

A statistical study of precipitation in Cyprus*

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ABSTRACT: In this paper, using mean monthly precipitation totals from 63 stations, the general statistics for time and space distribution of precipitation in Cyprus is first described. The mean annual precipitation varies from 280 mm (Peristerona, altitude 225 m) at the central Cyprus, to the more of 1000mm (Troodos, altitude 1725 m) with a large variability. For the study of intra-annual variation used Fourier analysis. The variation is well described by two harmonics, explaining about 97 % of the total variance. The first harmonic, over 87 % of the variance, shows a maximum in January in all the stations (especially, in most of them, at the first 15-17 days) and is caused by the Mediterranean depression activity. The second harmonic, about 10 % of the variance, exhibits maxima, in the majority of the stations, on July and January. This is mainly caused by thermal thunderstorms and upper air instability. Using Factor analysis the spatial distribution of precipitation is studied. The 12 months of a year are classified in two parts corresponding to two statistically significant factors explaining 92.6 % of the total variance. Finally, the combination of positive and negative scores of the two factors showed that Cyprus is characterised by four precipitation regimes, depending on the combination of depression activity, the effects of the sea and topography.

Key-words: Cyprus, harmonic analysis, factor analysis, polynomial regression.

ΠΕΡΙΛΗΨΗ: Σε αυτή την εργασία περιγράφονται κατ' αρχήν τα γενικά χρονικά και χωρικά στατιστικά χαρακτηριστικά της διανομής της βροχής στην Κύπρο με την χρήση των μέσων μηνιαίων τιμών βροχής 63 σταθμών. Το μέσο ετήσιο ύψος βροχής κυμαίνεται από 280 mm στην κεντρική Κύπρο (Περιστερόνα, υψόμετρο 225 m) μέχρι 1000 mm και περισσότερο (Τρόδος, υψόμετρο 1725 m), με μεγάλη μεταβλητότητα. Για την μελέτη της ενδοετήσιας μεταβολής χρησιμοποιήθηκε η ανάλυση Fourier.

Η μεταβολή περιγράφεται καλά από τις δύο πρώτες αρμονικές που ερμηνεύουν το 97 % της ολικής διακύμανσης. Η πρώτη αρμονική, ερμηνεύει πάνω από το 87 % και δείχνει ένα μέγιστο τον Ιανουάριο σε όλους τους σταθμούς, στους περισσότερους μάλιστα τις πρώτες 15-17 ημέρες, πράγμα που αποδίδεται στην δραστηριότητα των υφέσεων της Μεσογείου κατά την περίοδο αυτή. Η δεύτερη αρμονική εξηγεί περίπου το 10 % της ολικής μεταβολής με μέγιστο στην πλειονότητα των σταθμών τον Ιούλιο και Ιανουάριο. Αυτό αποδίδεται γενικά στην αστάθεια της ατμόσφαιρας κατά την θερμή περίοδο του έτους και σε θερμικές καταιγίδες.

Η χωρική διανομή της βροχής μελετήθηκε με την χρήση της παραγοντικής ανάλυσης (Factor) επί των 12 μηνιαίων τιμών του έτους. Η ανάλυση έδωσε δύο κύριους παράγοντες, στατιστικά σημαντικούς, που ερμηνεύουν το 92.6 % της ολικής μεταβολής. Τέλος ο συνδυασμός των θετικών και αρνητικών τιμών των δύο παραγόντων (pc scores) έδωσε για την Κύπρο 4 περιοχές βροχομετρικού καθεστώτος που έχουν σχέση με τον συνδυασμό από την μία πλευρά την δραστηριότητα των υφέσεων και από την άλλη την επίδραση της θάλασσας και της τοπογραφίας.

Λέξεις-κλειδιά: Κύπρος, αρμονική ανάλυση, παραγοντική ανάλυση, πολυωνμική συσχέτιση.

INTRODUCTION

Cyprus is the third in size island of the Mediterranean, after Sicily and Sardinia, and is lying at the SE edge of the Mediterranean sea between 32°16'30" – 34°35'50" E longitude and 34°33'00" – 35°41'10" N latitude. The magnitude of island is 9282 Km². A major part of the island is covert by two big mountains, Olympus (Troodos, 1945 m) and Pentadaktylos (Kyparissobouno, 1023 m), with direction from west to east and the one about parallel to the other (Fig. 1). Between the two mountains reaches the greatest plan of the Cyprus, the campus of Messoria. Cyprus belongs to the subtropic zone of the N temperate area of the world which reaches between parallel of 28° and 40° N latitude. So the climate is Mediterranean, with mild winters and relatively warm

summers. The cool period is characterized by relatively high precipitation and low temperatures thanks to depression activity in the hole area of the Mediterranean. According to NICOLAIDES *et al.* (2004), during the cold season, the cyclonic systems that reach the eastern Mediterranean from the surrounding geographical region and those that are formed over the area are largely associated with unsettled weather conditions over the island of Cyprus. In contrast the hot period is characterized by drought weather because, at this time, dominates trade winds and Etesians which did not offer to the precipitation, MARIOLOPOULOS & CARAPIPERIS (1955), CARAPIPERIS (1963). The small amount of precipitation at this period is caused from the nearly thermal storms, which happens usually in the internal areas of the country.

