

COMPARISON BETWEEN THE WEATHER AT BIRD ISLAND AND KING EDWARD POINT, SOUTH GEORGIA

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ABSTRACT. Recent meteorological observations at Bird Island (off the north-west extremity of South Georgia) have revealed climatological differences between it and the main meteorological station at King Edward Point, 67 miles (108 km.) away in Cumberland East Bay. A comparison of the data from both stations indicates that the drier, warmer and sunnier weather at King Edward Point is due to the close proximity of high mountain ranges. Although local topography interferes with the accurate recording of winds at both meteorological stations, it appears that the weather at Bird Island is more representative of the latitudes in which South Georgia is situated.

SOUTH GEORGIA lies between lat. 54° and 55° S., and long. 36° and 38° W., almost 1,100 miles (1,770 km.) due east of Cape Horn, in the great westerly wind belt commonly known as the "Roaring Forties". It is a narrow mountainous island, just over 100 miles (160 km.) long and varying from 3 to 25 miles (4.8 to 40 km.) wide, with its axis trending north-west to south-east. The highest mountain ranges, rising to between 6,000 and 9,000 ft. (1,830 and 2,745 m.), are generally separated by deep glacial valleys. Along the northern coast of the island the mountains are at their lowest and there are many offshore islets.

The currents from around Cape Horn and from the Weddell Sea displace the Antarctic Convergence from its position south of Cape Horn to a lower latitude north of South Georgia. The result of the Antarctic Convergence being in a south-west to north-east position to the west of South Georgia is that the prevailing westerly winds in these latitudes which carry relatively mild air are cooled by the sea surface, resulting in the formation of much low cloud and sea fog.

From a purely meteorological aspect, it is almost impossible to find a site on South Georgia which has an effective exposure in all directions. King Edward Point in Cumberland East Bay (Fig. 1), is about one of the least desirable in this respect, having high ground almost completely surrounding it and the highest ground to the west sheltering it from the prevailing

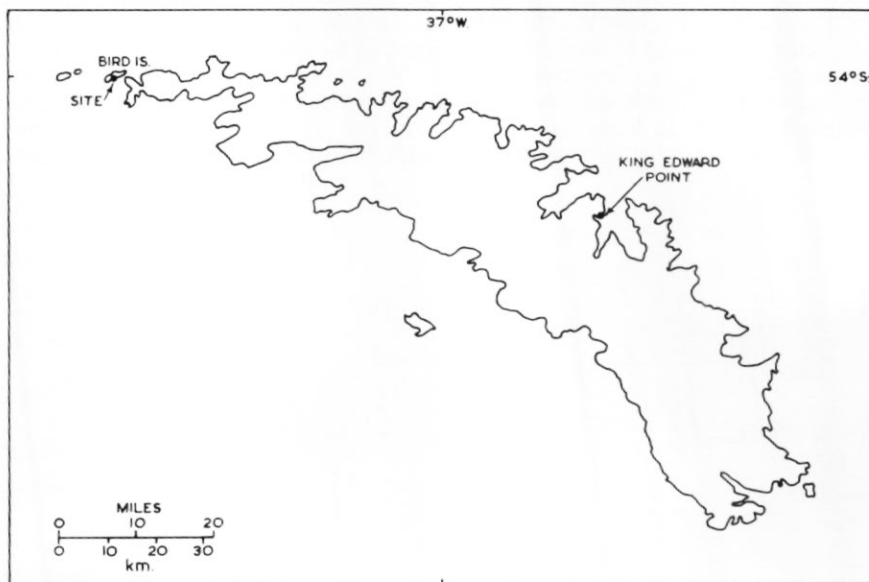


Fig. 1. Map of South Georgia and adjacent islands, showing the relative positions of the meteorological observation sites at Bird Island and King Edward Point.

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westerly winds. In some respects the site on Bird Island, off the extreme north-west tip of South Georgia (Fig. 1), is much better exposed but even so it is sheltered by high ground from north-west and north winds, and from east to south-east winds by the high ground of South Georgia.

