CIRA/RAMMB Support to OCONUS and Future Plans

JPSS OCONUS R2O Interchange Meeting

Honolulu, Hawaii

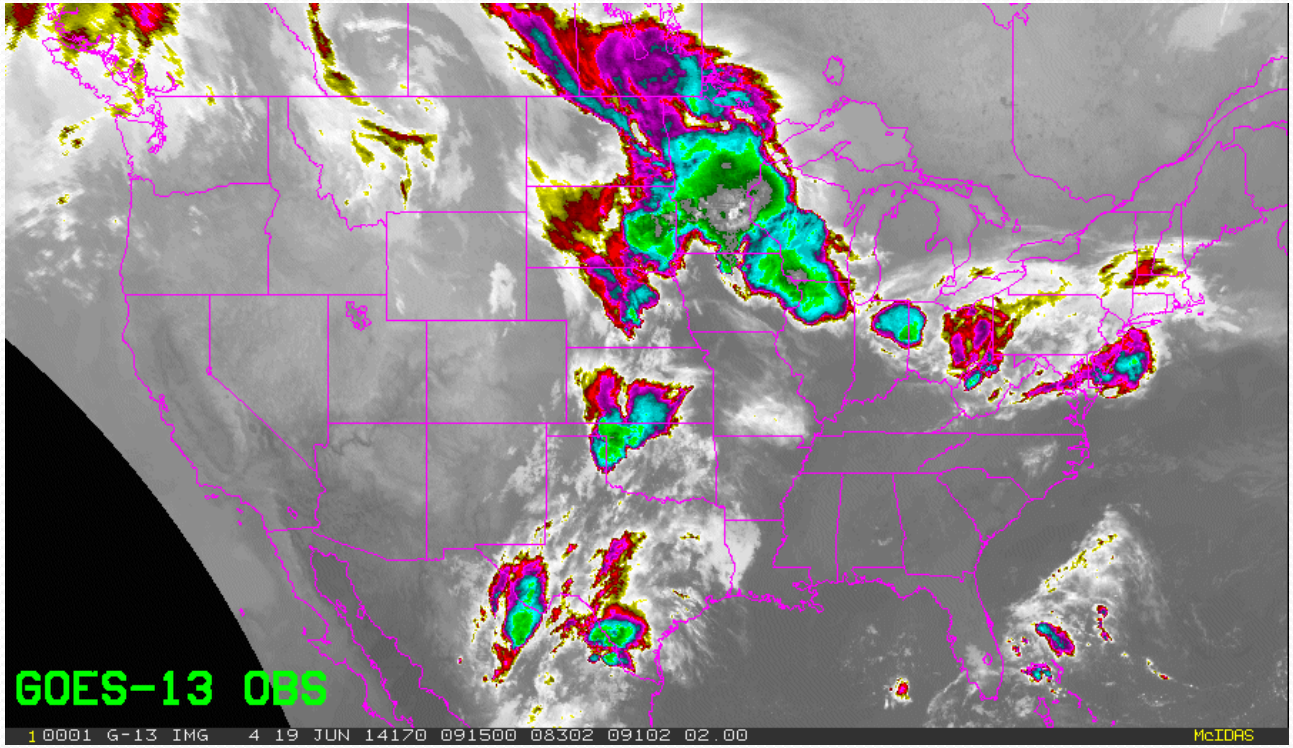
July 29 – August 1, 2014

John Knaff, NESDIS/StAR/RAMMB

Synthetic Imagery Generation over Alaska and Hawaii for GOES-R Product Development

Dan Lindsey (NESDIS/StAR/RAMMB)
Louie Grasso (CSU/CIRA)

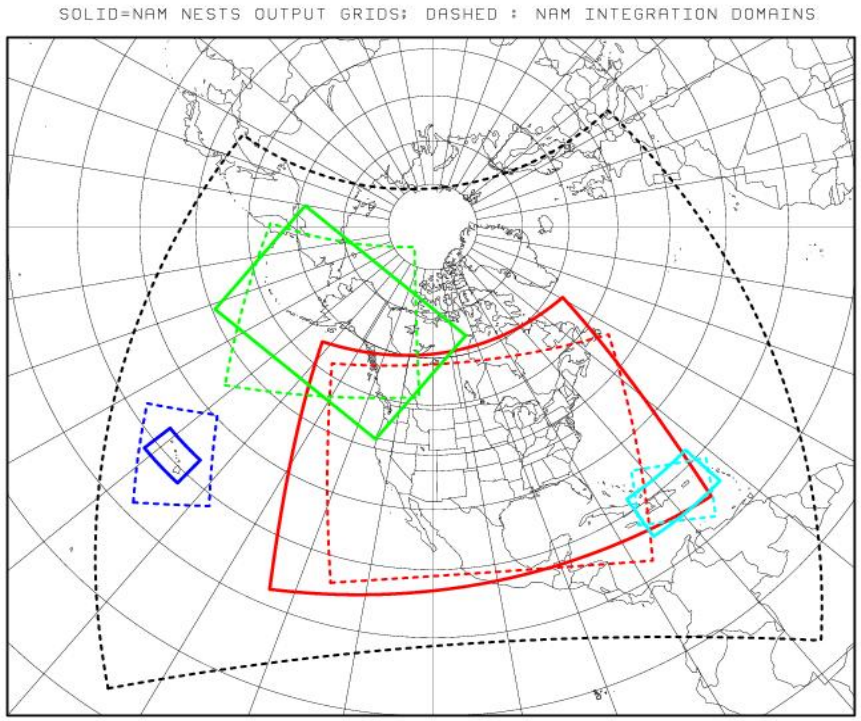
GOES-R Proving Ground:
Real-Time Synthetic Imagery



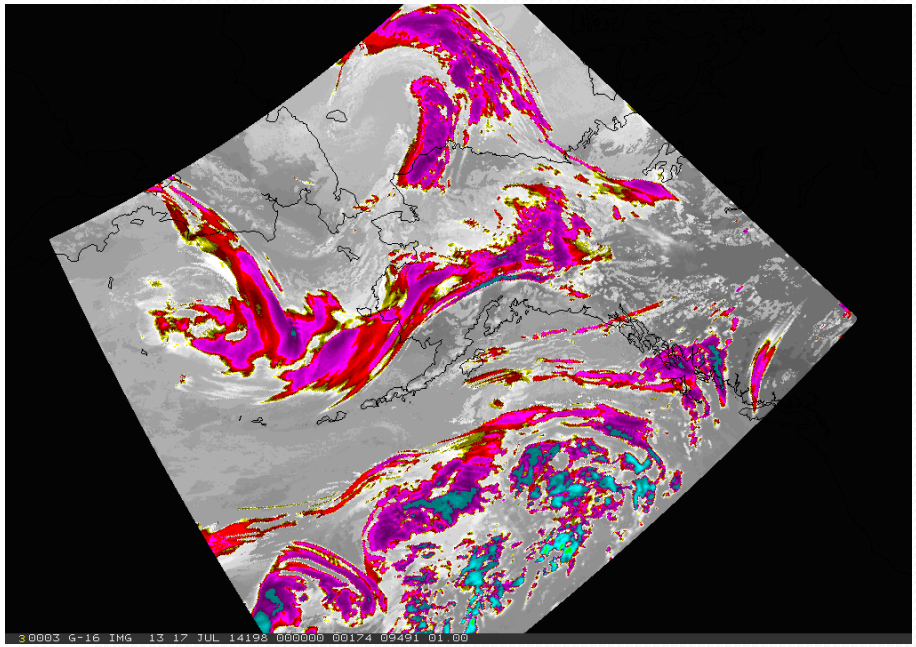
- *Synthetic ABI imagery is being generated in real time each day from the 4-km NSSL WRF model, and provided to the NWS for evaluation.*
- *Primary uses for forecasters include:*
  1. *To become accustomed to what the ABI bands will look like*
  2. *To visualize clouds from the model*
- *The loop above shows one way to view the imagery: an observed GOES-13 10.35 µm loop from 19 June 2014 that morphs into the forecast loop at the current hour (20 UTC in this case)*

Bikos, D., D. T. Lindsey, J. Otkin, J. Sieglaff, L. Grasso, C. Siewert, J. Correia, M. Coniglio, R. Rabin, J. S. Kain, and S. Dembek, 2012: Synthetic satellite imagery for real-time high-resolution model evaluation. *Wea. Forecasting*, **27**, 784-795.

