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Bistatic specular scattering measurements for the estimation of corn crop growth variables using fuzzy inference system

Rajendra Prasad, Ajeet Kumar Vishwakarma, and Vijay Pratap Yadav
Department of Physics, Indian Institute of Technology (BHU), Varanasi, India

Multi-temporal and multi-angular bistatic scatterometer measurements were conducted on the specially prepared crop-bed of corn crop at eight growth stages in the angular range of 20° to 60° for specular direction (φ=0°) at multi-frequencies (X-, C-, and L-bands) for HH- and VV-polarization. The crop growth variables such as leaf area index (LAI) and vegetation water content (VWC) were measured on each day of the bistatic specular scattering measurements. The subtractive clustering based fuzzy inference system (S-FIS) was evaluated to estimate corn crop growth variables at different growth stages. The correlation analysis was carried out between σ° and measured corn growth variables to select the optimum frequency, polarization and angle of incidence of the bistatic specular scatterometer system for the estimation of corn crop growth variables using S-FIS. The optimum value of cluster radius was chosen to have the good balance between the number of fuzzy rule and root mean square error (RMSE) due to the higher value of cluster radius. The estimation of corn crop growth variables using S-FIS model was found almost close to the observed values for the optimized values of cluster radii. The performance of S-FIS for the estimation was compared by calculating RMSE for different crop growth variables. These experimental results may provide the useful information for the design of future bistatic radar system for sensing the corn crop as well as other agricultural applications.