than from two independent impulses because of the repeated occurrence of hook whistlers with nearly the same time delay between the two components. Fig. 2 shows six successive hook whistlers which occurred within a time interval of about 20 sec. All six have the same frequency-time spectra within the accuracy of the measurements of the spectrogram. We believe that it is highly improbable that the whistlers shown in Fig. 2 could have originated from six pairs of lightning impulses with the time delay between elements of each pair being essentially the same in each case. It seems much more plausible that the two components of a hook whistler originate from the same lightning impulse and that they arise from different propagation paths from the lightning source to the satellite.

A preliminary study of the *Injun* 3 data has shown that hook whistlers are found for all altitudes sampled by *Injun* 3 (240 km–2,780 km altitude), for all local times, and principally near the magnetic equator (less than 40 degrees magnetic latitude). A more complete investigation of the occurrence of these unusual whistlers is being conducted. The theoretical explanation of these whistlers is being sought by one of us (S. D. S.) using computer ray tracing techniques.

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Biennial Oscillation in the Equatorial Troposphere

SINCE the discovery in 1961 of the 26-monthly zonal wind oscillation in the equatorial stratosphere[1,2], a large volume of literature has accumulated on this subject. An excellent review of the work up to the end of 1964 has been given by Murgatroyd[3].

Although Veryard and Ebdon[4] examined the available data to see whether a similar oscillation existed in the equatorial troposphere, they could not arrive at definite conclusions. Angell and Korshover[5] studied the zonal wind data of a number of stations in the north Pacific region, and could trace the 26-monthly oscillation to the 200 mbar level and often to lower levels at tropical stations, the amplitudes rapidly decreasing downwards.

We have studied wind data from two equatorial stations, Gan and Singapore in the Indian Ocean, for the periods 1960–64 and 1959–64 respectively, taking 12-monthly running means of the zonal winds. Clear evidence for the existence of biennial oscillation in the lower troposphere is found at both these stations. The results for five lower tropospheric levels and two stratospheric levels are shown in Fig. 1.

The oscillations are more conspicuous and can be clearly noticed over a greater depth of the lower troposphere at Gan than at Singapore. The range is about 6 knots at Gan and about half this value at Singapore. The maxima and minima occur at almost the same epoch at both the stations at all the lower tropospheric levels. For example, over Gan the annual mean wind is westerly at 1·5 and 3·0 km and easterly at 7·2 km, the transitional level being approximately 5·4 km. The minima of the zonal westerlies at 1·5 and 3·0 km occur at practically the same epoch as the maxima of the easterlies at 7·2 km. (There is a slight indication that the extreme values at 7·2 km occur a month or two after the corresponding values are reached at 1·5 and 3 km; however, this matter requires further confirmation.) The biennial oscillation is less clearly perceptible in the upper tropospheric levels at the two stations.

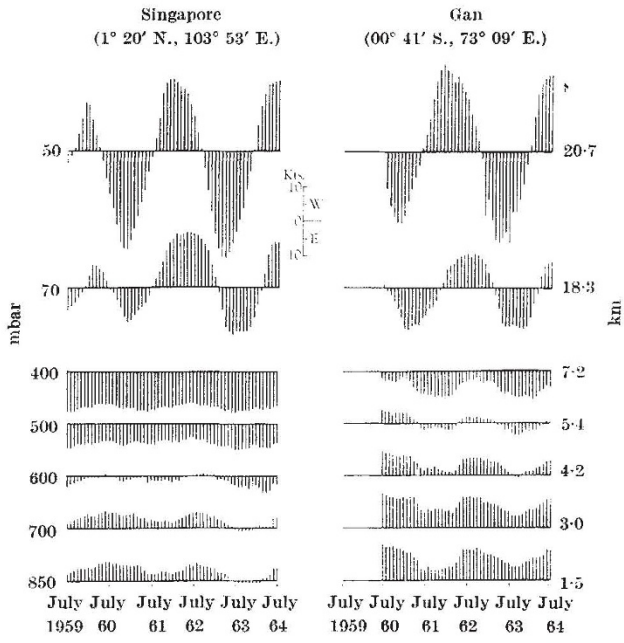

Fig. 1. 12-monthly running means of zonal winds.

It is well known that the period of oscillation of the stratospheric zonal winds varies from about 23 to 29 months. As can be seen from Fig. 1, the stratospheric oscillation over Gan and Singapore had a period of about 29 months from 1960 to 1964. In the lower troposphere the period of oscillation was only about 24 months. As a consequence of this, while the minima of the westerlies at 1·5 and 3·0 km occurred almost simultaneously with the maxima of the westerlies at 20·7 km in October 1961, the westerlies were in their increasing phase at all the three levels towards the end of the period.

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Seamounts in the Gulf of Guinea

IN the course of two recent geophysical traverses across the Gulf of Guinea, H.M.S. *Hecla* has discovered a number of marked elevations of the ocean bed approximately on a line between St. Helena and the islands of the Bight of Biafra.

The separate elevations which were found are shown in Table 1.

Table 1

Latitude	Longitude		
05° 44′ S.	00° 26′ W.	688	fathoms
06° 25′ S.	00° 17′ E.	242	,,
08° 26′ S.	01° 32′ E.	687	,,
07° 54′ S.	00° 58′ E.	298	,,
06° 40′ S.	00° 22′ W.	869	,,
04° 15′ S.	02° 44′ W.	794	,,