Synthetic Imagery Generation over Alaska and Hawaii for GOES-R Product Development



NAM Alaska Nest 24-hr forecast 10.35 IR image
Valid 00Z 17 July 2014

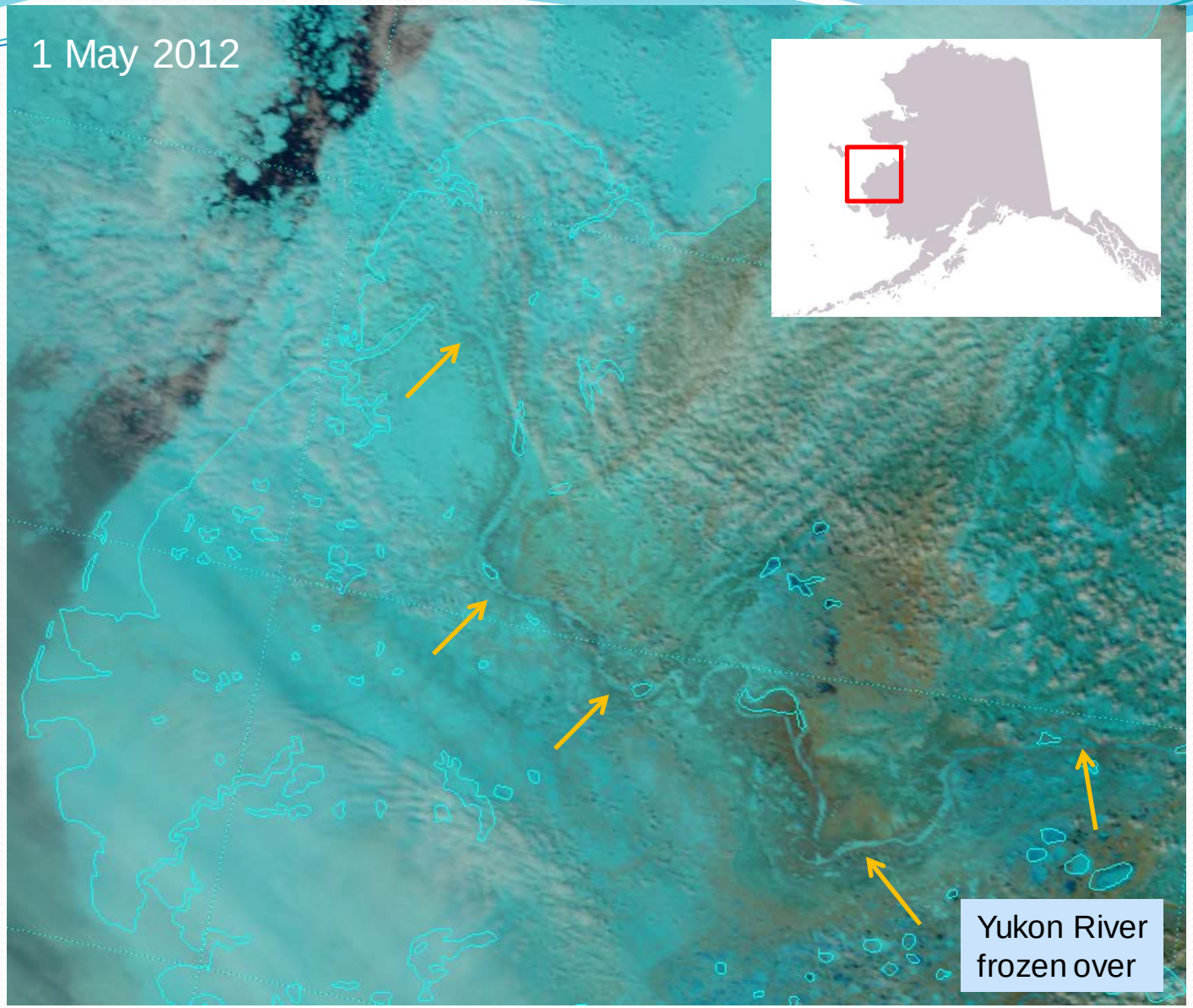


- The map above (left) shows the domains for the operational NAM and its nested runs (dashed = integration domain, solid = output domain)
- We will soon begin generating GOES-R ABI synthetic imagery using output from the Alaska nest (dashed green); an example IR image is above right
- After that, synthetic imagery over the Hawaii nest (dashed blue) will be created
- We will also investigate synthetic imagery generation from WRF-Chem output that includes volcanic ash, in collaboration with Martin Stuefer (U. Alaska-Fairbanks)

Leveraging of Suomi NPP VIIRS: RGB Imagery

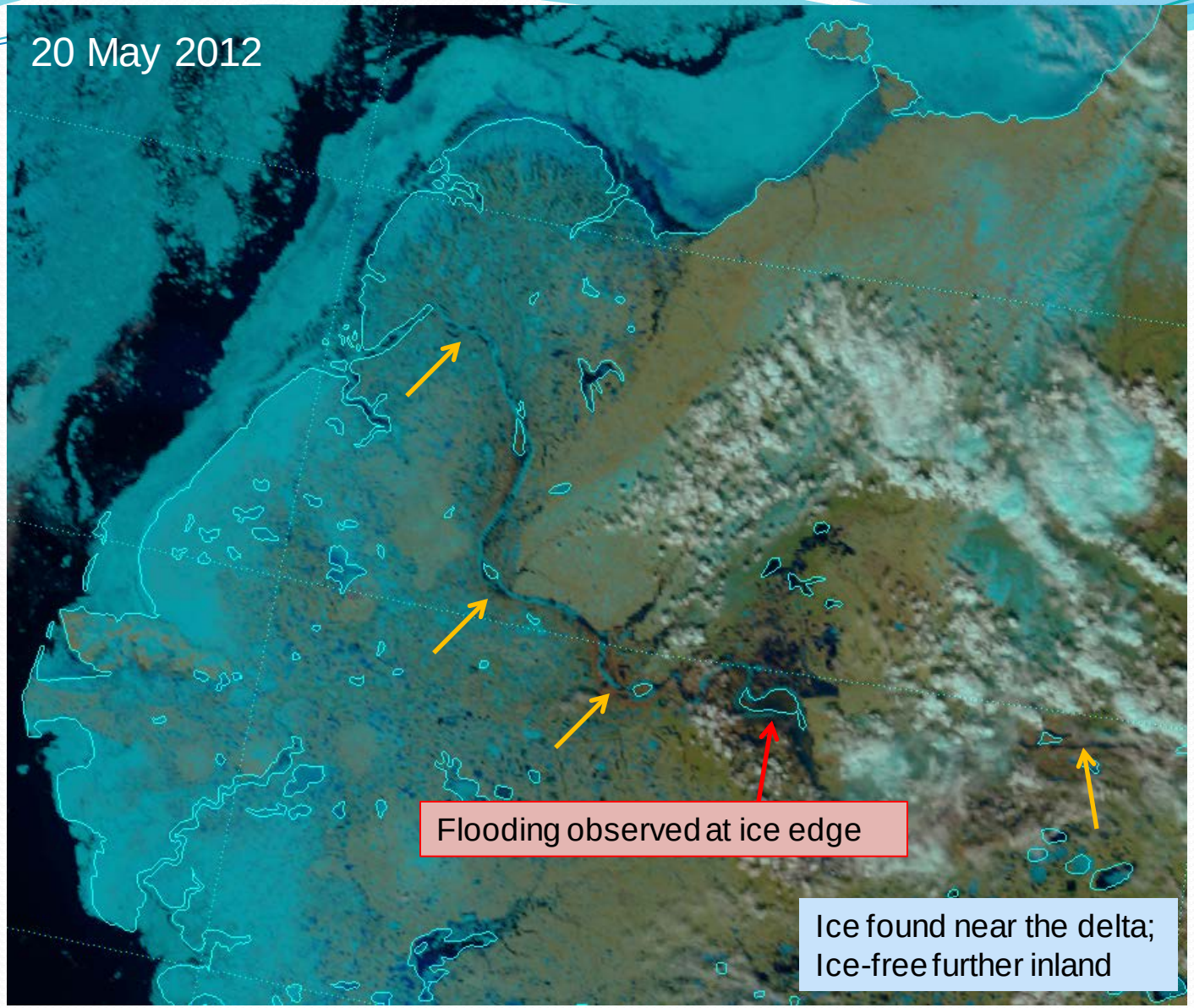
Curtis Seaman(CSU/CIRA)

Ice Jams and Flooding: Yukon River Example



VIIRS "Natural Color" [I-1 (11.45µm), I-2 (0.87µm), I-3 (1.61µm)] imagery is useful for detecting snow/ice and flooding. Detecting ice and ice-free areas in rivers is useful for identifying ice jams, which cause flooding.

