

METEOROLOGICAL HAZARDS IN THE BANAT PLAIN MENTIONED IN ANCIENT AND MEDIEVAL WRITINGS

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Abstract: *Global warming as well as the intensifying effects of meteorological hazards on human society are topics of increasing concern to the international scientific community. However, for a good knowledge of these phenomena, it is absolutely necessary to know their evolution over time, this work being an attempt to build an image of the evolution of meteorological hazards and their effects on the Banat Plain until 1700, using the information from historical sources. Although the number of identified phenomena is not high enough to achieve a climate reconstruction in the researched area, an intensification of such studies, doubled by a correlation with studies conducted for neighboring areas, as well as dendrochronological and other studies, are absolutely necessary not only for making a diagnosis of them, but also for making forecasts on the future evolution of meteorological hazards, at the level of the Banat Plain.*

Key words: *meteorological hazards, historical writings, Antiquity, Middle Ages, impact on human society, Banat Plain.*

1. INTRODUCTION

One of the actual topics of our times is related to global warming and the intensification of extreme weather events. In order to be able to form an opinion about them, we need to know their evolution over time. Even if for the instrumental period these phenomena are easy to follow, due to the existing meteorological data series, for the pre-instrumental period the study of these phenomena can be based only on climatic reconstructions, the latter being realized with the help of three large groups of information sources (Ingram, Underhill, Farmer, 1981): physical – chemical – biological sources, archaeological sources and written and iconographic sources. Without claiming to achieve a climate reconstruction, in the following lines we will focus on the last category,

trying to identify historical sources that mention the existence of meteorological and climatic phenomena in the Banat Plain or in its proximity, during Antiquity and The Middle Ages.

2. DEFINITION OF TERMS AND RESEARCH METHODS

According to UNISDR (United Nations International Strategy for Disaster Reduction) resolution A/71/644 of 1 December 2016, a **hazard** is „a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation”¹. Meteorological hazards are hazards generated by atmospheric activity, in the Banat Plain the most common during the pre-instrumental period being cold or heat waves, rainfall excess, drought, strong winds, hail and thunderstorms.

The working methodology used in the elaboration of this paper falls within the boundary of geography and history, many of the materials used in the writing of this paper being historical works and documents. Thus, the documentation of meteorological and climatic events was made with the help of three categories of sources:

- chronicles written by Romans/Byzantines, Hungarians, Turks etc., historical documents, reports, letters or diaries;
- history works, especially of the history of Banat area;
- databases containing meteorological and climatic events that occurred in different parts of Europe or in Hungary and Transylvania.

Chronicles, letters and journals have the advantage of accurate descriptions, being works of authors more or less contemporary with the events, most of them being narrations of events experienced by the authors. The disadvantages are related to the difficulty of locating events in space and time, especially for those written in Roman times, the huge amount of information that must be traveled to detect possible climatic events that took place in the area of interest, the subjectivism of the authors and the fact that not all works are translated, studying them sometimes implying the need to know languages such as Latin, Greek, Hungarian or Turkish.

Historical documents are generally represented by documents related to the postponement or the results of perambulation actions, to court decisions, royal decrees etc. and appear in our area since the second part of the High Middle Ages. They have the advantage of a higher degree of objectivity, the main disadvantage being the very small number of meteorological events that can be deduced after their passage.

The *history works* of Banat have the advantage of restricting the research area to the area of interest, as well as locating the events in space and time, but the disadvantage is, in addition to the huge volume of information, that the object of study of these works does not coincide with the research object of the present paper, the meteorological events being neglected most of the times.

Databases containing information related to the climate of the Roman Empire, Central Europe, Hungary, Transylvania or Europe in general can be a starting point in conducting studies such as this, but their disadvantage is the relatively small amount of information related to the area of interest, as well as the existence of some errors or inaccuracies regarding the location of the events in space and time, errors encountered

¹ https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf, p.18, accessed on 25.01.19

especially in older works that approach the meteorological – climatic phenomena that took place in large regions.

In addition to the problems mentioned above, problems that can be solved by studying in parallel the three categories of documentation sources, there are also problems related to the accuracy of describing some phenomena, the subjectivism of the authors, and the sporadic nature of information.

