A NEW METHOD OF INTEGRATING SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS

A NEW method which is in many ways superior to the existing ones, has been discovered for constructing solutions of second order linear differential equations, which may find considerable application in many branches of applied mathematics.

The process consists first in converting the given equation in the normal form,

$$\frac{d^2y}{dt^2} + f(t)\, y = 0 \qquad (1)$$

and then guessing an nth order approximate solution which fits in with the boundary value conditions of the problems. Let this solution be y_n. The $(n+1)$th order approximation will then be

$$y_{(n+1)} = y_n \cdot y_n'^{-\frac{1}{2}} \exp -\tfrac{1}{2} \int^{t} \frac{f(t)\, y_n}{y_n'}\, dt, \qquad (2)$$

where

$$y_n' = \frac{dy_n}{dt}.$$

This process may be repeated indefinitely, and a solution of equation (1) may be obtained to any desired degree of accuracy.

It can easily be shown that if the above process is convergent, the limit, as n increases actually satisfies the equation (1).

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FLUCTUATIONS OF TEMPERATURE NEAR THE GROUND

THIS note gives a brief outline of the method adopted in recording the fluctuations of temperature near the ground These fluctuations arise as a result of turbulence in the lower layers of the atmosphere and they are strongly correlated with the gradient of temperature and vanish as the gradient becomes small. The layer in which these fluctuations exist is explained as the 'Shimmering layer' by L. A. Ramdas[1] and an attempt has been made by the present worker to measure the fluctuations of temperature in the air layers near the ground. These fluctuations are recorded with the aid of a quick-run photographic recorder made by Messrs. P. J. Kipp and Zonen of Holland. The temperature is recorded with the aid of a 40 S.W.G. copper constantan thermocouple connected to a sensitive Moll galvanometer of period 1/5 of a second

W. Hande[2] and many other workers took measurements of these fluctuations in temperature close the ground by using either platinum resistance thermometers or thermistors. P. K. Raman[3] has also recorded these fluctuations using copper constantan thermocouples but the method adopted by the present worker is slightly different. A thermocouple made of 40 S.W G. copper constantan wires is coated with a thin

