

# SYNOPTIC SITUATIONS IN THUNDERSTORMY DAYS IN POLAND, DURING WHICH THUNDERSTORMS WERE OBSERVED OVER THE MAJORITY OF THE COUNTRY

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## I. INTRODUCTION

The atmospheric circulation, observed on a synoptic scale, and atmospheric processes with a mesoscale coverage, are responsible for the occurrence of thunderstorm phenomena (Barnes and Newton 1986, Schaefer and all 1986). The said circulation processes, determining the transport of humidity and heat, also influence the intensity and duration of storm phenomena. Numerous authors occupied with thunderstorm activity have noted the strong connections of this activity with specific synoptic situations (Bielec-Bąkowska 2003, Brazdil 1998, Changnon 1998, Changnon and Changnon 2001, Kolendowicz 2006, Walker 1992). In the present study, we have performed an analysis of synoptic situations in thunderstormy days, during which the thunderstorm phenomenon was noted at at least 80% of meteorological stations located in Poland.

## II. DATA AND METHODS

The paper is based on the data pertaining to the occurrence of days with thunderstorm in 53 Polish synoptic stations within the IMGW (The Institute of Meteorology and Water Management) network in the years 1951-2000 (Fig.1).

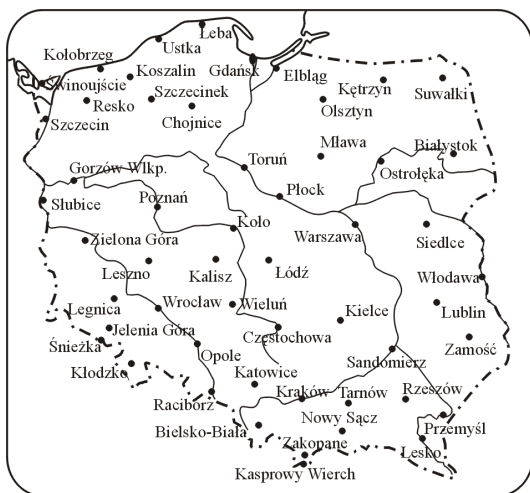


FIG. 1 Location of weather stations

In order to identify the synoptic situation characteristic for thunderstormy days occurring on almost the entire territory of Poland (at least 80% of synoptic stations) daily weather maps as at 00 UTC hour in the years 1951-2000 were used. The analysis of lower synoptic maps made allowed isolation of five different synoptic situations characteristic for such days. In the study, we calculated the probability of occurrence of thunderstormy days under the selected situations and

probability of occurrence of storms under these situations throughout the entire country.

## III. RESULTS AND CONCLUSIONS

The analysis of the occurrence of thunderstormy days at 53 synoptic stations in the territory of Poland has allowed us to discern 32 days with thunderstorms, noted at at least 80% of the stations taken into consideration in the study. The percentage share of the stations that noted storms in individual days of the researched 50-year period is presented in Figure 2. These situations occurred only from May to August, during the season of the greatest storm activity in the territory of the country (Kolendowicz 2006).

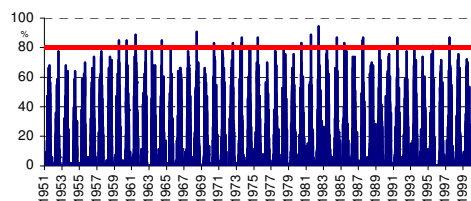


FIG.2 Percentage of weather stations in Poland where the thunderstorms occurred in days of the period 1951-2000

An analysis of synoptic situations in days with thunderstorms occurring during the day and night over the majority of the country unequivocally points to the important role of atmospheric fronts passing over Poland in the creation of conditions conducive to the occurrence of storm phenomena. Phenomena of increased convection, which accompany the clash of air masses with differing thermal and humidity characteristics, in particular at a dynamic cold atmospheric front, are responsible for the occurrence of thunderstorms over large areas. The above processes were noted by Walkner (1992), who described instances of severe thunderstorms in Switzerland, southern Germany and the USA, Changnon and Changnon (2001) when analysing the variability of thunderstorm activity in the USA, or the author of the present paper (Kolendowicz 1998), who analysed selected synoptic situations in thunderstormy days in Poland.

Attention should also be turned to pressure high situations, which over Poland occur considerably less frequently than cold or occluded atmospheric fronts. Under favourable circumstances, connected with the long-term presence of air masses over the territory of Poland and the simultaneous occurrence of a pressure high, thunderstorms may occur simultaneously in many regions of the country (Bielec-Bąkowska 2002).

#### IV REFERENCES

- Barnes S.N., Newton C.W., 1986: Thunderstorm in the synoptic setting. [In:] E. Kessler (red.), Thunderstorm Morphology and Dynamics. University of Oklahoma, Volume 1/2 of Thunderstorms: A Social, Scientific, and Technological Documentary, 75–112.
- Bielec Bąkowska Z., 2002: Zróżnicowanie przestrzenne i zmienność wieloletnia występowania burz w Polsce. *Spatial differentiation and long-term variability of thunderstorm occurrence in Poland (1949-1998)*. Wydawnictwo Uniwersytetu Śląskiego, Katowice.
- Bielec-Bąkowska Z., 2003: Long-term variability of thunderstorm occurrence in Poland in the 20th century. *Atmospheric Research* 67–68 35–52.
- Brazdil R., 1998: Casová a prostorová analýza bourek, krupobití a extrémních srážek v jižní části Moravy v období 1946–1995. *Meteorologické Zpravy*, 51 45–52.
- Changnon S.A., 1988: Climatology of thunder events in the conterminous United States. Part I: Temporal aspects, *J. Climate*, 1 389–398.
- Changnon S.A., Changnon D., 2001: Long-term fluctuation in thunderstorm activity in the United States. *Clim. Change* 50, 489–503.
- Kolendowicz L., 1998: Zjawiska burzowe w Polsce a warunki synoptyczne. *Thunderstorm occurrence and synoptic conditions in Poland*. Bogucki Wydawnictwo Naukowe, Poznań.
- Kolendowicz L., 2006: The influence of synoptic situations on the occurrence of days with thunderstorms during a year in the territory of Poland. *International Journal of Climatology*. *Int.J.Climatol.* 26. 1803-1820
- Schaefer J.T., Hoxit L.R., Chappell C.F., 1986: Thunderstorms and their mesoscale environment. [In:] E. Kessler (red.), Thunderstorm Morphology and Dynamics. University of Oklahoma Press Norman and London, Volume 1/2 of Thunderstorms: A Social, Scientific, and Technological Documentary, 113–132.
- Walkner A., 1992. Grossräumige Austauschprozesse der Atmosphäre als Ursache von Starkgewittern. *Phys. Geogr.*, vol. 35, Zürich.