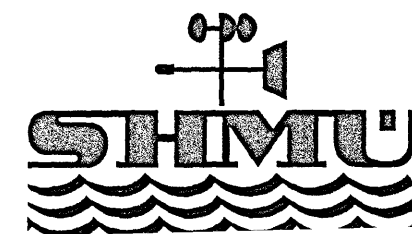


# **Klimatický atlas Slovenska**

## Climate Atlas of Slovakia

© Slovenský hydrometeorologický ústav  
© Slovak Hydrometeorological Institute



# Obsah

Úvod.....	11
Fyzicko-geografické pomery Slovenska.....	12
História pozorovaní.....	15
Metodika spracovania atlasu.....	17
<b>I Teplota vzduchu.....</b>	<b>19</b>
Úvod.....	20
Priemerná teplota vzduchu.....	21
Extrémne teploty vzduchu.....	29
Záver.....	34
<b>II Atmosférické zrážky.....</b>	<b>35</b>
Úvod.....	36
Priemerný úhrn zrážok.....	36
Počet dní so zrážkami.....	41
Maximálne úhrny zrážok.....	42
Zrážkové indexy a sucho.....	46
Palmerove indexy sucha.....	46
Štandardizovaný zrážkový index.....	47
3-mesačný SPI.....	48
6-mesačný SPI.....	50
Záver.....	50
<b>III Sneh a snehová pokrývka.....</b>	<b>51</b>
Úvod.....	52
Sneženie.....	52
Snehová pokrývka.....	56
Záver.....	62
<b>IV Vlhkosť vzduchu.....</b>	<b>63</b>
Úvod.....	64
Vlhkosť vzduchu.....	64
Relatívna vlhkosť vzduchu.....	64
Tlak vodnej pary a sýtosťný doplnok.....	66
Dusné dni.....	68
Výpar.....	69
Potenciálna evapotranspirácia.....	70
Výpar z vodnej hladiny.....	70
Klimatický ukazovateľ zavlženia.....	71
Záver.....	71
<b>V Oblačnosť, slnečný svit a slnečné žiarenie.....</b>	<b>73</b>
Úvod.....	74
Oblačnosť, jasné a zamračené dni.....	74
Slnečný svit.....	75
Slnečné žiarenie.....	77
Dlhodobé zmeny slnečného svitu a globálneho žiarenia.....	80
Záver.....	81

<b>VI Tlak vzduchu a vietor.....</b>	<b>83</b>
Úvod.....	84
Tlak vzduchu.....	84
Vietor.....	87
Priemerná ročná a sezónna rýchlosť vetra.....	89
Variabilita ročného, mesačného a denného chodu rýchlosti a smeru vetra.....	89
Veterné ružice.....	91
Záver.....	92
<b>VII Meteorologická charakteristika vyššej atmosféry.....</b>	<b>93</b>
Úvod.....	94
Teplota vzduchu.....	94
Tlak vzduchu a geopotenciálna výška.....	95
Vlhkosť vzduchu.....	95
Vietor.....	95
Tropopauza.....	97
Medziročné kolísanie teploty vzduchu a geopotenciálu.....	97
Celkový atmosférický ozón.....	98
Záver.....	99
<b>VIII Nebezpečné atmosférické javy.....</b>	<b>101</b>
Úvod.....	102
Búrka.....	102
Krupobitie.....	102
Hmla.....	103
Silný a búrlivý vietor.....	104
Záver.....	104
<b>IX Fenologické charakteristiky.....</b>	<b>105</b>
Úvod.....	106
Fenologické hodnotenie vybraných druhov.....	107
Začiatok kvitnutia liesky obyčajnej.....	107
Začiatok kvitnutia čerešne vtácej (skorá odroda).....	108
Vybrané fenologické fázy pšenice ozimnej.....	108
Vybrané fenologické fázy jačmeňa jarného.....	109
Záver.....	110
<b>X Teplota a premrzanie pôdy.....</b>	<b>111</b>
Úvod.....	112
Charakteristiky teploty a premrzania pôdy.....	112
Záver.....	115
<b>XI Klasifikácie klímy.....</b>	<b>117</b>
Úvod.....	118
Klimatická klasifikácia podľa Končeka.....	118
Záver.....	120
<b>XII Staničná sieť.....</b>	<b>121</b>
<b>Register.....</b>	<b>130</b>

