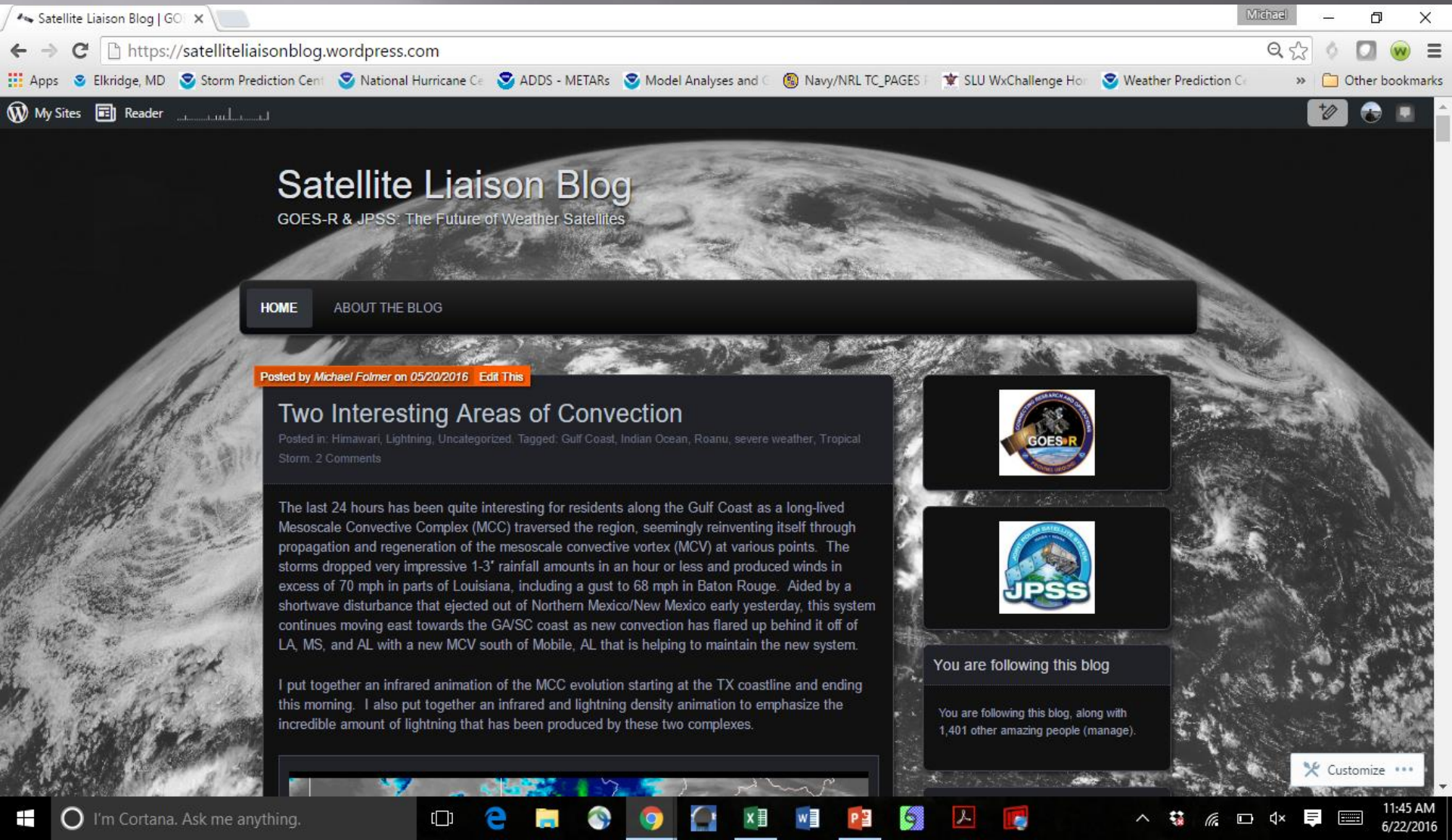
Conclusion

- Stratospheric air intrusions → +PV → Explosive cyclogenesis → Hurricane-force winds
- Single Water Vapor channels supply forecasters with information about jet stream interactions and tropopause folds
  - Not complete!
- Potential in RGB Airmass + ozone products to identify stratospheric air intrusions
  - Case studies
  - Use for real-time events

Future Steps

- Build instructional toolkit for OPC and Alaskan WFOs
  - More real-time use
  - How to use Airmass RGB + Ozone as supplementary data for stratospheric air intrusions
  - Apply this to GOES-R

GOES-R and JPSS Satellite Liaison Blog



Questions?

michael.folmer@noaa.gov
emily.b.berndt@nasa.gov