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Plant Water Stress Detection Using Radar: The Influence Of Water Stress On Leaf Dielectric Properties

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Recent research on an agricultural maize canopy has demonstrated that leaf water content can change considerably during the day and in response to water stress. Model simulations suggest that these changes have a significant impact on radar backscatter, particularly in times of water stress. Radar is already used for several vegetation and soil monitoring applications, and might be used for water stress detection in agricultural canopies. Radar observations of the land surface are sensitive because it results in two-way attenuation of the reflected signal from the soil surface, and vegetation contributes to total backscatter from the canopy itself. An important driver that determines the impact of vegetation on backscatter is the dielectric constant of the leaves, which is primarily a function of their moisture content. Understanding the effects of water stress on the dynamics of leaf dielectric properties might shed light on how radar can be used to detect vegetation water stress. Previous studies have investigated the dielectric properties of vegetation. However, this has mainly been done using destructive sampling or *in-vivo* measurements of tree trunks. Unfortunately, few *in-vivo* measurements of leaf dielectric properties exist. This study presents datasets of *in-vivo* dielectric measurements of maize leaves, taken during two field experiments. One experiment was done using was done during a period of water stress, the other during a period without. Field measurements revealed a different vertical profile in dielectric properties for the period with and without water stress. During a period of increased water stress, the diurnal dynamics of leaves at different heights responded differently to a decrease in bulk moisture content. This study provides insight in the effect of water stress on leaf dielectric properties and water content, and highlights the potential use of radar for water stress detection in agricultural canopies.