Weather and Weather-Related Environmental Phenomena Including Natural Hazards in Medieval Hungary I: Documentary Evidence on the 11th and 12th Centuries

Andrea Kiss

Introduction: aims and sources – the spatial and temporal distributions

The present paper is the first part of a series, providing evidence on high and late medieval weather events and related phenomena reported in and/or referring to medieval Hungary. When available, other Carpathian Basin-related weather events (like those in Slavonia and northern Bosnia) are also presented. Thus, an important aim of these papers is to provide information, analysis and an easy access to the presently available evidence on the subject. Moreover, the series is also designed to act as a background to later, long-term analysis papers. After providing a concise, systematic database of floods that occurred in medieval Hungary[1] in the form of case studies on individual events reported, this is the first attempt to give an overview of weather-related source evidence related to the medieval Carpathian Basin. Since no systematic investigations have been carried out in the area so far, these papers are meant to provide useful information for medievalists in general, and those studying military, social, economic, environmental, or climate history in particular.[2]

As part of this series on medieval weather-related documentary evidence, in the first paper the weather events and other weather-related phenomena (e.g., fires, floods, locust invasions, famines) concerning 11th- and 12th-century Hungary are described. For a better insight into large-scale processes, where possible, some parallels concerning the neighbouring areas are also provided.

[1] A. Kiss, "Floods and long-term water-level changes in medieval Hungary," Diss. (Budapest: Central European University, 2011).

[2] When collecting Hungary-related high-medieval evidence (especially those in foreign sources), as a first step, I applied (and examined the originals of) the references available in the following collection: A. F. Gombos, *Catalogus fontium historiae Hungariae aevo ducum et regum ex stirpe Arpad descendentium ab anno Christi DCCC usque ad annum MCCXI*, 4 volumes (Budapest: Akadémiai Kiadó, 1937-1943).

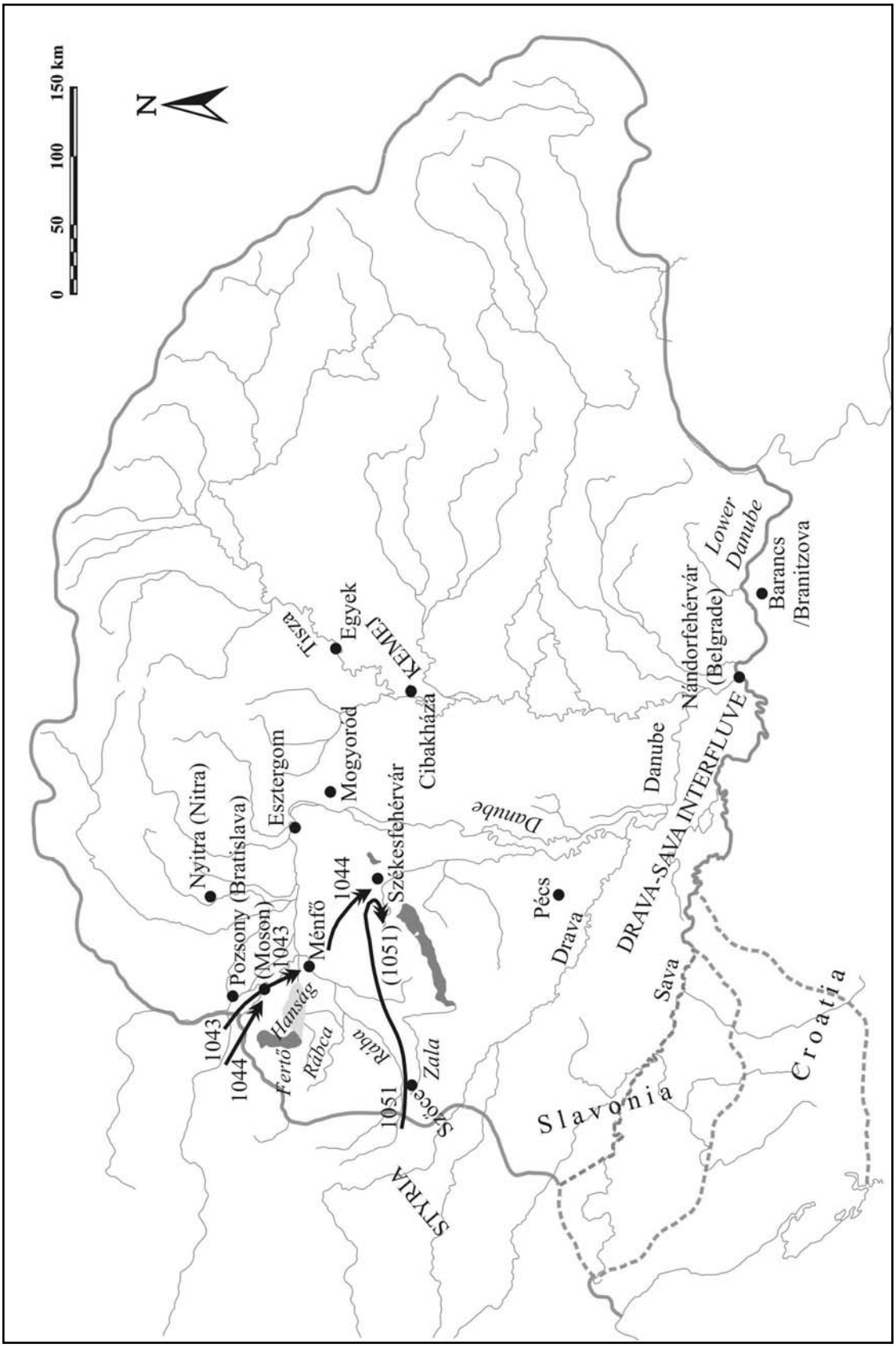

Fig. 1: Locations in the Carpathian Basin mentioned here (loess fall events discussed separately)

For the 11th and 12th centuries only sporadic reports are available, mainly in foreign narratives; only in exceptional cases do domestic sources provide any information. This is due to the fact that very few domestic documents have been handed down to us. Out of these sources the information preserved in the 14th-

century chronicle composition, in which some high medieval domestic narratives were also identified, probably contains the most useful data.

As regards the temporal distribution, at present almost the same amount of evidence is available for the 11th century as for the 12th century. Due to some better-documented military campaigns and battles, more is known about the years 1044, 1074 and 1147. In western evidence, often the entire country is mentioned, even if sometimes only the western parts may have been meant. When specific locations and/or regions inside of Hungary are reported in the texts, the spatial distribution of known events is relatively even between the western, and the central and southern parts of the country (see fig. 1), whereas practically no evidence is yet available for the eastern and northeastern parts of the Carpathian Basin (e.g., Transylvania and most of the Great Plain).

In contrast to the late medieval period, most of the evidence for the 11th and 12th centuries is available in foreign narratives. The references in source evidence have an interesting (but logical) distribution: for the entire country as well as the western parts, the authors of western narratives provide more data – the Lower Danube area being 'covered' specifically by Byzantine sources[3] –, while evidence related to the central parts chiefly appear in domestic sources (in the 14th-century chronicle composition). Many of the sources that contain information are not contemporary. This is mainly due to the fact that almost no contemporary domestic evidence has remained from this period. Even basic political history data (concerning the general history of Hungary) can often only be found in foreign and non-contemporary sources (whose datings were, therefore, closely examined and potential misdatings extensively discussed in the literature).

Uncertain fragments or lucky survivors? The role of 11th-century evidence

1022 (1020, 1021): two suns (and fires)

In the year 1022, besides a fire and an earthquake, both the *Chronicon Monacense*[4] and the 14th-century chronicle composition (*Chronici Hungarici compositio saeculi XIV*)[5] mention that two suns were seen in the sky (halo-

[3] In the present analysis I could use some contemporary Byzantine source references. These sources were not included in the catalogue and analysis of Ioannis Telelis ["Climatic Fluctuations in the Eastern Mediterranean and the Middle East AD 300-1500," *Jahrbuch der Österreichischen Byzantinistik*, 58 (2008): 167-207]. However, due to their great value and broad use in reconstructing high medieval Hungarian military history, I decided to include these references.

[4] I. Szentpéntery, *Scriptores Rerum Hungaricarum*, 2 vols., new ed. (Budapest: Nap Kiadó, 1999) (hereafter: *SRH*), vol. 2, 67 (*Chronicon Monacense*): 31. *Anno Domini MXXII. In multis locis grandia incendia facta sunt et terre motus.*

[5] *SRH* vol. 1, 318 (*Chronici Hungarici compositio saeculi XIV*): *(S) Incidentia de aliquibus / (V) Incidentia: Anno Domini M° XX° II° in multis locis incendia multa et magna facta sunt, ingens etiam terre motus contigit. IIII° Idus Maii decima hora diei, sexta feria post Ascensionem Domini quasi duo soles visi sunt decimo Kalendas Iulii.*

phenomenon). The 14th-century chronicle composition, referring to the 11th and 12th centuries, is mainly built on contemporary evidence. The question of how close in time it was as well as the application of foreign narratives raise several further questions. In many cases, misdatings are possible. In our present case, for example, the 14th-century chronicle composition, besides an early (later vanished) domestic *gesta* dated to 1060, presumably applied the evidence available in the *Annales Altahenses maiores* (or both narratives used the same source). Subsequent parts of the chronicle composition are frequently built on legends[6] or a later-vanished early 13th-century Hungarian chronicle (dated to the 1210s) that also seems to be partly based on earlier works.[7]

The information concerning 1022 similarly appears in the *Annales Altahenses maiores* where the event is, however, mentioned for the year 1021.[8] Also, the *Annales Altahenses*, for the year 1020, refer to fires in many places (without specifying any location),[9] which appears in the 11th-century Hungarian chronicle composition for the year 1021.[10] The same data can be found in the *Chronicon Dubnicense* (15th century, compiling earlier narratives), for the year 1022.[11] As a possible parallel, it is worth mentioning that R. Glaser especially highlights the hot summer of 1022, as part of a warm and dry phase.[12]

Rainy or not? German military campaign in 1043 – and a comparison with the 1044 events

Concerning the year 1043, *Herimannus Augiensis* mentions a rainy summer when the German ruler came to Hungary to fight against the Hungarian King Aba. It was in fact so wet in the German territories that there was shortage of food because of a bad harvest.[13] At that time, in August 1043, Emperor Henry

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[6] *SRH* vol. 1, 312-44.

[7] Gy. Kristó, *A történeti irodalom Magyarországon a kezdetektől 1241-ig* (Historical literature in Hungary from the beginning to 1241) (Budapest: Argumentum 1994), 99 (hereafter: Kristó 1994).

[8] E. Oefele, *Scriptores rerum Germanicarum in usum scholarum. Annales Altahenses Maiores*, vol. 4 (Hannover: Impensis Bibliopolii Hahniani, 1891) (hereafter: Oefele 1891), 17 (*Annales Altahenses Maiores*): 1021. *Ingens terrae motus IIII. Idus Mai, hora X. diei, feria sexta post ascensionis Domini, quasi duo soles visi X. Kal. Iulii*. See also Kristó 1994, 100.

[9] Oefele 1891, 17 (*Annales Altahenses maiores*): *1020. Benedictus VIII. papa, ab imperatore Babinperc vocatus, advenit. In multis terrarum locis multa et magna incendia.*

[10] *SRH* vol. 1, 318 (*Chronici Hungarici compositio saeculi XIV*): *III° Idus Maii decima hora diei sexta feria post Ascensionem Domini quasi duo soles visi sunt decimo Kalendas Iulii.*

[11] M. Florianus, *Chronicon Dubnicense*, Historiae Hungaricae Fontes Domestici. Pars prima: Scriptores, vol. 3 (Leipzig, 1884), 47: 66. (22a) *Anno domini millesimo vigesimo secundo in multis locis incendia multe et magna facta sunt, ingens eciam terre motus contigit quarto Idus May decima a hora diei feria sexta post ascensionem domini; quasi duo soles visi sunt decimo kalendas July.*

[12] R. Glaser, *Klimageschichte Mitteleuropas: 1200 Jahre Wetter, Klima, Katastrophen* (Darmstadt: Primus Verlag, 2008), 61.

[13] G. H. Pertz, *Monumenta Germaniae Historica. Scriptores*, vol. 5: *Annales, chronica et historiae aevi Salici* (Hannover: Impensis Bibliopolii Hahniani, 1844) (hereafter *MGH SS*

III entered Hungary, but the swamps and inundations of the Rábca River frustrated his progress in Northern Transdanubia (Western Hungary; see fig. 1).[14] From this description, although the German troops could not cross the swamps and the waters of the Rábca river, it does not necessarily follow that there was a rainy summer season in Hungary in the period before or during the military campaigns.

