FLOODS IN EASTERN ROMANIA DURING JUNE AND JULY, 2010

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I. INTRODUCTION

During June and July, 2010, Romania has experienced a period of strong atmospheric instability. The number of days with heavy rain was high and especially in the eastern regions produced historic growth of the rivers debit and levels (figure.1).

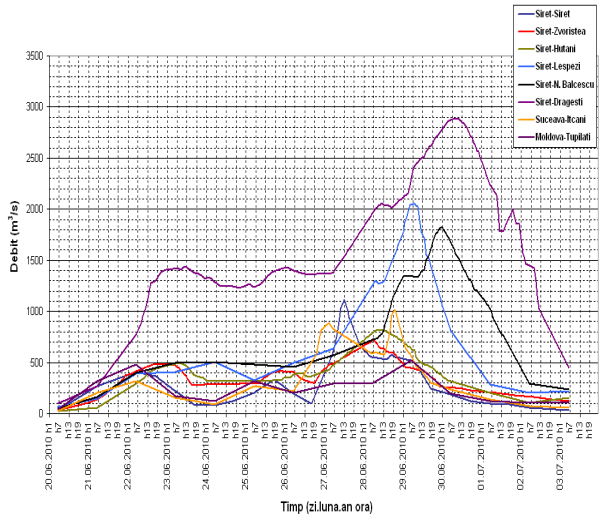

Fig.1 The hydrograph (discharge) for the rivers: Siret, Suceava and Moldova (Anghel et al., 2011)

The floods have led to significant economic losses and casualties. During 18th June and 9th July the water amount exceeded the multiannual monthly average (in the eastern regions locally exceeded 200 mm and isolated 300 mm) (figure. 2).

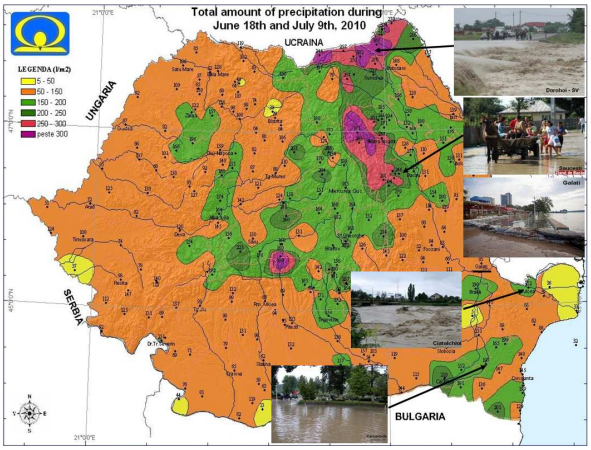

Fig.2 Accumulated rainfall during June 18th and July 9th, 2010

This situation was caused by the persistent action of two atmospheric blocking structures - one of them acting above the Western Europe and the other over the eastern part of the continent. In these circumstances the south and the south-eastern part of the continent were under the influence of a cyclonic field which also influenced Romanian territory. This situation facilitated the development of the Mesoscale Convective Systems (MCS).

The paper's aim is to illustrate the links between atmospheric blocking within the European area and the severe weather phenomena that occurred in eastern Romania, and to analyze the convective system responsible for the storms occurred in 28th and 29th June and caused disastrous floods in the northern part of Moldavia.

II. PRESENTATION OF RESARCH

For this study were used NCEP/NCAR re-analysis, the analysis of the limited area model ALADIN, the EUMETSAT satellite images, radar data (Doppler), SatRep analysis and observation from meteorological and hydrological stations of the National Meteorological Administration and National Institute of Hydrology and Water Management.

Between 18th of June to 9th of July the total amount of precipitation in eastern Romania was very high, reaching locally 200 mm and isolated 300 mm (figure. 2). This situation has determined increases in levels and flows of rivers and floods. The subsequent flooding have resulted in casualties and significant damages.

