USE SPECTRAL DERIVATIVES FOR ESTIMATING CANOPY WATER CONTENT

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ABSTRACT:

Hyperspectral remote sensing has demonstrated great potential for accurate retrieval of canopy water content (CWC). This CWC is defined by the product of the leaf equivalent water thickness (EWT) and the leaf area index (LAI). In this paper the spectral information provided by the canopy water absorption feature at 970 nm for estimating and predicting CWC was studied using a modelling approach and in situ spectroradiometric measurements. The relationship of the first derivative at the right slope of the 970 nm water absorption feature with CWC was investigated with the PROSAIL radiative transfer model at a 1 nm sampling interval and tested for field spectroradiometer measurements obtained at an extensively grazed fen meadow as test site. PROSAIL simulations (using coupled SAIL/PROSPECT-5 models) showed a linear relationship between the first derivative over the 1015 – 1050 nm spectral interval and CWC (R2 = 0.97), which was not sensitive for leaf and canopy structure, soil brightness and illumination and observation geometry. For 40 plots at the fen meadow ASD FieldSpec spectral measurements yielded an R2 of 0.68 for the derivative over the 1015 – 1050 nm interval with CWC. This relationship appeared to match the simulated relationship obtained from the PROSAIL model. It showed that one may transfer simulated results to real measurements obtained in the field, thus giving them a physical basis and more general applicability. Consistency of the results confirmed the potential of using simulation results for calibrating the relationship between this first derivative and CWC. Another advantage of using the derivative at the right slope of the 970 nm absorption feature is its distance from the atmospheric water vapour absorption feature at 940 nm. If one cannot correct well for the effects of atmospheric water vapour, the derivative at the right slope is preferred over the one at the left slope.

TOPIC: Multi-spectral and hyperspectral remote sensing
ALTERNATIVE TOPIC: Physical modeling and signatures