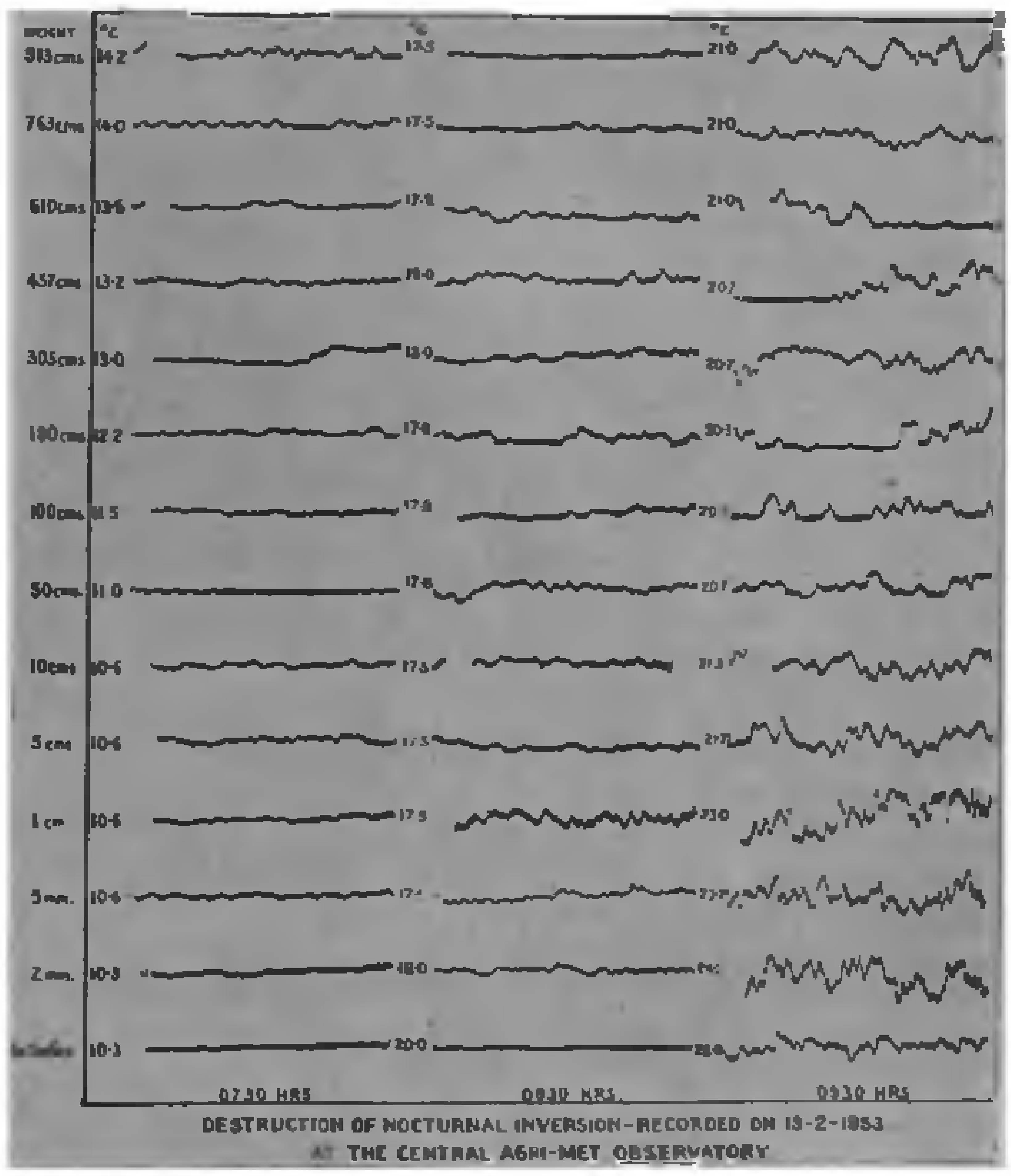

FIG. I

layer of magnesium oxide to eliminate the radiation effects to the maximum extent possible. This thermocouple is connected in series with a sensitive Moll galvanometer of period 1/5 of a second. The deflections in the galvanometer are recorded by means of a photographic recorder. Using this technique, the characteristics of these fluctuations and their variation with height above the ground as well as with the time of the day are studied. These features have been briefly discussed by L. A. Ramdas[3] in a recent paper.

Fig. 1 shows a set of records taken during the destruction of nocturnal inversion on 13-2-1953. The mean temperatures in °C. at the corresponding heights are also marked. The records indicate the way in which the amplitude of these fluctuations increase with time as the inversion is destroyed. Similarly, a set of records were taken during the development of nocturnal

