LETTERS TO THE EDITORS

RADIOPHYSICS

Constant Ionosphere Height for Audio-frequency Propagation

THE wave-form of an atmospheric, resulting from a distant lightning flash to Earth, has variously been interpreted in terms of pulse reflexion between parallel or concentric conducting Earth and ionospheric layers[1,2] or as pulse dispersion during propagation in the region between these same layers[3]. Recent papers[4,5] have discussed the equivalence of these approaches. In each case the Earth–ionosphere separation and the storm distance are the principal determinants of the positions of the peaks of the trace. Within certain limits these propagation parameters may be estimated from the observed wave-forms.

Smooth type wave-forms[5] of distant Atlantic origin, received both by day and night, have recently been studied extensively at Nottingham. Wave-form analyses of 70 traces, using wave-guide concepts, together with distance estimates in the range 1,750–5,000 km., kindly provided by the Meteorological Office Sferics network, have permitted estimation of the effective ionosphere height both by day and for several hours after sunset in the case of winter-time storms. A constant ionosphere height of 83 ± 2 km. irrespective of the time of day was the most reasonable conclusion from the results available, with no significant variations from this mean value for individual recording periods and no suggestion of a systematic variation with the onset of night-time conditions even up to 4 hr. after local sunset. This suggests a fundamental difference between smooth and reflexion type wave-forms, for the latter of which various workers[1,2] have reported an increase in effective height at night.

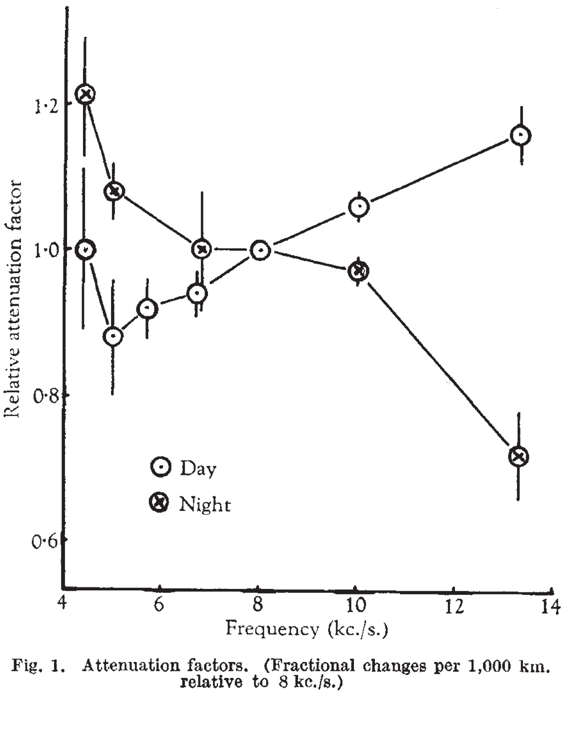

Fig. 1. Attenuation factors. (Fractional changes per 1,000 km. relative to 8 kc./s.)

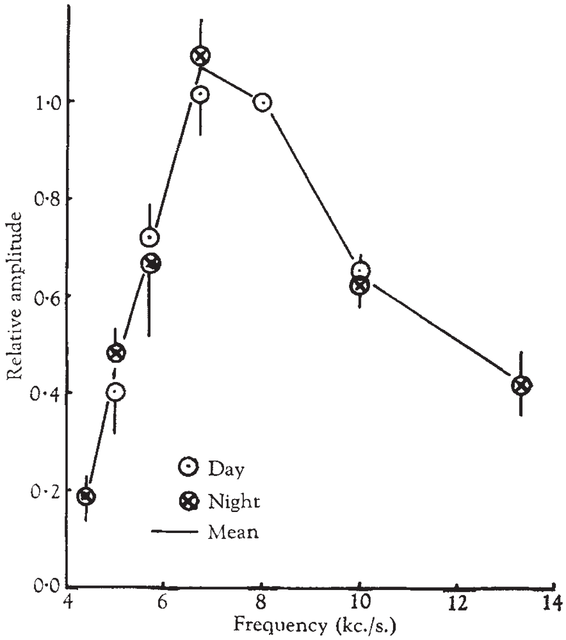

Fig. 2. Average source spectra

An earlier paper[5] has discussed the derivation of relative attenuation coefficients for propagation and the mean amplitude-spectrum at the source from statistical analysis of the oscillation amplitudes throughout the observed wave-forms. For a group of 150 apparently regular smooth type wave-forms, it was found that attenuation factor per 1,000 km. relative to that at 8 kc./s. varied little throughout the frequency-range 4–14 kc./s. A slight systematic increase with frequency was noted by day and a less precise and regular decrease at night (Fig. 1). The corresponding source spectra were indistinguishable (Fig. 2).

The very slight diurnal variation of attenuation in the appropriate frequency band, while unexpected when comparison is made with previous atmospherics measurements[6], might have been predicted from the very close similarity of day- and night-time forms of this restricted group of smooth type wave-forms. The identity of the day and night source spectra provides gratifying confirmation of the analysis and the significance of its conclusions.

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