# Content

Introduction.....	11
Physical geographical conditions of Slovakia.....	12
History of observations.....	15
Methodology of atlas processing.....	17
<b>I Air temperature.....</b>	<b>19</b>
Introduction.....	20
Mean air temperature.....	21
Extreme air temperature.....	29
Conclusion.....	34
<b>II Atmospheric precipitation.....</b>	<b>35</b>
Introduction.....	36
Average precipitation total.....	36
Number of days with precipitation.....	41
Maximum precipitation totals.....	42
Precipitation and drought indices.....	46
The Palmer Drought Indices.....	46
The Standardized Precipitation Index.....	47
3-monthly SPI.....	48
6-monthly SPI.....	50
Conclusion.....	50
<b>III Sneh a snehová pokrývka.....</b>	<b>51</b>
Introduction.....	52
Snowfall.....	52
Snow cover.....	56
Conclusion.....	62
<b>IV Air humidity.....</b>	<b>63</b>
Introduction.....	64
Air humidity.....	64
Relative air humidity.....	64
Water vapour pressure and saturation deficit.....	66
Sultry days.....	68
Evaporation.....	69
Potential evapotranspiration.....	70
Evaporation from water surface.....	70
Climatic indicator of humidification.....	71
Conclusion.....	71
<b>V Cloudiness, sunshine duration and solar radiation.....</b>	<b>73</b>
Introduction.....	74
Cloud cover, clear and overcast days.....	74
Sunshine duration.....	75
Solar radiation.....	77
Long-term variability in sunshine duration and global radiation.....	80
Conclusion.....	81

<b>VI Air pressure and wind.....</b>	<b>83</b>
Introduction.....	84
Air pressure.....	84
Wind.....	87
Mean annual and seasonal wind speed.....	89
Variability of the mean annual, monthly and daily course of wind speed and its direction.....	89
Wind roses.....	91
Conclusion.....	92
<b>VII Upper-air characteristics.....</b>	<b>93</b>
Introduction.....	94
Air temperature.....	94
Air pressure and geopotential.....	95
Air humidity.....	95
Wind.....	95
Tropopause.....	97
Year-to-year variation of air temperature and geopotential.....	97
Total atmospheric ozone.....	98
Conclusion.....	99
<b>VIII Hazardous atmospheric phenomena.....</b>	<b>101</b>
Introduction.....	102
Thunderstorm.....	102
Hail.....	102
Fog.....	103
Strong breeze and gale.....	104
Conclusion.....	104
<b>IX Phenological characteristics.....</b>	<b>105</b>
Introduction.....	106
Phenological evaluation of chosen species.....	107
The beginning of flowering of common hazel.....	107
The beginning of flowering of sweet cherry (early variety).....	108
Chosen phenological phases of winter wheat.....	108
Chosen phenological phases of spring barley.....	109
Conclusion.....	110
<b>X Temperature and freezing of soil.....</b>	<b>111</b>
Introduction.....	112
Characteristics of temperature and freezing of soil.....	112
Conclusion.....	115
<b>XI Classification of climate.....</b>	<b>117</b>
Introduction.....	118
Climatic classification according to Konček.....	118
Conclusion.....	120
<b>XI Station network.....</b>	<b>121</b>
<b>Index.....</b>	<b>130</b>

