



## Projections for prolonged drought, rainy and heat periods in Finland: comparison between statistical downscaling methods

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Indices describing prolonged drought, rainy, and heat periods tell about challenging conditions for agriculture. This study considered frequencies of three-week drought period (Dry3w), three-week rainy period (Wet3w), and two-week heat period (Warm2w) during the warm half of the year. The indices were originally defined for agricultural applications to support adaptation actions (Peltonen-Sainio et al., 2016). Future changes in the indices were assessed using three different approaches to downscale outcomes from simulations performed with 13 global climate models (GCMs) under the RCP8.5 scenario. At first, the individual GCM results for daily mean and maximum temperature and precipitation were downscaled with i) a delta change method (DC) and ii) bias correction with quantile mapping (BCQM). After downscaling, the indices were calculated for each model separately, after which multi-model mean indices were constructed. For the sake of comparison, the indices were also computed from daily temperature and precipitation time series that were iii) adjusted using multi-model mean delta changes (DCEM). Climatological features of each index in April-September (or warm season) were then examined, comparing results between the three methods.

Compared to observed warm-season frequency of Dry3w and Wet3w in the baseline period 1981-2010, the multi-model means with BCQM produced too even spatial distributions across the country, still performing better than any individual BCQM-downscaled model. The number of Warm2w was overestimated by all BCQM-adjusted models.

When using BCQM, the projected changes in the indices from 1981-2010 to 2071-2100 were on average larger, and spatially more wide-spread, in comparison to the results based on DC. The projections indicated less frequent Dry3w in northern Finland and more frequent Wet3w in southern half of the country. The number of Warm2w was projected to increase on average at least by one per decade based on all the methods, most strongly in southern Finland.

The intra-seasonal cycles of drought and heat periods in 1981-2010 were caught well with BCQM, but for rainy periods the differences from the observations were larger. For all three indices, the projected monthly changes from 1981-2010 to 2071-2100 were larger with BCQM than with delta change method, but differences were not significant.

Peltonen-Sainio, P. et al., 2016: Harmfulness of weather events and the adaptive capacity of farmers at high latitudes of Europe. *Climate Research*. 67, 221–240.