

12. SPATIAL AND TEMPORAL VARIABILITY OF RAINFALL ON ALDABRA ATOLL

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Introduction

In spite of the existence of substantial amounts of information on atoll climates in both the Indian and Pacific Oceans, remarkably little attention has been paid to the possible existence of climatic variations within individual atolls. There is a presumption that because of pervasive marine influences, small area, and negligible elevation above the sea, atoll land areas have a sufficiently homogeneous climatic regime (neglecting the effect of different vegetation types on microclimate) that a single recording station will give an adequate characterisation of atoll-wide conditions. Three observations at least raise doubts about this proposition. One is the generally recognised distinctiveness of windward and leeward situations on atolls in the Trade Wind belts. A second is the sharply limited incidence of individual rainfall events, often generated by single cumulus clouds of smaller-than-atoll size, especially in equatorial regions. A third, known for centuries, is the coincidence of cumulus development with atoll locations.

Rainfall variability on atolls

A study of intra-atoll rainfall variability was made at Enewetak Atoll, Marshall Islands, in 1957-58. The raw data were published by Blumenstock and Rex (1960) but no analysis appeared. The daily observations show wide variability between stations (e.g. 5.28 mm on 13 November 1957 at Enewetak Island compared with 0.06 mm on Engebi Island 38 km away), with some individual monthly totals varying between stations by a factor of up to 2. Nevertheless, over a 5 month period (December 1957-April 1958) the total rainfall at three stations (Enewetak Island, Parry Island, Engebi Island) varied by less than 5 per cent, and over an 11 month period (September 1957-August 1958) total

rainfall at two of the stations (Enewetak Island and Parry Island, 9 km apart) varied by only 6 per cent.

Longer-term records are available for two stations 5.5 km apart on the western rim of Canton Atoll, Phoenix Islands, for which monthly and annual rainfall data are available for the 16 years 1948-1962 and 1966. Individual monthly totals frequently differ between the two stations by more than 40 per cent (maximum 71 per cent). Few annual totals differ by more than 20 per cent, however, and the annual means for the 16 years of record differ by only 5.5 per cent. Overall there is a correlation greater than 0.9 between all pairs of both monthly and annual records.

Rainfall on Aldabra Atoll

Aldabra Atoll (46°20'E, 9°24'S) is located in the dry southwestern sector of the tropical Indian Ocean (Stoddart 1971). It is a slightly elevated atoll, with a land area of 155 sq km, enclosing a lagoon of similar area, with a limestone rim that reaches a maximum altitude of 8 m and with coastal dunes reaching 15 m above sea level. In consequence of a high tidal range, large areas of the lagoon floor are emersed during low spring tides. The atoll is affected by strong and persistent Southeast Trade winds between April and November, and by weaker and less constant Northwest Monsoon winds for the rest of the year. For all these reasons it might be expected that if climatic differences were to be found on land areas of atolls, they would be exhibited on Aldabra.

A Meteorological Station was established at the Settlement on Ile Picard, on the western side of the atoll, in September 1967. It was subsequently relocated at the Royal Society Aldabra Research Station, 1 km to the south, in 1970. Initially a single daily synoptic observation was made at 0900 hours (GMT +3), but in January 1975 the Station was upgraded to World Weather Watch standards, jointly staffed by the U.K. Meteorological Office, Bracknell, England, and the Royal Society. Three-hourly synoptic observations and daily rainfall records are available from this date. Before 1967 rainfall had been measured at the Settlement by the atoll manager between June 1949 and June 1953 (only one complete year of record: 1192 mm in 1950), and again in 1958 and 1959 (very low figures of 381 and 349 mm). These earlier monthly data are listed by Stoddart and Mole (1977), but because of their dubious reliability they are not considered further here.

Table 1 lists the monthly and annual rainfalls at the Meteorological Station for the 15 years 1968-1982. The mean annual total is 1089 mm, with a minimum of 547 and a maximum of 1467 mm. The scatter diagram of monthly rainfalls in Figure 13 shows the great variability of rainfall at a single site from year to year, and the annual histograms in Figure 14 show the variability in seasonal incidence from year to year. Though the Aldabra record is too short for analysis, it seems likely that the annual totals show substantial cyclical fluctuations from decade to decade, as identified for the granitic Seychelles

(Stoddart and Walsh 1979). There high rainfalls occurred before 1905, between 1923 and 1937, and since 1959, with markedly lower rainfalls during 1905-1922 and 1938-58. The changes are of the order of 500 mm, or 20 per cent, between each period, and all are statistically significant at the 99 per cent confidence level.

Local rainfall variability on Aldabra

Since active research began on Aldabra there has been speculation about the possibility of systematic climatic differences existing between different parts of the atoll. Farrow (1971, 85) discussed these, and provided daily rainfall data for the period 24 September-17 October 1968 at the Meteorological Station and at Passe Houareau (Middle Camp). These indicated day-to-day variability comparable to that already described at Enewetak, though totals were similar over the period of record. Subsequently J. Frazier maintained rainfall records for a total of 221 days between June 1969 and June 1970 at Dune Jean-Louis on the south coast. The total rainfall at the Meteorological Station over this period was 70.5 per cent of that recorded at Dune Jean-Louis, and the number of rain-days 69.5 per cent. Correlation of daily rainfall totals between the two stations was only 0.35, though the mean rainfall per rain-day was very similar. Rain at that period thus fell on more days on the windward than on the leeward coasts (Stoddart and Mole 1977, Table 15).

A systematic effort to study local rainfall variability on Aldabra began in 1973. Between April 1973 and November 1977 thirteen recording stations were established at sites around the atoll (Table 2, Figure 15). They consisted of a plastic 1-gallon container, firmly anchored in soil or rock, with a plastic receiving cylinder. At Middle Camp, however, a standard metal Bradford gauge was installed from the beginning, and similar gauges supplied by the U.K. Meteorological Office replaced the plastic containers at all other sites during 1976-77. To minimise evaporation a small quantity of oil was placed in the gauge to form a film on the water surface; the initial use of coconut oil for this purpose was discontinued because of its attraction to coconut crabs *Birgus latro*. The plastic gauges had to be frequently replaced in the early days on account of being chewed by coconut crabs or deteriorating in sunlight. Ants and rats proved troublesome at some sites. On one occasion the date of a reading was lost when the data card was chewed by a goat.

