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**CLIMATE OF ALDABRA ATOLL**  
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## CLIMATE OF ALDABRA ATOLL

by

D. R. Stoddart<sup>1</sup> and L. U. Mole<sup>2</sup>

### Introduction

Weather records have been maintained by the Royal Society at Aldabra Atoll (9°24'S., 46°20'E.), southwest Indian Ocean, continuously since mid-October 1967. The recording station is located on West Island, on the northwest side of the atoll, first at the Settlement, but after 1970 at the Royal Society Research Station 1 km to the south. These are both leeward and rather protected situations. A single synoptic observation is taken at 0600 GMT (0900 local time).

Records for the period November 1967 to October 1968 were very fully analysed by Farrow (1971), in the light of general information available for the southwest Indian Ocean, and the rainfall records up to 1970 were placed in a regional context by Stoddart (1971). Records now available since 1967 in some respects modify these preliminary reports and also permit a more detailed analysis of ecologically significant parameters such as rainfall frequency and duration of drought. This paper presents an abstract of the climatic data to the end of 1974 (seven complete years), with fuller analysis of the daily rainfall records for the five years 1968-1972. Daily observations for the period of record are available on request from the Royal Society.

In addition to these records J. Frazier maintained rainfall records at Dune Jean-Louis on the exposed south coast for most of the period July 1969-June 1970, and G. E. Farrow made records at East Channel on the northeast side of the atoll during September-October 1968. A more detailed investigation of local and microclimate is now being made by R. J. Hnatiuk.

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### Pressure and Winds

Farrow (1971, 69) points out that during winter pressure is high and the Southeast Trades blow strongly, while in summer pressure is low and winds are lighter and northwesterly. Records for 1968-74 (1969 is absent because of equipment failure) confirm this pattern (Table 1 and 2; Figures 1f, 1g and 2). These show substantial agreement from year to year in pressure distribution, with a maximum in July, but considerable variability from year to year in mean monthly wind speed. 1970, 1973 and 1974 were years with generally low wind velocities, and 1972 a year of high velocities. 1971 was characterised by abnormally high wind speeds in February and March. Although both 1970 and 1973 had similar wind patterns, the former was an exceptionally dry year and the latter exceptionally wet.

Table 3 gives the number of occurrences in each month of calms, of winds in excess of 10 kts, and of winds in excess of 20 kts at the daily recording time. Calms are rare (less than 10 days per year except in 1971). The frequency of winds higher than 10 kts varies from year to year, being low in 1969, 1970, 1973 and 1974 and high in 1971 and 1972. As with mean monthly wind speed there is no obvious correlation with rainfall, though moderately high winds (10-20 kts) are most characteristic of the Trade Wind months August-October. Table 4 lists the maximum wind speeds recorded in each month. Occasional summer squalls bring speeds greater than 30 kts. The maximum wind speed recorded is 44 kts on 21 September 1968; the maximum in most months is less than 20 kts.

### Temperature

Figure 1 a-d gives curves of absolute monthly maximum (a), mean monthly maximum (b), mean monthly minimum (c), and absolute monthly minimum (d) temperatures over the period of record; maximum temperatures are missing for the period November 1969 to March 1970 because of instrument failure. Corresponding data are tabulated in Tables 5-8. The annual range in mean monthly temperature is about 4°C. The monthly range is least in winter (July-August) and greatest in summer (January). The 1967-74 averages of mean maximum and minimum monthly temperatures do not rise above 31.24°C (December) or fall below 22.15°C (August), respectively. The highest temperature recorded is 36.3°C and the lowest 17.5°C. Temperatures fell below 20°C on only eight occasions during the seven years 1968-74; four of these occasions were during the winter of 1969.

### Rainfall

Three complete and four incomplete years of rainfall record were available for Aldabra before the Royal Society began recording in 1967 (Table 9). The complete years gave a mean annual rainfall of 640 mm, with both 1958 and 1959 having less than 400 mm. Records since 1967 show a variable but substantially greater annual rainfall, with several years in excess of 1000 mm (Table 10). The mean annual rainfall for

the Royal Society period of record is almost exactly 1070 mm, and all records to the end of 1973 give a mean of 940.6 mm. Figure 3 gives histograms for the pre-1967 and post-1967 records and for all data combined. The earlier records showed considerably drier conditions during the Trade Wind months May-August, and also during November-December: during the last few years only the months of September and October have been consistently dry, whereas according to earlier records a comparably dry season had extended for nearly six months of the year.

