

## ANALYSIS OF CLIMATIC RISK PHENOMENA PRODUCED AT LUNGULEȚU, DÂMBOVIȚA COUNTY ON 20 JULY 2011

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**Abstract.** On 20 July 2011 in South Dâmbovița County weather was warmly, hot on middle of the day, with maximum heat values being between 32<sup>0</sup>C at Târgoviște and 35<sup>0</sup>C at Titu. Atmospheric instability has increased gradually in the evening, when there were rain showers, lightning and short-term intensification of the wind. Rains had torrential character and water quantities have locally exceeded 30 l/m<sup>2</sup> - the maximum amount registered being of 42 l/m<sup>2</sup> in Dărmănești. The wind has increased during rainfall, with gusts over 100 km / h (104 km / h at the meteorological station Târgoviste) or had an squall aspect. Thermal comfort index (ITU) has exceeded the threshold of 80 units. This paper presents the evolution of weather using data from weather stations, radar products, satellite and radio aerial surveys data, as well as synoptic maps. An evaluation was made of weather events and their environmental impact on Lungulețu locality from Dâmbovița County.

### Introduction

The knowledge, researching, investigation in detail of the local or regional weather conditions and climate in Romania which favor the emergence of atmospheric phenomena risk, sometimes incalculable, acquired a particular significance and interest in the contemporary period, situation that can be deduced from the many thematic specialized papers (Ciulache and Ionac, 1995, Bogdan, 1999, Apostol and Machidon, 2009, etc).

Weather and climate risks analysis, the mechanisms of their evolution and their consequences to some extent can facilitate the adoption of prevention activities, the avoidance, attenuation or controlling the occurrence of potential damages and sustainable development forecast for the investigated region area.

We consider that the analysis of the conditions for the occurrence of meteorological phenomena such as heavy rains, which sometimes are accompanied

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by intensification of wind, squalls, lightning and hail, the way of their manifestations, as well as environmental effects, continue to present a particular interest from both researchers and authorities in the current context of global warming.

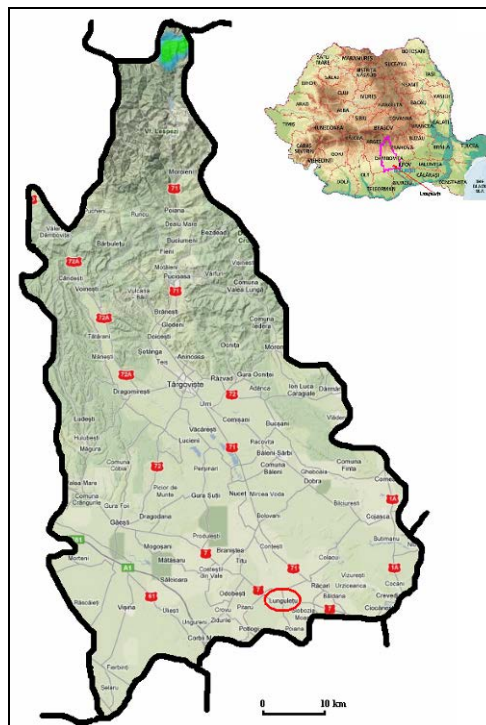


Fig. 1 - Geographical position of the Lungulețu locality (processing after Google Maps)

Because of extreme weather events that have occurred on the 20<sup>th</sup> of July 2011 Lungulețu was one of the worst affected localities from Dâmbovița County (Fig. 1). Four hundred roofs were partially or totally destroyed, the cork forest was destroyed, the crosses from cemetery were knocked down and hundreds of meters of electricity and telephone cables were broken.

## 2. Meteorological and impact analysis of the phenomena produced on July 20, 2011 in the Lungulețu locality of Dâmbovița County

During the day of July 20, 2011 Romania was under the influence of a low pressure area which occupies as a belt from north-west to south-east of the

European continent, with the main centers of low pressure on Island, Norwegian Sea, Asia Minor and several secondary centers in Europe, one of them being located on the western part of our country, associated with the height thalweg (Fig. 2). Our country was under the influences of warm air masses of tropical origin in the temperature field at 850 hPa, entire Romanian territory being framed by the isotherme of 20 °C (fig. 3).

