

Climatological aspects of derecho events for the area of Central Europe

(Description for general public)

Thunderstorms are one of the most violent and dangerous atmospheric phenomena. Damages caused by them may be the effect of tornadoes and wind gusts, large hail, or excessive precipitation. Based on the European Severe Weather Database (ESWD) around 9000 severe storm incidents occur in Europe every year, accounting for 100 fatalities. Significant damages are often caused by well-organized storm clusters such as the mesoscale convective systems (MCS). Long-lived MCSs that persist in producing widespread damaging winds are known as derechos. Based on the available studies of derecho in Europe, a few such events occur every year.

Methodology of the research includes collection observational datasets from various sources (data from meteorological stations, atmospheric soundings, radar data, and others). Based on this data, derecho cases for Central Europe for last ten years (i.e. 2009-2018) will be defined. It will be based on criteria used for derecho determination those can be find in literature. For determined cases, we will look at spatial and temporal variability of derecho occurrence. Selected cases will be also considered in the context of synoptic, thermodynamic and kinematic conditions. The author is looking for answers to the question of whether the climatological patterns and thresholds of thermodynamic and kinematic parameters for derecho development in the area of Central Europe can be defined. In this project numerical modelling methods will be also used in analysis of derecho events. For that, the Weather Research and Forecasting (WRF) model is going to be used. It is planned to prepare high-resolution simulation for each defined derecho case. Using the results of the WRF simulation as gridded data, the analysis of the peak wind gusts for an entire domain will be possible. It means that creating new spatial information is important for derecho analysis. Based on simulated radar structures, we will try to identify quasi-linear MCSs with radar structures that support high values of wind speed (bow echoes). Simulated thunderstorms will be compared with observational data from meteorological radars.

Considerations about derecho climatology were provided mostly for the area of the United States of America. For the area of Europe, derecho analyses have focused mainly on the environmental conditions and often consist of case studies, or multiannual summaries. However, to date, no study has been able to determine the meteorological conditions favourable to derecho and its climatology for Central Europe and for a longer period.