

# ATMOSPHERIC PRESSURE OSCILLATIONS IN TASMANIA

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## ABSTRACT

Fifty-one 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 reverses phase from summer to winter and is probably a world-wide phenomenon. The average monthly pressure is lowest during the last half of 1964, coinciding with the most recent minimum of solar activity.

## 1. INTRODUCTION

A microbarograph was operated, from December 1962 through February 1967, five miles north of Bothwell, Tasmania. This same instrument was used in a previous study (Reber, 1959). The instrument was sited in the centre of a flat plain, a few miles in extent, which was surrounded by hills 300 to 700 feet high on the east, north and west. The altitude of the plain was 1373 feet above sea level, at latitude  $42^{\circ} 19.8'S$ , longitude  $147^{\circ} 02.1'E$ . The instrument was located in a large tight building which greatly reduced wind surges. Long term storm variations were many times the amplitude encountered at Haleakala.

## 2. PROCESSING OF DATA

The microbarograph charts were graduated in even millibars pressure and in hours time. At each hour the trace was estimated to the closest one-fifth millibar and the readings tabulated. The tabulations at a given hour for each day of the month were combined to produce an average monthly value of pressure for the given hour. Twenty-four such hourly averages produced an average monthly diurnal pressure variation. Storm effects usually caused small changes in observed pressure between the start of the first day and the end of the last day of the month. This prevented the average monthly diurnal pressure variation from properly closing between 23 and 00 hours. Examination of the charts provided a simple arbitrary pressure correction which was applied proportionally along the average monthly diurnal pressure variation. In this manner storm effect discontinuities were removed.

In order to further reduce scatter caused by storms, the average monthly diurnal pressure variations for a given month for each year were combined to produce a characteristic diurnal pressure variation for the given month. Hourly values of pressure for each month of the average, and the characteristic diurnal pressure variations were subjected to harmonic analysis (Conrad and Pollak, 1950).

Results were returned for the first six harmonics in terms of amplitude and phase plus residual errors. The latter were usually less than 0.02 millibar beyond the fourth harmonic. They represent random scaling errors and abrupt storm pressure changes.

The phase and amplitude of harmonics composing the characteristic diurnal pressure variations are shown in Figures 1 to 4. The months are denoted by 1 to 12 for January to December. Average points for summer and winter seasons are denoted by S and W respectively. The months of any given season for any given harmonic were chosen subjectively. After plotting the points, those clustering together near the middle of the year were chosen as representative of winter and those clustering towards the end of the year as summer. Half the points composing a given season are within the ellipses shown in the diagrams. These ellipses were computed by taking independent quartile ranges as the axes of the ellipses shown. The reliability of this was checked by plotting individual monthly points. In all cases 50 percent  $\pm$  10 percent of points

It is in this context that the assessment by Slatyer of the reduction in evapotranspiration as soil moisture is reduced, would be particularly helpful. The individual response of plants to varying conditions of water stress may also be important at this time.

### ACKNOWLEDGEMENTS

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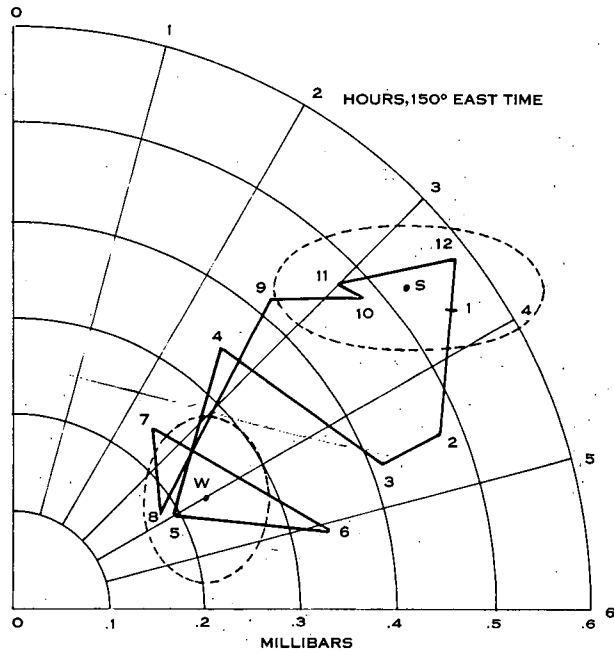


Fig. 1 Phase and amplitude of pressure oscillation with 24 hour period and 50 percent probability ellipses.

