Monitoring of water fluxes by self-potential and TDR probes in the unsaturated vadoze zone during an intense cyclone.

Feder, F.[a], Finizola, A.[b], Crovisier, M.[b] Payet, N.[a,b]

[a] *CIRAD (centre de coopération internationale en recherche agronomique pour le développement), UPR recyclage et risques,* station de la Bretagne, BP 20, F-97408 Saint-Denis messagerie Cedex, Réunion, France.

[b] Laboratoire Géosciences Réunion – IPGP, université de la Réunion, 97715 Saint-Denis - cedex 9, La Réunion, France

Réunion is an island located 700 km east of Madagascar in the southern Indian Ocean region. The Colimaçons research station is located on the western slope of Piton des Neiges at 800 m ASL (21°07'47 S and 55°18'19 E). The soil studied at the Colimaçons research station was located in the middle of a toposequence in which Andosols prevail. It was classified as an andic Cambisol, which included: (i) a surface A horizon (0–40 cm) altered to a shallow depth (<50 cm) by anthropedogenic processes, and (ii) an andic B horizon (40–200 cm). A pit dug down to 9 m showed that the subsoil is constituted by altered fissured and fractured rocks. The subsoil is composed of three types of rock levels. The first type of rock is hard and very compact, very little altered but cracked. Mineralogy was determined by optical microscopy and polarized light and natural XRD: 65% plagioclase (labrador), 15% Augite, Olivine 10% and 10% oxides (Illmenite, Magnetite and Hematite). They correspond to plagioclase basalts. The pit dug down to 9 m was equipped and protected against weather. The pit was equipped ca. each meter from the floor to the surface (-9, -8, -7… -1 and -0.4 m) with instruments to monitor water contents and fluxes. Time Domain Reflectometry (TDR) probes (CS616, Campbell Scientific) and Self-Potential (SP) probes were connected to a datalogger (CR10X-2M, Campbell Scientific) that recorded measurements on a 10-min basis from January 2007 to the end of March 2007 (day 1 to 80). This study was aimed at assessing whether (i) a continuous measurement with time of self potential and humidity allows us to follow water fluxes in the unsaturated zone and, (ii) which internal and external phenomenon could explain these variations of self potential and humidity during a cyclone period. The strategy adopted was, at first, to analyse simultaneously humidity signal from TDR probes and self-potential signals recorded before and after a cyclone (360 mm in 3 days). During the cyclone Gamède and during the following two weeks, the humidity measurements deducted from TDR probes have all increased. The more they are close to the surface, the more moisture measurements increased earlier and quickly. During this same period, the signals of SP probes showed a coherent and different dynamic. No major signal was observed despite a water flux of 360 mm in three days. The minima of the signals from sensors SP 2 to 10 are offset in time. As the depth increases, the signals of SP probes reach their minimum later. However, these fluctuations have remained low over the entire signal (a few mV to ten mV) throughout the period.