Figure 1e gives the sequence of monthly rainfalls since 1967 and Figure 4 the actual monthly totals over the period of record. The former shows great variability in incidence and amount from year to year; the latter demonstrates that whereas the driest months of the Trades are consistently dry, the wet months can be highly variable. The main control of total annual rainfall appears to be the extent to which rainfall during January and February is high (1969, 1973) or is suppressed (1968, 1970), though in 1974 a substantial part of the total fell during March and April. There is no clear correlation between monthly rainfall and other monthly mean characteristics such as temperature, pressure and wind. The highest monthly total so far recorded is 423 mm (March 1950); several months have recorded zero rainfall, but all these records are before 1967. Annual totals vary from 547 mm (1968) to 1467 mm (1974).

Daily rainfall records permit the analysis of daily intensities and frequencies. Table 11 gives the frequency of occurrence of daily rainfalls in 5 mm/day class intervals for 1968-1972. 70 per cent of all rain-days have less than 5 mm rainfall, and 90 per cent less than 15 mm. Three days in five years have recorded more than 100 mm of rain, and the highest daily fall recorded is 165.5 mm on 7 April 1969, almost the same as the 6 inches recorded on 12 January 1891 (Spurs 1892, 48). During 1968-72 rain fell on 38 per cent of the days.

Data on the frequency of daily falls in excess of 10, 25, 50 and 100 mm are given in Table 12. Normally three-quarters of all annual rainfall comes in falls greater than 10 mm/day. There is a close positive correlation between the annual rainfall in any year and the number of days in the year with 10-25 mm/day rainfall (Figure 5); the correlation with higher intensity falls is, however, erratic, presumably because of the brevity of the record.

An important ecological correlate of these rainfall patterns is the duration of wet and dry periods. If wetness is simply defined as a day with recorded rain and dryness a day with no recorded rain, then most wet and dry periods (i.e. sequences of such days) are of short duration (Table 13, Figure 6): only one wet spell and seven dry spells lasted more than 14 days during 1968-72 (though according to earlier records three consecutive months passed without recorded rainfall in 1949). If, however, 5 mm/day is taken as the threshold dividing 'wet' and 'dry' days (Table 14, Figure 6), most wet spells lasted only one

day and virtually all three days or less, whereas there was no less than 30 dry spells lasting more than 14 days, 24 lasting more than 3 weeks, 16 more than 4 weeks, 8 more than 5 weeks, 5 more than 6 weeks, 4 more than 7 weeks, and 2 more than 8 weeks. The longest dry spell so defined lasted 88 days. By contrast the longest wet spell lasted 7 days. These long periods of dry weather, especially during dry years, must have profound ecological consequences.

All these rainfall records come from the station on the leeward side of the Atoll. Farrow (1971) drew attention to the need for comparative data from different parts of Aldabra, to establish local variability, and presented one month's comparison in 1968 between West Island and East Channel. In 1969-70 J. Frazier maintained records for most of the period July 1969 to June 1970 at Dune Jean-Louis on the south coast. It is possible to compare the days for which he has records (221) with Station records (Table 15). The total rainfall at the Station over this period was 70.5 per cent of that at Dune Jean-Louis, and the total number of rain-days at the Station was 69.5 per cent of that at Dune Jean-Louis. The correlation between daily rainfall at the two sites is only 0.35. The mean rainfall per rain-day is, however, very similar (6.33 mm at the Station and 6.24 mm at Dune Jean-Louis), and the higher totals on the south coast clearly arise from rain falling there more frequently than on the leeward coast. These data are, of course, preliminary, and more detailed work on local climatic variability is now being carried out by R. J. Hnatiuk.

These new rainfall data modify the pattern of Indian Ocean rainfall north of Madagascar presented by Stoddart (1971, Figure 2), making the arid zone in the Aldabra area less evident. The Aldabra records are strikingly parallel to those for the Iles Glorieuses to the south, which were also not included in the earlier analysis. Battistini and Cremers (1972, 1) show that the mean annual rainfall for the Iles Glorieuses is almost identical to that for Aldabra over the Royal Society period of record, though the summer period is drier on Aldabra and the onset of the Trades is wetter (Table 16).

