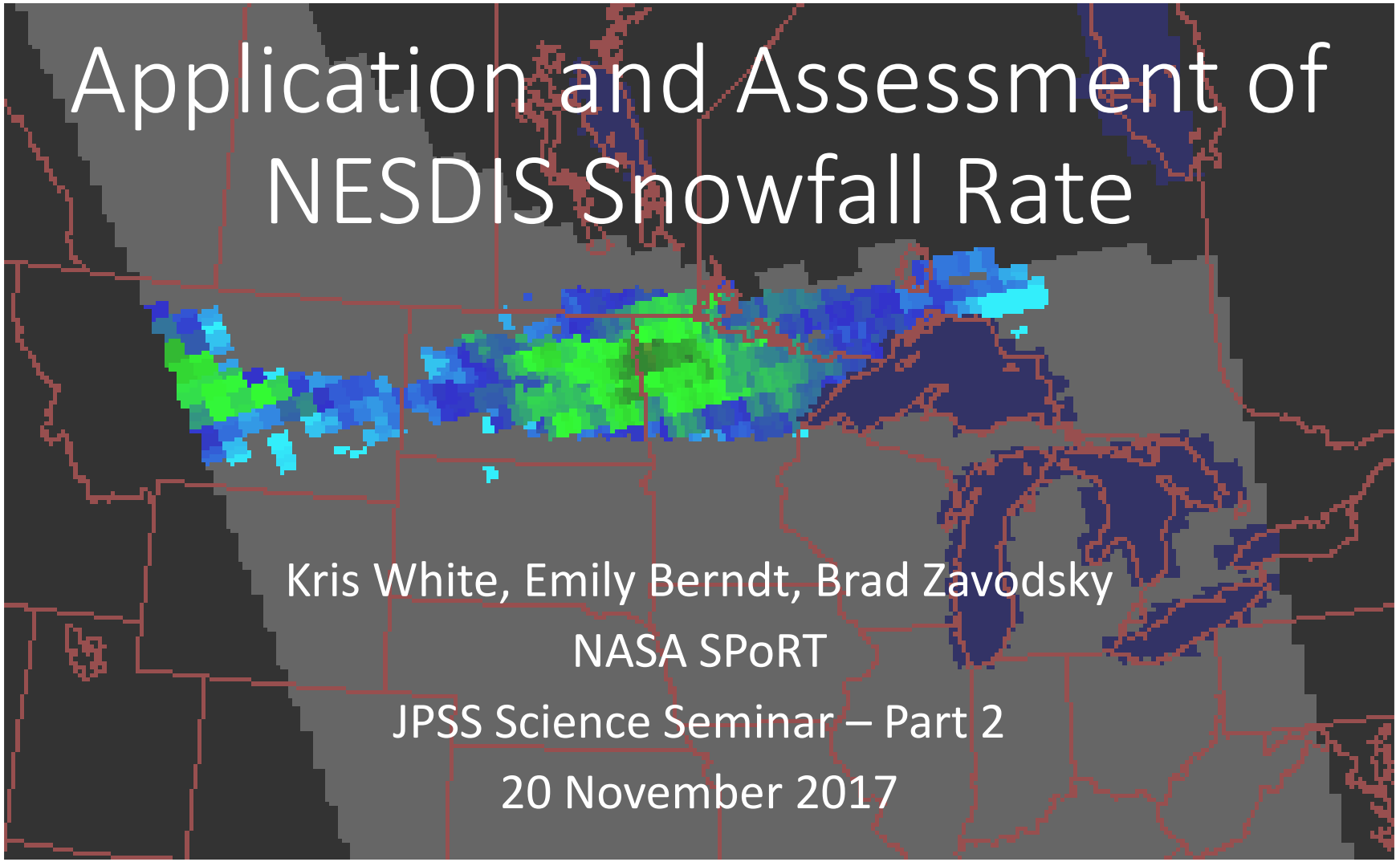
Application and Assessment of NESDIS Snowfall Rate



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JPSS Science Seminar – Part 2

