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Anita Bokwa, Danuta Limanówka

WEATHER OBSERVATIONS CARRIED BY MICHĄŁ OF WIŚLICA IN CRACOW IN THE YEARS 1527-1551

Abstract: Mean seasonal numbers of days with chosen phenomena calculated for Cracow for the periods 1535-38 and the 20th century show that in 16th century: winters were generally more frosty, numbers of days with precipitation show the same distribution as in the 20th century, number of clear days was much higher in every season than in the 20th century, the number of days with thunderstorm was very similar for every season and so was the yearly course, compared to the 20th century. Michał of Wiślica was much more careful and detailed in observations than Marcin Biem (the most important weather observer in Cracow at that time). The notes of Michał of Wiślica for 1535-36 were used together with the notes of Marcin Biem for 1537-38 in the international research programme EURO-CLIMHIST.

Key words: Cracow, climate, history, pre-instrumental data, 16th century, weather notes.

1. Michał of Wiślica and his weather notes

Michał of Wiślica (called also Michał Wiśliczka) was an astrologer and a professor at the Academy of Cracow (today: Jagiellonian University). He was born about 1499 and in 1511 began to study liberal arts at the Academy. In 1524 he completed his studies and received a Master's degree. Two years later he became rector of the cathedral school at Wawel Castle in Cracow, but after a few months he left the post to spend some time at the Bernardine convent as a novice. At the end of the year he returned to the university and in 1527 obtained the title of minor colleague. In 1531 he commenced the lectures at the chair of astrology and in 1535 was given the title of major colleague. One of his tasks was the preparation of astrological prognostics for the years 1532, 1533 and 1536. He left the chair in 1540 to begin the studies in theology, which he completed in 1546 with the title of doctor. Then he was a chapter member at St. Florian's collegiate church, where he was given the position of dean. In 1574 he took up the duties of the canon in Cracow's cathedral. Michał of Wiślica died in Cracow on 22 November, 1575 (*Historia nauki polskiej* 1974).

In the years 1527-1551, weather observations were one of Michał of Wiślica's passions. Following the example of Marcin Biem, the most important weather observer in Cracow at that time (Limanówka 1996), he daily noted the weather conditions using some general Latin expressions. The notes were made on the margins and between the lines of the printed astrological calendars, specified in the references. As shown in Table 1, Michał of Wiślica's notes are the most complete for the years 1535-1538, so this period was taken for further analysis. Fortunately, Biem's notes are also almost complete for the period 1537-38, so we can compare the notes of both observers for those two years. This gives us a unique opportunity to verify the data quality, which is extremely important in case of pre-instrumental weather observations.

2. Numbers of days with chosen phenomena in Cracow in the periods 1535-38 and 1950-95

Michał of Wiślica's notes considered air temperature, precipitation, cloudiness, wind speed, thunderstorms and fog. As no instruments were used, only numbers of days with chosen phenomena can be analysed. For the 4-year period the following indices are presented for months and seasons (Tab. 2 and Tab. 3):

- number of days with frost,
- number of days with precipitation,
- number of clear days,
- number of days with wind,
- number of days with thunderstorm.

Table 2 shows that the number of frosty days was decreasing during the winters, from 54 in the winter of 1535/36 to 39 in the one of 1537/38. The winter of 1537/38 was significantly longer than others and the days with frost were observed from November to March. Annual number of days with precipitation fluctuated from 82 (1538) to 135 (1537) and higher values were observed for 1535 and 1537 than for 1536 and 1538. In the yearly course the highest values occurred in summer or early autumn, with the exception of 1537 when 19 days with precipitation were observed in March. Annual numbers of clear days decrease constantly from 196 (1535) to 153 (1538) and so do the values for days with wind: from 180 in 1535 to 102 in 1538. Summer is the most windy season and it is also marked with the highest numbers of days with thunderstorms.

The comparison of the seasonal index values obtained for 1535-38 with the long-period values for the 20th century let us evaluate the severity or mildness of the weather conditions in Cracow at that time (Tab. 3). For the number of days with wind no comparison is included as it was not possible to evaluate wind velocity on the basis of very general notes. In the period of 1535-38 winters were generally more frosty than in the 20th century and lasted longer. Numbers of days with precipitation show the same distribution in both cases, with the maximum in summer. The seasonal values for both periods are very similar, except in winter – in the 16th century winters were drier. The number of clear days was much higher in the 16th than in the 20th century in every season, but in both cases the lowest values were noted for winter. The number of days with thunderstorm was very similar for every season and so was

Tab. 1. Frequency (in %) of days with weather observations carried by Michał from Wiślica in Cracow in the period of 1527-1551.

