

A local scale assessment of the climate change sensitivity of snow in Pyrenean ski resorts

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The Pyrenees host one of the largest ski area in Europe after the Alps that encompasses the mountain area of the south of France, the north of Spain and the small country of Andorra. In this region, winter tourism is one of the main source of income and driving force of local development on these mountain communities. However, this activity was identified as one of the most vulnerable to a future climate change due to the projected decrease of natural snow and snowmaking capacity.

However, within the same ski resorts different areas showed to have a very different vulnerability within the same resort based on the geographic features of the area and the technical management of the slopes. Different areas inside a same ski resort could have very different vulnerability to future climate change based on aspect, steepness or elevation. Furthermore, the technical management of ski resorts, such as snowmaking and grooming were identified to have a significant impact on the response of the snowpack in a warmer climate. In this line, two different ski resorts were deeply analyzed taken into account both local geographical features as well as the effect of the technical management of the runs. Principal Component Analysis was used to classify the main areas of the resort based on the geographic features (elevation, aspect and steepness) and identify the main representative areas with different local features. Snow energy and mass balance was simulated in the different representative areas using the Cold Regions Hydrological Model (CRHM) assuming different magnitudes of climate warming (increases of 2°C and 4°C in the mean winter temperature) both in natural conditions and assuming technical management of the slopes.

These first results showed the different sensitivity and vulnerability to climate changes based on the local geography of the resort and the management of the ski runs, showing the importance to include these variables when analyzing the local vulnerability of a ski resort and the potential adaptation measures in each particular case.