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NASA

SPORT
Short-term Prediction Research and Transition Center

End User Interactions

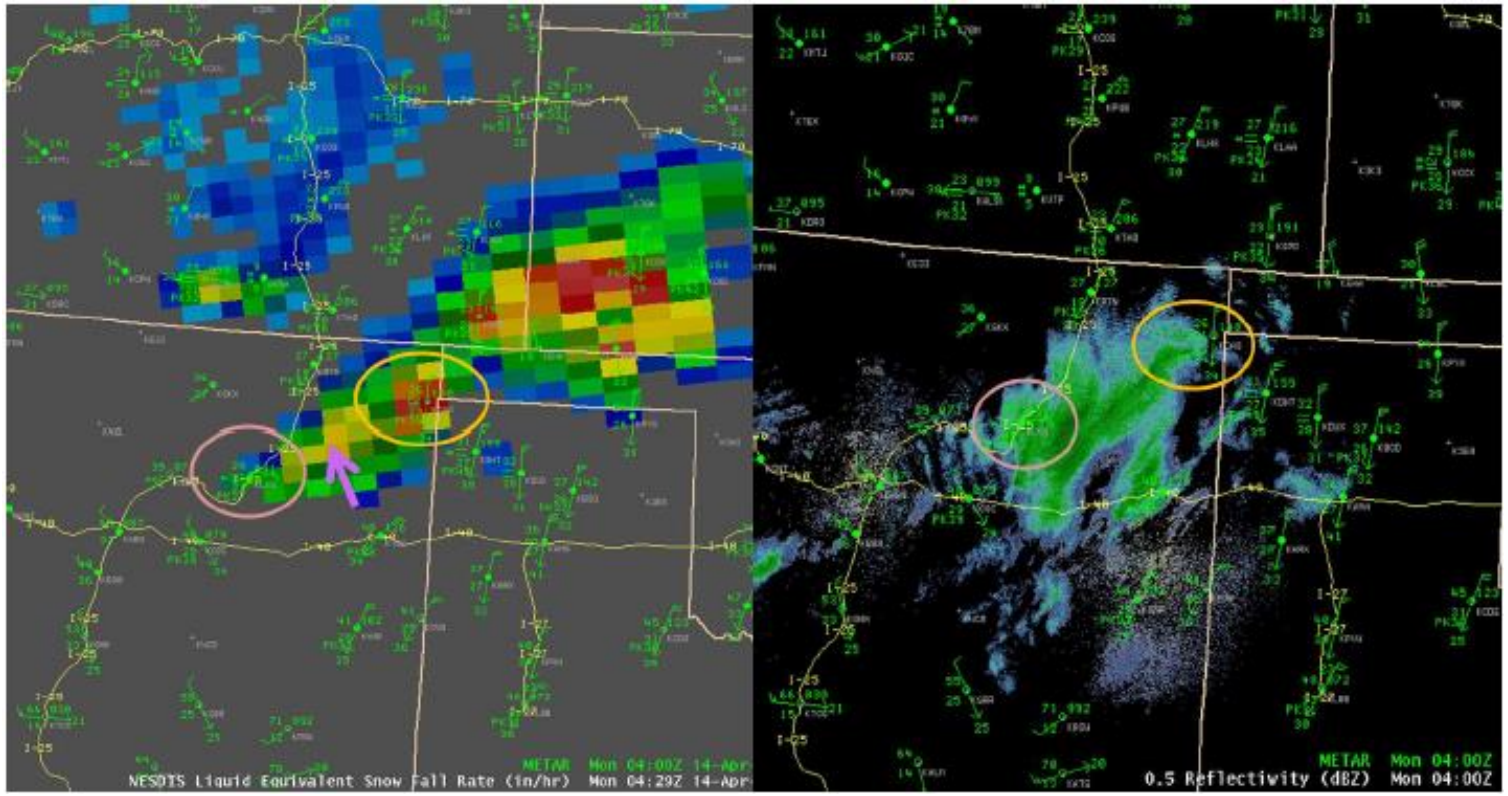
- **Winter 2014 assessment**: January to mid April 2014
- **Goal:** determine operational utility in the forecaster environment as it relates to:
  - radar gaps
  - beam blockage/overshooting
  - tracking snowfall rate maxima (in combination with other satellite imagery)
- **Participating Offices**
  - Albuquerque, NM
  - Burlington, VT
  - Charleston, WV
  - Sterling, VA
  - Satellite Analysis Branch

