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Impacts of climate change to storm events over West Germany: application of a statistical-dynamical regionalisation method

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Possible changes in the frequency and intensity of winter storms affecting Northrhine-Westphalia (West Germany) under increasing greenhouse gas forcing are investigated with a statistical-dynamical regionalisation method. Based on Reanalysis data, typical weather developments (over 3 days) are first classified via K-means cluster. Four classes are defined as 'storm-classes' as they include most of the historical storms. For each of these clusters, mesoscale simulations are performed with the mesoscale model FOOT3DK (20km and 5km resolution) for representative elements within the reanalysis period. Based on these simulations, a high-resolution (5km) climatology is derived for the present climate conditions. Moreover, 30 historical storms which affected West Germany in the last 15 years are simulated with FOOT3DK featuring the gust parameterisation by Brasseur (2001). The derived wind gusts are then normed with the 98th percentile of the climatology for present climate conditions, enabling a functional relationship with the intensity of insured losses. Results based on the climate simulations with the ECHAM5/MPI-OM1 GCM show an enhanced frequency of the 'storm-classes'. These changes are related with a downstream stretching of the North Atlantic storm track into Western Europe detected in the GCM, which results in an enhanced cyclone intensity and wind gusts over Western and Central Europe. These changes in wind gusts frequencies have, however, different magnitudes, depending on the region and scenario (A1b, A2) considered.