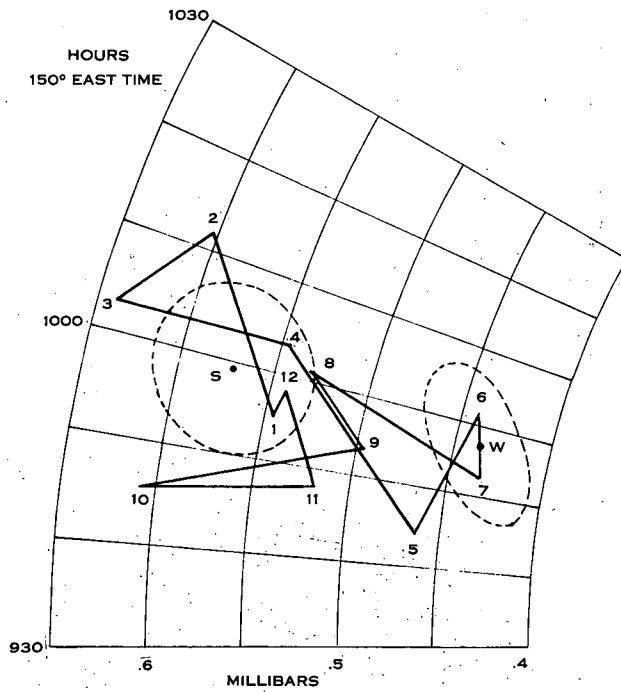


Fig. 2 Phase and amplitude of pressure oscillation with 12 hour period and 50 percent probability ellipses.

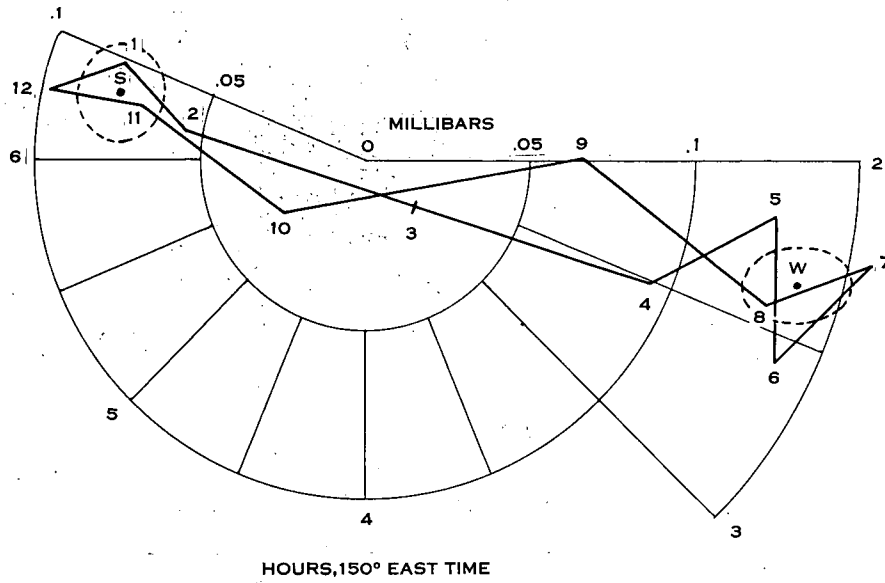


Fig. 3 Phase and amplitude of pressure oscillation with 8 hour period and 50 percent probability ellipses.

