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Artificial snow production with respect to the altitude: a case study in the Italian Western Alps

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The production of artificial snow is strongly conditioned by air temperature and humidity, two meteorological factors depending on altitude and aspect. For instance, a narrow valley, where thermal inversions and the stagnation of cold air are favored, may have lower air temperatures compared to a sunny high-altitude slope. This may have important effects on timing of the artificial snow production. Such evaluations are extremely important while designing an artificial-snow plant, with respect to the potential utilization during the winter season.

Study Area is in Alagna Valsesia Municipality, in the Italian Western Alps. Air temperature and humidity were monitored during winter 2003-2004. The monitoring was devoted to give suggestions for designing a new artificial snow plant at a altitude ranging from 1350 and 2400 m a.s.l. Measurements were taken hourly using Testo 175 H2 data-loggers at 4 sites along the ski slope (1350, 1900, 2150 and 2395 m a.s.l., respectively). Dataset was then elaborated to calculate the wet-bulb temperature (t_u) and to determine the potentially available hours (PAH) for the artificial snow production (i.e. t_u <-4˚C). The frequency of optimal-conditions (i.e. t_u <-10˚C) was evaluated as well.

The PAH in December were less than 25 at 1350 m a.s.l., and more than 100 at higher sites. January was found to be the most favorable month for artificial snow production, showing a maximum of 350 PAH at the higher sites and more than 250 hours at 1350 m a.s.l., thanks to the occurrence of thermal inversions. In the first half of February PAH

sharply decreased at all sites, because of the occurrence of a subtropical anticyclone. In the second half of February PAH increased again, and finally decreased at all sites in the second half of March. Optimal conditions did not occur at none of the sites before January.

From our data, it is evident that in early winter the artificial snow production could be extremely limited, especially between 1300 and 1400 m a.s.l.. Nevertheless, the occurrence of thermal inversions could increase the potentially available hours during winter at low elevations. The occurrence of persistent subtropical anticyclones may cause PAH to decrease sharply, even at the higher sites.