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ATMOSPHERIC PRESSURE OSCILLATIONS ATOP HALEAKALA

by Grote Reber

Research Corporation, New York 17, New York*

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Abstract: Forty months of observations are analysed. The oscillations with 24 and 12 hour periods are in accord with other results. An oscillation with 8 hour period is clearly depicted. It rotates in phase similar to sidereal time. No oscillation with a 6 hour period could be found.

1. INTRODUCTION

A microbarograph was operated at an altitude of 10,012 ft atop Kole Kole Hill at the very peak of Haleakala, Maui, Hawaii, from July 1952 through October 1954 and from October 1957 through September 1958. A short note was published [1] describing the results of the first group of observations. Unfortunately the last step in the calculations was omitted and the results were left in trigonometric angle which is opposite in sense of rotation to clock angle. Also the separate plot of phase and amplitude turned out to be a poor way of depicting the results. Consequently, when the second group of observation became available it was decided to rework both into the form given here. The data for each month was analysed [2] separately. Then all the years for any given month and period were combined vectorially to provide one point on the figures. The time is that of the positive maximum of pressure. The months are denoted as 1 to 12 for January to December.

2. PRESSURE OSCILLATIONS

Fig. 1 shows the 24 hour component. It varies between nearly opposite phases from summer to winter. The spring transition is very rapid while the autumn return is quite slow. This oscillation is probably a local effect associated with the steep isolated peak over an immense body of water. The amplitude is quite small compared to values quoted [3] for low altitude places.

* Presently at Associated Universities, Green Bank, West Virginia.

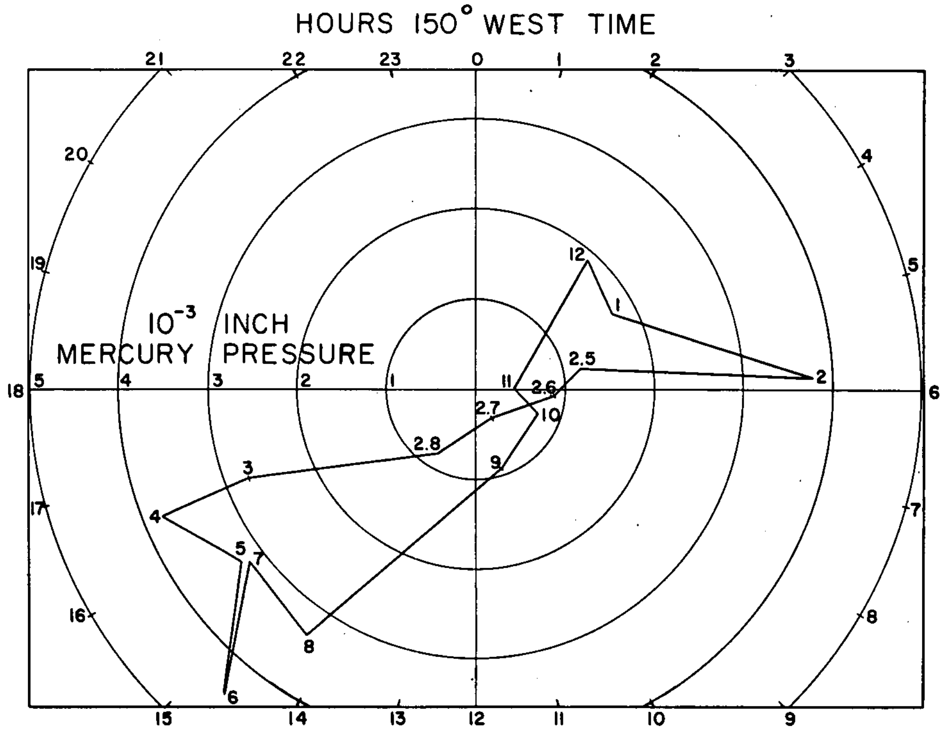

Fig. 1. Phase and Amplitude of Pressure Oscillation with 24 hour Period.