# List of maps, graphs and tables

Introduction	
M.1 Physical map .....	12
M.2 Landcover .....	13
M.3 The main rivers basins .....	14
M.4 Geomorphological units.....	14
I Air temperature	
M I.1 Mean annual air temperature .....	21
M I.2 Average seasonal air temperature – spring .....	22
M I.3 Average seasonal air temperature – summer .....	22
M I.4 Average seasonal air temperature – autumn.....	22
M I.5 Average seasonal air temperature – winter .....	22
M I.6 Average seasonal air temperature in warm half of the year (April – September).....	23
M I.7 Average annual effective temperature sum 10 °C and more.....	23
G I.1 The highest and the lowest values of annual and monthly mean air temperature and areal means in Slovakia.....	23
G I.2 Selected values of frequency distribution of monthly air temperature means at selected meteorological stations.....	23
G I.3–10 Selected statistical values of mean annual air temperature at selected stations .....	23
M I.8 Mean monthly temperature in January.....	24
M I.9 Mean monthly temperature in February.....	24
M I.10 Mean monthly temperature in March .....	24
M I.11 Mean monthly temperature in April.....	24
M I.12 Mean monthly temperature in May .....	24
M I.13 Mean monthly temperature in June.....	24
M I.14 Mean monthly temperature in July .....	25
M I.15 Mean monthly temperature in August.....	25
M I.16 Mean monthly temperature in September .....	25
M I.17 Mean monthly temperature in October.....	25
M I.18 Mean monthly temperature in November .....	25
M I.19 Mean monthly temperature in December.....	25
G I.11–17 Long-term fluctuations of annual and seasonal temperature means shown as deviations from normal 1961 – 1990 at meteorological station Hurbanovo.....	26
G I.18 Variation of mean cold half of the year (October – March) air temperature calculated from all meteorological stations in Slovakia.....	26
G I.19 Variation of mean warm half of the year (April – September) air temperature calculated from all meteorological stations in Slovakia .....	26
G I.20 Variation of mean annual air temperature calculated from all meteorological stations in Slovakia.....	26
G I.21 Daily air temperature variation at meteorological station Hurbanovo, local mean solar time –1 h, period 2001 – 2010.....	26
G I.22 The highest, mean and lowest values of annual air temperature maximum and minimum from all meteorological stations of Slovakia .....	26
G I.23 Variation and some descriptive statistics of annual duration of prevailing daily air temperature averages at least 5 °C and annual number of such days at Hurbanovo .....	27
M I.20 Average duration of average daily air temperature of 5 °C and more .....	27
M I.21 Average beginning of average daily air temperature of 5 °C and more .....	27
M I.22 Average end of average daily air temperature of 5 °C and more .....	27
G I.24 Variation and some descriptive statistics of annual duration of prevailing daily air temperature averages at least 10 °C and annual number of such days at Hurbanovo .....	27
M I.23 Average duration of average daily air temperature of 10 °C and more .....	27
M I.24 Average beginning of average daily air temperature of 10 °C and more .....	28
M I.25 Average end of average daily air temperature of 10 °C and more.....	28
G I.25 Variation and some descriptive statistics of annual duration of prevailing daily air temperature averages at least 15 °C and annual number of such days at Hurbanovo .....	28
M I.26 Average duration of average daily air temperature of 15 °C and more .....	28
M I.27 Average beginning of average daily air temperature of 15 °C and more .....	28
M I.28 Average end of average daily air temperature of 15 °C and more.....	28
M I.29 Mean annual, monthly maximum and minimum of air temperature at selected meteorological stations .....	29
G I.26–33 Annual course and frequency distribution of mean daily extremes and monthly extremes of air temperature at Hurbanovo and Telgárt .....	30
G I.34 Variation in the annual of July mean daily air temperature maximums at meteorological stations Hurbanovo and Telgárt including 20 <sup>th</sup> and 80 <sup>th</sup> percentiles .....	30