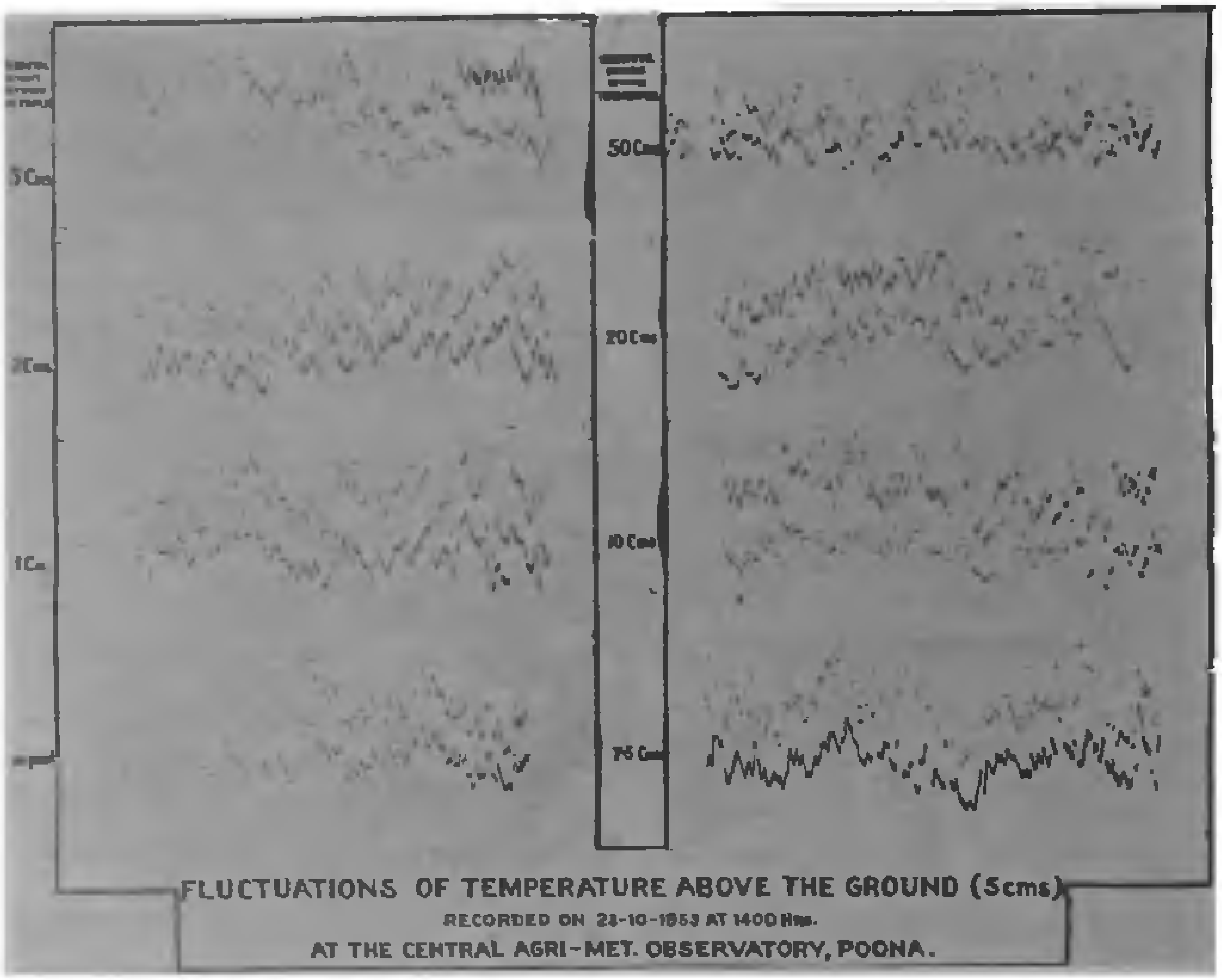

FIG. 2

inversion and they showed a decrease in amplitude as the inversion is setting in. These fluctuations go on decreasing as the inversion sets in and they are almost negligible in the inversion layer.

Fig. 2 shows a set of records of fluctuations of temperature recorded simultaneously by two thermocouples at the same height above the ground. Then by means of increasing the horizontal distance between the thermocouples in stages of 1 cm., 2 cm, 5 cm., 7·5 cm, 10 cm., 20 cm. and 50 cm. the fluctuations are recorded and they show that these fluctuations agree almost upto 7·5 cm. separation and beyond that there is a lag in these fluctuations Further experiments are being conducted to find out the size of the eddies in relation to the nature of the ground. A detailed discussion of these will be published later on.

Grateful thanks are due to Dr. L. A. Ramdas for suggesting the problem and for the necessary guidance given.

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FURTHER STUDIES OF SAND MOVEMENT ACROSS WALTAIR BEACH

IT has been found by La Fond and Prasada Rao[1] that sand oscillates around mean sea-level, and these short period oscillations in sand level are mainly related to tide range Further investigations showed that the Beach in addition to undergoing such short-period cyclic changes, also undergoes long period erosion cycles. In the calm months of January and February, the Beach stands higher, while during the months of July and August it retreats. This has been observed at two stations, one near Andhra University (Fig. A) and the other near Scandle Point (Fig. B).