Product in 2014

- AMSU/MHS from NOAA-18, -19, MetOp-A, -B
- Up to 8 SFR retrievals per day at any location
- Land only retrievals
- Limited to regions with surface temperature > 22°F
- 30 to 90 minutes time lag between retrieved snow and snow reaching the ground
- Detectable snowfall rates from 0.004 in/hr to 0.2 in/hr (2 in/hr if snow to liquid ratio is 10:1)
- Processed near real-time at NOAA/NESDIS with a 30 min to 3 hour latency
- SPoRT made data AWIPS/NAWIPS compatible for dissemination to NWS
- Module and Quick Guide developed

Results

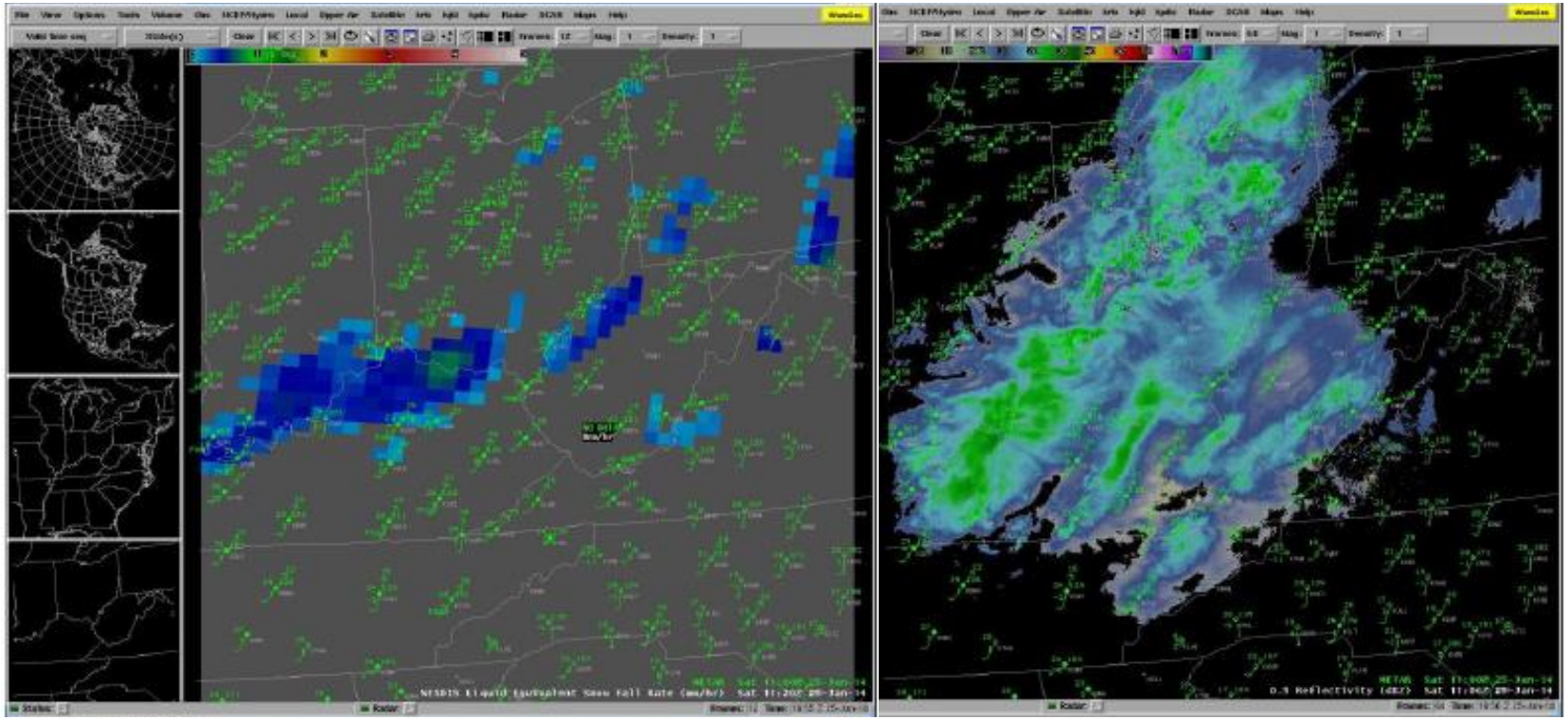
- Heavy snowfall events in warmer temperature regimes were captured well
- 13-14 April 2014 a fast-moving upper level trough and a backdoor cold front moved south from the eastern plains of Colorado to New Mexico