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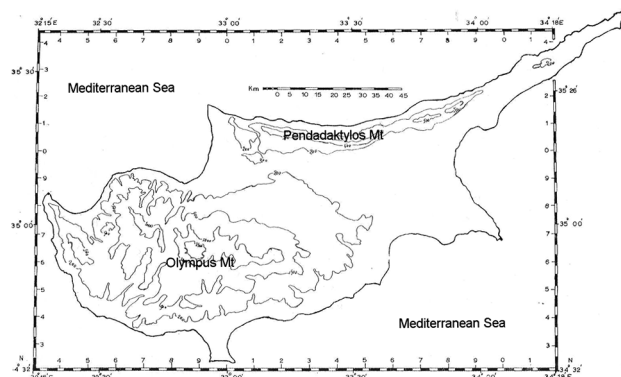


Fig. 1. Physico-geographical chart of Cyprus.

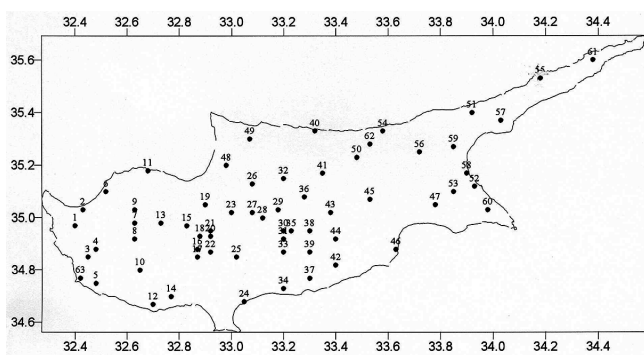


Fig. 2. Geographical distribution of the stations (according to the Table 1).

DATA AND STATISTICAL METHODS

In this work mean monthly precipitation values of 63 stations were used. All the stations belong to the Cyprus Meteorological Service. From these stations 46 have operation period from 1911 to 2000, covering the southern regions and the other 17 stations are obtained by ZERVOS (1976) and concern the period from 1911 to 1970, covering the northern regions (They remarks with asterisk in the Table 1). In the figure 2 are presented the network of the 63 stations, according to the table 1. At first the general statistics of precipitation are given along with their dependence on station altitude latitude, longitude and distance from the sea.

Then the intra-annual variation of precipitation is analysed using fourier analysis in order to find the dates of maxima and minima and the relative amplitude of the statistically significant harmonic terms. Finally the statistical distribution of precipitation modes is studied during the year, using Factor analysis. The 12 calendar months are classified in groups according to their characteristics spatial distribution of precipitation and then the study area is divided objectively into sub areas with a precipitation regime.

In the process, Factor Analysis, a widely known method applied to various climatic parameters and to precipitation. In this case the T-mode was applied. The data matrix consists of 12 columns (months) and 63 lines (stations). Thus is accomplished the classification of 12 months in groups with the rain distribution as a characteristic.

The method, at first, estimates the correlation coefficients between the precipitation 'space series' of each month and the ones of the other months and the symmetric correlation matrix (12 x 12) is formed. Then, using linear algebra, the eigenvalues and the eigenvectors of this correlation matrix are estimated, which are further used for the formation of 12 new uncorrelated 'space series' (factors), consisting of the so-called factor scores. Then, by using various statistical criteria (see eg. HANNES, 1974; OVERLAND & PREISENDORFER, 1982; JOLLIFFE, 1986; JOLLIFFE, 1990) the statistically significant factors are found and kept while those explaining a very small percentage of the total variance are considered non-significant and are neglected. The final stage of the method is the 'rotation of the axes', a process necessary in order to achieve a better discrimination among the factor loadings and thus an easier physical interpretation of the results (RITCHMAN, 1986; BARTZOKAS *et al.*, 1994). The most popular method of rotation is 'Varimax' (RUMMEL, 1970) which, moreover, keeps the factors uncorrelated.