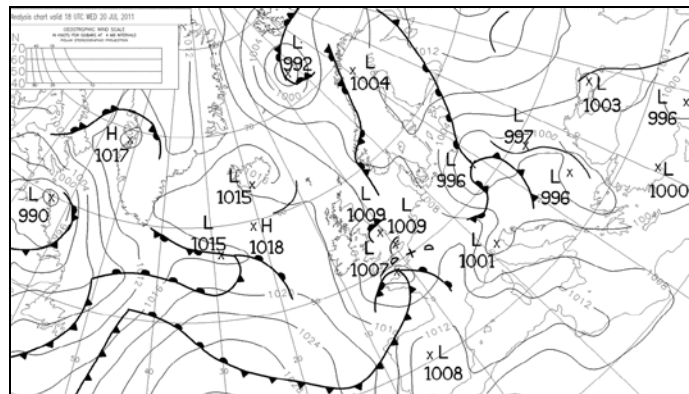


Fig. 2 - The ground frontal analysis map on 20 July 2011 at 18 GMT (source: [www.wetter3.de](http://www.wetter3.de))

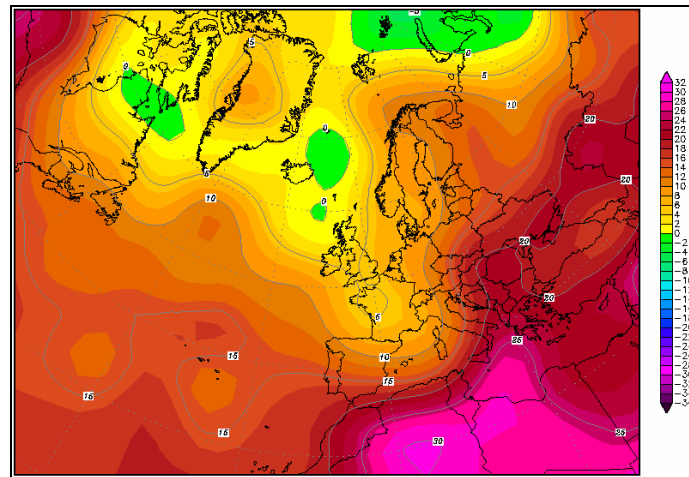


Fig. 3 - Air temperature distribution at the 850 hPa isobaric surface on 20 July 2011 at 00 GMT (source: [www.wetterzentrale.de](http://www.wetterzentrale.de))

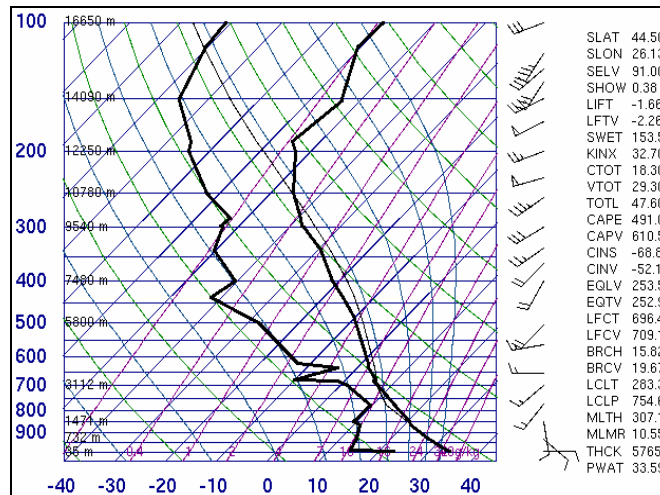


Fig. 4 - T-Skew diagram of Bucharest on 20 July 2011 at 12 GMT (source:<http://weather.uwyo.edu/upperair/europe.html>)

