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Influence of spring snowpack melting on thunderstorm activity in the Catalan Pyrenees

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Catalan Pyrenees, the eastern half of the Pyrenees range, is a very popular area for tourism, hiking and climbing. This sector of the range is 200 km long and, on average, 80 km wide. Its highest peaks reach 3000 m ASL and there are many summits above 2500 m ASL.

Two of the main climatic characteristics of the region are the very frequent summer convective storms and the late autumn, winter and spring snow-cover. Both characteristics have normally been studied from different points of view, and weather forecasts in late spring have not normally considered the plausible relationship between them.

The snowpack melting from April to June, especially rapid in May, leads to important changes on the surface energy balance since the evolution from snow-covered ground to bare soil or canopy, significantly alters the surface albedo and the turbulent, latent and sensible, heat fluxes. These modifications have a noticeable influence in developing or inhibiting thermally-induced mesoscale circulations such as upslope winds, valley breezes or plane-mountain breezes, and could condition the triggering of convection, showers and storm activity.

In order to gain insight into the relationship between the spring snowpack melting and the location of thunderstorm activity, a comparison between seasonal snow-cover and thunderstorm frequency evolution (using lightning network data) for a period of 5 years has been carried out, showing a progressive transition from a non-convective to a convective precipitation regime in areas where the snowpack has melted recently

Furthermore, a meso-beta scale non-hydrostatic numerical weather prediction model at a 2.5-km horizontal resolution is used to study the sensitivity of snowpack extension on the thunderstorms development over the complex orography of the Catalan Pyrenees. A spring case with thunderstorm activity restricted to snow-free areas has been selected and accurately simulated. A number of sensitivity runs with different initial snow fields has been performed, so allowing evaluation of the influence of snow-cover on the triggering of convection.