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THE MARITIME WEATHER OF JAMAICA : ITS EFFECTS ON ANNUAL CARBON BUDGETS OF THE MASSIVE REEF-BUILDING CORAL *MONTASTREA ANNULARIS*

LA METEOROLOGIE MARINE EN JAMAIQUE : EFFETS SUR LA PRODUCTIVITE DE *MONTASTREA ANNULARIS*

J.W. PORTER

Zoology Department, University of Georgia, Athens, GEORGIA 30602, U.S.A.

ABSTRACT

There are currently no continuous weather records for tropical coral reef regions. The fragmentary information that exists rarely includes information on irradiance or wind vector, perhaps two most important physical parameters influencing benthic growth and production. In this paper, the first twelve months of a continuing weather monitoring program from the Discovery Bay Marine Laboratory in Discovery Bay, Jamaica, is presented and these data coupled with a model of primary productivity as a function of depth (1-50 meters) and time (one annual cycle) for the massive Caribbean reef-building coral Montastrea annularis.

There are 1.366 X 10^4 E $m^{-2}y^{-1}$ of surface irradiance on the reef each year. Productivity data and the model reveal that the gross production of Montastrea annularis is 1,025 gC $m^{-2}y^{-1}$ at 1 m, 510 at 10 m, 318 at 30 m and 293 at 50 m. The daily integrated P/R ratio as defined is greater than or equal to one 89% of the time at 1 m, 29% at 10 m, 0.3% at 30 m and 1.4% at 50 m. The annual integrated P/R ratio for this species is 1.220 $\pm$ 0.218 at 1 m, 0.891 $\pm$ 0.166 at 10 m, 0.707 $\pm$ 0.161 at 30 m and 0.742 $\pm$ 0.163 at 50 m.

We can therefore make the first statement ever that, at least in this one species of coral and over an annual integrated average, specimens of Montastrea annularis are photoautotrophic with respect to carbon only in the shallowest part of their depth range, but require substantial inputs of carbon from exogenous sources to meet their basal metabolic needs over the majority of their depth range. While the potential for photoautotrophy exists at all depths, incident light patterns preclude this from actually occurring except at the shallowest depths of this species' distribution.

RESUME

Actuellement, il n'existe pas de données météorologiques continues pour les régions tropicales coralliennes. L'information qui existe est très fragmentaire, et comprend rarement les données du rayonnement ou de la direction du vent, qui sont peut-être les deux paramètres physiques qui affectent le plus la croissance et la distribution des organismes benthiques. Ici, nous présentons les premiers douze mois d'un programme météorologique en continu, du laboratoire marin de Discovery Bay, Jamaïque, et couplons ces données avec un modèle de productivité primaire en fonction de la profondeur (1-50 m.) et du temps (un cycle annuel) pour le corail massif Montrastrea annularis, de la mer des Caraïbes.

Il y a 1.366 x 10^4 E $m^{-2}an^{-1}$ du rayonnement sur le récif chaque année. Les données des productivités et les résultats du modèle montrent que la production brute de M. annularis est 1,025 C $m^{-2}an^{-1}$ à 1 m, 510 à 10 m, 318 à 30 m, et 293 à 50 m. La proportion P/R qui est integrée quotidiennement est plus grande, ou égale à 1.0 89% des fois à 1 m, 29% à 10 m, 0.3% à 30 m, et 1.4% à 50 m. La proportion P/R integrée par année de cette espèce est 1.220 $\pm$ 0.218 à 1 m, 0.891 $\pm$ 0.166 à 10 m, 0.707 $\pm$ 0.161 à 30 m et 0.742 $\pm$ 0.163 à 50 m.

Ainsi, les résultats obtenus permettent-ils de prétendre, au moins chez cette seule espèce de corail et sur une moyenne annuelle, que les spécimens de M. annularis ne sont photoautotrophes à l'égard du carbone, que dans la partie supérieure de leur étagement, mais nécessitent des sources exogènes de carbone pour satisfaire leurs besoins métaboliques élémentaires, dans la plus grande partie de leur étagement. Bien que le potentiel d'autotrophie existe à toutes les profondeurs, l'insuffisance de l'éclairement empêche la photoautotrophie de cette espèce dans la plus grande partie de sa zone d'extension, sauf dans la partie supérieure.

INTRODUCTION

All ecology texts state that climate influences the metabolic activity and patterns of abundance of species (Odum, 1983), but the precise relationship between weather and species distrubtion or metabolic activity is available only for a few terrestrial plant species (for example, see Bormann *et al.*, 1970). These examples are almost exclusively for temperate regions where seasonality extremes and the availability of long term weather data bases make the analysis somewhat simpler. Tropical marine examples are also mostly plant studies (Prince, 1980; O'Neal and Prince, 1982; Morrison, 1984; Carpenter, 1984) and frequently deal with seasonal correlations of species replacement patterns or seasonal appearance of reproductive parts (Bernatowicz, 1953; Tsuda, 1974; Dawes *et al.*, 1974; Prince and O'Neal, 1979) rather than with metabolic rates such as productivity or respiration. To make analysis more difficult, most weather stations publish only temperature and rainfall information (World Meteorological Organization, 1983 and 1984), but not data on irradiance or wind vector. This is to say that the two major weather factors described by force units are left unmeasured. It is obvious that to leave out information on light (Bainbridge *et al.*, 1966; Evans *et al.*, 1975), which drives all productivity in the euphotic zone, and wind, which contributes to the availability of nutrients, is to miss the major forcing functions controlling primary and secondary productivity in the ecosystem. Light reduction in sea water through absorbtion and differential attenuation also compounds the problems of utilizing surface sensor data even if it were available.

To correct the situation of a lack of adequate weather data from coral reef regions, and to address the question of seasonal patterns of productivity by corals on the reef, we established a long-term weather station at the Discovery Bay Marine Laboratory in Discovery Bay, Jamaica. Jamaica is typical of central Caribbean high islands in both rainfall, temperature, and tradewind patterns (World Meteorological Organization, 1983) and also in its coastal development of coral reefs (Goreau, 1959). Discovery Bay's notable features include an extensive depth range of coral development over a steep depth gradient (Lang, 1974) and a relative lack of fresh water input (D'Elia *et al.*, 1981). In this paper, we combine information on surface weather patterns with an intensive study on primary productivity of the major reef-building coral, *Montastrea annularis* (Linnaeus), at four depths (1, 10, 30, and 50 m) on the Jamaican reef. We address the fundamental question: does this coral live autotrophically with respect to carbon, given ambient light availability, or does it require inputs of heterotrophically derived carbon to survive?

MATERIALS AND METHODS

A Campbell CR-21 Micrologger Remote Weather Station (Campbell Scientific, Logan, Utah) was established on the Discovery Bay Marine Laboratory water tower approximately 200 m from the reef crest in late June, 1983. Data on PAR irradiance (LiCor 190 SB Quantum Sensor), temperature (Campbell Model 102 Sensor), precipitation (Sierra Model RG2501 Tipping Bucket), wind direction (Met-One Model 024A Sensor), wind speed and maximum and minimum wind speed (Met-One Model 014A Sensor) were recorded every minute and summed into hourly rates (available from author upon request), daily rates (Tables: August, 1983 through July, 1984), and monthly totals (Figures: August, 1983 through July, 1984). Accuracy of the temperature, rain, and light sensors was confirmed by ground truth observations. Precision of each sensor is considered to be ± 1% of values listed in the monthly tables.

Coral productivity was measured in situ at depths of 1, 10, 30, and 50 m (Porter *et al.*, in preparation) using a bioassay respirometer (Porter, 1980; Porter *et al.*, 1984). This instrument measured oxygen flux on specimens contained in triplicate quartz-topped experimental chambers over a 24 hour period. A PAR-sensitive spherical quantum sensor simultaneously gathered information on ambient light intensity. These measurements were made in both June and January at most depths.

Two mathematical models were used to interrelate the oxygen flux data and the surface irradiance data. Coral photosynthesis-irradiance curves (Porter, 1980; Chalker, 1980) are best modeled on the hyperbolic tangent function of Jassby and Platt (1976). Only three critical parameters are required to describe the relationship between light intensity and photosynthesis: (1) respiration rate (r_c), the initial slope of the photosynthesis curve (α), and the maximum gross production rate (p_c gross max). All of these parameters change significantly in this species as a function of depth (Porter *et al.*, in prep.). Rates and totals were normalized per unit area of coral surface as this provided the least variance of any normalizing biomass unit (Porter *et al.*, in prep.). Conversion from oxygen to carbon units was accomplished by the equation: 0.375 x 1/PQ x weight of oxygen produced with PQ = 1.1; RQ = 0.8.

Light attenuation was determined by the ratio of total surface illumination determined by the surface sensor, to total in situ irradiance measured by the subsurface sensor. A sine wave was then used to model cloudless day ascending and descending irradiance. These depth related factors are listed in Table I.

Two additional mathematical models are required to interpret the total amount of carbon fixed on any given day. The amount of carbon fixed by the zooxanthellae and available to the coral to meet its metabolic demand can be computed as: P_z net 24 hrs x % Tr ÷ R_a 24 hrs (Porter *et al.*, 1984). P_z net 24 hrs is the total net production of the zooxanthellae, R_a 24 hrs is the total respiratory demand of the animal fraction of the symbiotic

Table I

Depth characteristics ($\bar{x}$ ± S.D.) of light and oxygen flux for *Montastrea annularis*

Depth (m)	Instantaneous I max ($\mu E\ m^{-2}s^{-1}$)	Integrated I max ($E\ m^{-2}d^{-1}$)	α ($\mu g O_2 cm^{-2}h^{-1}\mu E^{-1}m^2s^1$)	P_c gross max ($\mu g O_2 cm^{-2}h^{-1}$)	r_c ($\mu g O_2 cm^{-2}h^{-1}$)
1	1500	28.42	0.245 ± 0.079	109.94 ± 5.42	30.61 ± 5.81
10	600	17.05	0.194 ± 0.048	56.90 ± 19.98	20.57 ± 5.46
30	200	5.68	0.280 ± 0.032	55.75 ± 5.26	15.96 ± 6.14
50	75	2.04	0.752 ± 0.096	44.68 ± 0.91	14.04 ± 2.41

association, and %Tr is the percent of net carbon fixed that is translocated to the coral animal. This equation is discussed in Porter *et al.* (1984); it differs from similar developments presented in Muscatine *et al.* (1981) in that our P_z net value takes into account the 24 hour respiratory demands of the zooxanthellae rather than just zooxanthellae respiration during the day.

