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Study of surficial weathering profiles using helicopter borne transient electromagnetic surveys: a case study in Mayotte volcanic island.

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In weathered volcanic tropical islands, geological studies are often limited due to the generally poorly outcropping conditions. Ground geophysical campaigns are also hard to perform due to difficult access in densely populated and forested areas. Recognition of geometric and petrographic characteristics of weathering mantles is a prerequisite to provide sustainable solutions to the management of natural hazards. In this particular context, airborne TDEM appears as the most suitable method to provide precise information about the Regolith.

In Mayotte (French volcanic island located in the Indian Ocean) much of the regolith is residual and consists of intensely weathered basaltic and phonolitic rocks. Weathering profiles are generally thicker than 10m. Saprolites can have a strong cohesion but torrential rainfall can brutally decrease the resistance and produce large landslides occurring at the interface between alloterites and saprolites.

In 2010, the BRGM (the French geological survey) and the Prefecture of Mayotte decided to fund a geological mapping project including a heliborne TDEM resistivity survey of the island. The SkyTEM helicopter borne transient electromagnetic method has been chosen in order to obtain a quasi-3D resistivity map of the island. Flight lines were oriented North-South with an average spacing of 200 m and 3000 km have been covered. Good conductivity contrasts (from 1 to 600 ohm.m) between the different rock types allow to define the geometry of the principal geological units, up to a depth of 200 m.

Preliminary results are very promising and have shown that TDEM is a powerful tool for regolith mapping and surficial weathering profile characterization. A statistical study shows that the correlation between the TDEM resistivity and the type of regolith is often good and can be used for regolith mapping.