The gauges were emptied and contents recorded whenever field workers visited the sites. Heavily-used camp sites such as Middle Camp and Cinq Cases thus generated large numbers of closely-spaced records (252 and 161 respectively, with mean time intervals of 12.7 and 19.5 days), but other more remote sites were visited less frequently. On some occasions the capacity of the gauge was less than the amount of rainfall between readings and the gauge overflowed; to some extent, therefore, the data will under-estimate actual rainfall. The frequency of recording declined during 1980-81, and records ceased to be maintained during December 1981-January 1982.

In addition to the main sites a further gauge was installed for a short period adjacent to the main Meteorological Station, to provide a check on the reliability of the method. This site is identified as Station.

The data available thus comprise a series of readings at irregular, variable and non-synchronous times. They were compiled onto standard record cards on site, periodically transcribed at the Aldabra Research Station, and one set of cards returned to London with a duplicate set maintained on the atoll; two cards were lost in this process. A preliminary analysis of records for eight of the sites for periods up to February 1975 has been given by Hnatiuk (1979, 32).

For each station the data of both date of observation and rainfall were then tabulated in cumulative form from an arbitrary origin on 1 January 1973. For stations with gaps in the record new cumulations were started when the record was resumed. Daily cumulative values for each station for the period of record were then generated using a program (INTERPOL), by linear interpolation between each successive pair of records. The interpolated cumulative totals corresponding to the last day of each month for the period of record were used to derive rainfall totals for all months. These were summed to give annual figures. While these calculated monthly totals cannot obviously be equal to actual monthly rainfalls because of the infrequency of the original observations, they do nevertheless provide a basis for comparison both between stations at any time and between months at any station.

Results

Calculated annual totals for all local stations, together with actual annual records at the Meteorological Station, are given in Table 3 and Figure 16. These show substantial differences between successive years at each locality, and also between different sites in the same year. That the temporal variability is real is indicated by the fact that over the period of this study the annual totals at the Meteorological Station itself varied from 826 to 1467 mm. The differences in annual means between sites is of the same order (minimum of 1098 mm at Middle Camp and maximum of 1567 mm at Anse Var). The level of annual variability is detailed in Table 4 (percentage difference between annual totals at each station and the mean at that station), Table 5 (percentage difference between annual totals at each station and the total for that year at the Meteorological Station), and Table 6 (percentage difference between annual totals at each station and the 15-year mean [1089 mm] at the Meteorological Station). Inspection of these tables shows that the level and distribution of percentage variability in time is very similar to that for variability in space. Tables 7-20 give the interpolated monthly figures and annual totals for each of the sites, together with means based on data for completed calendar years of record. Figure 17 gives histograms of mean monthly rainfall at each station.

These data clearly demonstrate the variability of rainfall in both space and time, as revealed by a monthly sampling interval, thus confirming the earlier inferences from the Enewetak and Canton data. The spatial dimension of rainfall events is thus smaller than the atoll dimension, and the occurrence of rainfall across the atoll is in general non-synchronised. These generalisations will not, however, necessarily hold when the atoll is affected by large-scale regional disturbances such as cyclones.

It is of particular interest to ascertain whether over longer time-scales the average conditions vary systematically with location. Inspection of the data suggest that they do. If we group together the stations on the northwest side of the atoll (Anse Mais, Bassin Lebine, Anse Var, Polymnie and Gionnet, with 31 individual annual totals altogether) the mean of all annual totals is 1340 mm. That for the south coast stations (Cinq Cases, Anse Takamaka, Dune Jean-Louis, Dune d'Messe, with 24 annual totals) is 1203 mm. That for the northeastern area (Anse Malabar, Middle Camp: 13 annual totals) is 1137 mm. The mean of all annual totals for all stations (92) is 1228 mm.

Conclusion

Whether these regional differences would be sustained by longer-term records is an open question, but as they stand at present they point to interesting geomorphological and ecological consequences. In his study of a long series of hourly observations, June 1949 to February 1959, at Enewetak Atoll, Lavoie (1963, iv) concluded that 'the atoll influence upon cloud or precipitation over the atoll itself is hardly detectable and probably insignificant'. However he did not have available rainfall data (other than occurrence or non-occurrence) for quantitative analysis. If Lavoie's conclusion can be taken to imply spatial heterogeneity of rainfall over the ocean irrespective of the presence of an atoll, then it is compatible with the Aldabra data. If, however, it is interpreted to mean that the atoll itself has a homogeneous rainfall environment at least up to time-scales of a decade and spatial scales of 30-40 km, then as a generalization it needs re-examination. It would be of great interest to examine rainfall characteristics on other atolls with large compact land masses (e.g. Christmas Island, Pacific Ocean) as well as those with small and scattered islets. Without the benefit of an active research programme, however, as on Aldabra, such a study could only feasibly be carried out using automatic recording equipment.

Acknowledgements

This paper would have been impossible without the rainfall recording carried out between 1973 and 1982 at remote sites under often difficult conditions by many members of staff of the Aldabra Research Station and by many visiting scientists. The recording programme was organised by successive Directors, Administrative Officers, Wardens, Staff Scientists and Meteorological Officers at the Station. Great

assistance in tabulation and analysis of the data was given by H. M. Green and D. J. Reed, of the Department of Geography, Cambridge, and the latter wrote and executed programs for deriving monthly figures. The raw data on which the analysis is based is held by the Aldabra Data Unit at the Department of Geography, Cambridge.

