Remote sensing for evaluating crop water stress at field scale using infrared thermography: potentials and limitations

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Abstract. Over the past few decades, the competition for freshwater resources has substantially increased in arid/semi-arid areas, exacerbating the pressure on the largest user of water, namely agriculture, to consume less water. However, reducing crop consumptive water use or evapotranspiration through water stress can have a negative impact on production economics if not precisely managed. Remote sensing of crop canopy temperature is a scientifically-based and easy-to-apply method that can be used at field scales to evaluate crop water status at or near real-time. In this study, thermal images of maize canopy under two deficit irrigation regimes were acquired using a hand-held thermal camera. The results showed that the low-frequency deficit irrigation treatment resulted in higher maize temperatures compared to the high-frequency deficit irrigation regime. A methodology for converting the temperature value of each pixel into a spatially variable crop water stress index (CWSI) is described. Within the low-frequency deficit irrigation treatment, estimated CWSI values were correlated with spatial variations in soil texture. Finally, the potential of infrared thermography and current limitations are discussed in detail.

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