CLIMATIC HAZARDS IN THE WARM PERIOD IN DOBROGEA

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ABSTRACT. - Climatic hazards in the warm period in Dobrogea. Climatic hazards occurring in the warm period all over Dobrogea have in common the positive temperatures. The different warming degree, either having a radiative nature , or with the penetration of warm tropical air (continental or maritime) is the main cause for genesis/occurrence and territorial climatic hazards differences in the warm period.Therefore, the abundant rain, the hail storm, etc depend on the intensity of the thermal convection. The contribution of the warm tropical air, to the amount of continental air masses leads to massive warming; these, combined with the thermal convection, against the background of a predominantly anti-cyclonic weather, generates episodical droughts (in spring, summer, autumn). I have to mention that there are also cases when dryness phenomena and drought happen regardless of the thermal summer or winter conditions. Therefore, in the warm period of the year, I have identified in Dobrogea the following climatic hazards: hail, pouring rainfall, massive warming, to which are added tornadoes and waterspouts.

Key words: climatic hazard, hail, pouring rainfall, tornado, waterspout, massive warming.

1. General considerations

Climatic hazards occurring in the warm period of the year in Dobrogea have in common the positive temperatures. The different warming degree, either having a radiative nature , or with the penetration of warm tropical air (continental or maritime) is the main cause for genesis/occurrence and territorial climatic hazards differences in the warm period.

2. Climatic hazards in the warm period

2.1 Hail

Hail is a form of solid rain, made of transparent or opaque ice particles, having different shapes (spherical or angular), sizes (variable diameter between 0.5 and 50 mm) and weight (from a few grams to over 300 grams), which fall during rain showers, along with tempest phenomena (thunder, lightning) and hard wind.

2.1.1. Average annual number of days with hail in Dobrogea

The average frequency of days with hail in the Dobrogea area depends on : the thermo-baric contrast between sea and shore/land, the instability of the air masses, the exposure of the relief to the solar rays and the advection of humid air masses, the relief configuration, the altitude, etc.

Fig. 1. Average annual number of days with hail in Dobrogea (1965-2005)

Therefore, the frequency of hail decreases, in general, from the seashore and the Danube Meadow (areas with more humid and unstable air), to the central part (i.e. the warmer and drier area, therefore more stable) figure 1; therefore, in other words, the days with hail decrease as the continental area increases.

2.1.2. The maximum number of days with hail in Dobrogea

This number has been in all cases 2-3 times bigger than the average annual number of days and it did not occur in all country areas, highlighting the local and regional characteristic features of the thermo-baric contrasts.

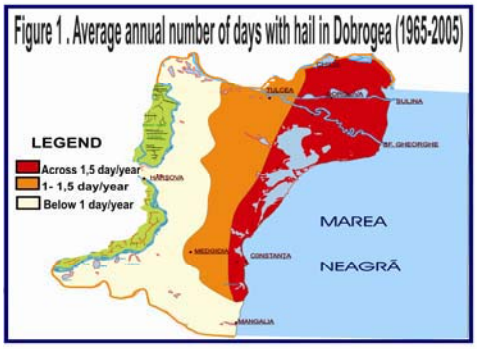

Fig. 2. The maximum number of day with hail in Dobrogea (1965- 2005

Therefore, in the Danube Delta the maximum number of days with hail was 3days/year; at the seaside, the maximum number of days with hail was 4days/year; in the central and western part of South Dobrogea the maximum number of days with hail was 5-6days/year, figure 2.

Among the years with most days with hail we mention: 1967, 1969, 1970, 1975, 1977, 1979, 1982, 1984, 1992, 1999, 2005.

2.3. Duration of hail

The average duration of hail is from a few minutes up to 15 minutes, observing once again, a differentiation of the maximum duration:

- in the central and northern part of Dobrogea, around 30% of the cases had a maximum duration of 15 minutes.

-at the seaside, around 65% of the cases had a maximum duration of 5 minutes.

There have also been cases when hail occurred having an exceptional duration, as it happened in May 1974 in Constanta (12 minutes).

During an average year, hail can lead to a total average of 0.3 hours in the higher areas from the north and centre and 0.1 hours at the seaside.

The maximal duration of hail is 2-3 times bigger than the average one.

