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Overlay for Use of the J.J. George Technique over the North Pacific

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INTRODUCTION

Legal (1981) demonstrated the use of the J.J. George Technique for the deepening of North Pacific cyclones in a southwest flow. He used the 1000-500 mb thickness data in place of temperatures, and the satellite pictures to locate the surface low centre.

His results suggested that the technique usually outperforms the numerical prognoses in the early detection and prediction of rapidly deepening Pacific storms.

The ability to use the thickness data instead of temperatures makes the J.J. George Technique much quicker to use. The author decided to facilitate the use of the technique further by constructing an overlay that can be used on the standard 1:20 million size CMC 500 mb final analysis chart.

THE GEORGE TECHNIQUE

For a complete explanation of the J.J. George Technique, the reader should refer to the original publication. This Technical Note will explain the main parameters used in the George Technique (see Figure 1).

The two parameters used to quantify the amount of deepening are:

(1) The difference in 500 mb height across the surface low within $7\frac{1}{2}°$ latitude either side of the surface low measured normal to the 500 mb current (open contours only).

(2) The difference in the 1000-500 mb thickness between a point directly above the surface low and the lowest thickness included in an arc extending 15° latitude into the northwest quadrant from the low.

These parameters are then entered onto the graph and George's procedure followed. George also found that for strong deepeners and in advance of the upper trough, the direction of motion of the low averaged $7\frac{1}{2}°$ angle across the 500 mb contours towards lower heights.

FEATURES OF THE OVERLAY

The vertical axis is used to measure the height difference at 500 mb above the low centre (see Figure 2). The low centre on the axis is placed above the surface low position and the height change is taken between the two

markings on the axis. As the latitude of the low varies, the distance across 15° latitude on the 500 mb chart will vary. Markings have therefore been placed on the vertical axis between which the measurement can be taken depending on the surface low position.

The horizontal axis is used to measure the difference in thickness (see Figure 3). The low centre marked where the horizontal and vertical axis intersect is placed over the surface low position on the chart. The thickness difference is then read from the low centre to the lowest thickness northwest of the low. Once again markings for the distance to be used for various latitudes has been added to the horizontal axis.

These values are then entered into the insert graph to find the deepening rate. To save further time, the number of contour lines or thickness lines may be used on the graph instead of the difference in decametres.

The horizontal axis marked 7½° is used in calculating the average direction of rapidly deepening lows (see Figure 4). Appendix A demonstrates a sample calculation using the overlay discussed in this note.

REFERENCES

1. Legal, L., Satellite Imagery and the Use of the J.J. George Technique for Maritime Cyclones over the Pacific, Pacific Region Technical Notes 81-026, November 25, 1981.

2. George, J.J., Weather Forecasting for Aeronautics, Acedemic Press, London, 1960, pp. 133-155.

DEEPENING PREDICTION GRAPH FOR
THE EASTERN PACIFIC (mb per 24 hrs)

CHANGE IN THICKNESS (contours)

CHANGE IN THICKNESS (decametres)

CHANGE IN HEIGHT (decametres)

CHANGE IN HEIGHT (contours)

