



The role of snow cover in ground thermal conditions in three sites with contrasted topography in Sierra Nevada (Spain)

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Snow cover has a high capacity to insulate the soil from the external thermal influences. In regions of high snowfall, such as the summit areas of the highest Iberian mountain ranges, the presence of a thick snow cover may condition the existence or inexistence of permafrost conditions.

In order to analyze the impact of the thickness, duration and interannual variability of snow cover on the ground thermal regime in the massif of Sierra Nevada, we have analyzed soil temperatures at a depth of 2 cm for the period 2006-2012 in three sites of contrasting topography as well as air temperatures for the same period:

- (a) Corral del Veleta (3100 m) in a rock glacier located in the northern Veleta cirque, with high and persistent snow cover.
- (b) Collado de los Machos (3300 m), in a summit area with relict stone circles, with little snow accumulation due to wind effect.
- (c) Río Seco (3000 m), in a solifluction lobe located in this southern glacial cirque with moderate snowfall.

Considering the air and 2 cm depth soil temperature records, the freezing degree-days were calculated for each year from November to May in order to characterize the role of snow as a thermal insulator of the ground during the cold season (Frauenfeld et al., 2007).

In all cases, the highest values of freezing degree-days correspond to years with little snowfall (2006-2007, 2007-2008, 2011-2012), while in years with a thicker snow cover (2008-2009, 2009-2010, 2010-2011) the total freezing degree-days were significantly lower.

The accumulation of freezing degree-days is maximum at the wind-exposed site of Collado de los Machos, where the wind redistributes snow and favours the penetration of cold into the ground. The opposite pattern occurs in the Veleta cirque, where most persistent snow cover conditions determine lower accumulated freezing degree-days than in Collado de los Machos and Río Seco.