"The 0429Z SFR product has the greatest values observed in NM for this event. Our Clayton observer (CAO – orange oval) did call in at 06Z with a report of 1.5 inches of snow. We didn't receive snowfall at the Las Vegas ASOS (LVS – pink oval). Another spotter call from 05Z reported 2.5 inches of snow at a location near the purple arrow." – Albuquerque, NM WFO.

Results

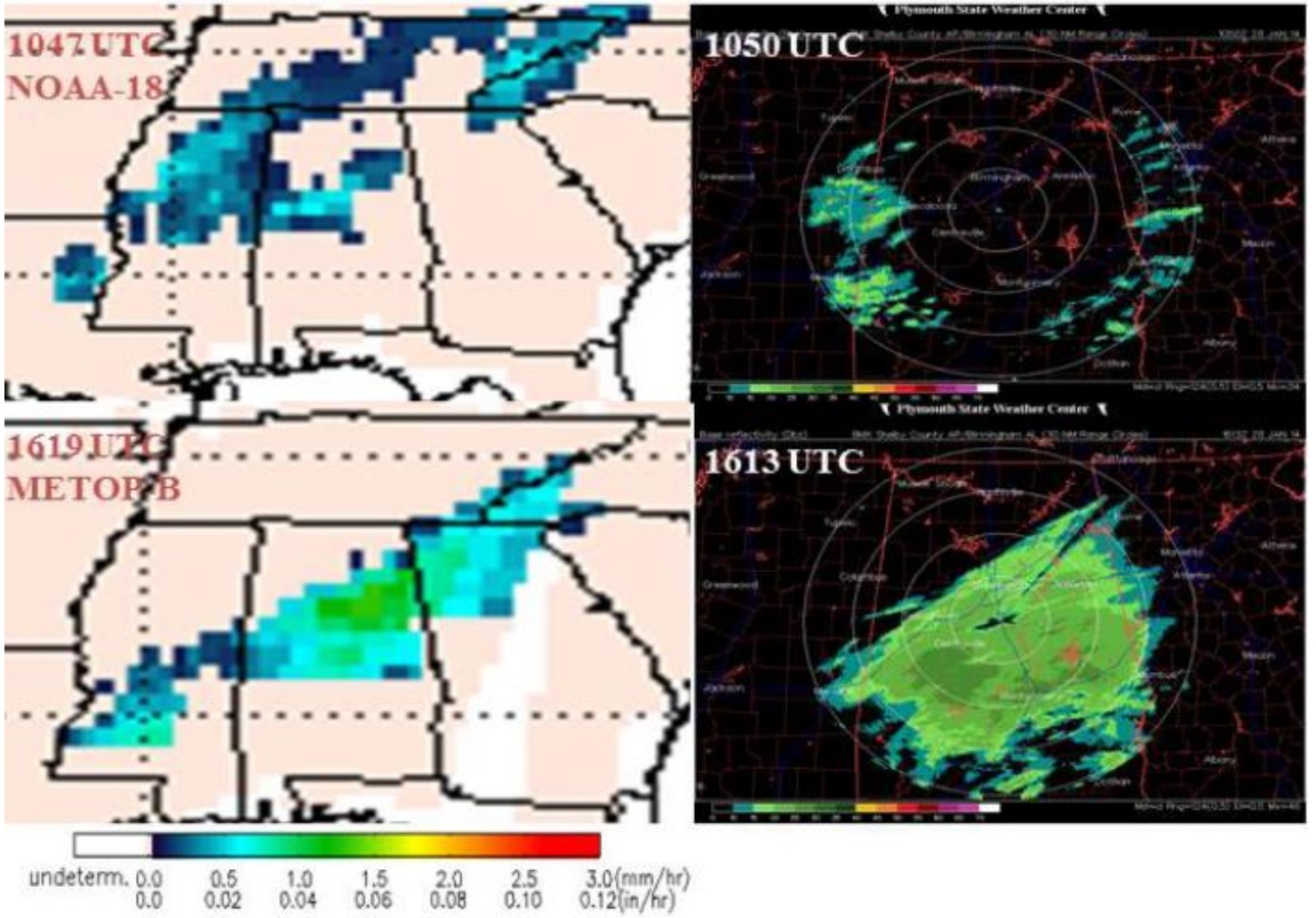
- Inability to detect lighter snowfall amounts that were detected by ASOS



