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UERRA Uncertainties in Ensembles of Regional ReAnalyses

Gridded ECVs and their use in Alpine region – experience from a national data Provider

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Introduction

The Alpine region is of particular relevance in regard to climate change due to the

- vulnerability of its natural systems (e.g. hydrology, Europe's stock of fresh water, glaciers)
- impact on different sectors (e.g. water and energy)

Shortcomings of current gridded ECV's are

- short period (e.g. limited use for glaciology)
- limited use for climate monitoring
- input data not homogeneous
- artefacts from variable station density

Within our current work we

- provide long-term periods (multi-decadal)
- resolve on mesoscale
- focus on a key region of Europe
- use high quality data

Data and network

- Short-term high-resolution component

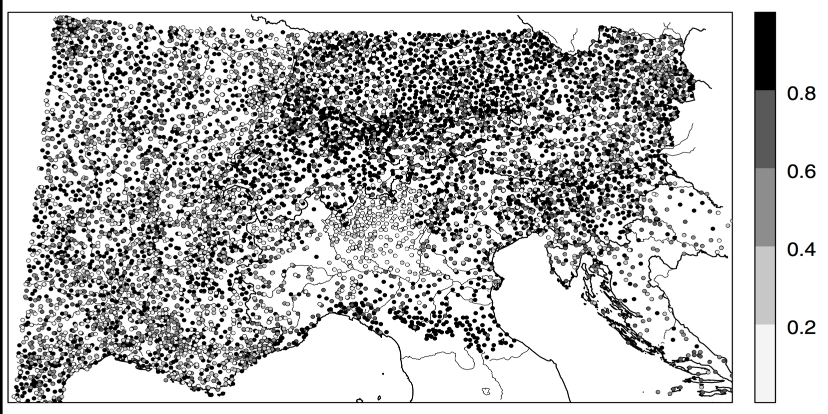


Figure 1. Short-term component, 1971-2008, daily, Spatial high resolution, 5700 stations on average, Availability of data: fraction of not NA days (1971-2008)

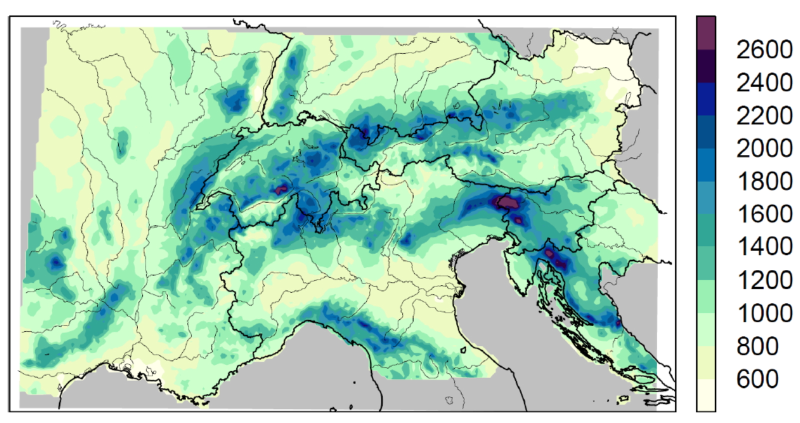


Figure 2. Alpine Precipitation Grid Dataset, period 1971-2008, mean annual precipitation (mm), 5 x 5 km, (Isotta et al., 2014)

- Long-term component consists of 153 monthly station time series extending over the entire study period with short interruptions only.

