The GOES-R Tropical Pacific Proving Ground (TPPG)

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School of Ocean and Earth Science and Technology (SOEST)

Overview

Collaboration & Focus

Challenges in the Pacific

GOES-R product integration & forecaster training

X/L Band Antenna Installation and utilization

Upcoming products

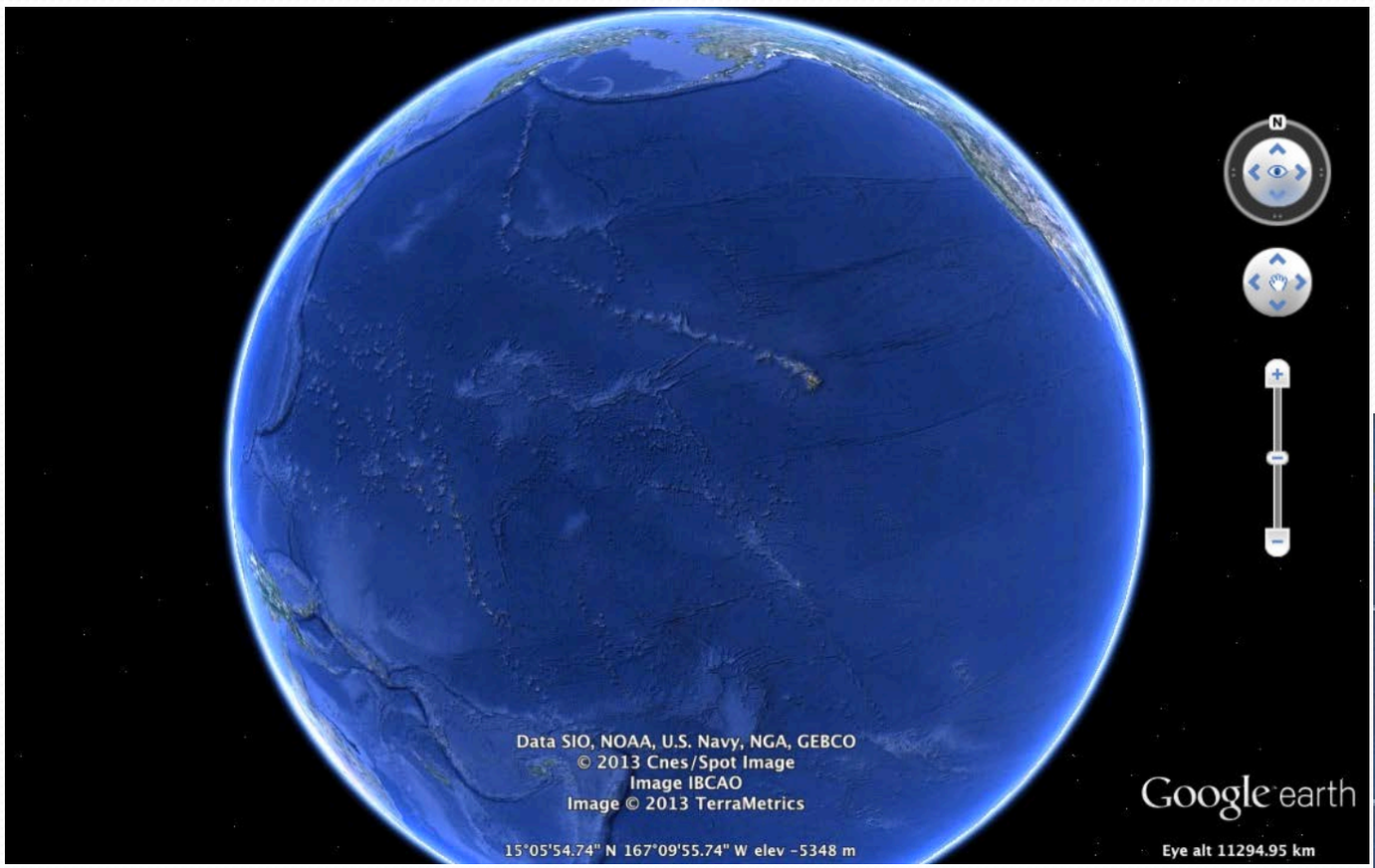
Pacific Region Goals

- A goal of the Tropical Pacific Proving Ground will be to foster communication & collaboration between the National Weather Service Honolulu Forecast Office, The University of Hawaii, The Joint Institute for Marine and Atmospheric Research and the GOES-R Algorithm Working Group.

Figure 1. University of Hawaii at Manoa campus

Challenges in the Pacific

Size of the Pacific Region:
Five times larger than
the continental United States



Limited In-Situ Data

Limited observational data makes the Pacific Region more reliant on satellites.

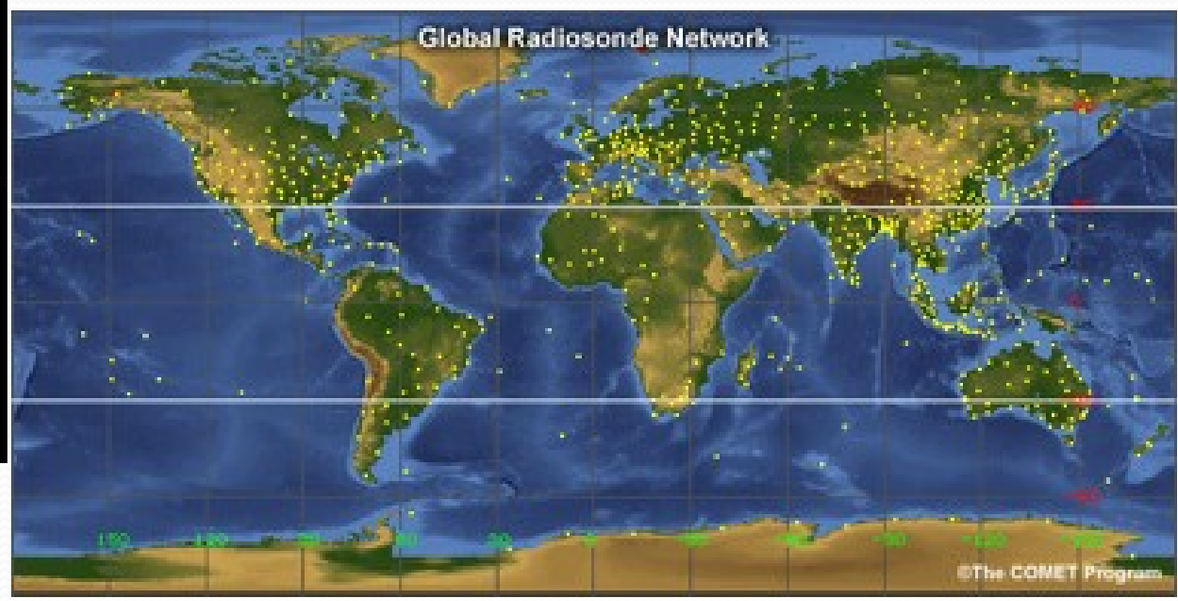


Figure 2. Global Radiosonde Network

The open water of the Pacific Ocean has no radar or soundings.

TPPG Focus includes

Heavy Rain Forecasting

http://flood.hawaiicounty.gov/storage/flood_bridge.jpg?__SQUARESPACE_CACHEVERSION=1271

