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Use of statistical downscaling for assessing future low flows in the River Thames basin.

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Many climate change impact assessments in the UK have been undertaken using the change factor methodology. This involves perturbing a baseline climatology using changes in climate projected by one or more General Circulation Models (GCMs). This study compares a statistical downscaling model against the method of change factors as applied to hydrological impact assessment. The Statistical DownScaling Model (SDSM) is a windows based tool that produces catchment-scale climate change scenarios. Statistical downscaling methods apply climate variable output from GCMs to statistical transfer functions to estimate local meteorological series. Using re-analysis data from the National Center for Environmental Prediction (NCEP), the model allows the user to construct a statistical downscaling model based on relevant predictor variables for the site in question. SDSM then allows the user to generate an ensemble of climate scenarios for target sites or catchment areas. SDSM produces meteorological data on a daily time scale which can then be fed into a hydrological model. In order to highlight the relative merits of each method, both the change factor and the statistical downscaling methods are applied to a case study of projected changes in low flow patterns in the River Thames and the River Lambourn. Projected changes that are centered on the 2020s, 2050s and 2080s are evaluated against a baseline period of 1961 to 1990. The GCM output fed into both methods also underpinned the 2002 UK Climate Impacts Programme (UKCIP02) scenarios. Both methods signal increased seasonality, in particular substantial reductions in summer precipitation and increased potential evaporation throughout the year. This leads to reduced flows in late summer and autumn. The main difference between the two projections is that the SDSM scenarios produce more modest changes in low flows than the change factor methodology. This arises due to variations in the treatment of multi-decadal natural variability, temporal structuring of daily climate variables, and large-scale forcing of local precipitation and PE by the two methods. The work highlights the need to apply multiple downscaling approaches when characterising uncertainty in future water resources.