AGRAVATING FACTORS IN THE BLIZZARD SITUATIONS IN THE SOUTH-EAST OF ROMANIA

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ABSTRACT. – **Agravating factors in the blizzard situations in the South-East of Romania.** The blizzards from the end of January 2014 stand out by the short period of time in which they occurred and by the duration of the phenomenon. As a consequence, the effects have accumulated, resulting special socio-economic consequences. In January 2014, in five days time, in the South-East of Romania there have been two blizzards. The maximum thickness of the snow layer has reached 99 cm, and the gusts of wind have exceeded speeds of 90 km/h. Therefore, in the South-East of Romania, the snowdrifts measured at the weather stations from Câmpia Bărăganului have reached heights of 280 cm. The first blizzard was unusual through its unusually long duration in which it occurred, 72 hours between 24 and 27th of January, and the second one, although short, it was very intense and it only occurred 48 hours after the end of the first episode. The cyclogenesis initiated in the Genova Bay was classic, but the main cause of both situations' aggravation was represented by the penetration and regeneration of the two cyclones of Mediterranean origin over warmer waters than usual in the Black Sea. This positive deviation of the water's temperature was provoqued by an autumn ending and a gentle winter beginning, due to the persistance of a zonal circulation, but also through thermic anomalies of the air temperature at two meters height. The agglomeration of more aggravating factors has eliminated the broadcasting, for the first time to the National Meteorological Administration of two red code nowcasting warnings. A short analysis of the numerical weather models run by the National Meteorological Administration proves with a relatively high precision over the parameters prognosed in the two severe weather situations.

Keywords: blizzard, aggravating factors, effects, synoptic analysis, forecast

1. INTRODUCTION

The blizzard is a normal phenomenon within our country's geographic space, causing many times situations of extreme weather. The frequence of the blizzard in the low areas exceeds 5 days a year in the centre of Bărăgan and North Dobrogea. Yet, the most affected are the high mountain areas, with more than 100 days/year at altitudes higher than 2000 m. By definition, the blizzard is a complex atmospheric event where the snow that falls or has fallen is strongly swept away by the wind, so that the visibility decreases a lot, and the approximation of the continuous snowfall is impossible. The synoptic mechanism that triggers the phenomenon allthrough our country is well known. The interaction between the

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dynamic particularities and the characteristics of the active surface create a special frame of the extracarpatic area of Romania. Besides the synoptic causes, an important role in the genesis of the blizzard goes to the particularities of the active surface of the structure and particularly to the presence, greatness and shape of the Romanian Carpatian. Bălescu and Beşleagă (1962), Drăghici (1968, 1980, 1983, 1986), Bordei – Ion Ecaterina and Bordei – Ion Nicolae (1983), Ciulache and Ionac (1995) are only some of the authors who have offered a clear vision over the forming and the development of the phenomenon. The narrowing of the draining section is done sideways between the orographic dam of the Curving Carpatians and the thermic one of the Black Sea, and on the vertical between the surface and the the significant thermic inversion around the isobaric surface of 850 hPa (aproximately 1500 meters in altitudine**).** Also, the cold air mass that comes through the North-East, has a vertical extension smaller than the height of the Carpathians and it receives a bilobate structure (Fig. 1). In the extracarpatic regions from the South-East the surface wind decouples from the altitude one.