• 0.6 hours in Constanta and Sulina (on the seaside).

• 0.7 hours in Medgidia and Corugea (in central and north part of Dobrogea)

2.4. Pouring rainfall

Pouring rainfall occurs in the warm period of the year as a result of the intensification of the Azoric Anti-cyclone activity, as well as of the intensification of the Mediterranean and oceanic cyclone. These generate a great amount of water, which falls in a very short spell, so they have a great intensity and cause great freshets that can have serious consequences on buildings and settlements.

The fundamental processes that lead to the appearance of clouds, capable of producing great amounts of rainfall, are, as already known, convection and boisterous exchange within the air masses.

Summer rainfalls in Dobrogea are frontal and usually occur during the day, as showers.

The correlation curve between the distance from the Black Sea of the pluviometrical points and the maximum daily amount of rainfall (24 hours) from every summer month looks similarly to the one of the average amount of rainfall in Dobrogea in the warm period (April - October).

The maximum amount of precipitations (24h) decrease gradually towards the shore, starting from 30-35 km , with the tendency of reaching the smallest values on the Black Sea coast. The significant factor/index/rate of correlation between the distance from the sea and the daily maximum quantities of precipitations (24h) confirm their obvious influence on the repartition/allotment of precipitations in Dobrogea.

During the warm period of the year and in summer months in particular, the longitudinal distribution of izohiet, according to the position of the seashore

and their rapid growth within mainland, encompasses a wider surface in the south of Dobrogea, where, compared to the north of Dobrogea, there is a fragmented relief. In the south of Dobrogea, the front of the sea breeze , which penetrates mainland, is somehow influenced by the steppe plateau, due to the low altitude and its relatively small fragmentation.

A particularity of the territorial distribution of the maximum daily amount of precipitations (24h) is that , in summer months, the biggest amounts are recorded at the distance of 30-35 km from the shore of the Black Sea, i.e. at the distance where the rise of the value of the izohiete within mainland disappears due to the attenuation of the influence of sea breezes.

Table 1. Maximum amount of rainfall in Dobrudja in 24 hours (1920-2007)

Place	Amount of rainfall (mm/sm)		Place	Amount of rainfall (mm/sm)	
	Maximal value in 24 hours	Multian nual average		Maximal value in 24 hours	Multian nual average
Cogealac	19.3/ 28.08.2004	378.5	Biruinta	222/03.07.2005	399.0
Mangalia	21.9/28.08.2004	412.3	Cernavoda	77.2/28.08.2004	467.7
Aliman	27.8/28.08.2004	470.2	Amzacea	82.6/28.08.2004	406.0
Ostrov	30/28.08.2004	484.0	Saraiu	84.4/28.08.2004	434
Oltina	35/28.08.2004	480.1	Crucea	105/28.08.2004	431
Negureni	37.2/28.08.2004	460.7	Cobadin	106.0/03.07.2005	443.7
Mihai Viteazu	37.8/28.08.2004	325.0	Mircea Voda	120/28.08.2004	440.5
Silistea	57/28.08.2004	430.3	Lumina	147.7/28.08.2004	390.2
Negru-Voda	59.2/28.08.2004	504.8	Valul lui Traian	151.5/28.08.2004	391.4
Adamclisi	59.8/28.08.2004	472.8	Techirghiol	200.7/03.07.2005	362.1
Independenta	60.2/28.08.2004	460.6	Mamaia-Sat	200/28.08.2004	390
Medgidia	83.4/03.07.2006	435.7	Constanta	205.5/28.08.2004	386.8
Pestera	83/03.07.2006	410.2	Agigea	280.5/28.08.2004	411.0
Harsova	76.6/28.08.2004	407.6	Pantelimon	312/28.08.2004	425.5
Sulina	219.2/29.08.1924	320.0	Corugea	81.5/06.07.1991	385.5
Tulcea	79.3/06.07.1991	455.0	Sf. Gheorghe	134.5/27.08.1997	351.7
Jurilovca	80.2/06.07.1991	335.0	Chilia Veche	83.7/03.08.1997	348.2
Gorgova	79.0/06.07.1991	404.6	C.A. Rosetti	530.6/29.08.1924	345.5

During downpours, the quantity of waters is in direct ratio with the intensity and the duration of the rain, and dependent on its genetic characteristics.