Tab. 1. Częstość (w %) dni z obserwacjami pogody wykonywanymi przez Michała z Wiślicy w Krakowie w okresie 1527-1551.

Years Lata	Jan. I	Feb. II	Mar. III	Apr. IV	May V	Jun. VI	Jul. VII	Aug. VIII	Sep. IX	Oct. X	Nov. XI	Dec. XII	Year Rok	Spring Wiosna	Summer Lato	Autumn Jesień	Winter Zima
1527				20		3	3						2	6	2	0	0
1531							6	26			17		4	0	11	5	0
1534										81	100	100	23	0	0	60	0
1535	100	75	100	90	100	90	100	100	93	100	100	90	95	97	97	98	92
1536	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	97
1537	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1538	100	100	100	100	100	100	100	100	100	100	100	45	95	100	100	100	
1539														0	0	0	15
1540	22	21	16	17	19	20	10	10	7	16	20	16	16	17	13	14	14
1541	6	21	6	6	10	13	19	10	7		10	19	11	8	14	5	14
1542	6		6	3		10	3	6	10	3	3		4	3	6	5	9
1543						3	3			22		3	3	0	2	8	0
1546						63	32	68	33				16	0	54	11	1
1547	19	71	64	20	64	30	6	52	37	19	20	29	36	50	29	25	29
1548	87	53	39	57	22	27	6	3	13	13	3	45	31	39	12	10	57
1549	10	21	32	23	3								7	19	0	0	25
1550	10					6	6	6	10	3			3	0	6	4	3
1551	13					3	6	3					2	0	4	0	4
1527-1551	32	31	31	30	29	32	28	32	28	31	32	30	30	30	31	30	31

Tab. 2. Monthly numbers of characteristic days in Cracow in the period of 1535-38.

Tab. 2. Liczby dni charakterystycznych w Krakowie w poszczególnych miesiącach w okresie 1535-38.

Days with: Dni:	Years Lata	Jan I	Feb II	Mar III	Apr IV	May V	Jun VI	Jul VII	Aug VIII	Sep IX	Oct X	Nov XI	Dec XII	Sum Suma
frost z mrozem	1535	20	14	15		1							17	67
	1536	11	26									5	21	63
	1537	13	9									7	14	43
	1538	15	10	15								4	3	47
	mean śr.	14,7	14,7	7,5		0,25						4	13,7	55
precipitation z opadem	1535	7	5	11	8	7	14	14	11	11	9	7	10	114
	1536	7	3	11	4	9	13	9	14	11	6	2	3	92
	1537	10	10	19	13	16	11	10	9	8	9	10	10	135
	1538	6	6	1	8	8	4	11	11	12	11	4		82
	mean śr.	7,5	6	10,5	8,2	10	10,5	11	11,2	10,5	8,7	5,7	5,7	105,7
wind z wiatrem	1535	6	4	15	23	24	22	18	15	11	11	8	13	180
	1536	7	7	17	14	27	19	17	15	17	20	7	5	172
	1537	6	4	12	18	12	12	18	15	13	7	8	2	127
	1538	3	5	9	13	16	10	12	13	9	6	6		102
	mean śr.	5,5	5	13,2	17	19,7	15,7	16,2	14,5	12,5	11	7,2	5	145,2
thunderstorm z burzą	1535				1	5	4	11	3	6	8			38
	1536				1	5	2	3	6	3				20
	1537					4	9	3	9					25
	1538				2	6	7	2	2	1		1		21
	mean śr.				1	5	5,5	4,7	5	2,5	2	0,25		26
clear days pogodne	1535	15	6	16	18	22	16	19	21	21	17	13	10	196
	1536	6	23	5	9	23	8	24	20	12	16	12	14	172
	1537	3	11	10	15	16	20	15	20	15	19	9	5	158
	1538	13	8	18	24	23	12	1	16	16	11	10	1	153
	mean śr.	9,25	12	12,2	16,5	21	14	14,7	19,2	16	15,7	11	7,5	169,7

Tab. 3. Mean seasonal numbers of characteristic days for Cracow in the period of 1535-38 and in multi-annual observational periods in the 20th century.

Tab. 3. Średnie liczby dni charakterystycznych dla pór roku w Krakowie w latach 1535-38 i w wieloletnich okresach obserwacyjnych w XX wieku.

