Geophysical Research Abstracts
Vol. 21, EGU2019-6038, 2019
EGU General Assembly 2019

Characterizing vegetation water content dynamics in a well-watered corn canopy in Florida through intensive destructive sampling

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Vegetation water content (VWC) is of interest as a measure of water status for agriculture, water resources management, forest fire risk and ecological monitoring applications. Furthermore, it is the most important confounding factor for soil moisture retrieval using microwave remote sensing. Current techniques to retrieve soil moisture and vegetation optical depth (VOD) from passive (radiometry) and active (radar) microwave remote sensing implicitly assume a homogeneous vertical distribution of moisture. Recent studies have found that this assumption may cause unrealistic retrievals in agricultural terrain. Therefore, it is crucial to have a good understanding of the dynamics of VWC in growing crop canopies. This is also of potential interest for hyperspectral remote sensing, as well as in-situ techniques in which the presence of water in/on vegetation has a confounding effect on the retrieval of soil moisture (e.g. GNSS-R, COSMOS).

The aim of this study was therefore to characterize and quantify the vertical distribution of VWC, and its diurnal and seasonal dynamics for corn. Pre-dawn destructive sampling was conducted three times a week, for a full growing season of corn in north-central Florida. Once a week, destructive sampling was also done at 6pm, in order to capture diurnal dynamics. In addition, surface water content, i.e. dew and interception, were monitored every 15 min at several heights. To support the interpretation of the vegetation water content data, a detailed dataset of ancillary data on phenological stage, soil and plant hydraulics, and hydrometeorology was also collected.

The results show that there was a strong vertical variation of moisture accumulation in this well-watered corn canopy. The relation between biomass and VWC varied with phenological stage and with height. Moisture is generally concentrated in the lower parts of the stems, with a maximum in the mid-season. The relative contributions of tillers and ears to total plant VWC also varied during the season. In the absence of water stress, diurnal differences were relatively small compared to seasonal variations. Dew formation was a considerable source of external moisture in the canopy, which could be significant for early morning satellite remote sensing observations.