THE COLD WAVE OF FEBRUARY 25 TO MARCH 2, 2018 AND THE ASSOCIATED RISKS

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Abstract. *The present paper proposes to highlight the evolution of the generating factors of the cold wave, which from February 25 to March 2, expanded from the northern and northeast of the European continent and affected much of it, including the Romanian geographic space. After a relatively warm winter as thermal aspect, with an ephemeral snow cover in the low relief areas, the last decade of February and the beginning of March, it creates the classic pattern for a genuine winter episode in Romania. Its location in the contact area between an anti-cyclonic field centered on northern and northeastern Europe and a cyclone in the south-east of the continent will facilitate in the first phase the transport of cold air. Then another factor climatic risk, was of interest, namely the blizzard, with the classic area of manifestation in the south, southeastern and eastern Romania. The thermobaric coupling made in this way ensures severe weather conditions, but normal for the cold season. Besides these triggering factors, it is important to mention the risks induced and associated with this severe weather episode, causing damage to agricultural crops, communication routes, to society in general and to the entire environment, affecting the quality of life as a whole. Special attention will be given to another phenomenon, which followed the cold wave, namely the freezing rain. The practical applicability of the study carried out in operative activity, as well as its actuality, consists in the fact that it is a useful support material, referring to an issue as alarming, as normal for the temperate climate zone during the cold season.*

Key-words: *cold wave, winter episode, thermobaric coupling, snow cover, blizzard, freezing rain.*

INTRODUCTION

All climatological phenomena with negative effects during the cold season of the year have a common feature and that is namely the existence of negative temperatures as they generate and maintain. In the framework of the climatic risks we can include the cold waves evidenced by thermal extreme sometimes with quite serious repercussions for man as an individual, society and the environment. The cold waves represent climatic risks, which characterize the tropical and temperate zones determined by cold air advections, arctic or polar. The last days of the 2018´s winter, but also the onset of the spring are under the sign of an intense cold air advection, materialized in the geographical area of Romania by minimum values below the frost temperature (-10°C), and negative maximum values.

MATERIALS AND METHODS

In order to describe the synoptic situation that generated and maintained these low temperatures in our country, were used maps with ground level pressure highlighting the distribution of barometric centers in Europe, elevation maps (with 500 mb geopotential, with

500-1000 mb cold advection), maps with temperature anomaly of February 25 - March 2, made by NOOA, archive data of National Meteorological Administration and mass-media images.

RESULTS AND DISCUSSIONS

The end of the Northern hemisphere winter has been marked by extreme weather conditions, with exceptionally high temperatures in the Arctic, an extended cold wave and heavy precipitation in Europe. Much of this winter (December 1 to February 28 -figure 1) was mild in the Arctic, culminating in extraordinary warmth in February. For the month of February, most of the inner Arctic was more than 5°C warmer than the 2004-2013 average.

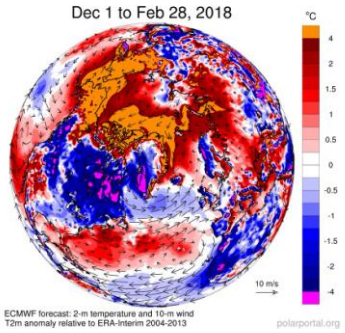

Figure 1 Temperature anomaly December 1 to February 28, 2018

While heating at northern latitudes on Europe the situation is the opposite one, many countries on continent issued severe weather alerts and warnings for cold, ice and snow, causing transport and energy disruption, and a health risk to vulnerable groups. The wind chill factor meant that temperatures felt even colder than recorded (figure 2).