“It looks like the SFR product did not detect all of the snow that was falling around 11 UTC. But the misses can either be described as either (1) the surface temperature being too cold or (2) the probabilistic model that is part of the calculations, indicating probabilities were too low to determine if there was snow” – Charleston, WV WFO.

Results

- Using the product as a forecasting tool: detecting snow in the cloud, not reaching the ground and not detected by radar
- Snow/Ice event in central Alabama 1/28/14 that stranded motorists
- No snowfall reports called in, weak radar returns, SFR showed substantial snow to the west, not detected by radar
- Could SFR be used to provide additional guidance or lead time on a snow forecast



Feedback Summary

- Product was limited at times by its latency but forecasters found it valuable in a operational sense and to validate snow reports
- Overall feedback was positive with more than 75% of responses indicating the product was useful to improve data coverage in areas with radar gaps and in combination with satellite observations to track snowfall maxima
- Limitations were uncovered
  - Lighter snowfall rates not detected
  - Sometimes missing snowfall captured by radar

Recommendations to Developers

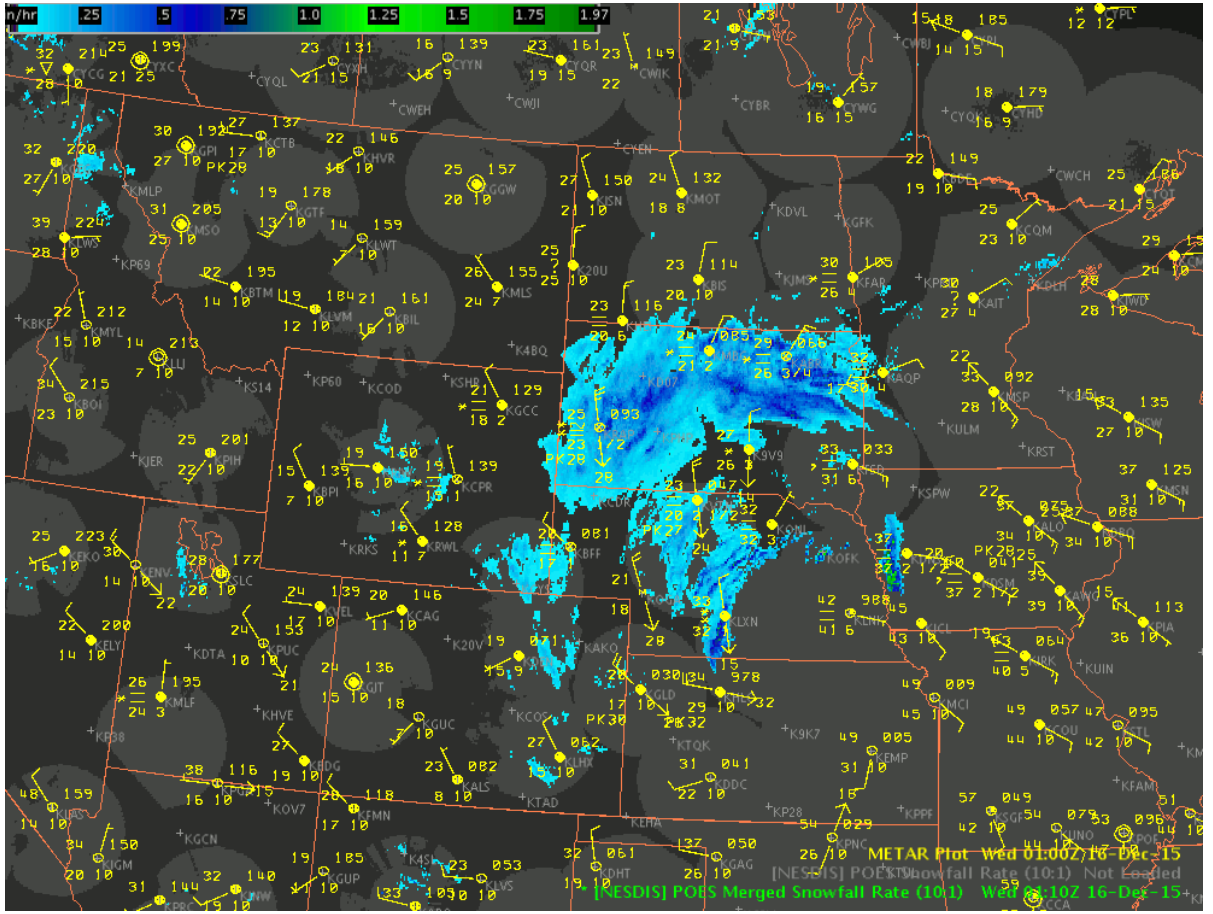
- Reduce the latency to < 60 minutes
- Explore improving the low snowfall rate detection efficiency (an increased false alarm rate may be acceptable if more events are captured)
- Investigate the ability to retrieve snowfall rates when surface temperatures are colder. This would make it easier for northern WFOs to use the product and enable use in Alaska