Our P/R Ratio model worked as follows. We entered all of the integrated hourly light values from the surface sensor for the entire year including previous-day extrapolated values for the three missing October dates. These light values became a look-up table and were used to generate an hourly total oxygen production value based on the average production versus light intensity curves described. These hourly total production values were then summed for an integrated 24 hour total and plugged into the P_z net formula listed above. For purposes of this model, we assumed that percent translocation was equal to 95 percent, and that the percent of respiratory demand of the symbiotic association belonging to the animal was also 95 percent. These are the most realistic values at hand (Muscatine *et al.*, 1984) but were incorporated into the computer program as input variables which can be changed easily. The model is quite sensitive to the % Tr number utilized, and further research needs to confirm the 95% value chosen. Total colony respiration was calculated by multiplying the average hourly nocturnal respiration rate (r_c) by 24. From an iteration of 366 days, total annual production and average annual P/R ratios were calculated for *Montastrea annularis* at each depth.

RESULTS

Climatological Data of Discovery Bay, Jamaica is presented as monthly summaries in the accompanying tables for August, 1983 through July 1984. A few days of data are available upon request for the last part of June, 1983 and for the months of July, 1983 and September, 1984. Due to the massiveness of the data set generated by readings every minute, the frequency of readings was reduced to readings every hour in October, 1984. Daily values are graphed in the accompanying Figures for August, 1983 through July, 1984.

Average daily temperatures ranged from 22.3° in March to 29.4° in August, with the highest instantaneous temperature recorded as 34.2° in August and the lowest as 18.1° in January. As to be expected, maximum temperatures occur near midday and minimum temperatures just before dawn. The average monthly temperatures compare well with those from the Kingston and Montego Bay weather stations (WMO, 1983; WMO, 1984).

Our weather station recorded 127.4 cm of rain, with the wettest month in February (31.4 cm) and the driest in July (2.1 cm). The sporadic entries of the Montego Bay weather station in the World Climatological Data reports (1983, 1984) make these values difficult to verify, but it appears that the Discovery Bay area received less precipitation than the Montego Bay area.

Our data show that the wind was almost always coming from the northeast, and that the major changes in wind parameters were in speed and not direction. Average wind speeds are highest in May and lowest in October. Ironically, the highest instantaneous wind speed recorded (13.7 m/s) occurred in the calmest month (October).

There were 1.366×10^4 E $m^{-2}y^{-1}$ of surface irradiance during this 12 month period. Due to the axial movement of earth and interaction with local cloudiness, August received the greatest solar radiation (1384 E $m^{-2}d^{-1}$), and February the least (843 E $m^{-2}d^{-1}$).

Productivity data and the model reveal that the gross production of *Montastrea annularis* is over 1,000 g C $m^{-2}y^{-1}$ at 1 m depth and falls to only 300 g C m^2y^{-1} at 50 m (Table II).

These gross values constitute the total amount of carbon available for partitioning between plant and animal tissue to meet respiratory demands. Assuming that only 5 percent of the gross production is used by the zooxanthellae respiration and that 95% of the remaining net zooxanthellae production is transferred to the coral, these production values give rise to P/R ratios suggesting that the annual integrated P/R ratio for this species was greater than one only for specimens growing at the very shallowest part of its extensive 50 m depth range (Table II). Specimens of this coral growing at and below 10 m must have exogenous sources of carbon to survive. Even in shallow water where the

TABLE II

Gross Production and P/R ratio characteristics ($\bar{x}$ ± 95% Conf.) in *Montastrea annularis* as a function of depth.

Depth (m)	Gross Production ($gC\ m^{-2}y^{-1}$)	Annual Integrated P/R ratio (N=366)	Percent of Time P/R≧1
1	1,025	1.220 ± 0.218	89.1
10	510	0.891 ± 0.166	29.0
30	318	0.707 ± 0.161	0.3
50	293	0.742 ± 0.163	1.4

annual integrated P/R ratio was above one, on only 326 days per year did local weather permit P/R ratios in excess of one; cloudy days dropped this value below one 11% of the time. The highest monthly P/R ratio at all depths occurred in August; the lowest in February. The highest single day P/R ratio occurred at 1m depth as 1.56; the lowest at 50m depth as 0.08.

DISCUSSION AND CONCLUSIONS

Critical information on local weather patterns can now be obtained for remote areas such as coral reefs due to the advent of portable, self-recording weather stations. These stations are required wherever process-oriented ecological research is contemplated. Using long-term information on surface irradiance and short-term subsurface information on in situ photosynthesis-irradiance curves, the surface light trace can be used to generate environmentally realistic production totals for any depth. We consider the major area of refinement required for further development of this model to be in the extinction coefficients generated by comparing surface with subsurface readings (Table I). Brakel's values (1979) and Dustan's values (1982) from the same region are similar to ours, but extrapolation of these determinations over a seasonal cycle requires assumptions on water turbidity which are probably not met. Further refinements could include (1) the location of the light sensor directly over the reef crest to avoid the land mass effect on cloud patterns and (2) the iteration of the productivity model at more frequent time intervals than once per hour.

Productivity totals of the kind listed in Table II have never been attempted for any other species of coral. Lewis (1977) and Kinsey (1977) conclude that most reef productivity falls in the range of 1-14 $gCm^{-2}d^{-1}$. Thus, if the shallow Jamacian reef were comprised solely of a *Montastrea annularis* pavement photosynthesizing at the above rates, it would appear on this scale as a highly productive reef.

This paper presents the first quantitative solution to the question posed over a half century ago by Yonge (1930): Can corals live by photosynthesis or do they require exogenous sources of carbon? This question has threaded its way through all major studies of coral physiology (Franzisket, 1969a and b; Coles, 1969; Johannes *et al.*, 1970; Wethey and Porter, 1976; Lewis, 1976; Davies, 1977; Porter, 1980; Muscatine *et al.*, 1981, and Porter *et al.*, 1984). Despite numerous allusions to the solution, "Riffkorallen Könen autotroph leben," (Franzisket, 1969a) the data here-to-fore has been missing.

Our data show that *Montastrea annularis* is not photoautotrophic with respect to carbon over 94% of its depth range. This species is in fact commonest at depths below its annual integrated compensation point. Despite clear photoadaptive responses (Porter *et al.*, in prep.; Table I), its zooxanthellae can account for only 70-90% of its basal metabolic needs over its primary depth range of 10 to 50 meters. Thus this highly successful and highly productive coral is not a photoautotroph. Exogenous sources of carbon in the form of zooplankton feeding or the utilization of particulate or detrital matter (Lewis, 1976) must be invoked to explain the success and survival of this major frame-building species.

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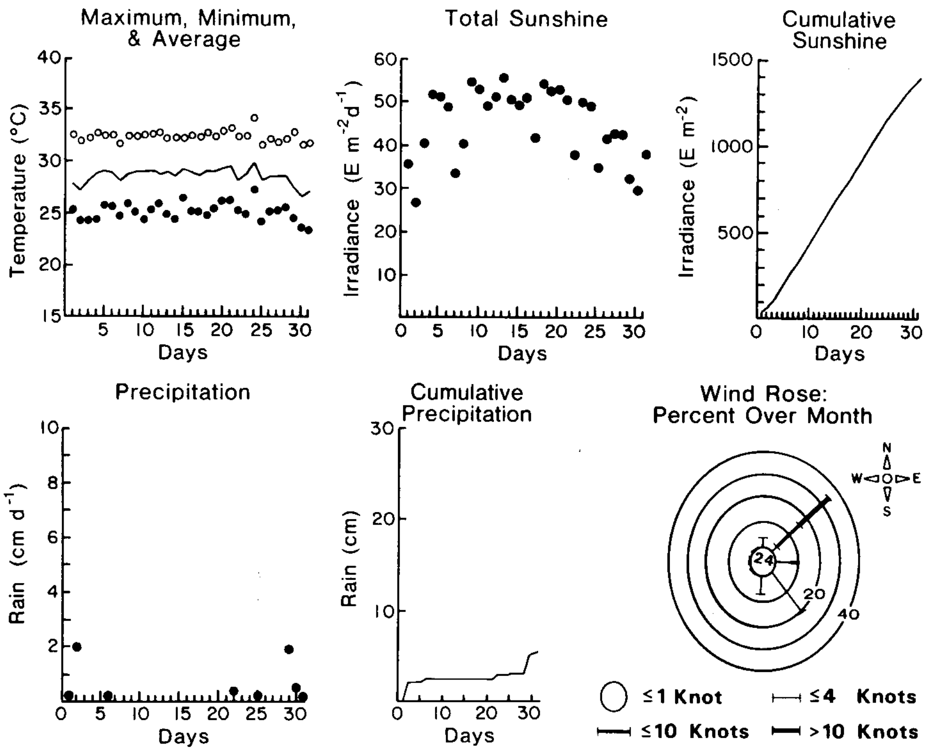
Climatological Data for Discovery Bay, Jamaica
Monthly Summary for August, 1983