3. HISTORICAL EVOLUTION OF METEOROLOGICAL HAZARDS DURING ANTIQUITY AND THE MIDDLE AGES

The earliest mentions of some phenomena that affected the Banat area and can be included in the category of meteorological hazards date back from Romans, these referring to frosts of the Danube from which very low temperatures can be deduced. Possibly the earliest mention of this kind is that of the Roman historians Florus and Dio Cassius, who tell us that the Dacians used to descend from the mountains and desert the neighboring lands, whenever the frozen Danube joined its banks (Florus II.28.18; Cassius Dio 54.36.2). These attacks are mentioned in the winter between 11 - 10 BC in the area of the Danube Gorges, being led by the Dacian king Cotiso (Bennett, 1997; Wheeler, 2011; Benea, 2016). Attacks of the Dacians who crossed the frozen Danube, possibly in the area of the Danube gorge at the Iron Gates, also took place in the winter between 85 - 86 (Bennett, 1997; Benea, 2016). Dio Cassius also describes a battle fought on the frozen Danube, this time between the Romans and the Iazyges (Cassius Dio 72.7.1-5), battle dated in the winter between 173/174 (Hornyik, 1860; Birley, 2000; McCormick *et al.*, 2012); although we do not know the exact location of the battle, given that the base camp of the Romans was at Sirmium (Sremska Mitrovica) and the Iazyges occupied the territory north of the Danube, in the eastern part of the Pannonian Plain (Birley, 2000), it is very possible that the battle took place near the Banat Plain. The floods caused by the Danube at the end of March or the beginning of April 358, during the military campaign of Emperor Constantinus II against the Sarmatians west of the Banat Plain, were caused by the sudden melting of snow (Ammianus Marcellinus, 17.12.4), this fact suggesting the existence of low temperatures until March 358, followed by a sudden warming of the weather.

The earliest mention of a meteorological phenomenon in the Banat Plain that can be considered a hazard dates back to the middle of the 5th century, probably in the summer of 448, when the Greek historian Priscus, member of a delegation from Constantinople to the court of king Attila is witnessing a strong storm in the south of the Banat Plain (Priscus, in Müller, 1851), in the area of the Alibunar Lake. He mentions a strong wind that tore the delegation's tent, dragging it into the lake, heavy rainfall and a high frequency of thunderstorms (Bencsik, 1897).

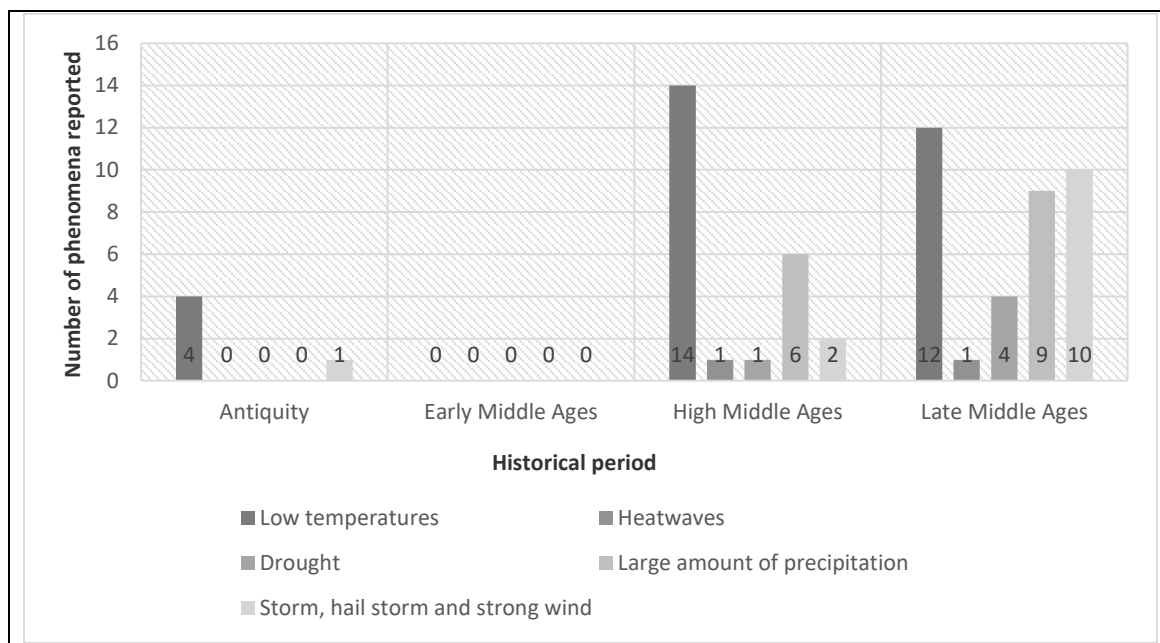


Figure 1. Number of phenomena that can be considered meteorological hazards, reported in the Banat Plain and its surroundings during Antiquity and the Middle Ages.

