CHARACTERISTIC BARIC STRUCTURES AT 500 MB ASSOCIATED WITH DANGEROUS METEOROLOGICAL PHENOMENA IN SOUTH WESTERN ROMANIA

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Abstract. *The dangerous weather phenomena considered in this study (regardless of whether damage occurred or no) have been reported by weather stations from Caras-Severin, Timis, Arad and Hunedoara county, pluviometric or hydrological stations and intervention reports of inspectorate for emergency situations units or from media presentations. Cases analyzed overlay the period between January 2002-March 2013 and covers characteristic weather phenomena both to the warm (torrential rain, hail, squalls or convective strong winds) and cold season (hoar frost, glaze ice).These phenomena, depending on their intensity, area of the events or other considerations (for exemple the existence of a previous rain period) were warned at national or regional level through warning messages in different colour codes.*

Key words: *atmospheric circulation, baric centers, dangerous weather phenomena.*

INTRODUCTION

Analysis of severe weather events is related to the atmospheric isohypses orientation of 500 mb. The layout of the main barometric centers over Europe dictates wet or dry air advection, loaded or not loaded with moisture, ingredients that can lead to anticipate hazardous weather.

MATERIAL AND METHODS

The study focused on baric configurations analysis at 500 mb atmospheric level for determining the main types of air circulation type associated to dangerous meteorological phenomena considered. There have been used diagnosis maps of GFS model at 500 mb. Related researches was also taken by other meteorologists, both within the National Administration of Meteorology (ANDREI ET AL., 2011, BOGDAN, NICULESCU, 1999 etc.) and in international projects at European level (COST 733) in which Romania was represented.

Having established the main types of atmospheric circulation at 500 mb level, we tried to get descriptions of synoptic situations for every phenomenon, by setting typical configurations at european level. Thus, were presented the positioning of the main baric centers at continental level and were shown, for each meteorological phenomena, maps of their settlement.

RESULTS AND DISCUSSIONS

Squalls, associated with convective storms, generally causes the most damages excepting the floods. Were analyzed a total of 61 cases of squalls. Southwest atmospheric circulation owns almost half of all cases, with a share of 44.29 percent, followed by the west circulation, with 32.78 percent (fig. 1). The two dominant types account for over 77 percent of the total. Note that the

squalls are missing entirely when atmospheric circulation at 500 mb has northeast and southeast component.

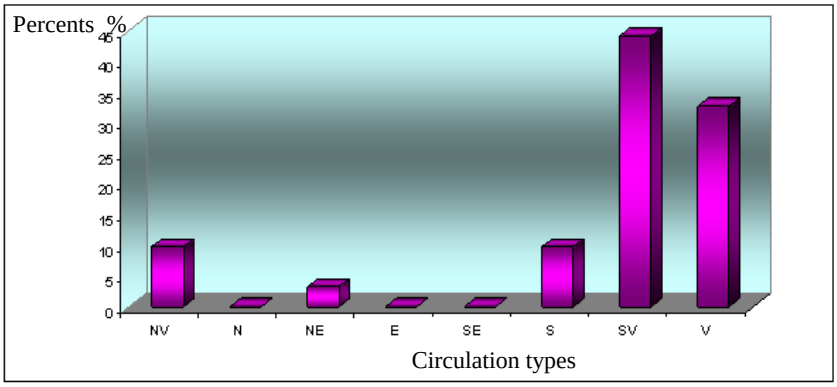

Fig. 1. Atmospheric circulation types for squalls.

Southwestern circulation is linked to the presence of a low-pressure trough deepened from Scandinavia, over central Europe to south-west of Italy peninsula (fig. 2) or of a cyclonic core to the south of the Gulf of Genoa. The zonal, western, circulation corresponds to an approximately meridional arrangement, from east to west of the isohypses at 500 mb.

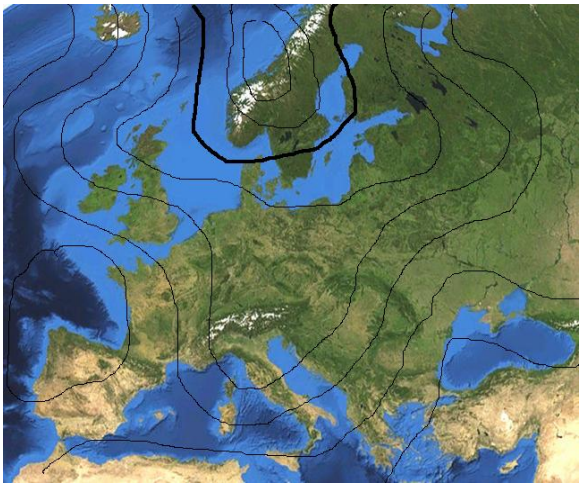

Fig. 2. Typical geopotential field configuration (500 mb) for squalls situations

The squalls often occur in July (30% of cases analyzed) and June (25% of cases analyzed). Not met storms in December, January and February.