This particular situation has been determined by a synoptic situation wich has involved a blocking circulation. In fact, during the above mentioned period, the blocking anticyclone activity was present in both main areas (Western and Eastern Europe). The continental blocking has the greatest extension and intensity as it is shown in figure 3, where an extended nucleus of positive geopotential anomaly can be observed. In these circumstances, Southern Europe was under the influence of a cyclonic field which continuously enriched this area with moisture from Mediterranean Sea and Black Sea. The synoptic structures have been maintained throughout the whole tropospheric column, being present both at the sea level and at the superior level of troposphere.

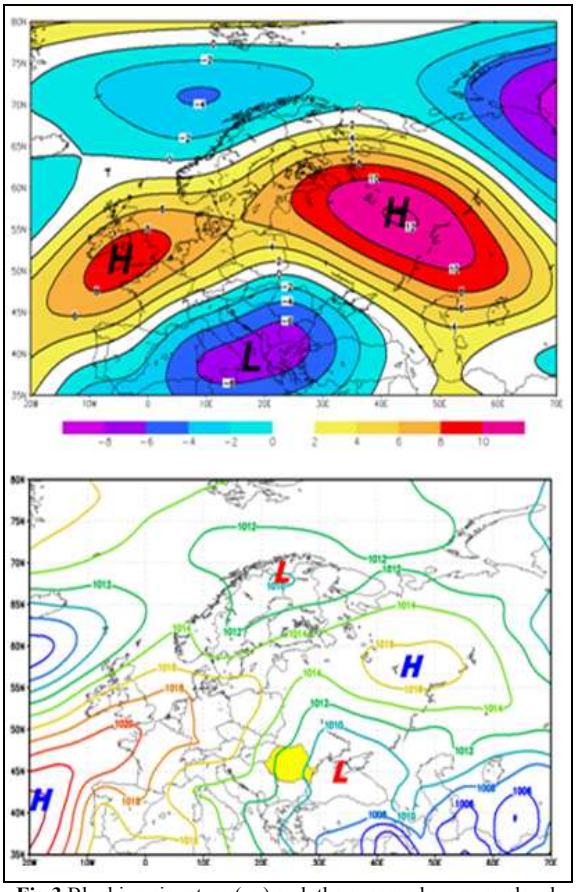

Fig.3 Blocking signature (up) and, the averaged mean sea level pressure (down) over Europe during June 18th and July 9th, 2010

The continuous warm air advection from the Middle East toward Russia has led to the strengthening and persistence of eastern blocking during the most part of the range of interest. As a result the trajectory of cyclonic nucleus had several cases of retrograde path over the western basin of the Black Sea. Following this trajectory, the air mass was enriched with a considerable amount of water vapour and became unstable, this situation being favourable four MCS.

Of the entire examined range, there were revealed six episodes of heavy precipitation: June 21st to 23rd, June 25th to 26th, June 28th to 30th, July 3rd to 4th, July 6th to 7th, and July the 9th.

The most representative event took place between 27th and 29th June. Convective systems responsible for manifestations of severe weather in the north-east of the country were set up in supercells (with very high reflectivity in the radar image and typical satellite images). In this period a decisive role was played by orography. Carpathian orientation facilitated the moisture convergence and forced the ascending motion on the mountain slope. On 29th June favored the development of a mesocyclone (figure. 4a, b).

Fig. 4 (up) Reflectivity and (down) Doppler speed – 29th June, 15 UTC

III. RESULTS AND CONCLUSIONS

The study concludes that the atmospheric double blocking over the European continent, on both sides of the longitudinal band which Romania is situated, has favored disastrous weather conditions. During this period the most sever episodes were those in which the Eastern European ridge determined a backward trajectory of the Mediterranean cyclones arrived in South-Eastern Europe and their reactivation over the Black Sea basin. The moist air transport from the Mediterranean and Black Sea played an important role in the atmospheric instability amplification.

In this period were affected Ukraine and Republic of Moldova, too. Heavy rains in these regions influenced also increasing levels of some rivers in Romania. Prior to their onset, all of these rainfall episodes in Eastern Romania, both during June and July, were the subject of meteorological warnings issued by the National Meteorological Administration of Romania with 12, or 24 hours in advance. Also, close to 100 warning messages – coded either Yellow, or Orange as per the significance of predicted events – were issued as nowcasting forecasts, based on RADAR observations.

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