

BLACK SEA BARIC DEPRESSION

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Key words: baric depression, atmospheric pressure, retrograde movement, occlusion, precipitations.

Abstract. This work is meant to demonstrate that, in the special synoptic conditions, on the surface of the Black Sea, a baric depression is being formed. This depression is formed when the Black Sea's water temperature is higher than the surrounding continental ground's temperature. There are situations when the baric depression of the Black Sea occurs because of the consequences of the movement of another baric depression from the east of the Mediterranean Sea to its north-east side. Due to the high atmospheric pressure of the continental zone that's surrounding the Black Sea, the baric depression will get a retrograde movement, towards the north or north-west. Eventually, this depression occludes in the eastern continental zone of Europe or even near the Baltic Sea. During a retrograde movement of a baric depression, the atmospheric precipitations will fall in big quantities, in many situations, causing floods.

Introduction

On the surface of the Earth there are regions from temperate and subtropical areas, where the baric depressions (cyclones) gain retrograde movements, meaning in another way than the general circulation of the atmosphere from these areas (from the west to the east). This category includes typhoons from the eastern Asia and hurricanes from the eastern North America.

It is required intense warming ocean waters for the initial formation of these cyclones, which can take place in the conditions of a clear sky, that is a period of sunshine. The sea and ocean water is getting warmer itself, but it takes a longer time to get cooler. It's needed an anticyclone regime (high air pressure) to achieve a longer period of sunshine, where the cloud cover is reduced. If this anticyclone regime lasts more than seven days, the sea and ocean water absorbs large amounts

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of heat that is yielded in a longer period of time. When the anticyclone system is replaced by a cyclonic one, and the continental territory around is getting cooler, the air over the sea is getting warmer and gains an upward movement, specific for the baric depressions (cyclones)

In fact, the Black Sea baric depressions with retrograde displacement are some tiny hurricanes, given their size and the consequences of their action.

1. The formation of Pontic baric depressions.

From the synoptic data analysis it results that, in the formation of Pontic baric depressions, there are two possibilities:

The first possibility is that of an occurrence of a baric depression even on the surface of the Black Sea. The second possibility is about the movement of a baric depression (cyclone) from the east of Mediterranean Sea and Small Asia to the north-east and north.

1.1 The formation of baric depressions directly on the surface of the Black Sea. These baric depressions could appear on every season, but the biggest frequency is at that from the end of spring and the beginning of summer, like that from the end of warm season and the beginning of cold season. For demonstrating of the formation of this type of baric depression with retrograde movement on the surface of Black Sea there were taken six points of weather observations from its seashore. These are: Constantza (Romania); Zoguldak and Samsun (Turkey); Soci (Russia); Keri and Kherson (Ukraine).

For the formation of this kind of baric depression with retrograde shifting it must exist more previous periods in which the air temperature exceeds 25°C (77°F), and the atmospheric pressure has daily average values of over 1015 mb, at sea level.

An example of this kind of baric depression of the Black Sea, with retrograde movement is the period between May 29th - June 3rd 1997. In the periods prior to the formation of this baric depression, the maximum daily temperatures in the observation points around the Black Sea have exceeded 80 °F (26,7°C) and even 90°F (32,2°C).

In figure 2 it is presented, by graphics, the daily course of the maximum and minimum temperatures in the periods May 5th – June 3rd 1997, in the observation points around the Black Sea.

From the analyses of these charts one can conclude that there were two warming periods in the points of Constanta, Zonguldak, Samsun and Soci (May 5th – 10th 1997 and May 16th – 25th 1997) and a single longer period (May 5th – 26th 1997) for the points in Ukraine (Kherson and Keri). These warmer periods have contributed to the warming of the Black Sea waters. The high values of the air

pressure have also contributed to the warming of the Black Sea waters by keeping the sky clear, which allowed the Sun to shine for a long period of time.

