Decadal variability of extreme winds and potential storm losses in Europe using large RCM ensembles

Jisesh Sethunadh, Joaquim G. Pinto, Patrick Ludwig, Hendrik Feldmann, and Florian Ehmele
Institute of Meteorology and Climate Research, Department Troposphere Research (IMK-TRO), Karlsruhe Institute of Technology (KIT), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

Windstorms (major winter storms) are one of the most important natural hazards in Europe. Despite the large observed socioeconomic losses, the impact of windstorms and its decadal variability is not yet fully understood. This study aims to assess the loss potentials associated with European windstorms and the variability in the wind speed climatology across Europe. We use the 12,500-years LAERTES-EU (LArge Ensemble of Regional climaTe modEl Simulations for EUrope) RCM ensemble to study the spatio-temporal distribution and variability of windstorms over Europe. LAERTES-EU is validated against reanalysis data (ERA5) and available ground-based station observations. The associated windstorm losses are estimated by computing statistics of extreme wind speeds and related indices. Different loss indices are validated using historical loss data from the insurance sector. The results reveal that the loss index (LI) is a good proxy for the estimation of potential losses associated with windstorms across Europe in winter. The derived statistics of extreme windstorms such as return periods (RP) show hardly any change in the severity and frequency of windstorms during the covered period 1900-2028, but a strong decadal variability is apparent.