When Henry III entered Hungary in 1044 (perhaps in June), before defeating King Aba at Ménfő (on 5 July), he also had to cross the Rábca River. Similar to 1043, it was again a rather difficult task due to the swampy areas (*invenit iter stagnantibus aquis*).[15] This is supported by the chronicle of Henrik Mügeln, who worked with some early sources.[16] However, people of the 'other' Hungarian king (Peter I) showed Henry a ford where it was easy to cross the river. No more difficulties with crossing were mentioned this time, only that Aba's army was waiting for them on the other side of the river.[17]

There is a chance that, similar to West Central Europe (with Bohemia), some parts of the summer of 1043 were also wet in the more easterly parts of Central Europe. Nevertheless, no such information is available from other parts of Central Europe for (the early summer of) 1044. Yet, as was reported, the emperor's army was again (at least for a while) obstructed by extensive swampy areas in Hungary. This is due to the fact that the Hanság (Wasen) wetlands are located south of them. The waters of the Hanság were collected and led to the

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vol. 5), 124 (*Herimannus Augiensis Chronicon*): *1043. ... Aestas pluviosa frugum et vindemiarum penuriam effecit. – Heinricus rex iterum Pannonias petens, ab Ovone, vis impetrante pactum, satisfactionem, obsides, munera, regnique usque ad Litaha flumen parte accipiens, discessit.*

[14] Oefele 1891, 33: *1043 ... Veniens ergo rex ad terminum regni, ubi exercitus recenseretur, decrevit, ut hostilis terra procul dubio invaderetur, et factis machinis contra opus, quo fluvium Rapinisa occluserant, in crastinum impugnare disposuerant.*

[15] Oefele 1891, 35.

[16] *SRH* vol. 2, 158 (*Chronicon Henrici de Mügeln*): *Do het sich daz wasser Raba genant und Rapcha genant ergossen, daz der keyser nicht uber daz wasser moch kumen, wann die weld warn dick ind die pruch warn tieff. Do czoh der keyser das wasser auf die ganczen nacht und kom dez morgens fru, do dye sunne schein, an ein furt und czoh laytlich uber dy Rab.*

[17] Oefele 1891, 35-36 (*Annales Altahenses maiores*): *1044. ... Quo die cum noster heros ad locum condictum venisset et illum minime reperisset, volens eum insequi ultra Rabanisa fluvium, invenit iter stagnantibus aquis et machinis more illis solito interclusum. Ducatum autem praebentibus Ungris, quos secum habuit, tota nocte equitato sursum per ripam crepusculo facili vado transit. .... Tercia demum die post condictum praelium, cum primi nostrorum transirent Rhaba fluvium, ecce innumerae acies armatorum eminus apparent, qui campum latissimum, quasi silva succrevisset, operuerunt*. Besides the *Annales Altahenses maiores*, the 13th-century domestic *Gesta Hungarorum*, written by *Simon de Keza,* described the situation in a rather similar way (*SRH* vol. 1, 176): *Concitato igitur cursu invasit fines Hungarie intrans per Supronium et, cum vellet in Bobut pertransire, non poterat propter aquas. Hungari ergo, qui erant cum ceasare et Petro rege, duxerunt caesaris exercitum sursum iucta flumen Rebche et utraque flumina tota nocte equitando orto sole facili vado transierunt*.

Danube by the short lower section of the Rábca river. Due to the small difference in elevation, it was rather easy to 'manipulate' the hydrological conditions of the lower Rábca, and thus it was possible to make crossing difficult or impossible for those not familiar with the environmental conditions of the area. As such, a natural flood event was not necessarily needed to 'produce' flooding.

Is there any information available to suggest that Hungarians influenced the water system or applied any sort of 'manipulation' of this fragile water system? Already in the case of the 1043 campaign the *Annales Altahenses maiores* mentions a certain *opus*, an artificial object on the Rábca river (*et factis machinis contra opus, quo fluvium Rapinisa occluserant*),[18] which indirectly reappears in 1044.[19] In the 14th-century chronicle composition the even more direct word *obstacula* is mentioned.[20] Thus, presumably the same sort of *machinae* appears in the *Annales Altahenses maiores*, and in both cases artificial intervention in the hydrological regime produced stagnant bodies of floodwater in 1043 and 1044. While, however, in 1043 the emperor's army could not cross the river due to the extensive wetlands, in 1044 they found an easy crossing place with local help.[21]

Concerning the neighbouring areas, there is a famine dated to 1043 in the Czech Lands (by *Cosmas Pragensis*). Although some later authors suggested that the famine was caused by the occupation of Bohemia, R. Brázdil and O. Kotyza (1995), similar to Glaser, drew our attention to the fact that there was a wet and cold spell in the summer at Lake Constance (e.g., Reichenau) and St. Gallen.[22] As we will see, for 1044 a different picture may be gathered from

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[18] Oefele 1891, 33 (*Annales Altahenses maiores*).

[19] Oefele 1891, 35-36 (*Annales Altahenses maiores*): *Quo die cum noster heros ad locum condictum venisset et illum minime reperisset, volens eum insequi ultra Rabanisa fluvium, invenit iter stagnantibus aquis et machinis more illis solito interclusum. Ducatum autem preabentibus Ungris, quos secum habuit, tota nocte equitando sursu per ripam crepusculo facili vado transit. Quorum adventum prospectantes, qui machinas custodiebant, relictis omnibus, quae habuerant fugerunt.*

[20] *SRH* vol. 1, 329.

[21] *SRH* vol. 1, 331 (*Chronici Hungarici compositio saeculi XIV*): *(S) Concitato itaque cursu invasit fines Hungarie intrans per Supronium et cum vellet per Bobuth Rabcha pertransire, fluvium Rabcha stagnantibus aquis et densissimis nemoribus et scaturinetibus paludibus impermeabilem transire non potuit. Hungary ergo qui erant cum cesare et Petro rege, duxerunt exercitum tota nocte equitantes sursum iuxta fluvios Raba et Rabcha, quos illucenscente sole facili vado transierunt.*

[22] R. Brázdil and O. Kotyza, *History of Weather and Climate in the Czech Lands* I *(Period 1000-1500)*, Zürcher Geographische Schriften 62 (Zurich: ETH, 1995), 92, with reference to P. Alexandre, *Le climat en Europe au Moyen Age. Contribution à l'histoire des variations climatiques de 1000 à 1425, d'après les sources narratives de l'Europe occidentale* (Paris: Ecole des hautes études en sciences sociales, 1987), 326 and 338, using the chronicle of *Herimannus Augiensis* and the *Annales Sangallenses maiores.* See also Glaser, *Klimageschichte*, 61.

contemporary documents: more of a dry than wet character of the early and mid-summer times is described.

Dust veil on 5 July, 1044:[23] *The battle of Ménfő*

Referring to the battle of Ménfő in 1044, both the *Annales Altachenses Maiores*[24] and the 14th-century chronicle composition mention that during the battle first a cloud arose above Aba's army and then a sudden dust storm, which disconcerted the army and was largely responsible for the victory of King Peter I's troops.[25] This event was as well mentioned by *Herimannus Augiensis*.[26] Further circumstances and background conditions of the battle were studied in detail by L. Négyesi.[27] Based on the latter's reconstruction of the geographical circumstances of the battle, the cloud appeared roughly towards the east, since Aba's army occupied this position (north-northeast from the medieval village of Ménfő). The event happened in the middle of summer, so hot and dry weather at that time was not unusual. Since the wind storm seemed to come from an

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[23] Calculating it for the Gregorian Calendar (hereafter: GC): 12 July.

[24] Oefele 1891, 37 (*Annales Altahenses Maiores*): *1044. ... Igitur eo die, cum vellent confligere, ut supra diximus, uterque populus, tantum progressus, ut facilis invicem esset prospectus, tenuis nubecula, id est caeleste signum, adparuit, quos apostolicus, successor beati Petri, eo quod regem suum dehonestarant, iam pridem anathemizarat. Et ecce turbo vehemens ex parte nostratium ortus pulverem nimium adversariorum ingessit obtutibus. Hoc sedato, nostris Dominum invocantibus et illis econtra incondite vociferantibus, pugna nimis atrox inchoatur et summa vi utrimque decertatur.*

[25] *SRH* vol. 1, p. 332 (*Chronici Hungarici compositio saeculi XIV*): *(S) .... Tradunt autem Teutonici, quod cum ad prelium appropinquassent, cum celesti signo nebula tenuis apparuit, turboque vehemens divinitus incitatus terribiliem pulverem obtutibus ingessit Vngarorum, quos iam pridem, ut dicitur, quia Petrum suum regem dehonestaverant, dominus apostolicus anathemate dampna verat feriendo.*

[26] *MGH SS* vol. 5, 124-25 (*Herimannus Augiensis Chronicon*): *1044. Maxima pestis pecudum, et hiems satis dura et nivosa magnam vinearum partem frigore perdidit, et frugum sterilitas famem non modicam effecit. .... – Ovo rex cum iusiurandum pactumque infregisset, Heinricus rex cum perparvis copiis Pannonias petiit. Quam Ovo, qui maximum paraverat exercitum, in tantum despexit, ut eum, quasi facile occidendum seu capiendum, provinciam ingredi sineret. Sed Heinricus cum parte copiarum Rabam fluvium festine, in divino confisus auxilio, transvadavit, pugnam cunctis militibus passim festinantibus iniit, et in prima congessione innumerabilem Ungariorum exercitum fugavit atque prostravit, et paucissimis suorum amissis, ipsemet fortissime pugnans, gloriosissimam victoriam adeptus est 3. Non. Iul.*

[27] L. Négyesi, "A ménfői csata" (The battle of Ménfő), *Hadtörténelmi Közlemények*, 107/3 (1994): 136-46. It seems likely that, as Négyesi also suggested in his article, the windstorm prevented Aba's traditional Hungarian archers from using their arches which provided favourable circumstances for the western type of 'close-fighting' tactics. Négyesi's paper is one of the nice examples in Hungarian research, in which – discussing the circumstances of the battle in great detail – the author also kept and eye on and provided a concise and systematic analysis of the geographical/environmental background, with a certain emphasis on weather conditions. When talking about the actual weather conditions of the battle, Négyesi even applied the results of scientific meteorological literature (p. 141).

easterly direction and there was great dust, dry (and warm/hot) conditions might have prevailed earlier for a time.

According to the *Annales Altahenses maiores*, after King Aba and his army had lost the battle of Ménfő, he ran away to the east where he was struck by lightning in a village,[28] while *Herimannus Augiensis* claimed that after the battle Aba was killed by his own people.[29] Similar to the domestic 13th-century *Gesta Hungarorum* of Simon Kézai,[30] Henrik Mügeln (14th century, but applying Hungarian narratives) suggested that Aba died from serious injuries.[31]

An important addition can be found in the (late-11th-century) *Chronicon Bernoldi*: Right after the (otherwise copied) sentence about the Hungarian campaign of Henry III, it is mentioned (without providing any exact location) that a great famine occurred (*Magna vis famis homines immunda animalia comedere coedit*).[32] Even if no further details are available concerning the location of this famine, it may have some connection with the famine in the time of King Peter (who became king once again right after Aba had died) when bones of St. Coloman were taken as a gift for him to Hungary (see the next case). Also, as said before, famine was mentioned for Bohemia in 1043.

Drought and famine in 1044?

An early-11th-century famine might be documented in the *Chronicon Austriae Mellicense breve*: When the bones of blessed Coloman were taken to Hungary, disease and famine occurred there. The dating of this possible event is rather uncertain. Even if the only date mentioned around in the text was 1012 (1018?), it can be more probably be dated, as the same chronicle also suggests, to the reign of Peter I.[33] Until 1038 King Stephen ruled in Hungary (1001-1038),

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[28] Oefele 1891, 37 (*Annales Altahenses maiores*): *1044. ... Caeterum Obo fugiens in quendam vicum pervenit, villaque fulmine succensa ipse pene interiit, et vix elapsus fugitando latitabat, usque dum comprehensus communi iudicio nostrorum et suorum capitalem subit penam.*

[29] *MGH SS* vol. 5, 125 (*Herimannus Augiensis Chonicon*): *1044. ... Et Ovone rege vix fuga elapso, omnes Ungarii ad dedicionem Heinrico regi catervatim concurrunt, subiectionem serviciumque promittunt.*

[30] *SRH* vol. 1, 176 (*Simonis de Keza Gesta Hungarorum*): *Aba vero rex fugiit versus Tizam et in villa quadam in scrobe veteri ab Hungaris, quibus regnans nocuerat, iugulatur et iuxta quandam ecclesiam sepelitur.*

[31] *SRH* vol. 2, 261 (*Chronicon rhythmicum Henrici de Mügeln*): *Post annos vero plurimos / Effoditur per Hungaros, / Qui eum invenerunt / Sanatum a vulneribus. / Quem ceteris funeribus / In Sarus posuerunt.*

[32] *MGH SS* vol. 5, 425.

