SIMILARITIES BETWEEN SEVERE STORMS PRODUCED ALONG THE ROMANIAN BLACK SEA COAST

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I. INTRODUCTION

Previous studies on the genesis and evolution of storms produced along the Romanian shore showed that the most frequent and the most violent storms occurred during synoptic conditions described as the „couple anticyclone/ depression, with travelling disturbances from the Mediterranean sea to the Black sea". More than 50% from the 185 events identified in 20 years (1974 to 1993) are the consequence of this type of circulation (Chiotoroiu, 1999).

Violent storms are a major risk for human activities, for the infrastructure and the shoreline stability. Such events have already caused important damages along the Romanian Black sea coast: maritime accidents, shipwrecks, coastal erosion and coastline retreat etc.

In this study the most severe storms have been examined using the SLP, 500 hPa and 850 hPa maps, the meteorological parameters recorded by the coastal and offshore meteorological stations, as well as vertical soundings and different satellites images.

II. PRESENTATION OF RESEARCH

Storms in the western part of the Black Sea have been already defined using two hydro meteorological parameters: *wind speed >12 m/s* (force 6 Beaufort) for at least 12 consecutive hours and *sea state 4 near the coast* (wave height 1.25 m–2.50 m), in order to assess meteorological risks in navigation (Chiotoroiu, 1999). Based on these values, 316 storm situations were identified to have occurred over a period of 32 years (between 1974 – 2005) along the Romanian Black sea coast (Chiotoroiu, 2009). The distribution of the storm frequency over the 12 months of the year for the 1974-2005 period, clearly indicates the maximum frequency of the storms in the western part of the Black Sea in the cold season, between November and March, with a maximum in February, December and January (Chiotoroiu, 2009).

Storm situations studied in this paper have been considered when the above mentioned values were registered in at least one of the Romanian meteorological coastal stations, Sulina or Constanta. The following events have been selected, depending on the maximum wind speeds and waves heights and on their consequences (often catastrophic): 17-23 February 1979 (considered as the historic storm, because of its duration of 5-6 days and of the consequences on the shoreline retreat and on the Constanta port infrastructure); 6-12 December 1991, 3-5 January 1995 (when two ships sunk near the north breakwater), 17-20 November 2007 (the maritime disasters in the Kerci strait caused an ecological catastrophe), 1-5 January 2008 (a barge laden with grain sunk in the port of Constanta).

During these storms, there is a „couple" anticylone/ depression over the Romanian coast at sea level. The term is frequently used in the litterature, e.g. by Cordoneanu (2004) when describing the winter wind „Crivatz" large scale pattern. The cold anticyclone is situated in the northern or the north-eastern part of Europe and the Mediterranean depression extends over the Black sea. Strong winds are the consequence of a strong pressure gradient (figures 1 and 2).

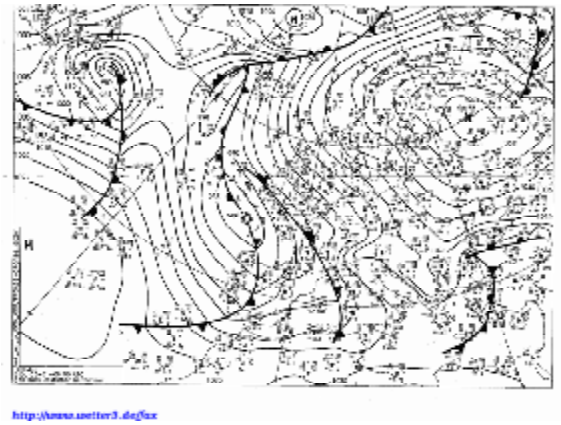

FIG. 1: SLP the 03.01.2008, 06UTC

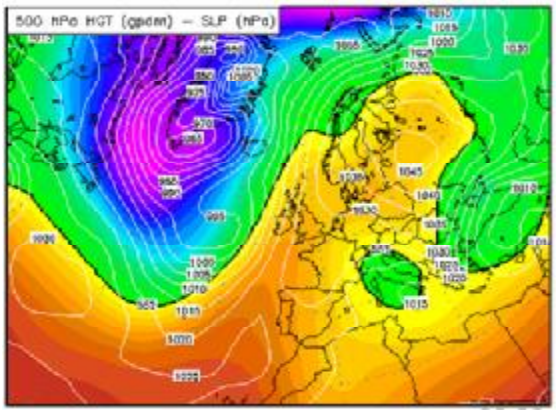

FIG.2 : SLP the 20.02.1979, 00UTC, www.wetterzentrale.de/topkarten/fsrea2eur.html

At 850 hPa and 500 hPa levels, a large trough can be observed, extended southerly over the Mediterranean sea. Its ascending part is situated over the Romanian Black sea

coast. Cold air advections from the west or south-west can be observed, according to the position and movement of the cold air pools (figures 3 and 4). The upper trough position favours the further development of the surface low over the Black sea (Trigo et al., 2002).

