Geophysical imaging of regolith in landscapes along a climate and vegetation gradient in the Chilean coastal cordillera

Dal Bo, Igor

Klotzsche, Anja

Schaller, Mirjam

Ehlers, Todd A.

Kaufmann, Manuela S.

Fuentes Espoz, Juan Pablo

Vereecken, Harry

van der Kruk, Jan

Many studies have recently shown the potential of geophysical tools in bridging the information gap between individual point-scale measurements. Here, we upscale and extend the point-scale layering information from pedons (excavated pit of 1 m2)using geophysical methods. We applied multi-frequency ground-penetrating radar (GPR)in four study areas in the extreme climate and vegetation gradient of the Chilean Coastal Cordillera. The main goals of this study were to understand how granitic based regolith material varies depending on climate, vegetation cover, aspect, and topography. GPR was successfully used in all four study areas. Reflections, which were imaged up to a depth of 8 m, could be associated with boundaries visible in the pedons. The main recognizable reflections were linked with the interface between the mobile soil and the immobile saprolite. This boundary is characterized by hyperbolic-shape features, probably connected to heterogeneities (e.g. pebbles). A deeper GPR penetration depth in south-facing hillslopes was observed than in north-facing hillslopes. This is probably due to less sun exposure in the south facing slopes, which results in higher soil water content and denser plant growth, facilitating weathering processes. Furthermore, thicker layers in the GPR profiles are visible going from north to south along the latitude. Most of these observations were in agreement with the soil pedons. These results demonstrate the utility of the GPR technique for characterizing subsurface variations in

regolith properties (e.g. thickness, boundaries). Additional soil pedons should be excavated based on GPR results. Applying noninvasive geophysical methods could improve the understanding of the interactions between soil formation, vegetation, and other environmental parameters.