Contents

	List of notations and abrevations	XVII
1	Introduction	1
2	Circulation Indices for the Northern Hemisphere	3
2.1	Mean North-hemispheric zonal wind component at sea level	4
2.2	Mean Atlantic-European zonal wind component at sea level	4
2.3	North Atlantic Oscillation	4
2.4	North Atlantic Index	5
2.5	Pressure difference over the British Isles	5
2.6	Central-European-Circulation Indices CECI	5
2.7	Geostrophic Zonal Wind Component in the Atlantic- European Sector U120	5
2.8	Location of the circulation indices in the field of Northern Hemisphere at 500 hPa surface	7
3	Temporal and latitudinal structure of the zonal circulation index U120a	9
3.1	Temporal structure of the zonal circulation index U120a from 1947 to 1988	11
3.2	High and low index years	12
3.3	U120a during El Niño/Southern Oscillation extremes	12
4	The approximate zonal circulation index U120b	14
4.1	Some general remarks concerning the Großwetterlagen	14
4.2	The calculation of the approximate zonal circulation index U120b	14
4.2.1	Test on normal distribution, homogeneity and trend in U120b time series	19
4.3	Spectral Analysis and Band Pass Filter Analysis of the U120b time series	21
4.3.1	Power spectrum analysis of the U120b time series	21
4.3.2	Running power spectrum and band-pass filter analysis	25
4.3.2.1	Band pass filtering	25
4.4	The influence of North Atlantic sea surface temperatures on the strength of the zonal circulation in the Atlantic-European region	28

- - - -

4.5	Teleconnections of U120b with the El Niño/Southern Oscillation	32
4.6	The association of U120b with 2 m surface air temperature fields on the Northern Hemisphere	40
5	Precipitation day - precipitation frequency	45
5.1	Correlation with other climatological elements	45
6	Precipiation frequency data in the Mediterranean	50
6.1	Raw data treatment	52
6.1.1	Filling gaps in the time series	52
6.1.2	Tests on data inhomogeneity	53
6.1.2.1	Absolute tests	53
6.1.2.2	Relative tests	53
6.1.2.3	The application of homogeneity tests on the Mediterranean precipitation frequency time series	54
6.2	Climatology of the precipitation frequency in the Mediterranean	56
6.2.1	General features of the precipitation frequencies in the Mediterranean	56
6.2.2	Spatial and seasonal distribution of precipitation frequencies in five Mediterranean sub-regions	57
6.2.2.1	The West	57
6.2.2.2	Northern Italy	57
6.2.2.3	Central and Southern Italy	57
6.2.2.4	South of the Sicilian and Malta Channels	58
6.2.2.5	The Levant	58
6.2.2.6	precipitation frequency series, period 1968 - 1994	58
6.3	Correlations between U120b and precipitation frequencies in the Mediterranean	59
7	Secular precipiation frequency time series in Europe	66
7.1	Meteorological stations and their history (metadata)	66
7.1.1	Athens / Greece	66
7.1.2	Padova / Italy	67
713	Cracow / Poland	68
714	Bochum Wetterwarte / Germany	50
7.1.4		09
1.1.5	I artu / Estonia	70
7.1.6	Tallinn / Estonia	71

7.2	Changing trends in the secular precipitation frequency time series	74
7.3	Correlations of secular seasonal precipitation frequency time series with U120b	80
7.3.1	The behaviour of the secular series of precipitation frequencies under the influence of externe U120b indices	81
7.3.2	Cross-correlation and cross-spectrum analysis of U120b and the secular precipitation frequency time series	85
8	Conclusions	86
Appendix	1: Tables	90
Appendix	2: Figures	102
Appendix	3: Statistical methods	115
AS 1	Non-parametric tests	115
AS 1.1	Kolmogorov-Smirnov Test on Standard Normal Distribution	115
AS 1.2	Wilcoxon one-sided rank sum test	115
AS 2	Test on Trends	116
AS 3	Seasonal Adjustment	121
AS 3.1	Moving Average Filter	122
AS 3.2	Variate Difference Method	122
AS 3.3	Mean Annual Course Difference Filter	122
AS 3.4	Weighted Annual Course Difference Filter - the use of band-pass filter results to remove seasonality	122
AS 4	Numerical Band-Pass Filtering	122
AS 4.1	Significance of band-pass filtered values	124
AS 5	Power-Spectrum-Analysis	124

References

128