Footprint and effective depth of mobile cosmic-ray neutron sensor technology

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The Soil and Water Management & Crop Nutrition Laboratory of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has finalized the first stage of the development of new area-wide soil moisture monitoring techniques using the cosmic-ray neutron sensor (CRNS) backpack.

In 2018, the research team validated the footprint, effective depth and accuracy of the mobile or "backpack" version of the sensor. Through sixteen different calibrations for five research sites in Austria, located between 300 and 1700 m a.s.l., a comparison was made between the volumetric water content measured by the backpack and gravimetric measurements for different radii of influence. Results indicated similar outcomes based on a 0-75-meter footprint as compared to a 0-200 meter study, suggesting that measurements by the mobile cosmic-ray neutron sensor have a footprint with a 200-meter radius (i.e. 20 hectares). The same data were also used to determine the effective depth, results showed that the effective depth is about 10 cm for volumetric water contents ranging between 30 and 60%.

In the coming year, the SWMCN Laboratory will focus on improving the calibration methods for the cosmic-ray neutron sensors, by having more data points near the sensor, which could play a major role in error reduction. Further, the technology will be tested for satellite imagery calibration.