Day	Temperature (°C) Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light E/m²/d
1	27.7	32.5	1408	25.1	434	0.2	255	2.9	2.6	9.3	1326	35.4
2	27.0	31.9	1329	24.2	1517	2.0	319	2.6	2.5	10.1	1406	26.3
3	28.0	32.1	1538	24.1	543	0.0	301	3.0	2.8	11.1	1039	40.1
4	28.7	32.6	1404	24.2	401	0.0	285	4.3	4.2	10.2	1545	51.5
5	29.1	32.4	1122	25.6	447	0.0	296	3.6	3.5	10.1	1110	50.8
6	28.8	32.4	1408	25.5	2358	0.2	240	3.5	3.3	11.4	1827	48.6
7	28.0	31.7	1228	24.6	457	0.0	237	2.6	2.4	10.6	1208	33.3
8	28.8	32.3	1458	25.8	133	0.0	282	4.4	4.2	11.3	1455	40.1
9	28.9	32.4	1206	24.9	448	0.0	291	3.4	3.2	7.8	1734	54.4
10	28.9	32.5	1509	24.2	519	0.0	295	4.8	4.6	11.3	1335	52.6
11	28.9	32.6	1336	25.2	600	0.0	269	3.6	3.4	8.0	1322	48.8
12	28.7	32.7	1524	25.8	309	0.0	236	2.1	2.0	6.3	1657	51.0
13	28.9	32.2	1502	24.8	534	0.0	226	3.8	3.6	8.6	1549	55.4
14	28.5	32.3	1252	24.2	555	0.0	210	2.7	2.5	6.7	1522	50.3
15	29.1	32.2	1109	26.4	530	0.0	268	3.3	3.2	8.0	1350	49.0
16	28.8	32.5	1315	25.1	523	0.0	252	3.9	3.7	9.5	1533	50.9
17	28.6	32.4	1300	25.0	410	0.0	224	3.0	2.8	7.2	807	41.5
18	29.0	32.7	1421	24.6	602	0.0	237	4.3	4.1	12.0	1402	54.1
19	29.0	32.3	1156	25.4	253	0.0	217	4.5	4.3	10.7	1443	52.3
20	29.3	32.9	1348	26.0	559	0.0	290	2.7	2.6	6.1	1530	52.7
21	29.5	33.2	1123	26.1	514	0.0	252	2.8	2.7	6.4	1411	50.2
22	28.1	32.4	1249	25.1	2359	0.4	306	2.9	2.7	11.2	1344	37.4
23	28.8	32.4	1301	24.8	348	0.0	278	5.1	4.9	12.7	1238	49.6
24	29.9	34.2	1319	27.1	243	0.0	275	3.6	3.5	7.6	950	48.8
25	28.2	31.6	1130	24.1	557	0.2	269	3.4	3.2	8.4	30	34.4
26	28.5	32.3	1321	25.1	543	0.0	253	3.4	3.2	9.1	1223	41.4
27	28.5	31.9	1202	25.1	521	0.0	300	3.3	3.1	8.9	1420	42.3
28	28.6	32.2	1450	25.4	536	0.0	288	2.3	2.1	5.3	1225	42.1
29	27.4	32.9	1055	24.5	2358	1.9	216	1.7	1.5	4.4	1332	32.0
30	26.5	31.6	1120	23.5	511	0.4	251	1.8	1.6	9.3	1235	29.2
31	27.1	31.7	1307	23.3	614	0.1	301	3.1	2.9	10.2	1511	37.7

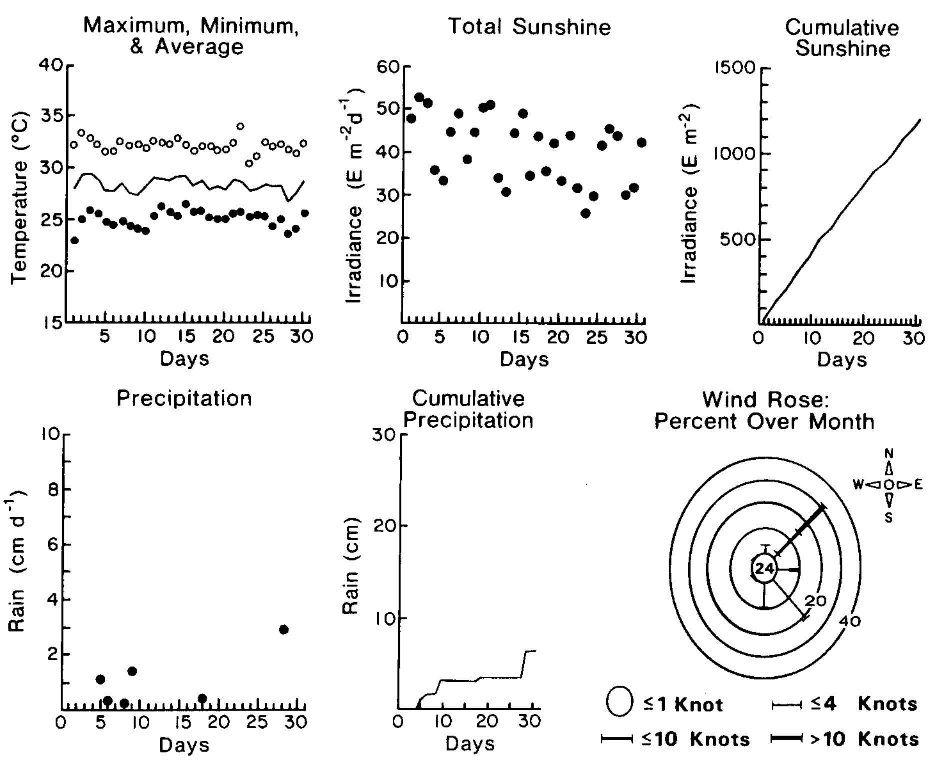
Monthly Summary For September, 1983

Day	Ave	Max	Time	Min	Time	Rain (cm)	Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light E/m²/d
1	28.1	32.3	1408	22.9	533	0.0	276	5.2	5.0	10.1	1459	47.1
2	29.4	33.4	1349	24.9	541	0.0	285	5.3	5.1	11.8	1511	52.2
3	29.4	32.8	1632	25.8	547	0.0	282	4.8	4.6	12.4	1421	50.6
4	28.8	32.2	1427	25.4	505	0.0	272	4.3	4.1	10.8	1351	35.1
5	27.6	31.5	1240	24.6	344	1.1	209	2.7	2.4	12.6	317	32.6
6	27.7	31.5	1340	24.4	519	0.3	210	2.9	2.7	7.1	1608	43.9
7	28.5	32.4	1419	24.8	450	0.0	247	2.7	2.5	6.6	1642	48.1
8	27.6	32.1	1323	24.3	531	0.2	182	2.5	2.1	8.7	1404	37.5
9	27.3	32.2	1232	24.0	539	1.4	258	3.1	2.8	10.2	1337	43.8
10	28.2	31.8	1356	23.8	505	0.0	296	4.2	4.1	8.8	1225	49.7
11	29.0	32.5	1251	25.2	513	0.0	291	3.5	3.4	7.7	1556	50.4
12	28.9	32.4	1412	26.2	606	0.0	305	3.4	3.2	10.6	1323	33.2
13	28.8	32.2	1104	25.7	350	0.0	286	4.2	3.9	10.2	1351	30.0
14	29.2	32.8	1443	25.2	456	0.0	278	4.7	4.5	12.3	1325	43.6
15	29.3	32.3	1411	26.4	27	0.0	289	4.2	4.0	9.1	1221	48.2
16	28.3	31.6	1545	25.7	538	0.0	276	3.2	3.0	9.6	1522	33.7
17	28.8	31.9	1224	25.7	233	0.0	263	4.1	3.9	9.9	1658	42.9
18	27.9	32.0	1034	25.1	2355	0.3	301	3.0	2.8	9.9	1247	34.8
19	28.2	31.5	1337	24.9	319	0.0	292	3.4	3.2	8.8	1531	41.3
20	27.9	31.7	1230	24.9	514	0.0	247	2.2	2.0	6.9	1317	32.5
21	28.8	32.4	1130	25.5	609	0.0	214	3.1	2.9	6.3	921	43.1
22	28.6	33.9	1438	25.5	426	0.0	237	2.7	2.4	10.6	1202	30.9
23	27.8	30.3	1054	25.1	549	0.0	287	3.3	3.1	8.8	905	24.8
24	28.0	31.1	1338	25.3	550	0.0	247	3.4	3.2	8.1	1419	29.0
25	28.4	32.4	1300	25.1	448	0.0	272	2.7	2.5	5.9	1526	40.9
26	28.2	32.0	1251	24.2	603	0.0	206	2.5	2.3	6.9	1530	44.7
27	28.4	32.3	1303	24.9	521	0.0	239	2.6	2.4	7.1	1326	43.0
28	26.7	31.7	1136	23.4	1445	2.9	229	2.2	1.9	8.6	1425	29.1
29	27.5	31.4	1333	24.0	520	0.1	256	3.2	3.0	8.3	1631	30.9
30	28.7	32.3	1206	25.4	437	0.0	243	3.1	2.9	7.5	1544	41.5

Discovery Bay, Jamaica Monthly Summary for August, 1983.



Discovery Bay, Jamaica Monthly Summary for September, 1983.