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Table 1. Monthly and annual rainfall at Aldabra 1968-1982

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u>
1968	11.9	28.0	133.0	72.4	21.0	38.0	69.5	14.8	9.7	7.3	56.5	85.0	547.1
1969	153.4	147.2	151.5	393.5	176.3	36.8	38.7	14.3	18.5	11.8	54.9	56.8	1253.7
1970	47.5	85.2	139.6	210.5	31.7	29.5	33.7	25.7	7.3	20.9	12.7	56.0	700.3
1971	244.5	57.4	285.9	192.5	34.7	65.9	14.3	19.1	8.6	6.0	89.6	201.8	1220.3
1972	224.5	15.0	112.2	162.2	28.2	100.3	54.6	75.1	4.2	12.7	25.6	240.2	1054.8
1973	261.0	286.8	262.8	56.7	57.1	47.7	81.3	25.2	21.8	33.7	9.2	77.6	1220.9
1974	290.6	114.5	380.8	346.4	50.4	29.4	52.2	31.8	1.9	1.1	19.4	148.9	1467.4
1975	131.4	162.8	111.1	166.7	76.7	41.4	16.1	14.9	14.5	2.9	91.7	136.2	965.8
1976	358.4	177.4	260.9	87.2	66.6	64.4	65.5	35.1	4.7	0	16.7	104.4	1241.3
1977	262.4	116.3	255.7	240.8	132.3	89.5	82.2	26.9	5.0	37.0	63.5	120.8	1432.4
1978	254.0	139.2	339.0	18.0	54.8	48.1	135.4	23.2	8.7	16.9	191.6	234.4	1463.3
1979	233.6	108.6	105.2	67.8	116.8	51.4	61.4	32.6	19.4	0.1	52.3	278.5	1127.7
1980	82.1	151.9	120.8	184.9	19.1	66.1	16.6	40.0	10.0	1.6	9.5	123.1	825.7
1981	143.5	52.9	238.1	17.8	94.5	26.2	22.1	24.3	12.1	8.6	10.8	339.6	990.5
1982	83.0	43.0	125.0	130.0	73.0	103.0	12.9	17.2	40.9	47.5	110.4	34.6	820.5
Mean	185.5	112.4	201.4	156.5	68.9	55.8	50.4	28.0	12.5	13.9	54.3	149.2	1088.8

Table 2. Local rainfall stations at Aldabra Atoll

<u>Locality</u>	<u>Grid reference</u>	<u>Gauge installed</u> ¹	<u>Final record</u>
Station	050 090	13 February 1975 (10 March 1977)	3 December 1981
Bassin Lebine	067 100	9 November 1976 (15 April 1977)	26 December 1981
Anse Var	070 100	18 August 1976 (11 May 1977)	28 December 1981
Polymnie	106 126	9 November 1973 (1 June 1977)	29 December 1981
Gionnet	139 125	15 April 1974 (9 February 1977)	29 December 1981
Anse Malabar	253 128	21 April 1974 (23 September 1977)	14 January 1982
Middle Camp	314 119	5 April 1973 (5 April 1973)	13 January 1982
Airstrip Trace	374 083	16 November 1977 (16 November 1977)	12 January 1982
Cinq Cases	398 058	1 June 1973 (3 August 1977)	11 January 1982
Anse Takamaka	346 035	28 February 1974	17 December 1977
Dune Jean-Louis	260 035	30 June 1973 (23 March 1977)	27 January 1982
Dune d'Messe	189 013	29 April 1973 (16 September 1977)	27 January 1982
Anse Mais	069 043	3 July 1973 (17 September 1976)	11 December 1981
Ile Esprit	105 061	27 June 1976 (31 August 1977)	29 December 1981

¹Date in parentheses is that of the installation of a standard Bradford gauge.

Table 3. Annual rainfall at different localities at Aldabra Atoll 1974-1982

Locality	1974	1975	1976	1977	1978	1979	1980	1981	No. of years	Mean
Meteorological Station	1467	966	1241	1432	1463	1128	826	991	8 ¹	1189
Station	-	-	-	-	-	1125	777	-	2	951
Bassin Lebine	-	-	-	1877	1682	1367	1047	978	5	1390
Anse Var	-	-	-	1538	2070	1411	1250	-	4	1567
Polymnie	1908	1443	1635	906	1439	1355	1000	919	8	1326
Gionnet	-	1338	2208	1656	1371	1418	1036	1107	8	1448
Anse Malabar	-	-	1217	-	1552	1129	1179	917	5	1199
Middle Camp	1235	1150	1201	921	1541	989	1070	679	8	1098
Airstrip Trace	-	-	-	-	1593	1092	1180	913	4	1195
Cinq Cases	1332	1690	1217	1355	1308	1085	1065	792	8	1231
Anse Takamaka	-	1442	1241	-	-	-	-	-	2	1342
Dune Jean-Louis	990	1029	-	1469	1443	997	1084	863	7	1125
Dune d'Messe	-	852	1129	2391	1398	947	900	855	7	1210
Anse Mais	-	1106	1416	2073	1401	1064	1033	-	6	1349
Ile Esprit	-	-	-	1196	1564	1029	955	960	6	1141
Number of stations ²	4	8	8	10	12	12	11	10		
Mean ²	1366	1256	1408	1538	1530	1145	1070	898		1284

¹ Total length of record 15 years and overall mean 1089 mm.

² Excluding Meteorological Station.

Table 4. Percentage difference between annual rainfall at each station and the mean annual rainfall at that station

<u>Locality</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Station	-	-	-	-	-	+18.3	-18.3	-
Anse Var	-	-	-	-1.9	+32.1	-10.0	-20.2	-
Polymnie	+43.9	+8.8	+23.3	-31.7	+8.5	+2.2	-24.6	-30.7
Gionnet	-	-7.6	+52.5	+14.4	-5.3	-2.1	-28.4	-23.5
Anse Malabar	-	-	+1.5	-	+29.4	+5.8	-1.7	-23.5
Middle Camp	+12.5	+4.7	+9.4	-16.1	+40.3	-9.9	-2.6	-38.2
Airstrip Trace	-	-	-	-	+33.3	-8.6	-1.3	-23.6
Cinq Cases	+8.2	+37.3	-1.1	+10.1	+6.3	-11.9	-13.5	-35.7
Anse Takamaka	-	+7.5	-7.5	-	-	-	-	-
Dune Jean-Louis	-12.0	-8.5	-	+30.6	+28.3	-11.4	-3.6	-23.3
Dune d'Messe	-	-29.6	-6.7	+97.6	+15.5	-21.7	-25.6	-29.3
Anse Mais	-	-18.0	+5.0	+53.7	+3.9	-21.1	-23.4	-23.4
Ile Esprit	-	-	-	+4.8	+37.1	-9.8	-16.3	-15.9

Table 5. Percentage difference between individual local and Meteorological Station rainfalls
for each year