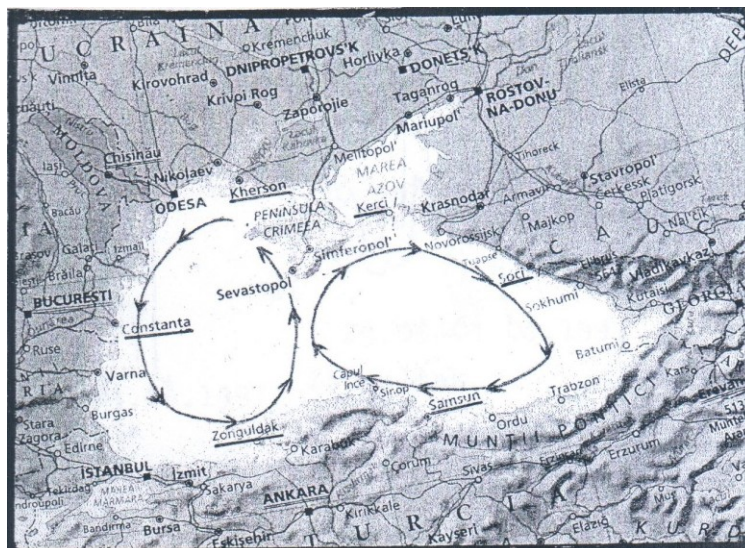


Figure 1. The Black Sea. The observation points and the surface sea currents.

In figure 3 it is presented, by charts, the evolution of the daily medium values of the air pressure at the sea level (zero meters), in the points selected for observations, during May 5th – June 3rd 1997.

From the analyses of these charts it results that there were two periods of time during which the air pressure had high values (May 7th –17th and May 23rd –28th 1997), over 1020 mb. Starting with the day of May 29th 1997 the air pressure has dropped, helping at the occurrence of the baric depression. This depression has gained a backward movement on the following days, as it can be seen in figures 4–7.

The backward movement of this baric depression is obviously starting even with the day of May 30th 1997. On June 2nd 1997, the baric depression reached nearby the Baltic Sea, where it occluded. Instead of this baric depression an anticyclone occurred.

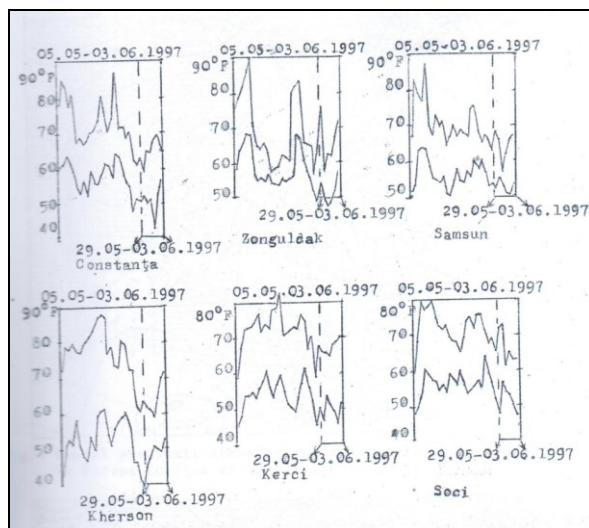


Figure 2. The evolution of the daily maximum and minimum temperature in the observation points around the Black Sea, during the period of May 29th - June 3rd 1997.

The period of the retrograde evolution for the baric depression May 29th - June 3rd 1997.