[33] According to the *Annales Mellicenses*, Coloman died in 1012, and was buried, then re-buried in 1013 and 1014, but still not in Hungary. See G. H. Pertz, *Monumenta Germaniae Historica*. *Scriptores*, vol. 9: *Chronica et annales aevi Salici* (Hannover: Impensis Bibliopolii Hahniani, 1851) (hereafter *MGH SS* vol. 9), 497 (*Annales Mellicenses*): *1012. Beatus Cholomannus martyrizatus est, et suspensus apud Stocchaerouwe. ... / 1013. Hoc anno beatus Cholomannus sepultus est eodem loco. / 1014. Hoc anno sanctus Cholomannus a Megingaudo Heibstatensis episcopo in Medilccha sepultus. ...*

and Peter became the king only afterwards (1038-1041, 1044-1046).[34] The non-contemporary (15th-century) compilator, *Vitus Arnperckius*,[35] not only mentioned the same diseases and famine, but also the excessive lack of rain (*nec pluviam habuerint*).[36]

Thus, the most probable dating of these events is the early-mid 1040s, especially the period of 1044-1046 when King Peter had close ties with Henry III.[37] About the same time, according to Glaser, in 1044, there was famine in the area of Nuremberg.[38] The great famine (which occurred in the Czech Lands) was dated to 1043 in the Czech sources.[39] As Glaser suggests, wet and cool summers prevailed in the German areas in the 1040s and 1050s; the summer of 1043 was particularly cool and rainy, and the wine of that summer was sour.[40]

While mentioning famine generally in Hungary, it is unclear, whether the western sources really referred to the whole country or only the better-known

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[34] G. Waitz, *Monumenta Germaniae Historica*. *Scriptores*, vol. 24: *Annales aevi Suevici* (Hannover: Impensis Bibliopolii Hahniani, 1879) (hereafter *MGH SS* vol. 24), 71 (*Breve Chronicon Austrie Mellicense*): *Hic autem H. marchio duravit per annos circiter quadraginta usque ad tempora Petri regis Ungarorum, qui sancto regi Stephano successerat. Istius Petri [T. Peter] precibus et minis circumventus Poppo Treverorum archiepiscopus, frater marchionis, obtinuit a fratre suo, ut mitteret in Ungariam ossa beati Cholomanni; que tamen postea Ungari pestilentia et fame compulsi reddiderunt. H. vero marchio decedens ipso anno, filium reliquit Adalbertum, attavum vestrum. (...) Ille cum filio suo L.II. commissa pugna cum Ovone rege Ungarorum, quo Petro regi superpositus fuert, maximam partem exercitus eius delevit, victor existens.*

[35] *Lexikon des Mittelaters*, vol. 1 (Munich and Zurich: Artemis-&-Winkler-Verlag, 1980), col. 1011.

[36] H. Pez, *Scriptores Rerum Austriacarum* (Leipzig 1721) (hereafter: *SRA*), 1181 (*Vitus Arnperckius*): *Sed tempore, quo sacrum corpus* [Saint Coloman] *in Hungariam permansit, Hungari multas plagas sustinuerunt, pestilenciam, famem, nec pluviam habuerint.*

[37] This dating is also clearly suggested in the academic literature: Poppo, the archbishop Trier, brought with him the bones to Hungary. However, due to the political changes in Hungary (Peter lost his crown in 1046), the bones soon reappeared in Melk. In spite of this fact, his herma was still mentioned in 1515 as part of the treasures in the basilica of Székesfehérvár. See: A. Borosy and J. Laszlovszky, "Magyarország, a Szentföld és a korai keresztes hadjáratok" (Hungary, the Holy Land and the early Crusades), in J. Laszlovszky, J. Majorossy and J. Zsengellér (eds.), *Magyarország és a keresztes háborúk. Lovagrendek és emlékeik* (Hungary and the Crusades. Military orders and their recollections) (Máriabesnyő and Gödöllő: Attraktor, 2006) (75-89), 78.

[38] Glaser, *Klimageschichte*, 71.

[39] See, e.g., B. Bretholz, *Die Chronik der Böhmen des Cosmas von Prag*. MGH SS Nova series, vol. 2 (Berlin: Weidmannsche Buchhandlung, 1923), 100 (*Cosmas Pragensis*): *XIII. Anno domince incarnationis MXXXXIII. Tanta fames fuit in Boemia, ut tercia pars populi interiret fame. / Anno dominice incarnationis MXXXXIIII*. For a further analysis of Czech evidence, see Brázdil and Kotyza, *History of Weather* I, p. 92.
It is interesting that while *Cosmas Pragensis* mentioned hunger for 1043, he fails to mention the year 1044. As a parallel, *Herimannus Augiensis* (*MGH SS* vol. 5, 124) in his chronicle mentioned that the summer of 1043 was rainy and a shortage (of grain and wine) occcured.

[40] Glaser, *Klimageschichte*, 61.

western parts. However, despite the controversies, 1044(-1046: Peter's second reign) seems to be the most likely date for the drought and famine.

Continuous rainfall: August 1051 – an(other) unlucky campaign of Henry III to Hungary?

A major German military campaign for Hungary was realized in 1051. While one part of his army proceeded along the Danube, the emperor himself rode to the south and invaded Hungary from the 'Carantan borders' (*per Carentani fines*), from today's Styria, downstream along the Rába river. According to *Herimannus Augiensis*, all this happened in autumn.[41]

At this time, however, learning from past mistakes, the emperor planned his attack more carefully, avoiding the 'fatal triangle' of the Fertő-Hanság-Rábca(-Danube) wetland area. Two armies entered Hungary: one (by ship) on the Danube, and the other, main one downstream along the Rába river, from Styria. As for the route of their march, the 14th-century chronicle composition mentioned the Zala and Zelice (Szőcei-patak) Rivers.[42] On the Austrian border these two waterflows lay quite close to each other. As the *Annales Altahenses maiores* interprets the events, it was a difficult campaign, largely due to the fact that the whole summer had abundant rains (*Totum namque aestivum tempus, pluviis abundans, inmanes fecit prorumpere aquas*). During this campaign, many people and horses went beneath the floodwaters (*Qua de re plures tam hominum quam equorum summersi sunt*).[43] Nevertheless, the emperor took the long way until he reached Hungary (in mid-August; which in GC is late August). Thus, the rainy conditions might mainly refer to the conditions of the German/Austrian areas. In addition, it is interesting to note that, according to the 14th-century chronicle composition, the Hungarians were able to successfully

[41] *MGH SS* vol. 5, 130 (*Herimannus Augiensis Chronicon*): *Sequenti autumno magno cum exercitu imperator, pctum Andreae regis ut per legatos offerebatur accipere contemnens, Pannonias petiit, Gebehardoque atisponense episcopo et Welf Brezizlaoque ducibus ad septentrionalem Danubii partem depopulandam transmissis, ipse, devecto e navibus, quantum in equis poterat, sumptu, longo propter fluviorum illuvionem circuitu per Carentani fines transiens, periurumque regnum invadens, hac ac illac Ungarico exercitu latrocinantium more fugitante et nusquam aequo Marte conferre manum audente, omnia circumquaque, quoad sumptus militi suppetebant, vasta reddidit.*

[42] *SRH* vol. 1, 347 (*Chronici Hungarici compositio saeculi XIV*): *Sequenti vero anno cesar cum magna multitudine bellatorum ob easdem causas venit in Hungariam iuxta fontes rivorum Zala et Zelice.* The medieval name of the Zelice River is preserved in the name of the village called Szőce. See G. Kiss and B. Zágorhidi Czigány, "Víznevek névalkotó szerepéről – Vas megyei példákon" (The role of water bodies in shaping the names of locations – examples from Vas county) *Helynévtörténeti tanulmányok*, 6 (2011), 111-119.

[43] Oefele 1891, 47 (*Annales Altahenses maiores*). A rainy August was also mentioned for Lobbes (today in South-Belgium, close to the French border). See Brázdil and Kotyza 1995, 93; Alexandre 1987, 338.

apply scorched-earth tactics against the emperor and his army.[44] So, this information would not by itself imply that rainy conditions prevailed in West-Hungary during the emperor's military campaign.

More is available in the description of *Aventinus*. Apart from the unpleasant and unusual fighting tactics of the Hungarians, he also blamed the unfavourable weather conditions for the disastrous result of the campaign stating that the rivers and swamps of Hungary were extended due to the rainy conditions.[45] In fact, *Aventinus* refers to the fact that not only the waterflows and wetland areas were extended, but there were also continuous showers (heavy rainfall), and the military campaign had to be aborted that year mainly because of the atrocious weather, bad floods and a shortage of food. Thus, it seems that rainy conditions were not only typical for Bavaria that summer, but they also most likely went with the German armies on the western border of Hungary (in Austria; and perhaps in the Czech Lands too).[46]

The coronation of King Salamon and the great fire event in Pécs in April 1064

According to the *Chronicon Monacense*, after the coronation of King Salamon on 11April, 1064,[47] at night the entire palace and the basilica in Pécs

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[44] *SRH* vol. 1, 347 (*Chronici Hungarici compositio saeculi XIV*): *Cumque cesar intrasset ad Hungariam et venisset in regiones combustas, neque militibus suis invenire potuit victualia nec equis et nesciebat ubi naves eiu nullumque subsidium ex eis poterat habere.*

[45] N. Cisnerus, *Ioannis Aventini Annalium Boiorum* (Basel: Impensis Ludouici Regis, 1615), 327: Liber quintus: *Imperator petiti coactoque exercitu Ungariam invadere imperioque subigere tentat. ...Vbi illi fines hostium attigere, agrosque vrunt, aedificia, vicos incendunt, eiusmodi tempestates sunt consecutae, vt expeditio necessario intermitteretur, & continuatione imbrium, torrentum, fluminumque diluuiae, plerisque equorum & mortalium absumptis, sub papilionibus milites contineri non possent: itaque cunctis praeda, igne, ferro attritis, domum reuertuntur. Porro Imperator cum valida Francorum, Gallorum, Polonorum, Longobardorum, Venedorum, Sueuorum, Saxonum manu, Pannoniam Australem Vngariae partem, terrestri itinere, absque carrucis, annona equis clitellarijs aduecta, inuadit: sed paludibus fluminumque eluuie iter sibi interclusum offendit: longisque anfractibus alluuiones amnium, qui iugi pluuia aucti excreuerant, alueosque egrediebantur, circuit, per Chaironum fines Vngariam intrat. Hostes in continentes syluas ac paludes se suaque omnia contulerant, pugnandi aperto marte potestatem nequeaquam Caesari faciunt, pabulum, aquarum fontes corruperant. ....*

[46] It is also worth mentioning that in the catchment areas of the Rába and Rábca Rivers, according to 20th-century observations, the main flood period is usually spring. And there is a secondary flood maximum on the Rába River (especially on its upper sections, in Styria) in the June-July period. For the annual course and main hydrological characteristics of the river (and those of its upper catchment) see, e.g., P. Ambrózy, "A Felső-Rába vízgyűjtőjének éghajlati jellegzetességei" (Climatic conditions of the upper Rába catchment) *Vízügyi Közlemények*, 79/4 (1997): (498-517) 508-509. See also: L. Goda and V. Vasvári, "A Felső-Rába vízjárásának statisztikai jellemzése" (Statistical analysis of the upper Rába water course). *Vízügyi Közlemények*, 79/4 (1997): (518-538) 530.

[47] GC: 18 April.

were destroyed by a fire.[48] The 14th-century chronicle composition (being probably the main source of the *Chronicon Monacense*) provided even more details, but no information is available in the sources concerning the possible cause of the fire.[49] This event is still worth mentioning because, among other reasons, major fire events are often associated with previous dry (or in winter with prolonged cold) conditions; and (as one will see in the next case) strong winds may also exacerbate the effects of a fire.

The weather conditions of 1064 in the Czech (or Polish) lands are not described; no data is available. For the German areas, Glaser refers to the winter of 1063 as a hard and snowy one, with a cold March and a cold mid-April, but also no information is available for 1064.[50]

Fire in strong eastern winds: autumn 1071

According to the 14th-century chronicle composition, in the third month of the siege of Belgrade (historical Nándorfehérvár), in autumn, fire caused by the enemy (Greeks) was fanned by strong eastern winds, and the buildings all over Belgrade were engulfed by fire.[51] According to previous historical investigations, both the political and military background suggest that the siege was begun in late August and ended in late November.[52] For this year, no comparative information is available in the literature for the German territories and the Czech Lands (neither for Poland or for the closer part of the Balkan area).

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[48] *SRH* vol. 2, 75 (*Chronicon Monacense*): *Et de manibus ipsius Geyse rex in Qinqueecclesiis coronatur, 'et facta est letitita' magna 'in populo'. Nocte sequenti ecclesia, pallatia omnia cum edificiis annexis repentina flamma corrumpuntur. Rex et dux attoniti ob inopinatum incendium in bona pace convenerunt et a rege Dalmacie rogati in subsidium eius transierunt et revertuntur.*

[49] *SRH* vol. 1, 363 (*Chronici Hungarici compositio saeculi XIV*): *(S) 98. In eodem autem anno, ducibus ibidem existentibus ecclesia oribiliter est combusta.*
(V) 98. Nocte autem secuta prognosticum future discordie et turbationis provenit. Totam enim ecclesiam illam et omnia pallacia ceteraque edificia ei apendentia repentia flamma corripuit et universa castante incendio corruerunt. Accepit autem omnes timor pre nimia concussione flammarum stridentium et terribili furore campanarum et turribus ruentium; nex sciebat quisquam quo se divertet.

[50] Glaser 2008, 72.

