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Acronyms and Abbreviations

ARM	Atmospheric Radiation Measurement
ARRC	Advanced Radar Research Center
CF	Central Facility
IOP	intensive operational period
KAZR	Ka-band ARM Zenith Radar
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
SGP	Southern Great Plains
UO	University of Oklahoma
XSAPR	X-band Scanning ARM Precipitation Radar

Contents

1.0 Summary

Our National Science Foundation (NSF)-supported project was designed to address two longstanding challenges in radar-, meso-scale-, and hydro-meteorology: (1) mitigating the effects of non-simultaneous data collection on radar data-based analysis products, and (2) improving estimates of the vertical velocity (*w*) field in dual-Doppler wind analyses. Errors associated with the non-simultaneous data collection introduce errors in all Doppler analyses and impose a lower limit on the time and space scales that can be studied. For many investigations the *w* field is of prime meteorological importance, but it is the velocity component most difficult to accurately synthesize from dual-Doppler wind observations.

Our original plan (proposed for short field campaigns at the Atmospheric Radiation Measurement [ARM] user facility Southern Great Plains [SGP] Central Facility [CF]) was to use multiple-Doppler radial wind data from the scanning ARM X-band radars to test and refine our multiple-Doppler wind analysis algorithms. An important part of our plan was the use of high-temporal-resolution *w* observations to verify the analyses. In our original plan, these data would be obtained from Doppler lidars, 915 MhZ profilers, and Ka-band ARM Zenith Radar (KAZR) zenith-pointing radars at the CF and nearby ARM facilities in north-central Oklahoma. Using the data, we planned to test the utility of new spatially variable advection-correction/analysis procedures, the utility of the anelastic vertical vorticity equation as a constraint in variational multiple-Doppler wind analysis, and other Doppler wind analysis procedures. Idealized tests with numerically simulated supercell data had suggested the vorticity constraint could help improve the vertical velocity field if the data were gathered with sufficiently high temporal resolution (e.g., volume scans completed in 30-60 sec), so we were interested in exploring the use of rapid-scan data from the X-band Scanning ARM Precipitation Radars (XSAPRs).

Unfortunately, the XSAPRs did not scan sufficiently quickly for our purposes. Moreover, we found the XSAPRs suffered from data-quality issues (e.g., second-trip echoes, data drop-outs, azimuthal "wobble" of either the antenna or other part of the radar structure) that further reduced their utility for our project, at least as originally planned. Because of these difficulties, we proposed a revised short campaign at SGP: up to five short intensive observing periods (IOPs; up to 3 hrs data gathering per IOP) during precipitation events during the 2018 warm season (more specifically, 10 April 2018 to 15 October 2018). In this revised campaign, the XSAPRs would not be used to supply volume scans of radial velocity as input to the retrieval algorithms (those would be obtained from two rapid-scan mobile Doppler radars brought to the CF from the Advanced Radar Research Center [ARRC] at the University of Oklahoma), but would supply vertical velocity data to help validate the retrievals. Toward that end, the XSAPRs would be operated in vertical stare mode.

Unfortunately, our project's timeline conflicted with that of two other projects at the CF, and although our project was approved, the days we were permitted to call an IOP were greatly limited because of the other projects' schedules. Between the limitations provided by (i) the need to not conflict with the other projects at the CF, (ii) nature's limited opportunities for convective weather, (iii) the need to work within schedules of the ARRC human resources (volunteer student operators) and hardware (ARRC radars are often leased to other groups for a variety of campaigns), and (iv) hardware and/or software failures that impacted the XSAPRs and one of the ARRC radars, our group did not gather any data at the CF during the period of the field campaign. Because of the critical need to obtain data for our project, our group

used the ARRC radars (and a third mobile Doppler radar operating in a vertical stare mode) to gather convective storm data locally (El Reno, 4 September 2018) rather than at the CF.

Most recently, our planned data-gathering activities at the CF for the spring of 2020 were further impacted in the spring of 2020 by the shutdown of all of the SGP XSAPRs and failures of the Doppler lidars at two SGP locations and a radar wind profiler at one SGP location. However, the most significant impediment was the suspension by the University of Oklahoma of all research and creative activity requiring fieldwork. This suspension, effective 24 March 2020 until further notice, was part of the university's response to the COVID-19 pandemic.

2.0 Results

None. No data were gathered at SGP during the field campaign. See section 1.0.

3.0 Publications and References

None. No data were gathered at SGP during the field campaign. See section 1.0.

4.0 Lessons Learned

As indicated in section 1.0, our NSF-supported research team had to contend with numerous problems with the XSAPRs (and other difficulties) at the Central Facility. Ultimately, it was not possible to gather the research-grade data sets we had proposed using those instruments.

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