GENERAL STATISTICS AND SPATIAL DISTRIBUTION OF PRECIPITATION

Although there is a difficulty in drawing the precipitation isopleths (isohyets) due to the complex topography can be recognized the following precipitation characteristics. The precipitation generally decreases from west to east. This is owed to the fact that the movement of cyclonic systems is usually from the west to the east. The precipitation increases from the lower to the higher altitudes in combination to the distance from the sea and the topography. So the precipitation increases round to the two big mountains (Olympus and Pendaktylos) from 280 mm at the low altimeter to 1000 mm and more on the tops of the mountain. The precipitation decreases from the top of the mountains to the campus of Messoria. This area is characterized as the driest of all the island, the precipitation is between 280 and 350 mm at the year (Fig. 3).

As noted above the most important parameters, which influence precipitation, are altitude, distance from the sea, latitude and longitude. Using polynomial correlations, in Cyprus, it found that there is strong correlation between precipitation and altitude, $r = 0.91$ (Fig. 4), orographic precipitation (KOTINIS - ZAMBAKAS *et al.*, 1992).

The correlation between precipitation, latitude and longitude is significant but no so strong ($r = 0.48$ and $r = -0.58$ respectively). This is owed to the fact that the Cyprus extents in only 1° latitude.

TABLE 1
The geographical characteristics of the 63 stations and the harmonic analysis results.