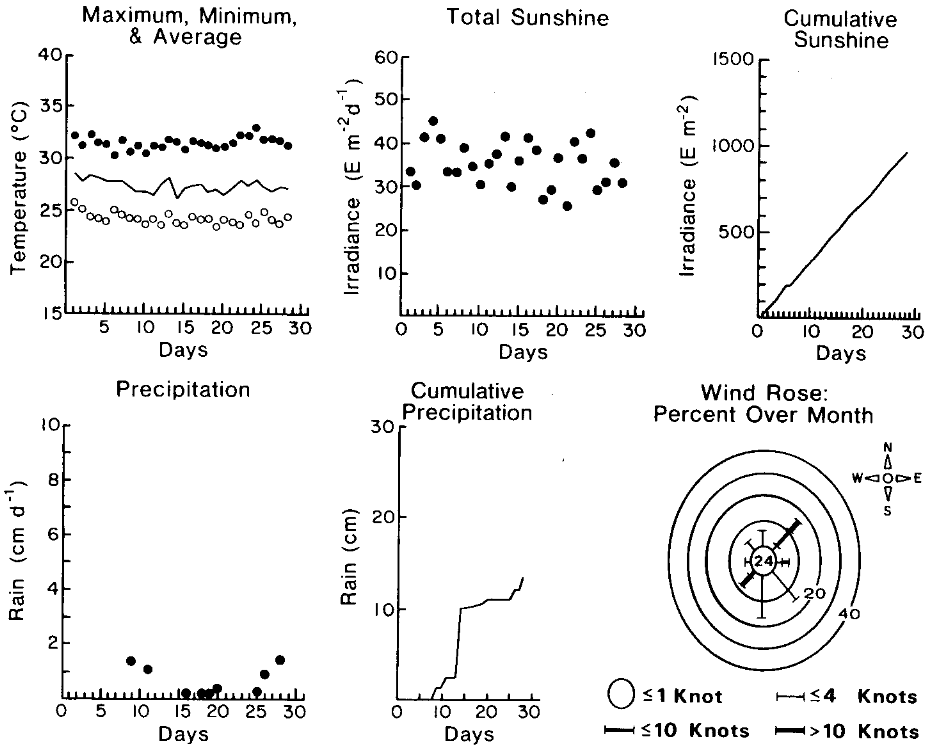
Climatological Data for Discovery Bay, Jamaica
Monthly Summary for October, 1983

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	28.6	32.3	1208	25.8	208	0.0	241	2.8	2.6	8.7	1328	33.2
2	27.9	31.4	908	25.1	2400	0.0	278	3.4	3.2	10.0	1101	29.9
3	28.4	32.4	1359	24.4	554	0.0	268	4.4	4.3	10.8	1546	41.0
4	28.2	31.7	1313	24.3	618	0.0	296	4.1	4.0	9.0	1523	44.8
5	27.9	31.5	1126	24.0	350	0.0	257	3.2	3.1	9.0	1440	40.8
6	27.8	30.4	1617	25.1	2224	0.0	193	2.7	2.5	11.1	1631	34.4
7	27.9	31.9	1142	24.6	522	0.0	135	2.8	2.6	7.6	1429	33.6
8	27.3	30.8	925	24.3	553	0.0	139	2.1	1.9	4.5	1524	38.2
9	26.8	31.4	1204	24.3	522	1.3	145	2.3	2.2	7.4	1427	34.4
10	26.8	30.7	1207	23.7	446	0.0	137	2.6	2.4	7.5	1535	30.4
11	26.6	31.4	1243	24.2	304	1.1	144	2.8	2.6	9.2	1310	34.9
12	27.6	31.3	1309	23.7	339	0.0	123	4.0	3.9	9.8	1509	37.3
13	28.3	31.9	1447	24.8	343	0.0	128	3.7	3.5	9.4	1453	41.3
14	26.3	31.7	1314	23.9	2400	7.5	171	1.8	1.5	8.1	503	29.8
15	27.2	31.0	1355	23.7	351	0.0	128	2.2	2.1	5.1	1209	36.0
16	27.5	31.7	1255	24.5	525	0.2	146	2.5	2.3	6.0	1612	41.3
17	27.6	31.6	1239	24.2	555	0.0	140	2.2	2.0	4.9	1220	38.2
18	26.9	31.4	1124	24.3	2346	0.2	158	2.2	1.9	5.8	1317	26.5
19	27.1	31.1	1206	23.6	603	0.2	144	2.1	1.9	4.6	1643	28.2
20	26.7	31.2	1402	24.2	408	0.4	144	3.1	2.9	8.5	1123	36.6
21	27.2	31.6	1402	24.0	607	0.0	142	2.3	2.0	9.4	1227	25.3
22	28.0	32.4	1234	23.7	602	0.0	161	2.3	2.2	5.4	1647	40.2
23	27.5	32.3	1244	24.7	304	0.0	144	2.3	2.2	5.8	1541	37.1
24	28.0	33.0	1114	24.0	607	0.0	129	2.7	2.5	7.5	1721	41.9
25	27.3	31.9	1010	25.0	2324	0.1	156	2.2	2.0	8.1	1500	29.6
26	26.9	32.0	1223	24.3	622	0.9	158	1.9	1.7	4.8	1419	30.9
27	27.4	31.8	1254	23.9	604	0.0	141	2.1	1.9	6.0	1419	35.4
28	27.3	31.4	945	24.5	603	1.4	133	3.2	3.0	13.7	1446	30.7
29	No record											
30	No record											
31	No record											

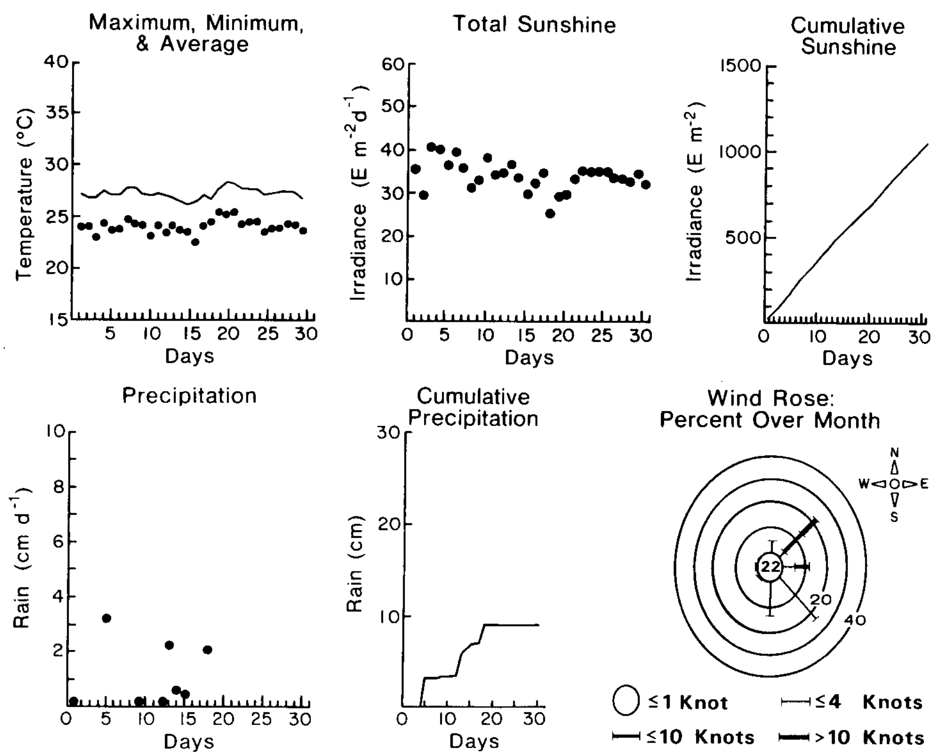
Monthly Summary for November, 1983

Day	Ave	Max	Time	Min	Time	Rain (cm)	Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	27.1			23.7	123	0.1	111	3.2	3.1	7.9	946	35.7
2	26.8			23.8	2312	0.0	141	2.1	2.0	4.9	1718	29.3
3	26.8			22.8	551	0.0	130	2.1	2.0	5.5	1304	40.9
4	27.5			24.0	717	0.0	131	2.9	2.8	6.3	1048	40.4
5	27.1			23.4	655	3.2	126	2.9	2.6	7.8	1943	36.8
6	27.1			23.6	644	0.0	141	2.3	2.2	5.2	1514	39.8
7	27.8			24.5	722	0.0	133	3.6	3.5	8.5	1302	36.3
8	27.8			24.0	725	0.0	161	1.3	1.1	4.0	2031	31.3
9	27.1			23.9	713	0.2	181	1.5	1.3	4.3	1458	33.0
10	27.0			22.8	406	0.0	142	1.6	1.4	3.5	744	38.4
11	27.2			23.9	36	0.0	149	1.7	1.5	4.7	1729	34.4
12	27.0			23.2	634	0.2	198	1.4	1.2	4.1	1605	35.0
13	26.8			23.7	618	2.3	147	2.0	1.8	5.0	1825	36.8
14	26.4			23.4	730	0.6	144	1.9	1.7	9.4	1733	33.6
15	26.0			23.2	432	0.5	148	2.5	2.3	7.7	1606	30.0
16	26.4			22.1	634	0.0	176	1.9	1.6	8.6	1654	32.4
17	27.0			23.8	533	0.0	129	2.5	2.3	7.2	1710	35.0
18	26.6			24.2	709	2.1	126	3.3	3.1	9.2	1141	25.0
19	27.8			25.2	9	0.0	116	3.9	3.7	10.1	1506	29.0
20	28.3			24.9	724	0.0	117	4.0	3.8	8.2	1651	29.8
21	28.1			25.2	719	0.0	126	3.5	3.3	7.7	1407	33.4
22	27.7			23.9	654	0.0	131	3.7	3.6	9.2	1624	35.4
23	27.5			24.2	408	0.0	131	3.4	3.2	8.7	1603	35.3
24	27.5			24.3	211	0.0	133	3.6	3.4	8.4	1624	35.4
25	27.1			23.2	554	0.0	126	2.7	2.6	5.3	1757	35.1
26	27.2			23.5	443	0.0	123	3.9	3.8	8.8	1532	33.7
27	27.4			23.6	432	0.0	130	4.1	3.9	9.5	1428	33.5
28	27.4			24.0	704	0.0	132	3.8	3.6	9.9	1507	32.8
29	27.2			23.9	711	0.0	121	3.8	3.6	9.0	1347	34.7
30	26.6			23.4	224	0.0	127	3.4	3.2	8.6	1708	32.2

Discovery Bay, Jamaica Monthly Summary for October, 1983.



Discovery Bay, Jamaica Monthly Summary for November, 1983.



