

# ATMOSPHERIC CONDITION AND SEVERE STORMS OCCURRENCE IN POLAND

Lupikasza Ewa<sup>1</sup>, Bielec-Bakowska Z<sup>2</sup>

<sup>1</sup>University of Silesia, Faculty of Earth Sciences, Department of Climatology, Bedzinska 60 str., 41-200 Sosnowiec, Poland, E-mail address: ewa.lupikasza@us.edu.pl

<sup>2</sup>University of Silesia, Faculty of Earth Sciences, Department of Climatology, Bedzinska 60 str., 41-200 Sosnowiec, Poland, E-mail address: zuzanna.bielec-bakowska@us.edu.pl

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## I. INTRODUCTION

In Poland severe storms, especially those accompanied by intense precipitation, are counted amongst the most extreme events causing damage to environment and strongly influencing human well-being. In Poland yearly number of storm days varies from 15 days in north-west to 33 days in south-east. Most of such days (85%) are accompanied by precipitation of which 7-8% is higher than 20 mm and 3% exceeds 30 mm. The long-term course of the number of storm days with precipitation is spatially incoherent and even differentiated from station to station. On the other hand storms are recorded on nearly 50% of days with more than 20 mm of precipitation (Bielec-Bakowska, Lupikasza 2009). Moreover, it was proved that the frequency of the storm days with precipitation in cyclonic synoptic types almost equals to their frequency in anticyclonic types (Bielec, 1997). However, the most severe storms (with the highest precipitation) are recorded in anticyclonic situations.

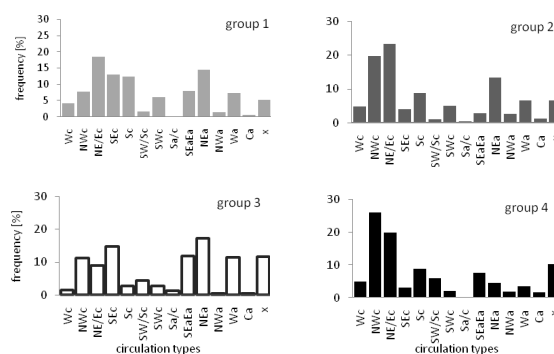
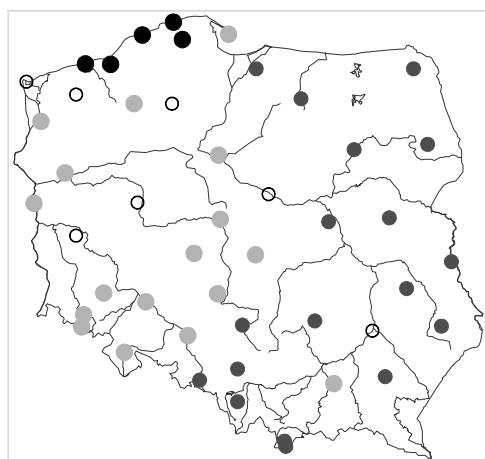
## II. GOALS AND METHODS

The results described above encourage us to research the relationships between severe storms (with precipitation higher than 30 mm) occurrence and synoptic conditions. Series of meteorological observations from 47 synoptic stations and circulation types by B. Osuchowska-Klein (1978, 1991, 2001) and synoptic charts for the 1951-2000 period were used.

All the severe storms selected from the database were focused upon based on the precipitation criterion. A storm was recognized as severe when it was accompanied by precipitation higher than 30 mm. In the next step, using synoptic charts, each of the severe storms selected was classified as frontal or inter-air mass one. Further research aimed to determine synoptic situations the most favourable to the severe storms occurrence. It was also checked if there is seasonal and long-term variability in the relations between severe storm occurrence and atmospheric circulation. The researches were completed by detailed analysis of synoptic conditions at days with the most severe storms, i.e., the highest precipitation.

## III. RESULTS

In Poland days with storm and very strong precipitation are recorded relatively rarely. More often than once a year they occur in the mountains in the south of Poland with maximum at Mt. Kasprowy Wierch (2.1 days/year on average).