AA	Stations	Lat. (deg.)	Long. (deg.)	Alt. (m)	PREC (mm)	C1 (mm)	V1 (%)	T 1 (date)	C2 (mm)	V2 (%)	T2 (date)
1	Drousseia	34.97	32.40	630	613.4	66.5	89.2	12/1	20.8	8.7	3/7
2	Polis	35.03	32.43	15	452.9	49.0	91.0	11/1	14.0	7.4	2/7
3	A.Neofitos	34.85	32.45	420	570.9	63.5	85.5	9/1	24.0	12.2	6/7
4	Stroumbi	34.88	32.48	460	651.6	69.7	88.9	14/1	22.2	9.0	5/7
5	Anatolikon	34.75	32.48	60	436.6	48.4	88.4	11/1	16.4	10.1	2/7
6	Gialia	35.10	32.52	3	441.5	46.6	92.5	12/1	11.8	5.9	2/7
7	Agia F.S	34.98	32.63	600	796.1	81.8	90.0	19/1	23.9	7.7	11/7
8	Panagia Pan.	34.92	32.63	820	729.3	73.3	88.9	16/1	22.7	8.6	7/7
9	Stavros Ps.	35.03	32.63	780	864.6	88.1	91.3	19/1	24.8	7.2	11/7
10	Kelokedara	34.80	32.65	520	600.2	62.7	89.4	15/1	19.4	8.5	5/7
11	Pyrgos Kato	35.18	32.68	5	449.9	46.8	92.6	13/1	11.4	5.5	3/7
12	Pissouri	34.67	32.70	188	450.0	51.4	86.6	11/1	18.5	11.2	6/7
13	Kykos	34.98	32.73	1120	878.5	85.4	87.2	20/1	28.8	9.9	11/7
14	Avdimou	34.70	32.77	90	454.0	52.2	87.2	12/1	18.6	11.1	6/7
15	Pedoulas	34.97	32.83	1080	925.8	90.3	87.6	21/1	31.0	10.3	12/7
16	Platres	34.88	32.87	1115	863.0	80.7	87.5	20/1	27.0	9.8	11/7
17	Kilani	34.85	32.87	820	763.2	75.8	88.7	19/1	24.7	9.4	10/7
18	Troodos	34.93	32.88	1725	1085.1	105.8	86.7	20/1	37.6	10.9	12/7
19	Evrychou	35.05	32.90	440	428.6	42.8	91.3	20/1	11.7	6.8	9/7
20	Amiandos	34.93	32.92	1380	1018.4	99.8	86.2	19/1	35.8	11.1	10/7
21	Platania	34.95	32.92	1120	912.6	89.5	86.7	18/1	31.9	11.0	10/7
22	Saittas	34.87	32.92	640	750.6	68.4	87.7	18/1	22.3	9.3	6/7
23	Kapouras	35.02	33.00	580	519.3	49.1	91.2	17/1	13.4	6.8	4/7
24	Lemessos	34.68	33.05	8	449.5	50.5	87.2	6/2	18.1	11.2	4/7
25	Kalochorion	34.85	33.02	740	646.9	61.6	87.0	16/1	21.0	10.1	4/7
26	Peristerona	35.13	33.08	225	284.8	27.8	92.3	17/1	7.1	5.9	2/7
27	Panagia B.	35.02	33.08	440	471.7	44.2	89.5	18/1	13.0	7.7	4/7
28	A.Epifanios	35.00	33.12	620	494.6	47.0	88.1	18/1	15.0	9.0	4/7
29	Klirou	35.03	33.18	420	428.2	39.9	88.3	18/1	12.5	8.7	1/7
30	Machairas	34.95	33.20	880	676.0	63.5	85.7	18/1	22.3	10.6	3/7
31	Kionia	34.92	33.20	1200	751.4	69.0	86.4	19/1	23.1	9.7	3/7
32	Kokinotrim	35.15	33.20	220	293.8	28.0	91.5	16/1	7.5	6.6	1/7
33	Ora	34.87	33.20	520	564.4	50.5	88.1	15/1	15.1	7.8	30/6
34	Moni	34.73	33.20	40	427.0	48.8	85.7	12/1	17.8	11.4	4/7
35	Mandra Kato	34.95	33.23	640	591.9	55.9	85.5	17/1	19.6	10.6	1/7
36	Deftera Kato	35.08	33.28	270	346.8	30.1	88.2	17/1	8.4	6.9	29/6
37	Kalavassos	34.77	33.30	90	441.8	48.8	85.1	11/1	17.6	11.0	2/7
38	Lithrodontas	34.95	33.30	420	500.3	46.9	86.1	15/1	16.2	10.3	29/6
39	Lefkara	34.87	33.30	600	583.3	55.5	87.6	14/1	18.1	9.3	29/6
40	Kirinia *	35.33	33.32	18	521.1	56.7	89.2	11/1	18.2	9.2	2/7
41	Lefkossia	35.17	33.35	160	343.7	29.0	88.5	17/1	8.6	7.8	27/6
42	Kofinou	34.82	33.40	155	436.9	47.4	85.4	12/1	17.2	11.2	3/7
43	Perachorio	35.02	33.38	255	363.8	31.8	85.9	17/1	10.9	10.0	27/6
44	Kornos	34.92	33.40	370	483.0	45.9	88.0	14/1	14.8	9.1	29/6
45	Athienou	35.07	33.53	170	328.8	29.5	86.2	16/1	9.9	9.6	26/6
46	Larnaka	34.88	33.63	2	384.6	41.2	84.7	10/1	14.9	11.0	30/6
47	Achna	35.05	33.78	50	340.3	36.3	85.3	10/1	12.6	10.3	27/6
48	Morfou *	35.20	32.98	46	306.1	33.2	89.1	14/1	10.4	8.7	7/7
49	Mirtou *	35.30	33.07	270	501.4	57.7	83.9	13/1	23.0	13.3	8/7
50	Kythrea *	35.23	33.48	140	370.5	36.5	84.5	16/1	12.9	10.5	2/7
51	Koronia *	35.40	33.92	473	588.6	60.7	86.5	12/1	20.6	10.0	27/6
52	Amochosto*	35.12	33.93	23	419.9	44.5	82.8	6/1	17.1	12.3	24/6
53	Aheritou *	35.10	33.85	18	362.7	35.9	83.7	8/1	13.0	10.9	20/6
54	A.Ambrosio*	35.33	33.58	137	511.3	53.6	89.4	10/1	16.3	8.2	29/6
55	Egialoussa *	35.53	34.18	107	502.4	54.6	86.6	7/1	19.4	11.0	27/6
56	Lefkoniko *	35.25	33.72	67	342.3	29.6	76.3	15/1	11.9	12.4	21/6
57	A.Theodoro*	35.37	34.03	31	415.0	42.5	84.1	8/1	15.6	11.3	22/6
58	Salamis *	35.17	33.90	9	382.5	39.4	81.7	6/1	15.8	13.1	22/6
59	Sygrassis *	35.27	33.85	58	397.2	37.7	82.9	8/1	13.6	10.8	29/6
60	Paralimni *	35.03	33.98	76	391.6	45.2	80.6	8/1	17.8	12.4	1/6
61	Rizokarpasso *	35.60	34.38	143	594.3	65.5	84.5	6/1	25.5	12.8	27/6
62	Chaleyka *	35.28	33.53	641	547.4	54.6	87.3	14/1	18.1	9.5	29/6
63	Pafos *	34.77	32.42	67	480.6	53.9	87.5	11/1	18.9	10.7	3/7

Cj, Vj, Tj are: the amplitude, the percentage of variance explained and the date of maximum.
PREC is the mean annual precipitation.

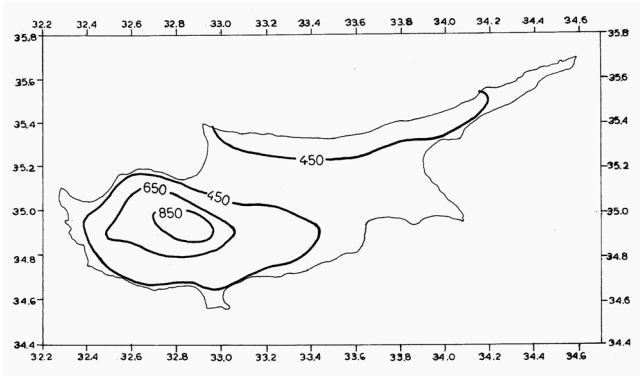


Fig. 3. Isopleths of annual precipitation totals (mm).

