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A centennial climate-consistent spatial analysis of precipitation for the European Alps

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Currently available grid datasets of precipitation rarely extend over a period of more than 60 years. This is because the density of available rain-gauge observations strongly decreases before the middle of the twentieth century. Also, there is a risk that long-term climate consistency in these datasets is compromised by variations in the density of station networks and by inhomogeneities in the underlying station data. These limitations are critical for the monitoring and analysis of long-term precipitation trends. In high-mountain regions the lack of dense long-term observations is particularly significant considering the large spatial variation of precipitation.

In this study, which is part of the COPERNICUS C3S_311a_Lot4 Project, we present an alternative to standard interpolation that improves spatial resolution and climate consistency in a centennial gridded precipitation dataset for the Alps. The method borrows ideas familiar from the combination of multiple observation platforms and applies these in a combination of data from coarse long-term series with high-resolution data from a few recent decades. The RSOI method (Reduced Space Optimal Interpolation), previously applied in Switzerland, is adopted to derive a mesoscale monthly grid dataset for precipitation over the Alpine Region, that dates back as far as 1870. A high long-term consistency is achieved by incorporating 90 homogenized and fully complete station series, taken from the HISTALP dataset (Historical Instrumental Climatological Surface Time Series Of The Greater Alpine Region). Spatial patterns not explicitly resolved by these series are integrated from a high-resolution grid dataset, the Alpine Precipitation Grid Dataset (APGD). APGD is available over a limited recent period (1971-2008) and builds on data from more than 8000 stations.

Our contribution will illustrate the ability of the technique to reproduce more spatial detail and better climate-consistency than conventional interpolation. The analysis yields plausible patterns in the long-term precipitation variation over the Alps and, despite being monthly only, reveals some prominent heavy precipitation events from the late 19th and early 20th century.