



Obtaining high-resolution soil moisture from proximally-sensed electrical conductivity (PSEC) surveys

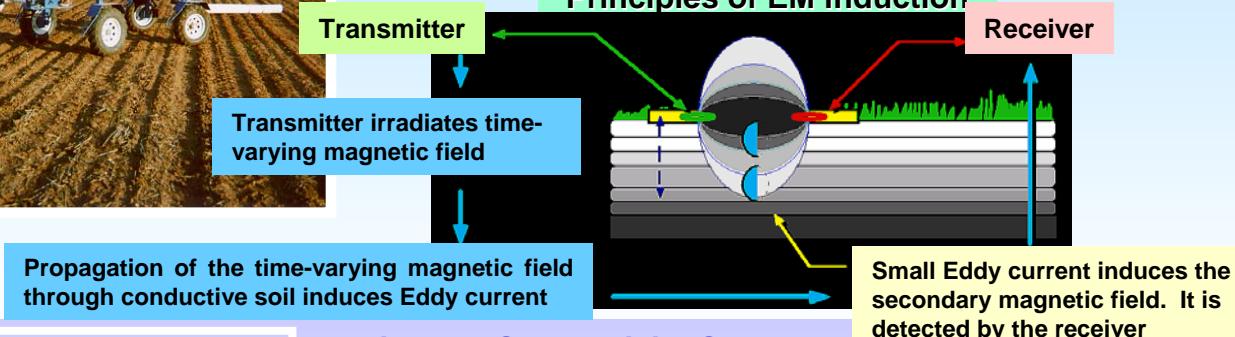
Australian Centre for Precision Agriculture

Alex. McBratney
Budiman Minasny
Brett M. Whelan



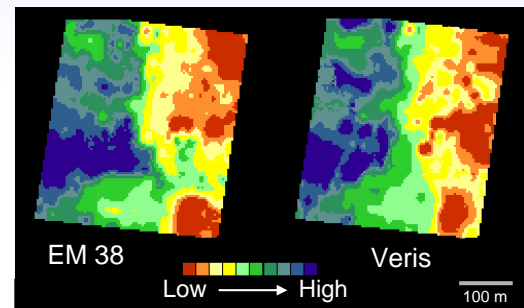
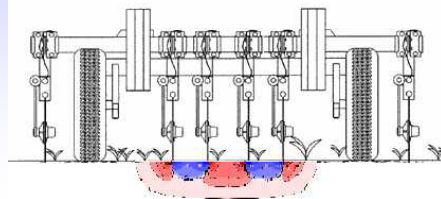
Mobile EM Sensing System (MESS)
uses EM induction to measure EC_a using two instruments (EM 38 and EM 31) that penetrate the soil to 2m and 6m respectively

Principles of EM induction



Veris 3100 Conductivity Cart

Directly passes a current through the soil and measures the EC_a using rolling electrodes. It measures over two depths (0-30cm & 0-90cm) simultaneously. The intermediate depth reading (30-90cm) can be calculated.



Comparison of EM and Veris measurements

EM 38 (90 cm above ground) and Veris (60 cm electrode spacing) measure soil EC_a 0-30 cm. Both measurements produce similar trend.

A model for interpreting EC data

In areas where soil salinity is negligible, these instruments should be useful in mapping the variability in soil texture CEC & moisture at the same scale as crop yield monitors.

$$ECa = \left(1 + A \left[\frac{T - 293}{293} \right] \right) \times B \left(\frac{\text{clay}}{100} \right) \times C \left(\frac{\theta}{\theta_s} \right) \times D \left(\frac{\rho_b}{\rho_0} \right) \times E \left(\frac{CEC}{CEC_0} \right)$$

A, B, C, D and E are empirical factors. If we assume that the mineralogy and bulk density are relatively uniform across a field, the model can be reduced into $ECa = \kappa$ (clay x moisture). Using pedotransfer functions clay content can be estimated as an inverse function of ECa .