Ice Jams and Flooding: Yukon River Example



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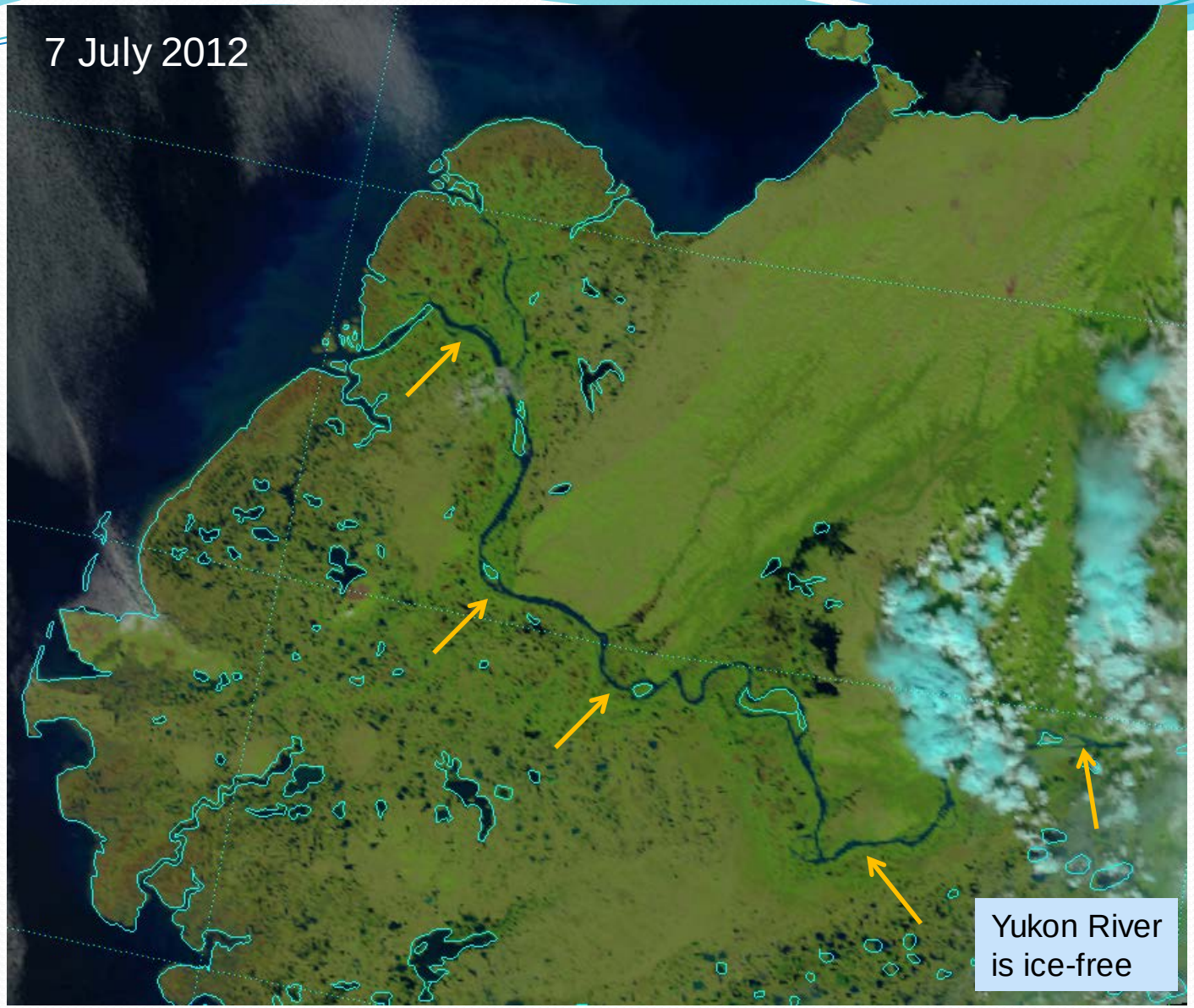

