



## **The Alpine snow-albedo feedback in the ENSEMBLES regional climate models**

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The effect of the snow-albedo feedback (SAF) on 2m temperatures and their future changes in the European Alps is investigated in several regional climate models (RCMs) of the ENSEMBLES project. 14 re-analysis-driven experiments covering the period 1961-2000 and 10 GCM-driven climate change scenarios until 2099 are analyzed. A positive SAF is found in most RCMs. However, the range of the diagnosed SAF-values is large. For some RCMs, values very close to the one determined using observational data are found; other models show a considerable overestimation of the SAF. Net shortwave radiation has the largest influence of all components of the energy balance on the diagnosed SAF and can partly explain differences in SAF intensity. Also model deficiencies in reproducing 2m temperatures above snow and ice, and associated cold temperature biases at high elevations seem to contribute to an SAF-overestimation in several RCMs. A quantification of the SAF contribution to 21st century temperature changes in the European Alps shows that its contribution strongly depends on the diagnosed SAF in the observational period. Until 2099 a temperature change between 0°C and 0.66°C or 0% and 30% of the total temperature change can be attributed to the SAF at elevations of maximum contribution (i.e. between 1500 m and 2000 m in spring and above 2000 m in summer). RCMs with a realistic SAF show a mean SAF contribution in the future of about 0.25°C or 8% of the total temperature change in MAM. For RCMs with an SAF-overestimation, results suggest that future temperature changes at medium to high altitudes may be overestimated in spring and summer as a consequence of non-stationary model biases.