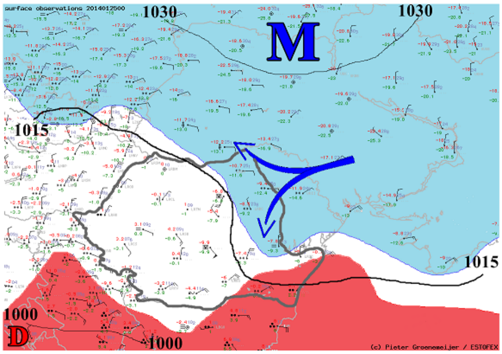


Fig. 1. ***Bilobate penetration of cold air (Source: ESTOFEX)***

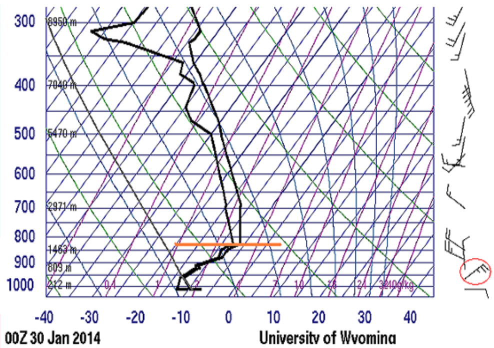


Fig. 2. ***Thermal inversion, low tropospheric jet (Source: Univ. Wyoming)***

Analysing the vertical structure of the troposphere in the area of the phenomenon (Fig. 2), two layers are identified as having different characteristics of the draining. A layer of an approximate depth of 1.5 km, is between the surface and the level of 850 hPa. This relatively well mixed layer is limited superiorly by a medium inversion of 10 °C, in the vicinity of which the circulation reaches the maximum of intensity, structure that include the Crivăţ wind in the LTJ type phenomenon. The second layer is above the thermic inversion, characterised by a predominantly South-Western circulation, through which hotter air is being transported. The inversion that delimits the two layers, due to the advective and radiative cooling within the lower layers of the atmosphere as well as the warm advection of altitude, reaches to unite the Carpatians with the Balcans.

The two blizzards at the end of January 2014 have caused devastating socio-economic consequences in the Southern half of Romania, finalised with human losses, the total freezing of transportation, the isolation of hundreds of villages and the interruption of the electric energy supply in more counties of the affected areas. The wind speed has exceeded on large areas 85 km/h (up to 94 km/h in Mangalia), the snow layer has got to 99 cm in Brăila county, and the height of the measured snowdrifts has reached 280 cm at Grivița.

2. PRELIMINARY CONDITIONS

Strarting with the second decade of October and towards the end of December the Arctic Oscilation (AO) and the North-Atlantic Oscilation (NAO) had mostly positive values (Fig. 5 and Fig. 6). The intense zonal circulation kept the polar air and the arctic one in the origin zone (Fig. 4). The end of autumn and the first part of winter characterised in the South-East of Europe by positive thermic anomalies of the air temperature near the surface. According to the positive reanalysis done by NCEP / NCAR, in the South-East of Europe, the thermic medium anomalies of the air had positive values up to 5˚C, implicitly in the area of the Black Sea, where the positive deviations were up to 3˚C (Fig. 3.).

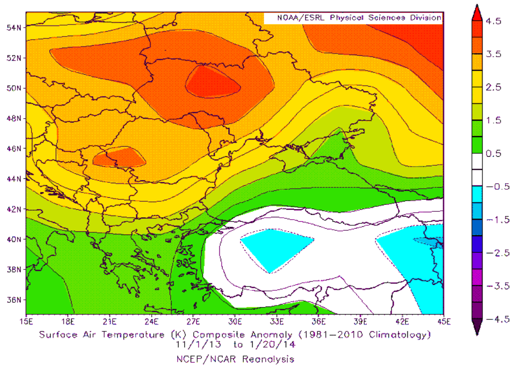


Fig. 3. ***The thermal anomaly of the air at 2 m (˚C) between 1/11/13 – 20/01/14 (Source: NOAA)***

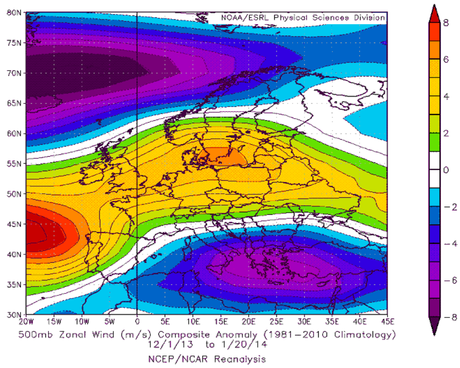


Fig. 4. ***The zonal wind anomaly at 500 hPa (m/s) between 1/12/13 – 20/01/14 (Source: NOAA)***