Locality	1974	1975	1976	1977	1978	1979	1980	1981
Station	-	-	-	-	-	-0.3	-5.9	-
Anse Var	-	-	-	+7.4	+41.5	+25.1	+51.3	-
Polymnie	+30.1	+49.4	+31.7	-36.7	-1.6	+20.1	+21.1	-7.3
Gionnet	-	+38.5	+77.9	+15.6	-6.3	+25.7	+25.4	+11.7
Anse Malabar	-	-	-1.9	-	+6.1	+0.1	+42.7	-7.5
Middle Camp	-15.8	+19.0	-3.2	-35.7	+5.3	-12.3	+29.5	-31.5
Airstrip Trace	-	-	-	-	+8.9	-3.2	+42.9	-7.9
Cinq Cases	-9.2	+74.9	-1.9	-5.4	-10.6	-3.8	+28.9	-20.1
Anse Takamaka	-	+49.3	0	-	-	-	-	-
Dune Jean-Louis	-32.5	+6.5	-	+2.6	-1.4	-11.6	+31.2	-12.9
Dune d'Messe	-	-11.8	-9.0	+67.0	-4.4	-16.0	+9.0	-13.7
Anse Mais	-	+14.5	+14.1	+44.8	-4.2	-5.7	+25.1	-
Ile Esprit	-	-	-	-16.5	+6.9	-8.8	+15.6	-3.1

Table 6. Percentage difference between the annual rainfall at each locality and the 15-year mean annual rainfall at the Meteorological Station

<u>Locality</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Meteorological Station	+34.7	-11.3	+14.0	+31.5	+34.3	+3.6	-24.2	-9.0
Station	-	-	-	-	-	+3.3	-28.7	-
Bassin Lebine	-	-	-	+73.4	+54.5	+25.5	-3.8	-10.2
Anse Var	-	-	-	+41.2	+90.1	+29.6	+14.8	-
Polymnie	+75.2	+32.5	+50.1	-16.8	+32.1	+24.4	-8.2	-15.6
Gionnet	-	+22.9	+102.8	+52.1	+25.9	+30.2	-4.9	+1.7
Anse Malabar	-	-	+11.8	-	+42.5	+3.7	+8.3	-15.8
Middle Camp	+13.4	+5.6	+10.3	-15.4	+41.5	-9.2	-1.7	-37.6
Airstrip Trace	-	-	-	-	+46.3	+0.3	+8.4	-16.2
Cinq Cases	+22.3	+55.2	+11.8	+24.4	+20.1	-0.4	-2.2	-27.3
Anse Takamaka	-	+32.4	+14.0	-	-	-	-	-
Dune Jean-Louis	-9.1	-5.5	-	+34.9	+32.5	-8.4	-0.5	-20.8
Dune d'Messe	-	-21.8	+3.7	+119.6	+28.4	-13.0	-17.4	-21.5
Anse Mais	-	+1.6	+30.0	+90.4	+28.7	-2.3	-5.1	-
Ile Esprit	-	-	-	+9.8	+43.6	-5.5	-12.3	-11.8

Table 7. Monthly rainfall at Station, Ile Picard

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1975	-	-	123	140	77	38	14	3	2	76	72	74	-
1976	-	-	-	-	-	-	-	-	-	-	-	-	-
1977	-	-	-	168	105	102	63	31	25	21	-	-	-
1978	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	260	100	108	105	77	50	62	27	17	0	50	269	1125
1980	87	143	112	144	63	64	21	27	27	28	27	34	777
1981	130	56	185	158	91	57	26	13	13	1	9	-	-

Table 8. Monthly rainfall at Bassin Lebine, Ile Picard

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1976	-	-	-	-	-	-	-	-	-	-	-	182	-
1977	260	338	470	310	90	91	28	20	16	35	35	184	1877
1978	245	216	235	202	60	44	200	30	13	8	177	252	1682
1979	306	150	165	114	98	94	69	33	28	11	124	175	1367
1980	104	140	173	186	86	57	37	37	35	37	35	120	1047
1981	172	60	108	71	59	45	32	30	7	19	240	135	978
Mean ¹	217	181	230	177	79	66	73	30	20	22	122	173	1390

¹Complete years only

Table 9. Monthly rainfall at Anse Var, Ile Picard

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1976	-	-	-	-	-	-	-	-	1	7	23	110	-
1977	154	384	198	155	134	111	57	24	7	9	98	207	1538
1978	766	114	449	30	45	74	180	28	6	3	211	164	2070
1979	350	122	311	103	85	54	49	30	21	1	93	192	1411
1980	66	314	314	129	94	73	56	56	33	43	41	31	1250
1981	21	19	21	21	21	25	15	0	0	34	23	282	482
Mean ¹	423	207	319	96	88	80	95	27	11	4	134	188	1673

¹1977-1979; frequency of readings after May 1980 too low for records to be reliable

Table 10. Monthly rainfall at Polymnie, Ile Polymnie

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1973	-	-	-	-	-	-	-	-	-	-	-	110	-
1974	320	368	405	551	44	52	60	12	0	0	0	96	1908
1975	331	355	196	192	63	42	7	6	4	6	114	127	1443
1976	288	234	513	87	31	162	117	10	2	7	91	93	1635
1977	104	94	104	74	82	85	48	35	14	33	79	154	906
1978	183	120	442	39	43	69	195	15	2	8	93	230	1439
1979	388	183	164	123	101	82	53	34	18	19	142	48	1355
1980	102	88	138	217	111	38	39	39	24	3	70	131	1000
1981	155	140	73	114	82	74	41	25	28	33	15	289	919
Mean ¹	234	198	254	175	70	76	70	21	12	14	76	146	1326

¹Complete years only

Table 11. Monthly rainfall at Gionnet, Ile Malabar

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1974	-	-	-	-	-	-	-	-	-	-	11	249	-
1975	445	319	144	150	66	48	17	4	2	5	33	105	1338
1976	286	263	841	193	32	167	188	14	12	13	21	178	2208
1977	333	119	124	111	110	143	246	123	8	50	121	168	1656
1978	131	145	417	25	63	59	141	43	15	9	93	230	1371
1979	325	226	152	137	94	75	77	49	16	15	98	154	1418
1980	86	77	145	206	87	55	51	32	18	19	122	138	1036
1981	174	162	74	115	104	87	27	32	19	20	41	252	1107
Mean ¹	254	187	271	134	79	91	107	42	13	19	76	175	1448