Torrential rains have appeared in all kinds of atmospheric circulation (fig. 3). Predominant are the south western (33.98%) and western (32.11%) and most rare the northern (1.83%) and

eastern (0.91%). For torrential rain we have chosen to show western orientation of the isohypses at 500 mb level (fig. 4).

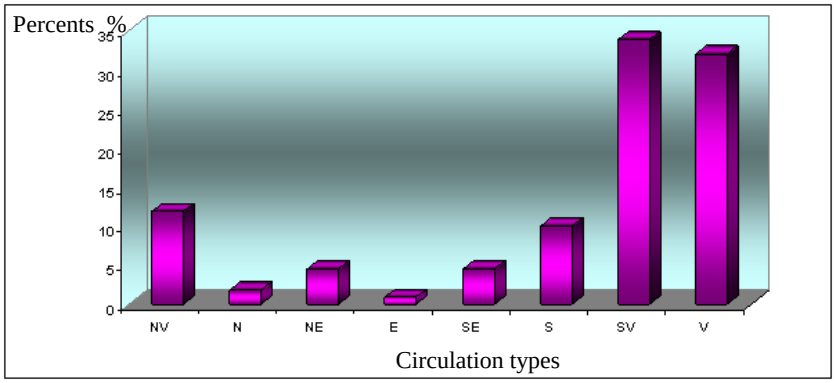

Fig. 3. Atmospheric circulation types for torrential rains.

June is the most favorable month for torrential rains appearance with nearly 40 percent (39.8%), followed equal by July and August, with 22.2%.

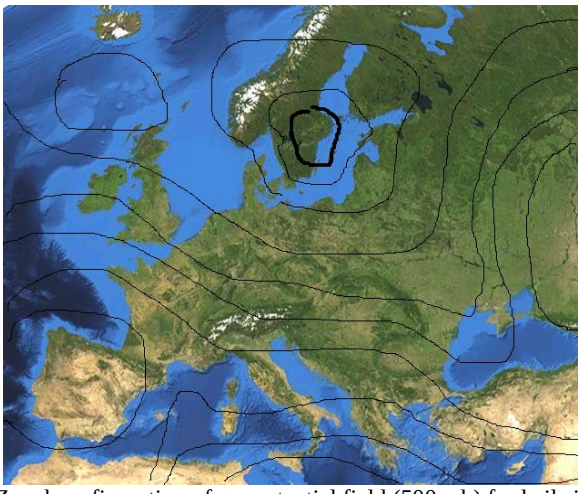

Fig. 4. Zonal configuration of geopotential field (500 mb) for hail situations

More than half of the cases (63.3%) were associated with atmospheric fronts, the rest due to the air mass instability.

For cases of hail there were analized a number of 104 synoptic situations. Most commonly, the hail phenomenon is related to the southwestern circulation (fig. 5), with 33.65 percent, followed by western circulation (24,03%). This fact is consistent with the general circulation of the atmosphere up to Romania latitude but also with Mediterranean influences in Caras-Severin and

part of Timis county. The two dominant types of circulation, south and west, together account 57.68%. Most rare the hail phenomenon occurred amid east circulation (one case).

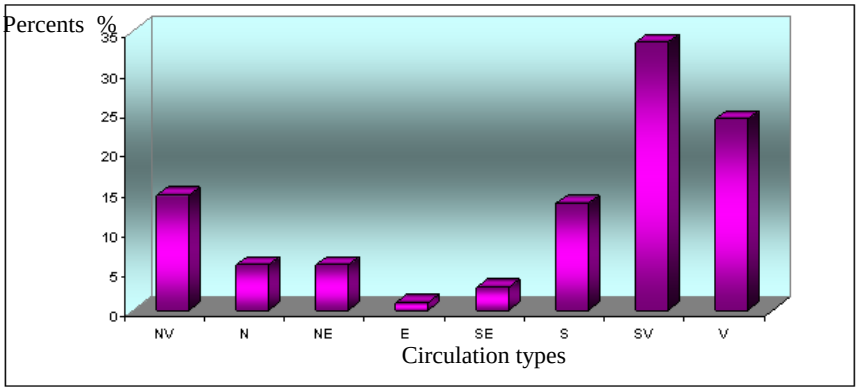

Fig. 5. Atmospheric circulation types for hail.

