Geophysical Research Abstracts
Vol. 21, EGU2019-14894, 2019
EGU General Assembly 2019

Spatial distribution of extreme wind speed statistics according to observations and high-resolution modelling data

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According to observational data over the Sakhalin Island and corresponding the long-term high-resolution regional modeling statistical approach of 'dragons' (Ds) and 'black swans' (BSs) was applied to extreme wind speed [Sornette, 2009; Platonov et al., 2017].
We found that the empirical pdfs consistently deviate from the theoretical Weibull line starting with certain large threshold values both for observational and modeling data. This means that the empirical tail diverges from the linearized Weibull model, indicating that a different model might describe the most extreme wind speed data well. Thus, each sample was splitted into two different (BSs and Ds), which were characterized by parameters k and A, regarded to a coefficient and free terms of linear Weibull model.
The first important feature is that extreme wind speeds in high-resolution model data (∼13.2 and 6.6 km) described well using the aforementioned approach, i.e. there are two well splitting samples having its own k and A Weibull distribution coefficients. It refers to ability of the model to reproduce the statistical structure of wind extremes. Furthermore, the most extreme wind speed parameters referred to the same stations in observations and model data. Thus, model has reproduced well the fact of increased winter extremes.
Further analysis was concerned to comparison k and A coefficients, threshold wind speed values and 0.99 quantiles between model and observational data according to BSs and Ds samples separately. A good agreement was shown for BSs, however, the Weibull distribution parameters related to the Ds sample obtained by model are significantly different. Wind speed thresholds and 0.99 quantiles reproduced by model are lower (12 – 22 m/s at most), i.e. the extremity of wind speed maximum is underestimated. Model quality of statistical parameters reproduction is also depended on underlying surface characteristics and sea-land spatial distribution. The spread commonly decreased on the flat seashore stations, increased over inlands and highly indented coastline.
In conclusion, model with a given resolution was not able to reproduce some essential parts of wind speed maximum' statistical properties. Therefore, this gap could be covered as using higher resolution, as by areal estimation techniques and many others. Thus, future investigations will be dedicated to the specific physical mechanisms of Ds formation, scaling problems and resolution dependencies.