Geophysical Research Abstracts
Vol. 17, EGU2015-13835-3, 2015
EGU General Assembly 2015

Evaluation of Little Ice Age cooling in Western Central Andes, suggested by paleoELAs, in contrast with global warming since late 19th century deduced from instrumental records

Jose Ubeda (1), David Palacios (2), Néstor Campos (2), Claudia Giraldez (3), Eduardo García (4), and Tatiana Quiros (4)

(1) Instituto Geológico Minero y Metalúrgico, Peru. Autoridad Nacional del Agua, Peru. Departamento de AGR y Geografía Física. Universidad Complutense de Madrid, Spain. NGO Guías de Espeleología y Montaña, Spain (joseubeda@ucm.es), (2) Universidad Complutense, Dep. AGR y Geografía Física, Madrid, Spain, (3) Department of Geography. University of Zurich, Switzerland, (4) NGO Guías de Espeleología y Montaña, Spain

This paper attempts to evaluate climate cooling (ºC) during the glacial expansion phases using the product GTV•ΔELA, where GTV is the vertical air temperature gradient (ºC/m) and ΔELA (m) the difference in level observed between the Equilibrium Line Altitude (ELA) reconstructions for current and past glaciers. With this aim the Area x Altitude Balance Ratio-(AABR) method was used to produce reconstructions of present ELAs (2002-2010) and paleoELAs corresponding to the last glacier advance phase. The reconstructions were produced in three study areas located along a N-S transect of the western cordillera in the Central Andes: the south-western sector of the Nevado Hualcán (9ºS, 77ºW; Giráldez 2011); the southern slope of the Cordillera Pariaqaqa (12ºS, 76ºW; Quirós, 2013) and the NW, NE, SE and SW quadrants of the Nevado Coropuna (16ºS, 72ºW; García 2013; Úbeda 2011; Campos, 2012). The three mountains exceed 6000 m altitude, their summit areas are covered by glaciers, and on their slopes there are existing well-conserved moraines deposited by the last advances near the present front of the ice masses. Although there are no absolute dates to confirm this hypothesis, it has been assumed that the last glacial advances occurred during the Little Ice Age (LIA), which the oxygen isotopes of the Nevado Huascarán (9ºS, 77ºW) date to the period 1500-1890. For the Hualcán and Pariaqaqa the mean global value of the Earth's GTV (6.5ºC/km) was used, considered valid for the Tropics. On the Coropuna a GTV=8.4ºC/km was used, based on high resolution sensors installed in situ since 2007 (Úbeda 2011). This gradient is approaching the upper limit of the dry adiabatic gradient (9.8ºC/km), as the Coropuna region is more arid than the other case study areas. The climate cooling estimates deduced from the product GTV•ΔELA were compared with the global warming shown by the 1880-2012 series, ΔT=0.85ºC, and 1850/1900-2003/2012, ΔT=0.78ºC. The differences are small (averaging 0.05 and 0.12 ºC) suggesting that the product GTV•ΔELA may be a good indicator of climate cooling during glacial expansion phases. However, the role played by precipitation has not yet been determined, and this will be examined in future research.

Campos (2012). Glacier evolution in the South West slope of Nevado Coropuna (Cordillera Ampato, Peru). Master Thesis. Universidad Complutense de Madrid (Spain), pp. 55. http://eprints.ucm.es/19889/.
García, E. (2013). Evolución glaciar del cuadrante noroeste del Nevado Coropuna. Master Thesis. Universidad Complutense de Madrid (Spain), p. 50. http://eprints.ucm.es/23671/.
Giráldez, C. (2011). Glacier evolution in the South West slope of Nevado Hualcán (Cordillera Blanca, Peru). Master Thesis. Universidad Complutense de Madrid (Spain), p. 125. http://eprints.ucm.es/14013/.
IPCC (2013). Climate Change 2013. The Physical Science Basis. Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge (UK) y New York (USA), 1535 pp.

Research funded by Cryocrisis (CGL2012-35858) and www.cryoperu.pe.