The drastic decrease in the number of historical information during the *Early Middle Ages* due to the fall of the Western Roman Empire and the retreat to the south of the influence of the Byzantine Empire is probably the main reason why we do not have records related to meteorological phenomena that would have occurred in the Banat Plain during this period. The absence of this kind of information also characterizes the first part of the *High Middle Ages*, a period from which we still have historical information that may suggest certain meteorological phenomena that affected the regions in the immediate vicinity of Banat, very possibly also the Banat Plain. Thus, the crossing of the river Tisza on ice by the army of the Hungarian king Solomon near Cibakháza, north of Szeged, in February 1074, mentioned in *Chronicon Pictum* (Kálti, 1370, Tarján, 1993), the harsh winter conditions at the end of 1129, mentioned by Byzantine chronicler Ioannes Cinnamos at Braničevo (on the Danube, SE of Banat Plain) (Cinnami, 1652; Kiss, 2013), the crossing of the Danube on ice by the Hungarian army somewhere in the southern part of the Pannonian Basin, mentioned by Byzantine princess Anna Comnena for the winter of 1146/1147 (Comnena, 1977), the coldness of the winter 1154/1155, mentioned by Byzantine chronicler Theodoros Prodromos in connection with a military campaign of Hungarians also in the southern part of the Pannonian Basin (Kiss, 2013) or the very cold winter between 1241/1242 with frozen rivers and swamps that favored the Mongol invasion on the Pannonian Plain, mentioned by Catholic cleric Rogerius and Thomæ Spalatensis (Rogerius, 1935; Perić *et al.*, 2006) reveals several cold waves that may have affected the area in study. Towards the end of the 13th century, in 1282, an intense rainfall which favored the victory of the Hungarian king László IV against Cumans is mentioned

in the area of Hódmezővásárhely, north of Mureş river, by Hungarian chroniclers (Podhradczyk, 1838; Florianus, 1885; Réthly, 1962; Heltai, 1981; Kiss, 2014).

Severe winter conditions that led to the postponement of the perambulation action that had to be carried out in Tiszaug, north of the Banat Plain, are mentioned in January 1330 (Kiss, 2016) while a document from 1358 mentions the postponement of a perambulation action from April 8 to May 27, due to the snow, on the property of Zekaspataka (now Secăşeni, on the river valley Caraş, upstream of the plain area) (Pesty, 1882), suggesting the existence of low temperatures in the spring of that year. The large amount of precipitation that fell in the summer of 1338 drove to the west the locusts that had caused great damages in the Lipova area (Réthly, 1962). Large amounts of precipitation also fell in the summer of 1409, when the trial against Demetrius, son of Dan from Duboz and the sons of Chep from Gherteniş, which was to take place at Şemlacu Mare, in the Bârzava Plain, on August 8, had to be postponed because these places were hardly reachable due to the floods (Kiss, 2011).

A possible period of drought in Banat Plain can be deduced from the German Düringische Chronik of Johann Rothe, that mentions a dry summer and the drying of water called Moßsir during a Turkish military campaign in the south-eastern part of Hungary, in 1439². A Moßsir hydronym could not be identified in Banat or in its proximity, but we can notice the resemblance to the Hungarian word mocsár (swamp) (Kiss, 2017). Considering that Ottoman troops led by Sultan Murad II, after conquering the eastern part of Serbia, in June besieged the fortress of Smederevo and a part of the troops crossed the Danube carrying out several raids in southern Banat (Bánlaky, 2001), an area with several swamps, we consider it plausible that the water called Moßsir refers to one of these.

Low temperatures are mentioned in the winter between 1441/1442, when the military campaign carried out by Ioan de Hunedoara against the Turks is interrupted due to the cold (Pethő, 1753) near Smederevo, south of the Banat Plain (Bánlaky, 2001). Excessive rainfall and floods can be deduced in the spring of 1443 from a letter sent to Ioan de Hunedoara, voivode of Transylvania, by János Kórógyi, owner of the Chery castle (Kiss, 2011). In that letter, sent on April 14, Kórógyi asked for help in order to rebuild his castle, which had been destroyed by floods³. Although the exact location of the former castle and town of Chery is disputed by historians, we can say with certainty that they were located in the Timiş Plain, east or southeast of Timișoara (Csánki, 1894; Ţeicu, 2009). We also do not know the date of the floods, but given the importance of the castle and the strategic role it played near the Hungarian border with the Ottoman Empire, we can deduce that this happened shortly before the letter was sent, possibly in the spring of 1443 (Kiss, 2011).

² „Nu was der Sommer etzwas dorre unde trocken, alßo das yn den landin das wassir gnant die Moßsir gar vortruckent was, ...” (Rothe, 1440, in Liliencron, 1859, p. 685)

³ „Thorrens et habundancia aquarum castellum nostrum in Chery habitum omnino destruxit” (Magina, 2015, p. 68)