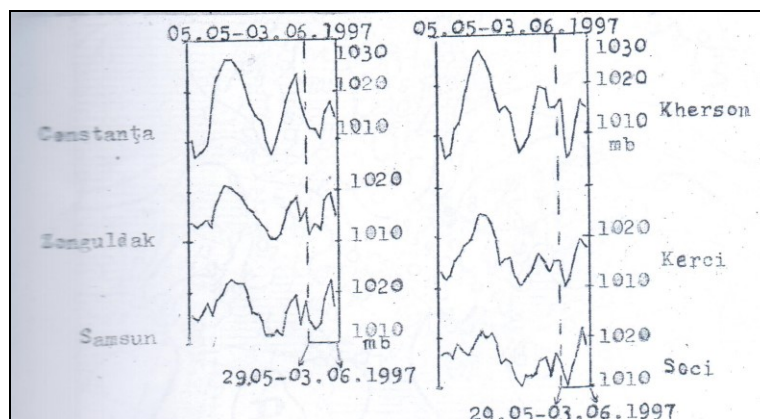


Figure 3. The daily movement of the atmospheric pressure (daily average values at the sea level) in the points around the Black Sea, during the period of May 29th - June 3rd 1997.

The period of the retrograde evolution for the baric depression May 29th - June 3rd 1997.

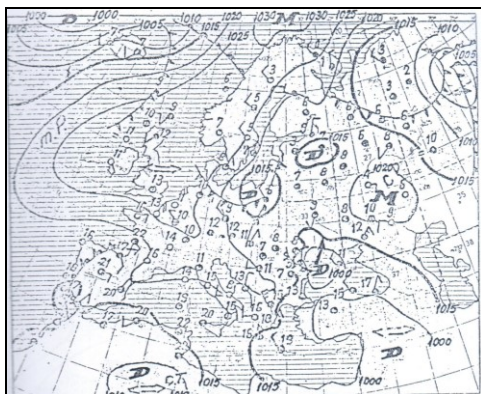


Figure 4. The field of the atmospheric pressure at the sea level (zero meters) in Europe, on the 30th of May 1997, 00 GMT

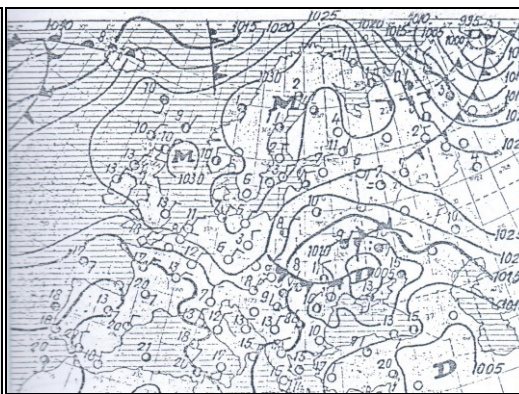


Figure 5. The field of the atmospheric pressure at the sea level (zero meters) in Europe, on the 31st of May 1997, 00 GMT

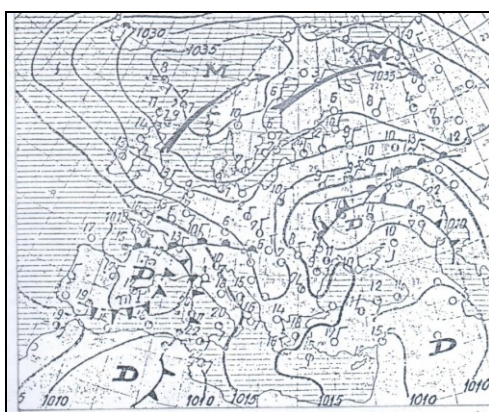


Figure 6. The field of the atmospheric pressure at the sea level (zero meters) in Europe, on the 1st of June 1997, 00 GMT

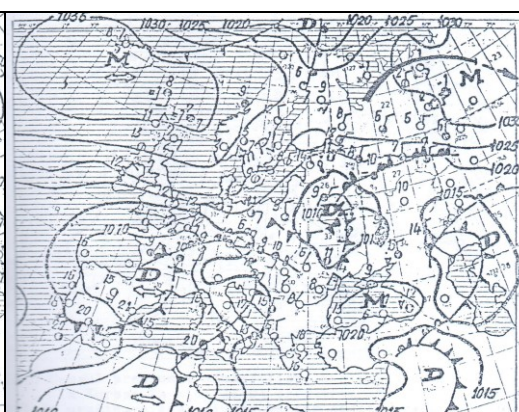


Figure 7. The field of the atmospheric pressure at the sea level (zero meters) in Europe, on the 2nd of June 1997, 00 GMT

