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Combining snow depth and innovative skier flow measurements in order to improve snow grooming techniques

Carlo Maria Carmagnola (1), Stéphane Albrecht (2), and Olivier Hargoaa (3)

(1) Dianeige, Meylan, France (c.carmagnola@dianeige.fr), (2) Lumiplan, La Bathie, France (stephane.albrecht@lumiplan.com), (3) Snowsat, Meylan, France (olivier.hargoaa@snowsat.com)

In the last decades, ski resort managers have massively improved their snow management practices, in order to adapt their strategies to the inter-annual variability in snow conditions and to the effects of climate change. New real-time informations, such as snow depth measurements carried out on the ski slopes by grooming machines during their daily operations, have become available, allowing high saving, efficiency and optimization gains (reducing for instance the groomer fuel consumption and operation time and the need for machine-made snow production). In order to take a step forward in improving the grooming techniques, it would be necessary to keep into account also the snow erosion by skiers, which depends mostly on the snow surface properties and on the skier attendance. Today, however, most ski resort managers have only a vague idea of the evolution of the skier flows on each slope during the winter season.

In this context, we have developed a new sensor (named Skiflux) able to measure the skier attendance using an infrared beam crossing the slopes. Ten Skiflux sensors have been deployed during the 2016/17 winter season at Val Thorens ski area (French Alps), covering a whole sector of the resort. A dedicated software showing the number of skier passages in real time as been developed as well. Combining this new Skiflux dataset with the snow depth measurements from grooming machines (Snowsat System) and the snow and meteorological conditions measured in-situ (Liberty System from Technoalpin), we were able to create a “real-time skiability index” accounting for the quality of the surface snow and its evolution during the day. Moreover, this new framework allowed us to improve the preparation of ski slopes, suggesting new strategies for adapting the grooming working schedule to the snow quality and the skier attendance.

In the near future, this work will benefit from the advances made within the H2020 PROSNOW project (“Provision of a prediction system allowing for management and optimization of snow in Alpine ski resorts”), which has been funded for the period 2017-2020.