The largest quantity of water is recorded during showers of frontal origin, when the thermo-baric contrast is very high.

Between 1920 –2005, the largest amounts of water, over 100mm, during some showers, lasted up to 60 minutes and were possible in all regions of Dobrogea, table 1.

3. Tornadoes and waterspouts

Tornadoes. The word "tornado" comes from the Latin "tonare" which means "to roar". The tornadoes are violent atmospheric perturbations, of reduced dimensions, a swirl , under the form of a column which rotates very quickly or a reversed funnel which touches the ground. However, meteorologists do not think it is so easy to define a tornado.

The tornado becomes extremely dangerous when: it occurs in high season of vegetation when the trees and the vines are blooming; it is accompanied by very powerful winds; the duration of the phenomenon is long; it occurs in inhabited areas.

In Dobrogea there have occurred tornadoes before the discussed period (1990-2005), but they were not brought to the attention of the public, especially before 1989. Among the most recent tornadoes which have produced great damage to the economy in Dobrogea , should be mentioned:

- July 30, 2002 in the area of Rahmanu village in the Danube Delta
- August 12, 2002 in the Central –West (also known among the specialists as the "tornado from Facaieni"), which will be dealt with in the next case study.
- May 7, 2005 – when no less than 9 tornadoes occurred in the area : Harsova (Ciobanu village), Olimp, Cernavoda, Nicolae Balcescu, Topolog.
- April 21, 2008 the Nuclear Plant from Cernavoda was disconnected on Tuesday night from the National Energetic System , due to violent storm in the Cernavoda area which led to anomalies in the evacuation system of the electric power.

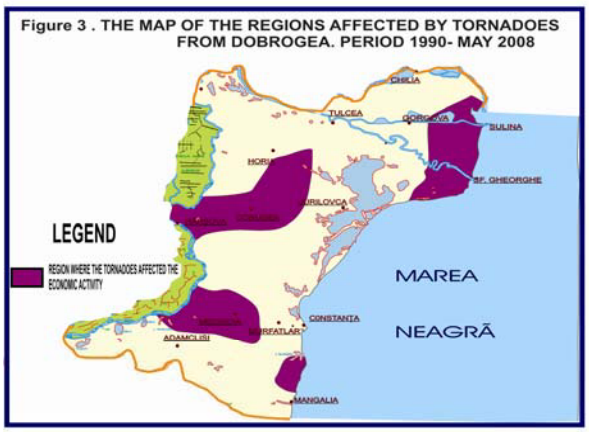

Fig. 3. The map of the regions affected by torandoes from Dobrogea. Period 1990 mai 2008.

Dobrogea, alongside the eastern part of the Romanian Plane, is the most suitable region for tornado occurrence (between 1990- May 2008 the most affected regions were in the central –western part, the

Danube Delta and locally in the seacoast area – fig. 3) , which explains the high frequency in these areas. Meteorologists consider that the number and the intensity of tornadoes will increase due to global warming.

The Regional Meteorological Center from Dobrogea monitors non stop all special meteorological phenomena, using the latest equipment, found only in the U.S.A. Although the designated area is represented by Dobrogea and the west of the Black Sea, satellites monitor a much vaster area. In spite of all these, tornadoes are phenomena which cannot be foreseen, only guessed. In order to be sure of the existence of a tornado, there should be visual contact. It is easy to mistake a blast for a tornado , which should necessarily contain a vortex.

The warning and monitoring systems for these phenomena do not exist, the inhabitants being left at the mercy of fate. For example, if a tornado were to affect the city of Constanta, people could find refuge in civil shelters. And this if, fortunately, the Inspectorate for Emergency Situations would have time to announce the population. There is, however, the problem of shelters. Most of them are disabled or flooded because of old water pipes from the basements of blocks of flats. Some of those functional ones are used for the storage of pickles and other items belonging to the tenants. Moreover, they are extremely difficult to locate. The Civil Protection marked the blocks where such shelters exist with the letter "A" in white paint. But taking into consideration the fact that when suck disaster strikes chaos sets in, it is left to be seen how the shelters will be found, especially because apart from those who take care of them, there are very few people who know about the existence of such places, and even fewer will walk looking at the walls of blocks. At the moment, in Constanta there are only 56 such shelters which can be used in the case of a disaster.

