

Soil Environment Monitoring by Multi-frequency Electromagnetic Sounding

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Surface soil environment was surveyed and characterized using a multi-frequency electromagnetic wave (EM) sensor. Traditional resistivity method needs multiple point electrodes in the field to investigate the deeper points, however, this method uses broadband electromagnetic data to obtain the apparent conductivity from different depth, i.e., the higher the frequency, the shallower data we can obtain. It is non-invasive and rapid, therefore, appropriate for wide area environmental survey. Five frequencies of 2310, 3870, 7950, 24510 and 47970Hz were applied so that we obtained vertical profile of the domain. Forest under different management, winter-ponded paddy field, orchard and tea farm in hilly mountainside and orchard in plain field were investigated using a broadband electromagnetic wave sensor sounding. Surface electrical conductivity (EC) obtained by Wenner array has the highest correlation with 47970Hz data, showing it is the appropriate frequency for surface soil investigation. Moreover, EC in the order of several tens milli-Siemens obtained by EM sounding corresponded very well with the EC obtained by traditional method. Conductivity data successfully showed management induced changes in soil environment by conductivity map along with vertical conductivity profile, which is advantage of broadband EM survey. Water content changes in forest after rainfall, effect of ponding management in paddy field, and the differences in fertilizer application practice in hilly farm, were clearly demonstrated by the broadband EM sensor.