Days with: Dni:	Period Okres	Spring Wiosna	Summer Lato	Autumn Jesień	Winter Zima
frost z mrozem	1535-38	7,7	0	4	43,1
	1950-95	4,2	0	2,6	30,5
precipitation z opadem	1535-38	28,7	32,7	24,9	19,2
	1950-95	26,8	31,1	24,3	26,6
clear days pogodne	1535-38	49,7	47,9	42,7	28,7
	1950-95	9,8	11,6	9,9	6,2
thunderstorm z burzą	1535-38	6	15,2	4,7	0
	1961-95	6,2	15	2,1	0,5

the yearly course. The largest differences between both periods are observed for cloudiness in all seasons and for all indices in autumn. The variability of all the phenomena was larger in the period of 1535-38 than in the 20th century. This is in accordance with the results of Pfister (1980, 1992) for the climate of Switzerland in the period of 1525-1863 (Little Ice Age). The comparison with the period of 1861-1965 showed that winter and spring months were colder and drier, while the climate of summer months was nearly the same. Also climate variability was greater. The 16th century notes may not be used for direct and detailed comparison with the 20th century data, as the difference in quality is too large. Nevertheless the notes let us obtain a general image of weather and climate conditions at that time and let us evaluate the climate variability and severity.

3. Comparison of the weather notes carried by Michał of Wiślica and Marcin Biem

Michał of Wiślica was one of the professors of the Academy of Cracow who carried weather notes. The most important observer was Marcin Biem and his notes are treated as a basis. Therefore it is useful to compare the notes of both scholars and this can be done for the years 1537 and 1538 when both of them noted the state of the weather in parallel. Table 4 shows the notes deciphered from 16th century astronomical calendars, made by M. Biem (Gauricus 1533) and Michał of Wiślica (Stoeffler, Pflaum 1513, 1531; Pitatus 1544). Both of them used simple Latin expressions, describing generally the most important weather features of a certain day. Michał of Wiślica paid more attention to the wind and noted that phenomenon more carefully than Marcin Biem. Therefore the number of days with wind is much higher for every year and season, which can be seen in Table 5. Also for other types of characteristic days the values noted by Michał of Wiślica are higher, which proves that he used quite detailed descriptions while M. Biem noted only the most important weather features.

Tab. 4. Examples of the original weather notes of Marcin Biem and Michał of Wiślica (in Latin) for Cracow, May 1537, deciphered from the astronomical calendars (Jagiellonian University Library), in Julian (1) and Gregorian (2) calendar.

Tab. 4. Przykłady oryginalnych notatek o pogodzie sporządzonych przez Marcina Biema i Michała z Wiślicy po łacinie w Krakowie w maju 1537, odczytane z kalendarzy astronomicznych (Biblioteka Jagiellońska), według kalendarza juliańskiego (1) i gregoriańskiego (2).

1	2	Marcin Biem's notes Notatki Marcina Biema	Michał from Wiślica notes Notatki Michała z Wiślicy
21 April	1 May	instabilis nubilosa erumpente claritate circa meridiem tonitru cum pluvia deinde serenitas	
22 April	2 May	tonitru cum nocturna (?) pluvia	serenitas pulchra ventulo flante
23 April	3 May	mutativi partim clari	serena, nubeculis decurrentibus et vento flante
24 April	4 May	grando, mutativi partim clari	instabilis, mane serena, circa meridiem pluit cum vento deinde serenitas
25 April	5 May	serena, nubeculis decurrentibus et pluit parum circa meridiem, mutativi partim clari	
26 April	6 May	nubilositas, erumpente claritate nocte sequenti pluit	
27 April	7 May	pluvia parva	nubilositas, erumpente claritate nocte sequenti pluit nubilosa, vento flante
28 April	8 May	turbida mane a meridie clara	nubilosa a meridie serenitas vento flante
29 April	9 May	in Ilkus grando magnus caligiosa mane post clara	instabilis, nubilosa erumpente claritate, circa meridiem ventus fortis et pluit parum
30 April	10 May	mutativa	
1 May	11 May	mutativi partim clari partim pluvia	instabilis, nubilosa erumpente claritate et plui parum per vices
2 May	12 May	mutativi partim clari partim pluvia, pluvia de nocte	similis precedenti
3 May	13 May	serena circa meridiem pluit per modum tempestatis et ventorum, mutativi partim clari partim pluvia	
4 May	14 May	clara	serena, pulit circa meridiem
5 May	15 May	mutativi cum pluvia	serena post meridiem tempestas cum tonitruis et ventis ac imbrum impetu transiit

4. Cracow weather notes and EURO-CLIMHIST

EURO-CLIMHIST is an international research programme organised to reconstruct the climate of Europe in the pre-instrumental period. It is co-ordinated by Ch. Pfister from Bern University, Switzerland. As the data from Cracow are unique

Tab. 5. The comparison of yearly numbers of characteristic days in 1537 and 1538 in Cracow according to the notes of Michał of Wiślica (1) and Marcin Biem (2).