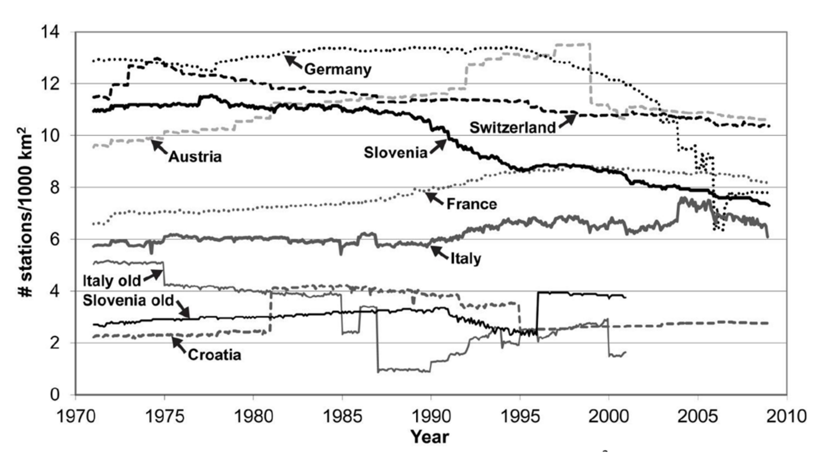


Figure 3. Number of stations per 1000 km2 and year

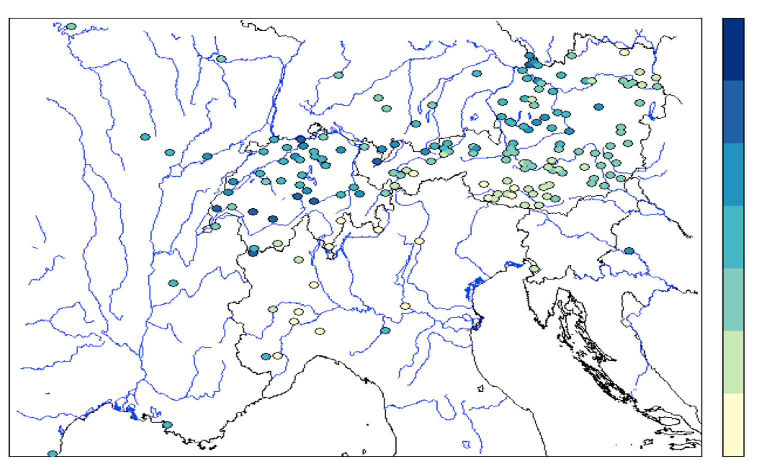


Figure 4. Long-term component, 1901-2008, monthly 153 stations (almost continuos)

Method

The statistical combination of a high resolution grid data set over few decades with centennial homogeneous station records (Masson and Frei, 2015) accomplished by reduced-space optimal interpolation (RSOI)

- Calibration during 1971-2008
- Reconstruction of 1901-2008

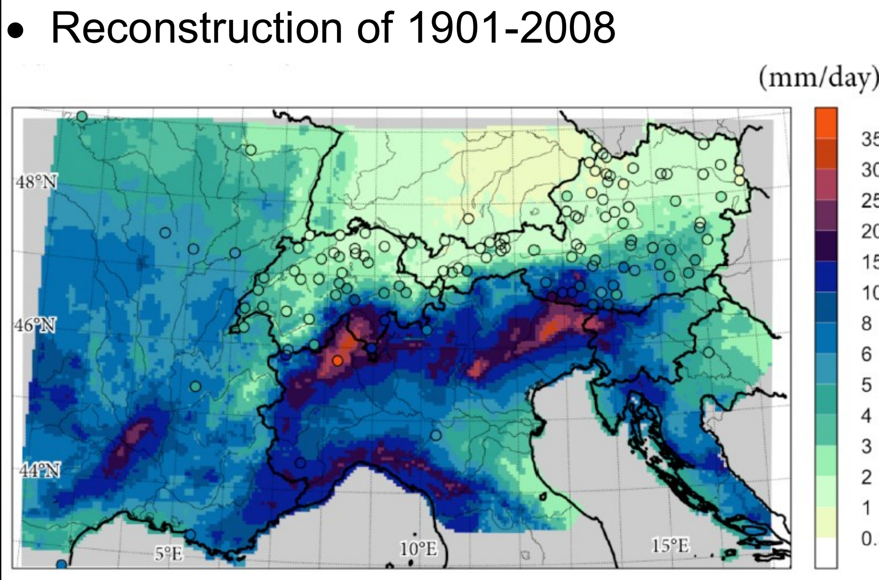


Figure 5. Example of a reconstructed field of precipitation [mm/day] for October 1907 (a documented flooding episode).

Figure 6. Photography taken in Locarno (Switzerland) at that time. Lago Maggiore: 4 m above average, Centovalli area: more than 1100 mm per month.

