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Calculation of extreme wind climate for landscape modelling

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Extreme wind events belong to the most damaging weather-related hazards in the Czech Republic. Forestry is among the most affected parts of the economy. Recently, a multidisciplinary project was launched to address the role of natural disturbances, i.e. windstorms and bark beetle outbreaks, in dynamics of temperate mountain spruce-dominated forests. A forested area of that type - Šumava Mts (maximum elevation 1456 m) - was chosen as a model domain. This large and compact landscape consists of two national parks that cover 68 000 ha on Czech side and 24 250 ha on German side of the border.
Extreme wind analysis is important part of the project. The main goal of corresponding working group is to provide spatial distribution and frequency of extreme wind speed over the selected area. The calculations were based on WAsP Engineering methodology. It allows the estimation of Gumbel distribution parameters with the mean wind climate statistics. Source data were derived both from surface measurements and from various mean climate sources. The results show that in case of limited availability or quality of wind time series the estimation based on averaged wind climate may be better choice than direct fit, even when the method uses severe simplifications. This approach is also more robust than plain extreme measured values and helps to alleviate various data quality issues, such as homogeneity and changes in surrounding landscape and instrumentation.
The extreme wind speed maps were produced for each sector of generalized wind direction and covered the whole model domain. Due to the desired application, the maps were calculated at 30 m above ground level. The results showed that terrain and roughness clearly affected extreme wind speed, especially in case of the windiest western sector. For example simulated 50-year extreme values ranged from 18 to 22 m/s on the plateau, but they almost reached 40 m/s at the most exposed parts of the domain. The maps are first step for production of extreme wind scenarios required as crucial input to the landscape disturbance model. A special method is suggested to provide the data in the form expected by the landscape model. The method is based on sector-wise treatment of calculated extreme distributions.