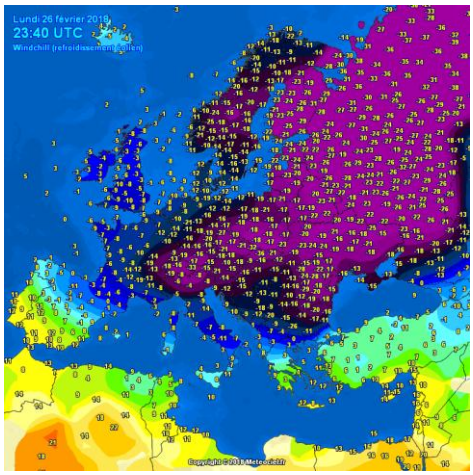

Figure 2 Windchill, February 26 2018, 23:40 GMT

The advance of this cold, arctic air mass follows an extensive anticyclone area centered south of Scandinavia extended northeast over Russian Plain (figure 3). This extension makes the properties of cold air mass to widen when it gets over this vast expanses covered with snow. Subsequently, the air mass will be carried on the northeastern part to central and southern Europe.

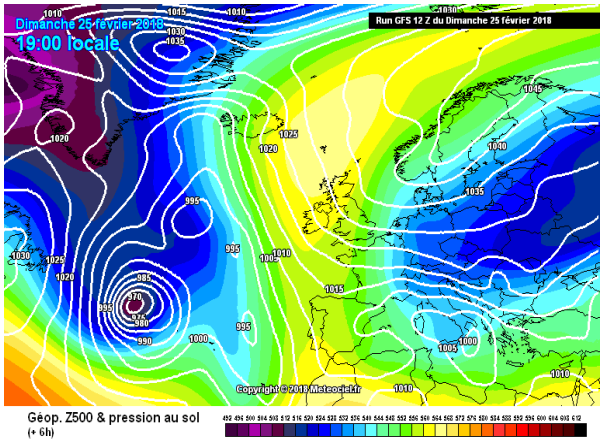

Figure 3 Ground pressure and 500 mb geopotential, February 25, 18 GMT

At 500 mb, in the middle troposphere (figure 3), most part of Europe is located under the influence of a cold core, except western half, where a ridge is located extended up to northern latitudes. Cold advection is suggestive, at all levels, and its intensity is revealed using the map 500-1000 mb, so that around 27 and 28 February its influence will be felt in Western Europe, but also on southern latitudes up to the Iberian Peninsula (figure 4).

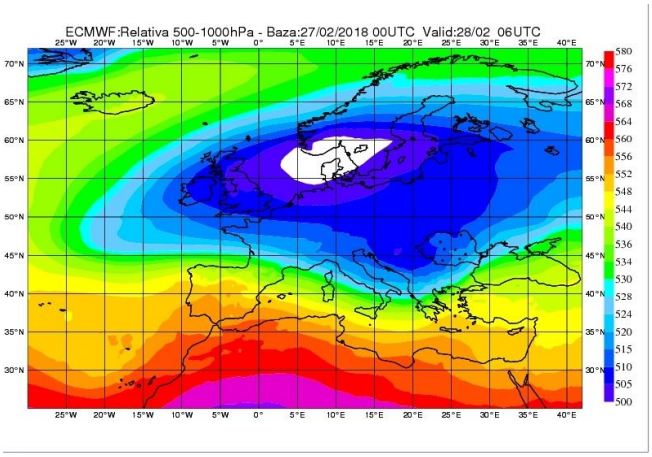

Figure 4, Relative 500-1000 mb, February 28, 06 GMT

This cold wave extends through Romania around 25 February, but in the next few days, until March, it will intensify. That is the reason why were issued severe weather alerts for blizzard, cold and frost during nights (figure 5). The most affected areas are located „outside" the Carpathian, while intraregions will be more"safe", thus emphasizing the role of the Carpathians orographic barrier.

