NEXRAD TAC - March 23, 2016
Meeting called to order at Noon (central)

TAC members in attendance: Rich Ice (acting Chair), Jim Wilson, Lee Crowley, Mike Jain, Jim Evans, Cam Tidwell, Paul Smith, John Zapotocny, Mike Istok, Dan Miller

4 Informational Presentations:

- Development and Validation of the R(A) Algorithm for Rainfall Estimation, Alexander Ryzhkov, NSSL
- Multi-Radar Multi-Sensor (MRMS) System - What is…?, Ken Howard, NSSL
- ZDR Calibration Update, Glenn Secrest, ROC
- Using the Crosspolar Power Technique for ZDR Calibration for S-Pol during PECAN, John Hubbert, NCAR

Development and Validation of the R(A) Algorithm for Rainfall Estimation, Alexander Ryzhkov, NSSL

- Dr. Ryzhkov stated that he believes ZDR will be well calibrated eventually
- In the meantime, attenuation based algorithms will help
- Concept of R(A) recently introduced in S, C, X-band in different parts of world
- Rain rate can be estimated from specific attenuation..key parameter defined (Alpha)
- Alpha is a function of ZDR and is especially pronounced with tropical rain
- Alpha can be optimized via the “ZDR Slope” concept
- For continental rain (ice aloft), alpha is close to constant (0.15 dB/deg)
- R(A) uses slope of ZDR, which is nearly immune to biases in ZDR
- 3 versions of R(A) currently being examined by NSSL
- Big advantage to R(A) is that the estimate is immune to partial beam blockage, but does not provide assistance in areas of full beam blockage
- In testing, R(A) outperformed MRMS Q3RAD

Questions:

Bob Saffle question: When correcting for hail, does the method also consider rain in the areas of hail?
A: R(A) is complimented by R(kdp), which is immune to hail contamination. NSSL also looking at refinements to R(kdp) in order to avoid overestimates in hail.

Jim Wilson: comment on use of KDP resulting in overestimation needing a different R(A) relationship...yes that is true.

Multi-Radar Multi-Sensor (MRMS) System - What is…?, Ken Howard, NSSL

- MRMS in development for over a decade, expect full operational capability in FY 2017
- This is the 3rd TAC briefing on MRMS
- MRMS provides severe weather, aviation, and model data over the CONUS and Canada
- 180 radars are continuously ingested, with 10,000 rain gauges every hour
- MRMS transitioned to NWS operations on Sept 29, 2014
- MRMS provides 2 minute updates
- 25 products are disseminated to NOAAPORT and are CONUS-wide
- LDM feed available from NCEP Central Operations with full suite of products accessible in grib2 format
- MRMS webpage on NSSL site to describe MRMS; using NWS VLab (virtual lab) as repository for documentation and code
- NSSL also maintains real-time development MRMS (web-based), which includes tools for interrogating products, used to gather feedback from the field
- MRMS can speed transition of Research to Operations (R2O)
- R(A) has been tested within MRMS testbed environment and the real-time research system; MRMS used to build business case for transferring R(A) into operations
- Other tools on MRMS: Z and ZDR calibration monitoring, real-time precip analysis
- Future techniques available on MRMS: Quasi-Vertical Profiles (QVP), surface precip type, turbulence, among others
- NSSL working with ROC and tri-agency partners to determine best platform for radar products (RPG, MRMS, or both)

Questions:

Terry Clark: What is the latency?
A: Minimal latency. There are 2 minute updates and the system accounts for differences in volume start times for radars included in the mosaic.

Bob Saffle: Does MRMS use the extra low-level cuts from SAILS?
A: Yes, MRMS uses SAILS data.

Jim Wilson: Does MRMS use dual pol for QPE, specifically in the year 2015?
A: Yes, but MRMS uses dual pol primarily for QC of the reflectivity field. Dual pol is critical for cleaning up the data (ground clutter, interference, etc).

ZDR Calibration Update, Glenn Secrest, ROC

- ZDR affects several products and algorithms
- +/- 0.2 dB is considered within acceptable limits
- In 2014, ROC committee completed review of projects and identified: 23 tasks categorized into 4 main projects (ECPs)
- ECP 715: involves RDA test software; initial upgrades deployed in Build 16

- Planned additional deployments in Build 18 and 19
- ECP 716: most impact on field; involves external methods for monitoring (shade charts)
- ECP 718: focused on hardware; ROC will be working on RF Pallet calibration
- Final ECP (not yet assigned): still defining tasks
- Constantly improving/evolving external monitoring methods and shade charts: recently increased precision to two decimal points, Build 18 will include Bragg scatter measurements in all VCPs, “Data Quality Dashboard” for field monitoring of ZDR bias in Build 18
- ROC undertaking several outreach initiatives to educate and inform the field on ZDR bias: webinars, field access to shade charts, publications

Questions:

Paul Smith: Has ROC contacted NIST about coupler calibrations?
A: Not recently, NIST was involved in previous studies led by NCAR. Those engineering reports are available. The ROC will take an action to reconnect with NIST.

