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Relative air humidity changes at station Bratislava, Mlynská dolina for the period 1983-2006

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Abstract The work brings the results of relative air humidity processing on the basis of hygrograph records enumeration at station Bratislava, Mlynská dolina for the period 1983-2006. The long-term changes of monthly averages, mean daily maxima and minima of relative air humidity, as well as changes its mean daily aperiodic amplitude in forms of graphs are introduced besides daily and annual courses.

Statistically significant decrease of mean monthly relative air humidity was found in June for the given period. The linear regression dependence of relative air humidity monthly mean on the air temperature was estimated for this month. In annual course the monthly means of relative air humidity move on the average from 65% in April to 84% in December for the period 1983-2006.

Key words: *daily course, annual course, long-term course, relative air humidity, daily aperiodic amplitude*

Introduction

The work brings results of daily and annual courses of relative air humidity processing for meteorological observatory of the Department of Astronomy, Physics of the Earth and Meteorology of the Faculty of Mathematics, Physics and Informatics of Comenius University in Bratislava, Mlynská dolina ($\varphi = 48^{o}09'$, $\lambda = 17^{o}04'$, H = 182 m a. s. l.) for the period 1983 - 2006 as well as the results its long-term changes in the given period. The enumeration of hygrograms and meteorological measurements of relative air humidity 3 times a day at 7, 14 and 21 o'clock of the mean local time serve as basic material.

Method and results

The maximum of relative air humidity in daily course is observed in time of minimum air temperature, that is at sunrise – Table 1 (Murínová and Ostrožlík, 1979). The mean hourly values with mean daily maxima and minima of relative air humidity for every month are introduced in this table. Minimum values of relative air humidity for every calendar day of the year are in Table 2. Maximum values of relative air humidity during fog or falling precipitation reach values close to 100% therefore we do not introduce the similar table for maximum daily values. The lowest relative air humidity 12% was measured on 19th March 1992. In annual course the lowest mean monthly relative air humidity occurs in April, the highest in December – Table 3, Figure 1 (Ostrožlík, 2007). We find out by comparison mean annual values of relative air humidity between the decades 1983-1992 and 1993-2002 that the mean annual relative air humidity decreased by 1.5% in the second decade. This fact can be explained by increase of mean annual air temperature in the given period. The decreasing tendencies of long-term course of mean annual relative air humidity – Figure 2 as well as long-term course of minimum annual relative air humidity – Figure 3 are not statistically significant. The decreasing tendencies are more distinctly expressed in the long-term course of minimum monthly relative air humidity in February – Figure 4 and especially in June – Figure 5. Statistically significant decrease of mean minima relative air humidity as well as increase of mean daily aperiodic amplitude in these months were computed – Figure 6 to Figure 9. The statistically important increase of mean aperiodic daily air temperature amplitude for both these months was determined (Hrvoľ, 2006).

February and June distinguished by higher mean monthly air temperatures in 10-year period 1993-2002 than in that 1983-1992 (Hrvoľ, 2004).

Figure 10 brings the statistically significant linear regression dependence of mean annual relative air humidity on mean annual air temperature. It follovs from this dependence that mean annual relative air humidity decreases by 2.7% when the mean annual air temperature increases by 1.0°C which is close to the value 2.4% at station Hurbanovo (Lapin and Melo, 2004).

The statistically significant linear regression dependence of mean monthly relative air humidity on mean monthly air temperature in June is shown in Figure 11. We can see that this dependence is similar to that for the mean annual values.