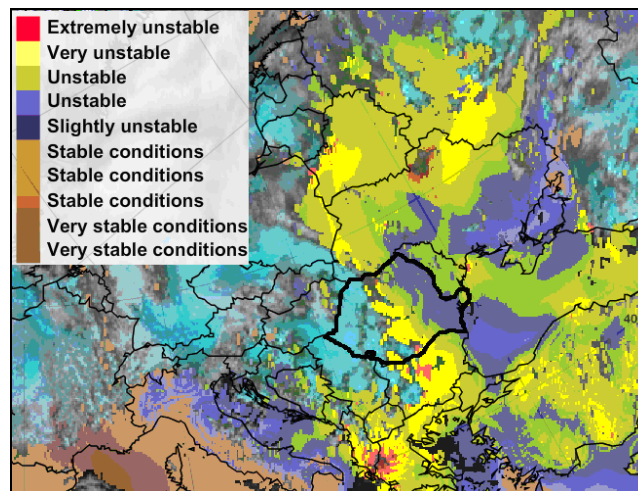


Fig. 5 - Level of atmospheric instability in afternoon of day 20 July 2011 at 12 GMT (source: [www.satraponline.org](http://www.satraponline.org))

CAPE provides a good measure of instability level, representing the quantity of potential energy required to lift a particle in the neutral buoyancy level. This index depends on the initial conditions of particle and thermodynamic processes used to increase the particle, and the measuring unit is J/kg (Joules per

kilogram). CAPE values for convective storms are often in the field of 1000 to 2000 J / kg, sometimes occurring values greater than 5000 J / kg.

The T-Skew diagram (fig. 4) which represents the vertical profile of the atmosphere and the atmospheric stability assessing at Bucharest on July 20 at 12 GMT indicates the following: the K-INDEX = 33 (very high chance of developing Cumulonimbus clouds), CAPE = 4910 J / kg, Total Totals Index = 47.6 (possibility of occurrence of highly developed Cumulonimbus clouds).

Heavy rains recorded during the day of July 20 had prefrontal causes (Fig. 2), to which added the high level of instability during the afternoon (Fig. 5).

So, conditions for the development of severe convective phenomena were accomplished in the second part of that day, due to the cold front passage and thermal convection. These were also captured by satellite images. (Fig. 6, 7, 8).

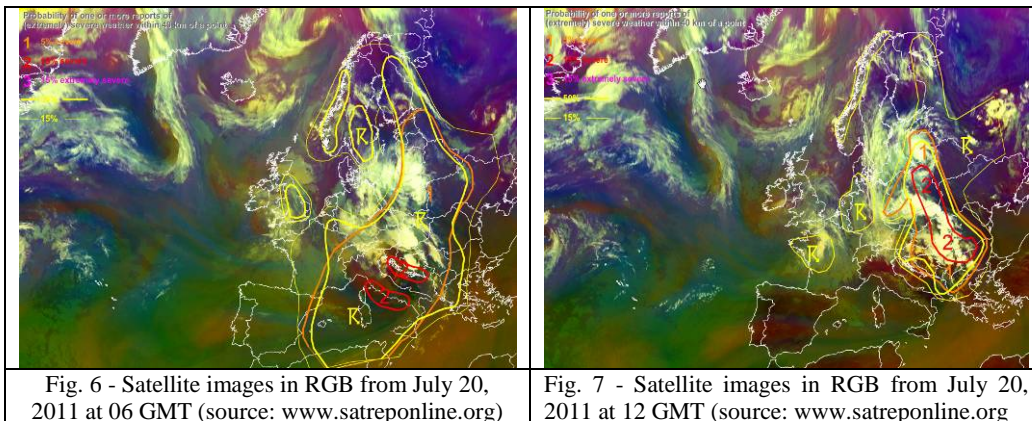


Fig. 6 - Satellite images in RGB from July 20, 2011 at 06 GMT (source: [www.satreponline.org](http://www.satreponline.org))

Fig. 7 - Satellite images in RGB from July 20, 2011 at 12 GMT (source: [www.satreponline.org](http://www.satreponline.org))

