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Mapping Catchment Surface Soil Properties Using High Resolution Gamma Radiometrics

K.R.J. Smettem (1), G. Pracilio (2)

(1) Centre for Water Research, The University of Western Australia, Nedlands, Western Australia 6009, Australia (smettem@cwr.uwa.edu.au), (2) School of Earth and Geographical Science, The University of Western Australia, Nedlands, Western Australia, 6009, Australia (gabbyp@segs.uwa.edu.au)

Defining the distribution of surface soil properties is an important step in spatially distributed hydrologic modeling. Pedotransfer functions are often employed in this step to derive the requisite hydraulic properties from more readily available soil survey data.

Existing soil survey data across many dryland agricultural catchments of Australia is only available at 1:100,000 scale or coarser and this scale is inadequate for specifying the spatial distribution of soil hydraulic properties in catchment models. Airborne gamma ray spectrometry offers a rapid, high resolution method for identifying the distribution of surface materials across catchments at low cost without the major interfering effects of vegetation.

In this paper we review the development and application of airborne gamma ray spectrometry for catchment hydrologic applications and discuss the correlations that have been identified between gamma emissions, surface soil properties and pedotransfer functions. Furthermore, although natural gamma emissions are primarily related to the distribution of surface soil properties, these may in turn be indicative of underlying regolith properties, particularly if data are interpreted in the context of soil development. By combining gamma radiometric information with high resolution digital elevation data and an understanding of soil development, it may be possible to infer soil distributions across catchments on similar parent material. We illustrate this concept using data from catchments overlying granitic parent material in Western Australia.