Design of C-band polarimetric phased array weather radar

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Most of the severe phenomena, such as a tornado, a downburst, and microburst, are caused by locally generated cumulonimbus cloud in a short time. In order to observe the evolution of the inner structure of the rain cloud that changes on a scale of several minutes, a weather radar with higher spatiotemporal resolution is needed.
A weather radar with polarimetric observations can provide multi-parameter measurements that reveal detailed microphysics of storms in addition to accurate precipitation estimation, and improve weather forecasts. As a next radar development project, we plan to develop a polarimetric weather phased array weather radar. It is expected that the future phased array radar will achieve a polarimetric capability. The transmitted frequency of the under consideration radar is C-band (5GHz).
It is capable of measuring the 3-D rainfall distribution in less than 1 min in a range of several hundred kilometers, respectively.However, it is difficult to maintain high accuracy of observation of polarimetric phased array weather radar because of the following topics.
1) the effect of deterioration of the antenna characteristics, which are formed by the digital beam forming, in oblique direction are deteriorated. 2) the performance of the cross polarization discrimination, which is performance to distinguish between horizontal waves and vertical waves, are reduced in oblique direction. These problems caused the ununiformity of the accuracy of rainfall estimates.In this paper, we proposed the design of C-band antenna elements and array antennas. We designed the three type of the antenna array, which are a planner, a cylinder, and a semi-spherical types. And also a numerical simulation was conducted to evaluate the accuracy of rainfall estimates using three different arrays.

