# GEOPHYSICAL SURVEYS ON PERMAFROST IN COROPUNA AND CHACHANI VOLCANOES (SOUTHERN PERU)

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A network of air and ground temperature sensors installed 2004-2014 has enabled the discovery of permafrost on the Coropuna (6377 m) and Chachani (6057 m) volcanoes. However, on the Misti (5820 m) volcano there is no permafrost, which can be attributed to geothermal heat.

Misti and Chachani are very close to each other, near the city of Arequipa (S. Peru). Coropuna is 150 km to the west. Various volcanic eruptions have taken place on Misti and Coropuna in the last 10 ka (Úbeda et al, 2012).

The volcanic activity on the Chachani seems to be much older, although it has not been researched to date. Coropuna is covered by a glacial system of _40 km$^2$ (23-11-2013) and the moraines surrounding the volcanic complex indicate a surface of >500 km$^2$ >10 ka ago (Úbeda et al, 2011).

On Chachani the evidence also suggests a great extent in the past although in this case there are no glaciers conserved at the present day. On Misti there are currently no glaciers either, nor is there any evidence conserved of their earlier presence, and this has also been related to geothermal heat.

As well as other study areas, the CRYOPERU sensor network includes 4 stations in the sector Coropuna-NE; 3 stations in Coropuna-SE; 3 stations in Chachani-SE and 3 stations in Misti-NW.

The stations are at different altitudes, in an interval of 4300-6000 m. Each station has a thermometer to measure the air temperature (at a height of 0.50 m) and three thermometers to measure the ground temperature (at depths of 0.15, 0.30 and 1.00 m). The sensors are synchronized in GPS time and record the temperature every 30 minutes.

**References**

Úbeda, J. et al (2012). Glacial and volcanic evolution on Nevado Coropuna (Tropical Andes) based on cosmogenic 36Cl surface exposure dating. EGU2012-3683-2.

Úbeda, J. (2011). El impacto del cambio climático en los glaciares del complejo volcánico Nevado Coropuna (Cordillera Occidental de los Andes Centrales). PhD Thesis. Universidad Complutense de Madrid. 594 pp. http://eprints.ucm.es/12076/

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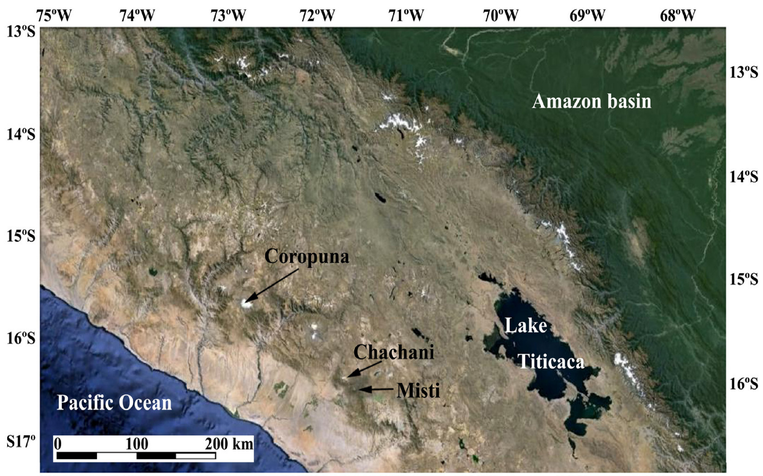