Table 1. Daily course of relative air humidity in percentages at station Bratislava, Mlynská dolina for the period 1983-2006

Hour	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	85	80	77	74	78	82	79	78	83	84	86	86
2	85	81	78	76	79	83	81	79	84	85	86	87
3	85	81	79	76	80	84	82	80	84	85	86	87
4	85	82	79	77	81	84	83	82	85	86	87	87
5	86	82	80	78	81	85	83	82	85	86	87	87
6	86	83	81	78	79	82	81	82	86	87	87	87
7	86	83	80	76	75	77	76	78	84	87	88	88
8	86	83	78	72	72	74	73	74	80	84	87	88
9	85	80	74	68	68	69	67	68	74	80	85	87
10	83	77	70	63	64	65	63	63	70	75	82	85
11	81	74	66	59	60	61	59	59	66	71	79	83
12	78	71	63	56	57	59	56	55	62	68	77	81
13	77	68	61	54	55	57	53	52	60	65	76	80
14	76	66	59	52	53	55	52	50	58	63	75	79
15	76	66	58	51	53	55	52	50	57	63	75	80
16	77	67	59	52	53	56	52	51	59	65	77	81
17	79	70	61	53	55	58	53	53	61	69	80	83
18	81	72	63	56	57	59	55	56	66	74	81	84
19	82	74	66	60	61	63	59	62	72	77	82	84
20	83	76	69	64	67	69	66	68	76	79	83	85
21	83	77	72	67	71	74	71	72	78	80	84	85
22	84	78	73	69	74	77	74	74	79	81	85	86
23	84	79	74	72	76	79	76	76	81	82	85	86
24	84	80	76	73	77	80	78	77	82	84	86	86
Mean max.	92	90	88	85	87	90	89	88	91	92	93	94
Mean min.	71	61	53	47	48	50	46	46	53	59	69	74

Table 2. Daily and monthly minima of relative air humidity in percentages at station Bratislava, Mlynská dolina for the period 1983-2006

Day	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	30	32	30	24	29	31	27	22	35	27	40	46
2	26	36	35	31	24	31	29	23	32	29	41	53
3	34	37	33	23	31	36	27	22	30	40	43	54
4	38	32	32	22	29	34	30	23	35	38	42	44
5	40	**21**	38	28	27	33	28	21	33	37	41	51
6	43	35	26	28	27	35	31	26	32	38	32	51
7	53	35	31	31	28	26	32	25	23	42	40	49
8	37	38	32	25	30	31	30	24	28	41	48	49
9	43	39	21	26	28	34	22	22	34	39	46	54
10	55	35	28	25	24	32	30	19	32	45	41	50
11	54	36	25	23	25	33	33	28	32	44	39	41
12	48	31	22	32	21	32	30	24	35	34	45	54
13	47	35	30	29	**20**	33	33	25	30	35	**31**	42
14	48	31	28	27	27	34	24	25	27	38	41	48
15	48	46	34	**19**	32	30	28	20	32	**24**	45	52
16	47	38	29	21	27	31	23	24	30	33	46	46
17	41	43	27	27	30	30	29	29	30	37	48	50
18	28	33	21	21	34	26	28	28	33	38	49	49
19	38	37	**12**	25	32	32	26	22	33	34	48	49
20	42	29	26	24	26	27	26	23	28	39	56	51
21	51	40	26	21	33	31	22	28	31	36	45	53
22	44	33	25	21	33	30	25	28	30	37	46	43
23	46	45	22	25	21	33	23	20	35	38	41	45
24	40	29	16	27	23	33	23	29	35	34	37	49
25	49	26	20	25	28	29	27	30	32	38	45	**39**
26	52	35	27	20	31	27	24	18	**20**	29	41	45
27	45	40	18	25	28	**23**	26	25	37	40	52	53
28	46	26	24	21	32	28	22	19	37	36	50	50
29	**18**	45	30	28	29	27	21	**17**	37	41	35	49
30	49		24	34	27	30	**19**	23	38	38	52	42
31	36		15		31		24	23		39	31	47
Minimum	18	21	12	19	20	23	19	17	20	24	31	39
Year of oc.	2002	2004	1992	1988	1993	2002	1994	1992	1992	1986	1983	2003

Table 3. Annual course of relative air humidity in percentages, maximum and minimum monthly means with year of occurrence and range at station Bratislava, Mlynská dolina for the period 1983-2006