#### Other Data

Daily records of maximum, minimum and dry bulb temperatures, dew point, relative humidity, pressure, wind speed, wind direction, cloud cover and rainfall are available from the Royal Society for the period since October 1967. In addition, daily records are also maintained of visibility, vapour pressure, form and height of cloud, and ground temperature at 1 ft depth, and could be provided on request. It is planned to increase the scope of the recording station to World Weather Watch standards during 1975. The standard Station records will also be extended by additional screen and microclimate records being maintained on a temporary basis in different parts of the atoll during 1973-74.

### Acknowledgements

The data recorded here were obtained by volunteers from the Royal Society Expedition to Aldabra 1967-69, and subsequently by the staff of the Royal Society Aldabra Research Station. We thank Dr. J. Frazier for making available his daily rainfall records for Dune Jean-Louis for 1969-70.

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Table 1. Mean monthly atmospheric pressure at Aldabra, mb

<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>
1967	-	-	-	-	-	-	-	-	-	1015.0	1012.0	1012.1
1968	1012.9	1012.8	1010.8	1012.2	1014.0	1015.7	1017.1	1017.3	1016.0	1014.8	1013.4	1011.6
1969	-	-	-	-	-	-	-	-	-	-	1013.7	1013.1
1970	1012.2	1011.6	1011.2	1012.9	1013.8	1016.6	1017.6	1016.4	1015.8	1015.4	1013.9	1012.8
1971	1012.2	1010.4	1012.4	1011.8	1013.8	1016.8	1016.2	1016.6	1016.6	1016.3	1013.9	1012.0
1972	1011.0	1010.4	1011.7	1012.2	1013.8	1015.1	1017.1	1016.4	1016.3	1014.8	1013.2	1013.2
1973	1012.3	1011.4	1012.2	1012.4	1013.8	1016.1	1016.7	1017.5	1016.4	1015.2	1015.4	1014.2
1974	1013.0	1012.1	1013.1	1012.9	1015.1	1016.4	1018.1	1017.9	1017.8	1016.5	1015.2	1013.2

Table 2. Mean monthly wind speed, kts

<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>
1967	-	-	-	-	-	-	-	-	-	6.4	4.1	5.2
1968	5.8	5.1	5.5	6.3	6.8	9.3	9.3	12.4	14.4	12.1	11.1	5.9
1969	4.9	5.2	4.3	3.7	7.0	7.8	10.2	13.0	9.1	7.5	6.3	5.1
1970	6.4	7.3	4.5	5.8	7.7	7.6	5.7	5.9	7.9	7.7	5.2	4.2
1971	6.5	16.6	19.5	7.3	10.6	10.3	13.4	12.1	10.9	10.5	4.5	4.9
1972	5.0	10.1	5.8	10.0	11.9	12.4	14.4	14.2	17.3	15.1	8.9	5.2
1973	10.1	6.7	7.2	6.4	8.2	8.5	7.1	8.0	7.1	7.2	4.2	3.6
1974	2.5	3.4	3.7	6.1	5.5	4.7	6.3	6.5	6.8	5.1	2.9	2.0



Table 4. Maximum wind speeds recorded in each month, 1967-1974 (kts)

(Figures in brackets are number of days on which the given speed was recorded)

<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>
1967	-	-	-	-	-	-	-	-	-	24 (1)	9 (1)	13 (2)
1968	19 (1)	9 (5)	13 (2)	13 (4)	13 (7)	24 (1)	24 (1)	19 (5)	44 (1)	19 (6)	27 (1)	25 (1)
1969	19 (1)	13 (3)	14 (1)	13 (1)	13 (7)	19 (1)	19 (4)	24 (3)	19 (3)	13 (3)	13 (1)	9 (8)
1970	9 (13)	13 (6)	13 (1)	9 (8)	13 (3)	13 (7)	9 (12)	13 (2)	12 (1)	13 (1)	13 (1)	12 (1)
1971	30 (1)	20 (1)	20 (1)	12 (2)	18 (3)	19 (1)	20 (1)	19 (2)	16 (2)	18 (1)	12 (1)	35 (1)
1972	18 (1)	18 (1)	30 (1)	20 (2)	25 (1)	28 (1)	25 (1)	23 (2)	35 (1)	25 (5)	20 (1)	12 (2)
1973	24 (3)	24 (2)	19 (2)	10 (3)	12 (7)	20 (1)	12 (2)	14 (1)	12 (4)	14 (1)	8 (2)	13 (1)
1974	6 (2)	10 (1)	8 (4)	22 (1)	12 (2)	12 (1)	16 (1)	14 (1)	11 (1)	10 (2)	6 (2)	5 (2)