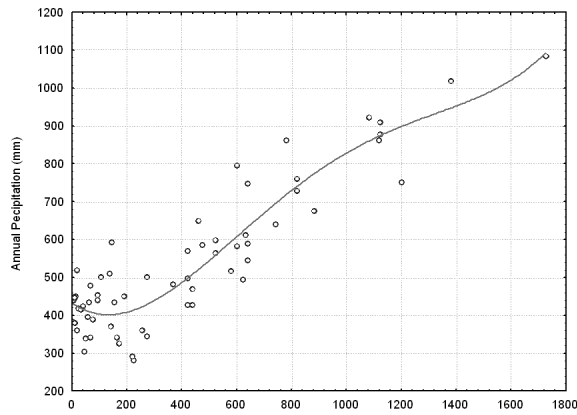


Fig. 4. Correlation of annual precipitation with altitude (polynomial order 4).

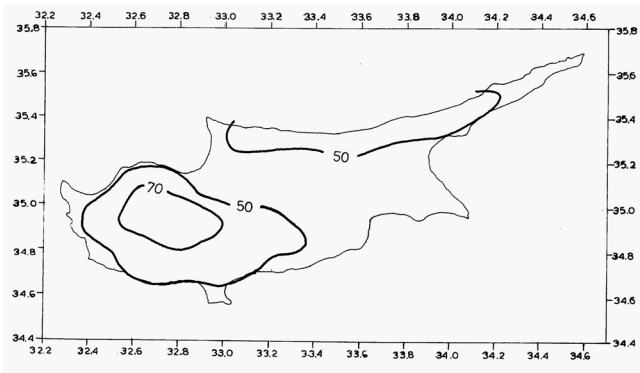


Fig. 5. Isopleths of the amplitude of the first harmonic C_1 (mm).

HARMONIC ANALYSIS OF INTRA-ANNUAL VARIATION OF PRECIPITATION

For the harmonic analysis of the intra-annual variance of precipitation, using mean monthly values, the following formula is applied:

$$P(t) = \bar{P}(t) + \sum_{n=1}^2 C_n \sin\left(\frac{2n\pi t}{12} + \phi_n\right)$$

where C_n is the amplitude and ϕ_n the phase angle of the n th harmonic term. Instead of the phase angle ϕ_n we use the time of the maximum:

$$t_{\max} = \left(\frac{\pi}{2} - \phi_n\right) \cdot \frac{12}{2n\pi}$$

The results of the analysis are presented in Table 1. It can be seen that two harmonics describe well the intra-annual precipitation variation since they cover about 97 % of the total variance. The first harmonic, the stronger of the two, explains about 87 % of the total variation, while the second explains about 10 %, smaller but equally important percentage. The spatial distribution of the amplitude of the first harmonic C_1 (Fig. 5) bears a great resemblance to the layout of the isopleths of the total precipitation height. The lowest values (30-50 mm) can be found in areas of the Messoria plain (central Cyprus) where the annual mean precipitation values are also low. The highest values, 100 mm and more, can be found in the Olympus (Troodos, 1724 m) mountainous area, that is in western Cyprus, where the highest annual mean precipitation values have been recorded (1085 mm).

The second harmonic presents a similar layout to both the first harmonic, only with lower values, and to the isopleths of the total precipitation height.

Observing Table 1 we can see that the first harmonic presents a maximum in all the stations during the January, especially at the first 20 days. This is owed to the maximum depression activity in this period. December and January are also the rainiest months during which occurs the exaltation of depressions in the Greek region and there is not significant difference in precipitation between them, MARIOLOPOULOS (1960), METEOROLOGICAL OFFICE OF CYPRUS (1961). These findings are in agreement with the results of BLOUTSOS (1993) for the Greece entire country. The minimum appears during summer, 6 months later (Jun or July) when depression activity is considerably reduced as cyclone tracks are displaced to higher latitudes (ALPERT *et al.*, 1990).

The second harmonic presents a maximum, in the 35 % of the stations, in June (15-30) and the other 65 % of the stations in July (1-15). It is the season of the end of depressions. The main reasons for these maximum are the topography and the afternoon thunderstorms (local instability). A minimum occurs in the dry season when depressions do not affect the area because their centers are moving from the west to the east have been displaced to the north. Although thunderstorms take place in the summer, they are of a local character and give small amounts of rain, so eventually they cannot overthrow the regime of the dry summer.