G I.35 Variation of annual air temperature minimum at selected meteorological stations Hurbanovo and Telgárt including 20 <sup>th</sup> and 80 <sup>th</sup> percentiles .....	30
G I.36 The highest, mean and lowest values of monthly means of daily air temperature maximums.....	30
G I.37 Variation of annual air temperature maximum at selected meteorological stations Hurbanovo and Telgárt including 20 <sup>th</sup> and 80 <sup>th</sup> percentiles .....	30
M I.30 Mean daily maximum and minimum of air temperature and mean daily amplitudes of air temperature at selected meteorological stations .....	31
G I.38 Monthly means of daily air temperature amplitude calculated from all meteorological stations of Slovakia .....	31
G I.39 Number of days with characteristic temperatures measured by the maximum and minimum thermometer calculated from all meteorological stations of Slovakia.....	31
M I.31 Average annual number of warm days ( $T_{\max} \geq 25\text{ °C}$ ) .....	32
M I.32 Average annual number of tropical days ( $T_{\max} \geq 30\text{ °C}$ ) .....	32
M I.33 Average annual number of days without frost ( $T_{\min} > 0\text{ °C}$ ) .....	32
G I.40 Variation of annual number of summer days at meteorological station Hurbanovo including 20 <sup>th</sup> and 80 <sup>th</sup> percentiles .....	32
G I.41 Variation of annual number of tropical days at meteorological station Hurbanovo including 20 <sup>th</sup> and 80 <sup>th</sup> percentiles .....	32
M I.34 Average annual number of days with ground frost ( $T_{\min} < 0\text{ °C}$ ).....	32
M I.35 Average date of the first frost day ( $T_{\min} < 0\text{ °C}$ ) .....	33
M I.36 Average date of the last frost day ( $T_{\min} < 0\text{ °C}$ ).....	33
M I.37 Average annual number of frost days ( $T_{\min} < 0\text{ °C}$ ) .....	33
M I.38 Average annual number of ice days ( $T_{\max} < 0\text{ °C}$ ) .....	33
M I.39 Average annual number of arctic days ( $T_{\min} \leq -10\text{ °C}$ ).....	33
G I.42 Variation of annual number of ice and arctic days at Hurbanovo and Telgárt including 20 <sup>th</sup> and 80 <sup>th</sup> percentiles .....	33
G I.44 Variation of annual number of days crossing 0 °C at meteorological stations Hurbanovo and Telgárt including 20 <sup>th</sup> and 80 <sup>th</sup> percentile.....	34
G I.45 Variation of annual number of frost days at meteorological stations Hurbanovo and Telgárt including 20 <sup>th</sup> and 80 <sup>th</sup> percentile.....	34
II Atmospheric precipitation	
M II.1 Average annual precipitation total .....	37
M II.2 Average monthly precipitation total in January .....	38
M II.3 Average monthly precipitation total in February .....	38
M II.4 Average monthly precipitation total in March.....	38
M II.5 Average monthly precipitation total in April .....	38
M II.6 Average monthly precipitation total in May.....	38
M II.7 Average monthly precipitation total in June .....	38
M II.8 Average monthly precipitation total in July.....	39
M II.9 Average monthly precipitation total in August .....	39
M II.10 Average monthly precipitation total in September.....	39
M II.11 Average monthly precipitation total in October.....	39
M II.12 Average monthly precipitation total in November.....	39
M II.13 Average monthly precipitation total in December.....	39
M II.14 Average precipitation total in warm half-year .....	40
G II.1–8 Types of annual variation of average monthly precipitation totals and their variability expressed by means of the variation coefficient for selected stations.....	40
M II.15 Average seasonal precipitation total – spring .....	40
M II.16 Average seasonal precipitation total – summer .....	40
M II.17 Average seasonal precipitation total – autumn.....	40
M II.18 Average seasonal precipitation total – winter .....	40
G II.9–18 Long-term fluctuations in the seasonal and annual precipitation totals at the Hurbanovo and Košice–airport stations, expressed as deviations from the average value for the period 1961 – 2010. Smoothed by 10-year moving average .....	41
M II.19 Average annual number of days with precipitation total $\geq 0.1\text{ mm}$ .....	41
M II.20 Average annual number of days with precipitation total $\geq 1.0\text{ mm}$ .....	41
M II.21 Average annual number of days with precipitation total $\geq 5.0\text{ mm}$ .....	42
