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AN X – BAND FREQUENCY PROCEDURAL STUDY OF INVESTIGATION OF AGRICULTURE PRODUCTS

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ABSTRACT

Dielectric constant values of the samples of powders (at various moist states) have been calculated using wave guide cell method at a single microwave frequency 9.78 GHz at 330C. The Backscattering coefficients for rough and bare soil surfaces soil σ are calculated by Small Perturbation Model (SPM). Fresnal reflectivity of the soil surfaces which is an input parameter for SPM is calculated using the values of dielectric constant of the soil (at different wetness) and observation angle as input parameters. The roughness of soil in SPM is characterized by RMS height and correlation length and isotropic Gaussian auto correlation function. The radar backscattering coefficient of vegetative soil surface is determined by water cloud model. The total back scattering coefficient is calculated adding the contribution of the vegetation, veg σ and that of the modified effect of underlying soil. The effect of vegetation canopy on the backscattering from bare soil surface is modified by a parameter vegetation transmissivity τ. The present study reveals that radar backscattering coefficient for bare soil surface soil σ and vegetative soil surface σ has a respective correlation with SMC of the soil. Further, soil σ and σ decrease as the angle of observation increases.

INTRODUCTION

On earth's surface soil moisture content (SMC) and vegetation water content (VWC) are the important state variables which control most of physical processes dominant in the hydrosphere, atmosphere, geosphere, and biosphere (e.g. ecosystem dynamics, biogeochemical cycles). Knowledge of SMC is a fundamental requirement in so many applications of the field of Agriculture, forestry, water and soil management, drought and flood forecasting and civil engineering. SMC serves a critical role in shaping the ecosystem response to the physical environment. Near-surface soil moisture controls the partitioning of available energy at the ground surface into sensible and latent heat exchange with the atmosphere and thus linking the water and energy balances through the moisture and temperature states of the soil. Adequate knowledge of the distribution and linkage of soil moisture to evaporation and transpiration is essential to predict the reciprocal influence of the land surface processes to weather and climate. Thus, the climate and agricultural yield on earth's surface are inter- related to each other and the knowledge of SMC is essential to understand the relationship. Microwave remote sensing is an important tool to monitor and measurement of SMC, VWC of agricultural field because SMC and VWC affect the dielectric properties of the soil and vegetation greatly. The basic observable parameter at the sensor in active microwave remote sensing is radar backscattering coefficient which a is strong function of dielectric properties of soil and vegetation. The sensitivity of microwave backscattering to soil moisture and vegetation biomass has been proved in several experimental and theoretical studies as given by Ulaby, et al (1986) and Paloscia. et al. (1999). In the present study the radar backscattering coefficient, at different volumetric SMC levels of soil and at VWC value corresponding to the growing stage of wheat crop are calculated using Small Perturbation Model developed by Engman and Wang (1987).

METHODOLOGY AND THEORY

Samples of soil are oven dried at 1100 C for twenty four hours. Desired percentage of distil water is mixed with these oven dried samples corresponding to different SMC levels of soil varying from 0 to 40 % (volumetric).Time of setting was twenty-four hours. Dielectric constant values (real and imaginary parts) are determined at a single microwave frequency 9.78 GHz using the shift in minima of standing wave pattern in side the slotted section of rectangular wave guide excited in TE10 mode. The experimental set up theory and procedure for the present work is the same as is used earlier by Yadav and Gandhi (1992) and Jangid et al (1996)

Coaxial lines have infinite sut-off wavelength. Calculations are thus greatly simplified if we use coaxial line set up and coaxial dielectric cell to obtain dielectric length in a multiple of quarter-of –half –waverngth. To processed we apply certified and Horzelski* simplification to. for low loss materials, Dinkins and works (1947) showed (for coaxial lines) by separating into real and imaginary parts that

$$\frac{\tan\beta_2 d}{\beta_2 d} = \frac{\lambda_0}{2\pi d}\tan\frac{2\pi x_0}{\lambda_0}$$

and

$$\tan\delta = \frac{\Delta x}{d}\left[\frac{\beta_2 d\left\{1+\tan^2\left(2\pi x_0\right)\right\}}{\beta_2 d(1+\tan^2\beta_2 d)-\tan\beta_2 d}\right]$$

where is the phase constant of dielectric, 4x is the contribution of the dielectric to the width at twice the minimum power, i.e., (Δx1 - Δx0), where is the width at twice minimum power when line is filled with dielectric whereas is its width line is empty , so is the distance of the first minimum from the dielectric surface, is free –space wavelength, and d is the length of the dielectric.