Complex terrain and flooding

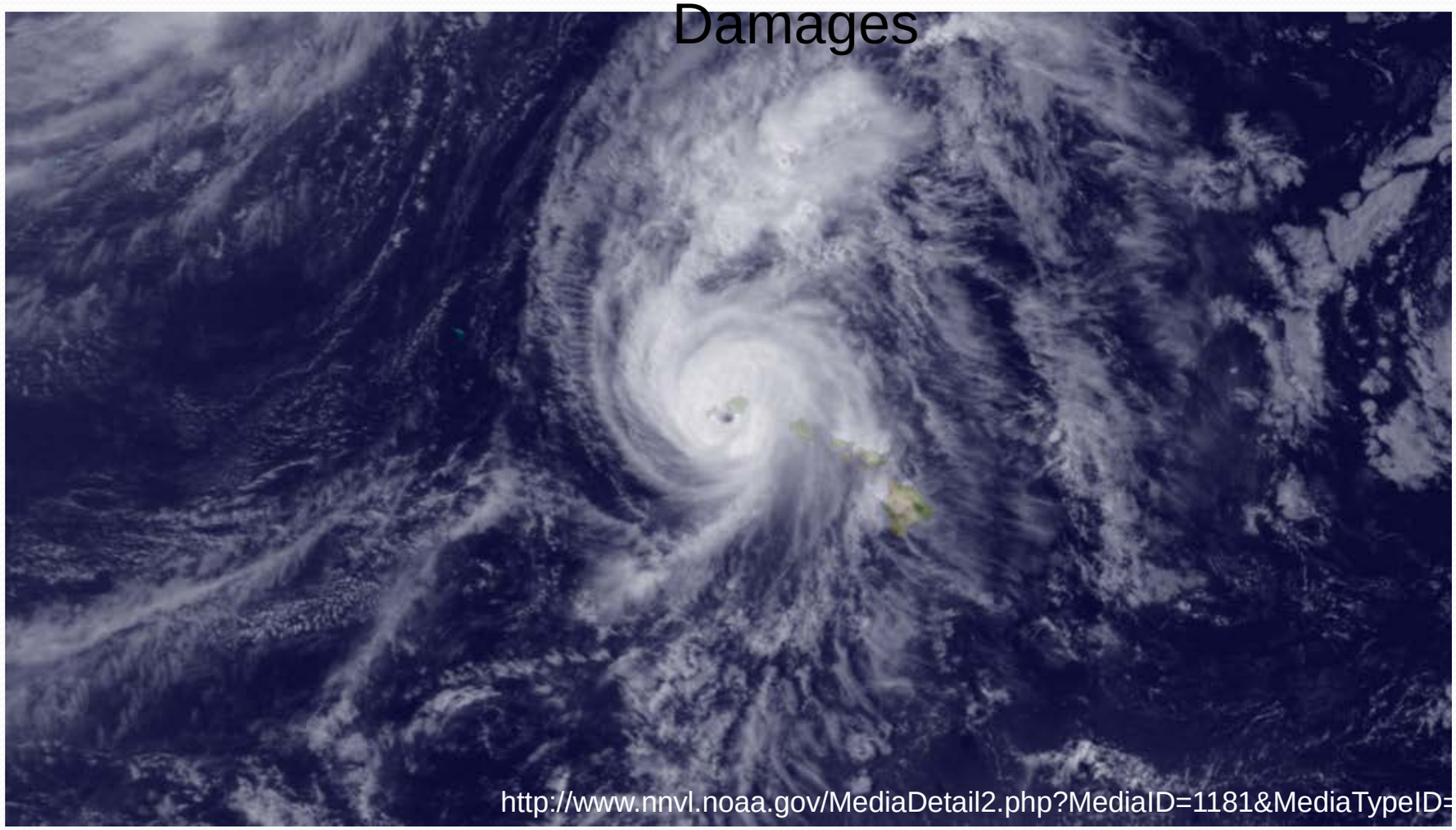
Figure 3. Windward Oahu, Makapu'u

TPPG Focus includes

Tropical Cyclone Prediction

Photo by Bruce Asato courtesy of the Honolulu Advertiser

Hurricane Iniki 1992. $1.8 Billion in Damages



http://www.nnvl.noaa.gov/MediaDetail2.php?MediaID=1181&MediaTypeID=

TPPG Focus includes

Detection & Modeling of Volcanic Emissions

Photograph by M. Poland, November 13, 2008, USGS HVO.

http://www.nationalgeographic.com/urbandrives/images/6_kilauea.j

The Active Kilauea Volcano creates an ongoing volcanic smog detection and forecasting challenge

GOES-R Product integration into AWIPS I

March 2012 installation of products in Pacific Region Headquarters and the Honolulu Forecast Office

- UW Convective Cloud Top Cooling

- Morphed Integrated Microwave Imagery at CIMSS
  – Total Precipitable Water (MIMIC-TPW)

- CIMSS Regional Assimilation System (CRAS)

- Advanced Very High Resolution Radiometer (AVHRR)

- AWIPS II ready

GOES-R Product integration into AWIPS I

March 2012 installation of products in Pacific Region Headquarters and the Honolulu Forecast Office

- The day after installation in March 9, 2012, severe weather outbreak occurred in Hawaii including supercell thunderstorms and record-setting hail.

Figure 4. Record-setting hailstone from Hawaii

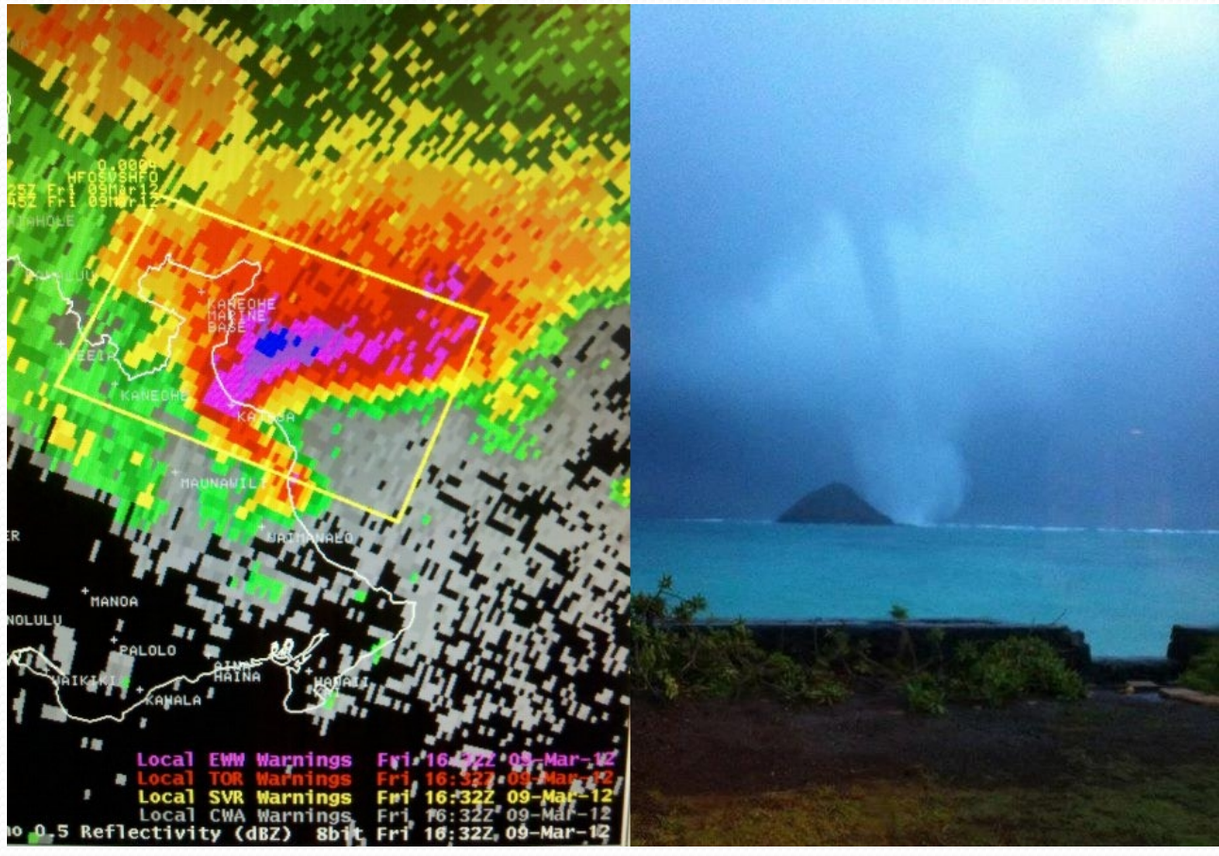
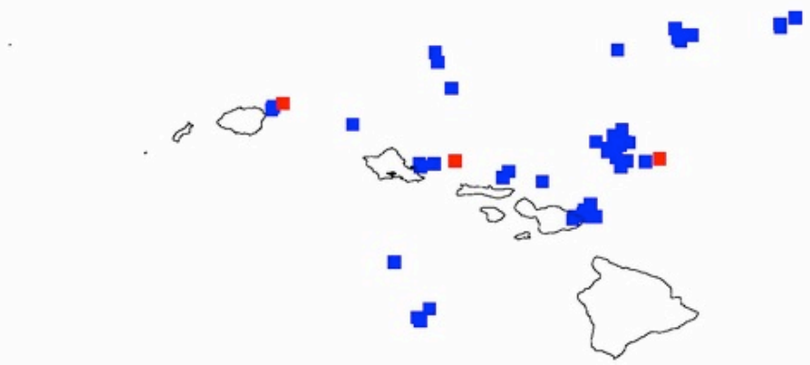