M II.22 Average annual number of days with precipitation total $\geq 10.0\text{ mm}$ .....	42
G II.19–24 Average annual variation in the number of days with various precipitation totals ( $\geq 0.1\text{ mm}$ , $\geq 1\text{ mm}$ , $\geq 5\text{ mm}$ , $\geq 10\text{ mm}$ , $\geq 20\text{ mm}$ ).....	42
G II.25 Fluctuations in the annual maxima of one-day, two-day and five-day precipitation totals at selected stations.....	43
M II.23 Average annual maxima of one-day precipitation totals .....	43
M II.24 Average annual maxima of two-day precipitation totals .....	43
M II.25 Average annual maxima of five-day precipitation totals.....	43
T II.1 One-day precipitation totals $\geq 150\text{ mm}$ for Slovakia in the period 1951 – 2010.....	44
M II.26 Absolute maxima of one-day precipitation totals .....	44
M II.27 Absolute maxima of two-day precipitation totals .....	44
M II.28 Absolute maxima of five-day precipitation totals.....	44
M II.29 Average monthly maxima of precipitation in the period 1981 – 2010 .....	45
G II.29–31 Estimations of one-day, two-day and five-day precipitation totals for different return periods.....	45
M II.30 The number of dry episodes according to the relative Z-index.....	46
M II.31 Ratio of months impacted by dry episodes according to relative Palmers Z-index in warm half-year... ..	48
M II.32 Ratio of months impacted by dry episodes according to relative PDSI in warm half-year.....	48
M II.33 Standardized precipitation index – 3-monthly.....	48
M II.34 Spatial distribution of the 3-monthly SPI in May 2007 .....	49
M II.35 Spatial distribution of the 6-monthly SPI in July 1968.....	49
M II.36 Standardized precipitation index – 6-monthly.....	49
III Snow and snow cover	
G III.1 Average monthly number of days with snowfall at selected stations.....	53
G III.2 Average monthly number of days with snow cover at selected stations .....	53
M III.1 Average seasonal number of days with snowfall.....	53
M III.2 Average monthly number of days with snowfall in December .....	54
M III.3 Average monthly number of days with snowfall in January .....	54
M III.4 Average monthly number of days with snowfall in February.....	54
M III.5 Average monthly number of days with snowfall in March.....	54
G III.3 Number of cases with new snow depth $\geq 20\text{ cm}$ in the period 1981/1982 – 2010/2011 .....	54
M III.6 Average seasonal number of days with new snow depth $\geq 5\text{ cm}$ .....	54
M III.7 Average seasonal number of days with new snow depth $\geq 10\text{ cm}$ .....	55
M III.8 Average seasonal number of days with new snow depth $\geq 15\text{ cm}$ .....	55
M III.9 Average of seasonal totals of the new snow depth .....	55
M III.10 Average date of the first snowfall .....	56
M III.11 Average date of the last snowfall.....	56
T III.1 Recorded maxima of snowfall and snow cover from selected stations during winter seasons in the period 1981/1982 – 2010/2011 .....	56
G III.4 Average depth of snow cover at low elevations.....	57
G III.5 Average depth of snow cover at mountain sites .....	57
M III.12 Average seasonal number of days with snow cover .....	58
M III.13 Average monthly number of days with snow cover in December.....	59
M III.14 Average monthly number of days with snow cover in February .....	59
M III.15 Average monthly number of days with snow cover in January .....	59
M III.16 Average monthly number of days with snow cover in March .....	59
M III.17 Average seasonal number of days with snow cover depth $\geq 10\text{ cm}$ .....	59
M III.18 Average seasonal number of days with snow cover depth $\geq 20\text{ cm}$ .....	59
M III.19 Average seasonal number of days with snow cover depth $\geq 50\text{ cm}$ .....	60
G III.6 Maximum depth of snow cover at low elevations .....	60
G III.7 Maximum depth of snow cover at mountain sites.....	60
M III.20 Average of the seasonal maxima of snow cover depth.....	60
M III.21 Average monthly maximum of snow cover depth in December.....	61
M III.22 Average monthly maximum of snow cover depth in January.....	61
M III.23 Average monthly maximum of snow cover depth in February .....	61
M III.24 Average monthly maximum of snow cover depth in March .....	61
M III.25 Average seasonal maximum of water equivalent of snow cover .....	61