Possible applications

- Climate monitoring
- Analyses of trends

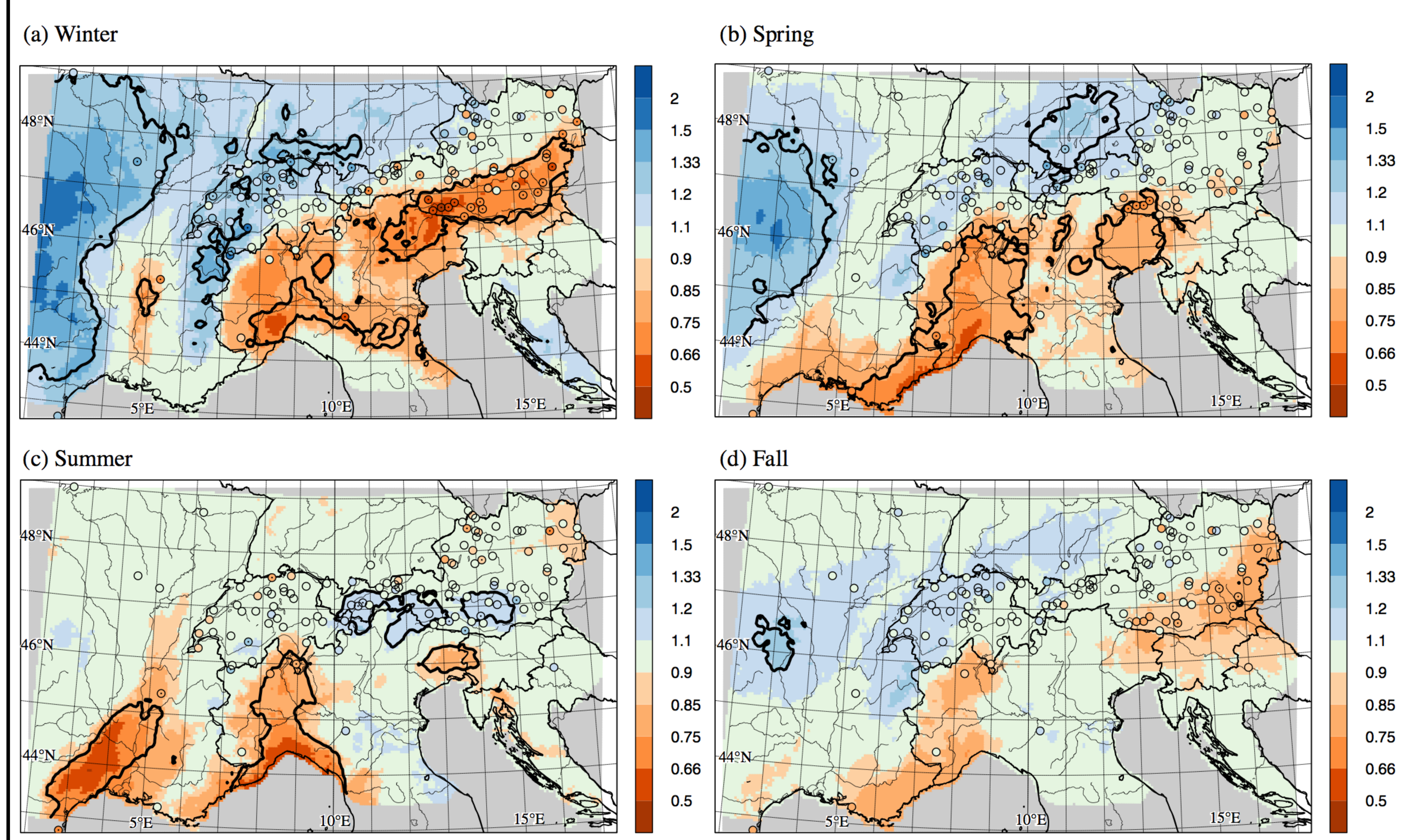


Figure 7. Linear trend of seasonal mean precipitation in the period 1901–2008, calculated from the reconstructed monthly precipitation analyses. Winter (a), spring (b), summer (c) and autumn (d). Trends are calculated using the Theil–Sen slope and are expressed as the precipitation ratio 2008/1901. The black contour line indicates regions where the trend is statistically significant (significance level 5%) according to the Mann–Kendall test. Colored circles represent the trend determined from the corresponding station time series and a small dot in the circle indicates that the trend is significant.