Period	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Mean													
1983-1992	82.6	77.3	71.9	67.7	68.9	72.9	66.1	67.5	72.8	75.6	82.3	84.2	74.2
1993-2002	82.2	74.5	69.6	63.6	63.7	66.0	66.8	65.5	74.9	78.2	82.4	84.8	72.7
1983-2006	81.8	75.7	70.2	64.9	66.4	69.0	66.6	66.8	73.2	76.8	82.1	84.1	73.1
Max. mean	89.6	82.4	84.2	74.0	78.7	80.1	76.2	78.5	84.1	84.7	87.1	89.6	77.9
Year of oc.	1997	1986	1986	1987	1987	1987	1997	2005	1984	1984	1993	1990	1987
Min. mean	73.8	63.9	58.4	55.8	57.9	54.7	54.3	53.0	62.1	70.7	76.1	79.7	67.4
Year of oc.	1993	1998	1990	2003	2000	2000	1994	1992	2003	1986	2004	1988	2003
Range	15.8	18.5	25.8	18.2	20.8	25.4	21.9	25.5	22.0	14.0	11.0	9.9	10.5

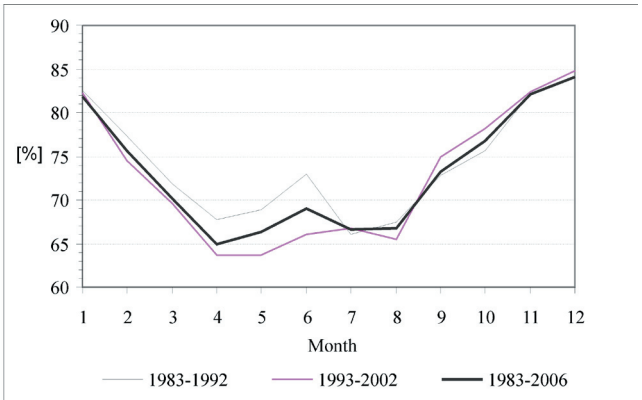

Figure 1. Annual course of relative air humidity at station Bratislava, Mlynská dolina for the periods 1983-1992, 1993-2002 and 1983-2006

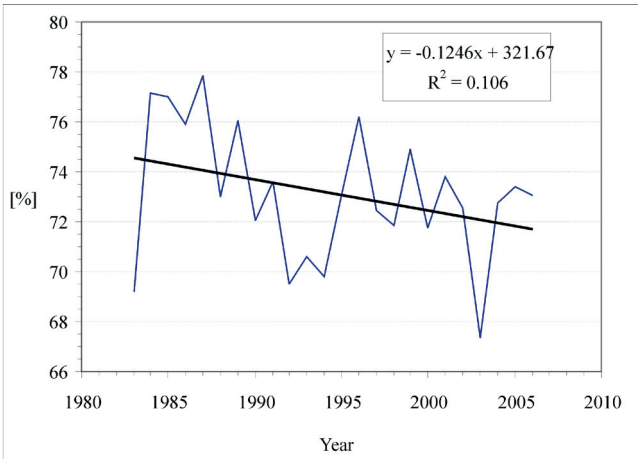

Figure 2. Long-term course of mean annual relative air humidity at station Bratislava, Mlynská dolina for the period 1983-2006

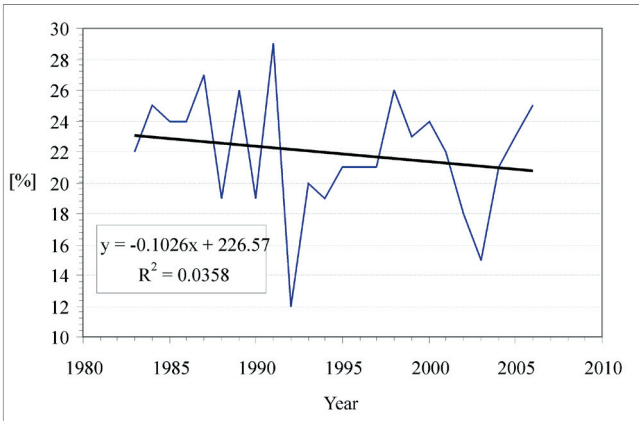

Figure 3. Long-term course of minimum annual relative air humidity at station Bratislava, Mlynská dolina for the period 1983-2006