Instability of the Mediterranean air masses or even of tropical origin or is enhanced by orographic ascendings, making the average annual number of days with hail to grow to mountainous areas: 10,4 days at Semenic (Clima României, 2008).

Specific situations in which hail phenomena were reported are those related on the occurrence of certain areas of diffluence at west of Romania (15 cases) or structures such as cut-off (fig. 6) just above Romania (ten cases).

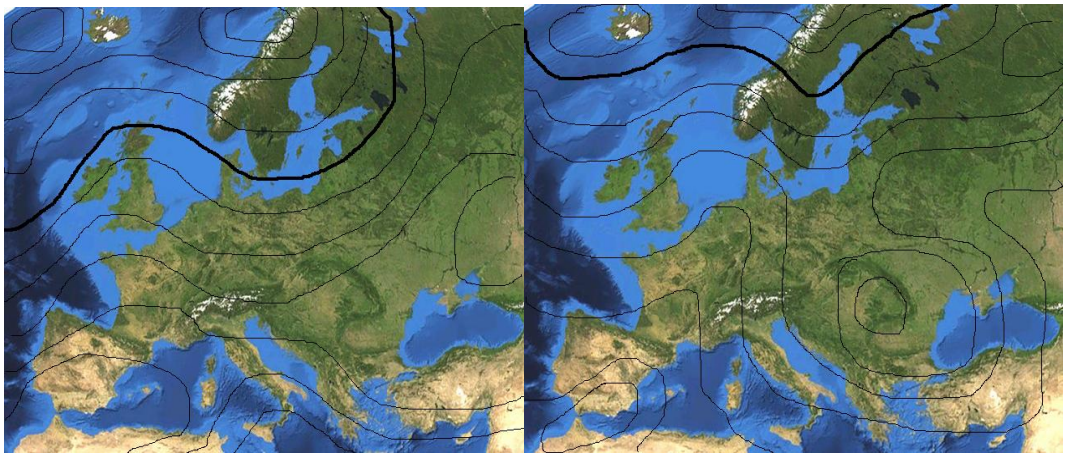

Fig. 6. Geopotential field configuration (500 mb) for squalls situations:
diffluence (left), cut-off (right)

58.6% of the hail situations cases examined have been associated with cold fronts the rest being associated with occluded fronts and air mass instability. Most often hail falls in June (38.6%

of the cases analyzed) and May (22.6% of all cases). Hail situations was not reported in October, November and February.

Phenomenon common of cold weather, hoarfrost produces significant damage in agriculture when overlap with the growing periods of the plants (after 20 March) or when vegetativ rest is not installed yet (until 15 October). Of the 24 cases analyzed, most (37.5%) were on northwest circulation. West circulation ranks second place with 33.3 percent (fig. 7). This context refers to the intake of cold air stationed in the Central Europe by zonal advection.

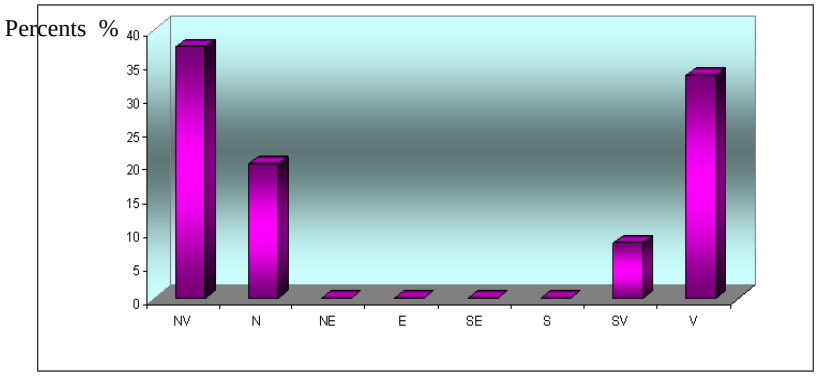

Fig. 7. Atmospheric circulation types for hoarfrost.