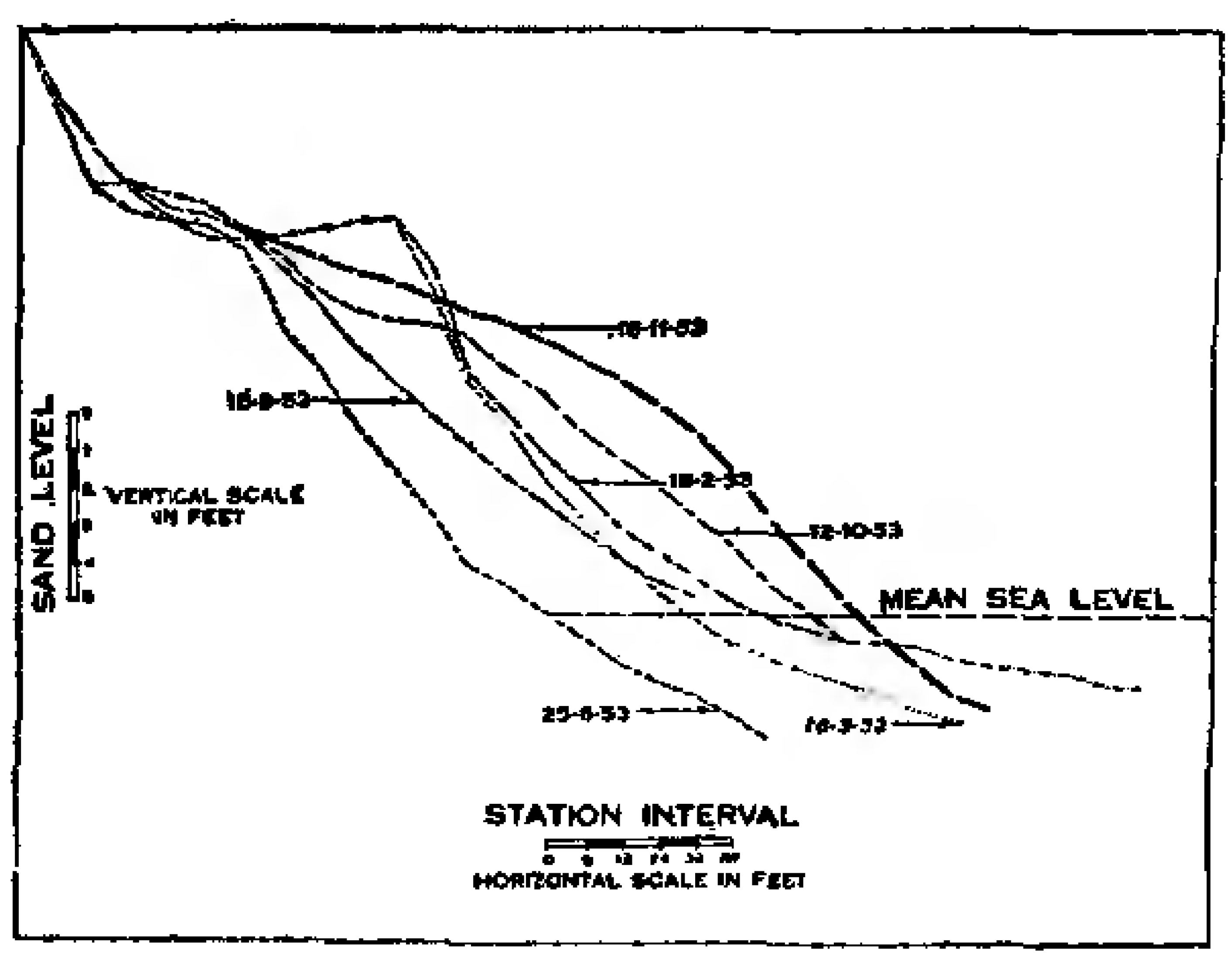

FIG. A. Profiles of beach taken over a number of months near Andhra University.