¹Complete years only

Table 12. Monthly rainfall at Anse Malabar, Ile Malabar

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1975	-	-	124	94	78	36	8	8	5	3	49	88	-
1976	218	200	279	97	45	111	95	30	5	4	3	130	1217
1977	116	127	69	-	-	-	-	10	12	23	61	166	-
1978	154	131	439	62	165	151	94	35	13	11	182	115	1552
1979	219	180	171	43	143	55	56	51	34	14	40	123	1129
1980	126	110	122	258	156	37	38	38	37	38	49	170	1179
1981	170	72	69	66	69	66	26	46	16	128	93	96	917
Mean ¹	177	139	216	105	116	84	62	40	21	39	73	127	1199

¹Complete years only

Table 13. Monthly rainfall at Middle Camp, Ile Malabar

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1973	-	-	-	-	13	15	40	44	16	4	25	121	-
1974	384	97	226	300	29	24	17	29	0	0	0	129	1235
1975	257	244	167	93	81	34	18	11	9	12	56	168	1150
1976	288	135	318	59	47	67	72	29	1	4	21	160	1201
1977	192	86	110	124	109	83	55	18	6	4	37	97	921
1978	265	294	335	109	54	25	118	14	2	0	151	174	1541
1979	207	139	165	52	93	30	36	30	47	4	57	129	989
1980	136	125	151	173	107	69	40	31	10	77	74	77	1070
1981	77	58	63	61	63	61	9	8	16	7	128	128	679
Mean ¹	226	147	192	121	73	49	46	21	11	14	66	133	1098

¹Complete years only

Table 14. Monthly rainfall at Airstrip Trace, Grande Terre

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1977	-	-	-	-	-	-	-	-	-	-	-	169	-
1978	353	171	341	51	132	65	125	29	11	22	165	128	1593
1979	302	135	143	47	114	50	52	45	15	5	33	151	1092
1980	177	156	168	162	101	80	42	37	36	37	54	130	1180
1981	130	74	72	70	72	70	58	24	14	148	89	92	913
Mean ¹	241	134	181	83	105	53	69	34	19	53	85	125	1195

¹Complete years only

Table 15. Monthly rainfall at Cinq Cases, Grande Terre

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1973	-	-	-	-	-	-	119	79	28	7	30	167	-
1974	280	125	439	133	43	60	110	46	22	6	1	67	1332
1975	501	453	147	338	55	36	13	6	11	14	29	87	1690
1976	138	125	484	74	77	105	92	7	0	1	26	88	1217
1977	183	86	195	120	131	180	186	45	19	20	39	151	1355
1978	190	226	295	33	50	115	34	31	7	10	160	157	1308
1979	307	121	128	47	125	45	66	26	20	12	23	165	1085
1980	182	156	170	162	100	30	27	20	15	16	41	146	1065
1981	146	60	53	52	53	52	45	31	11	128	79	82	792
Mean ¹	241	169	239	120	79	78	72	27	13	26	50	118	1231

¹Complete years only

Table 16. Monthly rainfall at Anse Takamaka, Grande Terre

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1974	-	-	189	460	84	0	0	0	0	0	0	300	-
1975	284	248	274	266	180	31	4	7	5	9	41	93	1442
1976	288	154	171	165	171	165	107	11	9	0	0	0	1241
1977	67	78	98	115	189	140	60	140	101	117	113	-	-
Mean ¹	286	201	223	216	176	98	56	9	7	5	21	47	1342

¹Complete years only

Table 17. Monthly rainfall at Dune Jean-Louis, Grande Terre

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1973	-	-	-	-	-	-	-	56	38	39	112	193	-
1974	188	63	215	186	17	53	30	44	1	0	6	187	990
1975	193	187	188	151	105	29	6	16	10	15	41	88	1029
1976	-	-	-	-	-	-	-	-	4	0	58	120	-
1977	360	207	242	143	101	89	54	19	23	26	59	146	1469
1978	287	136	354	33	68	34	100	18	2	7	158	246	1443
1979	222	128	94	56	103	68	70	48	20	5	15	168	997
1980	147	184	109	106	66	54	72	37	20	81	102	106	1084
1981	104	87	124	76	63	61	45	36	24	95	73	75	863
Mean ¹	214	142	189	107	75	55	54	31	14	33	65	145	1125

¹Complete years only

Table 18. Monthly rainfall at Dune d'Messe, Grande Terre

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1975	139	130	144	139	123	25	2	6	9	12	42	81	852
1976	358	231	177	78	49	19	70	60	2	16	25	44	1129
1977	437	252	130	346	330	230	236	123	48	47	104	108	2391
1978	146	245	385	33	44	94	71	39	7	3	163	168	1398
1979	251	150	96	60	79	47	48	36	10	8	34	128	947
1980	178	91	101	98	101	67	53	29	16	27	68	71	900
1981	109	123	137	73	57	55	26	25	99	51	49	51	855
Mean	231	175	167	118	112	77	72	45	27	23	69	93	1210

Table 19. Monthly rainfall at Anse Mais, Grande Terre

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1975	230	167	180	123	76	2	11	6	10	7	102	192	1106
1976	404	124	299	109	23	8	8	274	9	4	28	126	1416
1977	588	200	498	241	136	80	66	36	13	68	74	73	2073
1978	278	116	311	51	35	50	129	68	37	77	106	143	1401
1979	200	122	98	96	92	54	74	31	9	2	89	197	1064
1980	88	130	164	149	119	114	43	34	18	4	26	144	1033
1981	104	68	168	40	77	31	26	50	19	18	43	-	-
Mean ¹	298	143	258	128	80	51	55	75	16	27	71	146	1349

¹Complete years only

Table 20. Monthly rainfall at Ile Esprit

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Total</u>
1976	-	-	-	-	-	-	111	34	2	10	103	107	-
1977	145	204	191	132	143	124	52	33	8	32	35	97	1196
1978	182	210	270	200	55	221	18	17	4	83	92	212	1564
1979	209	144	139	80	61	64	66	34	10	14	50	158	1029
1980	287	213	108	26	27	26	27	27	30	62	60	62	955
1981	98	112	125	121	54	50	33	18	16	17	21	295	960
Mean ¹	184	177	167	112	68	97	39	26	14	42	52	165	1141