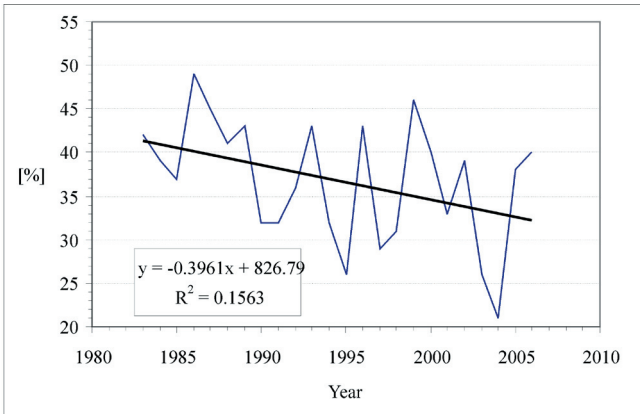

Figure 4. Long-term course of minimum relative air humidity at station Bratislava, Mlynská dolina in February for the period 1983-2006

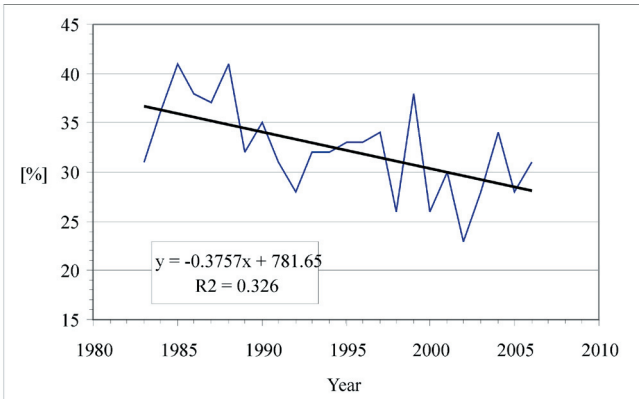

Figure 5. Long-term course of minimum relative air humidity at station Bratislava, Mlynská dolina in June for the period 1983-2006

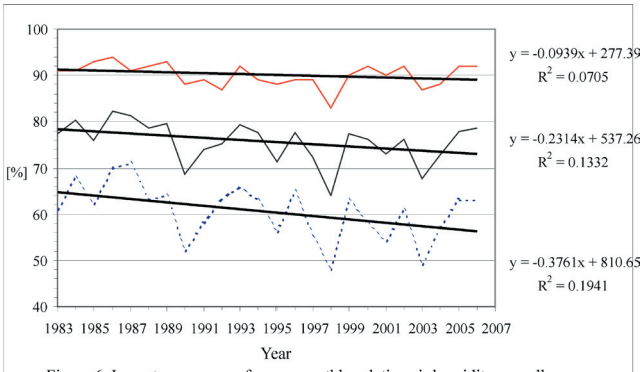

Figure 6. Long-term course of mean monthly relative air humidity as well as mean daily maxima and minima with linear trends at station Bratislava, Mlynská dolina in February for the period 1983-2006.

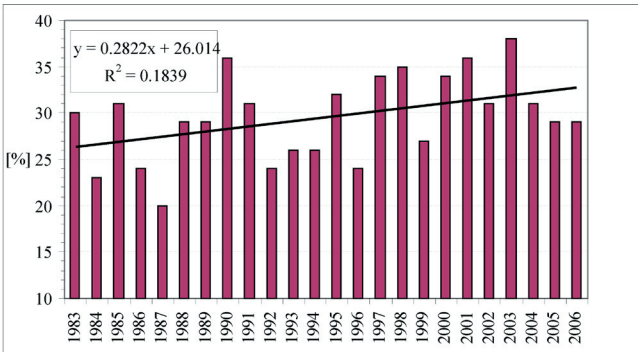

Figure 7. Long-term course of mean daily aperiodic amplitude of relative air humidity in percentages at station Bratislava, Mlynská dolina in February for the period 1983-2006.

