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## Observed impact of temperature increase on the altitude of snowfall and snow pack in the Swiss Alps

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We analysed snowfall and snow pack for up to 100 years at 140 stations, spanning elevations from 200 to 3500 m asl in Switzerland. Our results show that the decrease in snowfall as well as in snowpack was stronger at lower elevations, at locations with temperatures closer to the melting point.

Precipitation currently falls as snowfall on more than 90% of precipitation days in February from approximately 1400 m asl and above, and from 1700 m asl and above in December, January and March. During the last 50 years, the altitude with snowfall on 90% of precipitation days has increased by at least 300 meters in elevation. The transfer proportion was the same for snowfall on 50% of precipitation days.

The current frequency of snowfall for December, January and February are similar to those of the 1960s for November and March. The beginning and end of the ski seasons will be affected by the transfer in altitude of snowfall, as currently already approximately every second precipitation day consists of rain up to 1400 m asl in November and March and up to 1700 m asl in April.

These changes result in a decrease in snowpack and in the amount of snow available for water storage and runoff during the spring and summer months, because more and more winter precipitation will directly contribute to runoff. Impacts can also be expected on the alpine vegetation, which will experience a shorter snow season, independent of variability or changes in precipitation.