¹Complete years only

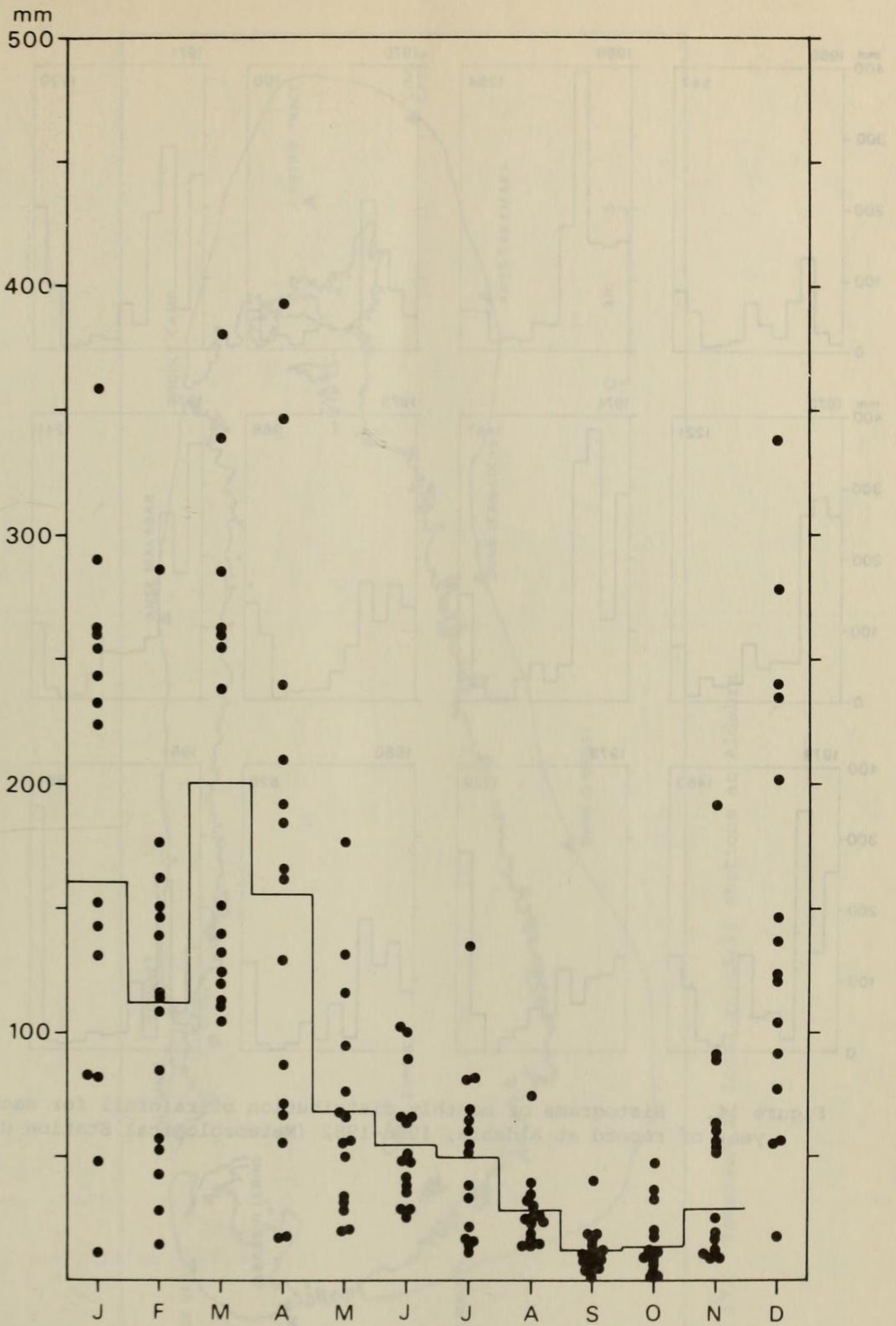


Figure 13. Monthly rainfall on Aldabra 1968-1982 (Meteorological Station data)