W, NW, ... – directions of air mass advection  
c / a – cyclonic / anticyclonic situation

FIG. 1: Frequency [%] of the occurrence of days with storm and precipitation higher than 30 mm during particular circulation types in Poland in the period 1951-2000

Depending on the region the storms in question accompany particular types of circulation with different frequency. On this basis 4 groups of stations were distinguished where days with storm and very strong precipitation occurred during specific circulation types. Storms with precipitation higher than 30 mm occur the most often during air mass advection from east and north-east (NE/Ec i NEa) at the majority of stations in Poland. It applies both with anticyclonic and cyclonic situations (Fig. 1). Severe storms occurring during north-west cyclonic situations (NWc) are also significant at stations located at the seaside and those situated in the east area of Poland. The

storms in questions occur the least frequently during the south air mass advection at the meeting of cyclonic and anticyclonic situations as well as central anticyclonic situation (Ca) (Fig. 1).

The most severe storms are connected with atmospheric fronts passing over Poland. Intermass storms were extremely rare and they occurred the most often in south-east Poland.

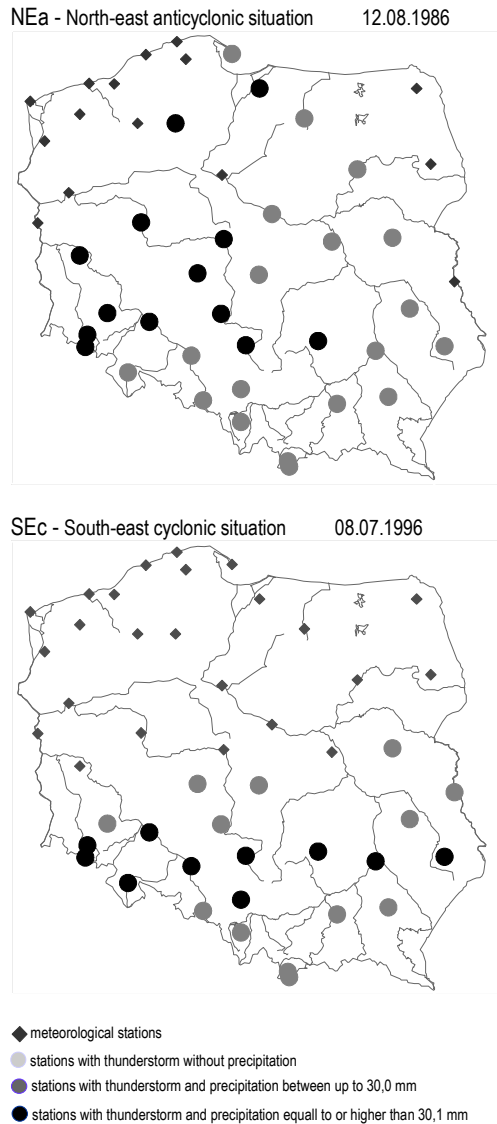


FIG. 2: Days with storms and precipitation higher than 30 mm in Poland in the period 1951-2000 - selected cases

The most interesting cases of storm with very strong precipitation are those that occurred in the coldest months (Nov-Mar). In this period the storms analysed were recorded in Poland only at 6 stations: at the Baltic seaside (Koszalin, Ustka, Łeba) and in the highest Polish mountains – Tatras (Zakopane and Kasprowy Wierch). At the Mt. Kasprowy Wierch a storms with precipitation higher than 30 mm occurred two times. The storms usually accompanied the air mass advection from west sector (Wc, NWc, SWc), as well as from east and north-east (NE/Ec) and also atmospheric fronts.

The research conducted shows also that days when storms with precipitation higher than 30 mm occurred at 1 or 2 station (ca. 96%) were the majority of cases. Only in 2%

of the days analysed (17 days) they occurred at 6 or more stations (13 station maximum). In most of the cases storms with precipitation between up to 30 mm or without precipitation were recorded also at other stations in Poland (Fig. 2). During the days in question air mass advection from north-east and east (NEa, NE/Ec) and from south sector (SW/Sc, SEc, SEaEa, Sc) dominated.

#### IV. AKNOWLEDGMENTS

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