During recent biological expeditions to Bird Island (Tickell and Cordall, 1960; Tickell, 1962; Tickell, Pinder and Clagg, 1965) routine meteorological observations were made. Continuous records were kept for the periods December 1958 to February 1959, February–March 1961 and January 1963 to February 1964. From the results of these observations at Bird Island the following comparison (Table I) has been made with King Edward Point, 67 miles (108 km.) away to the east-south-east on South Georgia.

From December 1958 to February 1959 and in February–March 1961 daily observations at Bird Island were made at 09.00 and 21.00 G.M.T. For the period January 1963 to February 1964 daily observations were made at 03.00, 09.00, 15.00 and 21.00 G.M.T., but after 2 November 1963 the 03.00 G.M.T. observation was replaced by one at 02.00 G.M.T. Daily observations at King Edward Point were made at 00.00, 03.00, 06.00, 09.00, 12.00, 15.00, 18.00 and 21.00 G.M.T.

The site of the meteorological station at King Edward Point has been described in detail by Pepper (1954, p. 116–17). At Bird Island the meteorological site was on the eastern shore of Freshwater Inlet in Jordan Cove, at the edge of a flat "meadow" about 100 yd. (91 m.) in diameter and surrounded by tussock slopes. Both the meteorological screen and the rain-gauge were sited in the middle of this "meadow". Roché Peak (1,199 ft.; 365 m.) and the ridge extending southwards from it effectively protect the site from all east-north-east and east winds. Winds from the west-south-west are comparatively unobstructed as there is only a slight ridge rising to about 200 ft. (61 m.) about 1 mile (1.6 km.) from the site. From south-west to south-south-east there is a clear exposure from the site seawards.

WIND DIRECTION

King Edward Point

With a gradient wind between south and west-north-west, King Edward Point lies in the lee of the highest part of the Allardyce Range which is about 8 to 12 miles (13 to 19 km.) away. If the gradient wind is sufficiently strong (greater than 15 kt. (7.7 m./sec.)), warm gusty surface winds result. Their onset is extremely sudden and the temperature may rise quickly as the cold stagnant air in King Edward Cove is swept away. On the 17 April 1951 such a rise in temperature amounted to no less than 12.2°C in 10 min. (Fig. 2). In most cases marked funnelling of the wind under these conditions gives rise to a west to north-west wind at King Edward Point. A south-west wind results only when the pressure gradient is steep and there is marked turbulence. Under stable conditions, with a south to south-west gradient, surface

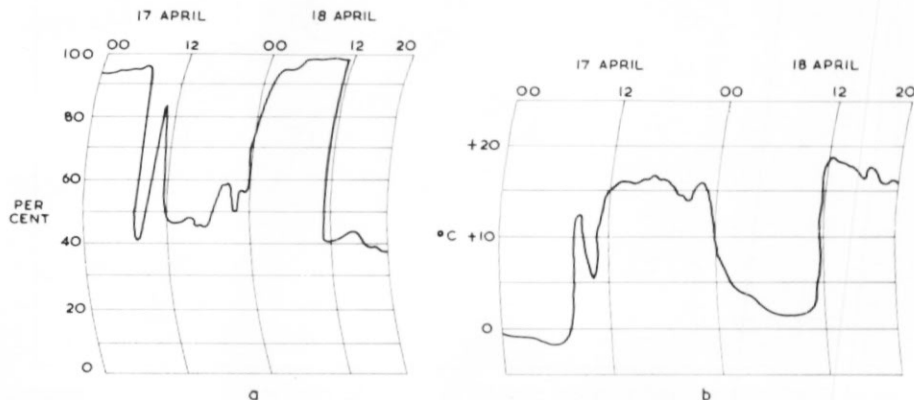


Fig. 2. Hygrogram (a) and thermogram (b) traces for 17 and 18 April 1951, showing the effects of a föhn wind at King Edward Point, South Georgia.

