Optimum classification of large-scale circulation patterns for statistical downscaling of daily precipitation from GCM output

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An objective weather-classification was developed for Sweden (SWP) by applying a multi-objective fuzzy-rule-based classification method (MOFRBC) to large-scale-circulation predictors in the context of statistical downscaling for local precipitation. The predictor data was MSLP and geopotential heights at 850 and 700 hPa from the NCEP/NCAR reanalysis project. The MOFRBC was used to evaluate effects of future climate scenarios (A2 and B2) on precipitation patterns on two regions in south-central and northern Sweden. The precipitation series were generated with a stochastical model conditioned on SWP simulated by the global climate models HADM3P and ECHAM4. Geopotential height at 850 hPa was found to be the optimum predictor for a classification covering all of Sweden (SWP), whereas MSLP was the optimum predictor for more local classifications. The downscaling results indicated an increase in maximum 5-day precipitation and precipitation amount on a wet day. The relative increase was largest in the northern region. Intra-annual precipitation was better modelled with the downscaling method compared to direct output from the GCM. The increase could be attributed to an increase in specific humidity rather than to changes in the circulation patterns.