

LITTLE CLIMATE OPTIMUM IN THE CARPATHIAN-DANUBIAN-PONTIC SPACE

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Abstract. Our knowledge of climate during the Little Climate Optimum (VIII-XIV centuries) in our country comes from some historical studies on climatic events occurring in countries around Romania: Hungarian, Italian peninsula, Ukraine, the Balkan peninsula and the region around Constantinople, from foreign chronicles, French, German, Russian, from some notes of foreign travelers in that territory. Were record mostly harsh winters, especially in the early interval, with frozen rivers and the Black Sea, or rainy summers, with floods, but also some very warm winters, with the flowering of trees in January, and summers long, hot and dry. Some of these events led to famine, pestilence, high morbidity.

Introduction

After the last glaciation, the climate on Earth begins gradually to warm.

Historical climatology shows across Europe, heating periods alternating with periods of cooling, among which stands out the Medieval Warm Period (Little Climate Optimum) (between 750 or 800-900 and 1100-1200 or 1300 AD), which will be followed by Little Age Glaciation (between 1300 or 1350 and 1850).

Researchers consider a difference of 0.5-1⁰C average temperature between cold and warm periods. We note, however, that within a few hundred years warm period, harsh winters and rainy and cold summers are numerous, just as in a cold period, can be recorded mild winters and hot, dry summers.

Sources of information about the climate of centuries past

All information about on prehistoric and historic climate use data of "natural archives": glaciers, terrestrial and marine sediments, rings of trees and sporo-pollen analysis.

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Also used data from the "archive of society": archaeological remains, data about different phases of vegetation, remarks on climate phenomena: floods, freezing rivers and seas, snow data (early, late, snow depth), drought. (Pfister, 1999). Notations are found in local archives about the value and price of crops, the parish and monastic and royal registers, religious or secular books, calendars, and in chronicles, letters, travel journals, reports of officials etc.

Some hydro-climatic events of the past on Central Europe and the lands around the Black Sea recorded by different historians can be downloaded and for regions around the Carpathians. Researchers Arago, Angot, Hann, Hennig used ancient sources, historians Latin: Titus Livius, Strabo, Tacitus, Zosimus, Teofanus and medieval German, French, Russian and other chronicles.

Romania's past historical conditions were not favorable to building a stable society up by thirteenth and fourteenth centuries, when the Romanian countries were formed. Therefore our knowledge on the climate of past centuries, in this territory, are virtually absent until the twelfth century. So we can not exactly reconstruct the climate of the Middle Ages, but we can get an idea about it.

To have a representation about the Little Climate Optimum in Romania we used climatic data recorded by Ch. Easton and Ch. Pfister, about Europe, also by C. Mihailescu, who used additional data provided by Russian researchers on medieval Russian chronicles, also data in Ch. Lebeau's work on the Byzantine Empire, the data marked by St. Hepites and N. Topor, recorded by Western sources, and data of P. Cernovodeanu and P. Binder, who used German and Hungarian sources, especially for Transylvania.

1. Some hydro-climatic events between VIII-IX-X centuries

During this time we have no historical climate information as strictly territories would later become Romanian countries. There are some foreign historians recorded events in neighboring regions around the Carpathians (Balkan peninsula, the region of Constantinople, the Italian peninsula, areas around the Black Sea or in Central Europe and plains of Ukraine), which might suggest similar climatic conditions in regions around the Carpathians.

Although researchers dealing with climate changes places beginnings of Little Climate Optimum around the years 750-900 AD, (Agostini and others, 2005, respectively Le Roy Ladurie, 2004), informations about cold winters in this period are more numerous than those of warmer winters. This may be due to high frequency of cold winters, after the last major glaciation, or because harsh winters are harder borne by people, and therefore better retained in memory society. Consequences in these cases (famine, epidemics, high mortality) are generally long. If the winter is mild, short, with little snow, the consequences are usually fewer and winter is easily forgotten.

Before 800 AD most of the information relates to harsh winters: 717, 768, 786, 791, 794-795 and especially to "one of the greatest winters ever known" (Easton, 1928), i.e. 763-764, when "all wars, all even civil affairs, stealing suspended by excessive cold that makes you think the total disappearance of people and animals" (Lebeau, 1831). Numerous sources German, French, Dutch, English mention it more detailed or summary. Severity of this winter was exceptional and spread throughout Europe and in Constantinople, the Black Sea was frozen from October to March, and spring floes came to the Aegean Sea. In this century there have been a few warm winters: 739, 767 and 776.

After 800 AD cold periods are still numerous. Black Sea froze in 800, 801, according some sources, 858-859, Adriatic in 850, 859 and 864, (the Venice lagoon froze and carriage could go ice), in 821 froze all the rivers of Europe, in 822, Rhine, Danube. Some of these extreme events have brought famine (in 801, it was very rainy spring, and all year barren) and high mortality of humans and animals, of hunger and cold (in 859-860, when the frost lasted from November to April, even in Italy, so that the seeds of the earth perished, vines were dried and wine froze in pots).