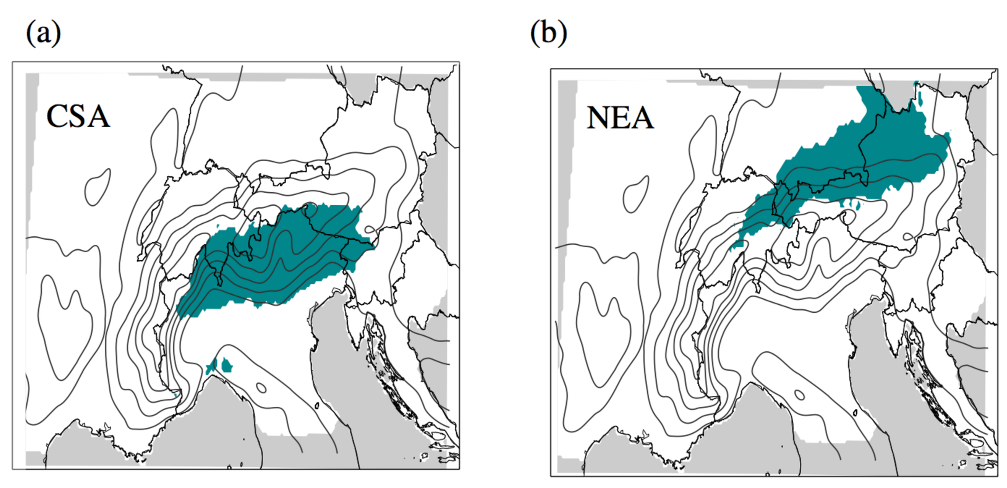
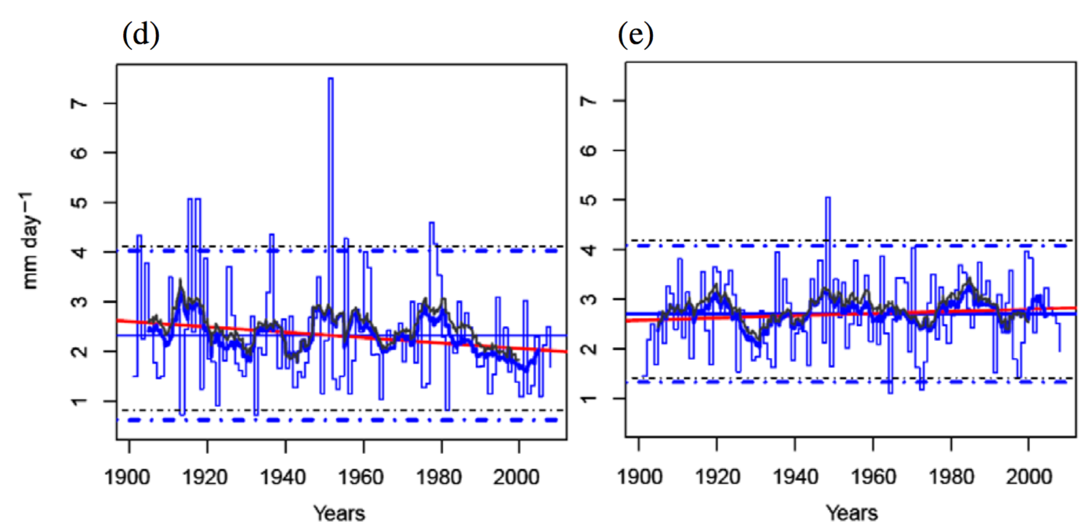


Figure 8.
Long-term variation of seasonal precipitation in two subregions of the Alps
(a) CSA: central Southern Alps
(b) NEA: North-Eastern Alps



Evolution of mean **winter (DJF)** precipitation (steps; blue in online) for (d) CSA- and (c) NEA-region. Low-pass filtered time series (8-year moving average, thick blue line), mean and standard deviation (horizontal thick blue lines), linear regression (thick red line) and low-pass filtered time series and the standard deviations for the HISTALP dataset (black lines).

Proposal of a contribution to Copernicus

- operational implementation of reconstruction of monthly precipitation
- whole Alpine region, mesoscale resolving
- since 1901, possibly back to 1870
- using high quality HISTALP station records
- as a regional element to the European ECV gridded products derived from observations
- Partners: all Alpine weather services (MeteoSwiss & ZAMG confirmed)

Gridded data sets from MeteoSwiss

- global radiation, temperature, sunshine duration, precipitation as well combined with radar data, Alpine precipitation grid dataset (EURO4M-APGD
- free of charge for research purposes
- http://www.meteoswiss.admin.ch/home/services-and-publications/produkte.html

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References

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