Final COMET Report

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Type of Project: Partners
Project Title: Synthesizing Dual-Polarimetric radar data with locally derived products and datasets within the National Weather Service AWIPS framework.
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Objectives and Overview

The objective of this particular project was to integrate dual-polarimetric radar technologies into real-time NWS warning and decision making processes via AWIPS. The NWS is particularly interested in the integration of these unique tools and technologies into the operational environment for the following reasons: (1) to identify key dual-polarimetric datasets and products for warning and decision making, (2) develop effective training strategies for unique dual-polarimetric technologies, (3) provide forecasters a better understanding of dual-polarimetric variables and their utility in warning and decision making in advance of the upgrade of the WSR-88D network of radars.

Accomplishments of the Project

During the 12 month study period, the collaborative effort between WFO HUN and UAH made significant strides to achieve the goals of this project.

I. Ingest and integrate ARMOR data into WFO operations utilizing IRIS software

The initial step in introducing the ARMOR dual-polarimetric data into operations was to provide a dedicated feed to the forecast office. This feed was provided via a pc provided by UAH running the IRIS Sigmet software. Through the use of the IRIS software, forecasters could view the entire suite of ARMOR dual-polarimetric variables and manipulate the data including cross section capabilities. The downside to this methodology was that the data were only accessible at one location in the office.

II. Add ARMOR data feed to Baron's Fastrac and VIPIR systems

WFO Huntsville also has access to level II radar feeds from across the country through a collaborative agreement with Barons Services. WFO forecasters utilize two software packages, Fastrac and VIPIR, to monitor regional level II mosaics and individual radars (as needed). With some minor configuration, an ARMOR level II feed was set up through the Baron Services

ingest and forecasters are able to view the base variables (reflectivity, velocity, and spectrum width) at select workstations.

III. Expand the use of ARMOR data by ingesting selected fields into GRII Analyst

The University worked with Mr. Mike Gibson, Gibson Ridge (GR) Software [a popular radar interrogation and analysis tool used by many in the meteorological community, including forecasters] to integrate ARMOR dual-polarimetric data into the GR software (in either level II or raw IRIS format). The WFO then purchased a copy of the GRII Analyst and configured the software to ingest and display the ARMOR base variables (reflectivity, velocity, and spectrum width). This application was loaded on the office's "communications" workstation and the relative ease of use of the software accelerated the visibility of the ARMOR data in real-time analysis. Due to the popularity of the GRII Analyst software, additional copies of the software were purchases for all workstations in the operations area. This has really accelerated the use of the ARMOR data in real-time, and the ability to view dynamic cross sections with the GR Analyst is quite beneficial.

IV. Set up LDM feed to ARMOR Level II data

To expedite the viewing of the real-time data within GRII Analyst, and to also set the groundwork for the future goal of integrating the data into AWIPS, WFO Huntsville worked with UAH to set up a real-time feed of Level II ARMOR date via LDM.

V. Ingest full suite of dual-polarimetric variables in GRII for operational use

WFO HUN recently worked with UAH and the developers of the GRII Analyst to include the full suite of dual-polarimetric variables in the display interface. Several copies of the upgraded software package have been purchased by WFO HUN, and these will be utilized to enhance the display and visualization capabilities of the office during warning and decision making events.

VI. Identify methods to integrate ARMOR data into AWIPS

Given constraints of personnel and time at the WFO, it was not possible to integrate the Level II ARMOR data on LDM directly into AWIPS. Further, it seemed that using the GR software and its capabilities provided a more expedient and satisfying means of analyzing the data in real time.

VII. Training and interaction of NWS WFO HUN forecasters with UAH researchers.

Forecaster training took place primarily over direct interaction with UAH researchers and students on the IEM Chat tool. When researchers were conducting operations with the radar, the IEM Chat was operated with the WFO online. In this manner direct communication regarding

both interpretation of radar data and operation of the radar were facilitated. It was noted that use of such chat tools is an optimal way for the university researchers to interact with the forecast office during ARMOR radar operations.

One other mode of forecaster training concerned the provision of analysis datasets for use in preparation of case studies related to specific problems encountered in the WFO HUN office. These studies are indicated in the publications section.

Benefits and Lessons Learned – Operational Partner Perspective

I. Benefits

The collaborative project between UAH and WFO HUN was beneficial in several ways. First, the office was able to gain familiarity with dual-polarimetric variables in a real-time operational setting. Most NEXRAD radars will be upgrading to dual-polarimetry by 2010, and the ability to gain an advance understanding and feel for similar datasets will be a huge advantage to the operational staff. In addition, the training and interaction that has taken place between UAH and WFO HUN as part of this project has been beneficial. Scientists and graduate students from UAH have provided valuable input both in real-time through instant messaging tools and also as part of case studies and event reviews to assist WFO HUN forecasters in learning better methods for use and applications of the dual-pol information. Forecasters have also found the output invaluable during severe weather episodes with the data being shared with our partners and customers both through verbal communications and briefings and also to assist with critical warning decisions. In short, the ability to view the full suite of dual-polarimetric variable in real-time alongside other datasets in the operations area has proved invaluable to the office's "weather watch" and paved the way for the future transition of the neighboring NEXRAD sites to dual-polarization.