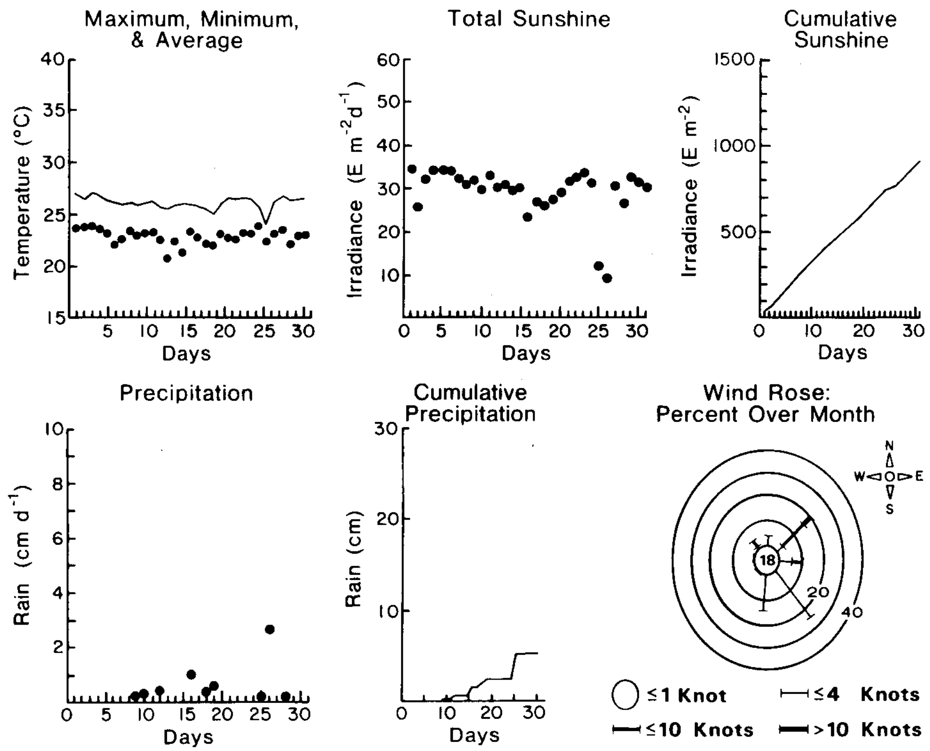
Climatological Data for Discovery Bay, Jamaica
Monthly Summary for December, 1983

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	27.1			23.7	548	0.0	131	3.5	3.3	7.7	1530	34.8
2	26.6			23.9	556	0.0	128	2.5	2.3	7.2	1736	25.8
3	27.2			24.0	37	0.0	124	3.6	3.5	9.0	1454	32.4
4	27.0			23.6	744	0.0	127	3.2	3.0	7.0	1800	34.4
5	26.5			23.2	722	0.0	129	3.5	3.3	7.6	1213	34.5
6	26.2			22.0	733	0.0	132	2.6	2.4	5.0	1259	34.2
7	26.0			22.6	446	0.0	139	2.0	1.8	5.1	1711	32.5
8	26.3			23.4	25	0.0	125	2.5	2.3	7.0	1039	30.8
9	26.0			22.9	257	0.1	131	2.3	2.1	7.6	1606	32.0
10	26.1			23.3	517	0.2	127	2.5	2.2	7.0	1114	29.8
11	26.3			23.3	301	0.0	128	2.7	2.5	5.9	1038	33.2
12	25.8			22.6	2359	0.3	240	2.3	2.1	4.4	1606	30.4
13	25.6			20.7	314	0.0	171	2.0	1.8	3.7	54	31.1
14	25.9			22.3	622	0.0	133	2.6	2.5	7.9	1529	29.5
15	26.0			21.3	604	0.0	118	2.8	2.6	8.7	1625	30.2
16	25.7			23.3	215	0.9	126	3.2	3.0	8.0	1151	23.5
17	25.7			22.7	616	0.0	141	2.3	2.1	7.6	1722	27.2
18	25.5			22.2	2319	0.3	138	2.6	2.4	8.9	1152	26.2
19	25.0			21.9	607	0.6	150	2.5	2.2	7.9	1419	28.0
20	26.0			23.1	644	0.0	140	2.9	2.7	7.3	1438	29.7
21	26.5			22.8	650	0.0	130	3.5	3.3	8.0	1658	32.4
22	26.5			22.6	553	0.0	128	3.4	3.3	9.2	1618	32.9
23	26.7			23.3	551	0.0	128	2.6	2.5	5.6	1622	33.3
24	26.4			23.2	613	0.0	141	2.1	1.9	5.2	1452	31.2
25	25.8			23.9	239	0.1	264	4.1	3.5	11.2	2210	11.7
26	24.0			22.4	1021	2.6	274	3.5	3.0	10.2	16	9.0
27	26.3			23.2	208	0.0	101	5.1	4.9	10.8	1446	30.6
28	26.8			23.6	650	0.1	118	4.1	4.0	11.0	1317	26.7
29	26.4			22.2	654	0.0	128	4.1	4.0	10.4	1334	32.9
30	26.5			23.0	2352	0.0	131	2.5	2.3	6.6	1310	31.9
31	26.6			23.1	632	0.0	211	2.5	2.2	5.4	1839	30.5

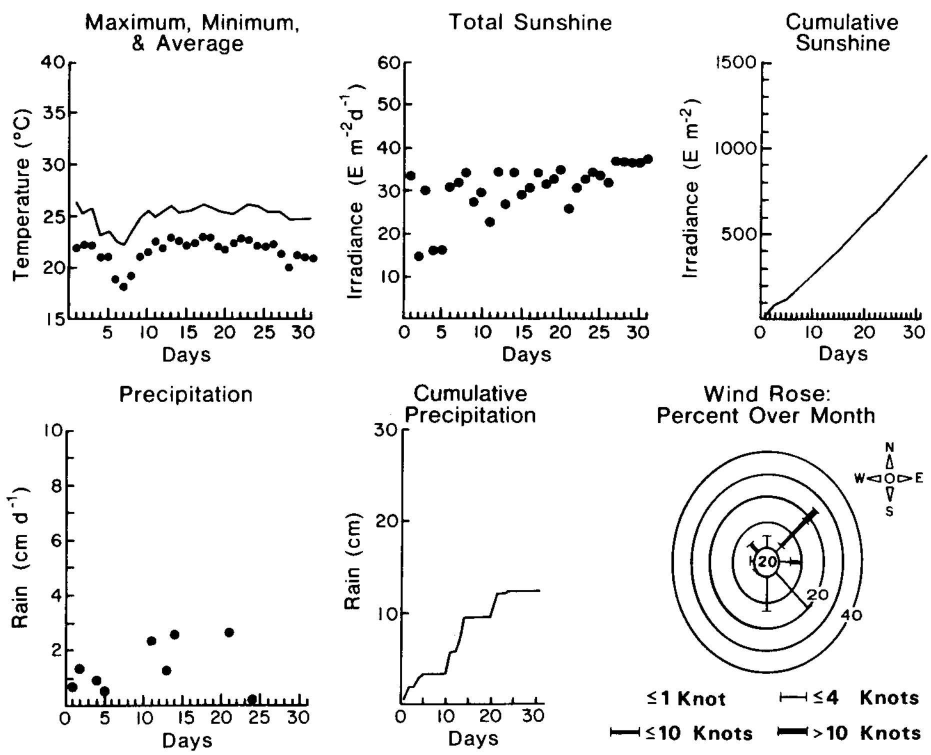
Monthly Summary for January, 1984

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	26.6			22.0	2314	0.6	164	2.7	2.3	10.4	1924	33.7
2	25.3			22.3	139	1.3	86	3.9	3.6	8.5	1008	14.8
3	25.8			22.1	2354	0.0	94	3.9	3.6	6.9	1530	30.3
4	23.1			21.0	834	0.9	176	2.4	2.1	6.9	844	16.1
5	23.6			21.0	240	0.5	295	4.3	4.0	8.6	2328	16.2
6	22.7			18.9	2356	0.0	303	4.2	3.7	9.7	125	31.0
7	22.3			18.1	636	0.0	137	2.2	2.0	4.5	1027	32.3
8	23.6			19.2	643	0.0	144	2.7	2.6	5.8	1541	34.2
9	24.9			21.0	335	0.0	131	3.2	3.1	8.9	1411	27.5
10	25.5			21.4	700	0.0	139	2.5	2.4	7.9	1608	29.4
11	24.8			22.6	2302	2.4	185	1.7	1.5	6.8	1502	22.7
12	25.4			21.9	343	0.0	135	2.4	2.3	6.6	1542	34.5
13	25.9			22.9	2352	1.3	116	3.7	3.4	8.0	1350	27.0
14	25.4			22.6	146	2.6	124	2.8	2.5	7.6	1610	34.5
15	25.4			22.1	613	0.0	136	2.5	2.4	7.0	1337	29.0
16	25.7			22.4	645	0.0	139	2.4	2.3	6.8	1022	30.7
17	26.1			22.9	652	0.0	128	3.3	3.2	7.6	1235	34.4
18	25.8			22.9	702	0.0	134	3.8	3.6	10.6	1552	31.6
19	25.6			21.9	2225	0.0	133	3.6	3.5	10.7	1221	33.0
20	25.5			21.8	559	0.0	126	2.6	2.5	7.0	1652	34.9
21	25.2			22.4	805	2.7	133	2.6	2.3	6.2	716	25.9
22	25.9			22.8	2351	0.0	137	2.9	2.8	9.1	1540	30.8
23	26.2			22.7	120	0.0	119	4.1	4.0	8.7	932	32.7
24	26.1			22.2	2253	0.2	111	4.4	4.2	9.4	325	34.3
25	25.5			22.1	655	0.0	128	3.3	3.1	6.9	1213	34.0
26	25.6			22.3	2323	0.0	133	3.7	3.5	10.0	1354	32.1
27	25.5			21.3	552	0.0	133	3.7	3.5	9.3	1531	37.0
28	24.8			20.0	236	0.0	141	2.1	2.0	4.4	1314	36.9
29	24.8			21.2	630	0.0	129	2.0	1.9	4.1	1715	36.7
30	24.8			20.9	447	0.0	136	3.0	2.8	7.0	1600	36.6
31	24.9			29.9	23	0.0	124	2.9	2.8	5.7	1205	37.5

Discovery Bay, Jamaica Monthly Summary for December, 1983.