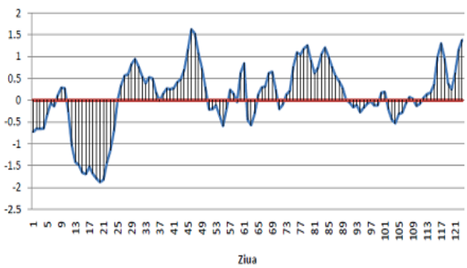


Fig. 5. ***NAO daily between 1/10/13 – 31/01/14 (Data source: NOAA)***

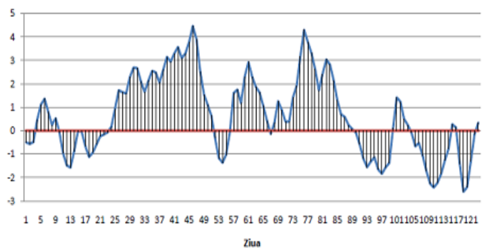


Fig. 6. ***AO daily between 1/10/13 – 31/01/14 (Data source: NOAA)***

The land-ocean coupling determined in the first half of of January a positive anomaly of the temperature of Mediteranean Sea and of the black Sea's surface, especially in the North-Western basin. Due to the big thermic inertia of the water, this thermic regime of the Black Sea has maintained also after the beginning of the blizzard, determining a remarkable thermo-baric contrast between the extracarpatian regions and the sea.

In December and in the first half of January, the expansion of the snow layer on the European continent was below the multiannual mean, but the layer set in the second half of January in the North-West of Russia and only a few days before the first blizzard episode in Ucraine and in the North of Moldova (Fig. 9, 10), favorised the cold air advection during the blizzard towards Romania.

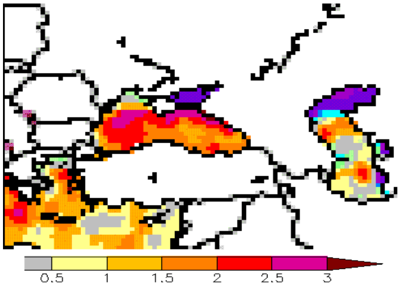


Fig. 7. ***The thermal anomaly of the sea surface water in 15/01/14 (˚C) (Source: NOAA)***

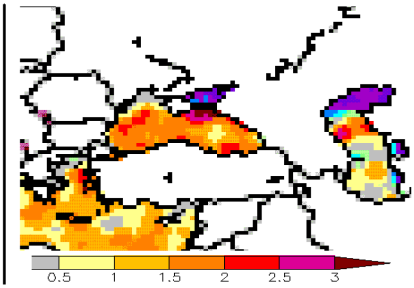


Fig. 8. ***The thermal anomaly of the sea surface water in 20/01/14 (˚C) (Source: NOAA)***

This cumulation of factors led to the progressive aggravation of the effects of the two blizzards. We consider that the presence of a positive thermic anomaly at the surface of the Black Sea has an important effect in the aggravation of the blizzard situations from the South-East of Romania, by increasing the thermo-baric gradients, but also by the possibility of modifying the cyclones trajectory, despite the altitude conditions.

