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# Analysis of non-stationarities in the context of statistical downscaling of extreme precipitation in the Mediterranean area

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In the context of statistical assessments of regional climate change, different approaches are developed. Emphasis is put on non-stationarities in the relationships between the large-scale atmospheric circulation and regional climate.

Mean and extreme precipitation values are taken from different weather stations and a high-resolution gridded dataset for the second half of the 20th century in the Mediterranean area. Analyses are conducted for the winter season (December 1950 to February 2010). Principal component analysis (PCA) is applied to the precipitation data in order to obtain regions of similar precipitation variability.

Different variables of the NCEP/NCAR-reanalysis dataset (Kalnay et al. 1996) are used as predictors, i.e. geopotential heights at different levels, as well as humidity, vertical velocity and horizontal wind components. The large-scale circulation is described by centres of variation, determined by means of s-mode PCA, or by large-scale weather regimes, defined by PCA and subsequent cluster analysis of the geopotential height fields.

One approach consists of a three-step censored quantile regression used as a transfer function. Thereby the predictors are selected according to their significance on the level of $\alpha$=0.01 for different quantiles ($\tau$=0.5, 0.55, ..., 0.95, 0.99). The predictands are the daily station-based datasets of 94 weather stations across the Mediterranean area. Another approach is based on Tweedie exponential dispersion models in the form of a Poisson-Gamma distribution. Thereby, the high-resolution gridded dataset provides the predictands for the Mediterranean land area.

In both cases the Brier Skill Score (BSS) is used to validate the probability of rain and the „Censored Quantile Verification Skill Score“ (CQVSS, Friederichs & Hense (2007)) to obtain information on the skill of the models to assess precipitation amounts. Scores are calculated on the basis of running calibration periods. Significant departures of the skill in validation are used to assess potential non-stationarities in the predictors-precipitation relationships.
A comparison of the quantile regression and the distribution-based approach allows conclusions about their ability to assess precipitation and shows whether or not both methods detect the same non-stationarities. Furthermore, results are compared for the gridded dataset and the station data.

Friederichs, P., Hense, A. (2007): Statistical downscaling of extreme precipitation events using censored quantile regression. Amer. Meteor. Soc., 135, 2365–2378.

Kalnay, E. and Coauthors (1996): The NCEP/NCAR 40-Year Reanalysis Project. Bull. Amer. Meteor. Soc., 77, 437-471.