Figure 5. Radar and photograph of a tornado in Kailua, March, 9, 2012

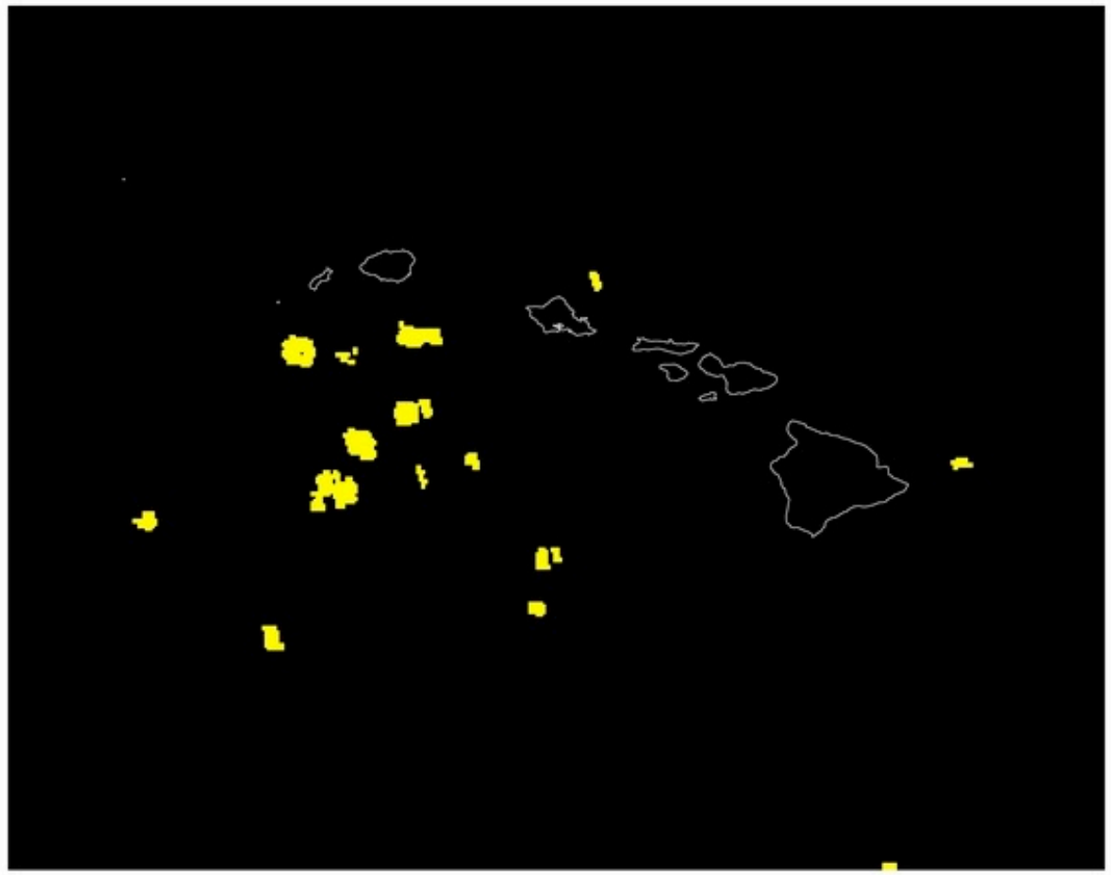
GOES-R Products

UW-CIMSS Cloud Top Cooling

Daily Cumulative OT/TC Detects: 20120309 at 1645 UTC



Daily Cumulative CI Hits: 20120309 at 1645 UTC



Assesses vertical convective cloud growth using cloud top cooling rates based on boxed average 11 micron band brightness temperatures and GOES Imager data

This cirrus capability added in 2012

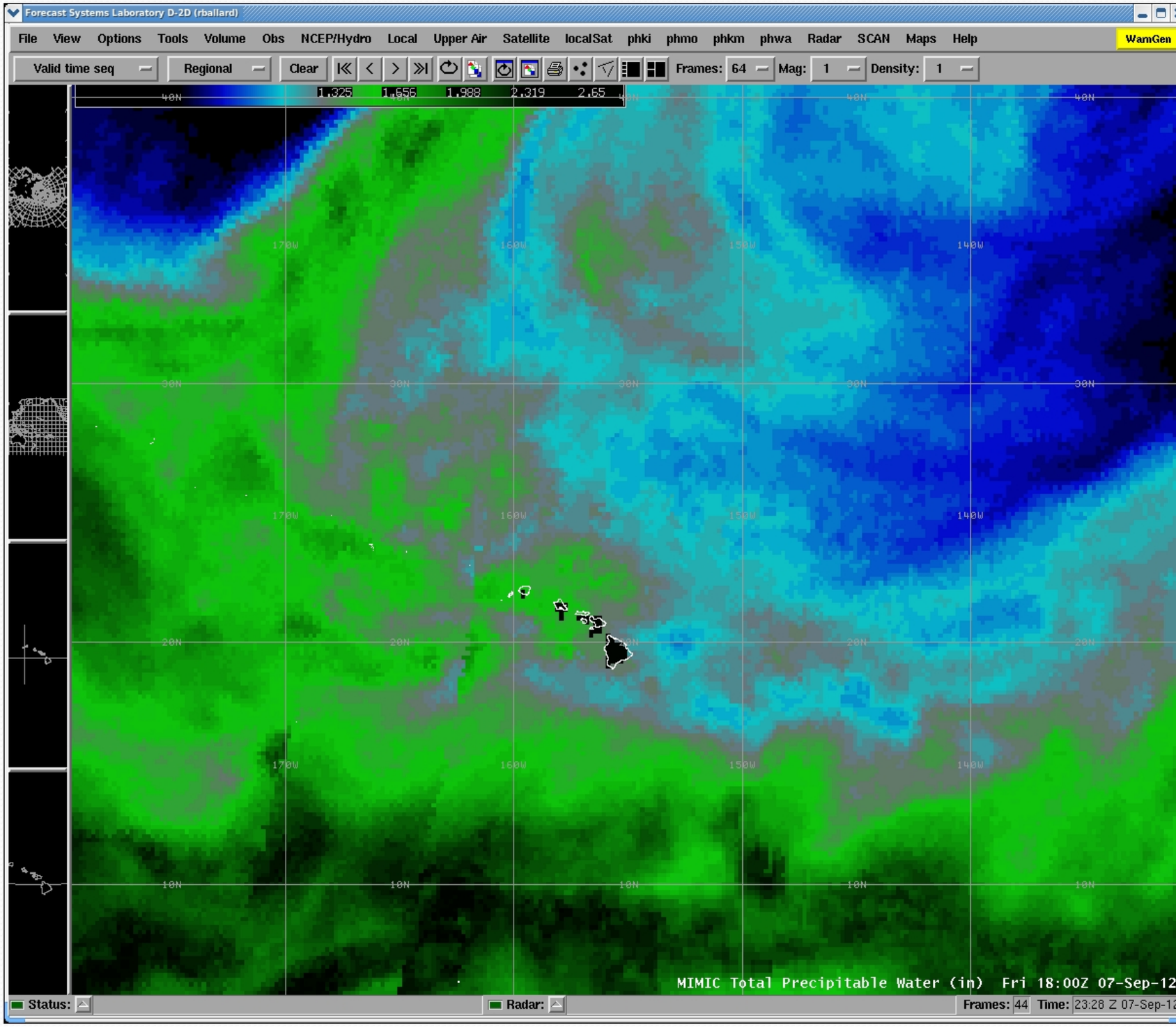
http://cimss.ssec.wisc.edu/snaap/convinit/uwctc_2012_hwt_training_final.pptx

GOES-R Products

MIMIC-TPW

Has allowed HFO forecasters to observe features lost in other Total Pricipitable Water (TPW) products due to smoothing

Uses TPW values and data blended from microwave observations to show advecting radiance features



http://tropic.ssec.wisc.edu/real-time/mimic-tpw/prodDesc/ Figure 6. MIMIC-TPW image from AWIPS I September, 7, 2012

Forecaster Feedback & Evaluation

Regular one on one training and feedback sessions coordinated with the satellite liaison and the Honolulu Forecast Office SOO have been initiated.

Additional training modules available online through Visit.