End User Interactions

- **Winter 2016 assessment**: January to February 2016
- **Goal:** determine operational utility in the forecaster environment as it relates to:
  - radar gaps
  - beam blockage/overshooting
  - tracking snowfall rate maxima (in combination with other satellite imagery)
  - Determine areas where cloud seeding may be occurring ahead of falling precipitation
- **Participating Offices**
  - Albuquerque, NM
  - Anchorage, AK
  - Juneau, AK
  - Boulder, CO
  - Charleston, WV
  - Sterling, VA

New Product Developments

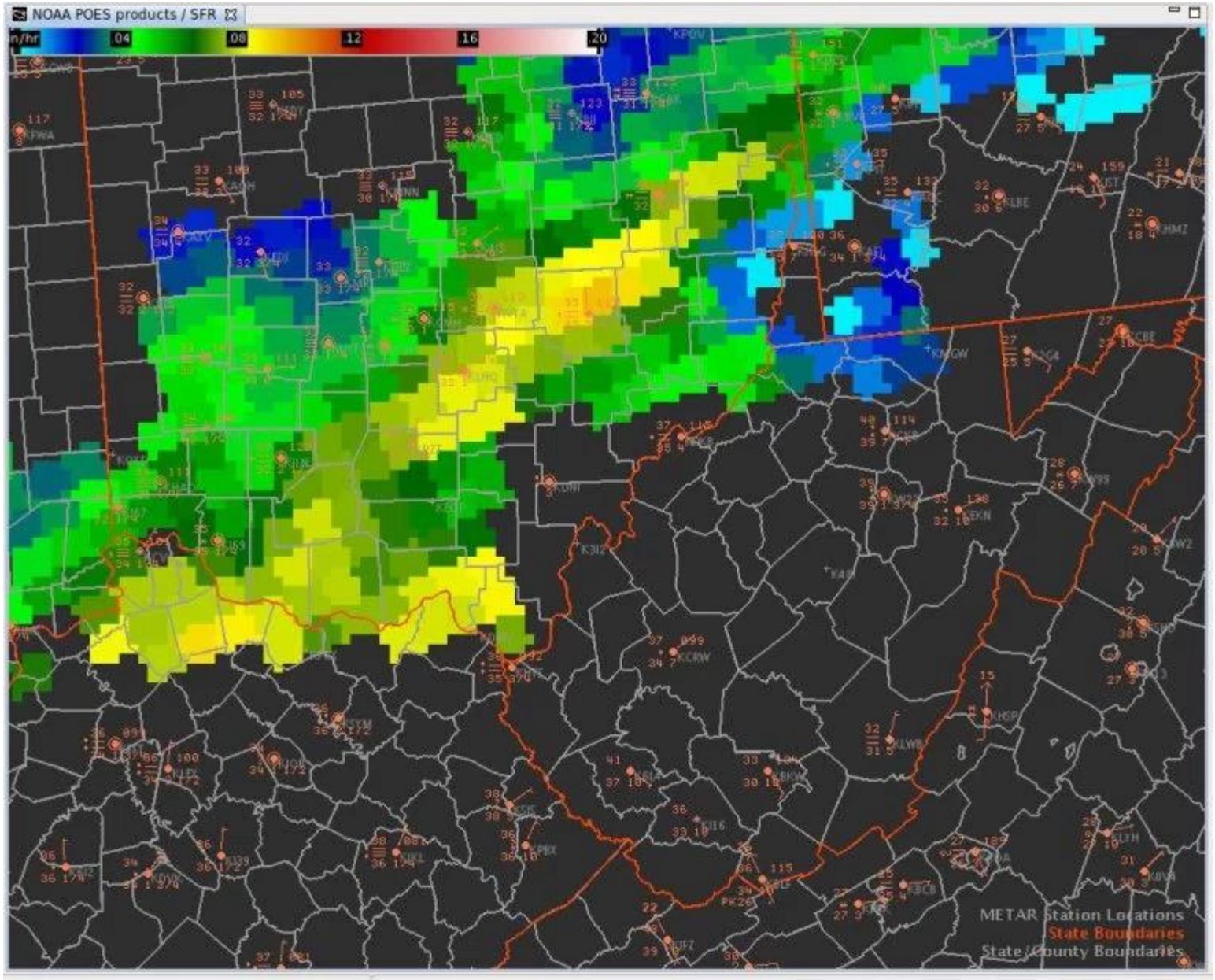
- Added ATMS
- Alaska product
- Snow to liquid ratio options
  - 10:1
  - 18:1
  - 35:1
- Merged snowfall rate product
  - Polar orbiter swath complimented with NSSL's Multi-Radar/Multi-Sensor precipitation data
  - Product updated every 10 minutes



