Reports

Radar Meteor Counts: Anomalous Increase during 1963

Abstract. *Radar meteor counts at Ottawa, Canada, show an increase of up to 50 percent in the hourly rates of short-duration echoes during the middle months of 1963. A similar increase has been observed in the Southern Hemisphere.*

Since the autumn of 1957 a patrol meteor radar has been operated continuously near Ottawa, Ontario (latitude 45°.2N, longitude 75°.5W), on a frequency of 32.7 Mcy/sec (*1*). Mean hourly echo rates for each day in the year have been determined for the 5-year period 1958 to 1962 (*2*). During 1963 a significant increase in meteor echo rates over the 5-year average was observed during the months of May through November. Monthly mean rates for all echoes are plotted in the upper part of Fig. 1 for the period 1958 to 1962 and for 1963. Normal variations from year to year in the monthly mean rates are illustrated by the 1962 values plotted separately in Fig. 1. The standard deviation of the five values for each month (1958 through 1962) has an average value of 20 counts per hour over the year. It should be pointed out that while the values given for 1962 and previous years are final rates, fully corrected for interference and reading errors, the 1963 rates represent only a preliminary analysis of raw echo counts. These corrections cannot account for excess rates during 1963 which are as high as five times the average standard deviation during July and August.

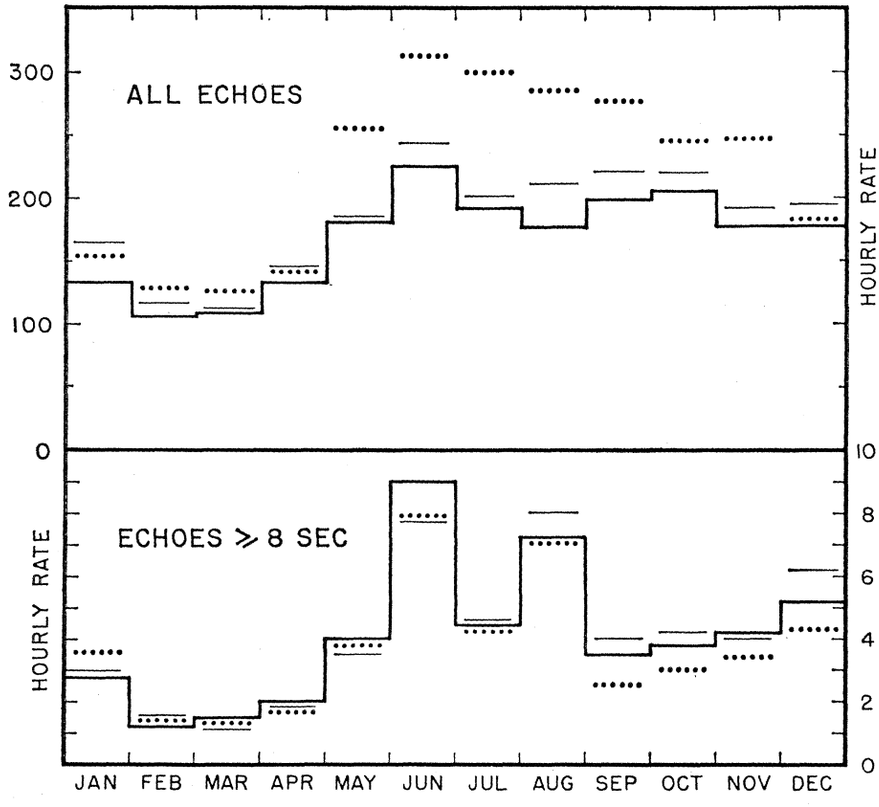

Fig. 1. Monthly mean radar meteor echo rates observed at Ottawa, Canada. Heavy lines, 5-year average, 1958 through 1962; light lines, 1962 data only; dotted lines, 1963 data.

A similar anomalous increase in the meteor echo rates for 1963 has been found in observations made at Christchurch, New Zealand (*3*). The increase in the counts at Ottawa does not appear to be as startling as the increase in the Southern Hemisphere counts. This is partly because the rates during June to September are normally the highest of the year at Ottawa and the lowest at Christchurch. Although the values from the Northern and Southern Hemispheres cannot be compared directly because the radar equipments differ in sensitivity, it may be noted that in June 1963, for example, the excess count above background is about 90 echoes per hour in both cases.

The commencement of the increase in the Ottawa data is not clearly defined since the April rates are unreliable because of a fault in the equipment. Our 1963 monthly mean rates do not return to normal until December, about 2 months later than the Christchurch counts. However, a qualitative examination of the data on a day-to-day basis shows that the Ottawa rates do return to normal at times during the September to November period whereas they are consistently high throughout the period May to August.

In Fig. 1 we have also plotted the monthly mean counts for echoes which have a duration of 8 seconds or more. The average standard deviation of the monthly-mean rates in the period 1958 through 1962 is 0.8 count per hour. It is apparent that there has been no significant increase in these rates. Hence, the anomalous increase appears to be restricted to the echoes corresponding to relatively small particles. Whether the effect can be attributed to a worldwide increase in the influx of small particles or whether it could be a result of the influence of atmospheric conditions on radar echo counts must await a more detailed study.

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References and Notes

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4. A portion of the Ottawa program has been supported by Duke University contract No. DA-31-124-AROD-59.