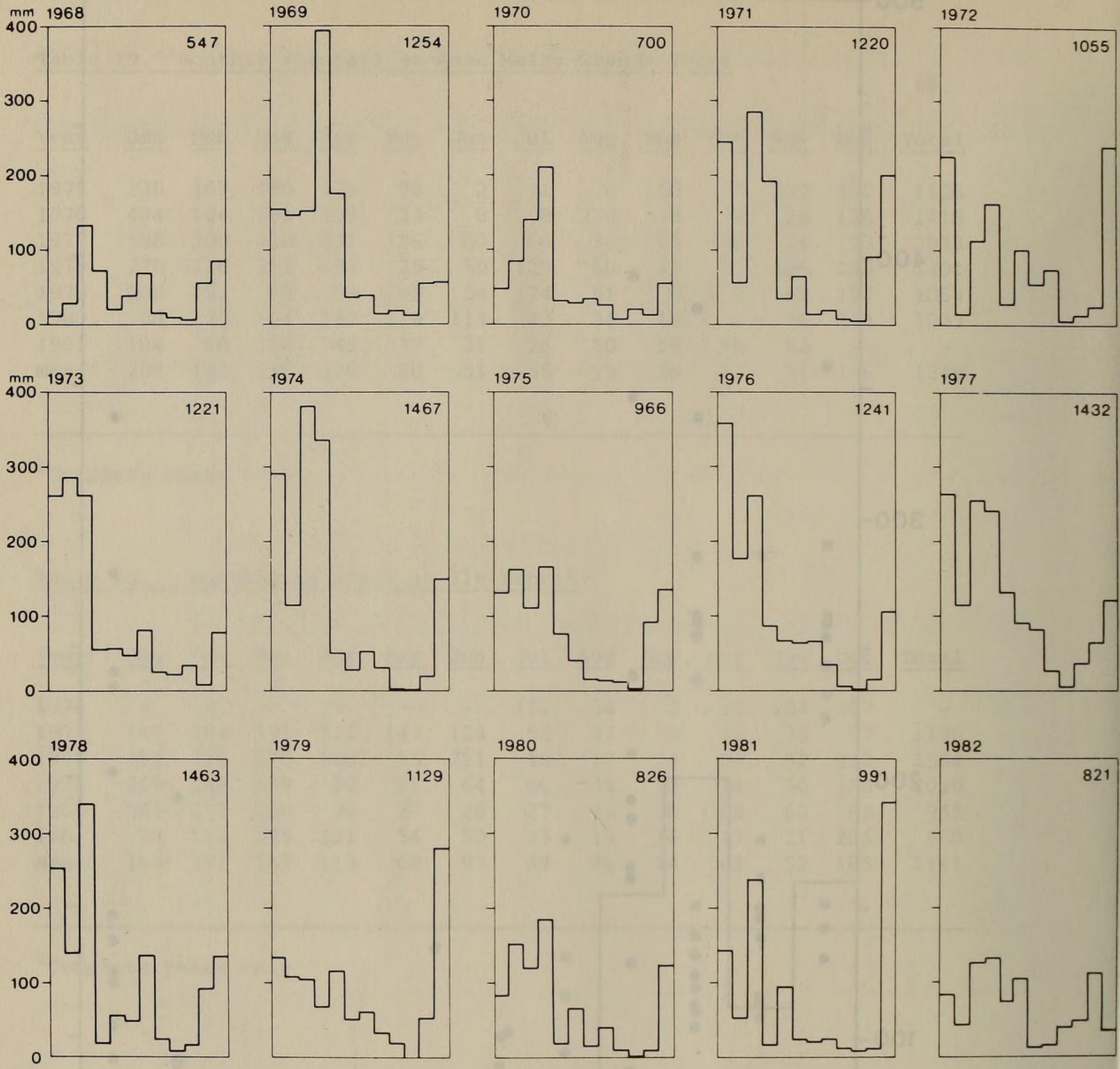


Figure 14. Histograms of monthly distribution of rainfall for each year of record at Aldabra, 1968-1982 (Meteorological Station data)

