Correction of the paper “A study of meteorite falls”

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The corrections refer to the paper “A study of meteorite falls” published in this journal (Wickman and Palmer 1979). Figure 3 (p. 263) of that paper shows that an empirical linear relation exists between the logarithm of the number of observed and recovered falls and a power function of the distance between the impact point and the witness, r . It is also stated that the power function is r^2 , however, the correct power function is $r^{1/2}$. The theory presented in the paper is therefore not valid.

One of us (FEW) has considered a number of other approaches based on various random walk models. They all seem to result in the incorrect r^2 - relationship. The reason for this is that important factors have probably been neglected.

Figure 1. The weight of recovered meteorites from a fall as a function of the shortest distance between witnesses and impact points. The figure illustrates the fact that small falls are only recovered when they fall close to a witness. The line is only drawn to emphasize the two fields.

It would appear that the number of objects falling at the same time is such a factor. A shower will make it easier to find a piece in a given area. The first find also stimulates further search which possibly results in a smaller r - value. Yet elimination of the shower and semi-shower data from our statistics gives almost no change in the position or shape of the line in our figure 3.

Another factor is the size of the meteorite. Of those listed, the weight of the recovered objects varies between about 10 g and about 300000 g. Such reported values are in many cases minimum values. The visual and acoustic effects from the fall vary enormously for this mass range. It is likely that a greater effort to find the meteorite(s) is made when a spectacular fall occurs than when the effects are almost unnoticeable. In addition, the impact effects on the ground are much easier to observe for a large meteorite than for a small one. A study of the statistics of the falls used in the paper revealed noticeable effects (figure 1) in the range below 1000g. The dashed line is only drawn in order to emphasize the effect.

Other effects can certainly be of importance. At present it is impossible to decide whether the $r^{1/2}$ -relationship is fortuitous or can be derived from known principles. Nevertheless the empirical relationship is still valid. It is therefore of interest to have the functions and corrected parameters.

Survivor function: $\exp(-\beta r^{1/2})$;

Distribution function: $1 - \exp(-\beta r^{1/2})$;

Density: $(\beta r^{-1/2}/2) \exp(-\beta r^{1/2})$;

where $\beta = 0.171 \text{ m}^{-1/2}$;

Average distance: $2/\beta^2 \text{ m}$ or 69 m.

Reference

Wickman F E and Palmer C D 1979 *Proc. Indian Acad. Sci. (Earth Planet. Sci.)* **A88** 247