Discovery Bay, Jamaica Monthly Summary for January, 1984.



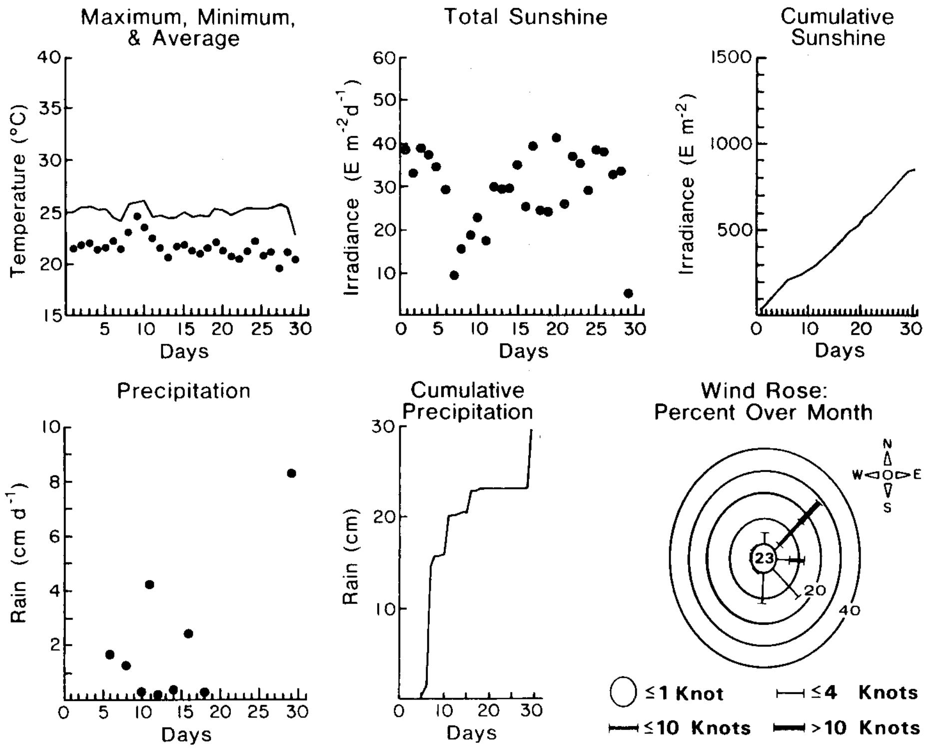
Climatological Data for Discovery Bay, Jamaica
Monthly Summary for February, 1984

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	Mean Wind Vector m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	25.2			21.6	228	0.0	137	3.3	3.2	7.1	1542	38.1
2	25.6			21.9	623	0.0	129	3.4	3.3	8.1	1203	32.9
3	25.6			22.1	620	0.0	134	2.8	2.6	5.8	1038	38.6
4	25.4			21.5	556	0.0	141	2.4	2.2	5.7	1602	37.2
5	25.3			21.6	508	0.0	137	1.9	1.7	4.8	1622	34.5
6	24.5			22.3	2353	1.6	147	2.0	1.8	7.9	1438	29.0
7	24.2			21.6	555	13.0	117	3.3	2.8	7.0	1332	9.4
8	25.9			23.2	1036	1.2	62	6.5	6.2	10.3	1211	15.5
9	26.0			24.7	2315	0.0	72	6.7	6.4	9.8	2350	18.7
10	26.2			23.7	102	0.2	83	8.0	7.7	12.9	1041	22.7
11	24.7			22.6	1923	4.2	98	5.1	4.9	11.1	555	17.2
12	24.8			21.7	520	0.1	133	3.3	3.1	9.2	1216	29.7
13	24.5			20.7	557	0.0	136	2.5	2.3	10.1	1453	29.1
14	24.6			21.7	608	0.3	159	1.8	1.6	6.1	1614	29.3
15	25.1			21.9	115	0.0	137	2.4	2.2	7.7	1426	34.7
16	24.5			21.4	2400	2.4	138	2.5	2.4	7.0	1022	25.0
17	24.8			21.0	26	0.0	131	2.2	2.0	4.3	1448	39.2
18	24.6			21.7	644	0.2	133	2.8	2.7	8.1	1351	24.2
19	25.4			22.3	2400	0.0	128	2.3	2.1	9.0	1304	24.1
20	25.3			21.4	340	0.0	137	3.5	3.2	10.3	1440	41.1
21	24.7			20.9	506	0.0	138	3.2	3.0	8.7	1442	25.9
22	25.2			20.6	526	0.0	134	3.3	3.1	10.3	1409	36.8
23	25.4			21.4	605	0.0	133	3.4	3.2	9.2	1651	35.1
24	25.4			22.3	2400	0.0	139	3.2	3.0	9.7	1143	28.9
25	25.3			20.9	616	0.0	137	3.2	3.1	10.0	1500	38.2
26	25.4			21.3	640	0.0	135	2.9	2.7	9.0	1346	37.7
27	25.8			19.8	611	0.0	135	2.5	2.2	7.4	1351	32.5
28	25.4			21.2	635	0.0	167	2.2	2.0	5.7	1309	33.4
29	22.7			20.5	1017	8.3	308	4.6	3.6	11.1	445	5.1

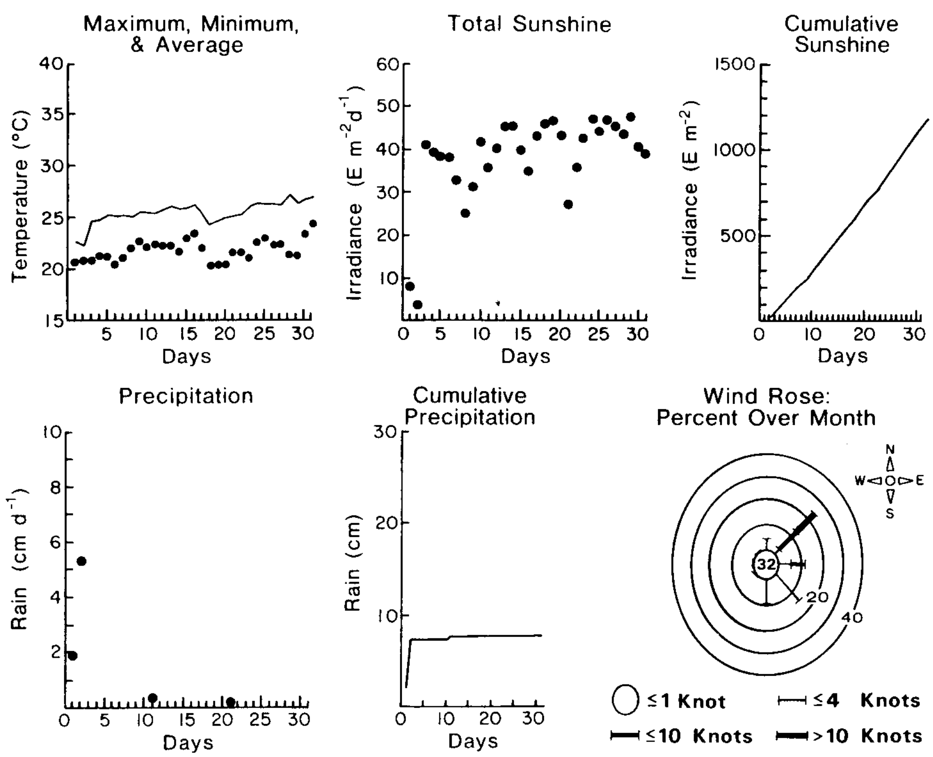
Monthly Summary for March, 1984

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	Mean Wind Vector m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	22.7			20.8	39	1.9	139	3.2	2.9	10.5	2248	7.9
2	22.3			20.8	2135	5.3	138	2.6	2.3	8.5	738	4.0
3	24.6			20.8	6	0.0	138	2.8	2.7	8.9	1510	41.1
4	24.9			21.3	226	0.0	138	2.4	2.3	7.9	1047	39.3
5	25.3			21.3	620	0.0	130	2.9	2.7	8.0	1526	38.5
6	25.2			20.5	521	0.0	146	2.9	2.7	9.1	1556	38.1
7	25.3			21.2	230	0.0	161	2.7	2.5	11.0	1412	32.8
8	25.1			22.1	259	0.0	159	1.7	1.5	5.1	849	25.2
9	25.6			22.8	236	0.0	134	1.9	1.8	7.3	1123	31.2
10	25.5			22.1	638	0.0	136	2.5	2.4	7.7	1309	41.5
11	25.5			22.4	2307	0.3	132	2.6	2.5	6.8	1149	35.5
12	25.8			22.3	251	0.0	120	3.7	3.6	10.4	1349	40.1
13	26.1			22.3	627	0.0	125	3.4	3.2	9.0	1435	45.1
14	25.9			21.7	336	0.0	123	2.1	2.0	5.5	1432	45.1
15	26.0			22.9	515	0.0	111	3.6	3.4	7.9	1707	39.6
16	26.3			23.4	2257	0.0	96	5.8	5.6	10.2	356	34.4
17	25.6			22.0	2127	0.0	110	3.8	3.6	7.3	1158	42.9
18	24.3			20.3	2302	0.0	131	3.5	3.3	7.9	1403	45.8
19	24.7			20.4	336	0.0	128	4.1	3.9	7.7	1121	46.5
20	25.0			20.5	545	0.0	136	3.4	3.3	10.1	1546	43.0
21	25.2			21.6	616	0.1	165	2.2	2.0	7.4	1318	27.0
22	25.3			21.6	612	0.0	129	3.2	3.1	11.4	1232	35.8
23	26.2			21.0	501	0.0	140	2.7	2.5	9.5	1239	42.4
24	26.4			22.6	554	0.0	151	2.0	1.8	5.6	1607	46.8
25	26.4			22.9	433	0.0	132	2.6	2.5	7.6	1514	44.2
26	26.4			22.3	542	0.0	127	2.5	2.3	7.1	1538	47.0
27	26.3			22.4	454	0.0	128	3.3	3.0	8.8	1629	45.6
28	27.3			21.4	558	0.0	152	2.1	1.8	7.3	1217	43.8
29	26.4			21.3	529	0.0	122	1.9	1.6	5.5	858	47.7
30	26.9			23.4	551	0.0	123	1.7	1.6	3.8	212	40.8
31	27.1			24.3	2359	0.0	146	1.6	1.5	4.4	1508	39.2

Discovery Bay, Jamaica Monthly Summary for February, 1984.