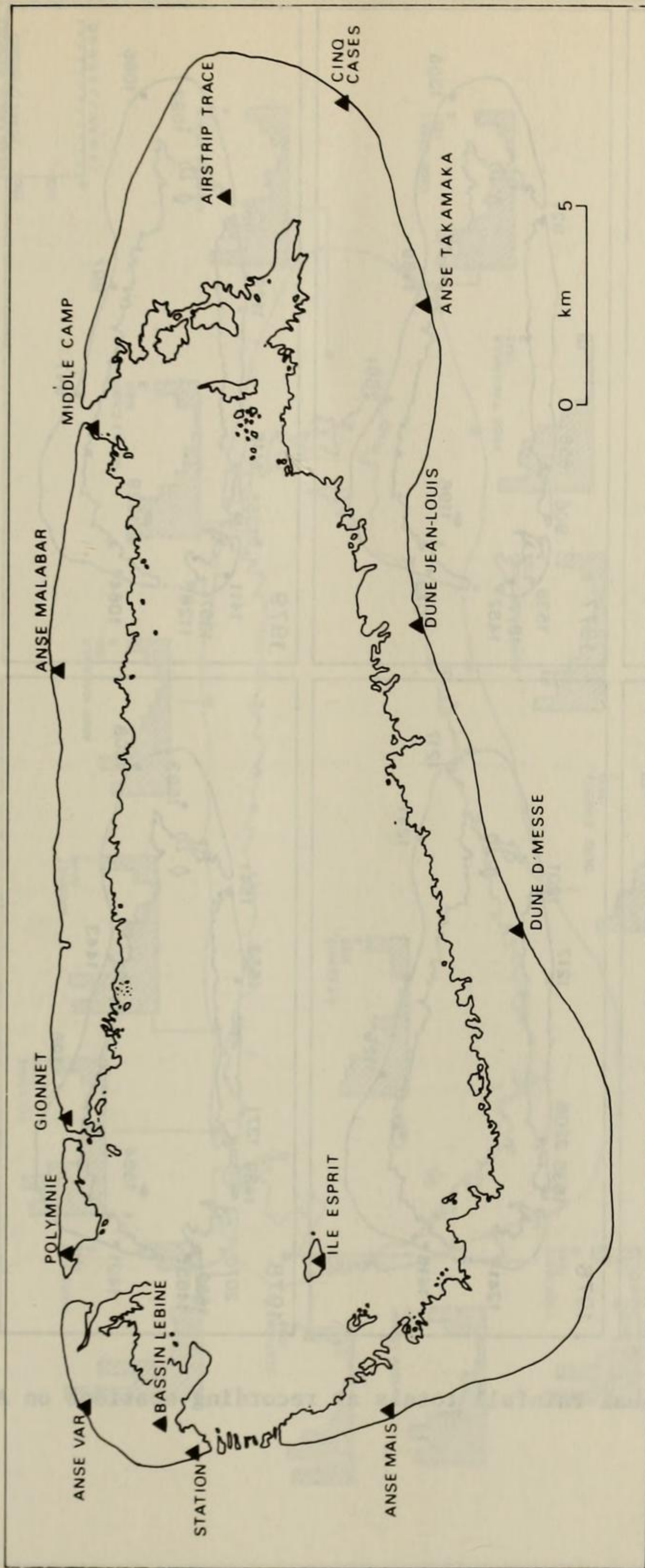


Figure 15. Location of local rainfall stations at Aldabra

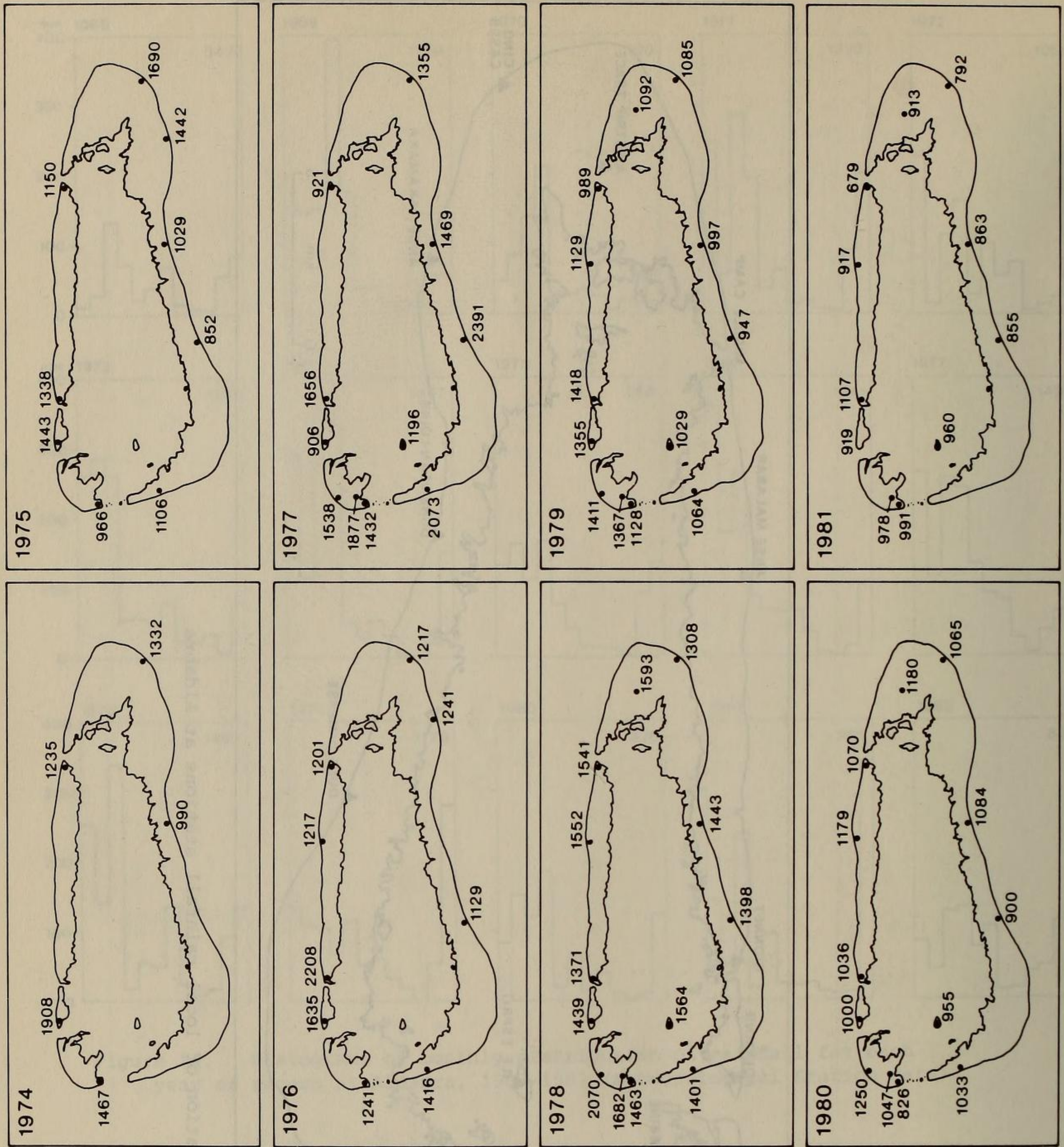


Figure 16. Annual rainfall totals at recording stations on Aldabra, 1974-1981

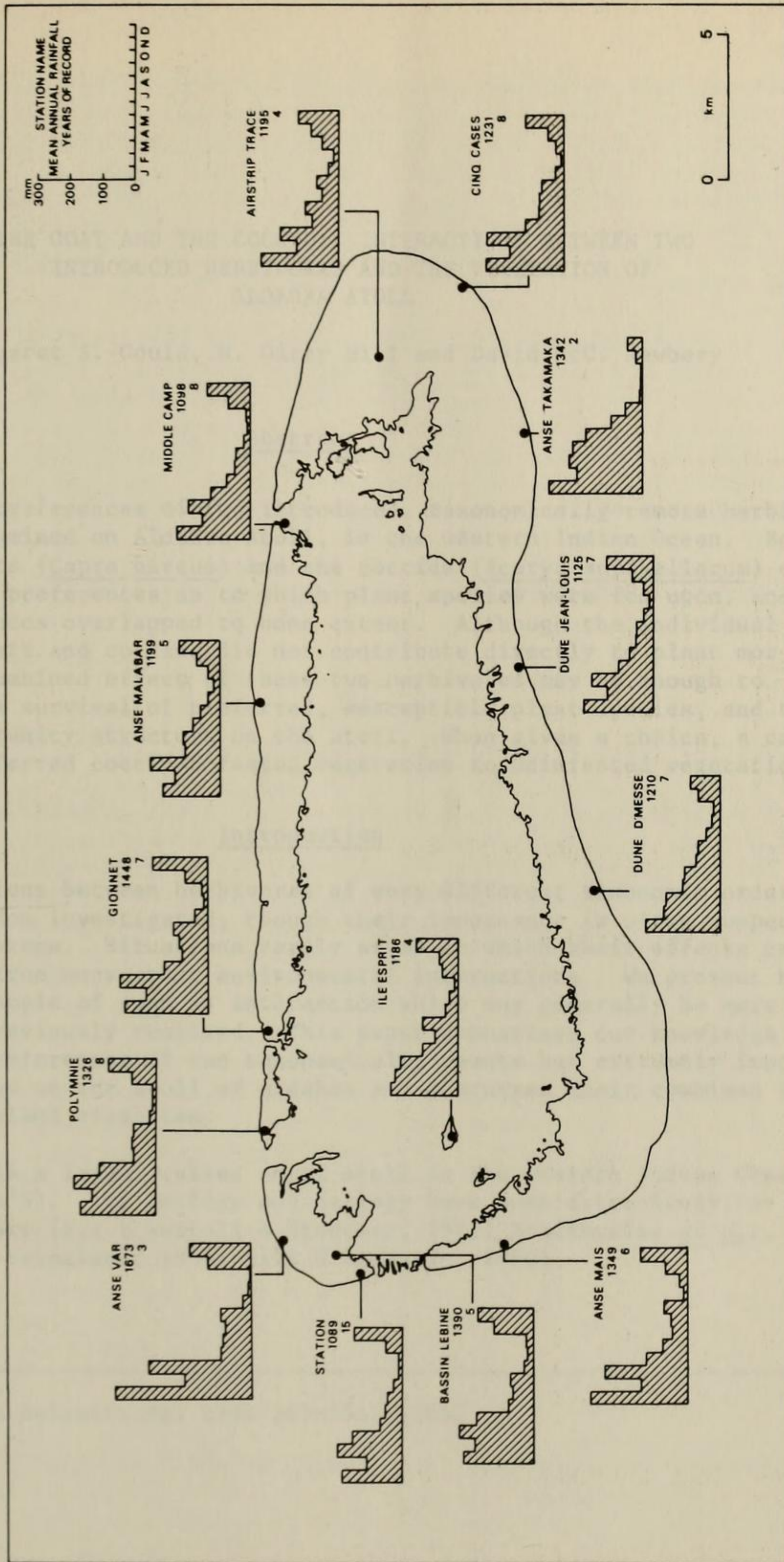


Figure 17. Monthly distribution of rainfall at local recording stations on Aldabra