accuracy of measurement of fE is somewhat less than that of p, and this diminished degree of accuracy in itself tends to reduce the calculated value of ε. The fact that the ε's are different and that the correlation coefficient between Δp and ΔfE is not particularly large may perhaps be taken to indicate that there is little direct physical connexion between the variations in p and fE, but that both might be affected by a common extraneous cause.

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[1] Lewis, R. P. W., and McIntosh, D. H., *Nature*, **170**, 488 (1952).
[2] Beynon, W. J. G., and Brown, G. M., *Nature*, **167**, 1012 (1951).
[3] Appleton, E. V., and Ingram, L. J., *Nature*, **136**, 548 (1935).
[4] Kendall, M. G., *J. Roy. Stat. Soc.*, **108**, 93 (1945).
[5] Kendall, M. G., "The Advanced Theory of Statistics", chapter 30 (1946).
[6] Kendall, M. G., Nat. Inst. Economic and Social Res., Occas. Papers, **9** (Camb. Univ. Press, 1946).
[7] Bartels, J., Mathematische Methoden der Geophysik, Fiat Review of German Science, **7**, V, 92 (1947).

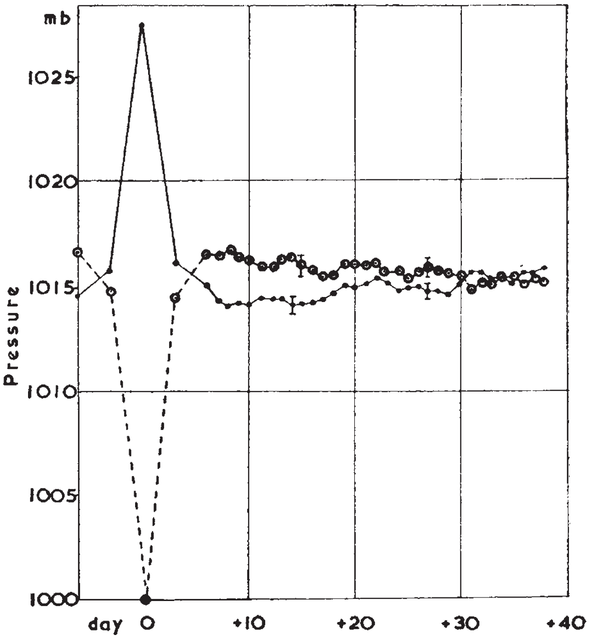
WE should like to make the following comments on the communication by Beynon and Brown.

(1) The fact that the correlation between K indices and $fF2$ is not necessarily significant over the period under discussion cannot "discredit the established relationship", because this correlation is known to persist as more and more data are taken; the lack of significance is due to the smallness of the sample. (In fact, the correlation coefficient between $fF2$ and corresponding daily sums of K indices was $-0{\cdot}21$, that is, almost the same as that between p and ΔfE.)

(2) The use of correlograms adds nothing to the previous graphical representation of smoothed variations, since no numerical significance test is applied.

(3) The differences between our results and those obtained by Beynon and Brown result from their use of values of Δp rather than p. We did not overlook the fact that there is an apparent downward trend in the pressure data, but we did not on that account use Δp instead of p for the following reasons. The monthly means of fE closely depend on the sun's zenith angle, and the variation of fE with factors other than the sun's zenith angle is clearly best considered by taking departures (ΔfE) from the smooth curve joining the monthly means, as was done in both analyses. In contrast, pressure at Kew shows no annual variation ascribable to a simple physical cause: monthly means of p at Kew are widely scattered for corresponding months from year to year, and the long-period means show a small and irregular annual variation. An apparent 'trend' in any individual period is consequently as much a part of the true variability of p as are the 'departures' (Δp) from the 'trend', and should not be eliminated before applying numerical tests. (It may be remarked that in Beynon and Brown's original paper p, and not Δp, was plotted and discussed.)

(4) It is difficult to conceive the possible nature of a physical agency responsible for causing world-wide variations in fE and simultaneous—but geographically very restricted—large variations in surface pressure. We would re-emphasize that this difficulty makes it very necessary for the p and ΔfE variations to be shown to be much closer than may be explained by the method of choice of this particular period, namely, the sequence of four maxima in p at 27-day intervals. We consider the facts as presented in our analysis to be entirely compatible with a chance general similarity of p and ΔfE with therefore no common physical cause.



Mean variation of Kew surface pressure at midday around 600 selected days of pressure-peak (●—●—) and of pressure-trough (○- -○- -) during 1926–50

(5) Independent evidence of the existence of a direct effect of variations of solar radiation on those of surface pressure is given by the results of a study we have made of pressure-recurrence tendencies. Our method followed that used so successfully by Chree and Stagg[1] for demonstrating the effect of the solar rotation period on geomagnetic disturbance. Two days of clearly defined mid-day pressure maximum at Kew were selected for each month in the period 1926–50. Independence was secured by ensuring that no two maxima in the whole pressure series were nearer than 7 days. The statistical variation of pressure was then determined from 6 days before to 38 days after the 600 selected pressure-peak days. The variation of pressure was also determined around 600 pressure-trough days selected in a similar way. The results are shown in the accompanying graph, in which the standard errors of the means are indicated.

The curves indicate complete randomness in the occurrence of lengths of interval separating pressure peaks and also in those separating pressure troughs. Subdivision of the data according to season and sunspot epoch gave similar results. It may be noted in particular that in neither case is there evidence of any systematic pressure effect after an interval of about 27 days. The method of analysis is independent of changes of phase or intermittency. Beynon and Brown state that in many years they have found no recurrence of the large 27-day pressure variation: our result shows that an oscillation of about this length had no more than random occurrence during 1926–50.

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[1] Chree, C., and Stagg, J. M., *Phil. Trans.*, A, **227**, 21 (1927).