**Figure 1:** General location on the Andean altiplano

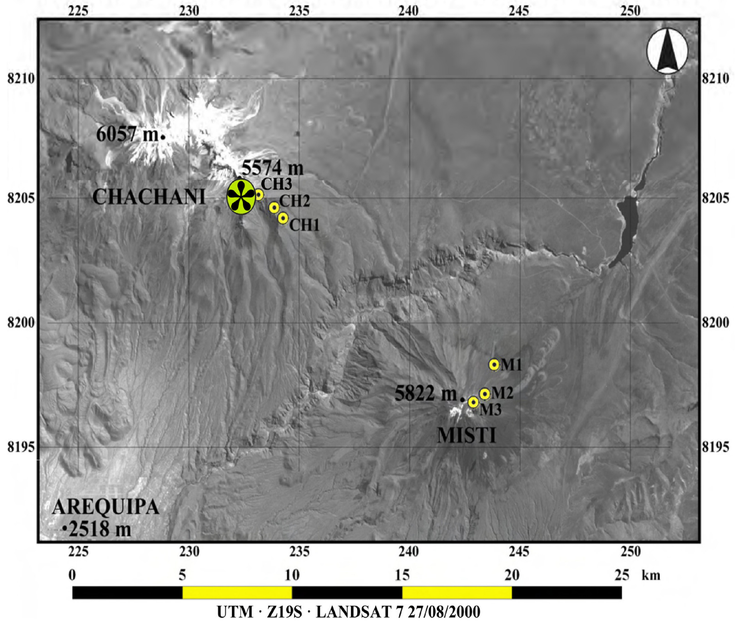


**Figure 2:** Temperature stations on Chachani

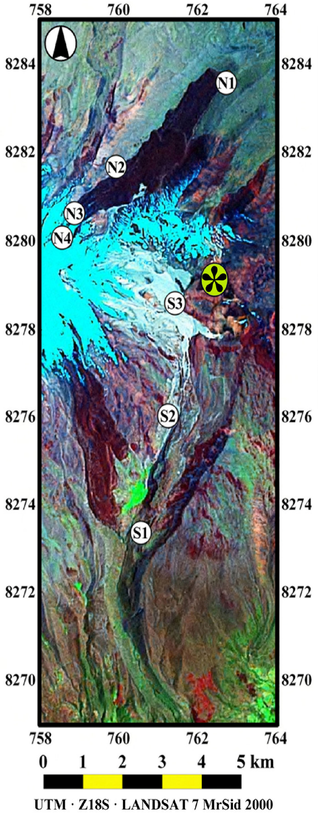


**Figure 3:** Temperature stations on Coropuna

## COROPUNA

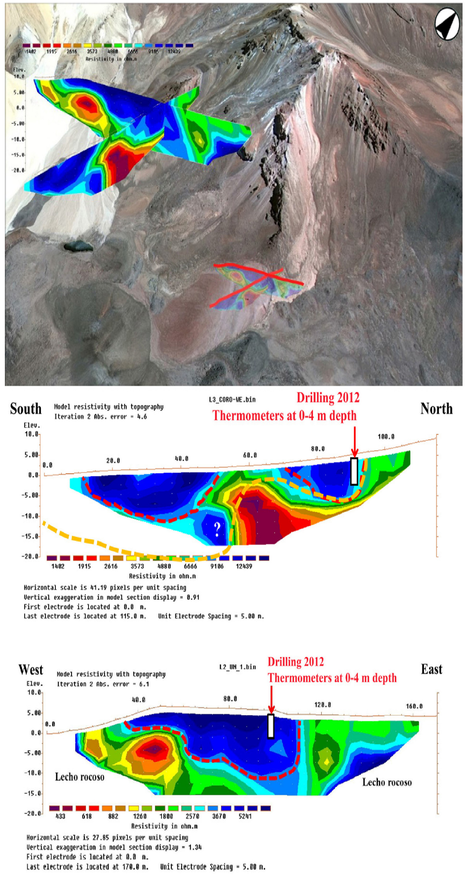


**Figure 5:** Geophysical profiles in Coropuna

## CHACHANI

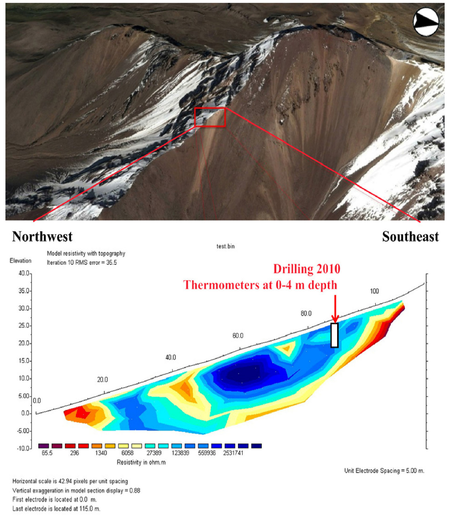


**Figure 7:** Geophysical profiles on Chachani

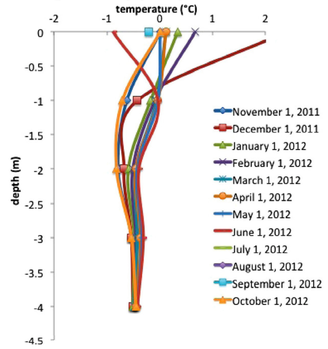


**Figure 8:** Soil temperatures on Chachani (monthly averages)


**Figure 4:** Fieldwork on Coropuna

**Figure 6:** Permafrost from Coropuna

**Figure 9:** Permafrost from Chachani