Were registered and warm periods: 800-801 (according to other sources), mild winter, followed by plague in the West, 807-808, winter "soft", very warm and very pernicious, following the terrible floods, 843-844, mild winter until February, 863 warm winter and rainy, windy, 907, 979, 981, drought in east and 999-1000, summers heat and drought unheard, all European rivers and springs dry up.

And in the next century, we have a lot of information about harsh winters. Thus in 932-933 was frosty winter and froze the Black Sea, in 943 and 981 winter was hard throughout all central Europe, in 992, was long and frosty winter in southern Europe. Were recorded and questionable information, for example that in 993 on July 15 (?) as frozen lakes and fish perished.

It is also a terrible storm recorded in 906 in Constantinople, with south-west winds that brought trees from the root, destroyed houses and churches. In 907 and 979, major droughts in Ukraine, in 981, a summer drought in Russia, in 945, large spring flood in Kiev (the oldest evocation of a flood on the river Dnieper).

In 994 was exceptionally hot and dry summer that almost all rivers of Europe dried up. Some of these phenomena have produced disasters: epidemics, death and famine.

From the information above, we can conclude that Little Climate Optimum, in Eastern Europe, it began not in the ninth and tenth centuries, but with 100-200 years later than in Western Europe.

2. Hydro-climatic information in the eleventh century

In regions around Romania harsh winters recorded in 1008, 1010, 1020, 1035, in 1060, hard winter in the Lower Danube, in 1077, frosty winter in Eastern and Central Europe. Black Sea froze in 1008, 1011, (Bosphorus) and in 1076.

Dry years (especially dry summers) were 1008, 1017, 1024, 1035 (in the East did not rain for 6 months), 1037 (over 6 months of drought in Thrace and Macedonia) and 1067. Rainy summers: 1009, 1012, 1015, 1016, 1020, with floods: 1012 (Danube), 1093 (Dnieper), 1096 (near Constantinople). Many of these events were followed by crop compromised, invasion of locusts, famine, pestilence, high mortality.

3. Hydro-climatic data in the twelfth century.

Most information relates generally about the cold winters, which usually makes it difficult people life. So cold periods are recorded: in 1100, hard winter in Thrace, in 1133, cold winter in Italy and Hungary, in 1044, snowy winter in Kiev, in 1167-1168, the Black Sea froze.

Rainy summers with floods: 1108, floods in Russia (around Kiev), 1150 (Danube), 1156, flooding in all European countries, 1162 and 1164, floods (Nistru), 1193, flooding in the upper Danube region. In 1177, the Russian winter was warm.

Begin to be recorded and some hydro-climatic exceptional events on Romanian territory that justifying the inclusion of this century in the medieval warm age. For example, in 1136, in the Western Plain ruled a hot summer and the rivers have dried up, in 1142, also in the Western Plain, was a hot and dry summer, famine, many people died. In 1186, trees flourished in January, birds had eggs and in late January, apples were as a nut, and the warmth make that all cultures have developed quickly. Some of these exceptional events bring again famine, epidemics, high mortality.

4. Special events in the thirteenth century

On the Romanian territories recorded some remarkable events. If we associate with information around the country, we can see clearer the profile of the climate of this time.

In 1209-1210, a terrible winter is felt throughout the Balkans, the Black Sea froze.

In 1216, was rigorous winter in Italy, Po river froze, froze wine in cellars, the weather was frosty and in east, followed a rainy summer with epidemics, poor harvests, famine.

In 1223-1224, in Russia was an unprecedented drought, forests and swamps burned "we all went through dry Dnepr" (Russian Chronicle, quoted by

Mihailescu, 2004). After a two-year of drought, rainfall was so great that all the fruit rotting on the field and throughout all Russia was famine.

In 1225-1226, on December 6, pastures flourished in Transylvania.

In 1232, Bosphorus froze, and summer was rainy: in July-August Danube overflowed. In 1234, was a hard winter, wine froze in cellars, froze the Black Sea and the Adriatic Sea,

In 1234-1235, summer was rainy and there were floods in the Danube basin, in 1236 was a very rigorous winter across Western and Central Europe, with rivers frozen, "Our old Danube river froze in depth", (Hepites quoted by Topor, 1964) then followed five months of drought in summer.

In winter 1241-1242, fell much snow, in Christmas was terribly cold, and Danube froze, cold spread to southern Europe and froze Po in Italy. Famine caused by poor harvest and increased because of terrible depredations of the Tatars, was followed by a great epidemic, probably the plague, with many victims. Famine and plague were extended until 1245, with repercussions in south of the Carpathians, "Cumania" (Wallachia), "remained almost depopulated." (Cernovodeanu, Binder, 1993)

In 1246, it was frosty winter in Central Europe and in Ukraine, "... horses perished because it was deep snow and could not get food in it", wrote papal legate Plano Caprini in his journey when to the Mongol Empire was forced to travel on ice Dnieper. (Mihailescu, 2004). The Black Sea was frozen over an area of over three miles of the shore. In 1247, in Kiev principality was big snows. In 1254, in the Danube countries, there has been strong frost in January. In 1267-1268, between Christmas and Epiphany occurred in the middle Danube an outpouring winter, in 1270, cold winter in Central Europe, Bohemia, Hungary, (in Novgorod, snow fell on 25 March covering many courts and people), in 1280 were large floods caused by overflowing Danube

In 1288-1289, in Christmas trees given in flower, and in April, blossomed vines. It is noted that in this exceptional winter, children bathed in rivers and harvest took place two months earlier than usual (Zolnay, quoted by Cernovodeanu, Bilder, 1993).