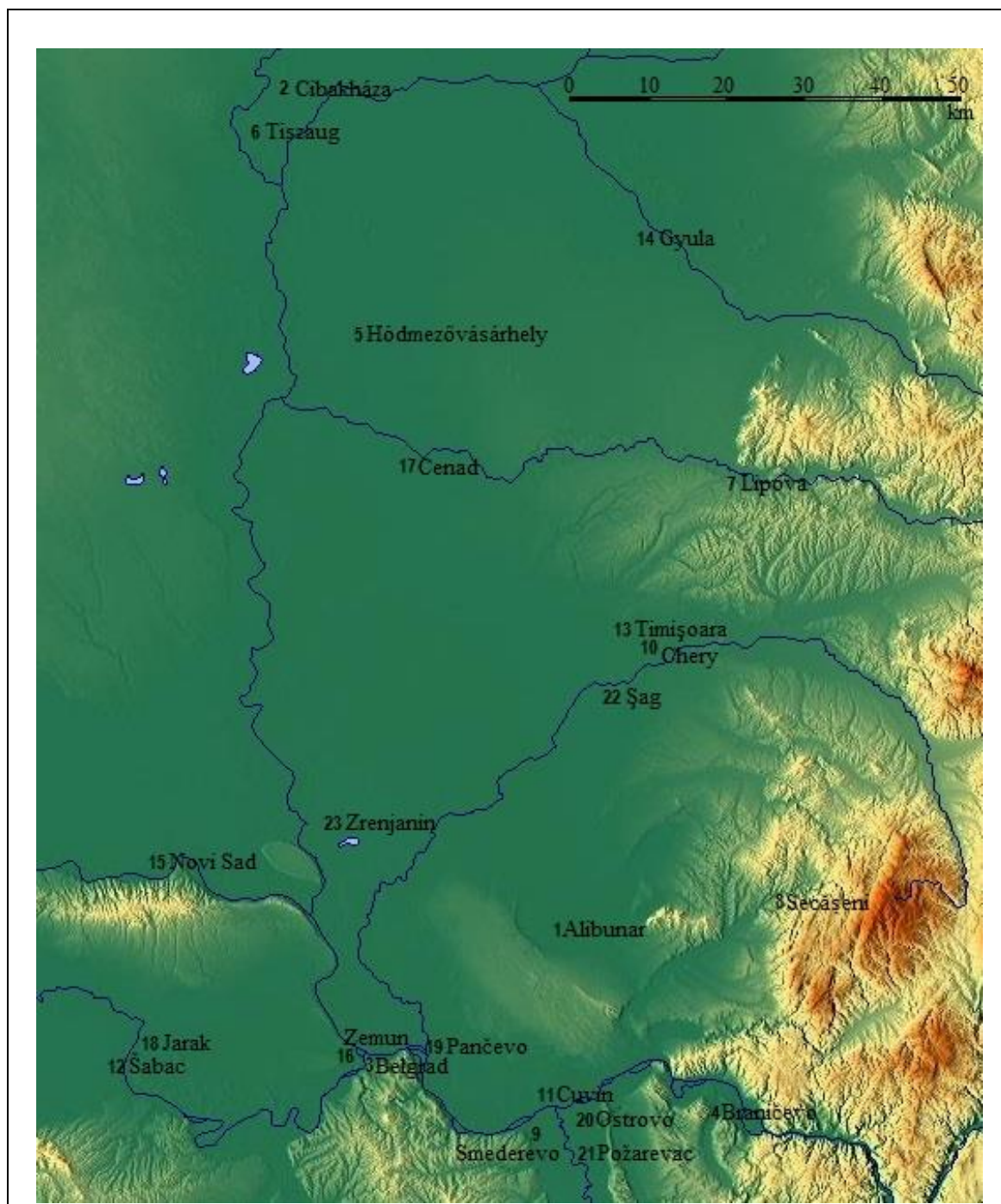


Figure 2. Localities where phenomena that can be considered meteorological hazards were mentioned during Antiquity and the Middle Ages

In the winter of 1463/1464, the frost of the Danube allowed the Ottoman army to cross it in the area of Cuvin (Réthly, 1962). A rainy year in Hungary, but also in the Banat Plain, was the year 1468, when the bishop and humanist Janus Pannonius describes in the

elegy *De inundatione* the autumn floods that took place on the main rivers of Hungary⁴, attributing these floods to the incessant rains brought by the southern winds. The painted picture is a very expressive one: „*Omnia sic facies aequoris una tegit, Noscere nec possis, ubi rus, ubi collis, ubi arbor*” („It covers all the faces of a smooth surface, You can't even know where the country is, where the hill is, where the tree is”), the author concluding that everything is subject to the absurd leagues of nature „*Nimirum naturas suas praepostera leges*” („Certainly their nature is an absurd law”) (Pannonius, 1552, p. 203). Low temperatures and a lot of snow are mentioned in January 1476, during the Hungarian siege of the Šabac fortress on the Sava River, east of Belgrade, while a sudden warming of the weather caused flooding on Sava, complicating the military operations (Kiss, 2011). In the winter of 1476/1477, a winter described as severe in Central Europe (Brázdil, Kotyza, 1995), during the fighting in Smederevo, in December, the army led by Muhammad II encamped on the frozen Danube, as mentioned by the Turkish chronicler Mehmed Neşri (Guboglu, Mehmet, 1966), while in January 1494, also near the town of Smederevo, the army led by Pavel Chinezu crossed the Danube on ice for an incursion into the Turkish territories (Böhm, 1867). The lack of hay for animals, probably determined by a long and hard winter, led to a series of thefts, reported in Timiș County in May 1511 (Kiss, 2019).