Table 5. Highest maximum temperatures in each month at Aldabra

<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>
1967	-	-	-	-	-	-	-	-	-	-	33.4	34.0
1968	36.3	36.0	32.9	32.9	31.3	30.6	29.1	28.5	30.6	30.7	31.2	33.0
1969	33.5	33.0	34.0	33.0	32.0	30.0	28.7	28.7	29.4	29.7 <sup>1</sup>	-	-
1970	-	-	-	32.5	31.5	29.5	29.0	29.0	30.0	30.5	32.0	34.8
1971	32.4	31.4	31.4	33.8	30.1	28.4	27.4	27.4	27.8	30.2	31.8	32.3
1972	31.6	32.3	32.2	32.0	31.2	30.0	28.8	28.9	29.9	31.2	32.4	32.6
1973	35.9	32.3	33.2	32.5	33.6	30.0	28.9	31.7	29.8	32.2	32.5	32.4
1974	32.3	33.1	33.0	31.6	31.1	30.0	28.8	28.5	29.3	30.6	32.1	33.0

<sup>1</sup>.4 days record only

Table 6. Mean maximum monthly temperatures at Aldabra

<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>
1967	-	-	-	-	-	-	-	-	-	-	30.81	32.04
1968	31.64	32.09	31.14	31.27	30.18	28.94	27.49	27.86	28.81	29.89	30.35	31.11
1969	31.61	31.60	32.05	31.63	30.59	28.77	27.98	27.57	28.33	29.48 <sup>1</sup>	-	-
1970	-	-	-	31.37	30.08	28.83	28.35	28.31	28.54	29.46	30.52	31.31
1971	30.71	30.31	30.28	30.45	29.08	27.18	26.81	26.69	27.07	28.07	30.15	30.95
1972	30.23	31.07	30.67	30.91	30.19	27.89	27.50	28.08	28.50	29.75	30.64	30.97
1973	31.06	30.57	31.40	31.33	30.08	28.49	27.50	28.00	28.58	29.62	31.13	30.85
1974	29.80	30.97	31.03	30.19	30.03	28.59	27.68	27.22	28.13	29.40	30.91	31.53
Mean	30.84	31.10	31.10	31.02	30.03	28.38	27.62	27.68	28.28	29.36	30.64	31.24

<sup>1</sup> 4 days of record only: disregarded in mean

Table 7. Mean minimum monthly temperatures at Aldabra

<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>
1967	-	-	-	-	-	-	-	-	-	-	24.38	25.67
1968	24.91	25.59	24.68	24.35	23.77	23.09	21.86	22.01	22.59	23.46	24.07	24.40
1969	24.30	25.72	25.49	24.92	25.08	23.49	22.45	21.84	21.85	23.55	24.46	24.53
1970	26.08	26.02	26.11	25.26	24.52	23.36	23.26	21.89	22.10	22.93	23.98	24.66
1971	24.82	25.40	24.73	25.13	24.67	22.70	22.43	21.85	22.35	23.26	23.84	24.19
1972	24.50	25.98	24.75	25.13	25.22	23.82	22.94	22.85	23.61	24.52	25.50	24.28
1973	25.87	25.99	26.36	25.86	25.03	23.62	22.86	22.45	22.91	23.98	24.42	24.26
1974	24.15	24.71	24.59	24.92	24.75	23.35	22.42	22.14	22.61	23.50	24.37	24.48
Mean	24.95	25.63	25.24	25.08	24.72	23.35	22.60	22.15	22.57	23.60	24.38	24.56

