



Effects of sunshine duration and large-scale flow on the evolution of minimum and maximum temperature in Switzerland since 1884

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The evolution of annual minimum (TMIN) and maximum temperature (TMAX) on the Swiss Plateau shows distinct differences largely depending on the time period considered. While TMIN increased much stronger than TMAX in the last roughly 150 years, TMAX trends were larger than TMIN trends since about 1950. Sunshine duration (SD) is the most promising parameter to explain some of the differences. Four long-term series of stations located on the Swiss Plateau have recently been homogenized back to 1884 and allow long-term evolution studies. SD shows large decadal variability with a significant decline from 1950 to about 1980 and a significant increase since 1980. The TMAX evolution can indeed be reconstructed very well using a linear combination of TMIN and SD ($R^2 = 0.90$, $RMSE = 0.28^\circ\text{C}$).

The TMIN and TMAX evolution has also been reconstructed using the dominant European climate modes (CM) and global mean temperature (GMT). While TMIN can be reproduced reasonably with the North Atlantic Oscillation, the Eastern Atlantic pattern and GMT as dominant components, TMAX is reproduced less well with a systematic positive bias from about 1950 to about 1990 and a negative bias since the 1990s. Adding SD to the model improves the TMAX model quality considerably and the systematic biases are strongly reduced. This confirms that SD variability is able to explain most differences in the Swiss TMIN and TMAX evolution since about 1950. It also shows that the SD effects are not well represented by the dominant European CMs. The differences in the TMIN and TMAX evolution between 1884 and about 1950 cannot be explained well by SD variability and further investigations are needed to explain them.