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A Statistical-Dynamical Downscaling Approach and Its Probabilistic Extension: Application on Storm Losses in Germany

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Statistical-dynamical downscaling (SDD) methods present an alternative to purely dynamical or statistical approaches to regionalisation as it combines characteristics and strengths of both methods. SDD relies on regional modelling, on changes in frequencies of weather types, and on estimated statistical distributions of problem-oriented climate indices. Recent studies have shown that SDD is an appropriate method for regional downscaling of GCM climate scenarios. In this study, the SDD method is extended by probabilistic aspects.
In this study, the theoretical framework of such a probabilistic point of view is presented using the example of storm losses in Germany. The relevant climate parameter for this problem is the gust speed of winds, which is estimated using the regional climate model (RCM) COSMO-CLM for simulations of historical storm events. The loss frequencies in districts in Germany, provided by the German Association of Insurances (GDV), are used to calibrate a wind-loss relation using quantile regression.
The study uses NCEP reanalysis for the representation of storm-relevant weather classes under recent climate conditions. ERA-40 and ERA-Interim reanalyses are used as forcing for the RCM simulations. In order to include the climate change signal in terms of changes of the large scale weather classes ECHAM5 simulations for recent (20C) and future (SRES A1B/A2/B1) climate conditions are used for loss estimation. A detailed discussion of return levels and times summarizes the findings, which fit well into formerly studies: results show a decrease of the absolute number of storm events, but an increase in frequencies of the most severe storms affecting central Europe.