BOOK OF ABSTRACTS

José M. Fernández-Fernández · Josep Bonsoms
Julia Garcia-Oteyza · Marc Oliva
Editors

EUCOP6 PUIGCERDÀ
18-22 JUNE 2023

Recent and ongoing transformations of the Nevado Coropuna tropical cryosphere (Central Andes): the Ground-Penetrating Radar perspective

Adriano Ribolini (Università di Pisa), Luis Mariano Del Río (Universidad de Extremadura), Ramón Pellitero (UNED. Universidad Nacional de Educación a Distancia), Álvaro Navarro (Universidad Complutense de Madrid), Beto Ccallata (Observatorio Vulcanológico del INGEMMET en Arequipa), Pablo Masías (Observatorio Vulcanológico del INGEMMET en Arequipa), Donato Flores (Comunidad Campesina de Unro), Edwin Calachua (Comunidad Campesina de Unro), Álvaro Arredondo (Guías de Espeleología y Montaña (GEM), Pablo Guijarro (Guías de Espeleología y Montaña (GEM) and Jose Úbeda (Universidad Complutense de Madrid).

Abstract

The evaluation of presence and origin of ground-ice in the non-glaciated peripheral areas of Nevado Corpuna can contribute to a more refined estimation of its real extent, as well as of the ongoing and recent transformation processes (i.e. permafrost aggradation/degradation). We carried out GPR surveys in sectors immediately outside the glacial tongues which diverge from the glaciated area, both on rock glaciers and debris-covered glaciers. The data acquisition was made with an unshielded antenna operating at a central frequency of 25 MHz, and according longitudinal and cross profiles. We defined a processing sequence particularly effective in removing in air-reflections generated by isolated blocks on the surface, and the numerous point-source diffractions. The signal-to-noise ratio consents a data imaging interpretable up to 25-30 m of depth, according to the estimated velocity of GPR waves propagation. In some sectors we calibrated the GPR data (depth and reflection amplitude) with those obtained from Vertical Electric Sounding. The rock glaciers examined show a reflective pattern consistent with a permafrost that extends from 2-4 m to more than 20 m depth. The GPR reflections also depict a permafrost stratigraphic architecture, and potential deformation structures in the frozen layers (i.e. shear planes). The GPR profiles made on debris-covered glaciers show a high-amplitude reflection consistent with the presence of near-surface (2-3 m depth) (sedimentary) ice, which in depth exhibits a radar facies less characterized by reflection events than those of rock glaciers. Also in this case an ice stratigraphy and potential deformation features in layers highly rich in ice are visible. The GPR data allowed a view of ice-ground presence in the ice-free areas in Nevado Coropuna and can be integrated with the glaciological evolution of the last decades to build a forecasting model that considers the transformation from clean-ice to debris-covered glacier or permafrost landforms.