II. Lessons Learned

From the WFO perspective, the primary challenge for this project was certainly one of time management. Both the IT and SOO are heavily tasked with other "mission critical" projects, and it's often difficult to find the necessary resources to work on required tasks. This is especially true for the more time consuming tasks of programming or troubleshooting existing scripts or programs. Also, it was often difficult to coordinate schedules with UAH personnel for training or event reviews due to varying workloads and time constraints. If I would make some minor suggestions for future collaborative projects it would be to work up a more formal calendar of events, timeline of objectives, and hold perhaps monthly meetings to discuss the progress of the project.

Benefits and Lessons Learned – University Perspective

I. Benefits

Perhaps the primary benefit of the project for the UAH researchers and involved students was the gaining of an appreciation for the limited amounts of time and resources available to NWS Forecasters. This lesson in resource availability enabled/pushed us to identify different methods for conveying the data and the interpretation of the data to the forecasters so that they could use the information more directly and in a more expedient fashion. A primary example was the original objective of providing the data in AWIPS- but recognizing that a) the NWS IT focal point did not have sufficient time available to complete this task; and that b) the forecasters actually seemed to prefer the Gibson Ridge approach to AWIPS. Along the same lines, with regard to training, there is no substitute for real time operations and interaction during those interactions. There are numerous training materials available to forecasters that wish to learn the basics of dual-polarimetric radar, however, there are few opportunities to look at data in its native form as it is being collected (warts and all) and enquire in real time as to the interpretation of the data or the scan strategy being implemented. In this instance the benefit to the researcher was immediate feedback on what is important to the forecaster when he/she is looking at the radar data.

II. Lessons Learned

Relative to real time and post-analysis feedback from forecasters, it was actually clear that the polarimetric variables themselves were interesting and useful, but ultimately derived products (e.g., hydrometeor identification; HID) as opposed to the raw data were most useful. Further, while polarimetric products like HID were useful, the real benefit to the forecasters (especially during warning situations) seemed to lie in our ability to adaptively target and hence more rapidly scan and storms of interest then the current inflexible NEXRAD scan strategy. The lesson learned here for the UAH researchers is that in the end, the HID products we are building in our research endeavors will indeed be used, but simple common sense approaches to warning situations are also critically important- a primary example being the ability to adaptively scan/select targets so that the updates in lifecycle are more frequent. Still to be determined and some interesting questions to pose are: How rapid an update on storm lifecycle is required via radar before the cost to benefit becomes too high in the nowcasting arena? How far can we push dual-polarimetric radar data collection in terms of sample numbers and antenna rotation rates so that more rapid volume scanning can be facilitated (if indeed, full volume scanning is to remain the mode of NWS NEXRAD scanning strategies)?

To summarize, the benefit to UAH researchers in this particular project really lies in the education we (researchers and participating students alike) obtained relative to NWS operations and the identification of key questions that should be answered along the way to designing robust radar systems (dual-polarimetric or not) for nowcasting and warning decision support.

Relevant Publications and Presentations

April 5, 2008 – Brian Carcione and David Nadler (WFO HUN Forecasters) *A Review of the North Alabama Violent Tornado Outbreak*, Southeast Severe Storms Symposium, Starkville, MS

April 9, 2008 – Brian Carcione and David Nadler (WFO HUN Forecasters) *A Review of the North Alabama Violent Tornado Outbreak*, NASA SPoRT Meeting Special Seminar

May 13, 2008 – Chris Darden (WFO HUN SOO) *Lightning in Relation to Nowcasting and Severe Weather Operations*, EUMETSAT Training Seminar, Tallin, Estonia

October 2008 – Michael Coyne (WFO HUN MIC) and Wayne Mackenzie (UAH) *Mesoscale Analysis of the Lawrence County Storms: February 6, 2008*, NWA Annual Meeting, Louisville, KY

Johnson, E. V. and W. A. Petersen, 2008: Behavior of lightning and updrafts for severe and non-severe storms in north Alabama. Preprints, 12th Annual Severe Storms and Doppler Radar Conference, West Des Moines, IA, March 27-29.

Johnson, E. and W. Petersen, 2007: Collaborative Expansion of Dual-Polarimetric Radar Applications for Academic, Public, and Private Venues. *INVITED PRESENTATION*, *32nd Annual NWA Meeting*, October 13-18, Reno, Nevada.

Petersen, W. A., K. R. Knupp, D. J. Cecil, and J. R. Mecikalsi, 2007: The Unversity of Alabama Huntsville THOR Center instrumentation: Research and operational collaboration. *INVITED PRESENTATION*, *33rd International Conference on Radar Meteorology*, American Meteorological Society, Cairns, Australia, August 6-10, 2007.

Summary of University/Operational Partner Interactions and Roles

The role of the operational (WFO HUN) partner was to work with UAH to ensure a smooth integration of the dual-polarimetric ARMOR data in operations. This was completed through an integrated approach of WFO staff training including seminars, one on one interactions, and followup discussions with UAH scientists and graduate students. In addition, the WFO HUN IT staff worked with UAH to ensure a steady and seamless flow of real-time data to the operations area. Through a series of feedback mechanisms which included personal interactions, real-time instant messaging, and post-event reviews WFO HUN was also able to determine strategies to make the optimal use of the available dual-polarimteric data in the warning decision making process.