M III.26 Average date of the first snow cover .....	62
M III.27 Average date of the last snow cover .....	62

## IV Air humidity

G IV.1 Annual variation of relative air humidity at selected stations.....	65
G IV.2 Daily variation of relative air humidity at selected stations in January.....	65
G IV.3 Daily variation of relative air humidity at selected stations in July.....	65
M IV.1 Average annual relative air humidity.....	65
M IV.2 Average monthly relative air humidity in April .....	66
M IV.3 Average monthly relative air humidity in July.....	66
M IV.4 Average monthly relative air humidity in October .....	66
M IV.5 Average monthly relative air humidity in December .....	66
M IV.6 Average annual water vapour pressure .....	67
M IV.7 Average monthly water vapour pressure.....	67
M IV.8 Average monthly water vapour pressure in July .....	67
M IV.9 Average annual saturation deficit.....	68
M IV.10 Average saturation deficit during the warm half-year.....	68
G IV.4 Annual variation of water vapour pressure, saturation deficit and air temperature at Hurbanovo .....	68
G IV.5 Daily variation of water vapour pressure at selected stations in January .....	68
G IV.6 Daily variation of water vapour pressure at selected stations in July.....	68
M IV.11 Average annual number of sultry days.....	69
M IV.12 Average water surface evaporation total at selected stations.....	70
G IV.7 Water surface evaporation total from May to September at selected stations.....	70
M IV.13 Average annual potential evapotranspiration total.....	70
M IV.14-15 Average monthly potential evapotranspiration total .....	71
M IV.16 Average annual value of climatic indicator of humidification.....	71
M IV.17-18 Average monthly value of climatic indicator of humidification.....	71

## V Cloudiness, sunshine duration and solar radiation

M V.1 Mean annual cloudiness in period 1961 – 2010 .....	74
M V.2 Mean annual number of clear days in period 1961 – 2010 .....	74
M V.3 Mean annual number of overcast days in period 1961 – 2010 .....	74
G V.1 Average number of clear days at selected stations in period 1961 – 2010 .....	75
G V.2 Average number of overcast days at selected stations in period 1961 – 2010.....	75
M V.4 Mean annual sunshine duration in period 1961 – 2010 .....	75
M V.5-8 Mean monthly sunshine duration in period 1961– 2010.....	76
G V.3-4 Mean daily course of sunshine duration at Štrbské Pleso and Milhostov in period 1995 – 2004.....	76
M V.9 Mean annual sums of global radiation in period 1961 – 2010 .....	77
M V.10-13 Mean monthly sums of global radiation in period 1961 – 2010 .....	78
G V.5-6 Mean monthly, seasonal and annual sums of diffuse radiation at selected stations in period 1981 – 2010 .....	78
G V.7-8 Mean daily sums of global, diffuse and direct radiation incident on horizontally oriented surface at Bratislava-Koliba and Štrbské Pleso calculated for period 1981 – 2010 .....	79
G V.9-12 Mean hourly sums of global, diffuse and direct radiation incident on horizontally oriented surface at Bratislava-Koliba and Štrbské Pleso in December and in June calculated for period 1981 – 2010.....	79
G V.13 Annual course of UV index at Poprad-Gánovce in period 1996 – 2010.....	80
G V.14-17 Mean hourly sums of solar erythral UV radiation at stations Poprad-Gánovce, Bratislava-Koliba and Košice / Milhostov in March, June, September and December in period 2001 – 2010 .....	80
G V.18 Smoothed annual sums of sunshine duration measured in period 1911 – 2010 and annual sums of global radiation measured in period 1981 – 2010 at station Hurbanovo.....	80

## VI Air pressure and wind

M VI.1 Mean annual air pressure reduced to sea level.....	85
M VI.2-13 Average monthly air pressure reduced to sea level .....	86
G VI.1-12 Number of daily pressure occurrence at station Bratislava.....	86

G VI.13 Annual variation of air pressure .....	86
G VI.14-17 Seasonal and annual daily variation of mean air pressure at selected stations .....	86
M VI.14 Annual mean wind velocity.....	87
M VI.15 Mean seasonal wind velocity – spring .....	88
M VI.16 Mean seasonal wind velocity – summer.....	88
M VI.17 Mean seasonal wind velocity – autumn.....	88
M VI.18 Mean seasonal wind velocity – winter .....	88
G VI.18-27 Mean monthly wind velocity at selected stations in period 1961 – 2010 .....	90
G VI.28-37 Mean annual and half-years wind velocity at selected stations in period 1961 – 2010 .....	90
M VI.19 Wind roses at selected stations in period 2001 – 2010.....	91