TABLE I. CLIMATOLOGICAL DATA FOR BIRD ISLAND AND KING EDWARD POINT SOUTH GEORGIA, 1958-64

	Mean monthly temperature (° C)		Highest maximum temperature (° C)				Lowest minimum temperature (° C)				Mean total cloud (oktas)		Average wind speed (kt.)		Mean humidity (per cent)		Total rainfall (mm.)		Maximum rainfall on one day (mm.)				Number of days of fog		Mean sunshine (hr.)	
	B.I.	K.E.P.	B.I.	Date	K.E.P.	Date	B.I.	Date	K.E.P.	Date	B.I.	K.E.P.	B.I.	K.E.P.	B.I.	K.E.P.	B.I.	Date	K.E.P.	Date	B.I.	K.E.P.	B.I.	K.E.P.		
1958																										
December	1.8	3.4	5.0	9, 10, 11, 24	15.0	24	-1.7	20	-1.7	7, 21, 22	7.4	6.6	8.0	9.5	89	71	53.2	59.8	12.3	3	18.9	10	N.R.	—	N.R.	—
1959																										
January	2.9	4.9	8.9	26	16.1	2	-1.7	22	-2.2	5	7.5	5.9	9.6	10.1	91	73	107.4	88.5	17.4	22	34.7	22	N.R.	—	N.R.	—
February	2.4	3.7	7.2	25	15.6	24	-1.7	19	-2.2	12, 16	7.3	6.1	6.7	7.6	88	71	83.1	84.1	21.4	8	23.4	13	N.R.	—	N.R.	—
1961																										
February	3.9	5.7	N.R.				N.R.				7.2	5.8	7.0	8.8	89	72	99.6	59.0	20.9	6	35.4	23	7	0	N.R.	—
1-25 March	3.3	4.3	N.R.				N.R.				7.4	5.5	7.0	8.4	84	72	120.0	150.3	27.3	15	32.1	7	5	2	N.R.	—
1963																										
January	4.6	6.3	8.3	5	19.6	14	0.1	11	-0.9	11	7.2	5.9	9.6	11.3	87	70	123.2	120.5	21.6	1	20.6	25	6	1	2.1	6.7
February	4.6	7.1	8.9	15	21.5	26	0.6	22	0.3	23	7.7	5.9	8.5	13.3	87	66	93.0	154.2	21.6	23	27.2	22	8	0	1.4	5.2
March	3.7	4.8	7.0	16	14.6	16	-2.9	28	-2.9	29	6.7	6.1	8.4	11.0	86	69	86.9	124.7	11.9	4	25.8	15	6	0	2.4	3.7
April	2.4	2.1	7.2	2	11.4	7	-5.7	30	-5.9	30	7.0	5.6	7.1	7.0	84	79	77.5	140.7	16.5	7	27.1	9	6	2	1.2	2.4
May	0.6	0.0	5.1	11	10.1	23	-5.4	8	-6.2	6	6.9	5.7	10.1	5.9	86	78	61.2	121.4	12.7	14	32.1	11	2	0	0.8	0.9
June	-0.4	-1.2	3.7	24	9.4	23	-6.5	12	-9.4	13	6.7	4.9	10.3	8.3	84	73	105.2	147.2	29.7	28	44.9	2	3	0	0.0	0.0
July	-0.6	-1.5	3.1	4	10.7	8	-8.5	31	-8.7	31	6.1	5.5	7.5	8.1	83	75	63.3	127.5	17.3	24	51.7	14	1	2	0.5	0.3
August	-1.7	-2.1	2.8	8	5.6	31	-10.2	29	-11.1	29	7.0	5.8	9.7	9.7	78	71	27.2	70.2	8.1	13	39.9	3	6	0	1.2	2.1
September	-1.2	-1.2	2.3	20, 25	7.2	8, 25	-6.3	5	-7.8	4	6.9	5.1	9.2	8.7	81	70	36.6	64.6	7.9	15	30.9	14	4	0	1.3	3.6
October	-0.8	-0.7	2.9	15	6.1	25	-6.7	2	-8.3	2	6.9	5.9	8.7	10.9	79	68	43.4	63.5	7.1	17	9.2	30	1	0	2.2	4.4
November	1.1	3.1	7.5	29	16.7	30	-5.8	3	-6.4	3	7.7	5.3	8.5	8.7	86	71	39.9	39.6	12.2	23	14.2	23, 30	12	0	1.4	6.6
December	2.6	6.0	9.3	16	17.8	26	-1.9	4	-1.9	4	7.4	5.4	7.7	12.5	89	67	95.3	74.0	15.0	19	28.5	18	14	2	1.7	6.9
MEAN	1.2	1.9	5.6	—	12.6	—	-5.1	—	-5.8	—	7.2	5.6	8.5	9.6	84	71	71.0	104.0	15.1	—	29.3	—	6	1	1.3	3.6
1964																										
January	2.9	4.3	9.0	24	16.0	22	-1.1	10	-2.2	13	7.5	6.4	6.1	6.8	89	76	111.8	146.6	23.9	24	87.8	15	13	0	1.3	4.0
February	4.1	5.3	9.0	26	18.3	26	0.0	20	-0.8	9	7.3	5.8	10.5	10.6	87	71	149.3	272.1	16.0	14	58.6	11	8	3	1.1	4.5