X/L Band Antenna Installation and utilization

Hardware Installation at HCC 7 on 8 August 2012

Photos courtesy of Liam Gumley

Supported Satellites and Sensors

Terra: MODIS

Aqua: MODIS, AIRS, AMSU

Suomi NPP: VIIRS, CrIS, ATMS

POES (NOAA 19, 18 etc): AVHRR, AMSU

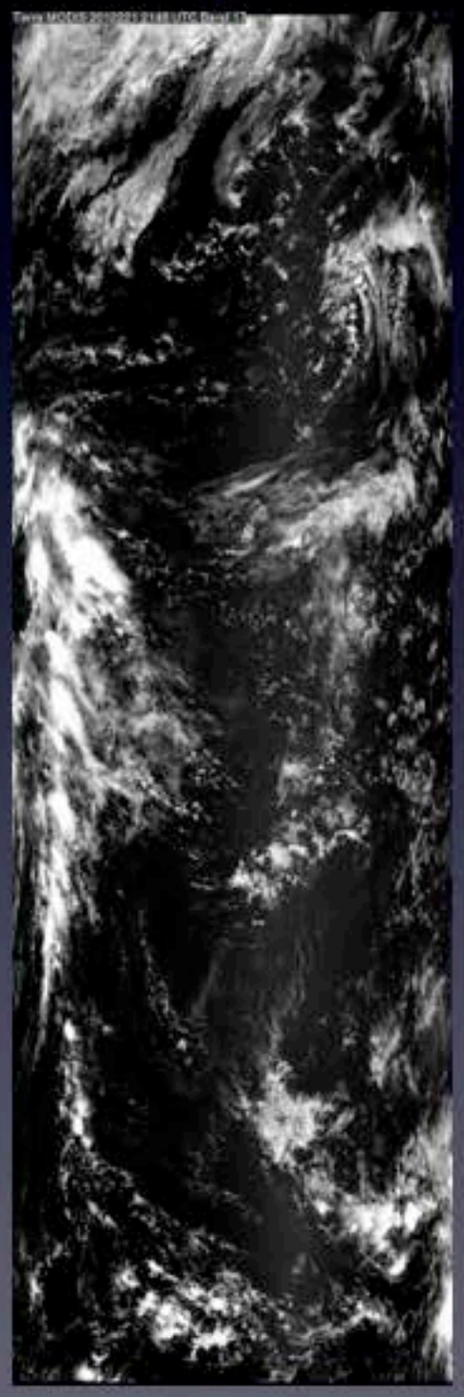
Metop: AVHRR, AMSU, IASI

FY-3: MERSI, VIRR

First Terra MODIS pass

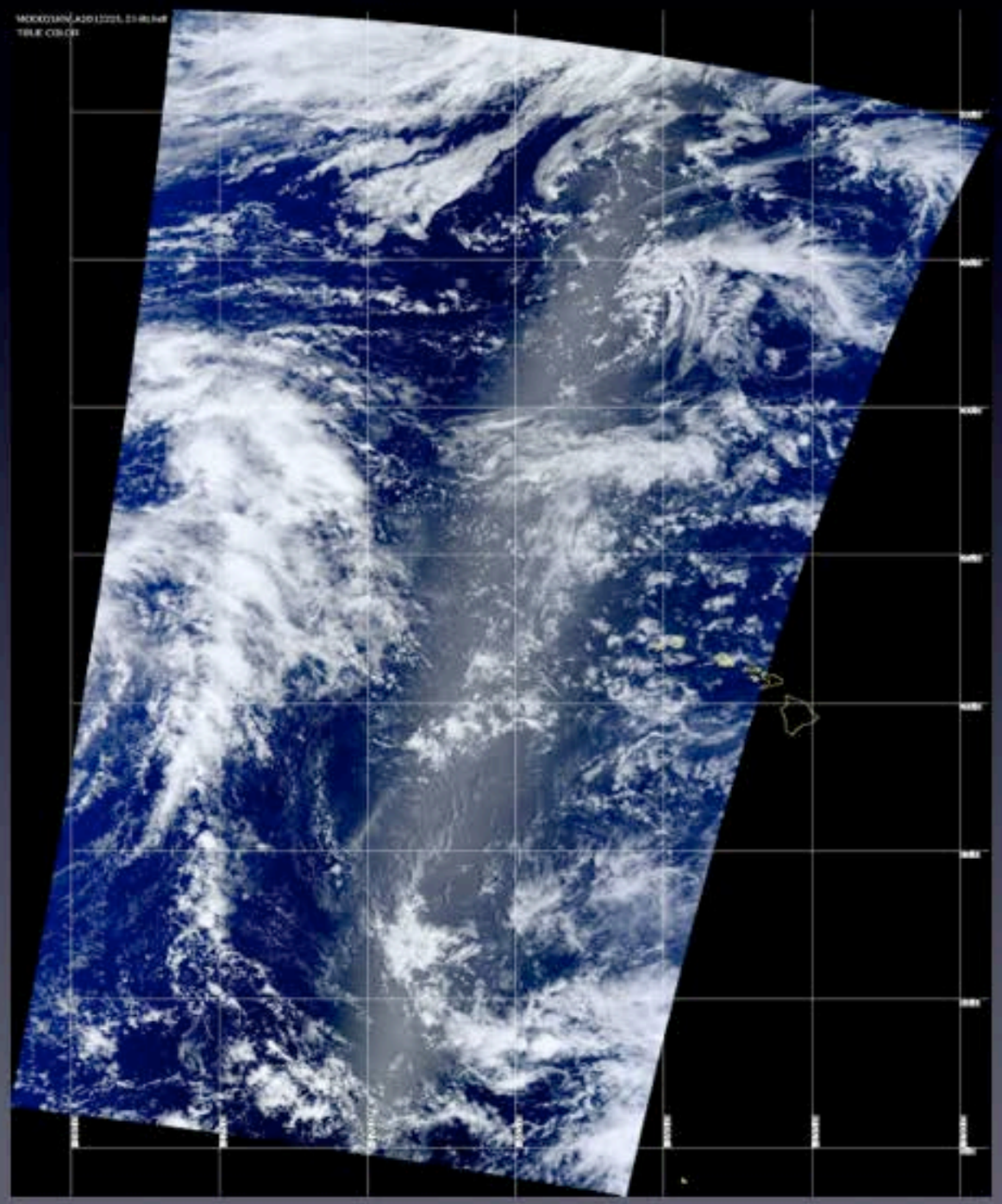
2148 UTC (11:48 am HST), 8 August 2012

Visible quicklook



Infrared quicklook

True Color GeoTIFF



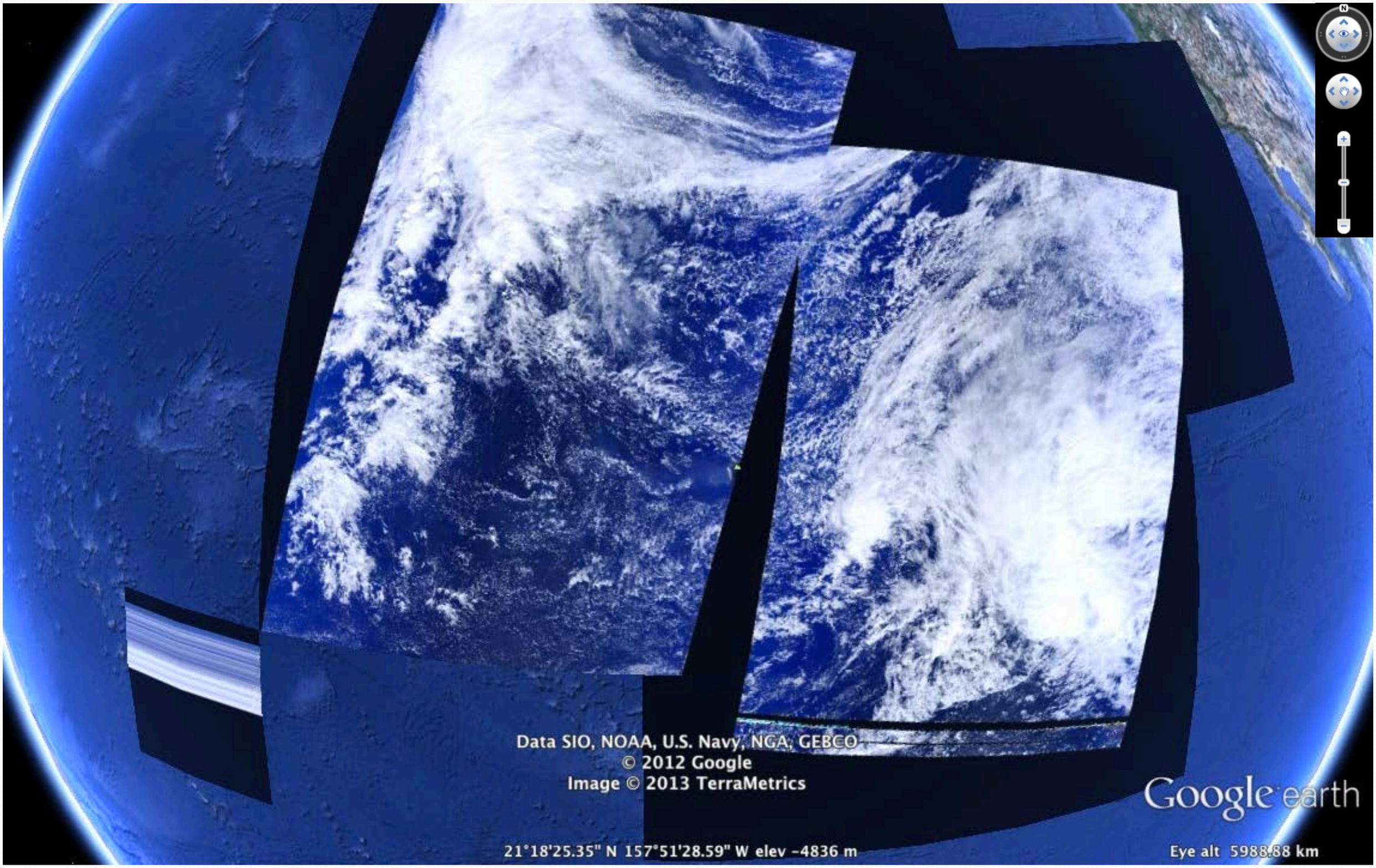
MODIS Level 2 Atmosphere Products

- Created by IMAPP from the University of Wisconsin-Madison
- Cloud Mask
- Cloud Top Pressure
- Cloud Optical Depth and Effective Radius
- Aerosol Optical Depth
- Temperature and Water Vapor Profiles
- Total Column Precipitable Water Vapor (Infrared, Day/Night)
- Total Column Ozone
- Total Column Precipitable Water Vapor (Near-Infrared, Day only)
- Level 2 browse images for all Atmosphere Products
- http://soest-hcc1.hcc.hawaii.edu

MODIS True Color Images for Google Earth

- MODIS true color images at 250 meter resolution are created for each new Terra or Aqua pass.
- Each new pass is composited over old passes from the same day.
- Users can download one small KML file and view the current Terra and Aqua imagery in Google Earth.
- Historical KML files for previous days are also available.

