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Inexistence of permafrost at the top of the Veleta peak (Sierra Nevada)

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Several deep drillings wew carried out along a latitudinal transect from Svalbard (78°N) to Sierra Nevada (37°N, Spain) within the project Permafrost and Climate Change in Europe (PACE). In this abstract we discuss the data corresponding to the drilling existing at the top of the Veleta peak, at an altitude of 3380 m.

This drilling reach a depth of 114.5 m depth, although we analyze here the data of the first 60 m depth. UTL-1 loggers were installed at depths of 0.2, 0.6, 1.2, 2.6, 4, 7, 10, 13, 15, 20 and 60 m. The observation period spans from 2002 to 2013 with data being taken every 2 h.

The most surficial loggersrecorded the largest annual temperature oscillations, reaching 22.6°C at 20 cm. Down to 10 m depth the annual temperature amplitude is still remarkable and seasonal temperature changes are even observed at depths of 15 to 20 m. Below this level the temperature remains constant. The logger installed at 60 m depth recorded small temperature changes between 2006 and 2009, oscillating between 2.38 and 2.61ºC. Since January 2010 the temperatures stabilized at 2.61°C. However, this slight temperature increase must be framed within the margin of instrumentation error of the devices.

Data shows evidence of the inexistence ofpermanent negative temperatures at depth. In contrast to what happens in the nearby Veleta cirque floor (3100 m), where marginal permafrost conditions have been recorded, in the Veleta peak (3380 m) data points to the absence of a permafrost regime. This may be due to several factors:

a) The existence of permafrost in the Veletacirque is directly related to the presence of fossil glacier ice corresponding to a glacier that existed there during the Little Ice Age.
b) The early melting of snow cover in the Veleta peak due to wind effect and incidence of solar radiation condition the absence of permafrost conditions at the summitin contrast to the Veleta cirquefloor, where the longer persistence of snow favours the presence of continuous negative temperatures.
c) The topographical setting of the Veleta peak favours a major incidence of radiation through therock walls,conditioning higher temperatures.