New high resolution gridded regional daily precipitation data set: first results from the STAMMEX project

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I. INTRODUCTION

STAMMEX[1] project is focused on the quantitative estimation and mechanisms of variability of extreme precipitation. One of the main aims of this project is the development of high resolution gridded regional daily precipitation data set over Germany. Using modern objective analysis approaches and the data from a very dense German Weather Service (DWD) station network, we constructed gridded daily precipitation data sets for Germany. Data files will be freely available online.

II. ORIGIN DATA

The original data source consists of 5600 daily rain gauges from the DWD collection covering Germany for the period from 1880 onwards. Gridded fields with different spatial resolution were derived for different time periods. We required that stations included in the interpolation procedure should cover the whole periods for which the sub-set is developed. We present here 0.1 degree gridded precipitation data set for the period from 1960 to 2008. From the original data records we chose **1200 stations** which practically do not have any gaps.

III. APPROACHES

We used several interpolation methods to construct the grids: method of local procedures (MLP[2]), distance – weighting method (WD) and ordinary kriging (OK[3]). The strategy of the development of gridded data sets included different objective analysis algorithms. Based on OK approach, we varied different kriging parameters (background "window", the type of kriging variogram, number of original irregular data entries) to determine sensitivity of the interpolation results.

A (~5600 stations) **B (1200 stations)** **C (4701 grid points)**

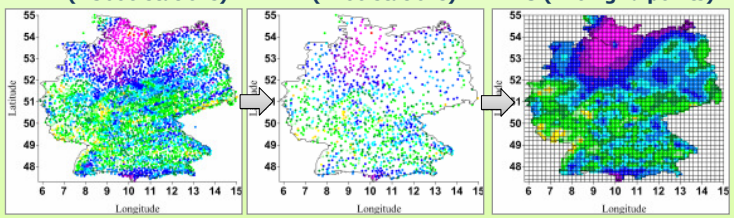


Figure 1 *A – daily precipitation from the original data; B – selected 1200 stations; C – gridded daily precipitation derive from B (27 august 1989)*

IV. PRECIPITAION PARAMETERS & INDICES

To get insights on the value of new data set we compared different characteristics of precipitation:

95% percentile of precipitation from Gamma distribution **[mm]** quantifies absolute extreme precipitation values

R95ptot[4] index [%] shows relative extreme precipitation or relative contribution for the 5% of the wettest days to precipitation total

Intensity [mm] is the mean of precipitation during the wet day

R20yreas return values [mm] show possible maximum precipitation occurring once per 20-yr period

For computation of all precipitation indices and their linear trends we selected daily precipitation values exceeding 1mm per day.

V. COMPARISON OF LINEAR TRENDS (1961-2008)

A - 95% percentile of precipitation

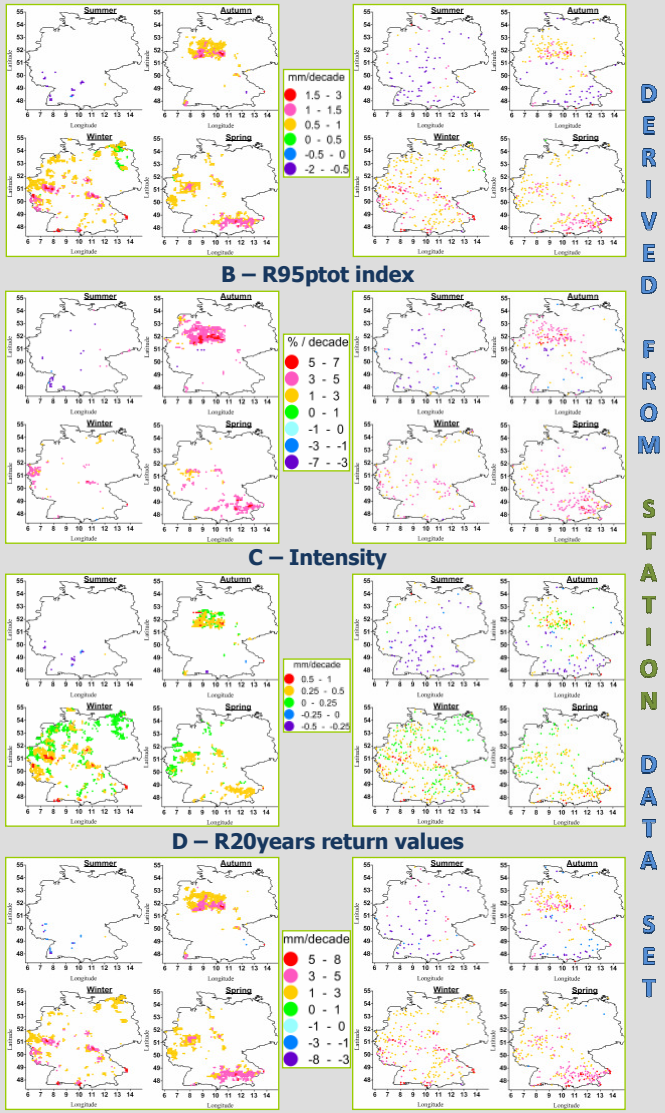
B – R95ptot index

C – Intensity

D – R20years return values

DERIVED FROM GRIDDED DATA SETS

DERIVED FROM STATION DATA SET



VI. CONCLUSIONS

A NEW GRIDDED (0.1-degree) PRECIPITATION DATA SET OVER GERMANY

We developed several daily precipitation gridded data sets for Germany with different spatial resolution and for different time periods, which will be freely available online soon

KRIGING INTERPOLATION FOR PRECIPITATION

Comparison of different interpolation methods has proven that kriging is the least biased approach for spatial interpolation of daily precipitation fields.

ANALYSIS OF SEASONAL CLIMATE PRECIPITATION TRENDS

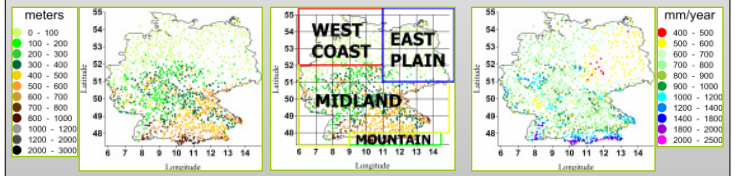
- Linear trends derived from original and interpolated data are qualitatively consistent.
- There is a **strong seasonality** in precipitation trends with primarily negative changes in summer and positive trends in all other seasons.
- For different seasons we identified the regions of highest positive trend values, specifically, Central Northern Germany in autumn, Alpine foothills in spring and Western Germany in winter.
- Maximum positive trend changes were identified in the mountain and foothills regions.

VII. DISCUSSION ISSUES

ELEVATION and CLIMATE PRECIPITATOIN

In the case of precipitation interpolation a strong relationship between elevation and precipitation implies constrains for the kriging setting.

It is useful to apply different variograms to different regions, according to the regional elevation and climate precipitation characteristics. Potential regions:



stations elevation *regions* *annual precipitation amount (1961-1990)*

VIII. REFERENCES

[1] STAMMEX (Spatial and Temporal Scales and Mechanisms of Extreme Precipitation Events over Central Europe) project is funded by DFG

[2] Akima, H., 1970: A new method of interpolation and smooth curve fitting based on local procedures. J. Appl. Comput. Math., 17, 589–602.

[3] www.gslib.com - Geostatistical Software Library and related software

[4] Klein Tank A.M.G., Koennen G.P. Trends in indices of daily temperature and precipitation extremes in Europe, 1946–99 // J. Climate. 2003. V. 16. P. 3665–3680.