Results

- Rain to snow transition event 15 Feb. 2016 where rainfall mixed with and then transitioned to all snow

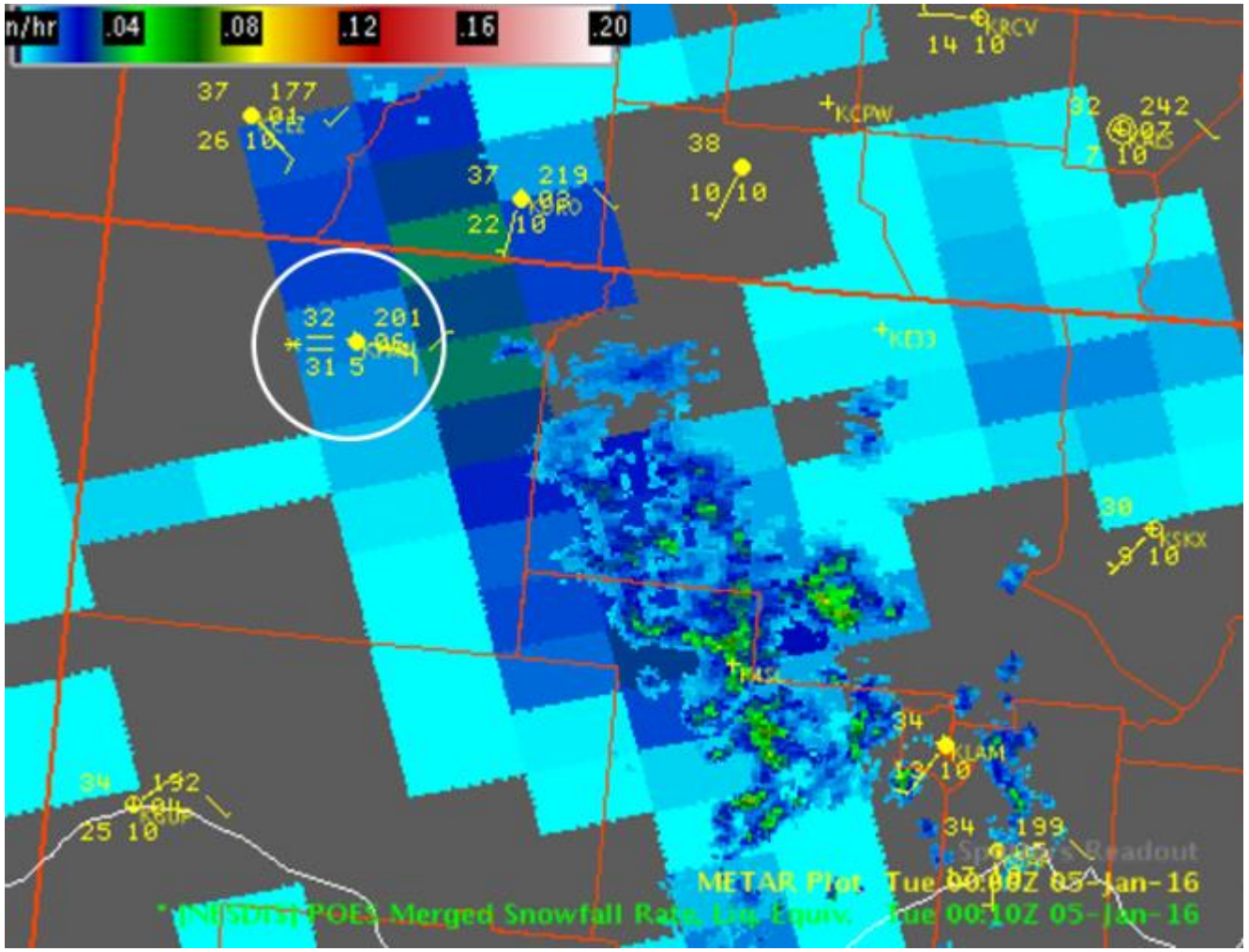
"Much of the precipitation across West Virginia was still in the form of rain…with an area of snow extending from northwest PA across Ohio into southwest portions of the state. There appears to be several observations of rain across Ohio with surface temperatures of 32 to 35 DegF where the SFR product indicated snow in the clouds" – Charleston, WV WFO.