## VII Upper-air characteristics

G VII.1-2 Air temperature isopleths [°C] .....	94
G VII.3-4 Variability in monthly mean temperature at standard isobaric levels .....	94
G VII.5 Air pressure isopleths [hPa] .....	95
G VII.6-7 Variability in monthly mean geopotential at standard isobaric levels.....	95
G VII.8-9 Relative air humidity isopleths [%].....	95
G VII.10-15 Wind direction frequency at standard isobaric levels.....	96
G VII.16-21 Annual course in wind direction frequency and average wind velocity at standard isobaric levels.....	96
G VII.22 Vertical profile of seasonal average wind velocity .....	96
G VII.23 Annual course of air temperature in tropopause.....	97
G VII.24 Annual course of geopotential in tropopause .....	97
G VII.25 Annual course of air pressure in tropopause .....	97
G VII.26 Annual course of wind velocity in tropopause.....	97
G VII.27-36 Air temperature and geopotential trend at standard isobaric levels .....	97
G VII.37 Daily averages of total ozone at Poprad-Gánovce, 1996 – 2010 .....	98
G VII.38 Average relative deviation of total ozone at Poprad-Gánovce, 1996 – 2010 .....	98
G VII.39 Yearly deviation of total ozone towards long-term averages, Poprad-Gánovce, 1996 – 2010.....	98

## VIII Hazardous atmospheric phenomena

M VIII.1 Average monthly number of days with thunderstorm .....	102
M VIII.2 Average annual number of days with thunderstorm.....	102
G VIII.1 Annual number of days with thunderstorm at selected stations .....	103
M VIII.3 Average monthly and yearly number of days with hail .....	103
G VIII.2 Annual number of days with hail at selected stations.....	103
M VIII.4 Average monthly and yearly number of days with fog.....	103
G VIII.3 Annual number of days with fog at selected stations.....	103
M VIII.5 Average monthly and yearly number of days with strong breeze .....	104
M VIII.6 Average monthly and yearly number of days with gale .....	104

## IX Phenological characteristics

G IX.1 Average onset of beginning of flowering of common hazel and sweet cherry .....	107
M IX.1 Average date of beginning of flowering of common hazel .....	107
G IX.2 Time course of beginning of flowering of sweet cherry.....	107
M IX.2 Average date of beginning of flowering of sweet cherry .....	107
G IX.3 Dependence of average onset date of chosen phenological phases of winter wheat on altitude .....	108
M IX.3 Average date of emergence of winter wheat .....	108
M IX.4 Average date of heading of winter wheat.....	108
M IX.5 Average date of full ripeness of winter wheat.....	108
G IX.4 Dependence of average onset date of chosen phenological phases of spring barley on altitude.....	109
M IX.6 Average date of beginning of flowering of spring barley .....	109
M IX.7 Average date of heading of spring barley.....	109
M IX.8 Average date of full ripeness of spring barley .....	109

## X Temperature and freezing of soil

G X.1-3 Annual course of daily mean soil temperature in 5, 10, 20, 50 and 100 cm in 1981 – 2010 at selected stations .....	113
G X.4-6 Daily mean soil temperature in 1981 – 2010 at selected stations.....	113
G X.7-9 Absolute extremes of soil temperature in climatological time of observation in 5, 10, 20, and 50 cm in 1981 – 2010 at selected stations .....	113
G X.10 Annual variation of soil temperature in different depth in Jaslovské Bohunice in 1991 – 2010.....	114
T X.1 Absolute maximal and minimal soil temperature in Hurbanovo in 1981 – 2010.....	114
T X.2 Absolute maximal and minimal soil temperature in Jaslovské Bohunice in 1991 – 2010.....	114
M X.1 Average maximum depth of frozen soil .....	114
M X.2 Average number of days with soil freezing .....	114
T X.3 Maximal and minimal depth of soil freezing in period 1981 – 2010 .....	115
T X.4 Maximal and minimal number of days with soil freezing in period 1981 – 2010 .....	115

## XI Classification of climate

M XI.1 Climate classification according to Konček (1961 – 2010) .....	119
M XI.2 Climate classification according to Konček (1961 – 1990) .....	119

## XII Station network

M XII.1 Climatological stations.....	122
T XII.1 List of climatological stations.....	122
M XII.2 Precipitation stations.....	124
T XII.2 List of precipitation stations .....	124
M XII.3 Phenological stations .....	128
T XII.3 List of phenological stations.....	128