The latest hoarfrost case analyzed was in early May (02.05) and the earliest at the beginning of September (10.09- earliest hoarfrost case ever registred in western Romania). Of the total cases, 16 were late cases (66.6%) and the rest early hoarfrost. In the western part of Romania were recorded an annual average of 60 days with hoarfrost.

Glaze ice phenomenon that occurs when water droplets (rain) fall on surfaces whose temperature is zero or below zero, causing freezing them. This happens usually after a period with low temperatures, when there is a warm and moist air advection. Most often, such cases are found in south-western atmospheric circulation (33.9% - fig. 8) when cold and relatively dry, at our country latitude is replaced by air laden with moisture and heat from the Mediterranean Sea.

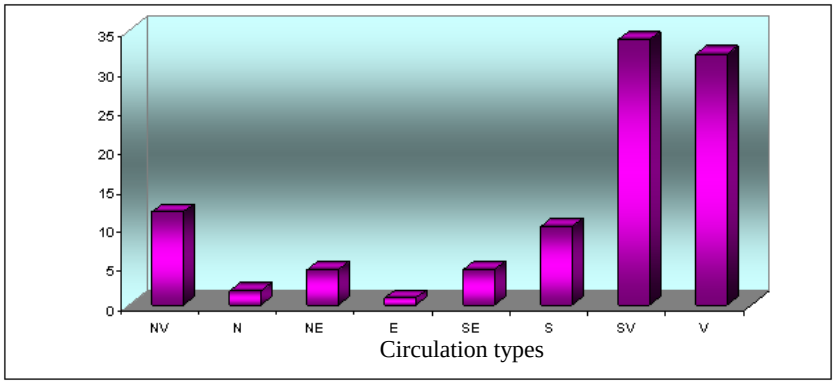

Fig. 8. Atmospheric circulation types for glaze ice.

In the western part of Romania maximum annual number of days with glaze ice varies between 5 and 10.

In gaze ice situations most cases when it occurred were due to the southwestern circulation (33,9 %), north-western (29,6 %) or western (25,9 %). Differentiation between southwest and northwest circulation is about the positioning and deepening of the altitude ridge at mesoscale level which causes warming weather behind the cold air mass (fig. 10).

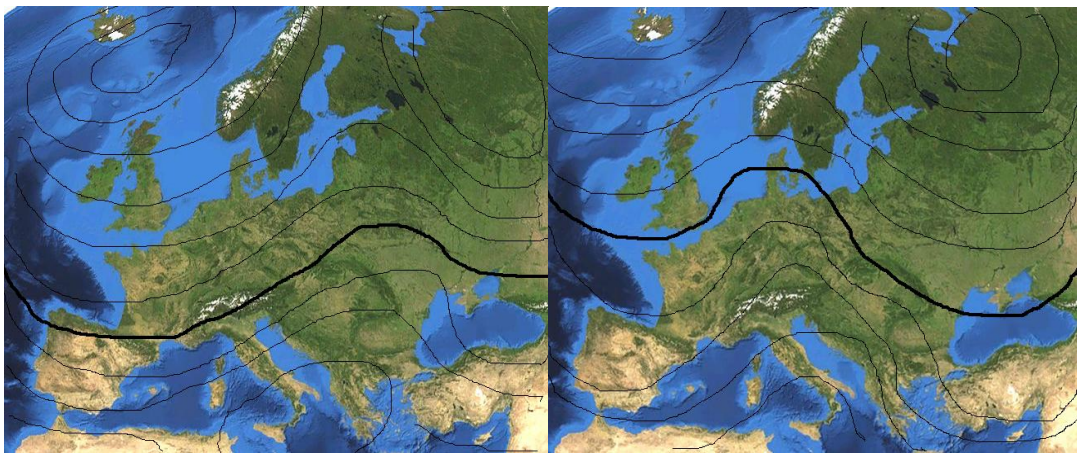

Fig. 10. Typical geopotential field configuration (500 mb) for gaze ice situations.

CONCLUSIONS

Dominant atmospheric circulation for severe phenomena specific in warm season is from southwest followed by the west one, according to the general circulation of our country level. In winter phenomena cases, the situation is different only in hoarfrost situations when atmospheric circulation is the predominant northwest, and followed by the south-west.

The proposal of a typical sinoptic configuration at 500 mb atmospheric level is useful in operative weather forecasting activity for anticipating the occurrence of dangerous meteorological phenomena potentially harmful. Also we were able to draw some conclusions about the climatology of these phenomena in the south western part of Romania.

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