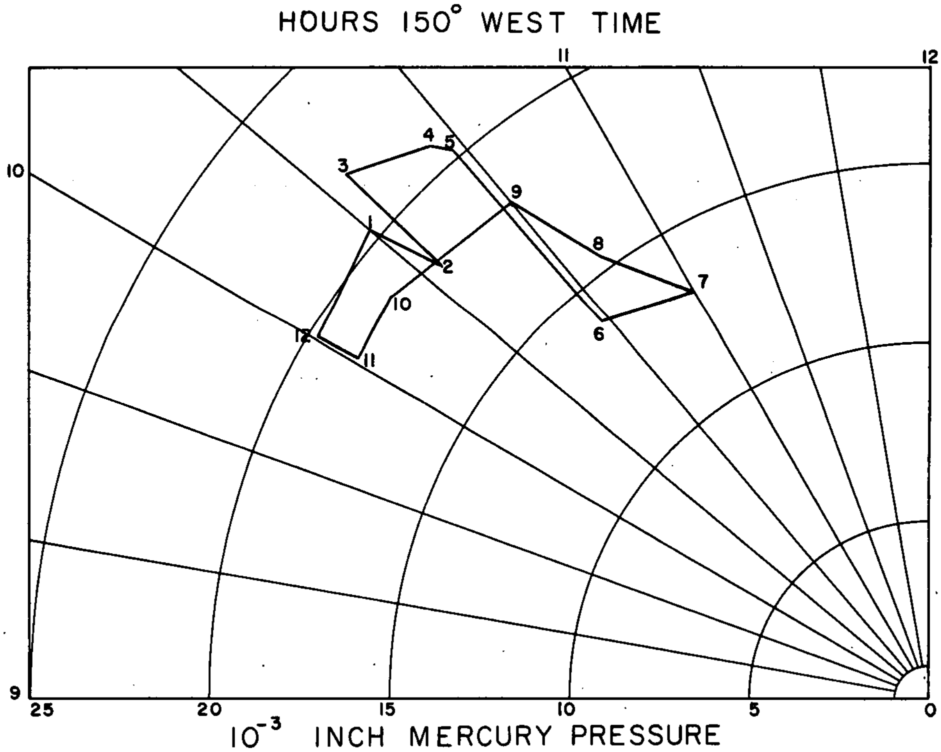

Fig. 2. Phase and Amplitude of Pressure Oscillation with 12 hour Period.

Fig. 2 shows the 12 hour component. It has amplitude and phase variations quite similar to what might be expected and in accord with the theory of a worldwide resonance in the earth's atmosphere [3].

Fig. 3 shows the 8 hour component. The phase of this oscillation is opposite in summer compared to winter. However the points enclose the zero. Consequently the phase rotates on a yearly basis instead of swinging as the 24 hour component. The smooth regular way in which the curve progresses suggests that the 8 hour oscillation is of worldwide nature, very little affected by local events. The phase progresses earlier and gains one turn in a solar year, the same as sidereal time. Consequently it is tempting to guess that the source of this oscillation may be associated in some way with the fixed stars.

Fig. 4 shows the 6 hour component. Only two months have amplitudes slightly greater than .001" mercury. The various months follow in quite random phase. Consequently this figure merely represents the residual of random storm effects and scaling errors. If a 6 hour component exists the amplitude is much less than .001" mercury and far below what the available data is capable of detecting.

The vectors for each year of a given month and period were plotted together to form some idea of the internal scatter of a given month. The average deviation of both amplitude and phase is usually less than the change from one month to the next. This is true for the 24, 12, and 8 hour components and lends confidence in the reality of the seasonal changes. However, the vectors of the 6 hour component frequently showed wide dispersion in phase and amplitude. Some added to nearly zero as February, June and August. This further confirms that the 6 hour component does not represent any physical phenomenon.

The average monthly pressure continued to be high in summer and low in winter. However the base curve had flattened out by 1957 because the instrument had become acclimated with time and lost its internal drift.

During the period October 1957 through September 1958 a second instrument was operated at an elevation about 100 ft lower and 1,000 ft east of the Kole Kole instrument. The data from it was analysed separately in the same manner in an attempt to check on the Kole Kole instrument. Unfortunately most of the results of the second instrument were vitiated due to an abnormal enviroment. It was housed in a building containing a television transmitter. The cooling blower operated from about 1 p.m. to midnight and depressed the building pressure in an irregular way. This effect was not detected until too late. What little information could be gleaned from the results of the second instrument confirms the Kole Kole analysis.

The temperature and humidity at Kole Kole appear in a separate discussion in a previous number of this publication (No. 24, p. 73).