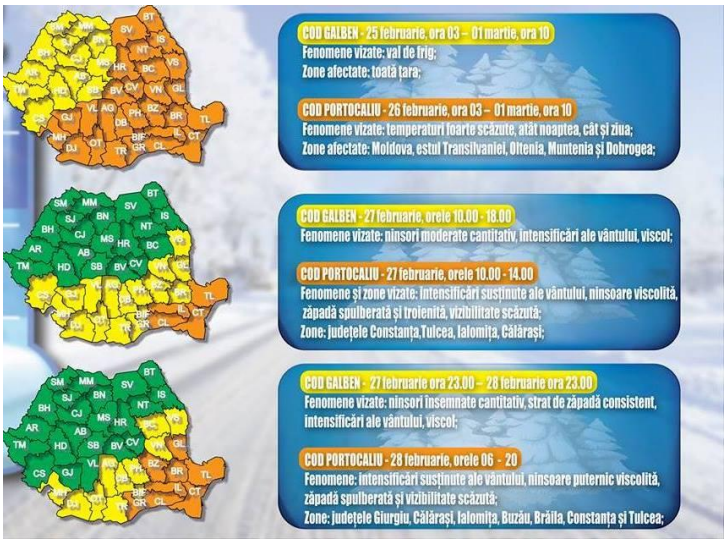

Figure 5 Severe weather alerts issued by National Meteorological Administration

A real help is due to the termobaric coupling between Scandinavian anticyclone area and a cyclone, active western basin of the Black Sea, arrived here after travelling to the northeast from central basin of the Mediterranean. The cyclone will ease cold air advection,

due to high gradient made by coupling with anti-cyclonic field centered on Scandinavia, but also it will will generate strong winds, creating this way another specifically phenomena for cold season, namely the blizzard.

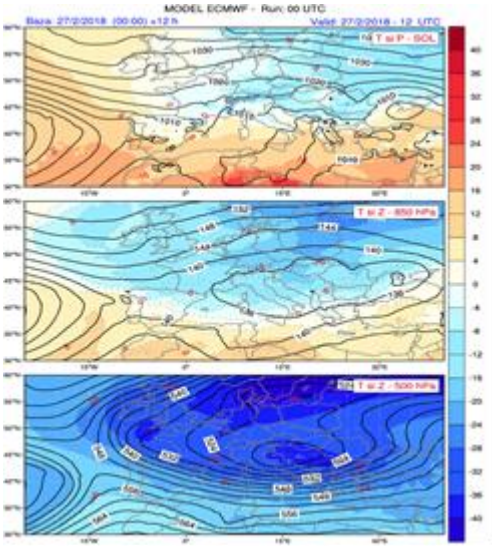

Figure 6 Ground pressure, 850 mb temperature and 500 mb geopotential, February 27, 12 GMT

Blizzard is a joint snowfall with strong wind, which significantly reduces horizontal visibility. In Romania, it is found mainly on the south, southeast and east of the country, as a risk phenomena with various effects. On 27 February, at ground level it is obvious that the coupling barrel made between the anti-cyclonic field from northeast and the cyclonic field from Black Sea basin. At ground level it is obvious that the air circulation is northeastern and at 500 mb a southwestern intense movement resulting from the gradient between the hot and cold mass installed above the Mediterranean (figure 6). February 26 it is a day marked by the same scenario so thick snowfall is consistent, and it is between 1 cm in northwest areas of the country, where snow was weak and was not accompanied by strong wind, up to 40-50 cm in the south and southeast of Romania (41 cm at Cernavodă, 50 cm at Craiova). There was blizzard, the wind speed was around 70-80 km / h, forming drifts with height of 1-1.5 meters (figure 7).

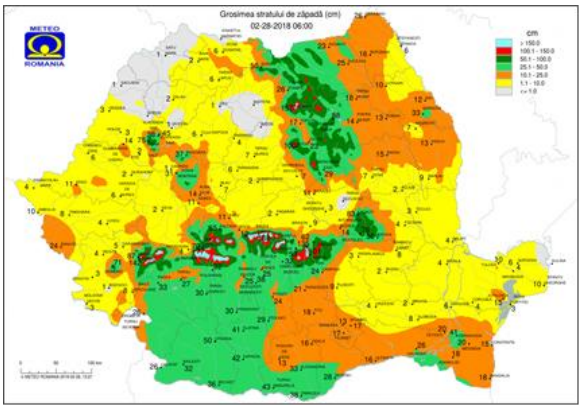

Figure 7 Snow cover (cm), February 28, 06 GMT

The return of the winter at the end of February and early March has generated extremely low temperatures, above 0°C during days (figure 8). During nights the minimun temperatures were all over the country above -10°C, reaching at Apa Neagra, in Gorj County, -25,1°C on March 1 (figure 9).