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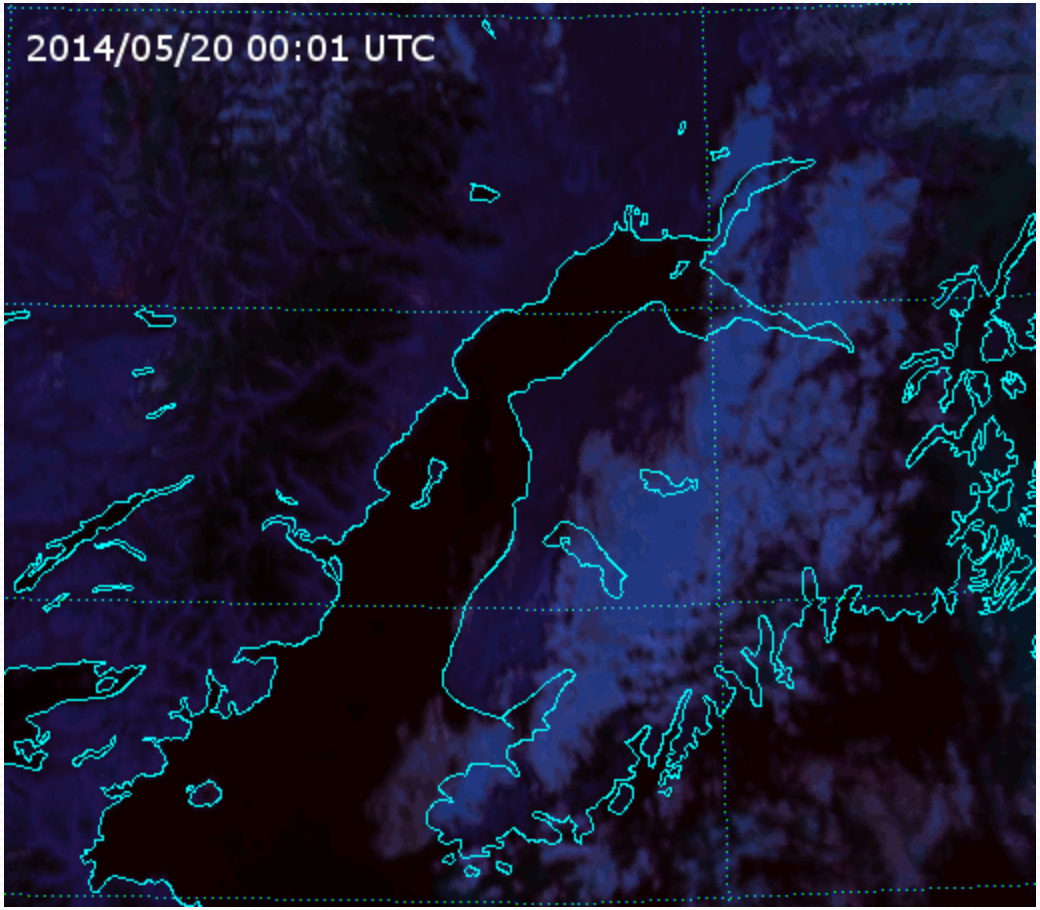
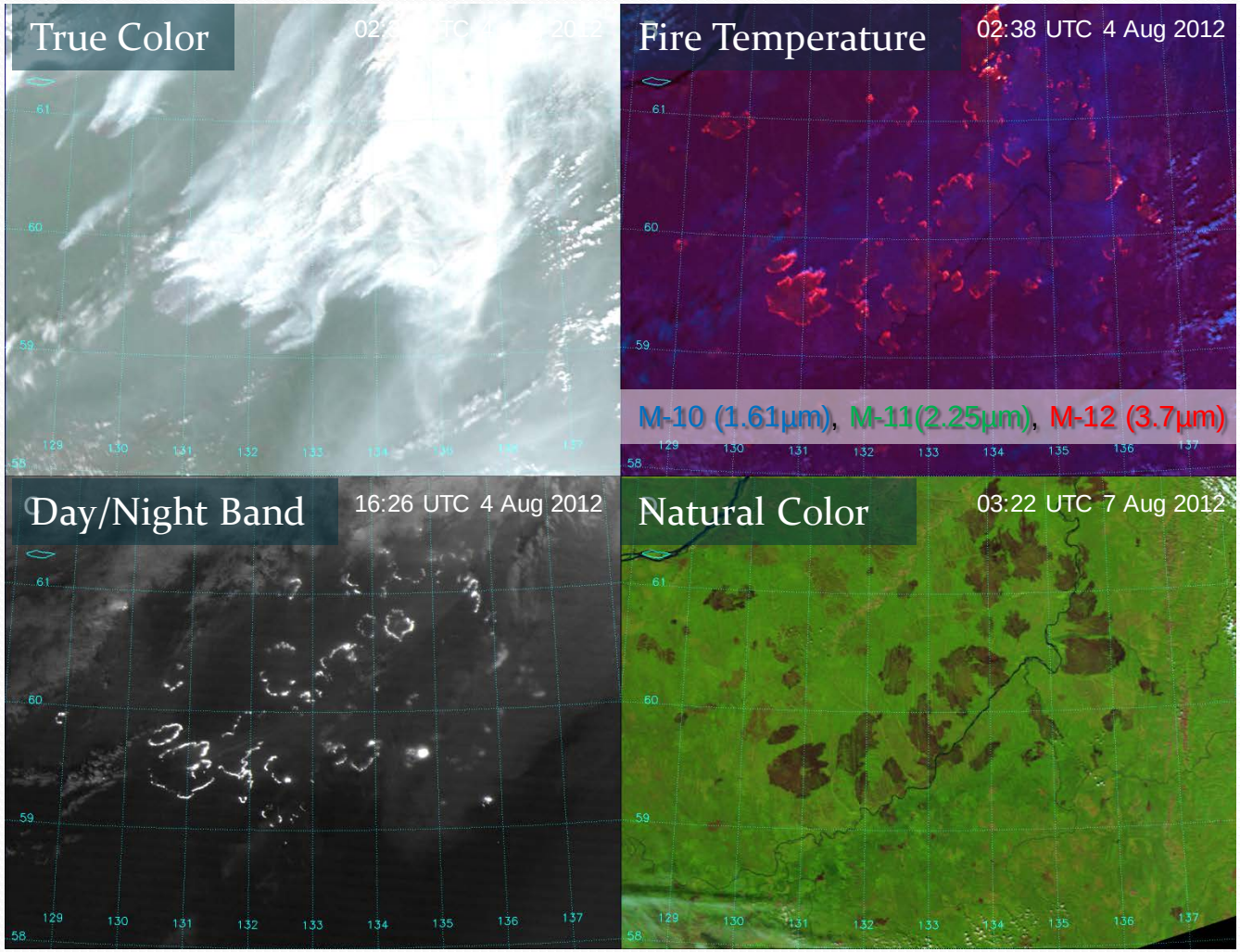
Fire Detection and Monitoring: Funny River Fire



VIIRS "Fire Temperature" RGB [M-10 (1.61µm), M-11(2.25µm), M-12 (3.7µm)] imagery is useful for detecting hot spots from fires. Pixel color is related to fire radiative temperature. This animation shows the growth of the Funny River Fire near Soldotna, Alaska (20-22 May 2014).

Fires from Multiple Perspectives

Fires in Siberia (Yakutia, Russia) August 2012



VIIRS captures fires from multiple perspectives: True Color RGB detects smoke, Fire Temperature RGB detects hot spots, DNB detects visible light emissions and smoke at night and Natural Color RGB highlights the burn scars

Orographic Rain Index (ORI)

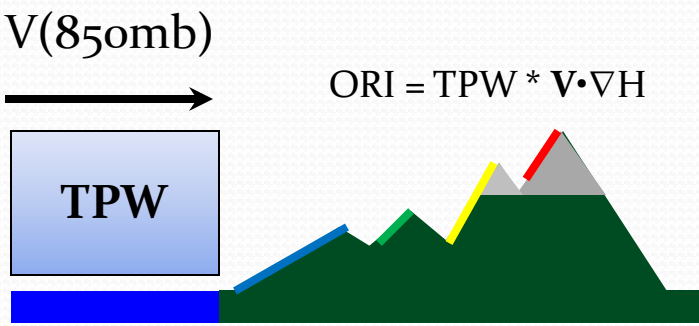
Steve Miller, Ed Szoke, and Dan Bikos
(CSU/CIRA)

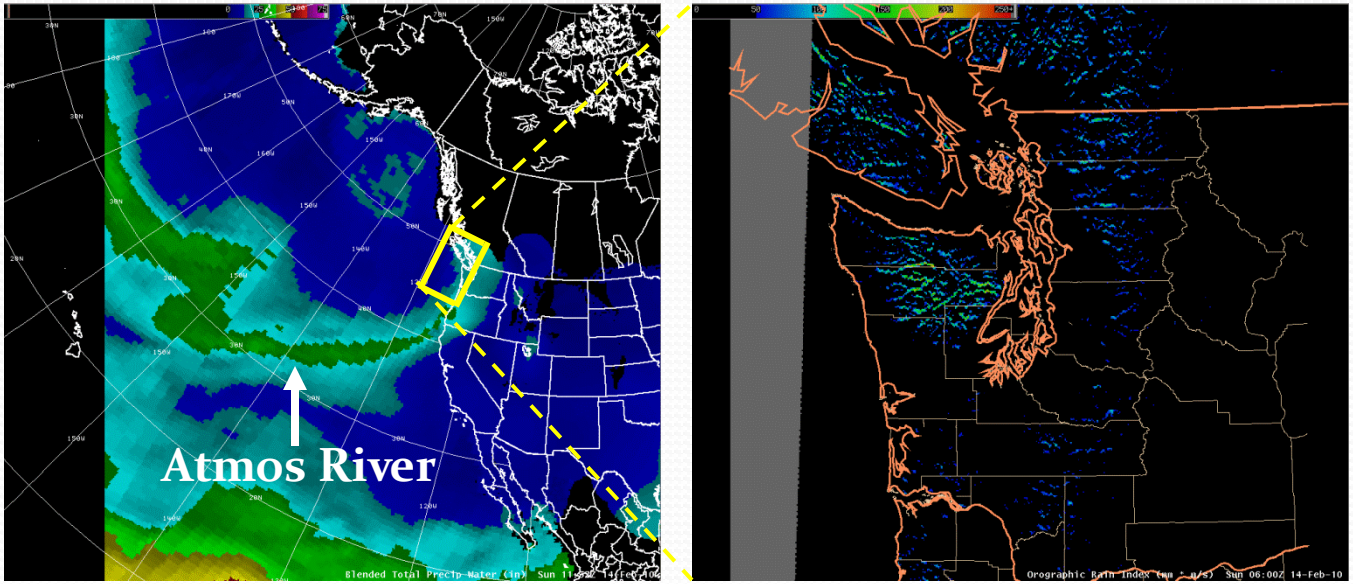
Orographic Rain Index (ORI) Short-Term Forecasting Tool

Satellite/Model Fusion Product:

