Geophysical Research Abstracts
Vol. 19, EGU2017-18818, 2017
EGU General Assembly 2017

3D characterization of the critical zone within a basaltic catchment using an airborne electromagnetic survey

Marc Dumont (1,2), Jean-Lambert Join (1), Valentin Wendling (1), and Bertrand Aunay (2)

(1) Laboratory Geoscience Reunion, University of Reunion Island/IPGP, Saint-Denis, La Reunion, France , (2) BRGM, French Geological Survey, Reunion Island Regional Office, Saint-Denis, La Reunion, France

Shield volcano islands come from the succession of constructive phases and destructive phases. In this complex geological setting, weathering and paleo-weathering profiles have a major impact on the critical zone hydrology. Nevertheless those underground structures are difficult to characterize, which leads to a leak of understanding of the water balance, infiltration, and ground water flows. Airborne transient electromagnetic method, as SkyTEM dispositive, allows to proceed regional 3D resistivity mapping with almost no topographic and vegetation limitations with an investigation depth higher than 300 m. Electromagnetics results are highly sensitive to conductive layers depending of clay content, water content and water mineralization. Skytem investigations are useful to characterize the thickness of the weathering profile and its lateral variations among large areas. In addition, it provides precise information about buried valleys and paleo-weathering of older lavas flows which control preferential groundwater flows.
The French Geological Survey (BRGM) conducted a SkyTEM survey over Reunion Island (2500 km2). This survey yields on a dense 3D resistivity mapping. This continuous information is used to characterize the critical zone of the experimental watershed of Rivière des Pluies. A wide range of weathering profiles has been identified. Their variations are highly dependent of lava flow ages. Furthermore, 3D resistivity model highlights buried valleys characterized by specific weathering due to groundwater flows. Hydrogeological implication is a partitioning of groundwater flows in three different reservoirs: (i) deep basal aquifer, (ii) perched aquifers and (iii) superficial flows. The two latter behaviors have been characterized and mapped above our experimental watershed. The 3D manner of airborne electromagnetics results allows describing the continuity of weathering and alteration structures. The identification of specific groundwater flow paths provides a better understanding of the relation between the surface hydrology, the unsaturated medium and the basal aquifer. This study underlines the key role of volcanic underground structures in the critical zone flows.