The correlation of C_1 , C_2 with the geographical factors latitude, longitude and altitude gave the following results: There is no statistically significant correlation between C_1 , C_2 and the latitude. This may be attributed to the small extent

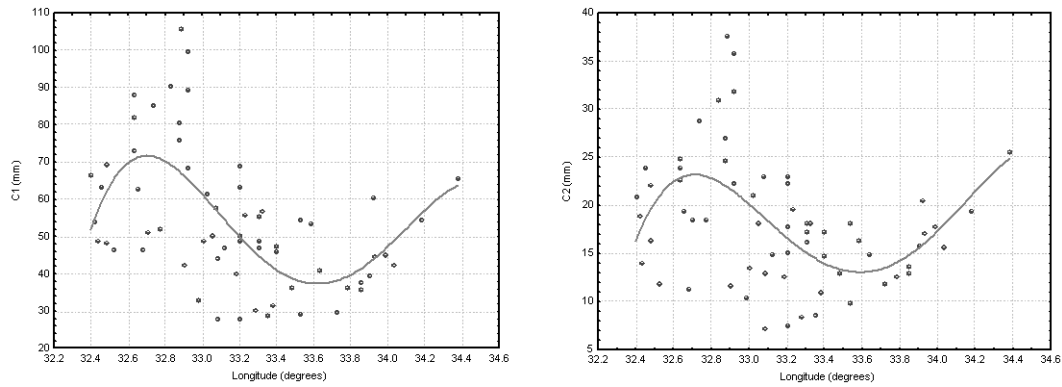


Fig. 6. Correlations of the amplitude of the harmonics C_1 , C_2 with longitude respectively (polynomial order 4).

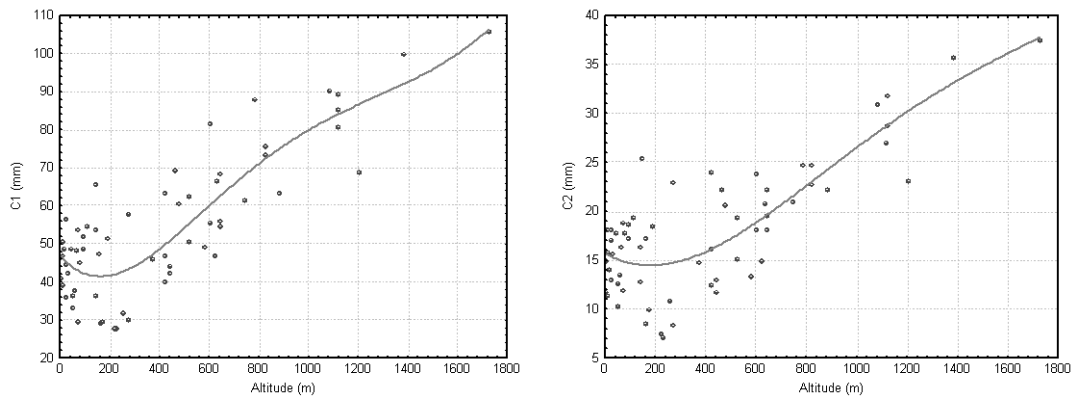


Fig. 7. Correlations of the amplitude of the harmonics C_1 , C_2 with altitude respectively (polynomial order 4).

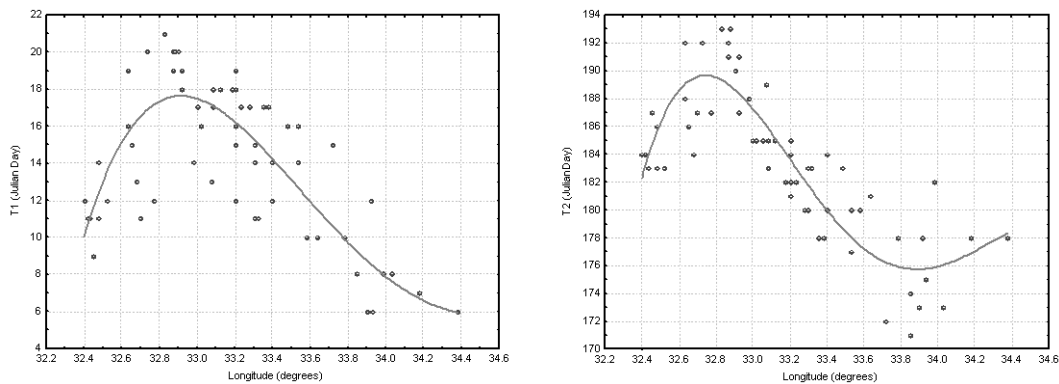


Fig. 8. Correlations between time of maximum T_1 , T_2 with longitude respectively (polynomial order 4).

of Cyprus as far as the latitude is concerned (about 1°).

