Non-invasive proximal soil sensing for improving water use efficiency in paddy fields

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Water losses from an irrigated paddy occur either by evapotranspiration (ET) or by percolation out of the rooting zone. However, preventing drainage losses of irrigation water from the paddy field remains a challenge for the rice growers. Despite rigorous efforts, the problem persists because the formation of a homogenous and continuous impermeable plough pan is complicated by the spatial variability of soil properties like soil texture. A small sandy patch within a clayey area is sufficient to create less impermeable conditions resulting in unexpected water losses affecting the entire paddy field. Tackling this problem requires precision agriculture practices, more specifically, **site specific soil crop management**. Site specific soil management has been a recent practice in western countries like the United States, Australia and Western Europe, and is still in many aspects in a research phase. Such management strategy involves the availability of detailed georeferenced information on soil properties relevant for crop growth. This approach became available by the introduction of accurate GPS technology, in combination with a diversity of crop yield and proximal soil sensors. This information can be combined in a geographical information system and helps the farmer to take site specific decisions, realizing an extra advantage both in terms of crop performance as well as reducing the environmental impact. Based on our experience, we expect proximal soil sensing to have a large potential in flooded paddy field conditions.

Research hypothesis
Site specific management of soil properties can improve water use efficiency of paddy rice.

Therefore, the **general objective** of this proposal is: *developing and testing a methodology for paddy rice growing fields of alluvial areas in Asia to improve the crop water use efficiency*.

Specific objectives and deliverables

To arrive at the general objective we put forward the following specific objectives and associated deliverables:

- Construct and test a floating EM38 based sensing equipment which can be used under paddy field conditions. *Deliverable*: an operational floating soil sensing system.
- Evaluate the floating sensor equipment to map in detail quasi-permanent soil properties, like soil texture, under paddy field conditions. *Deliverable*: validated maps of permanent soil properties at a field scale.
- Evaluate the floating sensor equipment to detect less compacted subsoil areas in paddy fields of Bangladesh. *Deliverable*: validated predictions of the compaction of the submerged plough pan in paddy fields.
- Evaluate the improvement of site specific soil management for water use efficiency in paddy fields. *Deliverable*: validated water balance of a paddy field with and without an application of the proposed methodology.