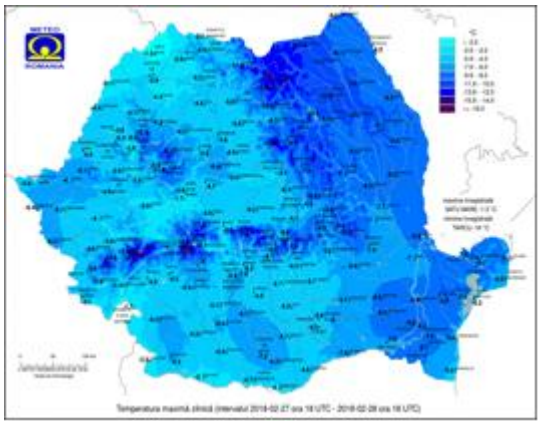

Figure 8 Maximum temperatures , February 27-28, 18 GMT

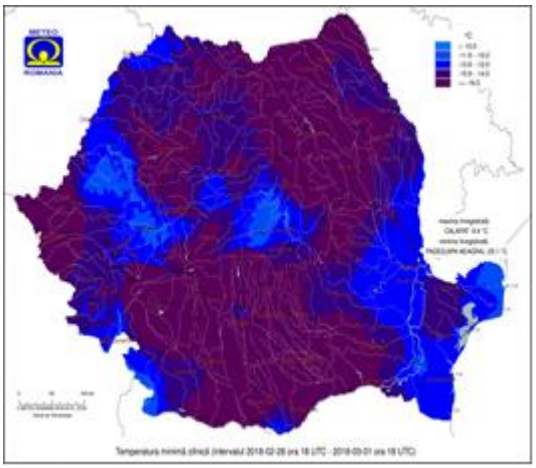

Figure 9 Minimum temperatures, February 28-March 1, 18 GMT

The magnitude of this cold wave is due to: the surface that reaches, almost the entire continent (MeteoFrance reported temperatures of more than -10°C below the long term average in southern and eastern France, with heavy snowfall in Corsica. Germany's weather service, Deutscher Wetterdienst said that temperatures fell to -30°C on the Zugspitze mountain in the south of the country on February, 28; in Hungary, the lowest minimum daily temperature record was broken, with a recording of -24.6°C in the Carpathian Basin on 28 February; Serbia had a top-level red alert for cold temperatures for several days), to uniqueness of the associated phenomena (in Rome, Italy, snowed for the first time since 2012, The Colosseum was covered with snow – figure 10, and the beaches in Naples were also white with snow, as was Mount Vesuvius), to its appearance at the end of the winter.

Figure 10 Images collage from mass-media

In Europe, negative temperature anomaly from February 25 to March 3, is the result of the cold air transportation, the lowest values extending through the center and just south of the continent (figure 11).