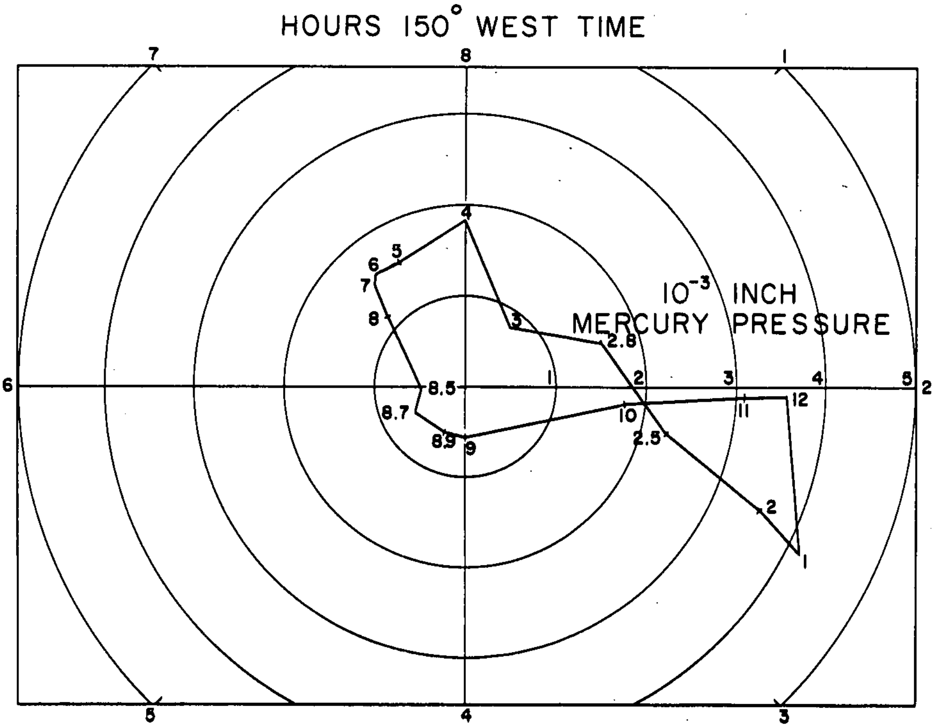

Fig. 3. Phase and Amplitude of Pressure Oscillation with 8 hour period.

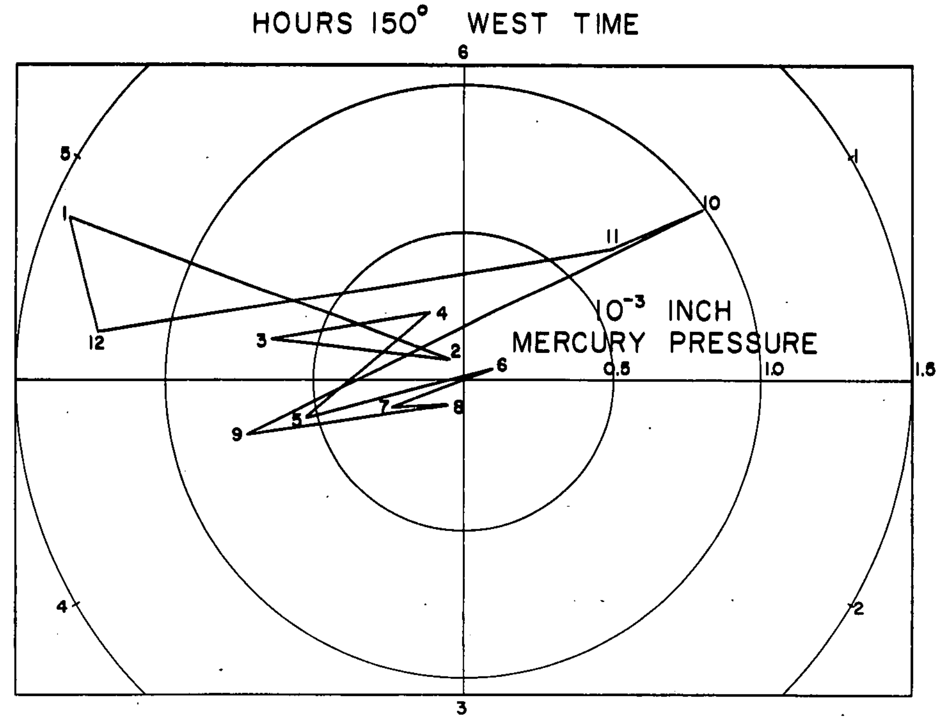

Fig. 4. Phase and Amplitude of Pressure Oscillation with 6 hour Period.

REFERENCES

[1] Reber, Grote	1957	"Atmospheric Pressure Atop Haleakala", Aust. Met. Mag., No. 18, p. 50.
[2] Conrad, V. and Pollak, L.W.	1950	"Methods in Climatology", p. 144 (Harvard University Press, Cambridge, Massachusetts).
[3] Mitra, S.K.	1948	"The Upper Atmosphere", The Royal Asiatic Society of Bengal, Monograph Series V, p. 32.