Tab. 5. Porównanie rocznej liczby dni charakterystycznych w latach 1537 i 1538 w Krakowie według zapisków Michała z Wiślicy (1) i Marcina Biema (2).

Days with: Dni:	Observers Obserwator	1537	1538
frost z mrozem	1	43	47
	2	32	38
precipitation z opadem	1	135	82
	2	121	85
clear days pogodne	1	158	153
	2	113	99
wind z wiatrem	1	127	102
	2	38	39
thunderstorm z burzą	1	25	21
	2	10	8

on a global scale (Limanówka 1996), especially for the time resolution (daily observations), it was coded and implemented to the data base of EURO-CLIMHIST. Biem's notes were mainly used, but they were completed with the notes of other professors of the Academy. Also the two years of observations made by Michał of Wiślica (1537 and 1538) were used to reconstruct the climate of Europe in the 16th century. The results are to be published soon.

Translated by Anita Bokwa

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Obserwacje pogody prowadzone przez Michała z Wiślicy w Krakowie w latach 1527-1551

Streszczenie

Michał z Wiślicy, nazywany też Michałem Wiśliczką, żył w latach ok. 1499-1575 i był profesorem Akademii Krakowskiej (dziś: Uniwersytet Jagielloński). Ukończył studia astrologiczne i teologiczne, w latach 1531-40 prowadził katedrę astrologii, w 1574 r. otrzymał kanonię katedralną krakowską (*Historia nauki polskiej* 1974). W latach 1527-1551 idąc za przykładem Marcina Biema prowadził codzienne zapiski o pogodzie na stronach drukowanych wcześniej kalendarzy astronomicznych (Limanówka 1996). Częstość notatek była zmienna (Tab. 1) i tylko dla czterech lat 1535-38 zapiski są wystarczająco kompletne, aby poddać je dalszej analizie. Obserwacje prowadzone były bez użycia jakichkolwiek przyrządów, stąd też jedynymi wskaźnikami możliwymi do odtworzenia okazały się miesięczne liczby dni charakterystycznych (Tab. 2). Liczba dni z mrozem w zimie malała od 54 zimą 1535/36 do 39 w zimie 1537/38. Roczna liczba dni z opadem wahała się od 82 w 1538 r. do 135 w 1537 r. Roczna liczba dni pogodnych malała stopniowo od 196 w 1535 r. do 153 w 1538 r., podobnie jak liczba dni z wiatrem: od 180 w 1535 r. do 102 w 1538 r. Porównanie średnich wartości wskaźników dla pór roku z okresu 1535-38 z wieloletnimi średnimi wartościami z XX wieku (Tab. 3) wykazało, że zimy w tych 4 latach były mroźniejsze i dłuższe, najwięcej dni z opadem w obu okresach występowało latem, w latach 1535-38 w każdej porze roku notowano znacznie więcej dni pogodnych, zaś liczba dni z burzą prawie się nie zmieniła. Tabela 4 pozwala porównać odczytane notatki Marcina Biema (Gauricus 1533) i Michała z Wiślicy (Stoeffler, Pflaum 1513, 1531; Pitatus 1544). Michał z Wiślicy był dokładniejszym obserwatorem niż Marcin Biem, co widać w zestawieniu obserwacji z lat 1537-38 (Tab. 5), np. notował każde wystąpienie wiatru a nie tylko silny wiatr. Obserwacje Marcina Biema stanowią najważniejszą część wszystkich obserwacji pogody wykonanych w Krakowie przez profesorów Akademii, gdyż prowadzone były w różnych okresach pierwszej połowy XVI wieku. Zapiski Michała z Wiślicy posłużyły do uzupełnienia zapisków Biema za lata 1535-36 i zostały włączone do bazy danych międzynarodowego programu badawczego EURO-CLIMHIST. Program ten ma na celu odtworzenie warunków klimatycznych Europy w okresie przed badaniami

instrumentalnymi i jest koordynowany przez Ch. Pfistera z Uniwersytetu Berneńskiego w Szwajcarii. Wyniki programu są w druku.

Anita Bokwa

*Zakład Klimatologii Instytutu Geografii Uniwersytetu Jagiellońskiego
ul. Grodzka 64, 31-044 Kraków*

Danuta Limanówka

*Instytut Meteorologii i Gospodarki Wodnej Oddział w Krakowie,
ul. P. Borowego 14, 30-215 Kraków*