The earliest mention of high temperatures in the Banat Plain, even if we do not know about their possible effects, is from the uprising led by Gheorghe Doja in 1514, when the army of the Transylvanian voivode Ioan Zăpolya, who came to save Timișoara, camped in the proximity of the city, “*during the hottest days of July*” (Böhm, 1867, p. 187). A storm, possibly blizzard, is mentioned in 1525 as killing a large number of sheep at Gyula, 50 km north of the Banat Plain (Réthly, 1962). From Turkish chroniclers Evliya Çelebi, Mehmed Bin Mehmed or Ibrahim Pecevi, none of them contemporary with the events, we find that the incessant rains and the cold of the end of October 1551 determined the Turks to raise the siege on the fortress of Timișoara and retreat to Belgrade (Réthly, 1962; Guboglu, Mehmet, 1966). It should also be mentioned that the Ottoman army came after a rather long and tiring military campaign in which they had conquered a series of fortresses in Banat, and the conquest of the citadel of Timișoara was not easy. Also, at that time the Turks were not forced to fight in the field after October 26, by a privilege given by Sultan Murad I (Hațegan *et al.*, 2006), all of which could lead to the abandonment of the siege, along with unfavorable weather.

In July 1566, north of the Banat Plain, in the area of Gyula, historical sources mention large amounts of rainfall and swamps, which hindered the siege of the city by the Ottoman army (Réthly, 1962), but in August, drought and dryness are mentioned, leading to lower water levels and favoring the conquest of the Gyula fortress by the Turks on September 1 (Réthly, 1970). Turkish historical sources mention in May 1572 that “*the sultan ordered the beylerbey of Timișoara to buy supplies from lands with good harvests*

⁴ “*Iam Savus et Marisus, iam Dravus et ipse Tibiscus, / Inter et Arctoas, maximus Hister, aquas*” (Pannonius, 1552, p. 203)

and to distribute them to the inhabitants who did not harvest due to the drought” (Hațegan, 2005, p. 78), which may speak for a possible drought that affected the area in the previous year. Lightning and thunder are mentioned in Timișoara in November 1597, these being considered a curiosity due to the month when they occurred (Réthly, 1962). In 1598, a year with floods mentioned in Transylvania, Hungary and Slovakia (Réthly, 1962), Turkish chroniclers mention the conquest of the fortress of Cenad by the Turks in early September, then *thousands of difficulties* encountered by the Ottoman army during the crossing of the Mureș River, which was swollen due to the rains and, again, difficulties encountered by the Turks on the way to Oradea, due to swollen rivers and swamps, as well as the rains that fell over 40 days without interruption in the Banato – Crișana Plain, between the end of August and the beginning of October (Guboglu, Mehmet, 1966; Guboglu, 1974; Mehmet, 1980; Réthly, 1998).

A long and severe winter is mentioned in Banat between 1641/1642, when the agricultural crops were destroyed by the October frost (Dudaș, 2006). Again, a severe winter is mentioned by Turkish chroniclers between 1659/1660, the Ottoman army being unable to reach Sibiu, a city besieged by the Transylvanian army led by Rakoczi, and having to spend the winter in Timișoara (Guboglu, 1974; Mehmet, 1980); in the same winter, the Hungarian chronicles mention low temperatures in western Hungary and the Transylvanian late frosts that destroyed the vineyards in April (Réthly, 1962). In the winter of 1663/1664, very low temperatures and frosts are mentioned on the Danube, in the immediate vicinity of the Banat Plain, both by Turkish and Hungarian chroniclers (Réthly, 1962; Guboglu, 1974; Mehmet, 1980), while in January 1664 is mentioned a blizzard, accompanied by snowfall and low temperatures, that caused damage and even deaths to the Christian army stationed at Jarak, southwest of the Banat Plain (Réthly, 1962). On May 6, 1683, the chronicles mention that a delegation that was to return to Debrecen, through Pančevo, after discussions with the sultan in Belgrade, was delayed due to storms (Réthly, 1962). The winter of 1684/1685, a winter with very low temperatures and frosts until April in Hungary and Transylvania (Réthly, 1962; Dudaș, 2006), is mentioned as very severe in Banat and Hungary, the vagaries of the weather making it difficult to supply the Ottoman cities from here (Hațegan, 2005).