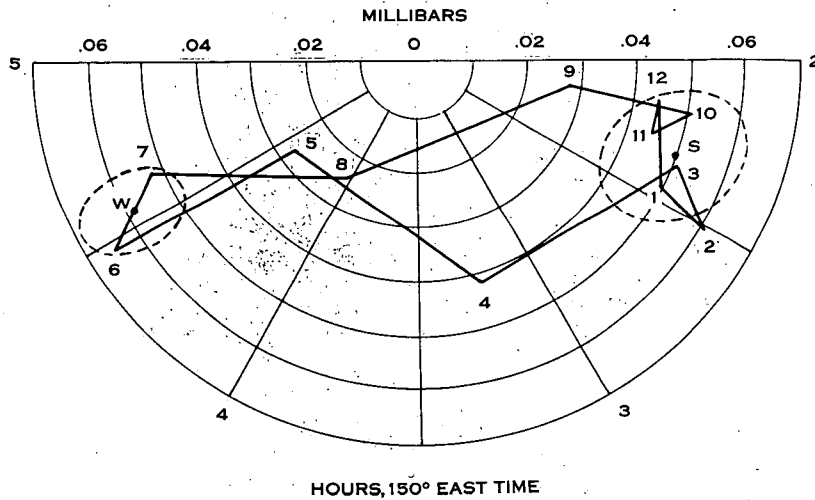


Fig. 4 Phase and amplitude of pressure oscillation with 6 hour period and 50 percent probability ellipses.

