SHORT COMMUNICATIONS

COSMIC RAY ASYMMETRY STUDIES AT HOBART, TASMANIA*

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The apparatus used previously by Burbury and Fenton (1952) has been modified by the introduction of a third counter tray and used with 12 cm. of lead absorber to obtain 91 days' measurements of the east-west asymmetry at a zenith angle of 45° and 56 days' measurements of the north-south asymmetry at 30°.

For correlation of the asymmetry with the radiosonde data, it was necessary to choose a period over which the radiosonde data could be assumed to represent the state of the atmosphere fairly well, at the same time including as much of the cosmic ray data as possible. A 4 hr. period centred on the hour nearest the time the radiosonde balloon reached the 300 mb. level was chosen, and the mean asymmetry and mean barometric pressure calculated for this period.

The correlation was tried in the same way as used by Duperier (1949) for the total radiation. The asymmetry, the barometric pressure, the height of an isobaric layer, and the mean temperature over a region above the layer were used as variables for several layers in turn. None of the correlation coefficients computed reached more than the 10 per cent. level of significance, so it was concluded that the effect of these variables on the asymmetry is probably too small to be detected under the present experimental conditions.

With the possibility of a null result in mind, each set of asymmetry values was tested for homogeneity by analysis of variance methods (Tables 1 and 2) and, in each case, the estimate of the variance from between days was not found to be significantly greater than the estimate of the variance from within days.

We may take the null result of the analyses of variance to indicate that the asymmetries are not dependent upon factors which change from day to day to an extent which can be detected by the present apparatus. It follows that the east and west or north and south cosmic ray intensities are similarly affected by external conditions.

We may, therefore, compare their sum with the barometric pressure in the usual way and find the barometer coefficients for the radiation from the inclined directions. From the north-south run at 30°, we find a barometer coefficient of $-1 \cdot 90 \pm 0 \cdot 08$ per cent. per cm. Hg and from the east-west run at 45°, we find a coefficient of $-3 \cdot 56 \pm 0 \cdot 05$ per cent. per cm. Hg.

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A tendency for the barometer coefficient to increase with zenith angle has also been found by Rossi (1939) and Trumpy and Orlin (1941). This result can be expected since the change in grams per square centimetre of air along

TABLE 1

RESULTS OF EAST-WEST ASYMMETRY MEASUREMENTS

Zenith angle 45°, 12 cm. lead absorber. Analysis of variance of 91 days' results classified according to days. (Asymmetry $+0\cdot03)\times10^4$ as variable

Source	Sum of Squares	Degrees of Freedom	Mean Square
Within days	300925193	1001	300625
Between daily means ..	27593391	90	306593
Total	328518584	1091	301117

Variance ratio 1·01 not significantly greater than 1.

Mean E.-W. asymmetry (for this experiment only) $=0\cdot0177\pm0\cdot0011$ (P.E.).

the paths of particles at a zenith angle θ accompanying a change in pressure is proportional to sec θ. Lindholm (1950) has found that the consistency of the observed barometer coefficient is increased when the effect of the upper-air

TABLE 2

RESULTS OF NORTH-SOUTH ASYMMETRY MEASUREMENTS

Zenith angle 30°, 12 cm. lead absorber. Analysis of variance of 56 days' results classified according to days. (Asymmetry $+0\cdot03)\times10^4$ as variable

Source	Sum of Squares	Degrees of Freedom	Mean Square
Within days	146643912	616	238058
Between days	15397135	55	279948
Total	162041047	671	241492

Variance ratio 1·175 not significantly greater than 1.

Mean N.-S. asymmetry $=0\cdot0056\pm0\cdot0013$ (P.E.).

conditions is removed. However, we consider the actual numerical values obtained to be less important than the trend with zenith angle.

The results of the east-west run combined with earlier results give a value of the asymmetry of $0\cdot0195\pm0\cdot0010$ compared with the predicted value of $0\cdot0192$ (Burbury and Fenton 1952). The north-south asymmetry was found to be $0\cdot0056\pm0\cdot0013$, which is different from zero, the north intensity being the greater (Burbury 1952). This agrees with a suggestion by Rose (1951) that in high latitudes the north-south asymmetry is almost as pronounced as the east-west asymmetry.

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