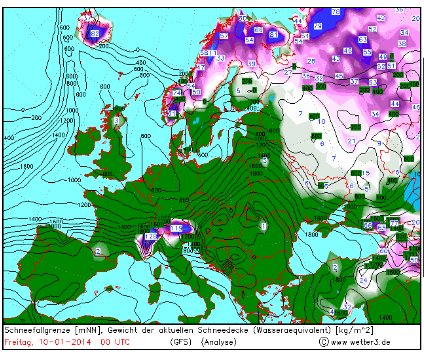


Fig. 9. ***Surface covered with snow on January 10 (Source: wetter3/NCEP)***

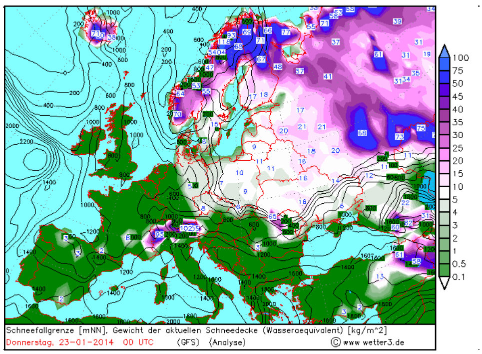


Fig. 10. ***Surface covered with snow on January 23 (Source: wetter3/NCEP)***

3. CYCLOGENESIS

The cyclone that caused the first blizzard formed in January 22nd and 23rd. The cyclogenesis was a classic one in the Genova Bay. Beforehand, at the safety of the Alpes, in this area there is a faintly shaped depression, preponderantly thermic. The passing of the North-Atlantic Oscilation into the negative stage favorised the forming of the waves in the high and medium troposphere. The approach from the North-West of a trough, determind the decrease of pressure at the surface level. The cyclogenesis initiated from the altitude is seen by the appearance of the dark shade characteristic to the satellite image MSG 6.2 (Water Vapour). A rapid decrease of the pressure was produced on January 25th, with the overlapping of more favourable conditions: the cold adecvation from the valey of the Rhon, the westward tilt of the vertical axis of the cyclone, the defasation of the baric and thermic trough into the medium troposphere, increasing this way the baroclin character, a significant divergency into the high troposphere at North-East from the ground cyclone. Starting with January 26th, the energetic conditions from the altitude became less favourable, the severe manifestations in the extracarpatic areas being mainly caused by the significant thermo-baric contrast between the land and the sea close to the surface.

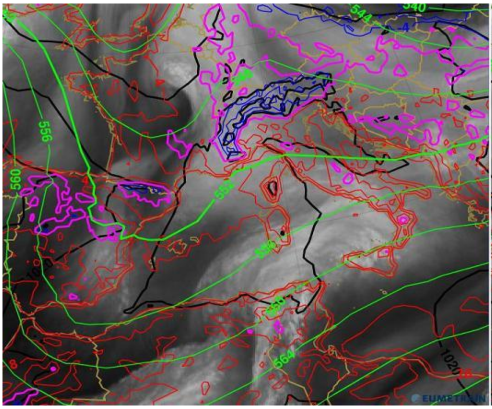


Fig. 11. ***23/01/14. 00 UTC. WV6.2 satellite image, MSLP (black), AT 500 hPa (green), temperature at 2 m(colored lines). (Source: Eumetrain)***

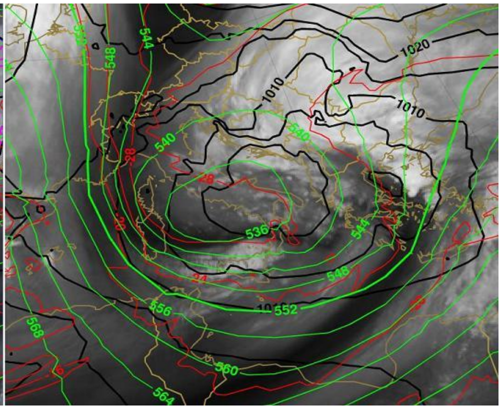


Fig. 12. ***25/01/14. 00 UTC WV6.2 satellite image, MSLP (black), AT 500 hPa (green), temperature at 500 hPa (red). (Source: Eumetrain)***

The second cyclogenesis, from January 27th, also took place in the Genova Bay, by the detachment of a low pressure nucleum from the Icelandic Cyclone. As it can be seen in the satellite images Water Vapour, as well as on the specific parameters maps, the conditions from the high and medium troposphere, both at the beginning and into the lower layers, have mostly been unfavourable, the depression quickly become deeper due to the surface conditions: the very high thermic contrast between the air above land and the one above the sea.

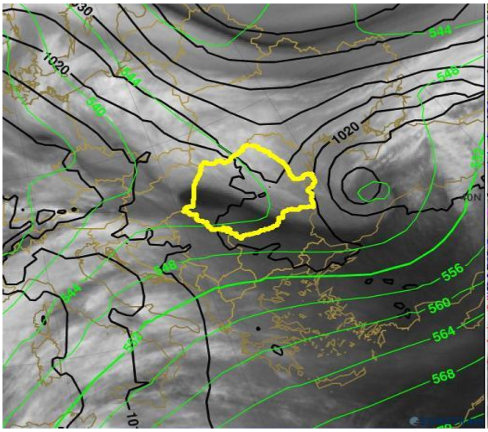


Fig. 13. ***30/01.2014. 00 UTC. WV6.2 satellite image, MSLP (black), AT 500 hPa (green). (Source: Eumetrain)***