[51] SRH vol. 1, 373 (*Chronici Hungarici compositio saeculi XIV*): (V) 108. *In tertio vero mense obsidionis quedam puella Hungarica olim illuc per captivitatem abducta in quarta feria civitatem succendit. Flabar autem subsolanus vehementissime, cunctaque edificia occupaverunt incendia. Exercitus itaque Hungarorum irruit in civitatem ea parte, qua muri eius per tormenta iam corruerant, et Grecos, Sarracenos atque Bulgaros crudeliter trucidarunt. ... Hungari ergo capta civitate sequenti die postquam ignis resederat, ...*

[52] For a detailed analysis of Byzantine and Hungarian sources, as well as Hungarian and international literature of the period and the siege itself, see, e.g.: F. Makk, *A turulmadártól a kettőskeresztig. Tanulmányok a magyarság régebbi történelméről* (From the 'turul' to the double-cross. Studies from the early history of Hungarians) (Szeged: Szegedi Középkorász Műhely, 1998), 148-52. See also Kristó 1986, pp. 63-64.

1074 (1): frozen solid Tisza River before and after 26 February[53]*; the battle of Kemej*

According to the Viennese version of the 14th-century chronicle composition, shortly before the battle of Kemej on 26 February (*quarta feria post Dominicam, que cantatur Exsurge*),[54] King Salamon crossed the frozen Tisza river at Thoroyd/ Cothoyd.[55] Then, after the successful battle, the king again crossed the Tisza on the way back.[56] Although the site of the battle is not precisely known, it was probably in the neighbourhood of Szolnok. The words *glaciatam* (before 26 February) and *congelatam* (after 26 February) are mentioned only in the (otherwise generally more detailed) Vienna-codex version of the *Chronica Picta*, whereas only the fact of crossing was mentioned in the less-detailed Sambucus (Buda)-codex version, both containing the 14th-century chronicle composition. Similarly, the 'frozen-Tisza' version appears in the chronicle of Henrik Mügeln, presumably taken from the Vienna chronicle.[57]

In order to cross in late February with a whole army, it was of course necessary that the Tisza was still frozen solidly. This means that there was a February (much) colder than usual in the central parts of Hungary. A cold winter month in 1074 is also mentioned by Alexandre, referring to Lower-Saxony, Vestfalia, Frankonia and Hessen.[58] According to Glaser, the winter of 1074 was especially severe in the German areas: the rivers froze "to the ground".[59]

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[53] GC: 5 March.

[54] SRH vol. 1, 385. For the chronology of events, see, e.g.: J. Bánlaky, *A magyar nemzet hadtörténelme*, vol. 3 (Budapest: Athenaeum, 1930), pp. 119-21.

[55] SRH vol. 1, 383 (*Chronici Hungarici compositio saeculi XIV*): (V) 117. *Dux vero cum exercitu suo obviavit regi in Kemey. Principes autem ducis ymo traditores, miserunt clamculo nuncios ad regem dicentes, quod sir ex eos in dignitatibus teneret et in gratiam in bello relicto duce ad regem confluerent. Rex autem certificavit eos super hoc prestito iuramento et securus tunc transivit Tysciam glaciatam super ducem.* As Bánlaky (1930) suggested (p. 119; also based on the 14th-century chronicle composition), the two armies probably crossed the Tisza on the one hand somewhere in the area of the present-day Cibakháza, on the other hand in the area of Egyek (close to the ferry of Dorogma; see fig. 1).

[56] SRH vol. 1, p. 386 (*Chronici Hungarici compositio saeculi XIV*): 119. … *Rex* [Salamon] *victoria potitus transivit Tysciam congelatam in Thoroyd et descendit Ladizlao et Otthoni ducibus cum valida multitudine pugnatorum ad se venientium.*

[57] *SRH* vol. 2, 183 (*Chronicon Henrici de Mügeln*): *Do der herczog Geysa ersah, daz in die sein liessen und der streit verlorn was, do wirt er sich dennoch, so er lengst mocht. Darnach floch er aus dem streit an die Teysa gegen Totoyd (sic). Do er kom gen Woczen, do begegent ym sein pruder Lasla und Otto, sein swager, mit grosser hilff. Darnach czoh der kunig mit sige uber die Teysa, die was gefrorn, und legt sich nider in den hoff Petus.*

[58] Alexandre 1987, 792, 803.

[59] Glaser 2008, 72.

1074 (2): gloomy weather on 13 March[60]

Hardly more than a fortnight later, another battle, this time fatal for King Salamon, took place about 120-150 km from the previous one, at Mogyoród (in the vicinity of Pest), on 14 March (*in diluculo ... sexte ferie*). In fact, the battle should have taken place on 13 March, but due to gloomy weather conditions (very dense fog), they could not commence fighting until the following day.[61]

Famine in Hungary: 1074 or 1075?

The 14th-century chronicle composition mentions famine referring to the first year of the reign of King Géza I.[62] In a later chapter, a famine (probably the same one) is mentioned during Géza I's rule (1074-1077).[63] It is the year when the latter king gained power and stabilised his reign in March (battle of Mogyoród) after a probably hard and late winter when armies marched through large territories of the country. Not only the two Hungarian armies of Salamon and Géza, but also Germans, Czechs and Moravians (each with their own armies) were present and participated in the battles of Kemej and Mogyoród.

However, although documentary traditions indeed dated Géza's coronation to 1074, the latter (with a 'royal' crown received from the Byzantine *basileos*) presumably took place in early 1075.[64] Thus, it may be that the actual famine year was not 1074 but 1075. No information is available concerning the Czech lands for 1074, nor for 1075; just the mid-summer heat and drought are mentioned in connection with a battle near the Unstrut river (Southwest-Saxony).[65]

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[60] GC: 20 March.

[61] *SRH* vol. 1, 389 (*Chronici Hungarici compositio saeculi XIV*): *121. Hoc dicto castra moverunt et descenderunt in allodio quod dicitur Zymgota* (Cinkota – today part of Budapest). *Mons autem quidam nomine Monorod* (today Mogyoród) *interiacebat exercitum, et lucescente quinta feria volebant preliari, sed densissima obscuritas supervenientis nebule eos impedivit. Nocte vero insequenti dextrarios suos per habenas in manibus tenentes ortum solis prestolabantur. In diluculo autem sexte ferie rex ordinatis agminibus suis equitavit trans verticem montis Monorod et precepit salmariis, ut in latere eiusdem montis remanerent, quatenus hostes videntes turmas illorum, non sarcinas, sed in presidio constitutos esse putarent.* For the battle, see, e.g., Bánlaky 1930, 122-25.

[62] *SRH* vol. 1, 403 (*Chronici Hungarici compositio saeculi XIV*): *In primo etiam anno regni sui (Géza I called Magnus) validissima fames regnum Hungarie afflixit*.

[63] *SRH* vol. 1, 457 (*Chronici Hungarici compositio saeculi XIV*): *In eodem autem prelio comes Vros cepit comitem Rapolt Teutonicum, quia iam pridem nocturnis insidiis castrum Poson occupaverat, et Gabriel Accionem. Post hec in diebus illis fames afflixit Hungariam, que magnam partem hominum in mortem obsorbuit.*

[64] Makk 1998, 155-157. Probably this is one reason why the *Annales Posonienses* dates the coronation itself for 1075 while the controversies are dated there to 1074. See *SRH* vol. 1, 126 (*Annales Posonienses*): 1074. *inter regem Salomonem et ducem Magnum* [Géza] *gravis discordia oritur, et Salomon regno privatur. / 1075. Magnus rex coronatur.*

[65] Brázdil and Kotyza 1995, 93.

1081: The basilica 'Crux Domini' in (Székes)Fehérvár was destroyed by thunder

Both the *Annales Posonienses* and (partly based on it) the 14th-century chronicle composition also reported on the lightening which struck and destroyed the basilica *Crux Domini* in Székesfehérvár some time in the year of 1081.[66] No information is available concerning this year in the German or Czech (or Polish) literature for Central Europe. Nevertheless, it is interesting to mention that, according to the Greek climate historian Ioannis Telelis, in Epiros drought and lack of water affected the Acheron river (reported in the summer), and in mid-July strong winds whipped up the sea at Corfu.[67]

Frozen Lower-Danube and dense snowfall: winter of 1087?

Similar to the (Hungarian) 14th-century chronicle composition, the 14th-century chronicle of Henrik Mügeln contains a description about the last years of the former King Salamon I.[68] After King Ladislaus I had allowed him to leave the country, Salamon (with Cumans and Pechenegs by his side) attacked the eastern parts of Hungary, and the battle ended only in 1085 when King Ladislaus forced them out of the country and down to the Lower Danube. Then Salamon participated in the Cuman(/Pecheneg) military campaign against Bulgaria in 1087:[69] According to the chronicle tradition, at this time in winter (mentioned after the failed battle), there was dense snowfall, and Salamon crossed the (Lower-)Danube when the river was frozen.[70]

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[66] *SRH* vol. 1, 126 (*Annales Posonienses*): 1081. *Ladizlaus rex et Salomon frater eius pacem fecerunt et (bis) crux Domini fulgure percussa est. SRH* vol. 1, 407 (*Chronici Hungarici compositio saeculi XIV*): (V) *Eodem etiam anno crux Domini, que Albe constituta fuerat, percussa est a fulgura.*

[67] Telelis 2008, 203.

[68] *SRH* vol. 2, 190-91 (*Chronicon Henrici de Mügeln*): *Das erfur der kunig und sante in gevangen gen Nytra in den kerker. Darnach lies man in aus dem kerker, do man erhub dem leichnam sant Stephans des kunges und sant Emreichs, seins suns. Also wart kunig Salomon ledig und frey. Darnach zoh kung Salomon heimlich czu dem heydenischen herczogen, der waz genant Kunkerly (sic), und globt ym sein tochter czu geben (sic) und das lant Sibenpurgen, das er ym hulf gen dem kunig Lasla. Do liesz sich der herczog Kumkerly uberreden und zoh mit grosser menig gen Vngern. Do daz erhort der kung Lasla, do fur er aus mit dem her gegen den Heyden und gegen dem kunig Salomon und slug ir manig taussent czu tode. Do floh der kunig Salomon und Kumkert (sic) aus dem streyt. Darnach zoh der kunig Salomon gen Pulgrey und nam ein raub in dem land. Do volg in der keyser und slug ir vil czu tode, und kunig Salomon (sic) uber die Tunaw, die was gefrorn.*

[69] Dating the siege of Plovdiv to 1087 seems to be relatively well-confirmed; see: J. Bánlaky, *A magyar nemzet hadtörténelme* (Military history of the Hungarian nation), vol. 4 (Budapest: Athenaeum, 1931), 7.

[70] *SRH* vol. 1, 409-10 (*Chronici Hungarici compositio saeculi XIV*): (V) 134. ... *At rex Salomon cum latrunculis Cunorum invasit Bulgariam et confinia Grecie, ubi ab exercitu imperatoris Grecie miserabiliter sunt percussi, e quibus pauci valde evaserunt. / 135. Cum enim vidissent Cuni magnam multitudinem loricatorum, timuerunt valde ceperuntque*

No information about the exact time (and place) of this Danube-crossing is available, and one does not know how much of the river was frozen. But the fact that the ice was thick enough for an army to cross suggests hard preceding winter conditions at least for a few weeks before. However, according to Glaser, heavy snow was reported in the Nuremnberg area for the winter of 1086 (and not 1087).[71]

Falling loess wall in 1092? Some natural phenomena and the possible environment behind

In the year 1092, an interesting set of natural phenomena, possibly related to wet conditions and flood, was included in the description of *Bernoldus monachus*, based on the reference of contemporary eyewitnesses.[72] He was not present at the events described, only heard about them from others, the actual eyewitnesses (*ut audivimus*). Since the monk (who died in 1100), in those few cases when he talked about Hungary, was otherwise quite well-informed about the Hungarian matters (e.g., 1083: canonisations; 1096: events around the First Crusade) and all of his reference concerning Hungarian events mentioned in his work were correctly dated, it is worth studying his account in more detail.

But before giving full credit to the present description of *Bernoldus monachus*, it is worth taking a closer look on his geographical and weather-related background of these 'possible' events. The monk mentioned five separate events he had heard about Hungary:[73]

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festinare, ut transirent Danubium priusquam ab hostibus concluderentur. Qui ergo loricas non habebant, celerius pre levitate precedebant. Salomon autem et sui atque alii loricati armorum pondere prepediti precedentes socios tardius sequebantur, et yems erat ningebatque densissime repleverantque nives oculos eorum et preoccupante nivium densitate non poterant videre socios suos, qui precesserant. Errantes itaque ferebantur per inania. Sed et hostes persequebantur eos cominus. Cumque devenissent ad quodam castrum desertum et vacuum, intraverunt illuc et tota die et nocte ibidem manserunt. Hostes autem circumdederunt castrum undique. Obsessi vero videntes se periculo famis perire, elegerunt magis pugnando mori, quam fame perimi. Summo itaque diluculo exierunt in hostes et simul cum interfectoribus suis interierunt et quamplures ex eis occidebantur, qui eos interficiebant. / 136. Rex autem Salomon fugiens (S: evasit cum paucis) (V) cum paucis vix evasit (S+V) et facili cursu transivit Danubium, quia glaciatus erat.

