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A Sensitivity Analysis of NDWI and SRWI to Different types of Vegetation Moisture

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There are many definitions of vegetation moisture, such as fuel moisture content (FMC), gravimetric water content (GWC), relative water content (RWC), leaf water content (LWC), canopy water content (CWC) and vegetation water content (VWC). They were introduced because of different applications. For example, FMC is with superiority in monitoring wildfire potential, and GWC responses well to determine whether the plant is in health. RWC is suitable for estimating vegetation water stress. LWC and CWC are often used in optical remote sensing and are always related to equivalent water thickness (EWT). For VWC, the main application is for improving retrievals of soil moisture content from microwave sensors.

For optical remote sensing technique, the absorption features of liquid water in plant leaves are readily detectable by spectroscopy. Spectral reflectance at 970nm, 1200nm, 1450nm, 1930nm and 2500nm are the basis of numerous remote-sensing indices that could be used in estimating vegetation moisture. Foregoing studies have introduced different spectral indices based on these bands to retrieve vegetation moisture. These spectral indices often fall into two categories, one is Normalized Different Water Index (NDWI), and the other is Simple Ratio Water Index (SRWI). NDWIs take the form of normalized difference spectral index, while SRWIs are in the form of ratio type. They were calculated from different combinations of spectral channels.

Since the sensitivities to vegetation moisture of reflectance at different spectral channel are distinguished from each other, the capabilities of these NDWIs and SRWIs in estimating different types of vegetation moisture will be distinguished from one to one. In this work, based on in-situ measurements collected in the north China plain from wheat and corn (Fig. 1), a sensitivity analysis of NDWI and SRWI to different types of vegetation moisture, such as VWC, FMC and GWC, was carried out. They were calculated from different combinations of spectral channels of MODIS and Landsat-8 OLI. Result shows that: 1) NDWI and SRWI are more sensitive to VWC than to FMC and GWC; 2) SRWI and NDWI calculated from reflectances of green band at about 550nm and shortwave infrared band at about 1240nm often yielded relatively higher correlation coefficients with VWC; 3) For a fixed two-band combination, SRWI shows a slight superiority to NDWI.

Fig.1 The north China plain and the experimental area with corn and winter wheat sample locations

A detailed description to this study work will be demonstrated in the fullpaper.