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Can modern reanalyses be used to monitor temperature in the Alps in recent decades?

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The interplay of topography and circulation can lead to altitude dependent temperature anomalies and trends in mountain regions such as the European Alps. In this study, I evaluate how well modern reanalyses such as the ECMWF global reanalysis ERA5 with about 31 km resolution and the DWD-HErZ regional reanalysis COSMO-REA6 with about 6 km resolution are able to represent the interannual variability of 2m temperature at low and high altitudes in the Swiss Alps in the last 20–40 years. The reanalysis data sets work reasonably well in all seasons for low altitudes and in summer for high altitudes. In winter, ERA5 shows considerable deficiencies at high altitudes, leading to spurious trends, e.g. a strong underestimation of the winter cooling in the 25 year period 1988–2012. There is also a tendency in ERA5 that very warm (cold) winter months are not warm (cold) enough at high altitudes. The regional reanalysis COSMO-REA6 performs clearly better at high altitudes especially in winter, indicating the benefit of the higher spatial resolution compared to ERA5. An analysis of the altitude dependence of the interannual temperature variability reveals considerable differences between the data sets. This is especially the case in winter where different weather types lead to strong altitude dependencies and small scale temperature effects. COSMO-REA6 is rather short to study altitude dependencies in detail. It will be interesting to see how useful the upcoming Copernicus regional reanalysis for Europe will be for temperature monitoring and the investigation of climate-change-related altitude dependencies in the Alpine region.