Classification, environments and impact of the most severe thunderstorms over Poland in last decade

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Thunderstorms in Poland occurs more than 150 days every year. Frequency of very strong thunderstorms reaches up to 1-2 every year, but damages associated with these thunderstorms more than once are bigger than the sum of all damages connected with thunderstorms during a year. This research focuses on the most intensive thunderstorms that occurred over Poland in 2008-2018. The main aim of the study was to create an objective classification of extreme thunderstorms and to inspect meteorological environments in which they developed. Secondary purpose was to examine radar and satellite structures in order to answer the questions if there was evidence of incoming severe weather threat and if there was a possibility to accurately predict region of the greatest danger. Classification was based on intervention data of State Fire Service, cloud to ground lightning data and wind speed measurements from automatic and synoptic stations in Poland. Weather data reports, as well as impact reports, were strictly checked and filtered in order to achieve the most homogenous database. Inspection of meteorological environment was made with use of synoptic and sounding data and also ERA5 reanalysis. Additionally, radar data of POLRAD system managed by the Institute of Meteorology and Water Management – National Research Institute (IMGW-PIB), and the geostationary and polar satellite data provided by NOAA and METEOSAT were used. Each case was analyzed in terms of synoptic conditions and patterns, upper air dynamics, and convective indices. This work focuses on development and improving tools and methods designed for operational meteorologist, which adds an application value for the following research.