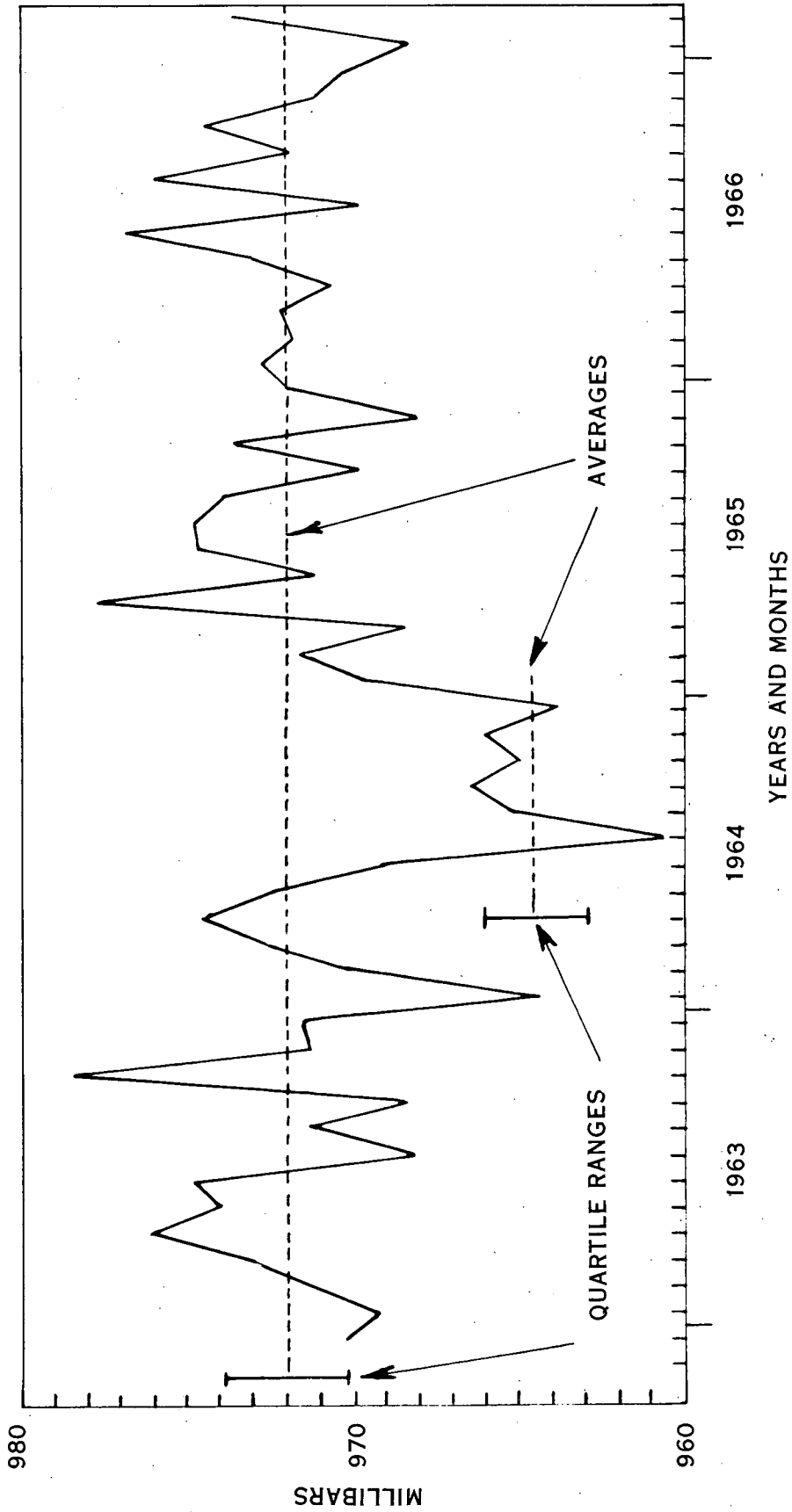


Fig. 5 Average monthly pressure.

fell respectively inside and outside the ellipses. When all the points of all the ellipses were added, 50.4 and 49.6 percent fell inside and outside respectively.

### 3. PRESSURE OSCILLATIONS

Figure 1 shows the 24-hour component. Winter and summer are respectively composed of months 5, 6, 7, 8 and 10, 11, 12, 1. The phase remains nearly constant. The amplitude during summer is over twice the winter value. The transition between seasons is marked. Summer and winter values will rarely interchange. This oscillation is a world-wide thermal effect which travels from east to west with the angular speed of the sun (Godske, Bergeron, Bjerknes and Bundgaard (1957)).

Figure 2 shows the 12-hour component. Winter is composed of months 6, 7. Summer comprises months 10, 11, 12, 1, 2, 3. Summer and winter values will occasionally interchange. The phase and amplitude are similar to what might be expected in accord with the theory of world-wide resonance in the earth's atmosphere (Mitra (1948)).

Figure 3 shows the 8-hour component. Winter and summer are respectively composed of months 5, 6, 7, 8 and 11, 12, 1, 2. The phase is opposite at the solstices, with very rapid transitions close to zero during the equinoxes. Summer and winter values never interchange. These results are rather similar to those secured atop Haleakala in accord with the theory of sectorial oscillation (Godske et al. (1957)).

Figure 4 shows the 6-hour component. Winter and summer are respectively composed of months 6, 7 and 10, 11, 12, 1, 2, 3. The amplitude of all months is small compared to periods of 24, 12 and 8 hours. Even so, seasonal change is clearly visible. This phenomenon is the tesseral oscillation which moves from east to west with the sun (Godske et al. (1957)). No component of 6-hours period could be found in Haleakala data having similar randomness. The tesseral oscillations have greater amplitude at higher geographic latitudes.

### 4. AVERAGE PRESSURE

The twenty-four hourly values of the average monthly diurnal pressure variation were combined to give the average monthly pressure. This value for the 51 months is shown in Fig. 5. Storm effects cause random variations of several millibars. The only significant feature is the six low values for the last half of 1964. Excluding these, the average monthly pressure for the remaining 45 months is 972.01 mb, with a quartile range  $\pm$  1.89 mb. The last six months of 1964 have an average monthly pressure of 964.58 mb, with a quartile range of  $\pm$  1.54 mb. It is tempting to note a probably unrelated phenomenon, namely, that the last minimum of solar activity occurred during October 1964. The microbarograph was stored near sea level for three years between the removal from the top of Haleakala and the start of operations at Bothwell. No long-term creep of bellows of type encountered atop Haleakala was found.

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