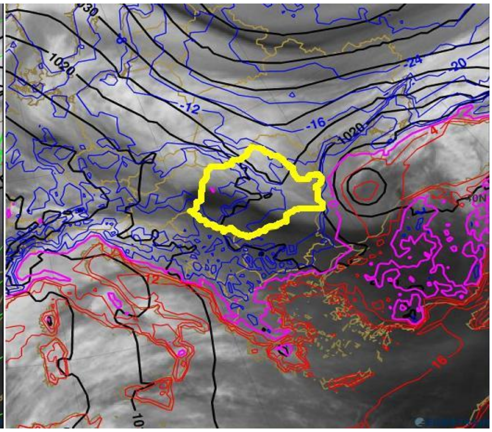


Fig. 14. ***30/01/14. 00 UTC. WV6.2 satellite image, MSLP (black), temperature at 2m (colored lines). (Source: Eumetrain)***

4. CONSEQUENCES

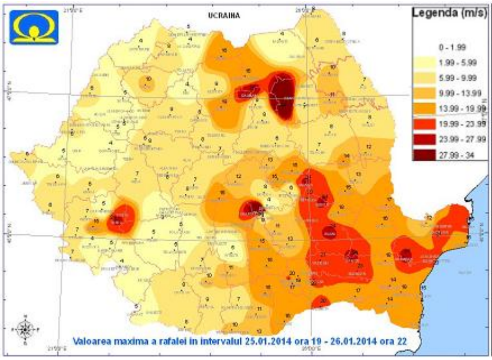


Fig. 15. ***Maximum windgust between 25/01/14 – 26/01/14 (Source: ANM)***

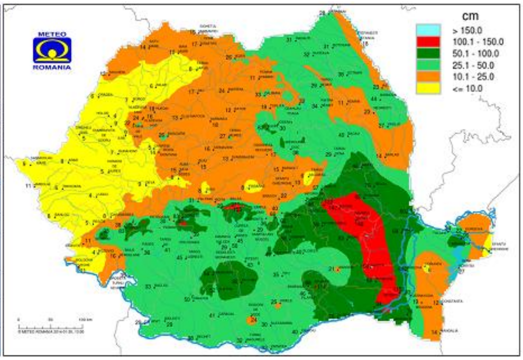
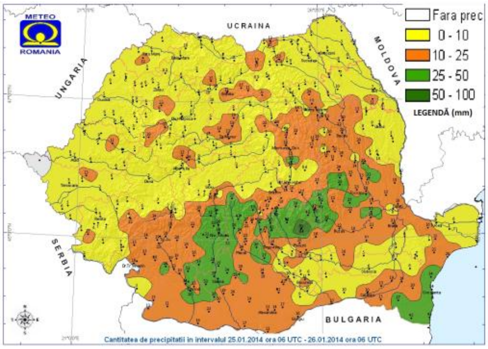


Fig. 16. ***Maximul height of snowdrifts between 24 – 29/01/14. (Source: ANM)***

During the first blizzard, the strongest gusts of wind were recorded in Banat (Coșava): Oravița 28 m/s, Moldova Veche 26 m/s. In the extracarpatic regions the most affected were Dobrogea (26 m/s at Mangalia, 25 m/s at Corugea, 23 m/s at Mahmudia, Jurilovca and Sulina, 22 m/s Gura Portiței) and (24 m/s at Buzău, Urziceni and Grivița, 23 m/s at Slobozia, 22 m/s at Alexandria and 21 m/s at Titu). The second blizzard was more intense in Dobrogea and Bărăgan: 25 m/s at Mahmudia, 24 m/s at Sulina, Grivița and Fetești, 22 m/s at Slobozia, 21 m/s at Urziceni and Corugea. On January 30th, the height of the snowdrifts measured 280 cm at Grivița, 260 at Râmnicu Sărat, 200 cm at Fetești and București Afumați, 170 cm at Slobozia and Galați, 160 cm at Călărași, 150 cm at Mahmudia and 140 cm at

Buzău. On January 30th, at 08:00 local time, the layer of snow measured a thickness of 99 cm in Brăila county (Muntenia), 78 cm in Vrancea county (Moldova), 69 cm in Tulcea county (Dobrogea) and 54 cm in Gorj county (Oltenia).