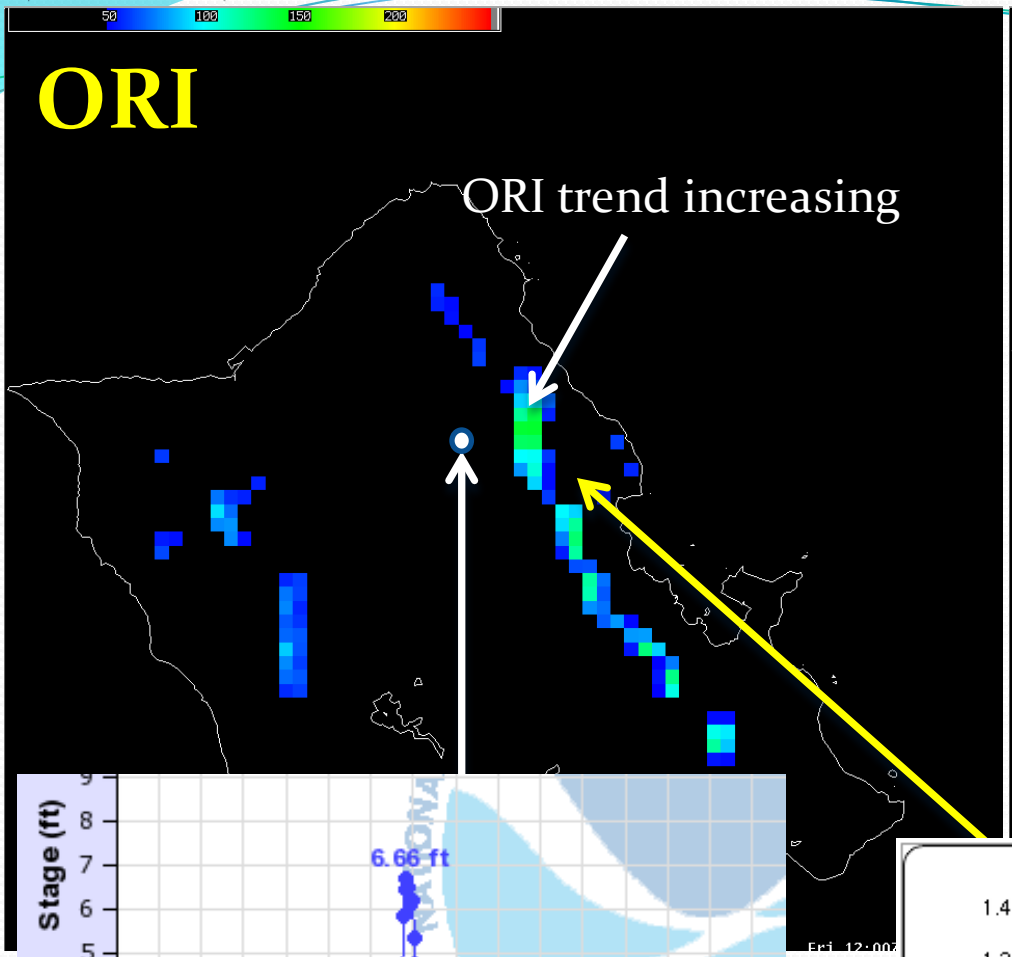
1. TPW retrievals from GOES/AMSU/GPS
2. Model wind fields from GFS
3. High resolution (30 s) terrain database

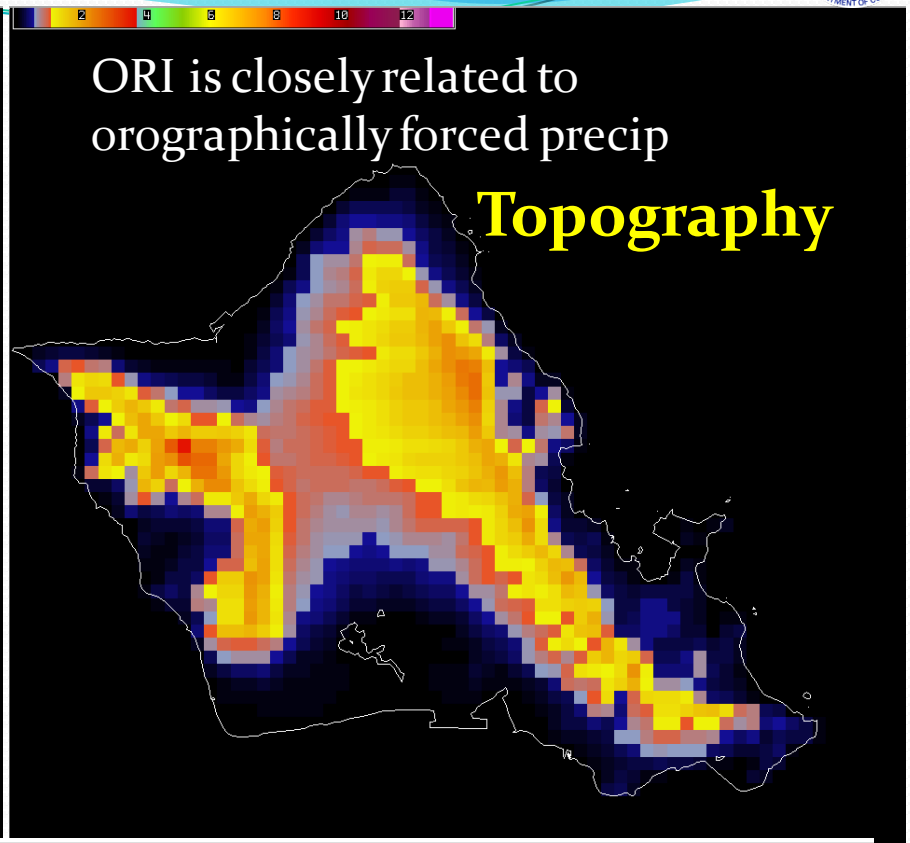
→ Predicts where land-falling moisture plumes will interact with strong terrain gradients in the 0-3 hr time frame.