Strong winds, possibly Coșava, are mentioned between 20 and 25 November 1685 in Belgrade by Thököly Imre, in his diary (Réthly, 1962). In 1686 is mentioned that in Timișoara was a great famine and “*being severe drought, everybody was worried about a greater famine in the future*” (Cernovodeanu, Binder, 1993, p. 100). In the autumn of 1691 Thököly mentions in his diary a sleet that fell in Vârșeț on September 10, low temperatures near the river Caraș on September 11, again low temperatures and sleet near the river Timiș on November 7 and snow at Vârșeț on November 8 (Réthly, 1962). The following winter and spring are also very cold, with frosts on the Danube and Tisza and very low temperatures in January 1692 at Gyula, where Austrian imperial troops crossed the frozen Criș river, while between March 2 and 16 snow is mentioned at Požarevac, in the immediate vicinity of the Banat Plain (Réthly, 1962; 1970). In October 1692 Thököly mentions low temperatures on his way to Timișoara, high snows and low temperatures

being mentioned in the Caransebeș area in December (Réthly, 1962). Thököly's temporary residence at Požarevac (Passarowitz), south of the Danube (Fig. 2), in the immediate vicinity of the Banat Plain, as well as the consistency with which he noted various events in his diary, bring us a series of notes related to meteorological phenomena that affected this region between 1692 and 1694. From the large number of meteorological events recorded in the diary, stand out the strong winds, possibly Coșava, which prevented the movement of the Ottoman troops on April 2 - 3, 1693, provoked waves that destroyed a water mill on September 3 and stopped traffic on the Danube on March 18, July 2 or September 6, 1694. In the same journal, there are mentions of hailstorms causing damage to crops on May 26, 1694 or a cold wind that caused the death of several animals on September 23 - 27, 1694 (Réthly, 1962).

Heavy rainfalls and floods, both north and south of the Banat Plain, are mentioned in May 1693, July and October 1694 (Réthly, 1962; Hațegan, 2005). The heavy rainfall on January 18, 1694 melted the thick layer of snow, transforming the area of Gyula, north of the Banat Plain, into a *sea* and making it impossible for the Austrian army to attack the fortress (Réthly, 1962). In the area of Požarevac (Passarowitz), on January 21, Thököly mentions "*snow as big as it has never been since we lived in Turkey*" (Nagy, 1863, p. 305). A cold wave reached the south of Banat at the end of January 1694, the Danube being frozen between January 27 and February 23 (Nagy, 1863). The winter of 1694/1695 is mentioned with low temperatures and snow in Hungary and Transylvania (Réthly, 1962), the Turkish troops that defended the Gyula fortress, after the capitulation in front of the Austrian troops in December, being forced to postpone the departure to Timișoara until January, "*due to the strong cold, the heavy snow and the lack of carts*" (Réthly, 1962, p. 249).

In the summer of 1695, the Turkish chronicler Silahdar Fândâklâlî Mehmed Aga, eyewitness to the events, mentions high temperatures during the works on the Ordiei bridge (on Timiș river, near Șag) on August 31, the workers and the buffaloes suffering from thirst (Guboglu, 1974). In the autumn of 1695, in the Banat Plain are mentioned heavy rainfalls and swampy roads that slowed down the movement of the Ottoman army between Lipova and Sarad (between Giarmata and Pișchia) on September 15 (Guboglu, 1974; Mehmet, 1980), torrential rains on September 20 in Lugoj (Réthly, 1962), swampy roads that caused the grounding of the carriage wherewith the Austrian general Veterani was trying to escape from Turkish captivity after losing the battle of Lugoj, on September 21, as well as a rain that jams all the Ottoman cannons on September 29 in Teregova, near the Banat Plain (Hațegan, 2005). In July 1696 the cannons that were to arrive in Timișoara from Oradea, Szeged, Buda and Transylvania to help the Austrian army besieging the city were stuck by the rains (Guboglu, 1974). A particularly harsh winter, which blocked almost any military initiative, is mentioned between 1696/1697 in Banat (Hațegan, 2005). Due to the torrential rains of July 1697, on the night between 16 and 17 July there is an overflow of the Timiș River at Lugoj (Réthly, 1962). In September 1697 the Ottoman troops withdrew to Timișoara after the defeat at Zenta. In Timișoara, they suffered from thirst, as mentioned by Dimitrie Cantemir, present in those days in the city (Hațegan,

2005, 2008). Between 1697/1698 a severe winter, with low temperatures is mentioned in Timișoara and Zrenjanin (Réthly, 1962).

4. CONCLUSIONS

In the end, after centralizing the meteorological events that can be considered hazards, found in historical sources on the territory of the Banat Plain or in its immediate vicinity until the end of the seventeenth century, we can draw some conclusions.

From the period of *Antiquity*, for the Banat Plain we have only one definite mention of a meteorological hazard, a mention that is related to a storm that took place at the end of this period and is due to a Byzantine delegation to the court of Hun king Attila. Four other events are related to military campaigns carried out by or against the Romans near the Banat Plain, all suggesting the existence of low temperatures, but we do not have data to attest possible damages caused by meteorological hazards during this period in the studied area. From the period of *Early Middle Ages*, there is a lack of information to attest with certainty the existence of meteorological phenomena that can be included in the category of meteorological hazards. Due to the fact that information from this period we have exclusively from Roman or Byzantine writings, we can say that their number is decisively influenced by the location of the Banat Plain near the borders of the Roman / Byzantine Empire, by their battles with neighboring populations, then by the disappearance of the Western Roman Empire and the retreat to the south of the borders and the influence of the Byzantine Empire.