MODIS KML Google Earth Images



Available VIIRS Bands

- VIIRS Imagery (SDR, HDF5)
- 15 bands at 750 meter resolution
- 5 bands at 375 meter resolution
- 1 Day/Night band at 750 meter resolution
- CrIS IR interferometer sounder (SDR, HDF5)
- ATMS microwave sounder (SDR, HDF5)

Current VIIRS Bands In Use at NWS HFO

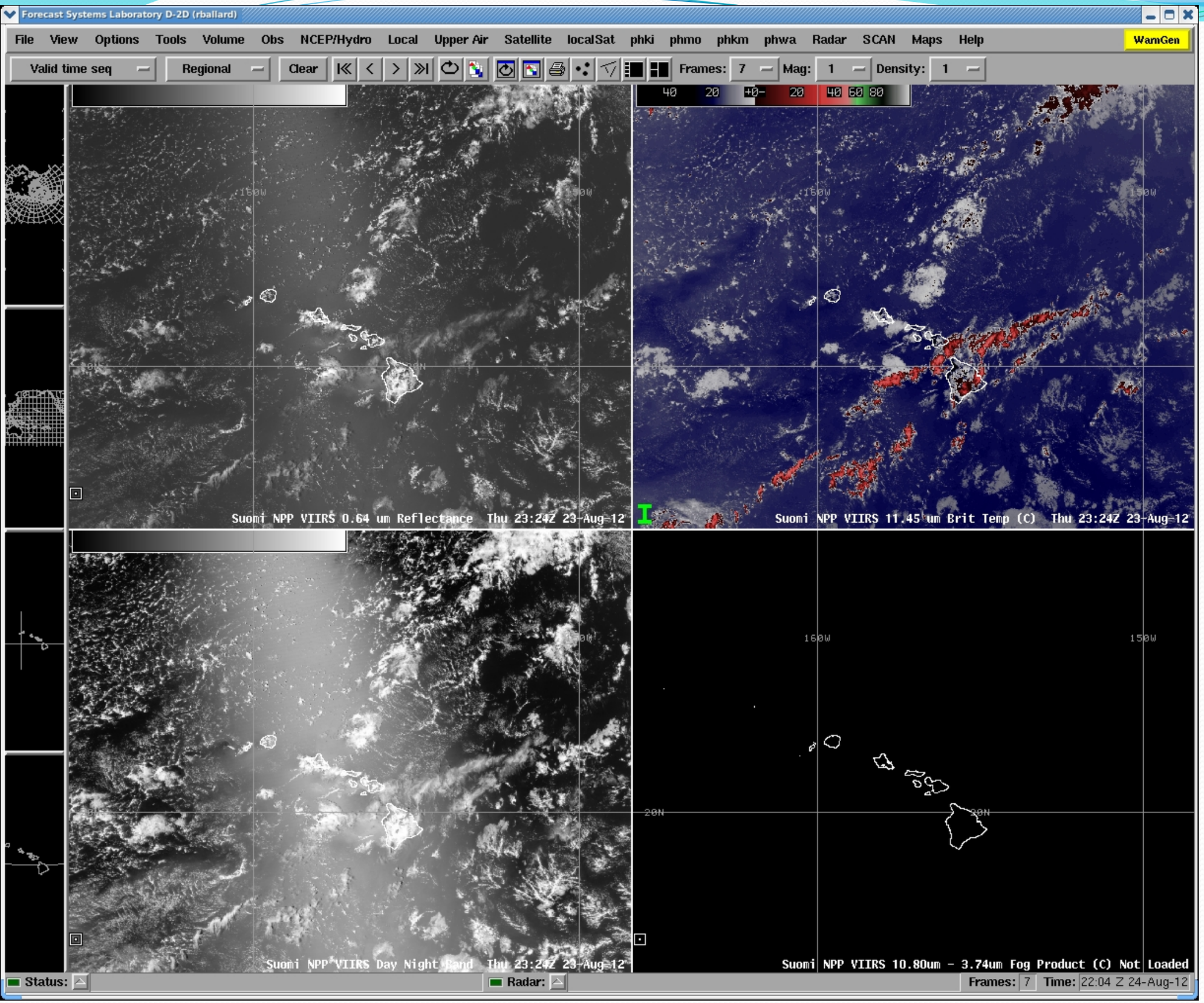


Figure 7. AWIPS I four panel image of VIIRS data, August, 24, 2012

5 bands

- Visible 0.64 um
- Snow/Ice 1.61 um
- 3.75 um
- IR Window 11.45 um
- Day/Night Band
- 11um-3.7um fog

Additional MODIS & VIIRS Bands

- MODIS Reflectance bands likely to be installed first in AWIPS II at the NWS HFO

- Additional VIIRS Bands added later in AWIPS II

- MODIS GeoTIFF and VIIRS bands to be made available on the Direct Broadcast Processing System (DBPS) Server and the web

- Additional SOUMI NPP instruments CrIS will be made available on the web

Upcoming product integration

Pseudo Reflectivity

- GLD360 Pseudo Reflectivity lightning density products
- 8km grid resolution
- Seasonal & regional coefficients correlates lightning stroke density & reflectivity
- Target installation date February 2013

