Letters to the Editors

On Darbyshire's Method of Analysing Microseims

H. M. Iyer

(Received 1969 January 21)

In a recent paper with the same title as this letter, Hurst (1968) has made some comments on my work on microseisms (Iyer 1958, 1959). He points out an error in Darbyshire’s equations and the ‘false conclusions’ I reached from them. Mathematically speaking Hurst is right. For a point source model of microseisms composed of Rayleigh and Love waves, it is true that in the horizontal components, the Rayleigh and Love parts are correlated in an opposite sense. In other words, in the horizontal components when the Rayleigh waves are in phase, the Love waves are out of phase, and vice versa. This leads to the modifications in Darbyshire’s equations as Hurst has pointed out. I indicated this effect in my thesis (1959) though I did not use the idea and change Darbyshire’s equations. I developed the equations in which two out of the three correlation coefficients were shown to be adequate to solve for $\theta$ and $L/R$, mainly because $r_{xy}$ was consistently a smaller quantity than $r_{xz}$ and $r_{yz}$, and it was often difficult to determine the peak in the correlation functions as plotted by the photoelectric correlationmeter. This was to be expected as the correlation function was the composite of two independent functions, the Rayleigh part and the Love part. Hence it was considered desirable to avoid using $r_{xy}$ to estimate $\theta$, if possible. When this was found feasible, I decided to use the new equations. After all when a problem can be solved with two measurements, why use three, especially when the third quantity is not as stable as the other two?

From another point of view also, it seems I was justified in modifying Darbyshire’s equations. In the light of developments that have taken place in the science of microseisms during the last ten years, a signal-plus-noise model for microseisms seems more realistic than a point Rayleigh–Love source. The fact that $r_{xy} \approx r_{xz}.r_{yz}$, mainly because $r_{xy}$ was consistently a smaller quantity than $r_{xz}$ and $r_{yz}$, and it was often difficult to determine the peak in the correlation functions as plotted by the photoelectric correlationmeter. This was to be expected as the correlation function was the composite of two independent functions, the Rayleigh part and the Love part. Hence it was considered desirable to avoid using $r_{xy}$ to estimate $\theta$, if possible. When this was found feasible, I decided to use the new equations. After all when a problem can be solved with two measurements, why use three, especially when the third quantity is not as stable as the other two?

From another point of view also, it seems I was justified in modifying Darbyshire’s equations. In the light of developments that have taken place in the science of microseisms during the last ten years, a signal-plus-noise model for microseisms seems more realistic than a point Rayleigh–Love source. The fact that $r_{xy} \approx r_{xz}.r_{yz}$, mainly because $r_{xy}$ was consistently a smaller quantity than $r_{xz}$ and $r_{yz}$, and it was often difficult to determine the peak in the correlation functions as plotted by the photoelectric correlationmeter. This was to be expected as the correlation function was the composite of two independent functions, the Rayleigh part and the Love part. Hence it was considered desirable to avoid using $r_{xy}$ to estimate $\theta$, if possible. When this was found feasible, I decided to use the new equations. After all when a problem can be solved with two measurements, why use three, especially when the third quantity is not as stable as the other two?

Hence I would like to point out that my model of point source of Rayleigh waves mixed with Love waves from wide-angle sources is not ‘a priori improbable’, but one way of looking at the problem from data available at that time. I am grateful...
to Hurst for showing that a point source model of Love and Rayleigh waves would also fit the case (Table 2) provided the modified Darbyshire’s equations (2) and (4) are used in this analysis.

National Center for Earthquake Research,
345 Middlefield Road,
Menlo Park,
California.

References