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Meteors: An Unexpected Increase in 1963

Abstract. *Counts of meteors observed by radar from Christchurch, New Zealand, rose unexpectedly by over 100 percent during mid-1963. A similar but smaller increase was also observed in Canada. Diminishing peaks have subsequently appeared at 6-month intervals in the Christchurch meteor counts.*

During 1960–61 an extensive survey of meteor rates was carried out near Christchurch, New Zealand (lat. 43.5°S). The equipment operated at 69.5 Mcy/sec, and an antenna was used with omnidirectional characteristics such that meteors arriving from all directions were detected, down to magnitude +8. Stringent precautions were taken throughout the survey to ensure that the sensitivity of the equipment remained constant (*1*, *2*).

A second survey was commenced in February 1963 and is still continuing. In mid-1963, as the records were processed, it became apparent that the rates from April onward had risen well above those obtained in 1960. This trend continued until July, after which the high rates subsided; they returned to the 1960 values by October (Fig. 1).

At the end of 1963 and beginning of 1964 the meteor rates again rose, but by a smaller amount, and a preliminary analysis of subsequent data indicates that the rates once again returned to the 1960 values by March 1964. This preliminary analysis of the data now being processed also gives evidence of yet another, but even smaller, increase during mid-1964. It rather suggests a decaying series of peaks at 6-month intervals.

The first unexpected increase in meteor rate led to a thorough re-examination of the equipment performance, but we could not account for the high 1963 rates. The only similar survey known to us was that being conducted by the National Research Council in Canada, and an enquiry was therefore made to ascertain whether they had obtained any unusual results. When the Canadian data revealed a broad agreement with that from the Christchurch survey as far as the major peak was concerned, it became apparent that the phenomenon was world-wide (*3*).

The extent of the collecting area of the Christchurch equipment amounts very closely to 10^{-3} of the total area of the earth at the 95-km level. From Fig. 1 we see that the excess number of meteors observed during the period of the increase was close to 300,000. This is therefore equivalent to an influx of some 3×10^8 particles over the whole of the earth. Furthermore, the increased influx did not appreciably alter the form of the diurnal variation in meteor rate. The monthly mean curves for the diurnal variation were magnified replicas of those obtained during the 1960 survey (*2*).

There are three possible agencies which may have caused this phenomenon: extraterrestrial, terrestrial, or man-made. It is difficult to imagine any extraterrestrial factor which could give rise to a marked increase in the amount of interplanetary matter encountered by the earth over a period of half a year. Likewise, it is difficult to conceive a terrestrial influence (such as varying ionospheric conditions) which would produce a proportionately greater effect at higher frequencies. This would be required to explain an increase of over 100 percent in the Christchurch rates obtained at 69.5 Mcy/sec compared with a 50 percent increase at 32.7 Mcy/sec observed in Canada. There remains the possibility of a man-made effect produced by some kind of high altitude or space experiment. The reentry of orbiting dipoles (or needles) is the most obvious thought, but such a cause would appear to be ruled out by the data already published (*4*).

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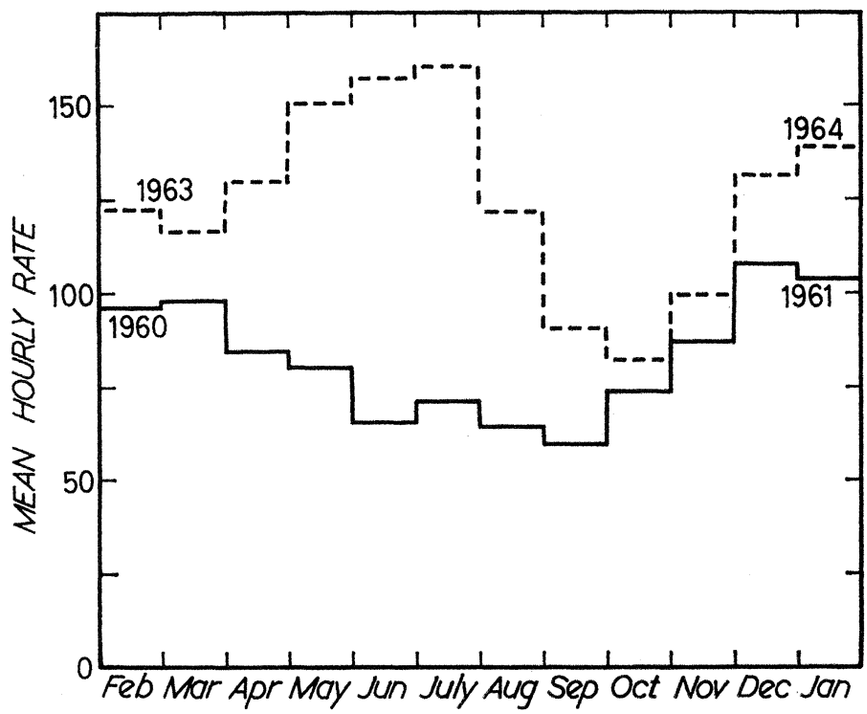

Fig. 1. Mean hourly rates of meteor echoes observed by radar from Christchurch, New Zealand.

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5. Supported by NSF grant G 24444 (U.S.A.).

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