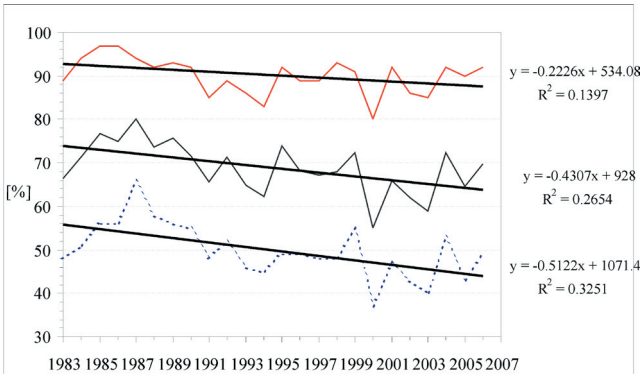

Figure 8. Long-term course of mean monthly relative air humidity as well as mean daily maxima and minima with linear trends at station Bratislava, Mlynská dolina in June for the period 1983-2006

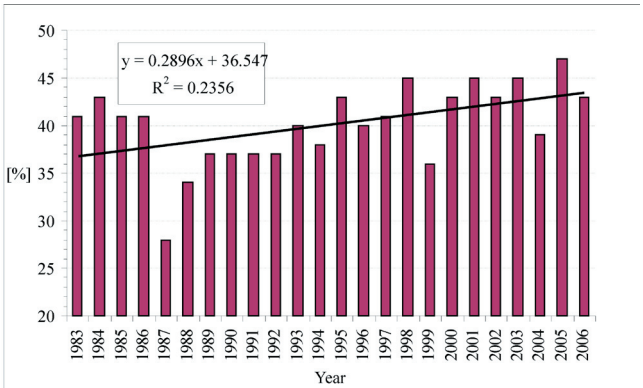

Figure 9. Long-term course of mean daily aperiodic amplitude of relative air humidity in percentages at station Bratislava, Mlynská dolina in June for the period 1983-2006

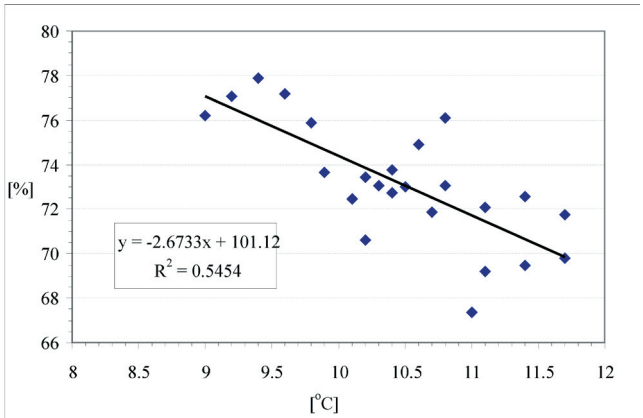

Figure 10. Dependence of mean annual relative air humidity on mean annual air temperature at station Bratislava, Mlynská dolina for the period 1983-2006

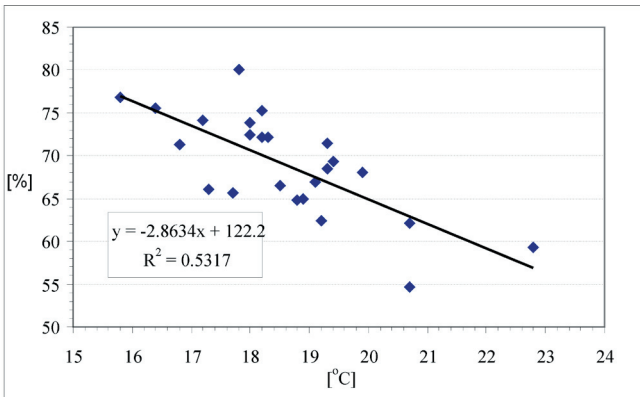

Figure 11. Dependence of mean monthly relative air humidity on mean monthly air temperature at station Bratislava, Mlynská dolina in June for the period 1983-2006

Conclusion

- Processing of relative air humidity data at station Bratislava, Mlynská dolina for the period 1983-2006 shows the decreasing tendency its minimum and mean annual values in long-term course.
- In February and in June the statistically significant decrease of mean daily minima and increase of the mean daily aperiodic amplitude of relative air humidity are observed.

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