If the length be an integral number of half wavelength, then

$$\in' = \left(\frac{m\lambda_0}{2d}\right)^2$$

and

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$$\tan\delta = \frac{x}{\in' d}$$

where m is the number of half –wavelengths in dielectric of depth d. Similarly for dielectric length which are multiples of odd number of quarter –wave length one has

$$\varepsilon' = \left(\frac{n\lambda_0}{4d}\right)^2$$

and

$$\tan\delta = \frac{\Delta x}{\in' d}$$

For solids it is easy to obtain sample length in multiples of half- wave- length but it is difficult to do that in the case of solids. However, for such samples which are reducible to waveguide dimensions, two –point method is used as an alternative.

CONCLUSION

The effect of a significantly vegetated surface is to increase the backscatter compared to a bare surface. Here this effect is relatively large at the higher observation angles for co-polarized channel. The degree to which vegetation affects the backscattering coefficient depends on several factors: SMC vegetation biomass, canopy type and configuration and crop condition. Thus, using a suitable retrieval algorithm these factors may be obtained by active microwave remote sensing data. The net effect of the vegetation is reducing the sensitivity of soil moisture to the back scattering. This effect increases as angle of observation increases. Hence the present study is very important. The drought monitoring and flood forecasting for a soil surface is possible by using active microwave remote sensing because dependency of back scattering coefficient on SMC.

REFERENCES

1. Attema, E.P.W. and Ulaby, F.T. 1978. Vegetation modeled as a water cloud. Radio Science, 13, pp.357–364.
2. Bindlish, R. and Barros, A.P. 2001. Parameterization of vegetation backscatter in radar-based soil moisture estimation, Rem. Sensing of Env, Vol. 76, pp. 130–137 Engman, E.T. and Wang J.R. 1987. Evaluating roughness model for radar back scatter, IEEE Trans. Geosci. And Remote sensin, Vol GE–25, No 6.
3. Hui, L., Toshio, K., Hiroyuki, T., Tobias G. and David.,A. 2008, Monitoring Winter Wheat Growth With Ground Based Microwave Radiometers (GBMR) 2008. IEEE

International Geoscience & Remote Sensing Symposium July 6–11, 2008 Boston, Massachusetts, U.S.A.

4. Jangid, R.A., Neeru, Bhatnagar, D. and Gandhi, J.M. 1996. Microwave probing to study particulate behaviour of basic powdered materials. Indian J. of Pure and Appl .Phys ,34, pp. 316–18.
5. Kong, J.A. 1990. Electromagnetic Wave Theory. Wiley. 2nd Ed. New York.
6. Paloscia S., Macelloni G., Pampaloni P. and Sigismondi S.,1999. The potential of C- and L-Band SAR in estimating vegetation biomass: The ERS-1 and JERS-1 experiments C-and X-band, IEEE Trans. Geosci. Remote Sens. 37. pp. 2107–2110.
7. Ulaby, F.T., Moore, R.K. and Fung, A.K. 1986. Microwave remote sensing: active and passive, Vol. III, from theory to application. Artech House, Dedham, MA. website:http://hydrolab.arsusda.gov/washita94/wash94.html, Hydrology and Rem. Sensing Lab., USDA, 2002, Accessed in Jan 2004.
8. Yadav ,J.S. and Gandhi, J.M. 1992. Simple microwave technique for measuring the dielectric parameters of solids and their powders. Indian J. of Pure and Appl. Phys, 30, pp. 427–432.