Abstract

A lack of soil water sensing techniques which measure soil water content (SWC)

new sensing technique's ability to measure soil water accurately (root mean square error-RMSE- 2 - 4 %) irrespective of soil type and quantify the spatiotemporal dynamics at soil column scale. The third study took the results of the laboratory experiments and extended the technique to the field scale. The sensing technique was shown to measure soil water accurately (RMSE -3 – 4 %) at high spatial (0.5 m) and temporal (6 h) resolutions throughout a cropping season. In comparison to the point-based soil water sensors, the new sensing technique was shown to provide a more accurate estimate of the averaged SWC at field scale and significantly reduce the error in water balance and estimated evapotranspiration particularly during wet periods of the season. Further, the wavelet coherency analysis examined the scale and locations dependency of the similarity of the spatial patterns of soil water storage (SWS) over time. Unlike the dry period of summer, spatial patterns of SWS were not similar across all scales and locations during the wet period of autumn and thus, it required many sampling locations to get an accurate field average of SWC. Overall, the research demonstrated the successful development of the

AHFO technique through laboratory and field calibration and validation and its ability to accurately measure SWC from point to field scales at high spatial and temporal resolutions. The new technique showed a great

potential to bridge the measurement gap from point to field scale and it will potentially improve our