Geophysical Research Abstracts
Vol. 20, EGU2018-885, 2018
EGU General Assembly 2018

Numerical modeling of wind gusts of different origin

Maria Kurbatova and Konstantin Rubinstein
Hydrometeorological Center of Russia, Russian Federation (marja1702@gmail.com)

Wind gusts are extreme events which can cause severe damage. Numerical atmospheric models are designed to represent average winds, not gusts. There are several parametrization or models of wind gusts based on atmospheric models output. They are often used to determine effects of climate change on severe wind gusts occurrence. However their ability to represent gust of different origins and formation mechanisms was not investigated. In this work seven different gust parametrization are realized using WRF-ARW model forecasts over European part of Russia. They are compared with each other and observation data from synoptic stations network and several high-frequency wind measurements during different weather conditions. One of the parametrization is hybrid method, recently proposed by us, which combines principles of using turbulent kinetic energy and air particle deflection depending on stability type of atmosphere.
We find that methods using the principle of deviation from higher levels show better predictability of wind gusts, but also a greater number of false alarms. We range all methods based on various scores (probability of detection, false alarm ratio, equitable total score, Pierce skill score, etc.). Despite the fact that the hybrid method does not show the best probability, it seems to be optimal from combination of all scores and gives stable results during the entire annual course.
Performance of all methods is much lower in summer months then in winter. Lower performance in summer can be associated with difficulties of convective winds forecast which can be theoretically improved by direct convection description in model. However skill scores are lower when using numeric atmospheric model grid with finer resolution. So existing gust parametrization may not suite or should be tuned for finer resolutions.
We divide all cases into groups depending on vertical temperature gradient, Richardson number, and presence of thunderstorm to try to distinguish between gusts of different origin. Gusts associated with mechanical turbulence are the easiest to reproduce. Performance of all methods for different gust formation mechanisms is analyzed.
In conclusion, based on the results we want to warn from determining changing patterns of wind gust using reanalyzes or climate model products. Proposed hybrid method can be optimal choice for describing gusts of different origin.
This work is partly supported by RFBR according to the research projects №16-05-00822, 16-05-00704, 15-05-02395.