On the days when this baric depression had a relegated movement (29.05-03.06.1997), the cold front merged with the warm front, forming the occluded front, which led to the recording of some big amounts of rainfall. The remarkable ones are the ones from Romania (Galati=127 mm; Constantza=146 mm; Botosani=106 mm), Ukraine (Odesa=127 mm; Kerson=96 mm; Cernăuți, 62 mm), Turkey (Zonguldak=206 mm; Samsun=126 mm) and Russia (Sochi=56 mm).

1.2. The making of the baric Pontic depressions origin from the Mediterranean Sea. The baric Pontic depressions with a retrograde motion can take birth by the movement to the east or north-east of a baric depression from the eastern Mediterranean Sea and Asia Minor. At one point, this baric depression, arrived already at the western half of the Black Sea, amplifies and gains a retrograde motion to north or even north-west. In this situation as well, in the prior period of the appearance of the baric depression with a retrograde movement, the temperature of the Black Sea's water is high. This aspect is emphasized by the maximum and minimum daily temperatures in the observation points in the western half of the Black Sea (Constantza, Kherson and Zonguldak). High temperatures are also noted in the other observation points.

An example according to this type of baric depression with retrograde motion is the one that acted between the 1st- the 6th of October 1998.

Between the 1st- the 3rd of October 1998 a baric depression in the central and eastern part of the Mediterranean Sea acted, which had a movement from west to east (normal), as you can see in figure 8.

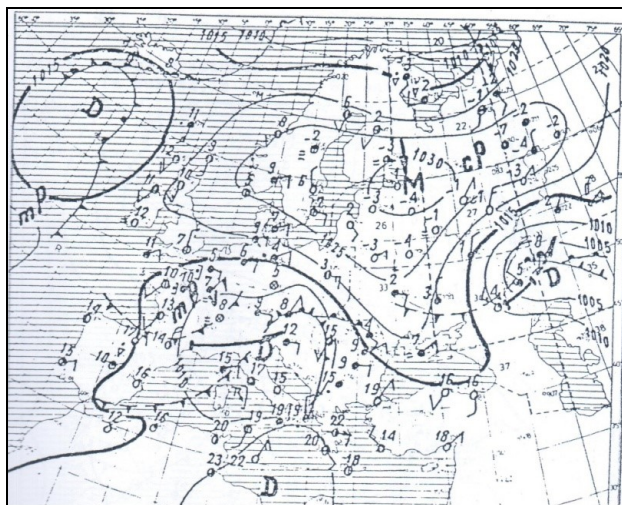


Figure 8. The field of the atmospheric pressure at the sea level (zero meters) in Europe, on the 3rd of October 1998.

On the next days the Mediterranean atmospheric pressure reached the Balkan Peninsula (figure 9), after which it had a retrograde movement, arriving in the north-west of the Black Sea (figure 10).