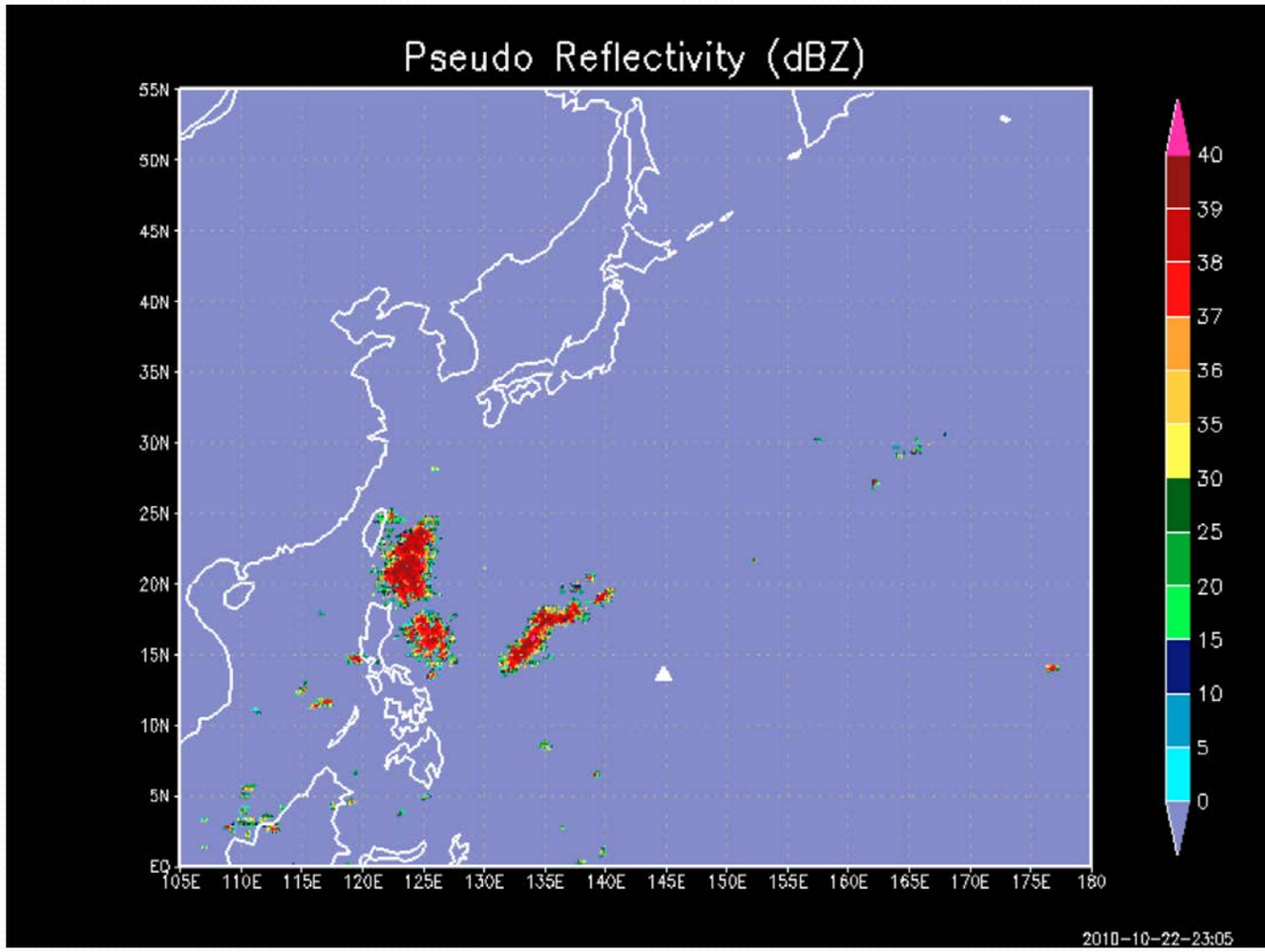
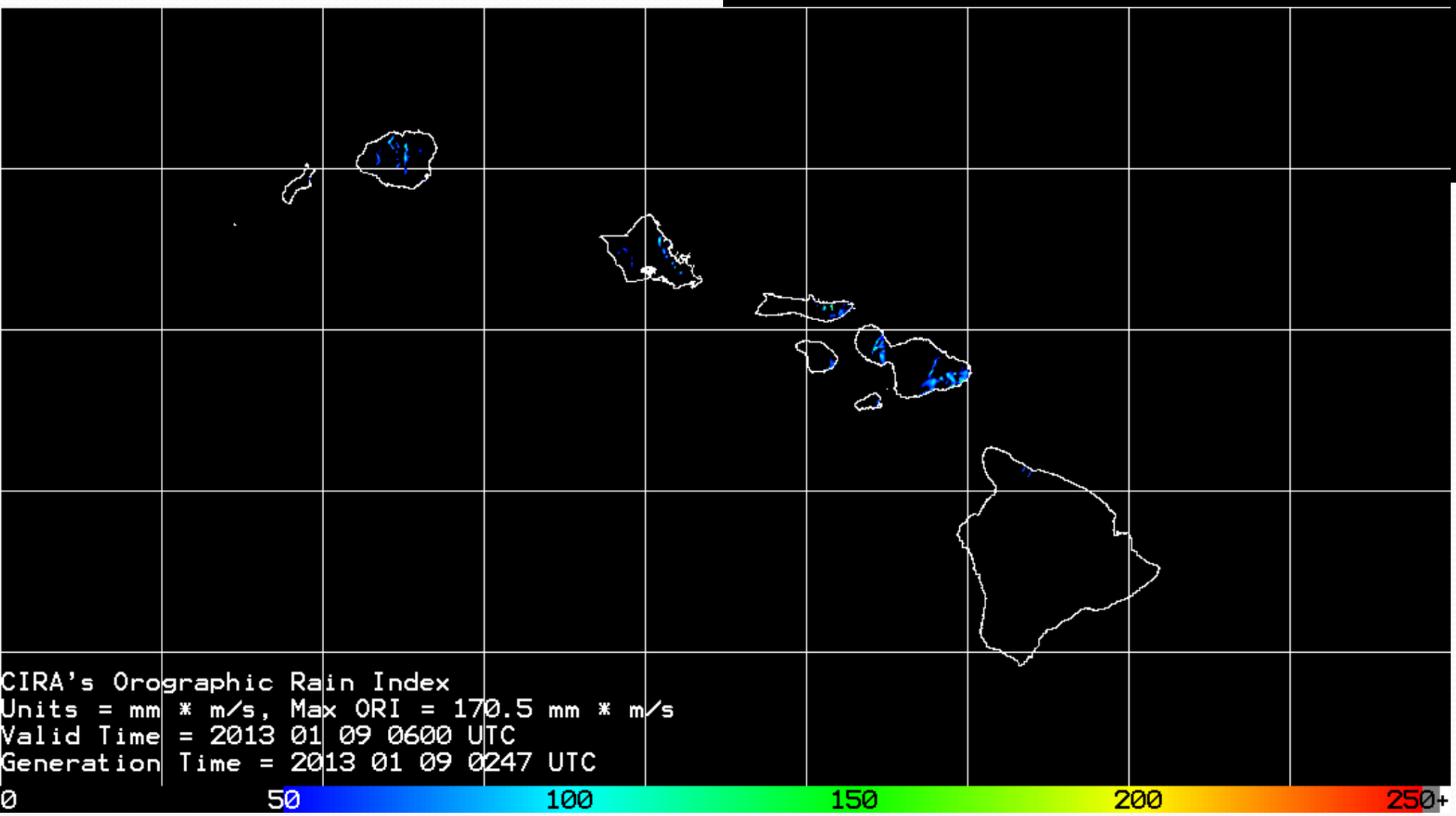
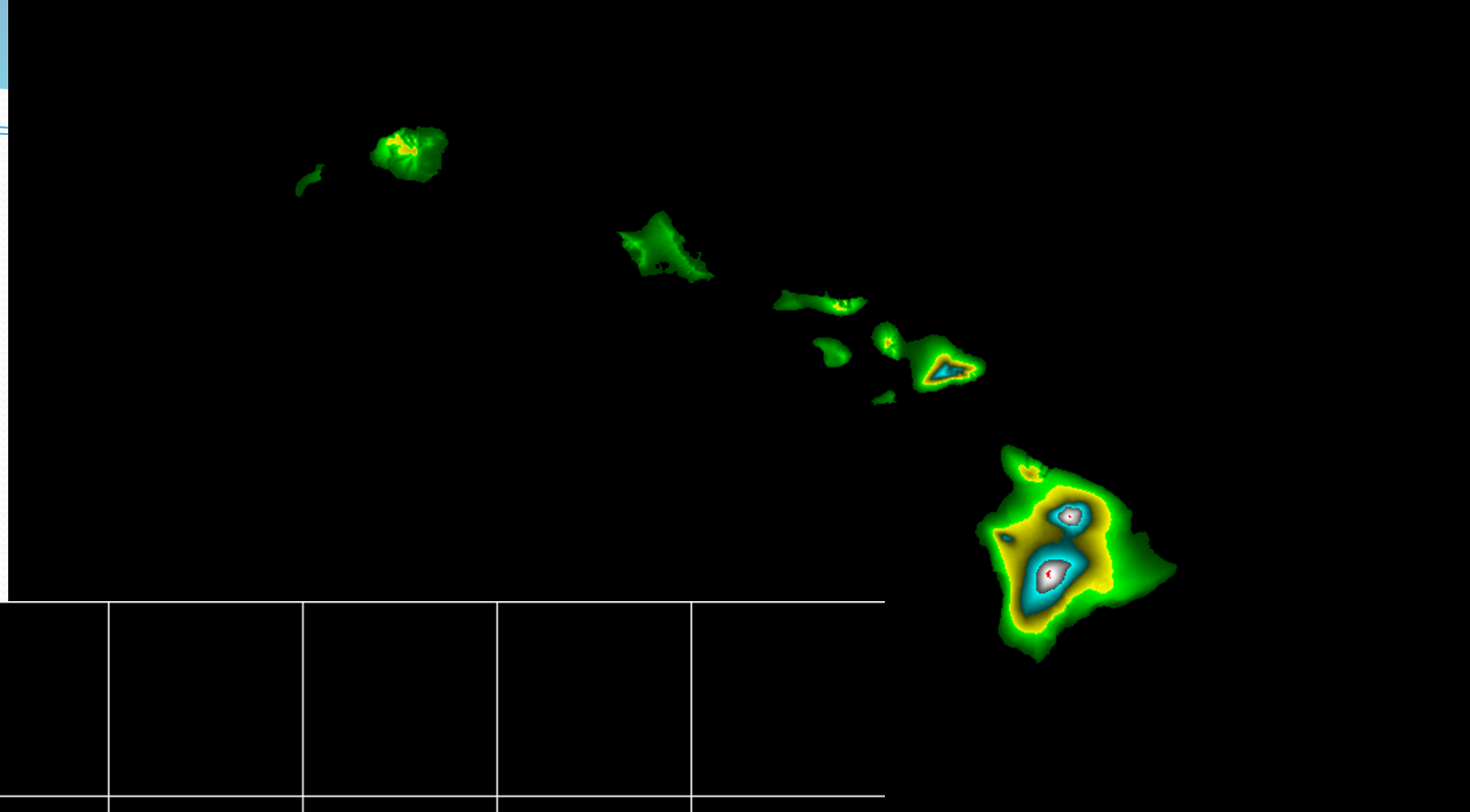


Figure 8. Example of a pseudo reflectivity product on 22 October 2010 at 2300 UTC showing estimates of radar reflectivity associated with a rainban from typhoon Megi.

Orographic Rain Index (ORI)