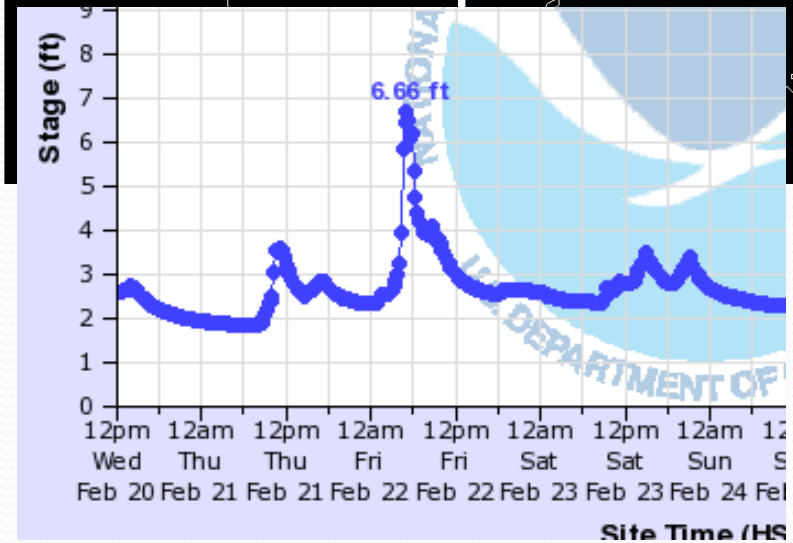


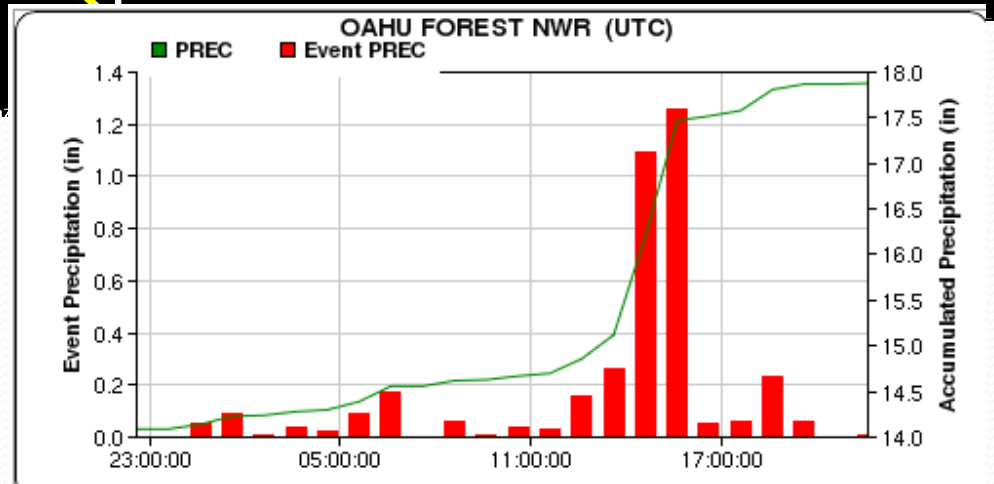


22 February 2013 Event Over Hawaii (Oahu)









ORI Notes

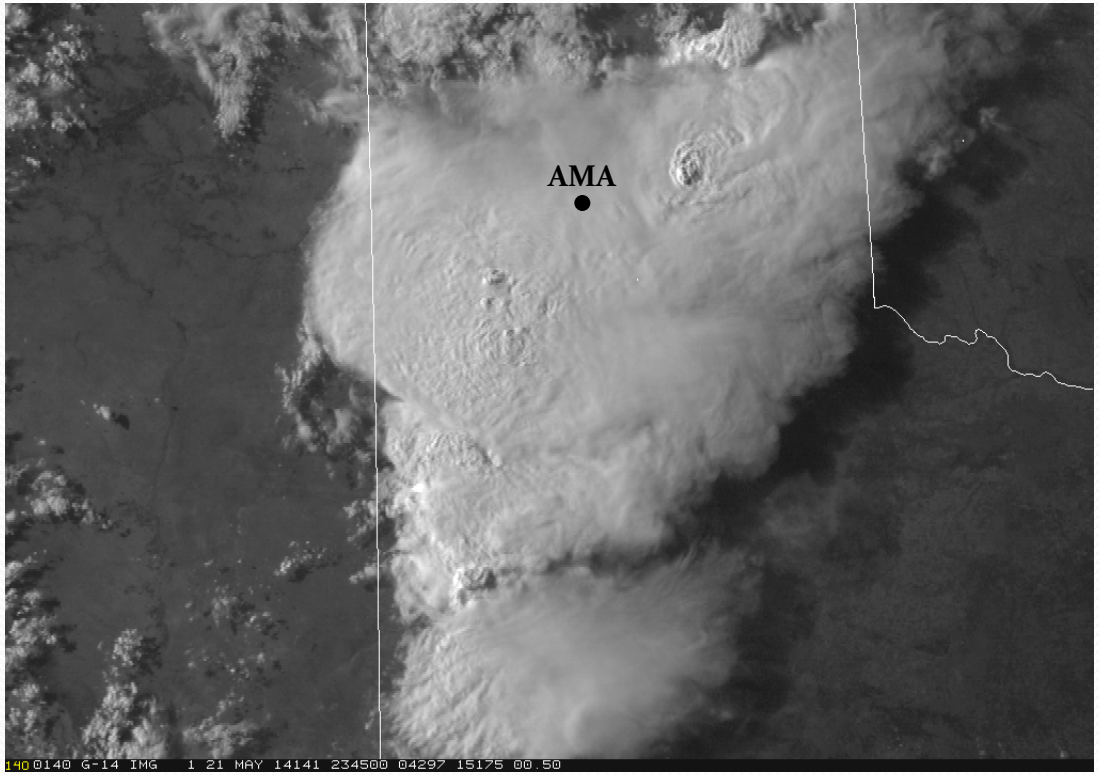
- The ORI product is experimental.
  - Additional research and development is still needed.

    → Your feedback is critical to product improvement!
  - Time trend of ORI more useful than instantaneous values.
- ORI does NOT predict precipitation.
  - Need to assess if precipitation is occurring (radar, satellite, surface observations, etc.).
- ORI can give you an idea of where/when orographic enhancement to rainfall may occur.
- Potential improvements:
  - Optimum wind level / layer to use.
  - Hourly output using HRRR winds (rather than 3 hourly GFS)
  - Couple with quantitative precipitation estimation (QPE) and forecasting (QPF) tools.

Anticipating Himawari-8/AHI and GOES-R/ABI

Dan Bikos, Jack Dostalek, Louie Grasso, and Kevin Micke (CSU/CIRA)
Dan Lindsey (NOAA/NESDIS/StAR)
Steve Miller (CSU/CIRA)

GOES-R Satellite Proving Ground:
CIRA provided GOES-14 1-minute imagery to SPC



"GOES 14 ONE-MINUTE IMAGERY SHOWS CONTINUED UPDRAFT GENERATION WITHIN A MORE MATURE CLUSTER JUST E OF AMA…AND ADDITIONAL TSTM DEVELOPMENT W OF MAF…SUGGESTIVE OF A CONTINUED SVR HAIL/WIND THREAT FOR AT LEAST THE NEXT 1-2 HRS."

[K. Micke, D. Lindsey, D. Molenar]

Storm Prediction Center

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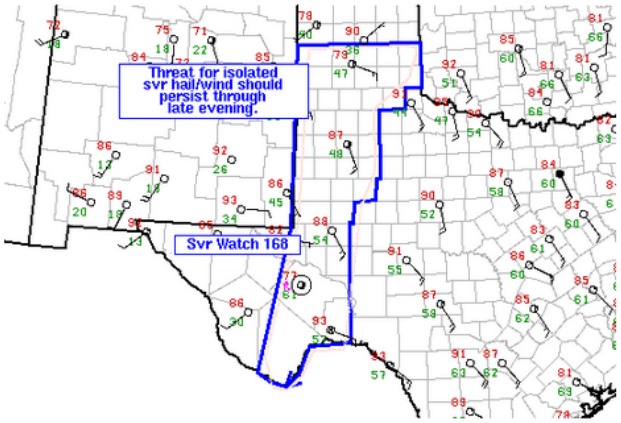
Mesoscale Discussion 647

< Previous MD Next MD >



SPC MCD #0647

MESOSCALE DISCUSSION 0647
NWS STORM PREDICTION CENTER NORMAN OK
0715 PM CDT WED MAY 21 2014

AREAS AFFECTED...TX PANHANDLE SWD TO THE TX BIG BEND

CONCERNING...SEVERE THUNDERSTORM WATCH 168...

VALID 220015Z - 220115Z

THE SEVERE WEATHER THREAT FOR SEVERE THUNDERSTORM WATCH 168 CONTINUES.

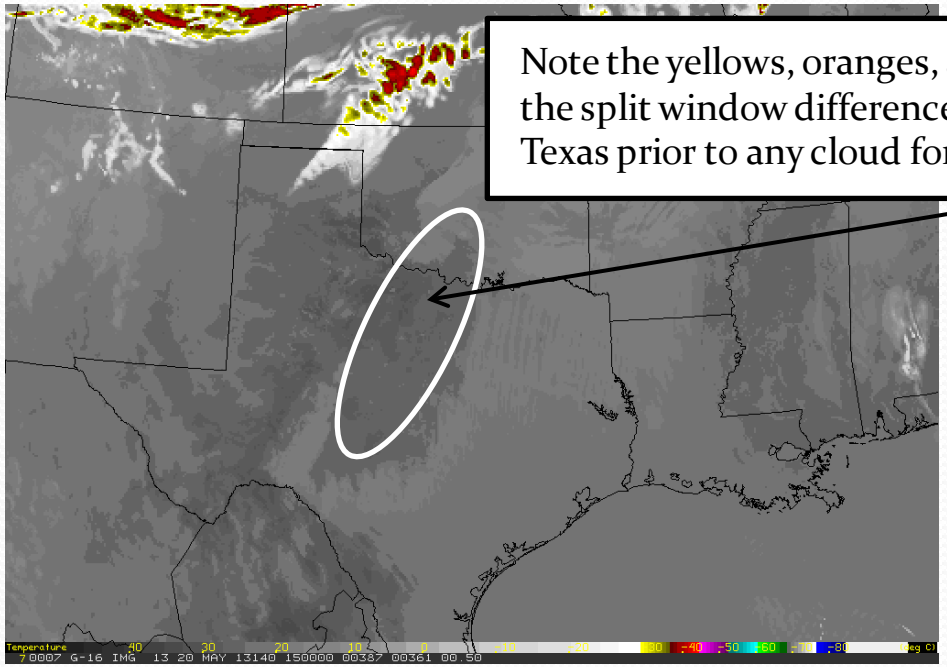
SUMMARY...AN ISOLATED SVR WIND GUST AND HAIL THREAT CONTINUES IN ASSOCIATION WITH A BROKEN LINE OF TSTMS FROM NEAR I-40 TO THE TX BIG BEND. THE LOSS OF DIURNAL HEATING IN THE NEXT COUPLE HRS SHOULD RESULT IN THIS THREAT SLOWLY DIMINISHING AND BECOMING MORE LOCALIZED.