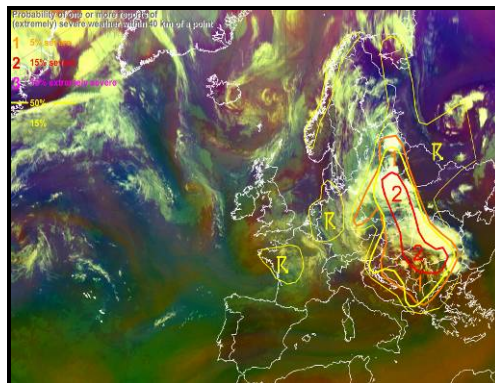


Fig. 8 - Satellite images in RGB July 20, 2011 at 18 GMT (source: [www.satreponline.org](http://www.satreponline.org))



On the evening of 27 July 2011 the composite reflectivity product, provided by the meteorological Doppler radar from Bucharest, indicated the occurrence of convective storms. These have evolved over the south territory of the Dâmbovița County in the first part of the night of July20/21, in accordance with the general air circulation in the half lower of the atmosphere, meaning to the east, and Lungulețu area was affected (fig. 9 a, b).

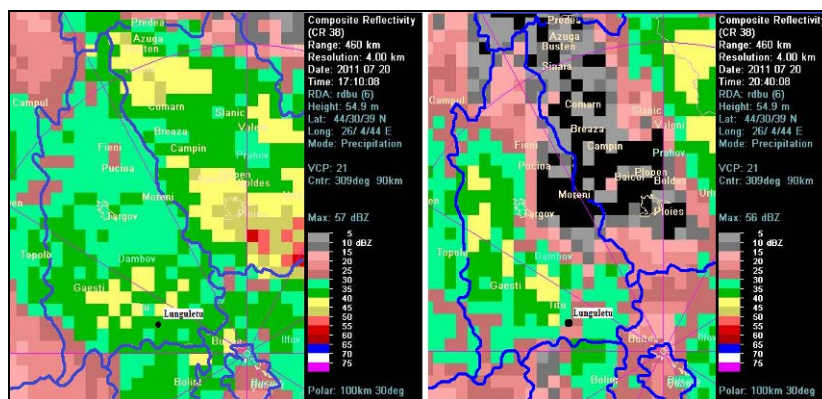


Fig. 9 - Reflectivity images supplied by meteorological Doppler from Bucuresti on 20 July 2011 ( left image – at 17.10 GMT; right image – at 20.40 GMT)

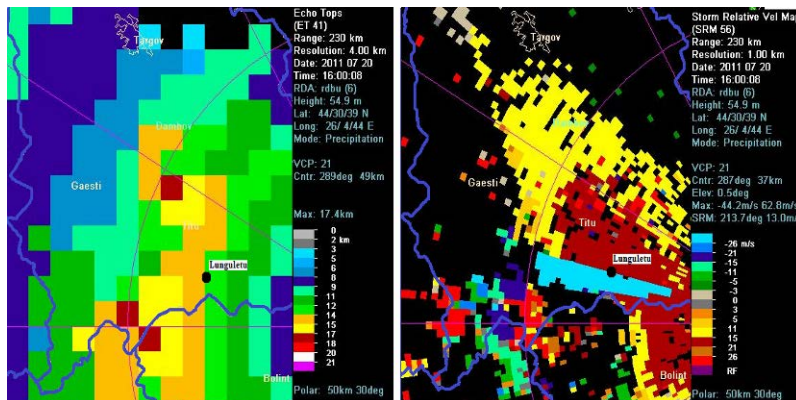


Fig. 10. Height clouds image (left) and velocity structure image (right) supplied by meteorological Doppler from Bucuresti on 20 July 2011 at 16.00 GMT

In its evolution, the convective storm reached the maximum stage at 16.00 GMT. The products supplied by the meteorological Doppler radar indicate that in the Lungulețu area, clouds had a vertical extension of up to 17 km (Fig. 10.a),

while wind speed was higher than 26 m / s (94 km / h) and presented the squall aspect (Fig. 10.b).

Convective events dated on July 20 have led to the accumulation of large amounts of precipitation on Lunguletu locality area as well as in other areas of Romania (fig. 11).

