



## **Use of Heliborne Electro-Magnetic survey as an assistance to improve landslide susceptibility/hazard mapping**

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Landslide hazard and risk assessment (LHA & LRA) in the French West Indies is a big challenge, particularly in Martinique, where several factors (volcanic grounds, high weathered materials, hurricane seasons . . . ) contribute to high slope sensitivity to landslides. More than 600 landslides have been inventoried in the territory. They can be shallow, deep, rotational or translational. Often generated by hurricanes or tropical storms, these processes regularly strike the coasts and the hinterlands and can generate damages on infrastructures (e.g. the Morne Callebasse landslide generated more than € 17.1 million of works to rehabilitate the neighborhood). Thus, in the framework of risk prevention, each municipality of the island is fitted with a risk prevention plan (PPR-Plan de Prévention des Risques) with the same rules as the metropolis territory in terms of territorial planning.

However, it seems sometimes difficult to apply them efficiently because: (1) the land pressure is strong (density about 355 inh.km<sup>-2</sup>; either the 11th French department) and (2) large areas are considered in moderate hazard and/or risk class with draconian planning rules. These areas could be developed but they need a better knowledge about the inherent parameters of slopes, soil and subsoil and about aggravating factors like anthropogenic actions.

In this context, practitioners are attracted by accurate analyses based on geotechnical studies (based on drilling, terrestrial geophysical surveys, laboratory tests . . . ). However, in Martinique the soil and subsoil are made from superimposed healthy and weathered lavas (very heterogeneous in terms of thicknesses and spatially). Thereby, to obtain a good knowledge of the regolith and reduce the uncertainties, it is indispensable to multiply the surveys. But the multiplication of tests increase the costs of the studies, which is inconsistent with cost reduction policies. One possible solution consists to obtained some information by the used of remote sensing techniques especially airborne geophysics. If the approach seems expensive, the multiplicity of sensors used in parallel allow reducing the costs by comparison with same investigations on the ground. In Martinique, such survey, based on Time Domain Electromagnetic Method (TDEM), is available since 2013. It reveals the subsoil (regolith, hydrogeology) up to 200 meters depth.

Thus, when the municipality of 'La Trinité' wished a study to develop an area untouched by any development, but located in a moderate susceptibility/hazard class, it appeared necessary to understand in which conditions the potential instabilities can occur. The use of new data, acquired during the geophysical helicopter campaign, will provide additional information about the type and the thickness of soil and the subsoil, which are often missing for this type of study. The overall objectives are: (1) to define weathered horizons of lavas by field observations; (2) to obtain the internal structure of the regolith with the help of TDEM data; (3) to assess stability of slopes by elaboration of scenarii based on physically based models tested for the same environment near the study site; (4) to know the most landslide prone areas and give some recommendations to the municipality taking into account.