Table 8. Lowest minimum temperatures in each month at Aldabra

<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>
1967	-	-	-	-	-	-	-	-	-	-	22.5	23.0
1968	21.6	22.8	23.1	22.0	21.3	19.5	20.2	19.6	21.2	22.0	22.8	22.4
1969	22.7	23.0	23.0	23.5	22.5	17.5	20.6	19.5	17.9	22.2	22.3	21.6
1970	22.6	23.0	23.7	22.8	22.0	21.0	20.5	20.0	20.0	21.5	22.2	23.0
1971	22.2	21.3	21.5	23.0	22.6	20.1	20.7	18.8	21.0	22.0	21.8	22.0
1972	22.4	23.6	21.9	21.9	22.8	21.0	21.8	21.5	22.4	23.5	23.6	22.8
1973	21.4	23.8	24.0	23.9	23.5	22.2	21.3	20.2	21.1	22.8	23.4	22.7
1974	22.3	22.8	22.8	22.4	22.4	21.1	20.3	19.8	20.9	22.0	22.6	22.0



Table 9. Aldabra rainfall records before 1967: monthly totals in mm

<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>
1949	-	-	-	-	-	2	26	0	0	0	13	57	-
1950	95	219	423	272	6	24	0	16	37	10	23	67	1192
1951	92	60	-	221	46	-	13	32	0	7	70	-	-
1952	160	306	29	250	13	18	4	0	-	-	-	-	-
1953	-	-	54	67	30	38	-	-	-	-	-	-	-
1958	92	101	40	36	2	2	9	8	4	2	45	40	381
1959	102	199	6	1	0	1	1	4	4	0	19	12	349
Mean	108	177	110	141	16	14	9	10	9	4	34	44	640

Table 10. Aldabra rainfall records 1967-1974: monthly totals in mm

<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>
1967	-	-	-	-	-	-	-	-	-	2.7	147.2	5.4	-
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
Mean <sup>1</sup>	176.2	104.9	209.4	204.9	57.1	49.7	49.2	29.4	10.3	12.0	51.9	109.0	1066.4
Mean <sup>2</sup>	108	177	110	141	16	14	9	10	9	4	34	44	640
Mean <sup>3</sup>	147.9	134.9	168.2	175.5	38.2	33.3	30.6	20.4	9.8	8.9	46.5	87.3	940.6
Years <sup>4</sup>	12	12	12	13	13	13	13	13	12	13	13	12	11

<sup>1</sup> 1967-1974;      <sup>2</sup> 1949-1959 (incomplete records);      <sup>3</sup> All records 1949-1974;      <sup>4</sup> All records

Table 11. Frequency of daily rainfalls at Aldabra Atoll, 1968-1972

<u>Daily rainfall, mm</u>	<u>Number of days</u>	<u>Percent total number of raindays</u>
0.1 - 5	487	70.38
6 - 10	86	12.43
11 - 15	43	6.21
16 - 20	14	2.02
21 - 25	15	2.31
26 - 30	8	1.16
31 - 35	6	0.87
36 - 40	11	1.59
41 - 45	4	0.58
46 - 50	3	0.43
51 - 55	4	0.58
56 - 60	4	0.58
61 - 65	1	0.14
66 - 70	2	0.29
71 - 75	0	0
76 - 80	0	0
81 - 85	0	0
86 - 90	0	0
91 - 95	0	0
96 - 100	1	0.14
>100	2	0.29

Table 12. Rainfalls occurring in intensities exceeding 10, 25, 50 and 100 mm/day, 1968-1973

Year	Annual rainfall		<u>&gt;10 mm/day</u>	<u>&gt;25 mm/day</u>	<u>&gt;50 mm/day</u>	<u>&gt;100 mm/day</u>
	mm					
1968	547.1	Total amount, mm	255.4	117.7	51.0	0
		% annual total	46.5	21.4	9.3	0
		Number of days	12	3	1	0
1969	1253.7	Total amount, mm	920.7	603.8	234.5	164.5
		% annual total	73.4	48.2	18.7	13.1
		Number of days	33	13	2	1
1970	700.3	Total amount, mm	416.8	231.8	152.8	101.4
		% annual total	59.5	33.0	21.8	14.5
		Number of days	14	7	2	1
1971	1220.3	Total amount, mm	894.2	535.0	387.3	100.0
		% annual total	73.3	43.8	31.7	8.2
		Number of days	32	10	4	1
1972	1054.8	Total amount, mm	783.8	564.6	170.0	0
		% annual total	74.3	53.5	16.1	0
		Number of days	29	14	3	0
1973	1220.9	Total amount, mm	936.7	549.2	439.9	236.5
		% annual total	76.7	45.0	36.0	19.4
		Number of days	32	9	5	2





















