REGOLITH LANDFORM MAPPING IN WESTERN BURKINA FASO, USING AIRBORNE GEOPHYSICS AND REMOTE SENSING DATA IN A NEURAL-NETWORK

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The regolith in West Africa represents an important economic resource, a constraint on the regions tectono-geomorphic evolution, and a hindrance to geochemical exploration techniques. Knowing the distribution of regolith units and understanding the processes which led to their formation is important for any kind of successful geological mapping, geochemical or geophysical survey, and minerals exploration. Traditional field-based regolith landform mapping can be a lengthy process, which can be further complicated by difficult access to remote and often large survey areas. At most scales, West Africa remains poorly covered by regolith landform maps such as those commonly used in Australia (Paine *et al*., 2000). Airborne geophysical data and remote sensing data are frequently employed in regolith mapping (Wilford *et al*., 1997; Tapley, J., 2002; Woolrych and Batty, 2007) to assess the diverse physical properties of regolith materials. One can estimate the chemical composition from airborne gamma-ray spectrometry or spectral remote sensing (Landsat, ASTER), terrain morphology from the digital elevation models (SRTM), and surface roughness or prevailing geometric shapes from radar imagery (ALOS, Radarsat-2).

The application of these techniques may be limited by dense vegetation cover or displacement of the regolith units by later erosion. Indeed, the best results in mapping of the diverse regions in West Africa would require the integration of several data sets. Concentration maps of K, eTh and eU and their ratios were computed from airborne gamma ray spectrometric data. In situ spectral measurements were used to calibrate ASTER and Landsat scenes from which band ratios and principal components were obtained. At places, parameters retrieved from polarimetric radar images were added as additional source data. Morphometric variables such as slope, curvature, and aspect were derived from the freely available SRTM 90 m resolution digital elevation model to characterize the topographic parameters of the different regolith landform units. An artificial neural-network, ADVANGEO® (Barth *et al*., 2009), was then applied to classify the regolith landform units according to the variables obtained from satellite and airborne data. Ferruginous duricrusts rich in hematite and goethite, clay rich mottled zones relics, fluvial sediments, and soft pediment materials were mapped successfully in the region. The results were compared with existing regolith landform maps, geomorphological maps, pedological maps, and field observations. We found that in particular, the distribution and shape of the iron rich duricrust is more accurate than in the current maps and demonstrates the potential of neural-networks for the combined analysis of airborne geophysics and remote sensing data in regolith landform mapping.

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