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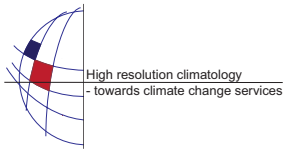

Estimation of wind storm impacts over Western Germany under future climate conditions using a statistical-dynamical downscaling approach

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A statistical-dynamical regionalization approach is developed to assess possible changes in wind storm impacts. The method is applied to North Rhine-Westphalia (Western Germany) using the FOOT3DK mesoscale model for dynamical downscaling and the ECHAM5/OM1 global circulation model for climate projections. The method first classifies typical weather developments within the reanalysis period using K-means cluster algorithm. Most historical wind storms are associated with four weather developments (primary storm-clusters). Mesoscale simulations are performed for representative elements for all clusters to derive regional wind climatology. Additionally, 28 historical storms affecting Western Germany are simulated. Empirical functions are estimated to relate wind gust fields and insured losses.

Transient ECHAM5/OM1 simulations show an enhanced frequency of primary storm-clusters and storms for 2060-2100 compared to 1960-2000. Accordingly, wind gusts increase over Western Germany, reaching locally +5% for 98th wind gust percentiles (A2-scenario). Consequently, storm losses are expected to increase substantially (+8% for A1B-scenario, +19% for A2-scenario). Regional patterns show larger changes over north-eastern parts of North Rhine-Westphalia than for western parts. For storms with return periods above 20 years, loss expectations for Germany may increase by a factor of 2. These results document the method's functionality to assess future changes in loss potentials in regional terms.