B.I. Bird Island.
 K.E.P. King Edward Point, South Georgia.
 N.R. Not recorded.

winds at King Edward Point are light and variable, and föhn winds from the south are rare. In a south to south-east gradient, King Edward Point lies in the lee of the Allardyce Range and the surface wind is usually calm or light and variable at the site. Föhn winds are not experienced with such a gradient wind. In an east to south-east gradient, a true wind is more often experienced. In an east to north-east gradient wind, King Edward Point lies in the lee of Mount Duse, only 0.25 mile (0.4 km.) away, and the surface wind is generally deflected to the east or south-east, and it is often variable both in speed and direction; this serves to distinguish such winds from those resulting locally from an east to south-east gradient. In a north-east to north-north-west gradient, King Edward Point lies in the lee of the ridge between Mount Duse and Bore Valley, less than 1 mile (1.6 km.) away, and the surface winds are calm or light and variable on most occasions. With gradient winds between west-north-west and north-north-west, King Edward Point lies in the lee of Mount Hodges, the ridge extending northward 1 mile (1.6 km.), and beyond this the Allardyce Range about 15 miles (24 km.) away. The resulting surface wind is usually gusty and variable between north and north-west.

As can be seen from the wind rose for 1963 (Fig. 3), the predominant wind at King Edward Point is from the north-north-west, which results from the funnel effect of most winds through Bore Valley.

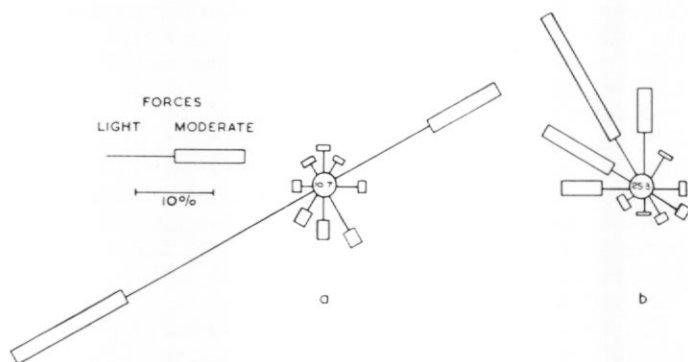


Fig. 3. Wind roses for 1963 for Bird Island (a) and King Edward Point, South Georgia (b). The figure inside the circle represents the percentage of calms.