DISCUSSION...A BROKEN LINE OF TSTMS GENERALLY ORIENTED N-S ACROSS W TX CONTINUES TO BE MAINTAINED AS AN IMPULSE EJECTS NEWD OUT OF NM. EMBEDDED MULTICELL CLUSTERS HAVE PRODUCED ISOLATED INSTANCES OF SVR WEST TEXAS MESONET. GOES 14 ONE-MINUTE IMAGERY SHOWS CONTINUED UPDRAFT GENERATION WITHIN A MORE MATURE CLUSTER JUST E OF AMA...AND ADDITIONAL TSTM DEVELOPMENT W OF MAF...SUGGESTIVE OF A CONTINUED SVR HAIL/WIND THREAT FOR AT LEAST THE NEXT 1-2 HRS. HOWEVER...THE LOSS OF DIURNAL HEATING...ALONG WITH CONTINUED BOUNDARY LAYER STABILIZATION VIA CONVECTIVE COLD POOL GENERATION...SHOULD FOSTER A SLOW DOWNTREND IN TSTM INTENSITY...WITH THE SVR THREAT BECOMING MORE LOCALIZED WITH TIME.

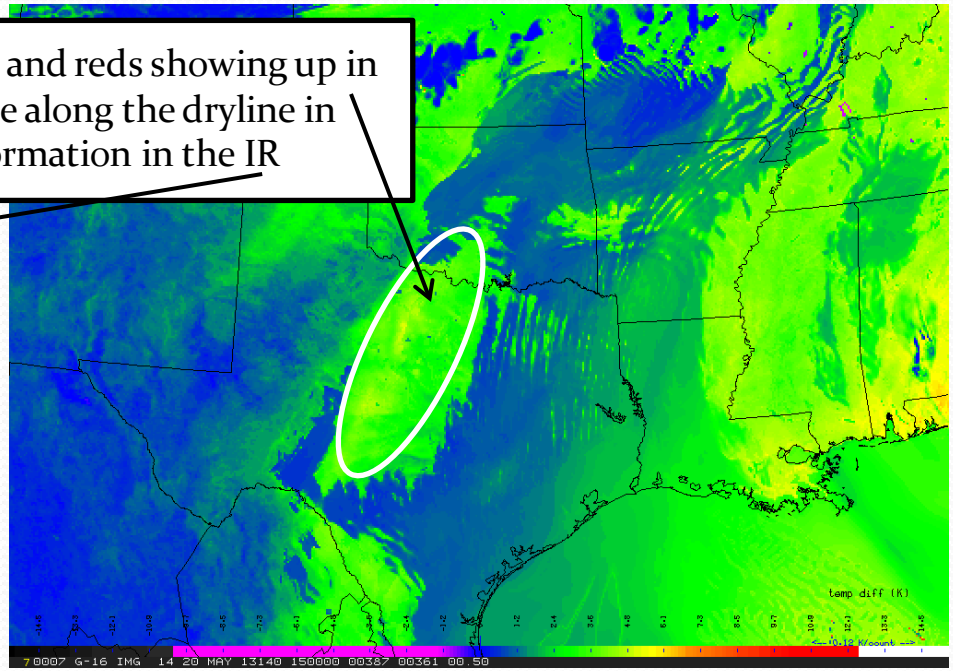
..ROGERS.. 05/22/2014

National Weather Service • Since 1870

GOES-R Risk Reduction:
Using the Split Window Difference to Diagnose Deeping Low-Level Water Vapor



Simulated GOES-R ABI 10.35 µm band based on a 15- to 24-hour forecast of the NSSL WRF from 20 May 2013



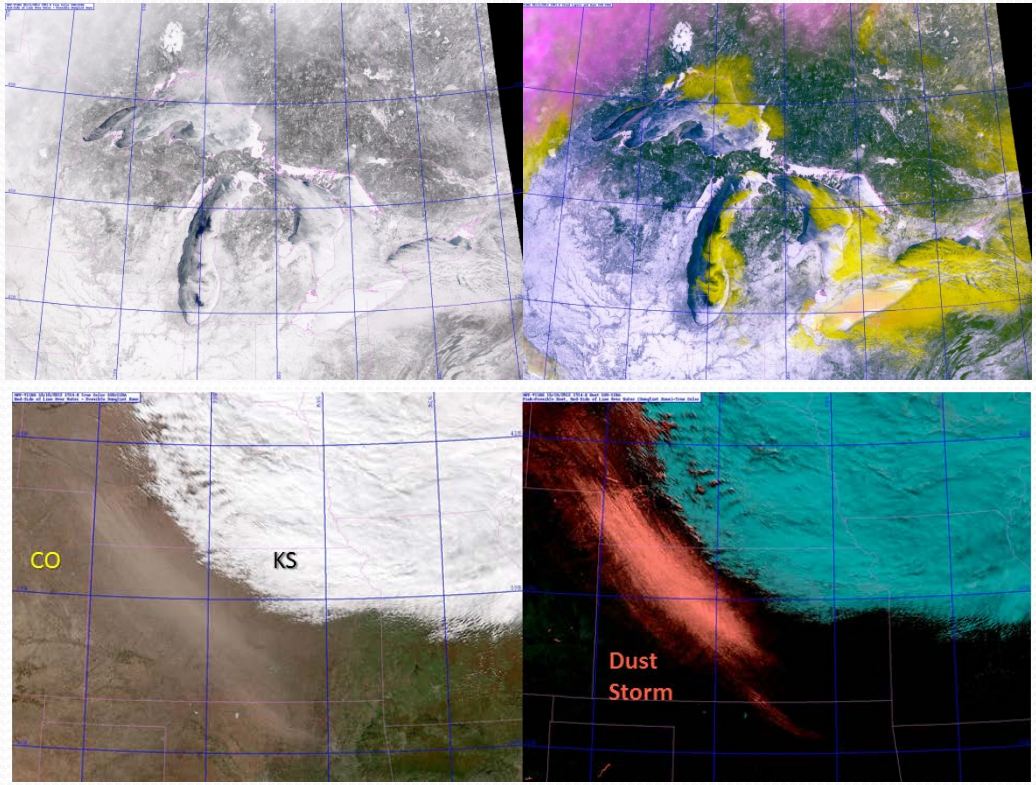
Simulated GOES-R ABI 10.35-12.3 µm Split Window Difference based on a 15- to 24-hour forecast of the NSSL WRF from 20 May 2013

After GOES-R data begins flowing, forecasters can use the 10.35-12.3 µm difference in clear sky regions to anticipate convective cloud formation

Lindsey, D. T., L. Grasso, J. F. Dostalek, and J. Kerkmann, 2014: Use of the GOES-R split window difference to diagnose deepening low-level water vapor. *J. Appl. Meteor. Climat.*, in press. Early Online Release: http://journals.ametsoc.org/doi/pdf/10.1175/JAMC-D-14-0010.1

GOES-R ABI Multi-Spectral Imagery for Visibility Hazard Assessment via Himawari AHI

- Value-added satellite imagery provides forecasters with a means to rapidly analyzing complex scenes while taking full advantage of multi-spectral info.
- The Advanced Himawari Imager (AHI) will offer an early view of GOES-R ABI imaging capabilities.
- **Visibility hazards related to lofted dust, clouds, and snow cover (blowing snow, nocturnal fog)** pose a considerable challenge to NWP.
- Develop MODIS/VIIRS dust and snow algorithms based on AHI bands.
- Demonstrate performance and prepare user training materials.
- Rapidly transfer these AHI-adapted algorithms to GOES-R ABI.