Discovery Bay, Jamaica Monthly Summary for March, 1984.



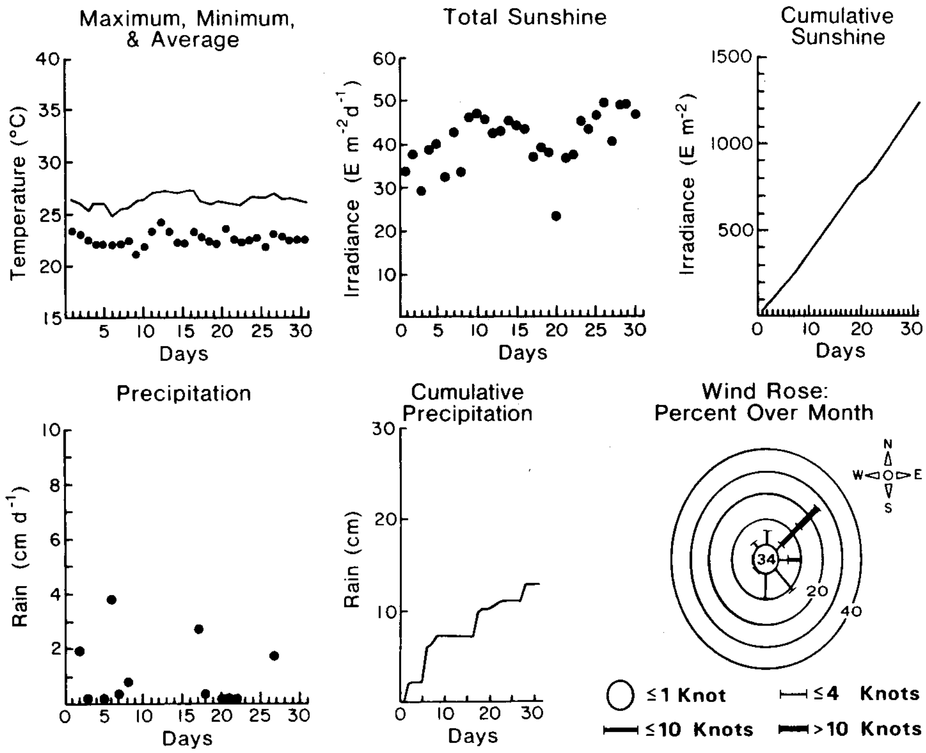
Climatological Data for Discovery Bay, Jamaica
Monthly Summary for April, 1984

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	26.4			23.4	604	0.0	261	2.2	2.0	4.7	1607	34.1
2	26.0			23.0	2355	2.0	150	2.4	2.2	6.9	1549	38.2
3	25.4			22.6	124	0.1	143	2.8	2.6	9.7	1514	29.7
4	26.3			22.1	527	0.0	128	3.3	3.1	9.2	1510	39.2
5	26.3			22.1	458	0.1	156	1.4	1.3	3.6	921	40.3
6	24.8			22.0	546	3.9	165	1.6	1.4	4.4	1336	33.1
7	25.5			22.2	542	0.4	134	2.2	2.0	6.6	1610	43.3
8	25.7			22.4	232	0.8	118	4.4	4.3	12.7	1709	34.2
9	26.4			21.2	335	0.0	144	2.6	2.4	8.5	1532	46.6
10	26.5			21.9	331	0.0	151	1.5	1.3	3.8	1200	47.5
11	27.2			23.4	606	0.0	124	2.2	2.1	5.0	1351	46.0
12	27.3			24.3	251	0.0	123	2.8	2.5	5.6	1804	43.0
13	27.2			23.4	332	0.0	131	2.9	2.7	7.7	1308	43.4
14	27.1			22.3	550	0.0	128	2.9	2.6	9.3	1559	45.9
15	27.3			22.2	551	0.0	149	2.2	1.9	8.0	1327	44.6
16	27.3			23.4	556	0.0	155	2.3	2.1	6.5	1044	43.8
17	26.3			22.9	2346	2.8	222	2.2	1.9	7.9	2034	37.2
18	26.1			22.4	253	0.3	176	2.2	1.9	6.3	2023	39.7
19	26.4			22.3	336	0.0	131	3.5	3.4	9.3	1608	38.5
20	26.1			23.6	2343	0.2	124	2.6	2.4	8.4	1550	23.5
21	26.0			22.5	345	0.3	129	2.6	2.5	7.9	906	37.3
22	25.9			22.3	521	0.2	134	1.7	1.5	6.2	1503	38.0
23	26.7			22.5	404	0.0	124	2.8	2.7	9.6	1619	45.4
24	26.7			22.7	558	0.0	122	2.1	1.9	7.9	1707	43.8
25	26.6			22.0	407	0.0	126	2.8	2.6	8.9	1614	46.9
26	27.1			23.1	539	0.0	120	2.9	2.7	7.6	1459	50.0
27	26.6			22.9	607	1.8	122	3.5	3.3	9.1	1522	41.1
28	26.6			22.4	2246	0.0	105	5.6	5.4	9.5	903	49.3
29	26.4			22.6	36	0.0	116	4.3	4.1	9.1	1709	49.4
30	26.2			22.6	2144	0.0	115	4.3	4.2	8.4	1540	47.2

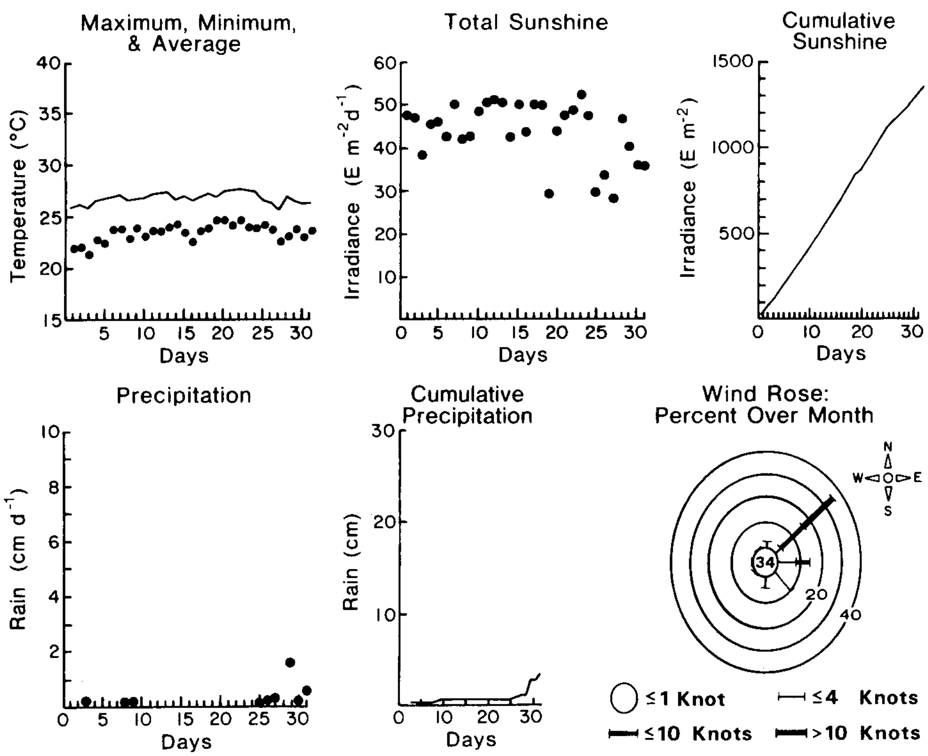
Monthly Summary for May, 1984

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	26.1			22.1	2355	0.0	119	4.1	3.9	9.5	1054	47.6
2	26.4			22.1	3	0.0	118	3.6	3.4	8.4	917	47.1
3	26.0			21.4	503	0.2	127	4.3	4.1	11.4	1246	38.4
4	26.8			22.8	531	0.0	118	4.1	4.0	10.7	1413	45.6
5	27.0			22.5	530	0.0	121	4.1	3.9	11.0	1409	46.0
6	27.2			23.9	258	0.0	110	3.8	3.7	8.7	1602	42.8
7	27.4			23.9	57	0.0	124	3.8	3.6	9.9	1407	50.3
8	26.9			22.9	546	0.1	129	2.4	2.3	8.2	1527	42.1
9	26.9			24.0	2222	0.2	133	2.6	2.4	7.6	1452	42.9
10	27.1			23.2	543	0.0	117	2.9	2.7	7.6	1455	48.5
11	27.5			23.7	536	0.0	118	2.7	2.6	6.8	1508	50.7
12	27.5			23.7	538	0.0	120	2.9	2.7	6.9	1400	51.2
13	27.6			24.0	543	0.0	118	3.1	2.9	8.5	1018	50.7
14	26.9			24.4	2350	0.0	126	2.6	2.4	7.5	1520	42.6
15	27.2			23.5	521	0.0	122	2.9	2.8	7.2	1142	50.1
16	26.8			22.7	540	0.0	126	2.8	2.7	7.9	856	43.8
17	27.1			23.7	528	0.0	128	3.2	3.1	8.4	1158	50.0
18	27.4			24.0	515	0.0	117	4.0	3.9	9.1	1335	50.5
19	27.1			24.7	56	0.0	103	4.3	4.1	8.9	1211	29.4
20	27.7			24.7	533	0.0	102	4.1	4.0	10.2	1450	44.1
21	27.8			24.2	535	0.0	110	5.1	4.9	11.3	1305	47.7
22	27.9			24.7	456	0.0	108	4.4	4.3	9.8	1406	49.0
23	27.7			24.0	502	0.0	117	3.6	3.5	9.5	1547	52.4
24	27.6			23.9	528	0.0	116	3.1	3.0	7.7	1550	47.6
25	26.8			24.3	2356	0.1	129	3.0	2.8	10.8	1432	29.7
26	26.5			23.8	401	0.2	131	3.0	2.8	9.8	1336	33.7
27	25.8			22.6	515	0.3	120	3.2	3.0	10.9	1315	28.3
28	27.2			23.1	541	0.0	116	4.1	3.9	10.7	1458	46.8
29	26.6			23.9	431	1.6	165	2.7	2.5	10.6	1406	40.4
30	26.4			23.0	544	0.1	144	2.6	2.4	9.5	1307	36.1
31	26.4			23.7	338	0.6	143	1.3	1.1	5.4	1540	36.1

Discovery Bay, Jamaica Monthly Summary for April, 1984.