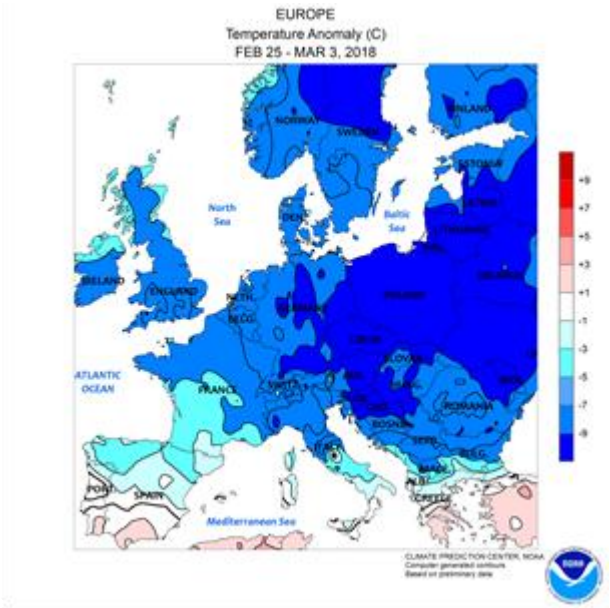

Figure 11 Temperature anomaly in Europe, February 25- March 3, 2018

In Romania, new records were reached, the highest minimum temperature deviation from the daily minimum average temperatures (1981-2010) was recorded on March , -21,5°C, at Tg. Logrești, Gorj County. Although the onset of the first month of spring was characterized by a specific winter time, days that will succeed it, will bring a more balanced temperature control, influenced by the movement to southwest of a warmer air mass, while withdrawing eastward cold mass. Thus, on March 1st, western and south-western regions of the country fall under the influence of this air circulation, as a consequences of the advance to east and southeast of Atlantic cyclone area, while in the rest of the country the cold mass of air persists until the next day, when it will gradually be deployed. But its displacement will be difficult, because of its density. Gradually, hot air in advance to the southwest will replace cold air, causing this way, another risk phenomena, namely freezin rain.

The training process is shown by this vertical structure: a layer of cold air in the first 400-500 meters (remainder of the cold wave), a layer of hot air coming from the south and south-west at 1500-2000 meters, and another layer of cold air at higher altitudes (figure 12).

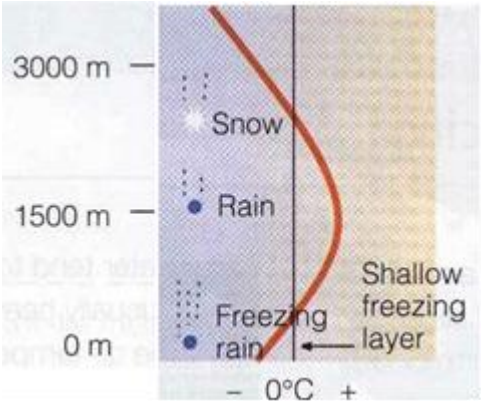

Figure 12 The training process of freezing rain

Thus, precipitation crossed layers with different air temperatures. At 850 mb level (1400-1500 meters), on March 2, 06 GMT (figure 13), in the southwest of the country can be identified 0°C isotherm, while at ground level, temperatures will be mostly negative. In this way, precipitation reaching the ground as supercooled water drops, will freeze on incindent surfaces, forming freezin rain.

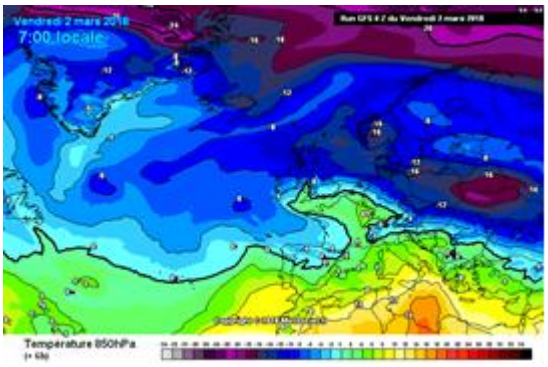

Figure 13 Temperature at 850 mb level, March 2, 06 GMT

CONCLUSIONS

So, cold wave from February 25 to March 2, 2018, can be considered as a milestone in what can be a true winter in Europe, especially since it generated new temperature records in a period of transition to spring season, not in a hivernal one. Risks associated with cold waves are numerous. The most affected is the human body, though it has a native potential to adapt at low temperatures. These very low temperatures disturb the social and economical activities, by hindering the transport by lowering the pressure in the natural gas supply network. Another affected area by the invasion of cold air, especially when it is done during the transition from one season to another is agriculture, which according to vegetative stage can be partially or totally compromised. On the other hand, associated phenomena such as blizzard, and those succeeding it, in the present case, freezing rain, can be classified as a risk phenomena, which

according to the way of manifestation, duration and intensity, causes temporary imbalances in weather natural evolution.

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