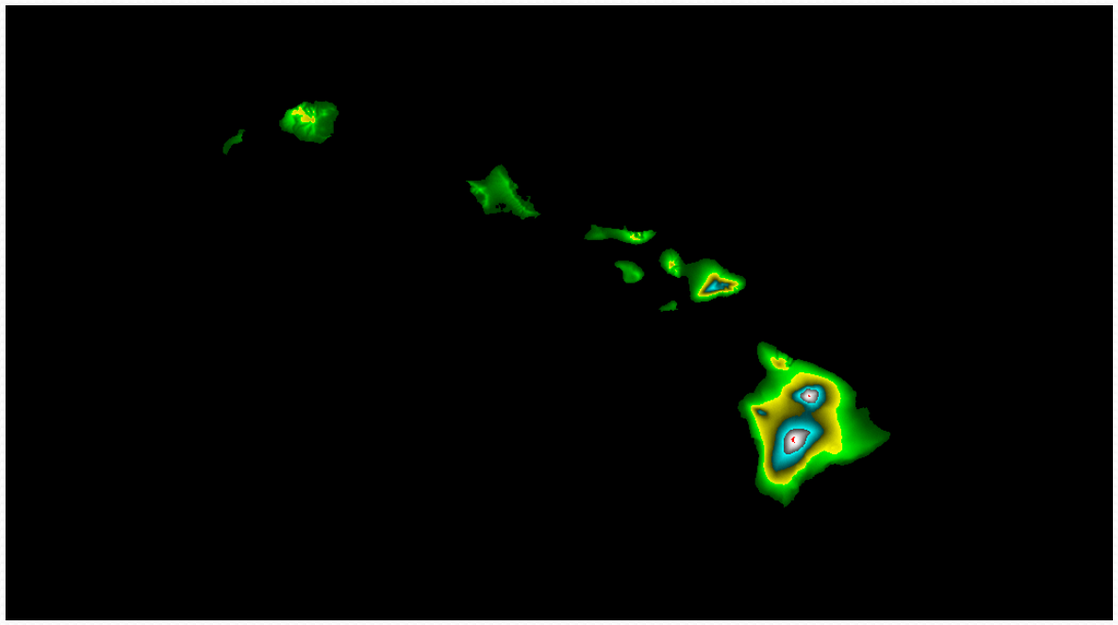




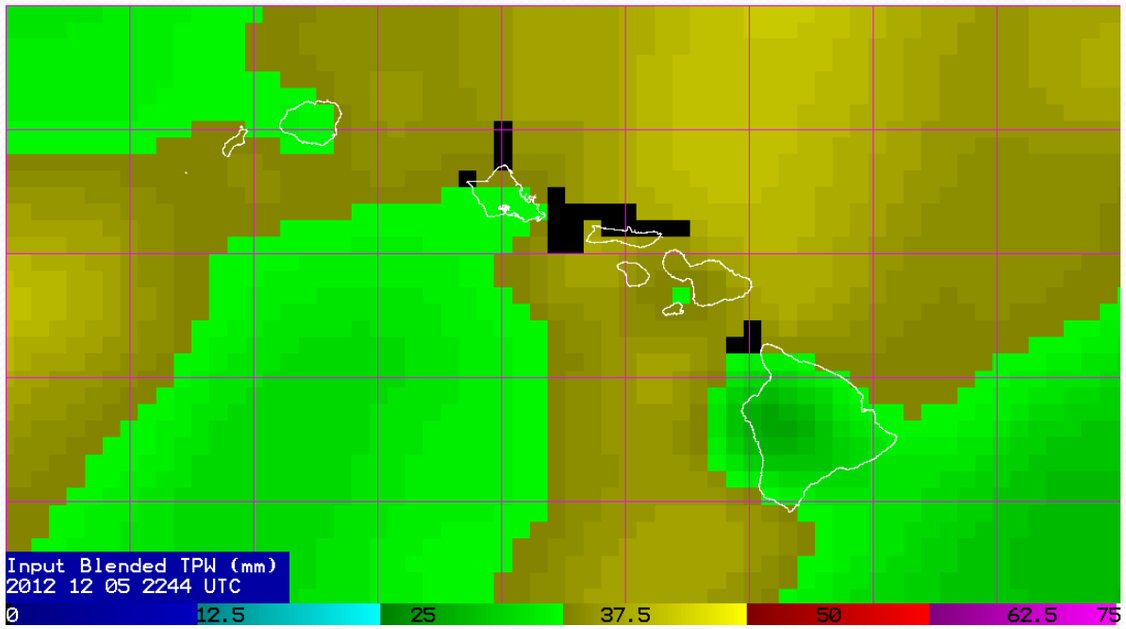
http://products.cira.colostate.edu/ORI/

ORI

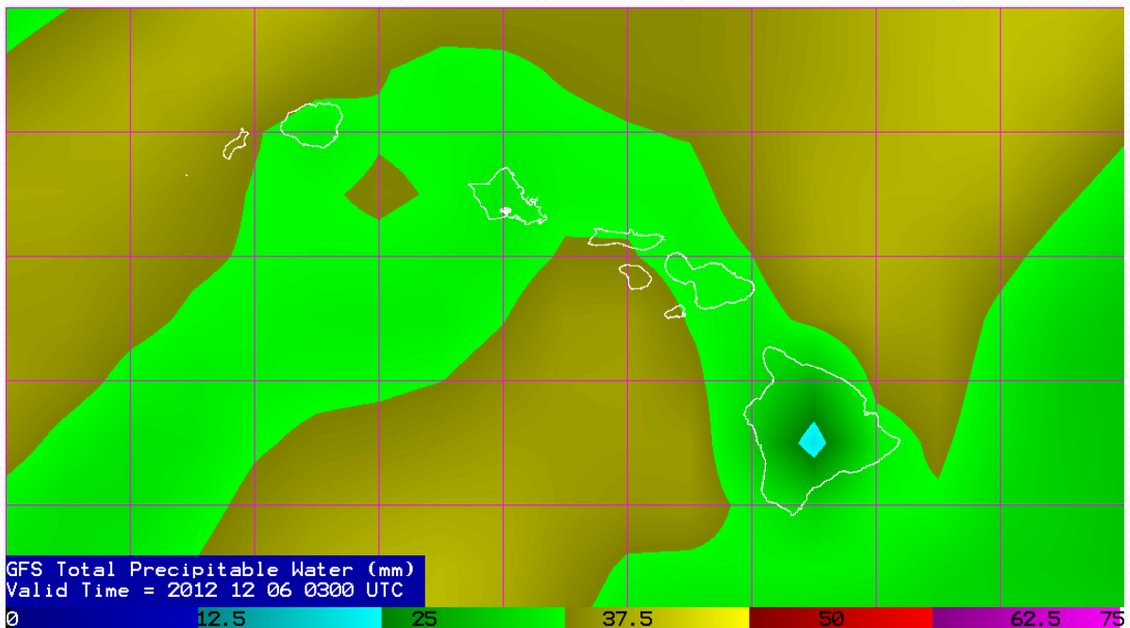
Inputs Terrain



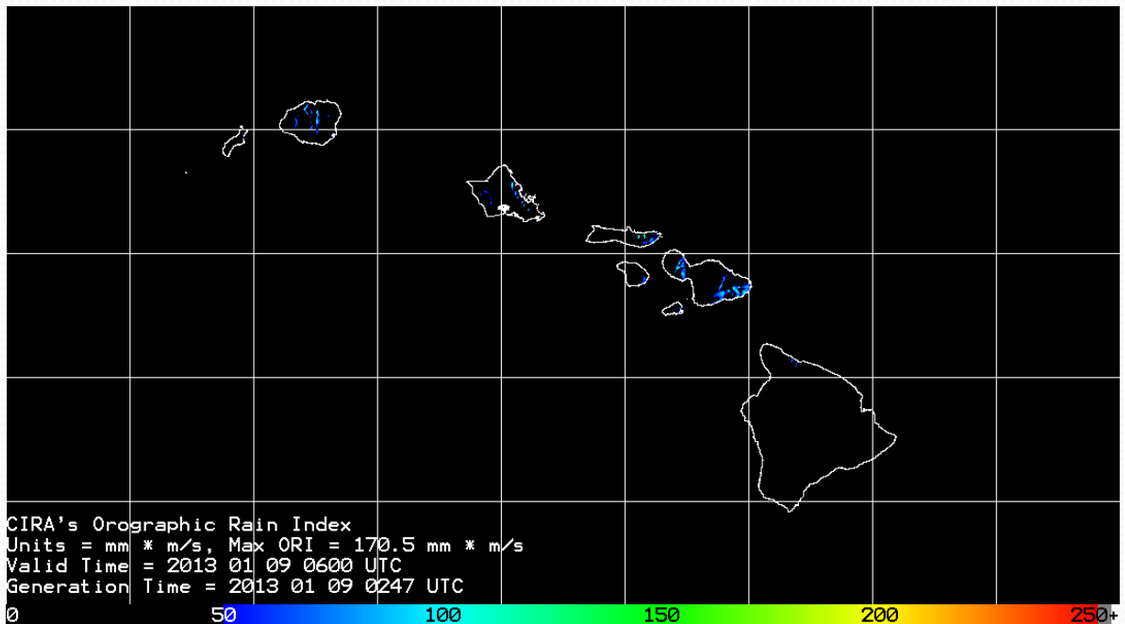
Inputs Winds at Product Time



Inputs GFS PW at Product Time



Outputs ORI at 1km grid resolution



Upcoming product integration into NWS pacific region operations

Lightning Based Rapid Tropical Cyclone Intensification Index (RII)

-Target date February 2013

Volcanic Ash Detection and Height

-Target date June 2013

SO_2 Detection

-Target date Late 2013

Rainfall Rate/QPE

-Target date Late 2013

Upcoming product integration

Volcanic Ash Detection and Height

GOES-R volcanic ash products Using Aqua MODIS satellite data from August 8, 2008 from the Aleutian Islands

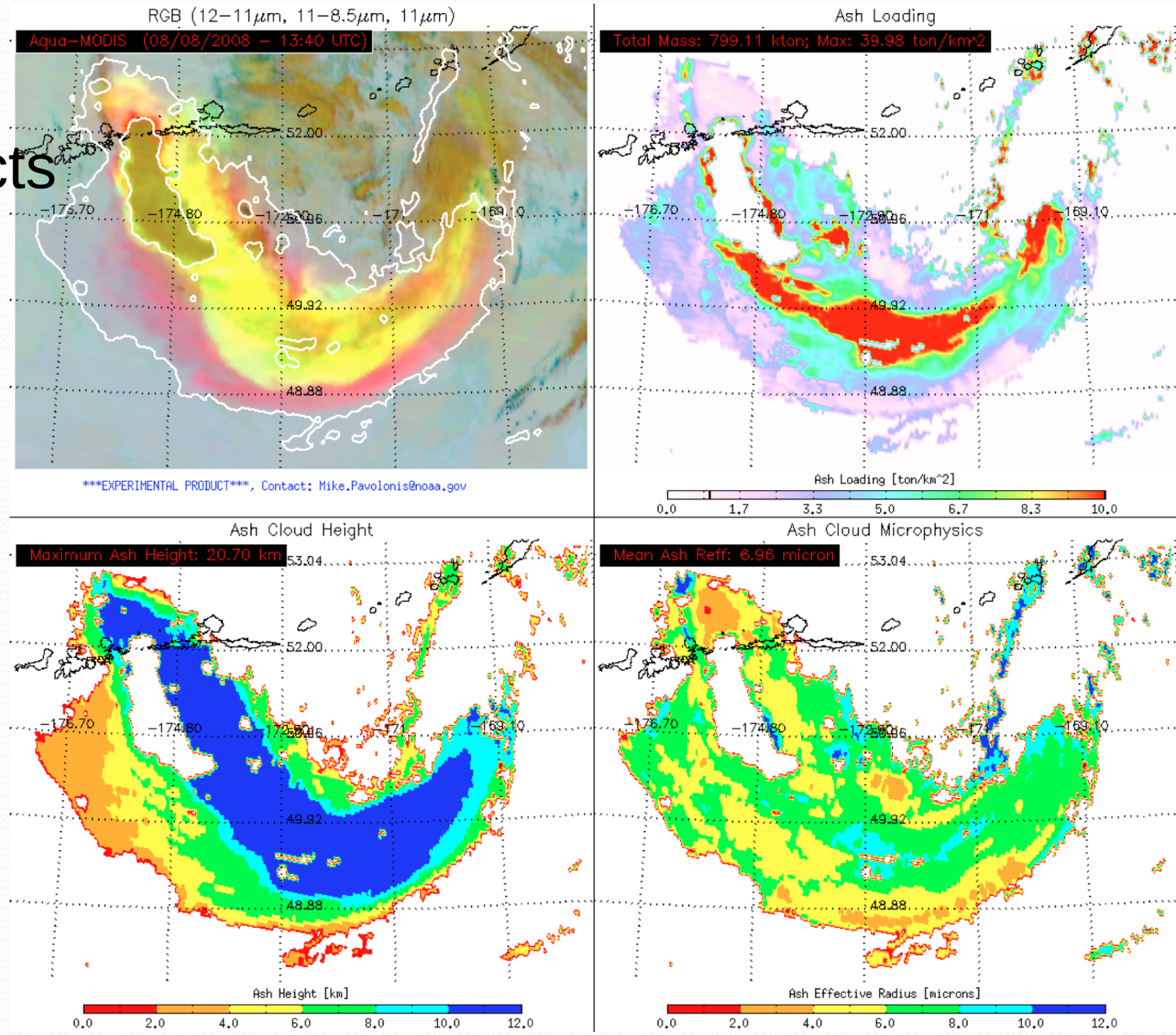
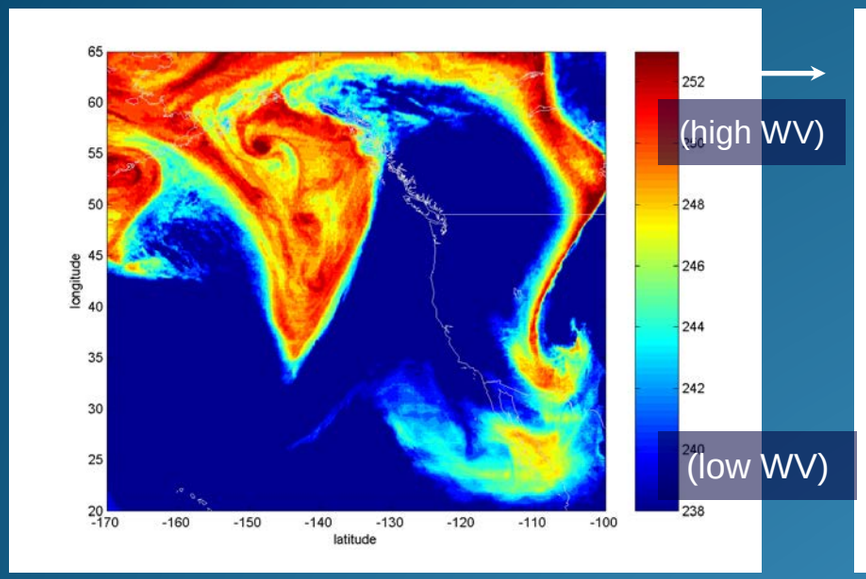


