# L-BAND RADAR BACKSCATTERING FROM A MATURE CORN CANOPY: EFFECT OF COBS

R. Lang*(1), S. Seker(1), Q. Zhao(1), M. Kurum(2) , M. Ogut(1), P. O'Neill(3), and M.H. Cosh(4)

(1) Dep. Of Electrical and Computer Engineering, The George Washington University, Washington, DC 20052 USA, lang@gwu.edu

(2) Information Technologies Institute, TUBITAK-BILGEM, Gebze, Kocaeli, 41470 TURKEY

(3) Hydrological Sciences Laboratory, Code 617 NASA Goddard Space Flight Center, Greenbelt, MD 20771 USA

(4) Hydrology and Remote Sensing Laboratory, USDA Agricultural Research Service, Beltsville, MD 20105 USA

The effect of cobs on radar backscatter from a mature corn canopy is considered. In the past, a number of papers have modeled the backscattering properties of corn plants when the cobs are not present. It has been shown by O'Neill et al. [1] that the cob can constitute as much as one third of the total biomass of a mature corn plant. The position of the cob close to the stalk and the lack of knowledge of its dielectric properties make it difficult to model. These difficulties have been overcome with the aid of advanced numerical analysis tools and new biophysical measurements of the corn.

ComRAD is an L-Band truck mounted active-passive remote sensing system that was built to monitor the soil moisture under vegetation. During the 2012 growing season, backscattering data have been taken over corn and soybean plants as a part of prelaunch algorithm refinement activities for NASA's upcoming Soil Moisture Active Passive (SMAP) satellite mission (launch scheduled for late October, 2014). At the same time as these measurements, the biophysical properties of the corn plant's stalks, leaves and cobs have been collected on a weekly basis. The dielectric measurements have been performed at various intervals over the growing season by the George Washington University.

In this study, the discrete scattering approach is employed to model the corn canopy above a flat ground layer. The corn canopy is treated as a layer of randomly distributed discrete stalk/cob scatterers and leaves. The stalks and cobs are treated as a single element since cobs on the corn plant are close to the stalk. The bistatic scattering cross section of the stalk/cob is modeled on the FEKO simulation program using the measured dielectric and biophysical properties. Leaves are modeled by thin elliptical disks. The distorted Born approximation is employed to compute the scattered field from the corn canopy. The backscattering properties of the corn field are calculated by varying the angle of incidence. The amount of attenuation over the corn canopy is noted for horizontal and vertical polarizations. The theoretical backscattering results are compared with the ComRAD radar data that has been taken at a 40 degree angle of incidence. The differences between measured and computed results will be discussed.

## References

[1] P.E. O'Neill, A. Joseph, G. De Lannoy, R.H. Lang , C. Utku , E. Kim , P. Houser and T. Gish, "Soil Moisture Retrieval Through Changing Corn Using Active / Passive Microwave Remote Sensing," *Proc of the International Geoscience and Remote Sensing Symposium* , Vol 1, pp. 407-409, 2003.