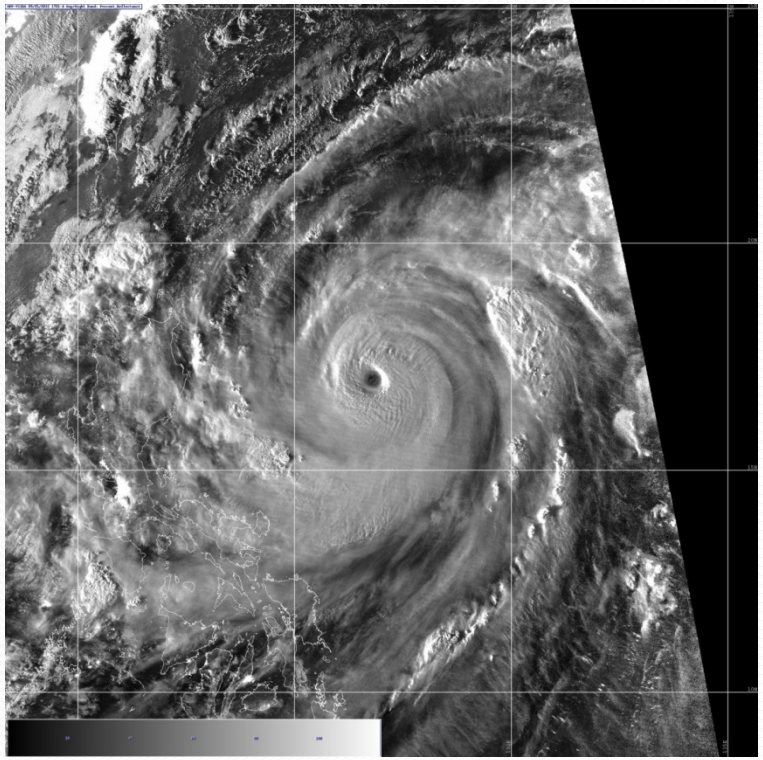
Examples of multi-spectral value-added imagery for snow/cloud (upper) and dust (lower) discrimination.

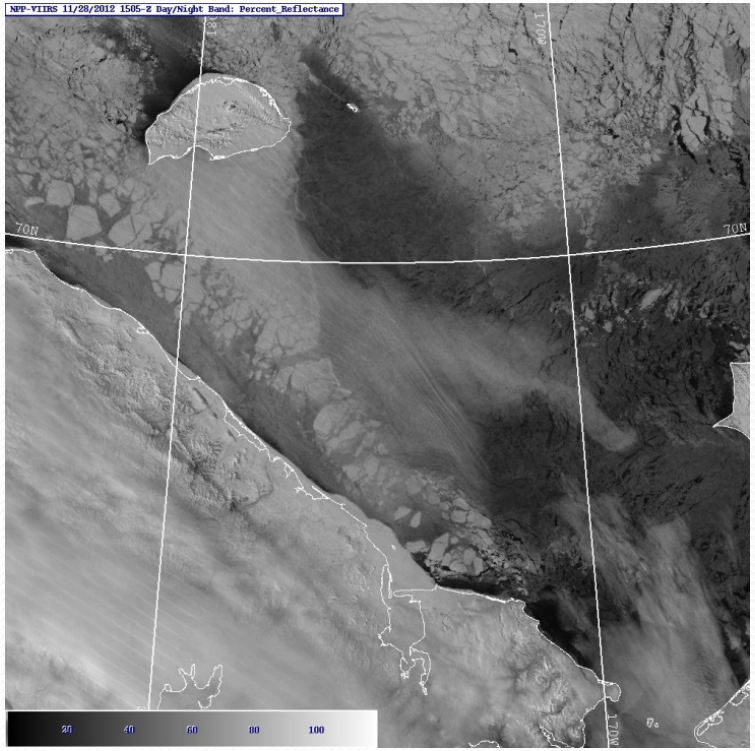
'First-Light' Availability of ABI Enhanced Imagery for Discrimination of Key Visibility Hazards

Potential CIRA/RAMMB research and product development using Himawari-8/AHI

- A end-to-end visibility hazards assessment capability (previous slide, S. Miller)—possible future capability product
- Further synthetic green LUT enhancements leading to an ABI Natural Color product (Miller, Hillger) – possible future capability product
- Examine possible cloud-top microphysics relationships to future TC evolution (Tourville, Knaff)
- Automated TC center-fixing, eye detection (R. DeMaria, Knaff)
- Cal/Val (VIIRS vs. AHI/ABI, Hillger, Seaman)
- Split-window application to pre-convective moisture pooling (Lindsey, Grasso)

Leveraging of Suomi NPP VIIRS Day/Night Band





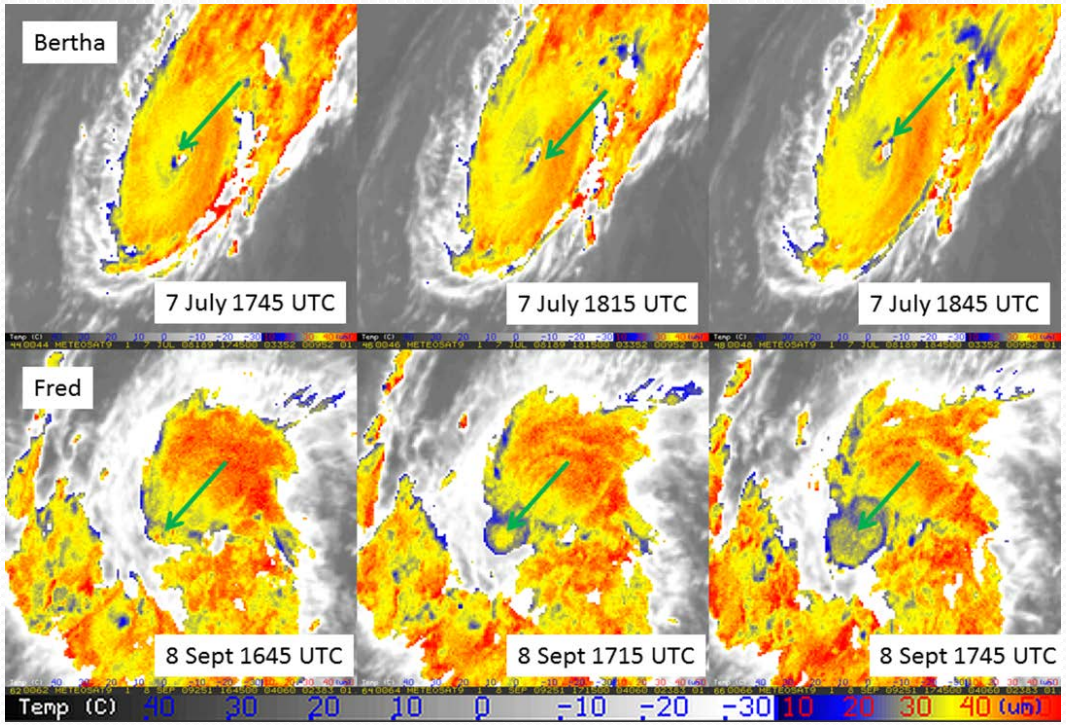
Remote Presentation by Steve Miller

Additional Slides Follow

TC Behavior Topic 1:
Understanding TC cloud-top microphysical relationships

Determine if the occasional occurrence of small ice particles at cloud top provides meaningful diagnostic or forecast information

- ✓ Use the CloudSat TC database + MSG data to identify and study such cases.
- ✓ Examine changes in TC behavior
- ✓ Document findings



Effective ice radius based on the Lindsey et al (2006) algorithm for Hurricanes Bertha and Fred in 2009 showing two types of small ice discharge typically seen in TCs. Bertha shows updrafts in the eye generating small ice particles and Fred has a single isolated updraft generating a large cirrus cloud. Green arrows point to these features. The scale of effective radius is provided by the color bar.