Bird Island

With gradient winds between south-south-east to south to south-west, true winds are experienced at Bird Island. Gradient winds between west-south-west and west-north-west are deflected by high ground less than 1 mile (1.6 km.) away from the site and the wind direction recorded is south-south-west to south-west. Gradient winds from the north-west are cut off by ground 400 ft. (122 m.) high, 0.25-0.5 miles (0.4-0.8 km.) away and the wind recorded at the site is usually calm or north-east. A north-north-west gradient results in a calm or south-east wind in the lee of the high ground. The south-east wind appears to be a "rotor" wind (Fig. 4), which is the reciprocal of the true wind direction. A north to north-north-east

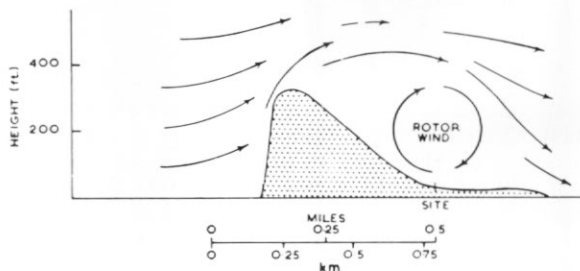


Fig. 4. North-north-west to south-south-east cross-section through the meteorological observation site at Bird Island, illustrating the resultant "rotor" wind in the lee of the ridge from Roché Peak.

gradient is nearly always recorded as calm due to high ground over 500 ft. (152 m.). A north-east gradient wind is recorded as calm or it is deflected to the east-north-east through Bird Sound between Bird Island and the mainland of South Georgia. East to south-east gradient winds are recorded as south-west "rotor" winds, in the lee of Paryadin Ridge, 2-4 miles (3.2-6.4 km.) away on the South Georgia mainland.

As can be seen from the wind rose for Bird Island for 1963 (Fig. 3), the predominant winds are from a south-westerly direction, and to a lesser extent from the east-north-east through Bird Sound.

WIND SPEED AT KING EDWARD POINT AND BIRD ISLAND

Because King Edward Point is so well sheltered by high ground to the north, north-west, west, south-west and south, the mean wind speed of 8.8 kt. (4.5 m./sec.) bears no relationship to the mean annual gradient wind in the area. But for this high ground, it should be similar to or perhaps greater than that experienced in the Falkland Islands (15.9 kt.; 8.2 m./sec.) and Signy Island (13.9 kt.; 7.2 m./sec.). Since both of these observing stations are sited on the east of their respective islands, they are partly sheltered from the full force of the westerly winds and therefore the reported winds are considerably less than the gradient wind speed in their respective areas. On many occasions when whale catchers have reported strong to gale-force winds only a few miles out to sea from Cumberland Bay, the wind in King Edward Cove has been light and variable or even calm.

25 per cent of the winds reported in 1963 at King Edward Point were calm, giving a further indication of the extent to which this station is sheltered by the mountains from the prevailing westerly winds. Since Bird Island is also well sheltered from winds from the west, north-west, north and north-east, and from the east to south-east, the average wind speed (8.3 kt.; 4.3 m./sec.) is well below that which might be expected from the mean annual gradient wind. Only 11 per cent of the winds reported at Bird Island in 1963 were calm, a lower proportion than at King Edward Point. The reason for this is that there is no high ground to protect Bird Island from the south-westerly winds.

For the period May 1963 to February 1964 a cup-anemometer counter was used at Bird Island to obtain the daily mean wind speed. It was found that the mean from the anemometer counter was appreciably higher than the mean from the four daily observations. The anemometer counter's mean for the 10 months was 10.3 kt. (5.3 m./sec.) compared with 8.5 kt. (4.4 m./sec.) from the standard observations during the same period (Table II).

TOTAL CLOUD COVER

Layered stratus and stratocumulus cloud is characteristic of the latitude of South Georgia but at King Edward Point the Allardyce Range acts as a barrier to cloud development. Quite a lot of the cloud that is reported there is of an orographic nature, being formed in the lee of the mountains. Under certain conditions orographic cloud gives rise to continuous precipitation from less than half cover of cloud. The annual percentage of cloud cover for 1963 at King Edward Point was 70 per cent, but at Bird Island where there is no really high ground to impede cloud development it was 90 per cent.

