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A snow climatology for the French Alps for the period 1958-2003

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A new snow climatology has been created for the French Alps, which covers the period 1958-2003. It is based on the Safran-Crocus-Mepra (SCM) model chain, which has been developed for the avalanche hazard forecasting. As input, the SCM chain uses observed surface meteorological parameters and meteorological analysis of the vertical structure of atmosphere. It calculates a complete set of surface meteorological surface parameters, which are used to simulate the snowpack evolution. The calculation is done for massifs with a typical surface area of 400 km2 and with a 300-meter vertical resolution. For the study, the input data are ground observations and the newly reanalysed atmospheric model data (ERA-40) of the European Centre for Medium-Range Weather Forecasts. The results have been validated by comparison with the available snow depth observations. The main characteristics of the French alpine snowpack are well reproduced, with a marked declining gradient from the north-western foothills to the south-eastern interior regions. A strong interannual variability is also noticeable, with snowy winters (especially from 1975 to 1985) and poorly snow winters (in the 1970s beginning and from 1987 to 1993). The trends results for winter air temperature shows no trend until 1980 and a strong increase since 1980 (between 0.5°C and 2.5°C depending on the massif). No significant trend is noticeable for total precipitation, but the ratio rain/snow is modified, especially since 1990. The snowfalls amount decreases because of the air warming. The results for the winter average snow depth is contrasted for the southern and northern massifs. In the north, the most significant decrease is noticeable since 1990. In the south, the compensations of air temperature increase by snowfalls increases are more complex. Hence the main decreases occurs in the 60's.and in the 80's.