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From monthly climatologies to daily gridded fields over Fennoscandia: a consistent chain of statistical models for precipitation

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A modelling framework based on the anomaly method has been recently set up and applied over Fennoscandia to computed a gridded dataset of daily precipitation at 1 km resolution and extending from 1970 to present.
The observational database used for the study covers Fennoscandia and neighbouring countries and it is composed by almost 5000 rain-gauge daily series which were all quality checked and filled for daily gaps. The use of station anomalies in the interpolation of precipitation aims at reducing the possible biases due to the uneven station coverage over the domain, especially between valley and mountainous regions.
Each daily precipitation field is obtained by the superimposition of a monthly and a daily field which are constructed independently.
Firstly, the monthly precipitation grid is computed by applying an inverse distance weighting interpolation of station monthly anomalies with respect to the 1981–2010 climatological values, computed by means of a geostatistical interpolation scheme modelling the local relationships between the station monthly normals and a set of chosen geographical parameters. The monthly fields of precipitation totals are finally obtained by combining the gridded anomalies with the corresponding monthly climatologies.
The daily interpolation is computed by applying the inverse distance weighting scheme on the daily station data after converting them into relative contributions of each daily value to the corresponding monthly totals. Finally, the gridded daily fractions are converted into millimetres by multiplying them times the corresponding field of monthly totals.
In the daily and monthly weighting schemes, the decreasing rate of weights with radial distance is regulated accordingly to data availability for each year and it is defined at each grid point as a function of the local data density.
The interpolation errors were evaluated by means of a leave-one-out cross-validation on the daily station series of three subdomains of Fennoscandia, which are characterized by different station coverage and orographic conditions. The results point out an overall tendency of the interpolation approach to slightly overestimate the small precipitation values and to underestimate the high-intensities. The error ranges depend on the data density and on the climate regime of each subdomain.
In addition, the gridded daily dataset was compared with two recent versions of the Norway Climate Gridded Dataset (NGCD) computed by applying the Optimal Interpolation (OI) method and a triangulation-based procedure on the same observational database and for the same period. The comparison of mean annual totals and wet-day frequency, together with an analysis of 95th quantile distributions and of mean annual cycles over target subregions allow to assess the main features of the three interpolation methods.