Results

- Enhanced snowfall detection in areas with lack of radar coverage – case from NW New Mexico, 4-5 Jan 2016

"The arrival of a SFR product at 0010 UTC 5 January 2016 showed the extent of the precipitation was much greater with the merged POES image overlaid on the radar data." – Brian Guyer, WFO ABQ



Results

- Although more the 75% of responses indicated low to medium confidence in SFR values, 75% of responses indicated the product was useful
- Most responses indicated SFR was used to identify snowfall in data-deprived regions
- Reasons the SRF product was not useful:
  - Underestimated snowfall amount
  - Not available over water or coastline
  - Missed location of light/moderate snow detected by other sources

Results

- More the 85% of responses indicated medium to high confidence in merged SFR values, 100% of responses indicated the product was useful
- 75% of forecasters indicated the ability to loop the product with blended radar made the product more useful
- Most responses indicated merged SFR was used to identify snowfall in data-deprived regions and track the maxima
- Reasons the merged SRF product was not useful:
  - Underestimated snowfall amount
  - Still too latent
  - Missed location of light/moderate/heavy snow detected by other sources

Upcoming Assessment Winter 2017-18

- Changes to product
  - Inclusion of SSMIS (DMSP: F16, F17, F18) and GMI (aboard NASA GPM)
  - Improved snowfall detection algorithm
- **Goal:** Determine operational utility in the forecaster environment as it relates to:
  - Temporal resolution of data/imagery
  - Accuracy of snowfall rates based on type of snowfall event
  - radar gaps
  - beam blockage/overshooting
  - tracking snowfall rate maxima (in combination with other satellite imagery)
  - Determine areas where cloud seeding may be occurring ahead of falling precipitation
- **Participating Offices**
  - Albuquerque, NM
  - Anchorage, AK
  - Boulder, CO
  - Charleston, WV (limited participation)
  - Great Falls, MT (waiting to hear)
  - Juneau, AK (waiting to hear)
  - Fairbanks, AK (waiting to hear)
  - Sterling, VA (waiting to hear)

Summary

- SPoRT and NESDIS have collaborated over the last 4 years to introduce the snowfall rate product to NWS forecasters and assess the utility in the operational environment
- User feedback has let to product improvements including a merged product, availability of liquid to snow ratio displays, and inclusion of additional polar-orbiting data
- Successful story of R2O and O2R with a period of intensive interaction between product developers and end-users.