Discovery Bay, Jamaica Monthly Summary for May, 1984.



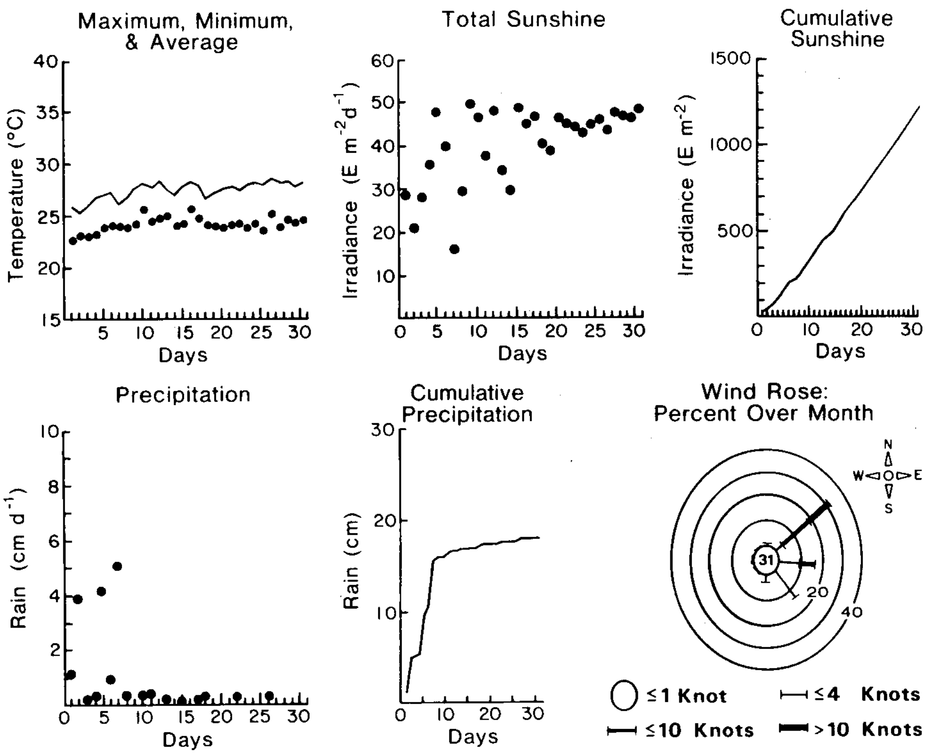
Climatological Data for Discovery Bay, Jamaica
Monthly Summary for June, 1984

Day	Temperature °C Ave	Max	Time	Min	Time	Rain (cm)	Mean Wind Vector Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	26.2			22.9	513	1.1	188	1.1	0.9	3.3	1022	28.8
2	25.5			23.3	2400	3.9	168	1.6	1.4	7.5	1213	21.1
3	26.2			23.1	430	0.1	148	1.5	1.4	6.1	1224	28.2
4	27.0			23.4	453	0.3	126	1.8	1.6	5.2	1543	35.6
5	27.4			24.1	1730	4.2	122	3.0	2.8	9.0	2238	47.7
6	27.6			24.3	538	0.9	98	4.5	4.3	10.2	656	40.1
7	26.3			24.2	618	5.1	107	3.2	3.0	8.9	1505	16.1
8	27.0			24.0	442	0.3	136	2.2	2.1	7.7	1445	29.5
9	28.0			24.3	503	0.0	114	3.6	3.5	8.0	1414	49.8
10	28.4			25.9	609	0.3	98	3.8	3.6	8.4	1721	46.8
11	28.0			24.6	224	0.4	103	4.5	4.3	12.2	243	37.7
12	28.7			24.9	546	0.0	103	4.1	4.0	8.3	2015	48.1
13	27.9			25.2	543	0.2	110	3.2	3.1	8.2	1317	34.3
14	27.2			24.2	526	0.0	133	2.0	1.8	9.1	1208	29.5
15	28.2			24.3	555	0.1	107	4.1	3.9	10.0	1432	48.8
16	28.7			25.7	54	0.0	110	4.6	4.5	10.5	1201	44.9
17	28.3			24.9	2357	0.2	106	3.1	3.0	7.9	1320	46.8
18	26.8			24.2	2133	0.3	137	2.7	2.5	10.1	1227	40.3
19	27.6			24.2	517	0.0	141	2.7	2.5	9.0	1310	38.8
20	27.9			24.0	541	0.0	121	3.4	3.3	8.0	1503	46.4
21	28.1			24.3	543	0.0	120	3.3	3.2	8.3	1542	45.0
22	27.7			24.4	520	0.3	129	2.7	2.5	11.0	1449	44.3
23	28.2			24.0	539	0.0	125	3.5	3.4	8.9	1604	42.9
24	28.4			24.4	531	0.0	133	3.0	2.9	9.0	1400	44.8
25	28.1			23.8	416	0.0	114	2.1	2.0	6.2	1522	46.1
26	28.8			25.4	551	0.3	116	2.6	2.5	7.1	1153	43.6
27	28.5			24.0	454	0.0	120	3.4	3.2	9.6	1416	47.5
28	28.6			24.7	527	0.0	112	3.8	3.6	7.9	1454	46.4
29	28.1			24.4	329	0.0	133	2.6	2.4	7.9	1540	46.2
30	28.5			24.7	200	0.0	125	3.9	3.7	9.7	1318	48.2

Monthly Summary for July, 1984

Day	Ave	Max	Time	Min	Time	Rain (cm)	Deg	m/s	Mean Wind Speed m/s	Max Wind Speed m/s	Time	Integ Light $E/m^2/d$
1	27.8			23.9	358	0.0	126	3.1	3.0	8.2	1104	45.3
2	28.2			25.0	430	0.0	112	4.7	4.5	12.2	1322	40.2
3	28.3			24.4	502	0.0	113	3.7	3.5	8.1	854	48.1
4	28.5			25.2	244	0.0	110	3.8	3.6	7.8	933	47.3
5	27.7			24.6	509	0.2	138	2.6	2.5	7.0	1238	43.6
6	27.5			23.8	556	0.1	130	3.3	3.1	9.9	1413	41.7
7	28.1			23.9	307	0.0	116	4.4	4.2	10.5	1625	44.0
8	27.2			24.2	1923	1.1	138	3.2	3.0	9.3	1349	37.3
9	27.8			23.3	235	0.0	121	3.4	3.3	8.0	1730	43.5
10	28.2			25.3	539	0.0	129	2.3	2.2	5.9	1243	38.5
11	28.0			24.7	558	0.0	129	2.4	2.3	7.7	1416	31.5
12	27.7			24.2	431	0.0	113	3.3	3.1	11.5	1420	37.7
13	28.4			25.0	404	0.0	121	4.3	4.1	9.8	1113	45.9
14	28.4			25.0	443	0.0	112	3.2	3.1	8.0	1734	44.7
15	28.3			24.9	510	0.0	125	2.5	2.3	6.5	1549	42.9
16	28.5			24.4	448	0.0	126	4.1	4.0	10.3	1408	45.3
17	28.4			25.0	455	0.0	118	3.8	3.6	9.5	1305	43.2
18	28.1			24.2	501	0.0	126	3.4	3.2	9.3	1557	38.4
19	28.1			24.1	601	0.0	139	3.5	3.3	9.3	1457	45.3
20	28.1			24.6	328	0.0	120	3.0	2.9	7.9	1610	45.9
21	28.0			25.0	442	0.0	135	3.1	3.0	8.0	1640	39.7
22	27.7			24.5	544	0.0	141	2.5	2.2	10.0	1350	34.9
23	27.7			23.7	511	0.0	120	3.3	3.1	8.0	1324	38.3
24	28.3			24.9	552	0.0	119	3.9	3.7	9.8	1502	48.1
25	28.3			25.5	721	0.1	118	2.5	2.4	7.4	1828	36.3
26	28.8			25.5	407	0.0	105	4.7	4.5	9.0	1416	38.2
27	28.0			24.4	410	0.6	106	5.5	5.3	12.5	1517	33.0
28	28.0			24.5	2400	0.0	118	4.2	4.0	10.5	1154	30.2
29	27.6			23.7	522	0.0	124	3.6	3.4	10.2	1414	43.4
30	28.3			24.4	537	0.0	128	3.6	3.4	9.9	1324	45.7
31	28.3			24.4	537	0.0	128	3.6	3.4	9.9	1324	43.5

Discovery Bay, Jamaica Monthly Summary for June, 1984.



Discovery Bay, Jamaica Monthly Summary for July, 1984.