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Long-term trends in temperature variables and their relation to sunshine duration in Switzerland

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Long homogenised series of daily minimum (T_{min}) and maximum temperature (T_{max}) as well as monthly sunshine duration (s_{dur}) are newly available at several Swiss stations for the period 1864-2016. On the Swiss Plateau, T_{min} increased by 2.9˚C, T_{max} by 1.4˚C and mean temperature by 2.0˚C since 1864. As a consequence, the daily temperature range (DTR) decreased by 1 to 1.5˚C in most regions (Plateau, Alpine valleys, Southern Alps). An analysis of the coldest and hottest day, week and 2-week period per year shows considerable differences between T_{min} and T_{max} trends. The coldest day and week warmed by 3.6˚C, the coldest 2-week period by 3.2˚C. On the other hand, the hottest day, week and 2-week period warmed only by 1.2 to 1.4˚C.

Changes in radiation are a possible cause for the considerable differences in the T_{min} and T_{max} trends. s_{dur}, as proxy for global radiation effects, is available for analysis in Switzerland since 1884. On the Swiss Plateau, s_{dur} has declined by roughly 15% from the late 1940s to about 1980. From 1980 to 2016, a rapid increase of about 20% was observed. The s_{dur} variability had a pronounced influence on T_{max}, DTR and their evolution. Long term (50+ years) T_{max} trends were lowered by long periods of declining s_{dur}, short term (less than 50 years) T_{max} trends raised by the strong increase in recent s_{dur}. Seasonal DTR and s_{dur} are highly correlated, especially in spring (r = 0.87) and summer (r = 0.83). Also the trends in DTR and s_{dur} trends behave similarly, indicating that s_{dur} indeed was a main driver of Swiss DTR variability in the past.

Regions at higher altitudes react differently to sunshine variability than the other Swiss regions: T_{min} and T_{max} trends are very similar and DTR trends are insignificant. In addition, no clear trend in s_{dur} is found.