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Thermal regime of soils in the atlantic high mountain. The central massiff of Picos de Europa (Spain)

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The study of ground thermal regime has got large interest because determine significant geomorphological processes, particularly in the high mountain where do not exist vegetal cover on the ground.
Picos de Europa massifs is located in the North of the Iberian Peninsula (43°18'to 43°7'N and 5°7' to 4°36'W, Spain). It is a wet and temperate high mountain environment characterized by the presence of calcareous rock, featured by karst processes and Pleistocene glaciers.
The aim of this work is analyse the thermal behavior of ground along the year at different altitudes and know limits of ice presence on the ground to differentiate stages without ice, with seasonal ice or potential permafrost.

Temperature data were obtained by 12 thermal micro sensors I-Bottom and UTL-Geotest AG data-logger with centesimal accuracy undertaken to 5-10 cm depth. Micro sensors distribution vary between 1110 and 2535 m a.s.l. exploiting the sites with best topoclimatic terms in order to obtain the coldest records like ancient glaciers. The period of recordings was 2003-2007. It was enough to obtain parameters like annual ground medium temperatures, freeze and thaw cycles, freeze index or number of months with temperatures below zero.

Thermal phases on the ground have been obtained. The thermal regime varies according topoclimatic conditions in the sites above cryonival stage (above 1800 m a.s.l.). It was possible to determinate four phases; highest temperatures, autumn change, winter isotherm and melt. The winter isotherm is the longest phase (6-10 months) due to the intense snowfall. During this period do not exist thermal daily amplitude and the minimum and maximum temperatures are similar; always into the interval (-0.1ºC to 0ºC). However there are sites where the cold is enough to break the wintry isotherm during several days with records around -6ºC. The days with freeze and thaw cycles are scarce and concentrated in autumn during periods without snow cover.

Results show that the snow has the main influence in the annual ground thermal regime. The protection of the snow cover avoids the gelifraction on the contrary of naked ridges where freeze and thaw cycles are usual. It was proved the existence of seasonal freeze soils (SFS) above 1850-1900 m a.s.l. It was possible to make a map with the sites with best conditions to have got SFS. The permafrost was ruled out.

Key words: Ground Thermal Regime, Temperate High Mountain, Snow cover, Geomorphology.