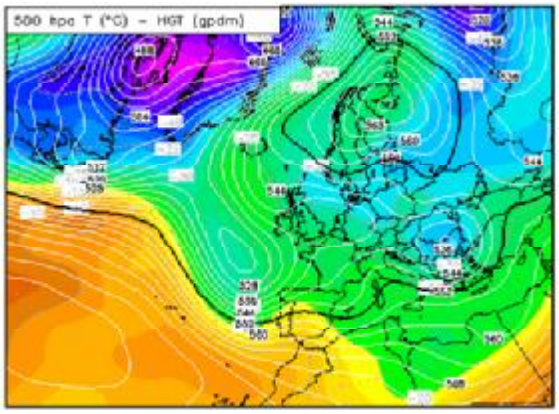

FIG. 3: 500 hPa temperature – gpdm the 03.01.2008, 00 UTC, www.wetterzentrale.de/topkarten/fsrea2eur.html

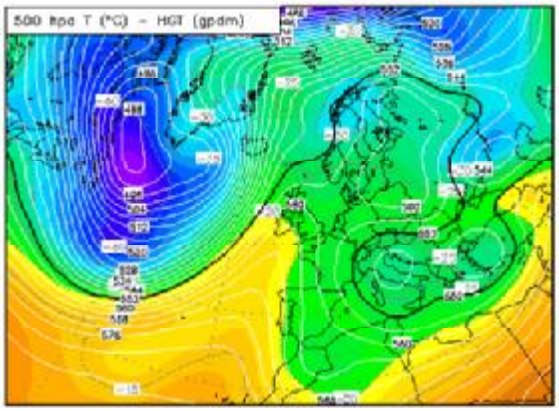

FIG. 4: 500 hPa temperature – gpdm, the 19.02.1979, 12 UTC, www.wetterzentrale.de/topkarten/fsrea2eur.html

Due to the location of the cyclone in the Black sea, winds blow constantly from north-east (4 cases) or north (December 1991). Maximum wind speeds exceeds 24 m/s in the open sea and waves height exceeds 8 m (figure 5). The vertical variation of wind speed and direction can be better examined on the vertical soundings.

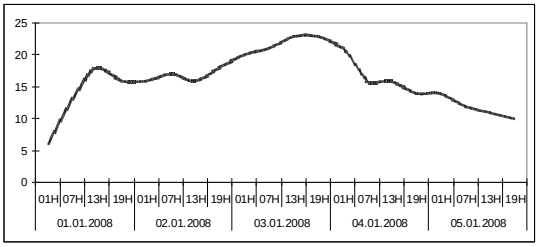

FIG. 5: Wind speed, m/s, Gloria offshore platform, 01.01-05.01.2008

The air temperature contrast between the cold and dry continental air and the warm and humid maritime air, which intensifies the wind, can attain 10°C (+5°C at Gloria due to the warm sea and –5°C at Constanta the 08.12.1991).

CONCLUSIONS

The most severe storms along the Romanian Black sea coast are the consequence of the decreasing geopotential associated with a mediterranean depression at sea level, with travelling disturbances from the Mediterranean sea to the Black sea. The dynamic of the two atmospheric centres at sea level - the continental anticyclone and the depression determines the wind force.

This study can contribute to a better recognition of similar synoptic situations with the main purpose to better evaluate severe storm risks.

REFERENCES

Chiotoroiu B., Ciuchea V., 2009: Severe weather conditions and maritime accidents along the Romanian Black sea coast, *Proceedings of the Marine Traffic Engineering Conference*, Malmo, Suedia, October 2009, Publisher Maritime University Szczecin, Poland (in print).

Chiotoroiu B., 1999: *Les tempêtes dans le bassin occidental de la mer Noire*, Presses Universitaires du Septentrion, Lille, France, 224 p.

Chiotoroiu B., 1997: Situation météorologique particulière. Tempête en mer Noire, *MetMar (Météo France)*, 177: 39-41.

Cordoneanu E., 2004: Atmospheric meso-scale phenomena related to the Black Sea proximity, *Proceedings of the International Workshop "Black sea Coastal-Air-Sea Interaction. Phenomena and Related Impacts and Application"*, 05/2004, Constanta, Romania, 469-479.

Draghici I., 1988: *Dinamica atmosferei*, Edit. Tehnica, Bucuresti, 475 p.

Trigo I.,Bigg G.R., Davies T.D., 2002, Climatology of cyclogenesis mechanisms in the Mediterranean, *Monthly Weather Review*, vol. 130: 549-569.

www.wetterzentrale.de/topkarten/fsrea2eur.html, Archiv der Reanalysis – Ubersichtskarten (checked on September 8, 2009)