Don Burgess: Is cross-pol still a possibility?
A: Yes, but there are several unresolved issues and difficulties in implementation due to differences between S-pol and the WSR-88D. ROC Engineering has an on-going project with NCAR to refine the cross pol methods.

Using the Crosspolar Power Technique for ZDR Calibration for S-Pol during PECAN, John Hubbert, NCAR

- During winter 2014-2015, using solar scans NCAR noticed antenna variation resulting in ZDR calibration variation
- NCAR placed 5 temperature probes on the S-pol antenna
- Further investigation done at the PECAN field experiment in Kansas
- Used regression analysis and comparisons between cross-pol and vertical pointing methods to confirm antenna variations
- 3 independent methods agreed there is a temperature dependence on ZDR; thus, cannot use one ZDR calibration for the entire PECAN period
- For S-pol, ZDR affected by ambient temp at the radar due to thermal expansion of the metal; measurements in ice can be used
- Examination of ZDR variations in carefully selected ice phase data confirms the temperature dependency of the antenna bias
- The regression analysis from the solar, vertical scan, and cross pol methods allowed for the ZDR data to be corrected
- Bragg scatter under consideration as another verification method
- Lessons learned from temp variation on S-pol could be applied to WSR-88D
- The Germans (DWD) also seeing temp dependence of ZDR, so S-pol is not unique
- Dr. Frech from the DWD Meteorological Observatory at Hohenpeissenberg Germany will collaborate with NCAR (and possibly ROC Engineering) this summer in Boulder.

Questions:

Paul Smith: What about the fact S-pol has no radome?
A: With a radome, temp effects are expected to be more complex, depending on use of radome heaters and thermal lag due to the insulating effects and possibly solar heating.

What about difference in the DWD system?
A: The DWD system uses a radome and they also experience temp variations. However, the radar has a smaller dish and is made of composite material.

Mike Istok: WSR-88D already reports a radome temp, can this be used?
A: ROC has considered this, but the sensor is down in the pedestal and may not reflect temp at antenna level. There are also questions about the quality of that sensor's measurements.

Other comments: Temp differentials need to be further investigated on the WSR-88D, analyzing temperature at different locations in the radome. ROC will continue to investigate.

Summary and Observations
Rich Ice, Acting Chair

There are three significant observations from the briefings. One is that R(A) has great promise to help mitigate dual polarization calibration issues with regards to precipitation estimation. Another is that the concept of ZDR Slope has many potential uses including a possibility for refining the ROC's ZDR bias estimates that are derived from scanning rain. This first came to light at the TAC meeting in March 2015 when Dr. Ryzhkov and Mr. Scott Ganson first presented the R(A) and ZDR slope concept. The third is that NCAR's investigation into the antenna bias dependency on temperature is really significant. The new revelation from Dr. Hubbert's briefing is that they have not only confirmed the existence of the phenomena, but have developed a way to mitigate it with the temperature and solar scan regression curves. At least this is the case for the S-Pol S-band research radar. The ROC may wish to investigate extending this to WSR-88D calibration techniques. It could potentially have a very positive effect on the ROC's bias mitigation efforts.

Executive Session

- Terry Clark, ROC Director, mentioned the ROC will consider an off-site TAC after the fiscal year. Funds and government travel cap will be dependencies.
- Another TAC may be needed before the end of this fiscal year for a decision briefing on R(A)
- It was noted that the briefing on MRMS provided useful background information
- It was suggested the TAC and ROC should consider involving others for ideas on ZDR calibrations (other academic interests, research organizations, etc). The TAC took note of NCAR and ROC activities with the DWD as an example of this suggestion
- Paul Smith requested information on Dr. Frech's visit to Boulder. Rich Ice coordinated this with John Hubbert, who forwarded the information to Paul.
- A ZDR working group was suggested - ROC will consider if other entities are needed beyond the current efforts/working group
- Some reservations on quality of shade charts were noted - some sites with apparent good ZDR calibration have experienced confusing ZDR values indicating further understanding of the relationships between the external target analysis derived bias estimates and real time meteorological observations is needed. ROC will continue to work with field sites and look for avenues to improve external monitoring techniques.