Evaluation/pilot test of a low-cost monitoring methodology to represent plot-scale soil water status for wheat cropping in India

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Optimal, realtime and low-cost farm monitoring is a prerequisite to achieving the overarching goal of understanding small holder socio-hydrology and inspiring data-based management decisions to improve agricultural water use efficiency in developing countries. An experiment was conducted to comparatively analyse the ability of scientific grade and low-cost instruments in representing plot-scale soil water status through a cropping season. A second objective was to select a suitable methodology for interpolating the continuous but scarce measurements to ultimately generate representative plot-scale maps. The experimental plot corresponded to the size of a typical smallholding in the food producing Ganga floodplains (Kanpur, India) during the wheat cropping season. Two levels of cost cutting were implemented and tested against the scientific grade instruments procured from Germany. The first level of cost cutting was implemented using relatively cheaper, but scientific grade sensors manufactured in the USA with indigenously developed low-cost data loggers and transmitters for realtime communication. The second level of cost cutting was implemented using off-the-shelf extremely low-cost sensors and the indigenous data logger and/or transmitters. A comparative assessment was made between soil water representation by the high-cost, medium-cost and low-cost sensor setup. An analysis of the spatial dependence of the measurements was conducted to realize an effective sensor spacing. Different interpolation techniques were comparatively analysed to identify a suitable method to estimate plot-scale soil water properties, for each level of cost-cutting, to establish an effective trade-off between accurate representation of soil water status and cost.