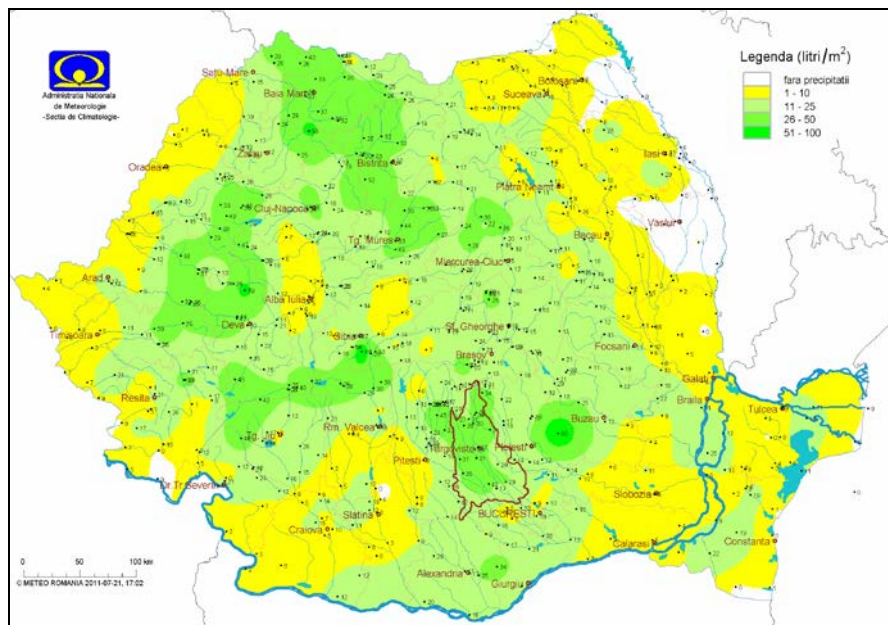


Fig. 11 - Rainfall amount recorded on 20 July 2011 by the meteorological stations and DESWAT network, rainfall and hydrological stations from Romania

In the evening of July 20 unleashed nature has swept all in the way in most of the Dâmbovița County. In Târgoviște six roofs were taken by the wind and more trees felled to the ground. Emergency County Hospital basement and Romlux passage of Târgoviște were flooded and there had been people wounded by the tin roofs tables flown from the buildings. The medium voltage power was affected and the Lazuri water supply station stopped, so drinking water supply from Târgoviște city was interrupted for more than 24 hours.

145 localities from Dâmbovița county remained without electricity because 497 power transformers and 40 medium voltage lines have been affected by the storm.

Other localities form Dâmbovița county were also affected, such as Titu and Moreni (11 roofs were torn off by the wind and several trees were knocked down

by the squall), Răcari (a tree has damaged a gas pipeline), Ciocănești, Poiana de Sus (some trees have fallen over houses), Cojasca (electrical cables and the roof of a house were damaged), Băleni (dozens of solariums were destroyed by strong wind).



Fig. 12. Effects of weather phenomena on 20 July 2011 in the Lungulețu locality and surrounding (source: [www.damboviteanul.com](http://www.damboviteanul.com))

However, the most affected area was Lungulețu where, as can be seen from the images presented in the local press (fig. 12). Natural and anthropogenic environmental effects have been devastating (400 roofs were partially or totally destroyed, the cork forest was destroyed, the crosses in the cemetery were knock down and hundreds of meters of electricity and telephone cables were broken, dozens of trees were prostrate and electricity poles were torn).



### Conclusions

The meteorological situation of July 20, 2011 should be retained as a reference for the center of Romanian Plain in terms of conditions for the occurrence of meteorological phenomena such as heavy rains, which sometimes are accompanied by intensifications of wind, squalls, lightning and hail, or for their manifestation manner and their environmental effects.

The date of July 20 remains remarkable through the rainfall intensity (42 l/m<sup>2</sup> at Titu meteorological station, which is over than 50% of the precipitation average quantity of July), by the speed and character of the wind (102 km/h were recorded at the same meteorological station) and not least through the significant negative impact which this event has had on the natural and anthropogenic environment from Dâmbovița County, especially on Lungulețu locality.

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