[71] Glaser 2008, 73, without reference to the original source.

[72] J. R. Strayer (ed.), *Dictionary of the Middle Ages*, vol. 2 (New York: Charles Scribner's Sons, 1983), 197: "Bernold of Constance (or of St. Blasien, around 1050-1100) was canon of Constance; monk of St. Blasien and then of Schaffhausen; chronicler, canonist, liturgist, polemicist; and earliest and most influential disseminator of the ideas of Pope Gregory VII in Germany. His chronicle (autograph in Munich, MS lat. 432, the Codex latinus monacensis) is the most extensive source for the history of the Investiture Controversy." See also: A. Vauchez, B. Dobson and M. Lapidge, *Encyclopedia of the Middle Ages* (Cambridge: James Clarke, 2001), 176.

[73] *MGH SS* vol. 5, 454 (*Bernoldi Chronicon*): *1092. .... In Ungaria his temporibus multa prodigia contigerunt, ut audivimus. Nam quidam mons se in Danubium praecipitavit: unde*

1. A hill located along the Danube 'slipped' or 'fell down' (*Nam quidam mons se in Danubium praecipitavit*) and devastated areas around it. The Danube changed its riverbed and destroyed wide areas (*unde fluvius ille alveum suum mutare coactus, circumiacentes terras longe lateque vastavit*).
2. In another place, a great lake emerged in a dry area (dryland) (*Item in sicca terra lacus magnus alibi emersit*, …).
3. In another lake, a hill suddenly appeared (*in alio lacu mons quidam de repente apparuit*).
4. The River Tisza(?) flowed with blood for three days (*Fluvius quoque nomine Thisaha per triduum sanguineus fluxit*).
5. Immensely great thunder, which had not been heard for centuries, frightened people, which was sensed to be crossing over the ground and then returning under the ground (*Tonitru quoque maximum et a seculis inauditum homines ibi terruit quod supra terram transivit, et sub terra redire sentiebatur eadem via*).

First, we need to ask how he came to this information. *Bernoldus* at that time (1092) lived in Schaffhausen, located in northern Switzerland on the Rhine River, west of Lake Constance. Since *Bernoldus* himself died in 1100, we can presume that he had relatively up-to-date 'news' about Hungary. Probably the main sources of information were the pilgrims coming from the Holy Land via Hungary (or travellers/merchants using this main route), crossing the town of Schaffhausen as well. And while staying at the monastery or in the town, they may have narrated their 'adventures' to *Bernoldus*, his fellow monks or others. This seems more likely when we look at the location of the transcontinental pilgrimage (and travel/trade) route through Hungary (see fig. 2). Not only each of the five events might be analysed separately, but with the grouping of most of them (no. 1, 2, 3, and 5) the hypothesis of one (complex) phenomenon can be suggested (after changing the order of some events).

The environmental hazard which can only be discussed separately is reference no. 4: namely that the Tisza(?) flowed with blood for three days. It is a 'typical' biblical expression, one of the scourges that affected Egypt and is mentioned in the Old Testament. Although the exact mechanisms have not been explained in every case, the bloody water flow on the one hand might be related to the phenomenon of 'blood rain', when red Sahara dust, with hot and dry African air masses, reached the Carpathian Basin in great quantities and affected the colour of the rain. On the other hand, it may be explained by the process of

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fluvius ille alveum suum mutare coactus, circumiacentes terras longe lateque vastavit. Item in sicca terra lacus magnus alibi emersit, et in alio lacu mons quidam de repente apparuit. Fluvius quoque nomine Thisaha per triduum sanguineus fluxit. Sed et terrae motus ibi inauditus factus est, ita ut homines eius impetum stando sustinere non possent. Tonitru quoque maximum et a seculis inauditum homines ibi terruit, quod supra terram transivit, et sub terra redire sentiebatur eadem via. On the next page (455) *Bernoldus* reported an earthquake in the same year, which occurred in the bishopric of Constance.

river eutrophication.[74] Of course, in this particular case, one cannot arrive to any firm conclusions concerning the reason of the "three-day blood flow". This one reference clearly stands out as a separate event, and cannot be related to the other events described by the monk.

Event no. 1 contains the reference to a Danube flood, when a hill or mountain (*mons*) fell into the Danube, which then caused a devastating flood event. At first sight it sounds like a typical description of a rapid mass erosion, which – in the case of the Middle-Danube – would most likely occur in the areas where loess walls are located close to the Danube. Events no. 2 and 3, namely that a great lake emerged in a dry area and in another lake a hill suddenly appeared, are more difficult to explain. In fact, these later events sound rather 'mysterious', even in spite the monk *Bernardus* – based on his other works – seems to be a particularly trustworthy (and well-informed) annalist of his time. Nevertheless, he said he only heard about these events and was not present when they took place.

Case no. 5, namely that an "immensely great thunder – which had not been heard for centuries, frightened people, and was sensed to be crossing over the ground and then returning under the ground" – is also difficult to interpret. It should be mentioned that an earthquake in Hungary, exactly dated to the same year (1092), is mentioned in the *Annales Augustani*.[75] The author in this case clearly referred to a major earthquake. Due to the possible similarities in physical sensation, these two cases might have some connections to each other, so it may be interesting to seek some later parallels.[76]

In the Carpathian Basin, the greatest earthquake known in detail is the one that occurred along the Danube with an epicentre close to Komárom/ Komarno (between Győr and Komárom) in 1763. The earthquake devastated the town of Komárom (over 600 buildings collapsed or were seriously damaged, 63 people died). The damage was also great in the settlements located several tens of kilometers away from Komárom.[77]

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[74] For an explanation on the 'blood rain' event and its meteorological background, see, e. g., J. R. White, R. S. Cerveny and R. C. Balling, "Seasonality in European Red Dust/'Blood' Rain Events," *BAMS*, 2012 April: 471-76. For a possible relationship to eutrophication, see, e. g., K. Richardson and B. B. Jørgensen, "Eutrophication, history and effects," *Coastal and Estuarine Studies*, 52 (1996): 1-19.

[75] G. H. Pertz (ed.), *Monumenta Germaniae Historica. Scriptores*, vol. 3: *Annales, chronica et historiae aevi Saxonici* (Hannover: Impensis Bibliopolii Hahniani, 1839) (hereafter: *MGH SS* vol. 3), 134 (*Annales Angustani*): *1092. In provincia Ungarorum una die, 6. Kal. Iulii ter terrae motus factus est urbesque submersae sunt.*

[76] And even if we treat case no. 5 separate from the earthquake report, due to the later complex interpretation issues, it is worth to discuss possible parallels already at this place.

[77] For an overview in Hungarian, see for example: P. Varga, "Földrengések a történelemben. Komárom katasztrófája 1763-ban" (Earthquakes in history. The catastrophe of Komárom in 1763) *História* 8 (1998); for an overview in English see, e. g., the case study in: U. Eisinger, R. Gutdeutsch and Ch. Hammerl, "Historical Earthquake Research – an Example of Interdisciplinary Cooperation between Geophysicists and Historians," in R. Gutdeutsch,

In line with the known evidence, cases no. 4 and no. 1 can be separately analysed and an interpretation given for each. No. 2, 3, and even no. 5 cannot be readily explained as separate events. However, if we combine these latter three events with the 'easy case' of no. 1, a rather reliable-looking 'story' can be provided, and it is relatively easy to find a modern, well-described parallel for this complex event.

As can be seen in fig. 2, the main branch of the high medieval transcontinental route through Hungary mostly led along the Danube. Entering Hungary, it first went along the Danube, then turned away from the river towards the southeast, and reached the Danube again at its middle section, continuing along the river for hundreds of kilometres. If travellers saw or heard about any natural phenomena related to the Danube, it is more likely to have taken place either at the upper, or the latter middle sections (with loess walls alongside it; see fig. 2).

In historical Hungary (except for the Devín Gate area), the Upper-Danube section is completely flat colluvium with several islands. The Danube passes through a hilly area in the Danube Bend. Here the hills are of volcanic origin and hence in this area with the hard volcanic stones it is relatively difficult to imagine that an entire hill would have just 'slipped' into the Danube. Along the sections south of Budapest, however, there is a rather extensive area that seems to be an ideal place for the phenomena apparently described by the monk. Although this is also a lowland area – for several dozens of kilometres the south-eastern edge of the Mezőföld loess plain (plateau) descending towards the Danube –, it is divided into a series of (locally called) 'hills'[78] following the western banks of the river (see fig. 2). The edge of this loess plateau is approximately 50-60 metres higher than the water level of the Danube. The eastern edge of the plateau, facing towards the Danube, is even today a high-risk area, and subject to such 'slipping' or 'falling' events (which actually happened, for example, in the extraordinary wet year of 2010).

G. Grünthal and R. Musson (eds.), *Historical Earthquakes in Central Europe*, vol. 1 (Vienna: Geologische Bundesanstalt, 1992), 33-50.

[78] In medieval and modern Hungarian terminology, the Hungarian word 'hegy' (Latin *mons*) was equally applied for a 'real' hill/mountain (in its present geographical meaning), but also for smaller mounds rising above its surroundings. See, e. g., Gy. Kristó, *Tájszemlélet és térszervezés a középkori Magyarországon* (Landscape perception and the organisation of space in medieval Hungary) (Szeged: Szegedi Középkorász Műhely, 2003), 37.

Fig. 2: International route of medieval pilgrimage (11th-12th centuries) going through Hungary,
and the high-risk edge of the loess plateau along the Danube[79]

Nowadays this middle section is the area where there could be such a mass-erosion event most likely within a very short period of time (several minutes to a few hours) and thus it is worth having a closer look on modern parallels of mass erosion events in this area. Here the loess plain of the Mezőföld reaches the Danube and forms an unstable set of loess walls between Paks and Dunaszekcső (fig. 2). Underneath the Mezőföld loess plain, clay layers form a hollow declining towards the Danube. This clay hollow collects and

[79] For the Hungarian section of the medieval route of pilgrimage, see Borosy and Laszlovszky 2006, 78, 81. See also L. Gerevich (chief ed.), *Budapest története az őskortól az Árpád-kor végéig* (History of Budapest from the Neolithich period until the end of the Arpadian period) (Budapest: Budapest Főváros Tanácsa, 1973), 274. The map is based on T. Dudar (chief ed.), *Történelmi világatlasz* (Atlas of world history) (Budapest: Kartográfiai Vállalat, 1991), 109.

leads waters towards the Danube, under the loess layer. There, with the slippery surface between the clay and the loess, a wet preceding period as well as human activity over the loess surface, (even minor) earthquakes and/or the existence of some nearby water reservoir, and water-level changes in the Danube may be chiefly responsible for the fall of a loess 'hill'.[80] Very frequently, such an event occurs at a place where a previous falling event already obstructs the water in its natural downflow underneath the loess layer. It should also be mentioned that the occurrence of this certain phenomenon requires the combination of specific conditions (e.g., wet period, water-level changes, minor earthquake/artificial damming) listed above. This phenomenon is very typical even today, and we know of several such cases like that in Dunaszekcső, Dunaújváros and Dunaföldvár (for the modelling of such a phenomenon, see fig. 3). In these towns, several buildings and streets are in constant danger of 'being engulfed' by a loess fall event, or being buried under a falling loess wall.[81]

The fall of the loess wall of Dunaföldvár called 'Öreg hegy' ('Old Hill', or it can also mean 'Big Hill' in old Hungarian), shown in fig.3, that occurred in 1970, perhaps provides a good parallel with the account of *Bernoldus monachus*. Here the previous, almost one-year period was wet (with a 20% precipitation excess) in the Mezőföld area. Moreover, the summer of 1970 was very rainy. Then the (sandy clay) layer between the clay and loess became wet and slippery. The water level of the Danube was high in late August – early September. Also some (minor) earthquake events had occurred previously. As a result, on 15 September the Öreghegy collapsed with an enormous cracking sound (just like case no. 5 in *Bernoldus*' description?). The loess pushed the clay up, forming two new rows of islands in the Danube. It also led to a sudden flood event that devastated and inundated the surrounding areas (see fig. 3).[82]

In summary, a preceding wet period (over several seasons, a year or several years) over the underground catchment area (the Mezőföld) as well as some physical disturbance (minor earthquake) and improper outflow (abundant rainfall, high water-level conditions of the Danube) are all necessary circumstances that could have induced the mass-erosion event described above. Hence, whenever such an event happens, it already suggests a previous wet period and high water-level conditions over a well-defined, larger area.

[80] M. Pécsi, "Az 1970. évi dunaföldvári földcsuszamlás" (The loess-fall event of Dunaföldvár in 1970), *Földrajzi Értesítő* 20/3 (1971): 233-38.

[81] M. Pécsi, *Geomorfológia és domborzatminősítés* (Geomorphology and morphological evaluation) (Budapest: MTA Földrajztudományi Kutató Intézet, 1991), 171.