TEMPERATURE

The mean annual temperatures for 1963 at King Edward Point (1.9° C) and Bird Island (1.2° C) are quite similar to each other, there being only 0.7° C difference. The range of monthly mean temperatures (Fig. 5) at Bird Island varied from -1.7° to +4.6° C (range of 6.3° C), whereas at King Edward Point it varied from -2.1° to +7.1° C (range of 9.2° C). The maximum temperature recorded at King Edward Point was 21° C, which was 12° C higher than the maximum of 9° C at Bird Island. The lowest temperature at King Edward Point was only 1° C below the lowest at Bird Island.

The unduly high maximum temperature at King Edward Point is the result of föhn winds blowing down from the Allardyce Range. The thermogram and hygrogram records for

TABLE II. COMPARISON BETWEEN MEAN WIND SPEEDS DETERMINED FROM FOUR DAILY OBSERVATIONS AND CUP-ANEMOMETER COUNTER AT BIRD ISLAND

Month	Mean wind speed from four daily observations	Mean wind speed from cup-anemometer counter
1963		
May	10.1	10.7
June	10.3	11.7
July	7.5	9.4
August	9.7	11.8
September	9.2	10.8
October	8.7	11.6
November	5.5	8.7
December	7.7	9.1
1964		
January	6.1	8.5
February	10.5	11.1
MEAN	8.5	10.3

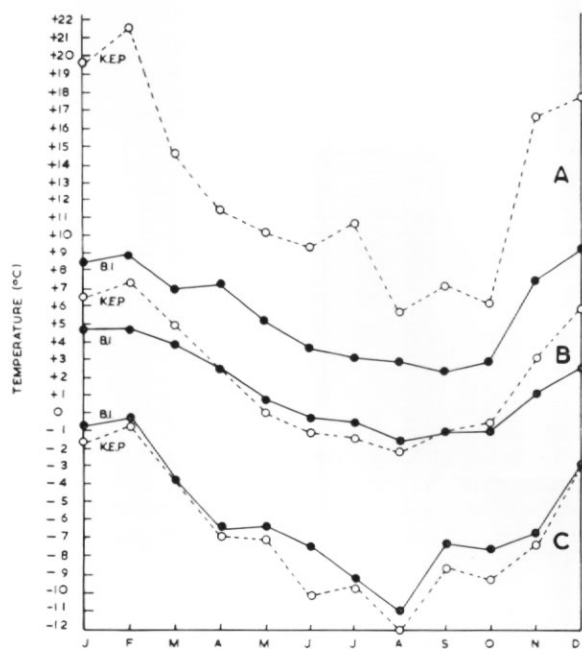


Fig. 5. Extreme maximum temperature (A), monthly average of daily mean temperature (B) and extreme minimum temperature (C) for 1963 at Bird Island (BI) and King Edward Point (KEP), South Georgia.

13–15 February 1963 for King Edward Point and Bird Island (Fig. 6) show the differences between the traces for both places when föhn conditions exist at King Edward Point.