From the first part of the *High Middle Ages* we only have information related to meteorological phenomena that affected areas in the vicinity of Banat Plain, information gathered from various Hungarian or Byzantine chronicles. Starting from the 14th century, there is an increase in the number of documents from which we can deduce certain meteorological phenomena, as well as a diversification of them, information being found not only in documents related to certain battles but also in documents relating to perambulations or lawsuits, letters, literary works, etc. A large amount of information, including meteorological events that took place within the Banat Plain limits, we have from the 15th century and the first half of the 16th century, this being due to both the political and cultural development of the Kingdom of Hungary in the 15th century, which led to the diversification of available sources of documentation, previously mentioned, as well as its contact with the Ottoman Empire and the battles between these two powers in the area of Banat or near it. Of the 24 meteorological hazards identified between the years 1000 – 1552, 14 are related to low temperatures, 6 to large amount of precipitation, 2 to possible blizzards, one to heatwaves and one to drought. Most of the hazards identified that would have affected the Banat Plain are mentioned in the context of some fights given here. Among the effects of these hazards, in addition to those related to the respective fights, which refers to the favoring or abandonment of military operations, we have floods, possible drying of the swamps or lack of hay for animals.

After 1552, with the occupation of Timișoara and the Banat Plain by the Ottoman Empire, information about meteorological events can be found in some Turkish, Hungarian or Transylvanian chronicles, but their number is relatively small until the end of the 17th century. The amount of information increased greatly in the second half of the seventeenth century, especially in the last two decades, the causes of this increase being related to the development of Turkish historiography, as well as to the increase of the interest shown by the Habsburgs for Banat or to the struggles in this area. A very important

source of information for the end of the seventeenth century is the diary of the ex-prince of Northern Hungary and Transylvania, Thököly Imre, who between 1676 and 1694 crossed most of Transylvania and Hungary, between 1692 and 1694 establishing his residence at Passarowitz (Požarevac), a locality located south of the Danube (Fig. 2), in the immediate vicinity of the Banat Plain. 36 meteorological hazards were identified between 1552 and 1700, 12 related to low temperatures, 10 to storms, hail storms and strong winds, 9 to large amount of precipitation, 4 to droughts and one to heatwaves (Fig. 1). Most of the notes are from the last 2 decades of the 17th century (Appendix 1), a fact due, as we mentioned before, to the increase in the number of information sources, but also to an accentuated cooling of the climate. This cooling was identified by some authors in Central Europe between 1675 and 1700 and coincides with the Maunder Minimum, the coldest period during the Little Ice Age (1550 – 1850) (Glaser, Riemann, 2009). Among the effects of meteorological hazards identified at the level of the Banat Plain between 1552 and 1700, we can mention: favoring or abandonment of military operations, floods, swampy roads, stopping traffic on the Danube, the impossibility of supplying cities with food, the death of animals, damage to crops or even famine.

Appendix 1. Phenomena that can be considered meteorological hazards, reported in the Banat Plain and in the immediate vicinity throughout Antiquity and the Middle Ages

Nr. crt.	Period	Mentioned events	Region where the events were mentioned	Consequence
1.	Winter of 11/10 BC	frozen Danube	Danube gorge	attacks of the Dacians
2.	Winter of 85/86	frozen Danube	Danube gorge	attacks of the Dacians
3.	Winter of 173/174	frozen Danube	south of the Pannonian Plain	fight on the Danube
4.	March/April 358	low temperatures/ sudden warming	south of the Pannonian Plain	floods
5.	Summer of 448	storm	Alibunar	
6.	February 1074	frozen Tisa	Cibakháza (north of Szeged)	Tisza crossed by the army of the Hungarian king Solomon
7.	November/ December 1129	harsh winter conditions	Braničevo (on the Danube, SE of Banat Plain)	
8.	Winter of 1146/1147	frozen Danube	southern part of the Pannonian Plain	Danube crossed by the Hungarian army
9.	Winter of 1154/1155	harsh winter conditions, possible blizzard	southern part of the Pannonian Plain, Braničevo	Hungarian army gives up attacking the Byzantine fortress
10.	Winter of 1241/1242	very cold winter, frozen rivers and swamps	Pannonian Plain	favours Mongol attacks
11.	April/May 1282	intense rainfall	Hódmezővásárhely (north of Szeged)	favours the Hungarian army in the fight against the Cumans
12.	January 1330	harsh winter conditions	Tiszaug (north of Szeged)	postponement of a perambulation action
13.	Summer of 1338	large amount of precipitation	Lipova area	westward migration of locusts
14.	April 1358	low temperatures, thick layer of snow	Secășeni (on the Caraș river, upstream of the plain area)	postponement of a perambulation action
15.	August 1409	large amount of precipitation	Bărzava Plain	floods
16.	Summer of 1439	drought	Banat Plain	possible drying of the swamps