Although it seems a reasonable number, they would accommodate only 23% of the current population. To this percentage we can add a few, taking into consideration that the Civil Protection has also shelters which can be used and built when necessary.

The waterspout. The waterspout represents a phenomenon of the nature of a whirlwind made up from a funnel-shaped or tubular portion of a cloud over the ocean or other body of water that, laden with mist and spray, resembles a solid column of water reaching upward to the cloud from which it hangs. In case it reaches the ground it takes up dust particles, sand and different debris or objects lifted up.

This phenomenon is considered a hydrometeor, due to the presence of water particles from the cloud and the sea surface, or any other surfaces it wipes out.

The devastating effect of waterspouts depends both on their intensity and duration. These are amplified by numerous other characteristics of the active surface such as: the presence of vegetation**,** the moment of the year when the

shower occurs (if it occurs in summertime when the beaches are full of tourists) etc. In these situations the waterspouts can become climatic hazards, triggering deflation processes, the destruction of the buildings around the beaches having repercussions on the entire sea coast area and on people's lives and activities also.

In the discussed period , 1990-May 2008, three such cases were signalled in the sea coast area: July 19, 2002 – Gura Portiței; May 7, 2005- Olimp, July 10, 2005 – Neptun.

The first case occurred in the summer of 2002, when in July-August, 2 special hydro-meteorological phenomena were signalled on the Romanian seashore: on sea moving towards the beach (waterspouts); in Baragan, at Făcăieni, having its origin near the lake Babadag (Northern Dobrogea) moving towards the West (according to statements from the Babadag pluviometric station).

The phenomenon described occurred on July 19, 2002, between 8.10-8.30 in the morning, moving from the sea towards the shore. The temperature in those days was between 28-32 C (14-18 July). At the moment of occurrence, the air temperature at Gura Portitei station was 29C , an unusually high temperature for a station on the Black Sea coast at that particular hour.

The waterspout noticed at Gura Portiței on July 19, 2002 occurred between 8.10-8.40.

It occurred during some days with high temperatures 28-32C; the air moisture between 70-85%, and the air pressure between 1010,0-1011,5 mb. For the period 15-19 July. At the moment it occurred the few people on the beach panicked, reaching for their belongings and running.

From the testimonies of those presents we may say that the phenomenon started accompanied by a roar followed by a typical whirlwind raising from the surface of the earth reed, dry grass, leaves and sand from the private beach.

4. Massive warming

As Dobrogea is situated in the temperate climatic area and in a continental area with multiple climatic influences, it is crossed by waves of tropical heat which determine high positive variations of air temperature from the normal one, sometimes having unique values or climatic records (Bogdan, 1992, 1994, Bogdan, Niculescu, 1992).

Between 1965-2005, in Dobrogea, there have been many situations when the absolute maximum temperatures past 30C in the hottest months of the year (July, August) and even from may to September. But not every tropical day can be the result of an accentuated warming. This depends on the persistence of the mass of anticyclonic air which determines the frequency of tropical days and the frequency of warming processes.

In the case of the problem studied only the absolute maximum temperatures (≥ 30 C) were taken into consideration from the meteorological stations from Dobrogea, between 1965-2005, which we called massive heating . It is obvious that this calculus ignores a series of values ≥30 C which, although present, did not become absolute maximum during the entire period of observations at each station, being surpassed by other higher values; however this does not mean that they cannot be considered as part of massive heating.

Massive heating in summertime has numerous negative effects on the environment, particularly on agriculture (causing plants to die down and even compromising the crops – as it happened in the summer of 2000) and on the people's activity.

An excessive heat, which surpasses the temperature we are used to causes adapting reactions of the organism in order to maintain its interior temperature constant. We add to this the fact that these thermic variations are accompanied by certain values of the other climatic components , which may amplify stress. An excessive high temperature , as it occurs in Dobrogea, in summer months, especially in July (when the most tropical and scorching days are recorded)and a high solar radiation , with very low or very high humidity, amplifies the sensation of drought and stuffiness.

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