In 1298 was higher drought, forest fires in the southern and central Russia. In 1299 was a summer with little rainfall, so bad fruit on a large territory in the east.

5. Fourteenth century. Little climate optimum end

Since some researchers extend Medieval Warm Period and beyond 1300, we recorded some more special events of this century. In the years 1300, 1301, 1302, 1304 were generally mild winters and short, no snow, in 1301, trees were blooming in January, summers were hot, dry, in 1304 Danube can go by foot.

A very cold winter was 1304-1305, Black Sea froze. In 1312 there were floods caused by overflowing Danube. Major floods in 1317 were followed by a plague in Transylvania and the in Wallachia, with a sharp demographic decline, epidemic spread across Europe ("Black Plague" from 1348 to 1350) (Cernovodeanu, Binder, 1993). In 1322-1323, were frozen shores of the Black Sea. 1327 was a year of mild winter, trees flourished in May in the Western Plain, in the first days of August began harvest. In the winter of 1330-1331 (or 1333-1334), the Arab traveler and geographer Ibn Battutah (1304-1377) accompanying a Byzantine princess to Constantinople through Dobrogea described this winter:

"It was then in the dead of winter. I dressed three coats and three pairs of pants, ... I was standing wool shoes and another pair over a third pair ... furry ... When I washed, the water ... turning into ice and if I shake beard, fall frost... I could not get on the horse because many clothes that were covered, so my companions had to get my ride" (Brătescu, 1923)

In 1338-1340, locusts did great damage to the land from Land of Barsa to Lipova, summer rains have driven them, yet he was hungry. In 1341, it was mild winter in Central Europe, in the east drought, famine and epidemic. It seems that in 1343, winter was warm, strong drought. 1346, 1347, 1348, 1349, 1350 are summers with maximum rainfall, very cold winters, poor harvests, famine, pestilence, in the east.

In 1363, drought, crop failure, famine. In west Plain, Hungarian king Louis I of Anjou ordered his governors to go from house to house, to note the inhabitants grain reserves and surplus to be sold on the market. (Cernovodeanu, Binder, 1993). In 1367, it was a mild winter.

1370 is recorded as rainy year, with large flood. In 1371, in Russia mild winter, hot and dry summer, drought has dried up rivers, lakes, swamps, forests and peat bogs and burned. In 1387, it was a very hot and dry summer. From 28 February to 19 September in Switzerland and Central Europe rained only 6 times. Heat was so great that after several hundred years, summer is called "the old hot summer." (Easton, 1928). In contrast to Russia was a large summer floods.

In 1396, September, Peter von Rez (? - 1396), German knight, participating in the battle of Nicopolis, with King Sigismund of Hungary, writes: "Blow winds and rains terribly and had to go through seeing big water (probably Olt) and many people drowned when. They (local Vlachs) bridges crumbling before us, we had to run all crazy by high mountains and some bad paths through large forests and among men severely ... People were dying of hunger and cold... It took more than seven days." (***, 1968) 1399 was a severe winter throughout the Danube basin.

Conclusions

The period between the VIII-IX and XIII-XIV centuries, called Medieval Warm Period or the Little Climate Optimum, started probably earlier in Western Europe and later in Eastern Europe. Besides the expansion Vikings in Greenland and beyond, in the American continent is explained in part by global warming in north-western Europe during this period.

Information about this period is few and cannot highlight a general climate characterization and about heating or cooling trend. Also, some information is too general, both in time and space: hard winter, but where? Or dry year, but do not know whether summer or winter?

Were numerous hard and long winters in many years, snowy, when the sea and rivers froze, or cold or rainy summer, with floods, especially in the first period. There were, however, some very warm winters, such as 1186, 1288-1289, 1327, 1341. 1343, 1367, 1371, 1387 or hot and dry summers: 1008, 1017, 1024.1035 1037, 1067, 1136, 1142, 1223, 1298-1304, 1363, 1387.

We must also mention that in Eastern Europe the weather was not always like that in Western Europe. For example, in 801, the Black Sea froze while in the West while it was a warm winter, in 1116 in Christmas has been picked fresh strawberries as a chronicle of Liège (Jouzel, Debroise, 2004), but we have no information for Eastern Europe, in 1387, was higher heat and drought in Central Europe, but in Russia were big floods etc.

However, were similar times across Europe, for example harsh winter of 1020, or warm year in 1300-1301-1302. Generally normal times were not mentioned, except in rare cases, anyway because were forgotten easy.

We can appreciate the values of temperature and precipitation, only very approximately, as noted information, such flowering trees in the winter months, which show long positive temperature or height of water during floods, on the walls of city, as known in some French cities.

Perhaps further research will provide more information and clarification in terms of climate in Europe during the medieval warm VIII-XIV centuries.

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