The correlation (polynomial order 4) between C_1 , C_2 and longitude gave, not very strong, but statistically significant coefficients $r = -0.62$ and $r = -0.52$ respectively (Fig. 6). Since the circulation takes place from the west to the east in combination with the bas-relief, the precipitation follows a decrease from the west to the east.

A statistically significant and important correlation

(polynomial order 5) by both C_1 and C_2 to the altitude was given $r = 0.84$ and $r = 0.80$ respectively (Fig. 7). As the altitude increases, the precipitation height increases as well, strong orographic influence (KOTINIS-ZAMBAKAS *et al.*, 1992).

The correlation of T_1 , T_2 with the geographical factors latitude, longitude and altitude gave the following results:

There is no statistically significant correlation between

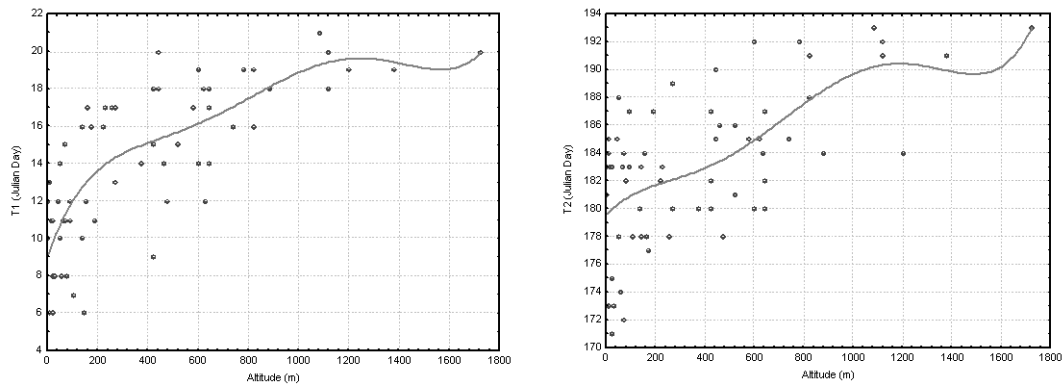


Fig. 9. Correlations between time of maximum T_1, T_2 with altitude respectively (polynomial order 5).

T_1 , T_2 and the geographical latitude. This may be attributed to the small extent of Cyprus as far as the latitude is concerned (about 1°).

The correlation (polynomial order 4) between T_1 , T_2 and longitude gave a statistically significant and important correlation coefficients $r = -0.73$ and $r = -0.88$ respectively (Fig. 8).

A statistically significant correlation (polynomial order 5), but not so strong, is noted between T_1 , T_2 and altitude $r = 0.53$ and $r = 0.64$ respectively (Fig. 9).

SPATIAL DISTRIBUTION OF PRECIPITATION

According to the Factor Analysis using the same relevant criteria of Gutman and Monte Carlo, it was found that the spatial precipitation distribution in the area of Cyprus is satisfactorily described by two factors (FOTIADI *et al.*, 1999). The results of the analysis (eigenvalues, loadings and variances) are shown in Table 2.

TABLE 2
The results of the Factor analysis.

Eigenvalues	Months	Loadings	
		Factor 1	Factor 2
9.89	January	0.89	0.43
1.22	February	0.85	0.49
0.35	March	0.81	0.54
0.19	April	0.74	0.65
0.10	May	0.37	0.88
0.08	June	0.37	0.89
0.06	July	0.41	0.86
0.05	August	0.38	0.87
0.02	September	0.39	0.81
0.02	October	0.83	0.46
0.01	November	0.95	0.24
0.01	December	0.90	0.40

Loadings < 0.27 are not significant statistically at the 0.05 level

The loadings are in fact the correlation coefficients between the 'space series' of the two factors. The first factor (82.5 % of the total variance) includes the months of the wet season October - April and the second factor (10.2 % of the total variance) includes the months of the dry season May-September.

In Figures 10, 11 are shown the spatial precipitation distribution of the first and second period respectively. The positive values of the PC-scores show regions with amounts of precipitation above the average and the negative values show regions with amounts of precipitation below the average.

During the cold-wet season (October - April, Fig. 10) the larger amounts of precipitation are received the west and the north east of the areas of the island. The precipitation increases round of the two big mountains as altitude increases and the smaller amounts are received in the central areas of the Cyprus between the two mountains (at the campus of Messoria) just like the spatial distribution of the total annual amounts.

During the hot-dry season (May-September, Fig. 11) the amounts of precipitation are located in smaller regions of the mountainous formations mainly on the tops and in the central of island in the areas far from to the sea.

The combination of information from figures 10, 11 (Fig. 12) presents us with four groups of stations with the following characteristics.