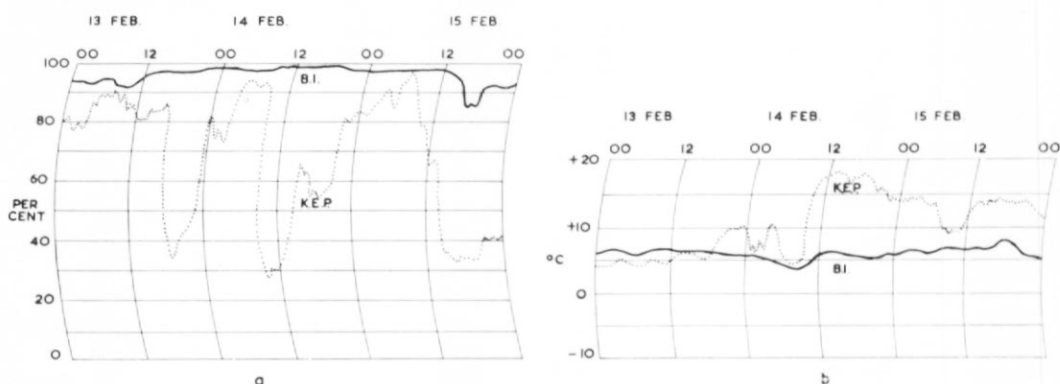


Fig. 6. Hygrogram (a) and thermogram (b) traces for 13–15 February 1963, showing the comparative effects of föhn winds from the Allardyce Range at Bird Island (BI) and King Edward Point (KEP), South Georgia.

HUMIDITY

In 1963 the annual average humidity at Bird Island was 13 per cent higher than at King Edward Point (Table III). As can be seen from the humidity records for 13–15 February 1963 (Fig. 6a), the trace for King Edward Point is extremely variable because of föhn wind effects, whereas the one for Bird Island is fairly steady.

The annual average humidity at Bird Island in 1963 was only 1 per cent lower than that for Signy Island (Table III). In fact, in many ways the weather at Signy Island during the summer months is similar to that at Bird Island. Signy Island experiences the same cloudy conditions, since both are small oceanic islands in similar environments.

TABLE III. COMPARISON OF HUMIDITY VALUES FOR KING EDWARD POINT, BIRD ISLAND AND SIGNY ISLAND, 1963

	<i>Annual average humidity (per cent)</i>	<i>Humidity over 90 per cent (per cent)</i>	<i>Humidity over 80 per cent (per cent)</i>
King Edward Point	71	14	34
Bird Island	84	40	70
Signy Island	85	38	77

PRECIPITATION

More precipitation is recorded at King Edward Point, where short heavy rain or snowfalls of orographic origin are common. At Bird Island, however, days with drizzle characteristic of damp overcast or foggy conditions are twice as frequent as at King Edward Point. During the 19 months that records were kept at both places the maximum precipitation occurred at King Edward Point in 17 months.

VISIBILITY

On the whole the visibility reported at Bird Island was far poorer than at King Edward Point. Because there is no clear exposure to the sea in any direction at King Edward Point, sea fog is effectively shut out. However, on Bird Island there are only relatively low hills,

which do not greatly interfere with any sea fog reaching the observation site. During February–March 1961, throughout 1963 and in January–February 1964, fog was reported at King Edward Point on only 12 occasions, whereas fog occurred at Bird Island on no less than 102 days. Fog is particularly common at Bird Island in the summer months (November–February) and in the period November 1963–end February 1964 (4 months) it was reported on 47 different days at Bird Island but only on 5 days at King Edward Point. In 1963, visibility of 6 miles (9.6 km.) or less was reported at Bird Island 38 per cent of the time, whereas similar visibility was reported at King Edward Point only 17 per cent of the time.

SUNSHINE

At both sites a large proportion of the sunshine is lost behind high ground to the north (20.4 per cent at King Edward Point and 23.4 per cent at Bird Island). For the whole of June the instruments at both sites are completely obscured. During 1963, King Edward Point recorded 29.4 per cent and Bird Island 11.1 per cent of possible sunshine. Allowing for obscured sunshine, the estimated totals are approximately 35 per cent at King Edward Point and approximately 14 per cent at Bird Island.

CONCLUSIONS

For two observing stations only 67 miles (108 km.) apart, there is a great difference between the weather experienced at Bird Island and King Edward Point, South Georgia, and the observations at Bird Island give a much truer picture of the weather to be expected in the latitude of South Georgia than King Edward Point.

In respect of the very high maximum temperatures, low humidities, total cloud cover and sunshine, King Edward Point is affected by the Allardyce Range, and the observations at Bird Island give a clearer idea of these elements in the South Georgia area. Because local topography greatly affects both the wind speed and wind direction at both observing sites, the observations give a false impression of what can be experienced at sea near South Georgia.

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