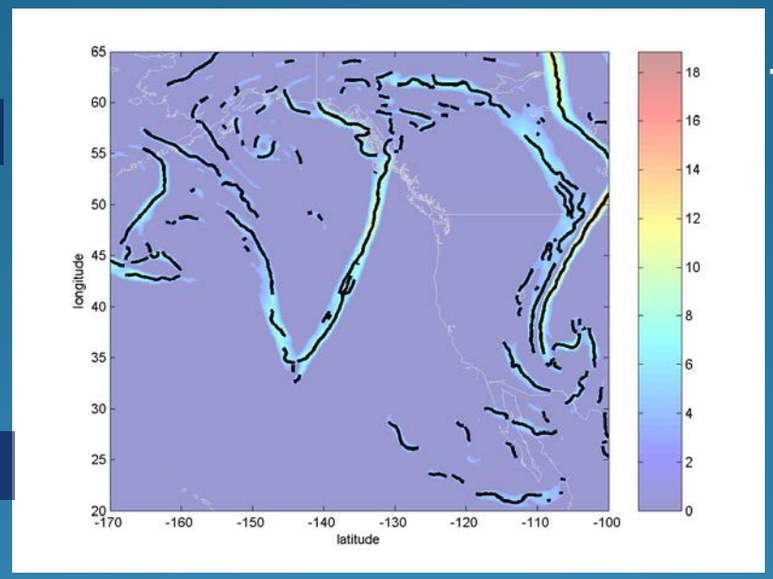
Image courtesy of Mike Povolonis

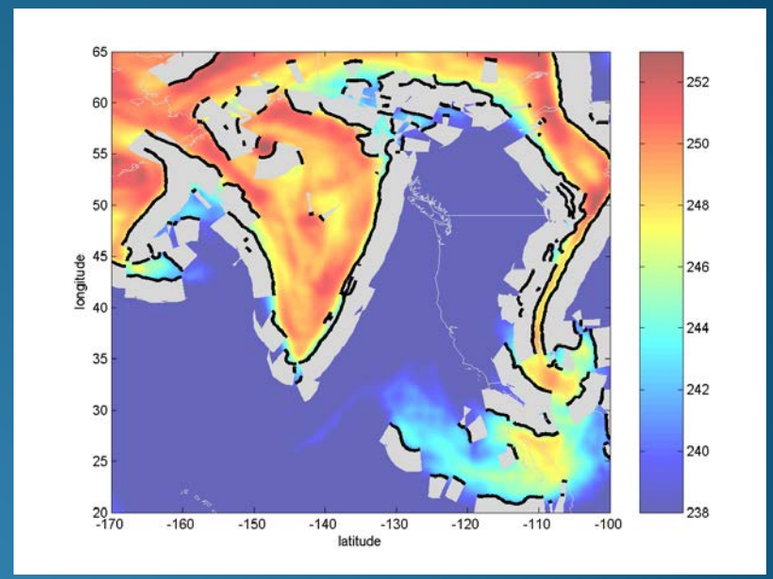
Figure 9. Example GOES-R volcanic ash products generated using *Aqua* MODIS data from August 8, 2008 at 13:40 UTC.

Possible future product addition for aviation Inferring turbulence through satellite based techniques

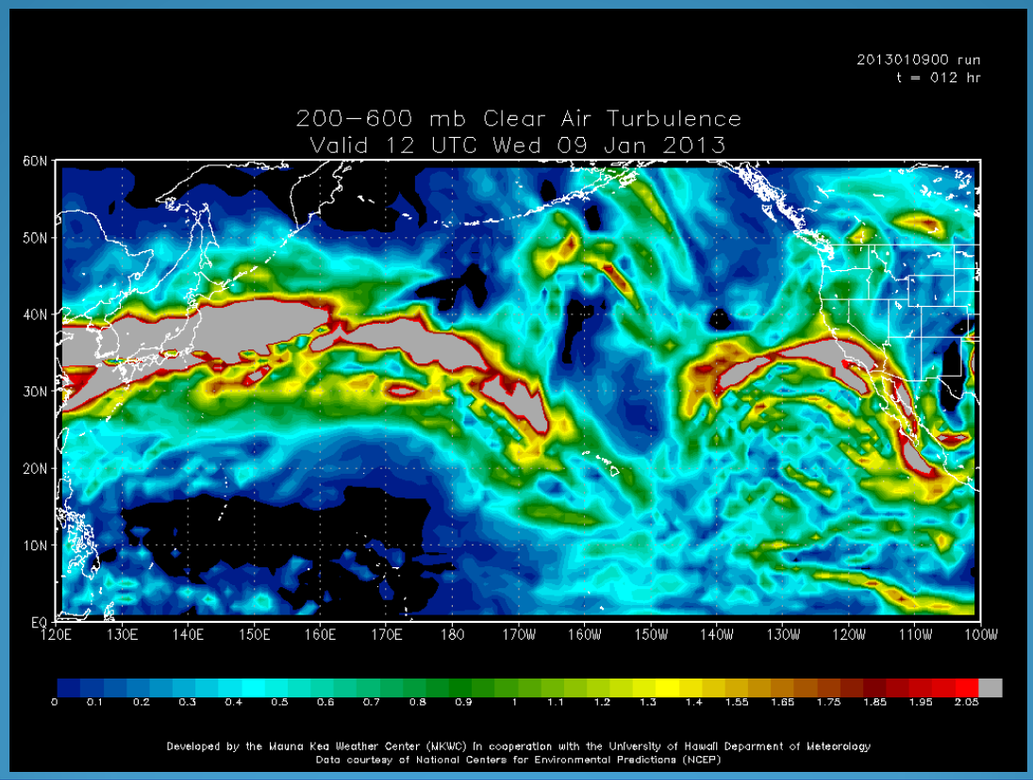
Tropopause Folding Turbulence Prediction (TFTP)







GOES Water Vapor | Edge Detection | Tropopause fold layer



//ftp.ssec.wisc.edu/validation/goesr/proving_grounds/awc/Satellite_Turbulence_research_overview_2012.ppt

Summary & Conclusions

The Tropical Pacific Proving Ground will be focusing on three forecast challenges by targeting applications and products that will help improve i) heavy rain forecasting, ii) tropical cyclone prediction and iii) detection and modeling of volcanic emissions.

The GOES-R Tropical Pacific Proving Ground began installation, training, and feedback of GOES-R Products as well as installation of an X/L band antenna for receiving polar orbital satellite data in January 2013.

Several products have been installed in the TPPG and will be transitioned into AWIPS II from AWIPS I. These products include CTC, MIMIC-TPW, and CRAS.

Additional products will be integrated into the HFO AWIPS II system in the near future for operational use and reduced latency.

A special thanks to NOAA for helping fund the project.