[82] Pécsi 1971, 233; Pécsi 1991, 171.

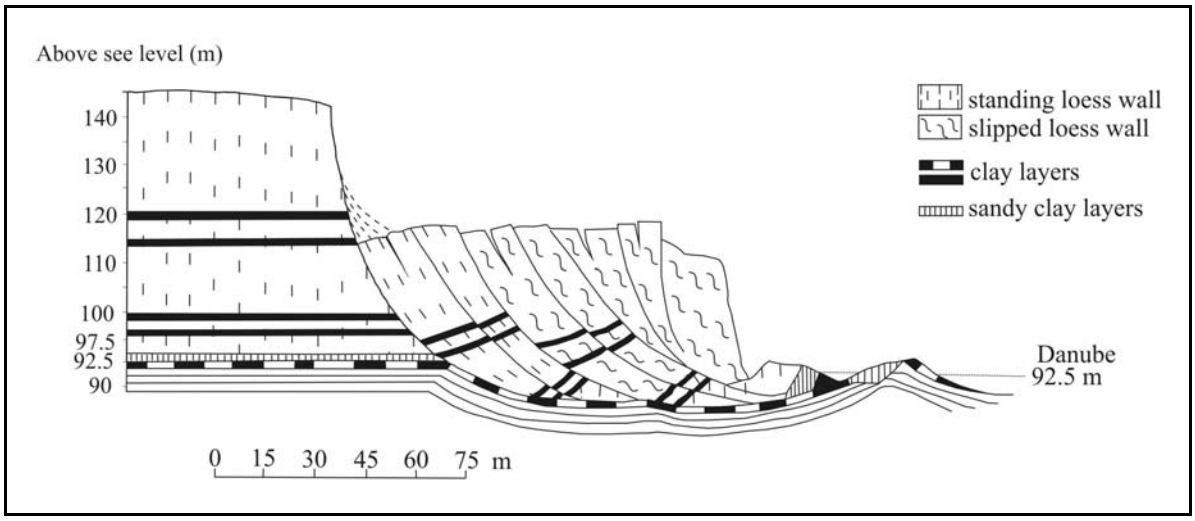

Fig. 3: Modelling the fall of a loess wall called 'Öreghegy' in Dunaföldvár, 1970 (after Pécsi 1971)

One can see several similarities between the description of *Bernoldus monachus* and the 1970-fall of the Öreghegy at Dunaföldvár. Not only the first, but nos. 2, 3, 5 (and probably even the earthquake 'story') as well might be worth taking into account, even if some of them are described as separate events. A separate analysis of the events nos. 2, 3 and 5, due to lack of information, would not lead us too far. Nevertheless, when taken together they show clear similarities to a prototype of a loess-fall event, like that described above: a hill falling into the Danube, the river changing its bed and destroying (flooding) broad areas, a lake emerging, a 'hill' appearing in the lake, an earthquake, a great thunder-like noise frightening people, which felt like it crossed over the ground and then returned under the ground.

It should be noted, however, that *Bernoldus monachus* was not an eyewitness. He narrated accounts from Hungary that he had not seen and only heard from others. A biblical meaning and therefore an attempt to find a set of events related to the disasters and signs predicting the end of the world might also have influenced his description of the events. Moreover, the present interpretation is a likely possibility, but no firm conclusions can be drawn in general. Therefore, further information and other possible parallels for the year of 1092 might have great significance when trying to explain what happened then. Based on *Cosmas Pragensis*, for example, a great intrusion of winter with ice, frosts and abundant snowfall was witnessed on 1 April, 1092.[83] No other direct, weather-related information in the vicinity is currently available for this

[83] B. Bretholz (ed.), *Monumenta Germaniae Historica. Scriptores rervm Germanicarvm nova series*, vol. 2: *Cosmae Pragensis Chronica Boemorvm* (Berlin: apvd Weidmannos, 1923) (hereafter *MGH SS rer. Germ*. NS vol. 2), 157: *Quos dux iam mutato animo benigne suscepit et celebravit cum eis pascha in urbe Wissegrad. Et in ipsa pasche ebdomada circa kal. Aprilis descendit maxima nix et tantum inhorruit frigus mixtum cum glacie, quantum raro in media contigit hyeme.* For a further analysis, see Brázdil and Kotyza 1995, 94.

year. Nevertheless, somewhat wetter autumns were mentioned for the 1090s by Glaser.[84]

Weather or not? Events documented in the 12th century

Hard winter of February 1109

Reported by *Cosmas Pragensis*, during the military campaign of the Czech prince Svatopluk into Hungary in February 1109, the waters were frozen.[85] Due to the favourable winter conditions, the prince very quickly reached the town of Nyitra (today Nitra in Slovakia). The information about his invasion refers to the northwestern areas of medieval Hungary, what is today's western Slovakia.[86] In the Middle Ages, a winter campaign in most cases was made when the circumstances were appropriate, and thus it usually took place in colder weather conditions.[87] Glaser, without further details, mentioned that the winter of 1109 was cold.[88]

End of 1129: (Hard?) winter conditions in Barancs/Branitzova

The Byzantine *Ioannes Kinnamos* blamed winterly weather conditions and the lack of the necessary equipment for the hardships of soldiers at the fortress of Barancs/Branitzova (today Braničevo in Serbia).[89] In the *Annales Mellicenses*, during the year 1129, a controversy between Greeks and Hungarians at the Sava river is mentioned where the siege of a fortress took place.[90] The medieval fortress of Braničevo, nevertheless, was located on the Lower Danube. It was destroyed at the beginning of the Hungarian-Byzantine

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[84] Glaser 2008, 88.

[85] G. H. Pertz, *Monumenta Germaniae Historica. Scriptores*, vol. 6: *Annales et chronica aevi Salici* (Hannover: Impensis Bibliopolii Hahniani, 1844) (hereafter *MGH SS* vol. 6), 747 (*Annalista Saxo*): *1109. .. Mense Februario, quia magnum frigus inhorruerat, et omnes aque congelaverant, dux Svatopluk, iam eruti sanato vulnere oculi, coadunato iterum exercitu, tribus diebus et tribus noctibus festinans intrat Ungariam, et omni regione illa devastata, cum multis captivis et magna preda reversus est.*

[86] *MGH SS* Nova series vol. 2, 115 (*Cosmas Pragensis*): Lib. III. (14 Feb. 1109) *XXVI. Anno dominice incarnationis MCVIIII. Decima luna mensis Februarii, quia grande inhorruerat frigus et omnes aque erant congelate valde, dux Zuatopluk iam eruti sanato vulnere oculi, continuo iterum coadunato exercitu tribus diebus et tribus noctibus continuis festinans intrat Ungariam et nemine eorum presciente ex inproviso applicuit cum exercitu ad urbem Nitram; et irrupisset in eam, si non vigiles, qui semper ibi sunt custodientes, clausissent portam.*

[87] See also Brázdil and Kotyza 1995, 95.

[88] Glaser 2008, 72.

[89] Gy. Moravcsik, *Az Árpád-kori magyar történet bizánci forrásai* (Byzantine sources of Hungarian history in the Arpadian Period) (Budapest: Akadémiai Kiadó, 1988), 198: *O δέ έν Βρανιτζόβη τό δεύτερον γεγονώς άνικοδομεϊν αύτήν σπουδήν έποιεϊτο. Χρόνου γοῦν έζ τό έργον τριβομένου ξυνέβαινε χειμώνι καί σπάνει τών άναγκαίων δυσπαθοϋν τό στρατιωτικόν ές άγαν ταλαιπωρεϊσθαι.*

[90] *MGH SS* vol. 9, 502 (*Annales Mellicenses*): *1129. Greci et Ungari discordantes apud fluvius Sowa castra metati sunt.*

war that had begun in 1127, when in summer the Hungarians attacked Braničevo. The Byzantine emperor took the fortress back in 1128, but the Hungarians destroyed it again in 1129. It was already winter time when the (Byzantine) emperor's army reached Braničevo to rebuild it, presumably around the time when the peace treaty was signed at the end of the year.[91] Based on the above-mentioned account, the winter of 1129(-1130) – probably late autumn or December – seems the most likely for dating the hard winter conditions mentioned by *Ioannes Kinnamos*. No information is available for this winter in the neighbouring regions.

The famine year of 1141

According to the 14th-century chronicle composition, during the reign of Géza II, a famine occurrred in 1141 (*Post hec in diebus illis fames afflixit Hungariam, que magnam partem hominum in morte obsorbuit*).[92] Following this statement, the *Chronicon Monacense* also reports the same event (with the same presumable exaggeration concerning the number of casualties).[93] The text mentions it right after the castle of Pozsony (today Bratislava in Slovakia) was taken back from the Germans. Hence, this famine could have occurred both due to poor harvests but also due to hostilities that were also going on in the neighbouring regions at about the same time.

In the Czech Lands, the winter of 1140-1141 was "changeable", while a great flood occurred in Prague in April 1141 (also mentioned in the same work at another place concerning Bohemia in general). The most interesting information, however, is provided for 1142: a great famine occurred in summer. According to Brázdil and Kotyza, it was not due to poor harvests caused by bad weather conditions, but rather due to the war. Thus, if the datings are correct in both cases, a famine was reported for Hungary in 1141, while the Czech Lands had to face with the same problems in the forthcoming year, namely in 1142.[94]

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[91] Gy. Kristó, *Az Árpád-kor háborúi* (Wars of the Arpadian period) (Budapest: Zrínyi Kiadó, 1986), 75-76.

[92] *SRH* vol. 1, 457 (*Chronici Hungarici compositio saeculi XIV*): *Ibi usque adeo contritum est robur Teutonicorum, quod nec rusticis Hungaris in confinium (sic) eorum habitantibus aliquam iniuriam seu quodcumque gravamen inferre presumperunt. Rex autem divina gratia felici potitus victoria, simul cum universa gente sua benedixit et gloriavit Deum. In eodem autem prelio comes Vros coepit comitem Rapolt Teutonicum, qui iam pridem nocturnis insidiis castrum Poson occupaverat, et Gabriel Accionem. Post lec indiebus illis fames afflixit Hungariam, que magnam partem hominum in morte obsorbuit.*

[93] *SRH* vol. 2, 81 (*Chronicon Monacense*): *54. Geysa, filius Bele Ceci coronatur. Contra hunc Henricus dux Austrie congregato exercitu de Saxonia et Bauaria, rex cum Hungaris accelerat super eos, et commissum est relium et Hungari a furore Teutonicorum territi sunt, ita quod a principio Teutonici prevaluerunt. Ipsi autem magna strage post prostrati sunt, circiter VII milia, reliquis fugientibus. Post hoc fames ingens afflixit Hungariam, ut magna pars hominum interiret.*

[94] Brázdil and Kotyza 1995, 98.

If we examine the other neighbouring areas, no famine and related problems are known for these two or the subsequent years. In the *Auctarium Zwetlense* a two-year famine is mentioned (for Austria) during the year 1149,[95] whereas the *Auctarium Lambacense* reported on the great death of domestic animals (from disease?) during the year 1148.[96]

It is also interesting to see that, according to Glaser, in the 1140s wet and cold summers prevailed in the German areas, whereas in Flanders the summer of 1141 was especially cold. No information is provided concerning 1142, but 1143 was mentioned by Glaser as a year with an especially rainy summer. The winter of 1141 was mild, but the winter of 1143 was long and snowy. The spring of 1141 was markedly warm, while in the autumn of 1141 there was extensive flooding along the coast.[97]

Frozen Danube: winter of 1147?

In her work entitled 'Alexiada' (about the life and work of her father), the educated Byzantine Princess *Anna Komnena* provided a testimony of the event that the (Lower) Danube froze in the winter of 1146-1147. The ice cover of the Danube was thick enough to hold the weight of an army when the Hungarians crossed it.[98] According to Glaser, there was heavy snow in the winter of 1147.[99] If both datings are correct, the winter of 1147 led to severe conditions in large parts of (Central) Europe.

Rainy weather caused the inundation of swamps around the Drava river in 1147?

Documented by *Odo de Deogilo* who travelled with the second Crusade through Hungary, an enlargement of local swamps occurred due to heavy rainfall in 1147. Here the river itself is not directly mentioned to be in flood, but rather the swamps in the vicinity, even if the river did burst its banks.[100] As the

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[95] *MGH SS* vol. 9, 540 (*Auctarium Zwetlense*): *1149. Fames valida duravit per biennum.*

[96] *MGH SS* vol. 9, 555 (*Auctarium Lambacense*): "*1148. ... Mortalitas pecorum maxima est facta."*

[97] Glaser 2008, 62, 73, 83, 88.

[98] Moravcsik 1988, 103 (*Anna Komnena*): *Διά ταϋτα καιρόν έπιτηροϋντες, έπεί τόν Ϊστρον άποκρυταλλωθέντα εϊδον, ώσπερ ήπείρω τούτω χρησάμενοι κεϊθεν πρός ήμάς μετανίστανται ολον εθνος τοϊς ήμετέροις έπιφορτισθέν όρίοις καί δεινώς έλήζοντο τάς παρακειμένας πόλεις καί χώρας.*

[99] Glaser 2008, 73.