17.	Winter of 1441/1442	harsh winter conditions	Smederevo (on the Danube, south of Banat Plain)	military campaign interrupted due to the cold
18.	Spring of 1443?	large amount of precipitation	Chery, in Timiș Plain	floods that damaged the castle
19.	Winter of 1463/1464	frozen Danube	Cuvin, southern part of the Banat Plain	Danube crossed by the Ottoman army
20.	Autumn of 1468	large amount of precipitation	southern part of the Pannonian Plain	floods
21.	January 1476	harsh winter conditions	Šabac (west of Belgrade)	
22.	Winter of 1476/1477	frozen Danube	Smederevo (on the Danube, south of Banat Plain)	Ottoman army encamps on the Danube
23.	January 1494	frozen Danube	Smederevo (on the Danube, south of Banat Plain)	Danube crossed by the Hungarian army
24.	Winter of 1510/1511	long and severe winter	Timiș County	lack of hay for animals, theft
25.	July 1514	heat wave	Timișoara	
26.	1525	storm, possibly blizzard	Gyula (north of Arad)	death of a large number of sheep
27.	September / October 1551	low temperatures and rains	Timișoara	abandonment of the siege of Timișoara
28.	July 1566	large amount of precipitation	Gyula (north of Arad)	swamps that make it difficult for the Turks to besiege the city
29.	July / August 1566	heatwave, dryness	Gyula (north of Arad)	drying of wells and swamps; low water level on Crișul Alb river
30.	1571	drought	Timișoara	lack of food
31.	November 1597	lightning and thunder	Timișoara	
32.	September 1598	large amount of precipitation	Cenad	high water level on Mureș
33.	Autumn/Winter of 1641/1642	long and severe winter	Banat	agricultural crops destroyed by the October frost
34.	Winter of 1659/1660	harsh winter conditions	Timișoara	the Ottoman army forced to spend the winter in Timișoara
35.	Winter of 1663/1664	low temperatures, blizzard, frozen Danube	Zemun, Jarak; SV part of Banat	the soldiers suffer from the cold; Danube crossed by the Ottoman army
36.	May 1683	storms	Banat Plain, possible Pančevo	
37.	Winter of 1684/1685	harsh winter conditions	Banat	the cities of Banat cannot be supplied with food; famine in Timișoara
38.	November 20 - 25, 1685	strong wind (coșava)	Belgrade	
39.	1686	drought	Timișoara	
40.	Autumn of 1691	low temperatures, sleet and snow	southern part of the Banat Plain	
41.	Winter of 1691/1692	low temperatures, frozen rivers, snow in March	Gyula; Ostrovo, Požarevac (south of the Banat Plain)	Criș river crossed by the Austrian army on ice; floods in late March
42.	October / December 1692	low temperatures	southern part of the Banat Plain	
43.	April 2 - 3, 1693	strong wind (coșava)	Požarevac (south of the Banat Plain)	prevents the movement of Turkish troops
44.	May 1693	large amount of precipitation	north and south of Banat Plain	high water level on Mureș, floods
45.	September 3, 1693	strong wind (coșava)	Ostrovo (south of Banat Plain)	mill destroyed due to the Danube waves

46.	18 January 1694	heavy rainfall	Gyula	melting snow, floods
47.	January/ February 1694	low temperatures, frozen Danube	southern part of Banat Plain	high water level on Danube at the end of February
48.	March 18, 1694	strong wind	South of the Banat Plain	stopped traffic on the Danube
49.	May 26, 1694	hail storm	Požarevac (south of Banat Plain)	damage to crops
50.	July 2, 1694	storm	Ostrovo (south of Banat Plain)	stopped traffic on the Danube
51.	July 1694	large amount of precipitation	Banat	floods
52.	September 6, 1694	strong wind	Pančevo	stopped traffic on the Danube
53.	September 25 - 27, 1694	low temperatures, rainfall and cold wind	south of Banat Plain	death of domestic animals
54.	October 1694	large amount of precipitation	north and south of Banat Plain	high water level on Mureş, floods
55.	Winter of 1694/1695	harsh winter conditions	Gyula	Turkish troops postponing departure to Timișoara
56.	August 31, 1695	heat wave	Ordiei Bridge, near Şag	several buffaloes died of thirst
57.	September 1695	large amount of precipitation	Vinga and Lugoș Plains	swampy roads
58.	July 1696	large amount of precipitation	Banat Plain	swampy roads, jammed cannons
59.	Winter of 1696/1697	harsh winter conditions	Banat	blocking military initiatives
60.	July 1697	heavy rainfall	Lugoș Plain	floods on Timiș River
61.	Septembrie 1697	drought	Timișoara	Turkish troops suffering from thirst
62.	Winter of 1697/1698	low temperatures	Timișoara and Zrenjanin	
L e g e n d	Winter Spring Summer Autumn season unknown	low temperatures and cold wave heat wave large amount of precipitation drought storm, hail storm and strong wind	within the limits of the Banat Plain outside the limits of the Banat Plain	

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