8.20 CALIBRATION OF THE POLARIMETRIC PHASED ARRAY WEATHER RADAR USING THE COMPUTATIONAL ELECTROMAGNETICS APROACH THE DIFFERNTIAL PHASE

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The polarimetric weather observations with planar phased array radar (PPAR), require radar′s calibration at each pointing direction. Preliminary polarimetric data collection at the NSSL, using the Ten Panel PPAR demonstrator (TPD), in light rain with the radar antenna pointing at the zenith, reviled some of the issues traced to the radar hardware. Measurements of the differential reflectivity indicated inconsistency of the broadside bias and concavity. The differential phase behaviour in measurements remained consistent between scans. The concave differential phase change with the pointing direction differs in the maximum swing it reaches depending on the radome conditions. Issues with the radome were caused by the structure support that created a tub in which rain water collected if antenna pointed at zenith.

The computational electromagnetic (CEM) model of the TPD antenna panel has been developed. Some ensuing patterns are compared withthe measurements provingaccurate co-polar and cross-polar radiation characteristics., Water coating 3mm thick is added to the radome to mimic the physical conditions at vertical incidence. For computing expediency this model considers only a single 8x8 element panel. The radome increases the differential phase as the beam is steered in the principal plane and the radome condition (either dry or wet) cause significant differential reflectivity bias compared to the one from the antenna without the radome. Nevertheless, the simulated increase of differential phase bias, due to radome setup, is not as significant as bias observed in measurements. To further study this issue we examine the effects using a 5x5 array of patch radiators and chose two location of the reference phase element.

In one the reference element is placed on the edge of the 5 by 5 array of patch radiators, and in the other the reference is in the center of the array. The beam is steered in the E-plane of the H polarization for angles of -45° to +45° away from broadside. Simulation results indicate an unexpected change of the differential phase bias ϕ_{DPbias} between the cases. The array with the reference element on the corner exhibites steady increase of the ϕ_{DPbias}, while the array with the reference element in the center of the array has minimal deviation of the ϕ_{DPbias} that remains close the zero.