[100] J.-P. Migne, *Patrologia Latina* vol. 185 (Paris, 1855), 21-23 (*Odo de Deogilo*): *De profectione Ludovici VII in Orientem (Odonis de Diogilo De Ludovici VII Francorum regis cognomento junioris profectione in orientem Cui ipse interfuit Opus septem libellis distinctum. Epistola Odonis ad venerandum abbatem suum Sugerium). Libellus Secundus: .... Hungaria ex hac parte aqua lutosa cingitur; ex alia vero a Bogaria amne lucido separatur. In medio sui fluvium habet Droam, qui stanni more unam ripam proclivem habet, et alteram arduam, unde modica pluvia effluit, et adjutus vicinis paludibus, etiam aliquanto remota submergit. Audivimus eum multos Alemannorum, qui nos praecesserant,*

swamps around the river extended, crossing the Drava river caused great difficulties; many Crusaders inadvertently went under the waters. There was also great pestilence.[101]

Since on 24 June the Crusaders were already at the Hungarian-Byzantine border,[102] the time of crossing the Drava River could have been around early-mid June. No significant problems were mentioned concerning the crossing of the (even larger) Sava River. As such, probably May – early June (and/or the preceding period) was rich in precipitation in the Drava catchment. As we saw earlier, Glaser suggested snowy winter conditions for 1147, and the contemporary Byzantine evidence (*Anna Komnena*) also provided information on prolonged cold winter conditions for the same part (frozen Lower Danube). If the winter was rich in precipitation, this could have affected the water system of the Drava River (as well as the lowland areas) for several months (especially if spring – early summer was not dry). It is interesting to compare this description with the case of 1189 when Crusaders again travelled through the country and again crossed the Drava River at that time without any notable difficulties.

1154(-1155)?: Cold winter, dense snowfall and flood

Theodoros Prodromos mentions in his work the dense snowfall and coldness of winter, in connection with the military campaign of Hungarians.[103] Since late 1150, with shorter or longer interruptions, a war was going on between the Byzantine Empire and Hungary, until spring 1155 when a peace treaty ended the controversy. In the course of this five-year war, the military campaign of the Hungarians described by Ioannes Kinnamos for the end of the year 1154, seems to be the most likely candidate for the event (and its dating).[104]

A probable Danube flood event was recorded by *Ioannes Kinnamos*, either for late 1154 or early 1155 (during the attack of Hungarians against

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subito inundasse; nos autem ubi castra eorum fuerant, vix potuimus transvadere. In hoc parvas naves habuimus et paucas; ideo fuit opus equos natare, qui facilem ingressum et egressum difficilem habentes, cum labore quidem, (1213B) *sed tamen Deo volente sine damno transibant. Caetera omnis aqua terrae hujus, lacus sunt, et paludes et fontes, si tamen fontes sunt, quos paululum fossa humo, etiam in aestate faciunt transeuntes, excepto Danubio qui hanc satis in directum praeterfluit, et multarum regionum divitias nobili civitati Estrigin navigio invehit. ....*

[101] G. H. Pertz (ed.), *Monumenta Germaniae Historica.* vol. 17: *Annales aevi Suevici* (Hannover: Impensis Bibliopolii Hahniani, 1861) (hereafter *MGH SS* vol. 17), 27 (*Annales ducum Bavarie Altahenses*): *1147. Cuonradus rex Ungariam intrat, ac ducem eorum Wardiz nomine bello petit, igne praedaque vastat universa, et rebellem ducem obsides dare sibique iureiurando fidelitatem confirmare coartat. Pestilentia magna facta est.*

[102] Borosy and Laszlovszky 2006, 86.

[103] Moravcsik 1988, 179 (*Theodoros Prodomos*): *Επί δέ τούτοις άμελώς ό Παννονάρχης έχων καί μόνοις τείχεσιν ύγροϊς θαρρών καί περιβόλοις άμεριμνών έκάθητο δεινόν ούδέν έλπίζων καί τοϋ χειμώνος τό δριμύ καί τοϋ καιροϋ τήν ώραν καί τών νεφών τήν πύκνωσιν όρών έπεγαρία παρέβλεπε τούς πρεσβευτάς, τόν Άρην έπεζήτει, έκόμπαζεν ούκ άνεκτά, ξυρόν τήν γλώσσαν εϊχεν, ...*

[104] Kristó 1986, 87; Moravcsik 1988, 209-14.

Braničevo): "However, when they (Hungarians) arrived (at the crossing place), the Danube was in flood (raging stormy weather), and therefore they turned towards Belgrade."[105] Since Byzantine authors of that period often used symbolic pictures to make fights more heroic, the evidence of a flood event cannot be completely confirmed, even if *Kinnamos* on political and other questions seems to be a reliable source. No other weather reports are currently known concerning the areas near the Carpathian Basin.

1189: Memoires of a Crusader about Hungary

During the Third Crusade, in June 1189, while crossing Hungary along the Danube, *Ansbertus clericus* noted that, in spite of all previous information and expectations, they travelled in much more pleasant conditions through Hungary than was usual here in the summer time, namely, without the disturbance of the 'usual animals'. The *clericus* mentioned the lack of mosquitoes, snakes and flies.[106]

From the same author we know that they entered the country in the last week of May, in the Pozsony (today Bratislava in Slovakia) area, where they stayed for a couple of days. Then they continued their way to Esztergom, down along the Danube and they crossed the Drava river; afterwards they went to Belgrade. After crossing the border, at the beginning of July, they reached the Byzantine Braničevo. Therefore, *Ansbertus*' (general) description refers to (the entire month of) June 1189 when the Crusaders crossed Hungary from Austria to the Byzantine empire, along the Danube.[107]

It seems likely that the weather conditions, unfavourable for the above-mentioned animals, occurred before or during the time when the Crusaders crossed the country along the Danube (thus, along or through its extensive floodplains). Due to biological factors necessary for the development of these animals (with special emphasis on mosquitoes), either constant dry conditions or prolonged floods are less favourable. The lack of these animals altogether might

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[105] Moravcsik 1988, 212 (*Ioannes Kinnamos*): *Οπως μέντοι Βρανιτζοβϊται τήν πόλιν τέως αύτώ τηρήσωσι, γράμμα χαράξας οσον ούκ ηδη άφίξεσθαι τοΰτον μηνΰον τών στρατιωτών τινι ένεχείρισε κελεύσας έπί τήν πόλιν αύτό διαφεναι βέλει ξυνδήσαντα. Ό μέν οΰν κατά τό κελευσθέν έποίει. Τό δέ βέλος πορρωτέρω ή έχρήν άφεθέν Οΰννοις είς χείρας ήλθεν. Εύθύς οΰν ταραγμός είσηλθεν αύτούς, καί δή τάς τε έλεπόλεις καί οσα πρός τειχομαχίαν αύτοϊς παρεσκεύαστο πυρί φλέξαντες έπί τόν Ίστρου πορθμόν ήεσαν. Πλήθοντι δέ αύτω έντετυχηκότες (χειμών γάρ έκ των άνωθεν ήπειγεν), ώς έπί Βελέγραδα πόλιν έφέροντο.*

[106] A. Chroust, *Monumenta Germaniae Historica. Scriptores rerum Germanicarum,* nova series vol. 5: *Quellen zur Geschichte des Kreuzzuges Kaiser Friedrichs I: Historia de expeditione Friderici imperatoris* (Berlin: Weidmannsche Buchhandlung, 1928) (hereafter: *MGH SS rer. Germ.* N.S. vol. 5), 27 (*Ansbertus clericus Austriensis): A. 1189 II nonas Iiunii ... In maxima denique tranquillitate et aeris temperie plus solito mitiore nobis arridente in tantum, ut culices, oestra, musce, serpentes, que in Ungaria estivo tempore iter in equis agentes graviter inquietant, non solum nos vel animalia non lederent, verum etiam raro a nobis visa sunt, Ungariam permeavimus. VI nonas Iulii ....*

[107] *MGH SS rer. Germ*. N.S. vol. 5, 17-27.

rather suggest prevailing dry conditions. According to Glaser the summer of 1189 was also warm in the German areas.[108]

Danube floods in 1194 in Bavaria and Austria – any relationship with Hungary?

Without mentioning the location, *Radulphus Niger* also provided information on a sudden great flood of the Danube in 1194 ('around this time'), which caused a large number of casualties and great material damage.[109] Referring to the Danube at Neuburg (Bavaria), flood in 1194 was also reported by the *Continuatio Cremifanensis*, according to the author, caused by ice. This fact would suggest prolonged cold winter conditions in Bavaria in the preceding period. In fact, the *Continuatio Cremifanensis* referred to three floods, and also mentioned that fire devastated towns and villages in the same year. All these events destroyed the harvest, and the floods caused significant damage to houses and settlements.[110] A devastating drought and fire in Vienna, and an unusual Danube flood are described for 1194 in the *Continuatio Claustroneo-burgensis*.[111] Moreover, famine is also mentioned at the same time in *Teutonia*.[112]

Since the first Danube flood event, reported for the Bavarian sections, was most probably an ice (jam) flood, this did not necessarily appear on the lower, Austrian sections. This would explain the fact that for Bavaria there were three floods mentioned in the sources, while for Klosterneuburg 'only' two floods. It

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[108] Glaser 2008, 62.

[109] G. H. Pertz (ed.), *Monumenta Germaniae Historica. Scriptores*, vol. 27: *Ex rerum Anglicarum scirptoribus saec. XII. et XIII* (Hannover: Impensis Bibliopolii Hahniani, 1885) (hereafter *MGH SS* vol. 27), 332 (*Radulphi Nigri Chronica Universali*): */A. 1194/ Circa hec tempora Danubius subito irrupit et multos fines terrarum extinxit, homines et iumenta et alia terrarum volatilia. Redeunte demum Danubio in alveum suum, exierunt de terra culices et vastaverunt agros et vineas et arbusta et depopulaverunt universam terram. Irrupuerunt igitur porci et alique alie bestie et irruerunt in culices, devorantes eas et ingrassati sunt vehementer, et muti mortui sunt.*

[110] *MGH SS* vol. 9, 548 (*Continuatio Cremifanensis*): *1194. ... Danubius in Austria glaciali molestia versus Niwenburch ebullit, et meatum suum longius vagando relinquens, homines cum villis mergendo adnichilavit. Eadem quoque regio mirabili incendio in civitatibus et opidis et villis et uredine in agris longius late raa annona consumendo depauperatur. Inundationes tribus vicibus magnae et intolerabiles atque insolitae omnes pene regiones, villas et circumpositas domos demoliendo occupaverunt.*

[111] *MGH SS* vol. 9, 619 (*Continuatio Claustroneoburgensis* II): *1194. Hoc in anno propter ariditatem terre que totam Austriam invaserat, coloni eiusdem terre cruces suas tollentes cum virginibus diversa limina sanctorum pecierunt. ..... Idus Aug. .... Wienna incendio flagrat. Danubius vice altera contra solitum inundans, vicina loca cum hominibus et iumentis occupat*. These events (according to the editors erroneously) are partly also described under the year 1193.

[112] *MGH SS* vol. 9, 619 (*Continuatio Claustroneoburgensis* II): 1194. *Fames valida facta est in Teutonia.*

is possible that these two floods occurred later (e.g., spring, summer or autumn), and affected larger sections of the Danube.

Why is this interesting from a Hungarian perspective? Since the Klosterneuburg annals clearly referred to the flood events, the Vienna area was most probably affected and thus, there is a good chance that these flood waves also arrived to Hungary. However, for the autumn of the same year, a locust invasion, usually associated with dry and hot (pre)conditions, was reported in Hungary at the Drava–Sava interfluve (see below).

Locust invasion in 1195 and/or 1194 (1193)

In the year 1194, whose spring and summer seasons were dry in Austria[113] and in large parts of Europe,[114] locusts were reported for Hungary, which occurred in the autumn. The chronicle of *Albricus* dated the locust invasion (*pluvia locustarum densissima*) to the autumn of 1194, which, according to his knowledge, was rather memorable and affected the Drava–Sava Interfluve.[115] Locust plagues are usually assumed to be a consequence of prevailing dry conditions, and it seems that in many parts of Europe the spring and summer of 1194 were quite dry. The shorter Austrian chronicle of Melk[116] as well as the *Chronicon Belgicum magnum*[117] (both non-contemporary) dated the locust invasion to the same time and place, namely to autumn 1194 for the Drava-Sava Interfluve. *Vitus Arnperckius* (non-contemporary: 15th century) provided 1193, and as locations Hungary, Styria, and Croatia.[118]

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[113] See, e. g.,: *MGH SS* vol. 9, 619 (*Continuatio Claustroneoburgensis* II): 1194. *Hoc in anno propter ariditatem terre qu totam Austriam invaserat, coloni eiusdem terre cruces suas tollentes cum virginibus diversa limina sanctorum eligitur.*

[114] For a broader European overview see Alexandre 1987, 368-69; see also Brázdil and Kotyza 1995, 100-01.

