Supplementary Information for "Wet-Radome Attenuation in ARM Cloud Radars and Its Utilization in Radar Calibration Using Disdrometer Measurements"

KaSACR at the 500 m is not saturated

There is concern that the KaSACR radar may be approaching saturation, particularly near its minimum range, potentially resulting in a low bias in the measured Ze compared to the disdrometer Ze. According to ARM radar engineers, the highest voltage digitizable by the radar's Analog-to-Digital Converter (ADC) corresponds to a power of 5.9 dBm. For KAZR, the saturation reflectivity at 500 meters is approximately 45 dB, given its calibration constant of -12 dBm. In comparison, KaSACR's saturation reflectivity at 500 meters is about 31 dB, with a calibration constant of -26 dBm. Since the measured radar reflectivities from both KAZR and KaSACR at 500 meters are generally below 25 dBZ, they are well below the saturation threshold. Four Ze profiles from the KAZR GE mode and KaSACR were selected from the period between 23:00 and 24:00 UTC on September 3-4, during the relatively heavy rain event. These profiles are shown in Figure S1. The Ze profiles from KaSACR closely match those from KAZR, with a mean difference of approximately 6.5 ± 1 dB. If KaSACR were saturated near the surface, the offset between KAZR and KaSACR would vary with range. Therefore, we confirm that KaSACR is not saturated, and that the 500-meter range gate is valid for use.
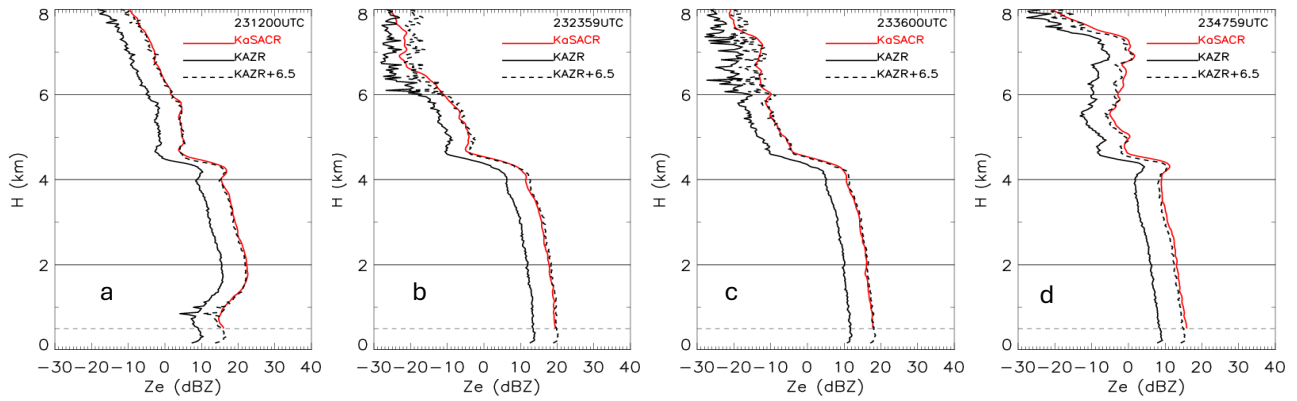
Figure S1. The Ze profiles from KaSACR (solid red) and KAZR (solid black) selected from the moderate rain during 23-24 UTC time in Figure 1. The KAZR plus 6.5 dB offset is plotted in dashed black lines for comparison. The horizontal thin dash line indicates 500 m, which is selected as the height for radar comparison with the surface disdrometer estimates.