Long-term consistent grid data for temperature in Switzerland

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A frequent caveat of currently available grid datasets is their lack of long-term climate consistency. Changes in the density of station networks over time, together with inhomogeneities in the underlying station series jeopardize their utility for climate monitoring and the analysis of long-term trends.

In this study we present a methodology to derive a monthly grid dataset for Switzerland, dating back as far as 1901, and targeted for applications with a need in long-term consistency. To this end, data is incorporated from a non-varying station network that includes only series that have been carefully examined and corrected for inhomogeneities and extend over the whole time period. The restrictive selection results in a very coarse station density (average spacing 40 km). To recover spatial patterns not explicitly resolved by the stations, we combine the measurements with statistical information from a high-resolution temperature analysis over a limited recent period and from a much denser station network. For this purpose, RSOI (reduced space optimal interpolation) is adopted, a combination of Principal Component Analysis and Optimum Interpolation.

We demonstrate – for the mountainous region of Switzerland – that the technique can remedy artifacts common to interpolation with variable station densities and that it is capable to reproduce more spatial detail than simple interpolation from the coarse high-quality stations only. We also investigate to what extent spatial variations in long-term temperature trends can actually be reproduced by gridding. This is a critical test for assessing the utility of long-term grid datasets for trend analysis.