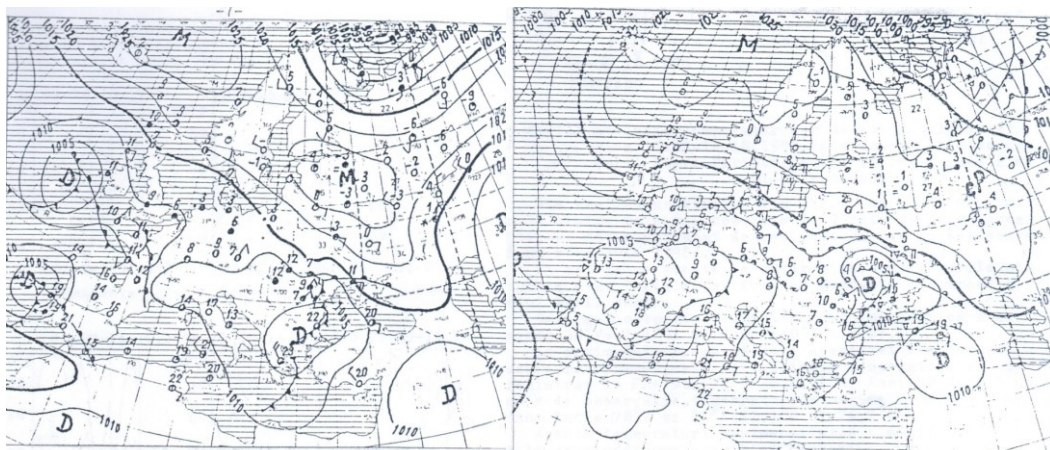


Fig. 9. The field of the atmospheric pressure at the sea level (zero meters) in Europe, on the 4th of October 1998.

Fig. 10. The field of the atmospheric pressure at the sea level (zero meters) in Europe, on the 5th of October 1998.

The evolution of the daily maximum and minimum temperatures in the previous periods, during the retrograde movements, but during the after period too, can be seen in figure 11.

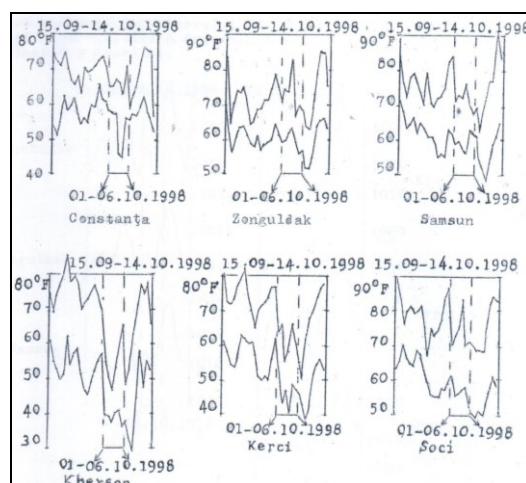


Figure 11. The evolution of the daily maximum and minimum temperatures in the 15th of September - the 14th of October 1998, in the observation points set around the Black Sea. The period of the retrograde evolution of the baric depression: 1st – 6th of October 1998

Based on the analysis of the graphics from figure 11, it can be established that the lowest temperatures at Constantza were recorded right when the baric depression with retrograde movement worked. (the 1st –the 6th of October 1998)

In the other observation points, the lowest temperatures were recorded after the baric depression had left the Black Sea territory.

The daily minimal temperatures were registered at Kherson(30°F = -1.1°C) and Kerçi (40°F=4.4°C)

In the periods preceding the arrival of the baric depression with retrograde movement, the highest daily maximum temperatures were registered at Kherson(86°F =30.0°C) and Soci(90 °F= 32.2°C). In the other observation points ,the daily maximum temperatures had values between 70 °F and 80 °F (21.1 °C and 26.7 °C).

These daily high maximum temperatures recorded in the periods preceding the onset of the baric depression with retrograde movement contributed to increasing the temperatures of the waters of the Black Sea at their surface , which was a contributory fact to the onset of this depression.

A contributing factor in the increase of air temperature and implicitly of Black Sea's water at the surface in the preliminary period of appearing of the baric depression with retrograde movement was also the high atmospheric pressure in the period of the 22nd -30th of September 1998. The high atmospheric pressure determined a clear sky, with a long duration of sunshine.

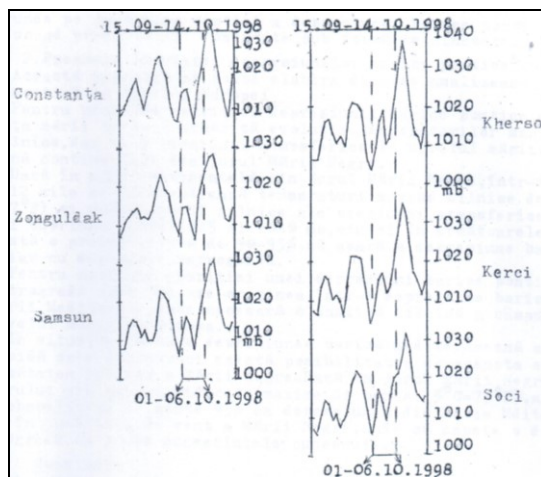


Figure 12. Daily statistics of atmospheric pressure (daily average values at sea level) in the points around the Black Sea between the 15th of September and the 14th of October 1998. Retrograde evolution period of baric depression: 1st of October 1998.