[115] *MGH SS* vol. 23, 870 (*Chronicon Albrici monanchi*): *1194. Memorabile quiddam contigit hoc anno in Hungaria, quia in autompno quadam die fuit inter Dravum et Savum pluvia locustarum densissima.*

[116] G. Waitz (ed.), *Monumenta Germaniae Historica. Scriptores*. vol. 24: *Annales aevi Suevici. Gesta saec. XII. XIII.* (Hannover: Impensis Bibliopolii Hahniani, 1879) (hereafter: *MGH SS* vol. 24), 223 (*Chronicon Austrie Mellicense breve*): *1194. Henricus imperator Calabriam, Apuliam et Siciliam sibi bello subiugavit. Item mirabile quiddam contigit in Ungaria hoc anno, quia in autumno, quoddam die, fuit inter Dravum et Savum pluvia locustarum densissima.*

[117] J. Pistorius, *Scriptores Rerum Germanicarum*, vol. 3 (Regensburg: Sumptibus Joannis Conradi Peezii, 1731), 223 (*Magnum Chronicon Belgicum*): *Item anno Domini MCXCIV. Henricus Imperator Calabriam, Apuliam & Siciliam sibi bello subiugavit. Item mirabile quiddam contigit in Ungaria hoc anno, quia in Autumno, quodam die, fuit inter Dravum & Savum pluvia locustarum densissima.* It is interesting that the author, who otherwise was seemingly rather well-informed in 'hot news', did not mention such or related events for any other parts of Europe in this year (neither in the preceding nor subsequent years).

[118] *SRA* vol. 1, 1204-05 (*Vitus Arnperckius*): *1193. Ea tempestate magna turma locustarum quatuor alas habentium et volantium per Hungariam, Croatiam et Styriam cuncta devastantium: et cum volabant, terram abumbrabant et nebula spissa.*

The contemporary *Annales canonici Sambiensi*[119] as well as the Klosterneuburg annals (*Continuatio Claustroneoburgensis* III), however, dated an invasion of four-winged locusts to the autumn of 1195.[120] The latter narrative generally talked about the devastation caused by locusts in Hungary (as well as in the Marchia and Carniola) and no longer mentioned the invasion of the Drava–Sava Interfluve.[121]

It is also interesting to note that the *Annales S. Stephani Frisingenses* mentioned many devastating fires in 1193, when – at the beginning of spring – their monastery completely burnt down.[122] As mentioned earlier, the *Continuatio Cremifanensis* also reported on the fires in the Neuburg area for the year 1194. Moreover, as provided by U. Bieber, an extremely devastating, prolonged fire event (having started around All Saints) was also documented for Novgorod in 1194.[123]

All these narratives may be of help to us if we take into account the fact that a hot and dry summer, followed (or preceded) by cold and snowy winters may provide favourable conditions for locust swarms[124] – conditions also favourable for the start of such an invasion in their usual breeding areas (i.e., where locusts are endemic, e.g., around and between the Caspian and the Black Seas). The winter of 1194 could have been a hard one and resulted in an ice (jam) flood on the Danube in Bavaria. Presumably, there were other flood(s) of

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[119] G. H. Pertz (ed.), *Monumenta Germaniae Historica. Scriptores*, vol. 19: *Annales aevi Suevici* (Hannover: Impensis Bibliopolii Hahniani, 1866) (hereafter *MGH SS* vol. 19), 698 (*Annales canonici Sambiensi*): *1195. Autumpnali tempore quoddam genus locustarum quatuor pennas habens venit a desteris regionibus transiens per Ungariam et Marchiam et Carniolam, vastans in circuitu omnia.*

[120] *MGH SS* vol. 9, 634 (*Continuatio Claustroneoburgensis* III): *1195. ... Hoc anno autumpnali tempore quoddam genus locustarum, 4 pennas habens, venit ab exteris regionibus, transiens per Ungariam et Marchiam et Carniolam, vastans in circuitu omnia; cum elevaretur a terra quasi nebula consurgebat, et pre multitudine sua lucem diei et splendorem solis obtenebrabat.*

[121] See for a catalogue of medieval locust invasions in Italy: D. Camuffo and S. Enzi, "Invasioni di cavallette e fattori climatici dal medioevo al 1800," *Bollettino Geofisico* 14/2 (1991): 1-51.

[122] G. Waitz (ed.), *Monumenta Germaniae Historica. Scriptores*, vol. 13: *Supplementa tomorum I-XII,* pars I (Hannover: Impensis Bibliopolii Hahniani, 1881), 55 (*Annales S. Stephani Frisingenses*): *1193. Hoc anno locus noster multis malis et infortuniis attritus est, tam incendii devastatione quam grandinis depopulatione; nam monasterium nostrum cum claustro totaliter combustum est 5. Idus Maii, incipiente noctis crepusculo*.

[123] U. Bieber, "The Reports of 'Climate Change' in Medieval Russian Chronicles and their Impact on Everyday Life," paper presented and handout provided at the International Medieval Congress 2008 (10 July), University of Leeds, p. 1: entry No. 1 (quoting original text in translation).

[124] See e.g. A. Kiss, "A sáska járások néhány területi és tájtörténeti vonatkozása a Kárpát-medencében" (Some regional and areal consequences of historical locust invasions in the Carpathian Basin), in *A táj változásai a Kárpát-medencében. Történeti emlékek a tájban* (Landscape changes in the Carpathian Basin. Historical monuments/memorial sites in the landscape), ed. Gy. Füleky (Gödöllő: Szent István Egyetem, 2012), 78-87.

the Danube in this year in Bavaria and Austria. A dry and hot spring and summer as well as devastating fires were also reported in Austria, Bavaria and other parts of Europe for the same year. The locust invasion can be dated with certainty only for 1195. However, if great devastation was also caused in 1195 in the (south-)western parts of the Carpathian Basin, the locusts most likely appeared there earlier (in 1194 or even in 1193).

An overview and discussion of results

Which weather and weather-related environmental information could be extracted from this period?

There is a small but well-identifiable group of evidence, which directly holds (direct or indirect) weather-related information. Apart from this, there is a mixed set of information which usually has some kind of connection with preceding or actual weather conditions and is hence interesting, also concerning their possible long term impact. The following results can be summarized:

1) Evidence of (prolonged: monthly, seasonal) weather conditions:
   a. Frozen-solid rivers – hard winter conditions
      Cold winters with great frost (the length of hard conditions unknown) can be identified for February 1074, when the River Tisza was frozen solid. Hard winter conditions with a frozen Lower Danube and dense snowfall was presumably reported for 1087. Winter conditions were also hard in February 1109 in the area of present-day western Slovakia. Related to a military campaign, problems caused by winter conditions in 1129 at Braničevo (Lower Danube area) were mentioned. A solidly frozen Danube was again mentioned in the south in 1147. The coldness of the winter and dense snowfall were blamed by Byzantine authors for difficulties in military operations, probably referring to events in late 1154 or early 1155.
   b. Dry conditions, heatwave and a drought
      A drought might have occurred in the summer of 1044, and dry conditions were potentially present in June 1189, when Crusaders crossed the country along the Danube (although in this case no firm conclusion could be drawn). Great heat and a drought prevailed in Central Europe, and also in the neighbouring countries (i.e, Austria and the Czech Lands) in 1194, which might have affected Hungary as well.
   c. Rainy summers?
      A rainy summer may have affected (Western)Hungary, but even more probably the upper (alpine) catchment area of the main Western Hungarian rivers in 1043. A rainy summer could also have affected the same area in 1051, before and during the military campaigns of the German emperor in Hungary. If we accept the hypothesis of the collapse of a loess wall in 1092, then this event, amongst others, had to be

preceded by a prolonged wet period (months) and high/changing water levels of the Danube.

2) Evidence indirectly related to weather conditions

a. Locust invasion

Probably an indirect consequence of the heat and drought of the mid-1190s was the locust invasion clearly reported for the year of 1195, but locusts might have already been there in 1194 (and in 1193), and not just in the Drava–Sava interfluve, but also in other parts of the country.

b. Floods

In 1043, inundations of the Rábca are mentioned. In 1051, the flood conditions of the Zala and maybe those of the Rába are described, even if one admits the possibilty of human intervention. In 1092, also the Danube was mentioned to be in flood (maybe also partly due to the fall of a hill; see 2/c). A (Lower) Danube flood event might have also occurred in 1154 or 1155.[125]

3) Individual weather events reported

a. A veil of dust (windstorm), arriving from an easterly direction, was described in connection with the battle of Ménfő that took place in 1044, which clearly suggests a prevailing dry spell in the area. This phenomenon might have had an impact on the battle, because the storm prevented Aba's soldiers from applying the eastern fighting tactics.

b. Dense fog hindered the armies from commencing fighting in 1074 at Mogyoród; the battle took place the next day, when weather conditions did not obstruct the fight.

c. According to some source evidence, lightning killed King Aba after he had fled from the battle of Ménfő in 1044. Other sources, however, claimed that he was killed by his own people. In 1081, the destruction of the basilica of Székesfehérvár was mostly attributed to some other lightening event.

d. The effects of strong easterly winds were emphasised during the siege of Belgrade, which occurred in autumn 1071.

e. An atmospheric phenomenon (halo) might have been observed; namely, two suns were seen on the sky in 1022 (or 1020, 1021).

4) Events indirectly connected to weather conditions, which directly affected the human population

a. Hunger and famine

[125] Concerning medieval Danube floods (in the Carpathian Basin) and source analysis problems, see also: A. Kiss, "Dunai árvizek Magyarországon a középkori írott források tükrében: 1000-1500. Esettanulmányok, forráskritika és elemzési problémák" (Danube floods in Hungary in medieval documentary evidence: 1000-1500. Case studies, source critics and analysis problems). In: A. P. Kiss, F. Piti and Gy. Szabados (eds.), *Középkortörténeti tanulmányok* 7 (Research in medieval studies 7) (Szeged: Középkorász Műhely, 2012), 339-55.

A famine in Hungary was reported for the years 1044, 1074 (or 1075), and 1141. All these three years coincide with periods of military conflicts. However, there were many other years, when wars occurred but no report of any hunger or famine survived. Moreover, since in these cases the domestic evidence (compiled in the 14th century) mentioned the events as well, it seems less likely that these are all cases where foreign authors would have been inspired by the impressions of foreign (mainly German) armies passing through (Western) Hungary. It is also an interesting fact that both in 1044 and 1141 there were also famines in Bohemia reported for the years before (1043) or after (1142). In both cases, wars were blamed for a bad harvest that led to severe food shortages. For 1043, however, it is clear that in the Czech lands bad (wet, cool) summer conditions and a generally bad year for grain harvest could also have caused severe food shortages.

b. The cause of the fire which occurred in Pécs in mid-April 1064 at the night after the coronation is unknown, but one cannot exclude the possibility of human intervention. The fire of 1064 has some similarities with another one that occurred in 1071 when, as it was reported, during the siege of Belgrade the fire was fanned by strong easterly winds.

* * *

As could be shown, reports for 11th- and 12th-century weather conditions and weather-related environmental phenomena are only available in some cases. While sometimes rather clear and unspecific evidence is given, especially concerning the hard character of the winter or a (partly) wet summer, many of the other reported events describe very specific weather phenomena. In some cases the reports refer to events that strongly affected the human population (e.g., hunger, fires, locusts). Whereas many of the events refer to specific locations, some cases (indirectly) hold clear large-scale weather-related signals (e.g., river floods or locust invasions). As to be shown in the next part of the series, in which weather events and weather-related phenomena reported for the 13th century are discussed, the number of cases will significantly increase, but the reports will be related to phenomena similar to the ones reported in the 11th and 12th centuries.

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M E D I U M A E V U M

Q U O T I D I A N U M

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HERAUSGEGEBEN
VON GERHARD JARITZ

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Vorwort

Das vorliegende Heft von *Medium Aevum Quotidianum* widmet sich zwei sehr unterschiedlichen Schwerpunkten, welche für die Geschichte des Alltags und der materiellen Kultur des Mittelalters und der frühen Neuzeit jedoch eine wichtige Rolle spielen. Andrea Kiss bietet den ersten Teil von in unserer Reihe erscheinenden Untersuchungen zu Wetterphänomenen in der chronikalischen Überlieferung des mittelalterlichen Ungarns, welcher sich mit dem 11. und 12. Jahrhundert auseinandersetzt. Da sich die Autorin stark auf vergleichende Analyse konzentriert, kann die Wichtigkeit des Beitrages für die gesamte mitteleuropäische Situation anerkannt werden. Die folgenden Teile der Untersuchung werden in *Medium Aevum Quotidianum* 67-70 (2014/ 15) veröffentlicht werden.

Matthias Johannes Bauer, einer der anerkannten Spezialisten für die mittelalterliche Fechtkunst und Fechtlehre im deutschsprachigen Raum, widmet sich dem Schweinespieß und seinem Auftreten in der schriftlichen und bildlichen Überlieferung zum Jagdwesen und zur Fechtkunst vom 13. bis zum 16. Jahrhundert. Er liefert dabei auch wichtige neue Erkenntnisse zur Waffenkunde.

Gerhard Jaritz