# CALIBRATING FREQUENCY DOMAIN ELECTROMAGNETIC INDUCTION INSTRUMENT WITH DC RESISTIVITY FOR FAST SOIL MAPPING

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The multifrequency domain electromagnetic profiling is very promising instrument for fast and detail soil mapping in precise agriculture. Mounting the EM device on a sled or a cart for towing by an ATV can speed up the data gathering process before and after the crop growing season. Mounting the EM device on an UAV provides the unique opportunity to obtain detailed soil maps during crop growth and monitor nutrients uptake by plants (especially nitrogen and potassium). This setup could also be used to access properties of flooded soils under rice production, where access to the field by any other means is not possible.

Several acres of the soils were mapped by authors using AEMP-14 – multifrequency (up to 14 frequencies) EM profiler with 2.5 - 250 kHz frequency range. The device signal was processed to convert it into soil resistivity. In conductive soils, where resistivity is less than 100 Ohm m, the penetration depth depends on the frequency, and the signal can be converted to the apparent resistivity with good accuracy. The EM data were compared to the laboratory tests of soil samples collected in key locations of soil electrical resistivity map, the strong correlations were found between EM data and soil pH and available water at different depths.

However, the EM signal strongly depends on soil conductivity and height of the device above the ground. The height can be adjusted through the construction of the device carrier. In some cases, in the resistive soils the signal can be too weak for a reasonable data processing into resistivity.

We propose a solution through a combined methodology, where EM data are calibrated with DC resistivity mapping at some depths and with vertical electrical sounding (VES) measurements at key locations rather than just by collecting and analyzing soil samples. All DC resistivity measurements can be carried by compact LandMapper instrument with various probes and cable sets, easily adjustable for different soil profiles. This combined methodology of EM and DC resistivity measurements shows a potential to be streamlined to quickly and non-destructively map agricultural soils under various crops and farm practices.