From analyzing the graphs in figure 12, it can be found that, after occluding the baric depression with retrograde motion, in the Black Sea area, the atmospheric pressure has registered a significant increase. In the observation points around the Black Sea, between 7th and 10th of October 1998, the atmospheric pressure at sea level has registered values between 1030 and 1040 mb.

In the case of this retrograde motion depression, significant amounts of precipitation have been registered. Thus, from 1st to 6th of October 1998, there have been the following precipitation amounts: In Romania, Constantza=59mm; Braila=71mm, Vaslui = 95mm. In Ukraine: Kherson=40mm; Cernauti = 55mm; Vinnita = 122mm. In Turkey: Zonguldak = 122mm; Samsun = 131mm.

The large amounts of precipitations come mostly from the cold front's actions that were united with the warm front, during evolution, forming the occluded front.

In the majority of cases, baric depressions from the Black Sea with retrograde motion with origins in the Mediterranean Sea occupy only the western part of the Black Sea, where they amplify because of the marine surface currents that have a counterclockwise motion here, the same as that of the baric depression.

The baric and marine depressions with backward displacement may also appear during the winter, when the Black Sea's waters on surface and the air above have higher temperatures than the shore around. In this situation, a baric depression appears on the surface of Black Sea's waters. If an anticyclone develops, at the same time, in the northeast region of Europe, then, this baric depression will get a retrograde movement and will unleash a blizzard phenomenon. The cold air from the east of the Europe will pervade in the western half of the baric depression with high speed, bringing significant precipitations as snow.

2. The forecast of baric Pontic depression with retrograde movement occurrence

This forecast can be elaborated if the synoptic situation across Europe is analyzed every day.

For the forecast of baric Pontic depression occurrence directly on the sea surface the evolution of maximum and minimum temperatures must be followed every day, but also the evolution of the atmospheric pressure at the sea level (zero meters) in the continental area around the Black Sea.

If in the continental area around the Black Sea in a period of 8-12 days, daily maximum temperatures over 25 °C (77 °F) and daily medium values of the atmospheric pressure at sea level of between 1015 and 1030 mb are recorded, the in the next 3-6 days there is a probability of 90-95% of a baric depression to appear, even with retrograde movement.

For the forecast of baric Pontic depression with retrograde movement apparition which has its origin in a baric depression from east of Mediterranean Sea, it is necessary a daily analyze of baric field at sea level in Europe.

In the situation in which the baric Mediterranean depression has a fast movement to east, then there is the possibility for this to reach the west of the Black Sea. If around the Black Sea the air temperature has high values 9 maximum over 25°C= 77 °F), then there is a probability of over 95% of the depression from Mediterranean Sea to reach the west half of the Black Sea, where to gain a retrograde movement with all known consequences.

Conclusions

From the analysis of the summery situations concerning the evolution of the Pontic baric depressions with retrograde movement it emerges the following conclusions:

- The Pontic baric depressions with retrograde movement form directly on the surface of the sea or by the movement of a baric depression from the eastern Mediterranean Sea;

- The most important Pontic baric depressions with retrograde movement form at the end of spring and the beginning of autumn;

- During winter, these Pontic baric depressions determine the appearance of the blizzard phenomenon;

- During summer, the Pontic baric depressions with retrograde movement determine large quantities of rainfall, in many situations causing floods;

- A forecast of the appearance of these Pontic baric depressions can be elaborated only if the summery situations are analysed daily European level.

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