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Krakatoa Easterlies and Berson Westerlies

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Mr. Ball of the Division of Meteorological Physics, C.S.I.R.O, Aspendale, drew attention to the fact that the knowledge of the equatorial stratospheric circulation had a rather abrupt beginning when on 27th August 1883 Krakatoa ($6^{\circ}9'S$, $105^{\circ}22'E$) erupted and ejected a large cloud of fine dust into the stratosphere. The movement of this dust cloud indicated easterlies of 30 m/sec at about 30 km (10 mb). Easterlies in the equatorial stratosphere are now known as 'Krakatoa Easterlies'.

The first soundings to penetrate the lower equatorial stratosphere were those of Berson and Elias in 1908, near Lake Victoria -Nyanza. These indicated west winds at about 20 km. West winds in the equatorial stratosphere are now known as Berson Westerlies. Despite the fact that observations by, for instance, Kuhlbrodt, Bossalasco and Vuorela in the first half of this century did not always indicate westerlies, the idea of Berson Westerlies as a permanent feature of the lower equatorial stratosphere gradually became accepted.

The analysis of the more detailed observations of recent years, by, for example, McCreary and Ebdon, discloses a more complicated equatorial circulation pattern than that of Krakatoa Easterlies overlying Berson Westerlies. It appears that at each level the wind oscillates between east and west with a period of about 26-27 months. The easterlies are rather stronger (30 m/sec) than the westerlies (20 m/sec) and the strength of both winds increases with height. Both easterlies and westerlies are very steady, except near the changeover time, and meridional velocities are small. The change in direction occurs first in the upper stratosphere and gradually descends, taking about 6 months to descent from 25 to 60 mb. Furthermore the change, at a given level, is approximately simultaneous at the various stations on the equator. On some occasions there appears to be a ring of westerlies round the equator in the lower stratosphere and a ring of easterlies in the upper stratosphere and on other occasions the easterlies underly the westerlies. There are also occasions in between when there are easterlies or westerlies throughout the whole stratosphere.

Virtually no trace of the oscillation appears anywhere in the equatorial troposphere. Furthermore the stratospheric oscillation is obscured by a very large annual variation at stations more than about 10° from the equator. However the oscillation shows up clearly at Aden $13^{\circ}N$, San Juan $18^{\circ}N$ and Khartoum $22^{\circ}N$ when twelve month running means are taken.