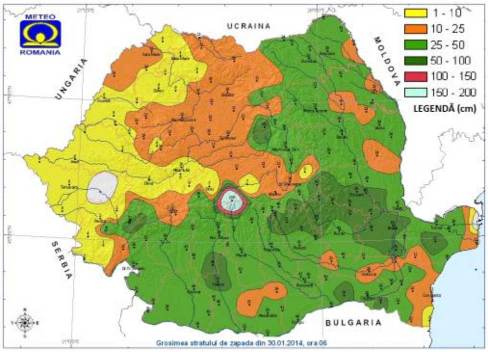
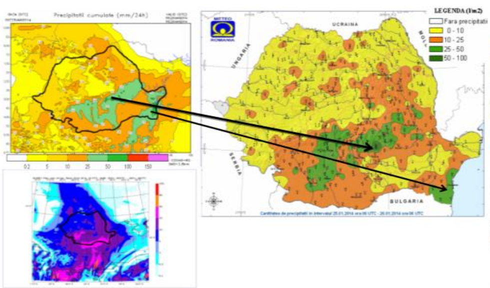


Fig. 17. ***Amount of precipitation accumulated between 25/01/14. 06 UTC – 26/01/14. 06 UTC (Source: ANM)***

Fig. 18. ***Snowdepth on 30/01/14. 06 UTC (Source: ANM)***

5. THE MANAGING OF THE SITUATION BY THE NATIONAL METEOROLOGICAL ADMINISTRATION

The runs of both models of limited area COSMO and ALARO have had good results regarding the forecast of precipitation fields, snow and wind. The 00 UTC run from January 25th, of the COSMO model shows almost perfectly the observations done in the morning of January 26th regarding the quantity of precipitations gathered in the last 24 hours, as well as of their spatial distribution (Fig. 19). The same very good results are also noticed regarding the prognosis of the maximum wind gust at the height of 10 m (Fig. 20).



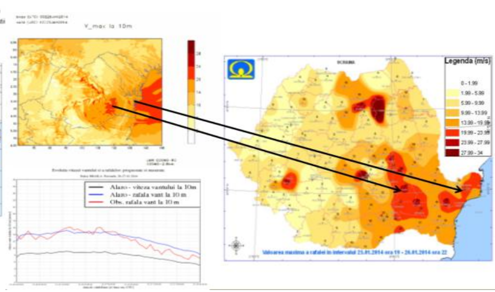


Fig. 19. ***Acummulated precipitations (left) by COSMO model (first) & ALARO (2nd) and measurements in the interval between 25.01, 08 - 26.01, 08. (Source: ANM)***

Fig. 20. ***Maximum wind gusts speed forecasts (left) COSMO (first image) and ALARO and measurements (right) between 25-26th of January. (Source: ANM)***

On the other hand, the same run of the ALARO model, shows a discrepancy towards South. Nevertheless, in picture 20 (lower left), we can see that the estimates for the wind gusts maximum speed at 10 meters height, of the ALARO model, is very close to the measurements done at the meteorologic station in Brăila. The global model ECMWF has sent signals concerning the producing of the phenomenon more than 72 hours before it started. The National Meteorological Administration from Romania has efficiently gestionated the phenomenon starting with the night of January 24th. In this way, six yellow code warnings have been issued on time and also, in premiere, from the introduction of the weather codes in Romania (2005), two red code nowcasting warnings.

6. CONCLUSIONS

In January 2014 in a period of about one week, in the South-East of Romania there have been two strong blizzards. The primary factor of the blizzard's continuing on January 26th, was the penetration of the low pressure area over the warm waters of the Black Sea. Before the blizzards were produced, the Black Sea had a positive anomaly of the temperature at its surface, which favorised the consecutive regeneration of three Mediterranean lows between January 20th and 30th 2014 and the forming of unusually pressure and temperature gradients. This anomaly was gradually accentuated on the basis of more zonal which determined a warm autumn and a mild beginning of winter. Between January 20th and 24th in the North of Moldova and on extended areas in Ucraine and the South-West of the Russian Field there was a layer of snow which favorised the cold air's advection from the East-European region. These factors had as a result, special socio-economic consequences, as well as the issuing by the National Meteorological Administration of the first blizzard red codes in Romania, of nowcasting type.

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