1. The first group consists of stations with positive factor scores during both seasons. This means that these stations receive both during the wet and the dry season the larger amounts of precipitation, over than mean. Their characteristic is that they are situated round of the mountainous area of Olympus, at the higher altitudes.
2. The second group consists of stations with positive scores of the first factor and negative scores of the second. This means that they receive large precipitation heights in the winter and smaller in the summer. They are situated in western and north Cyprus, and are found in lower altitudes.

3. The third group consists of stations with negative scores of both the first and the second factor. It composes the north and south plain (near to the sea) of Messoria between the two mountain formations, receives relatively low amounts of precipitation in both the wet and the dry season.
4. The fourth group consists of stations with negative scores of the first factor and positive scores of the second. These stations are located in the central Cyprus and in the central of the Messoria plain between the two big mountainous formations. This area characterized by the lower precipitation in all the year, the big distance from the sea and the lowest altitudes. So the negative scores means that this area takes the lower precipitation of the island during the cold-wet period and the positive scores means that this area takes more precipitation in comparison to the other areas of the island, during the hot period. The rain during the hot season is owed to thermal thunderstorms.

CONCLUSIONS

The above analysis shows that the intra-annual variation and the spatial distribution of precipitation in the Cyprus depends primarily on the general circulation, particularly during the winter, and secondarily on the complex topography of the region (interchange of mountainous formations and plain). The effect of the sea is relevantly big. The Fourier analysis gave us two harmonics. The first harmonic is strong and shows a maximum in January, while the second is weak and gives a maximum in Jun-July. The maximum of the first harmonic is linked to the intense depressional activity in combination with the bas-relief of the mountainous formations. The maximum of the second harmonic is owned to the atmospheric instability due to the topographical factor and the local breezes. The minimum in the whole area occurs during the dry and warm season, which is a main characteristic of the Mediterranean climate type.

The application of the Factor analysis on the monthly mean precipitation values showed that the twelve months are classified into two groups that compose the wet and the dry season with a distinct spatial rain distribution. Finally, the combination of the factor scores of the two factors showed that Cyprus can be divided into 4 subregions that are characterized by particular precipitation regimes.

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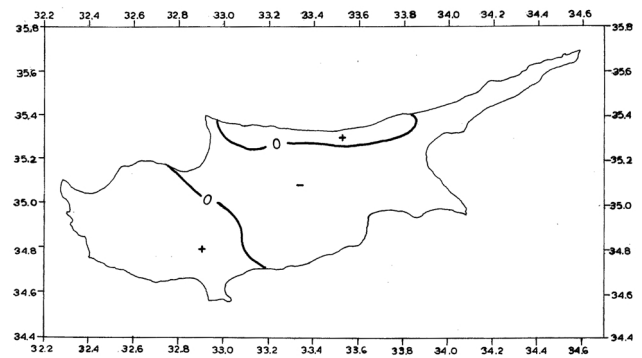


Fig. 10. Spatial distribution of precipitation during the “cold period” October-April (factor 1 pc scores).

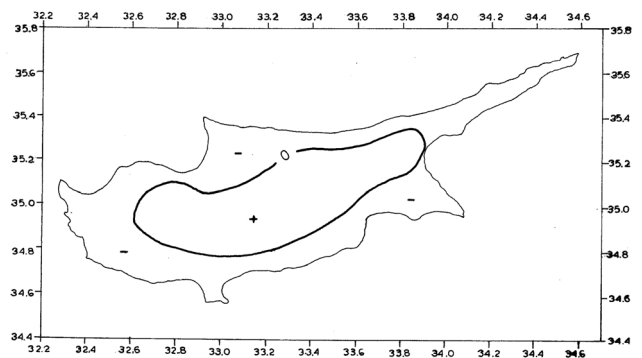


Fig. 11. Spatial distribution of precipitation during the “hot period” May-September (factor 2 pc scores).

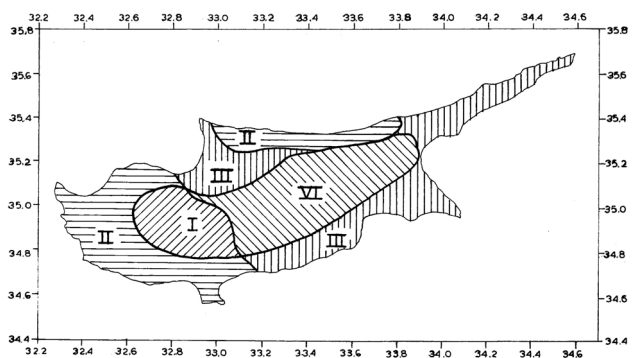


Fig. 12. The 4 subregions with particular precipitation characteristics.

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