NO OF CONTOURS AT 500 MB

lat of sfc low

LOW
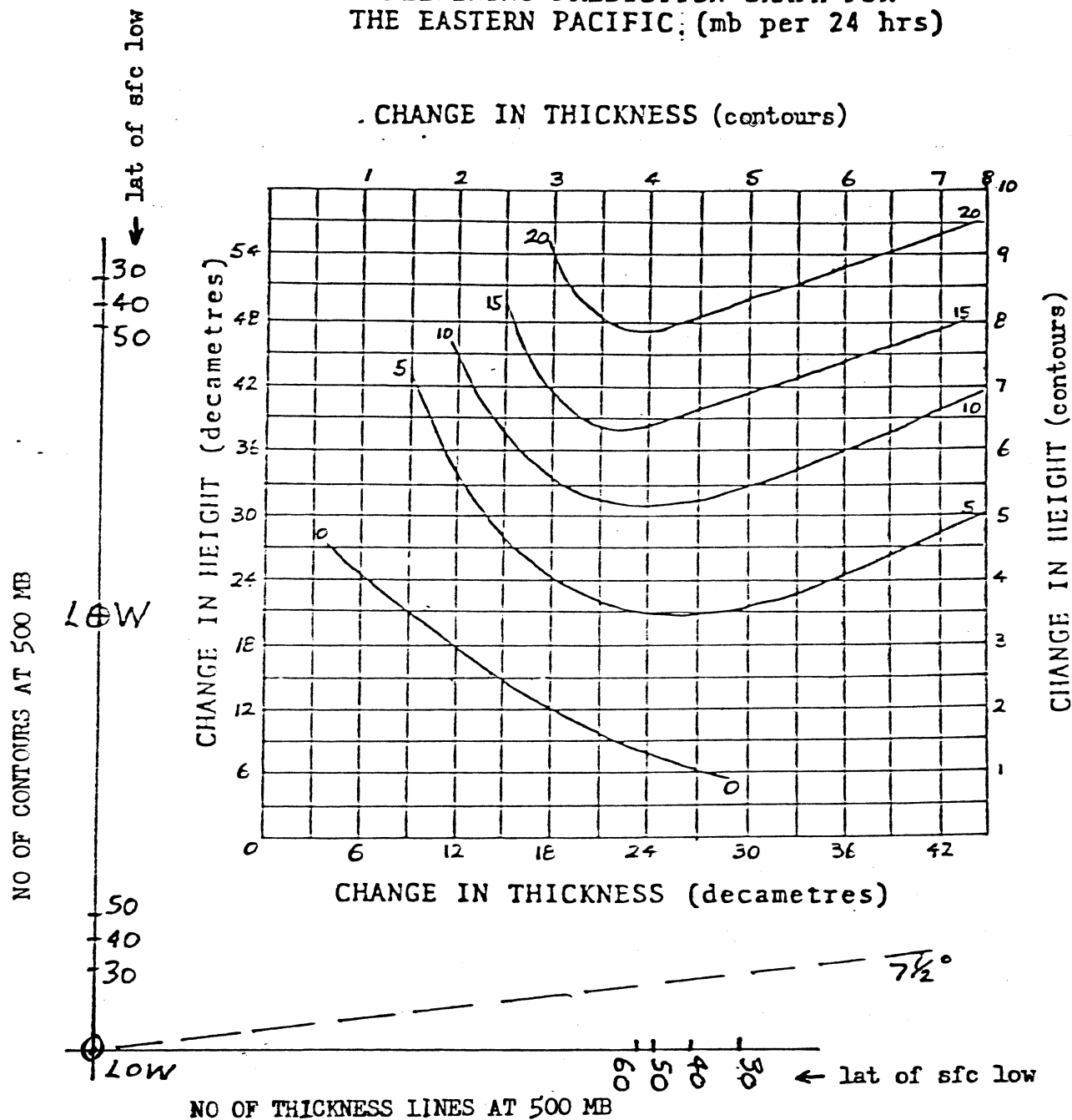
NO OF THICKNESS LINES AT 500 MB

lat of sfc low

7½°

FIGURE I.

COMPLETED OVERLAY WITH J.J. GEORGES DEEPENING
PREDICTION GRAPH INSERTED
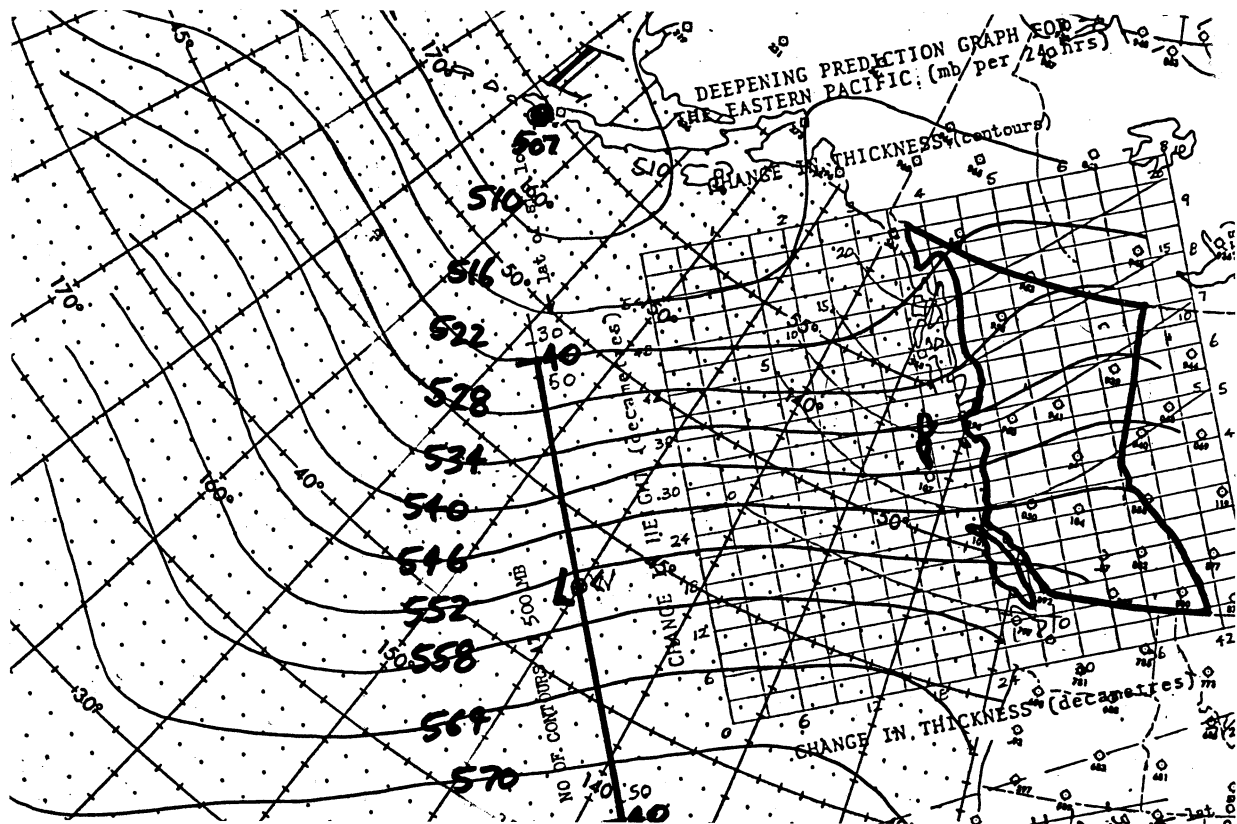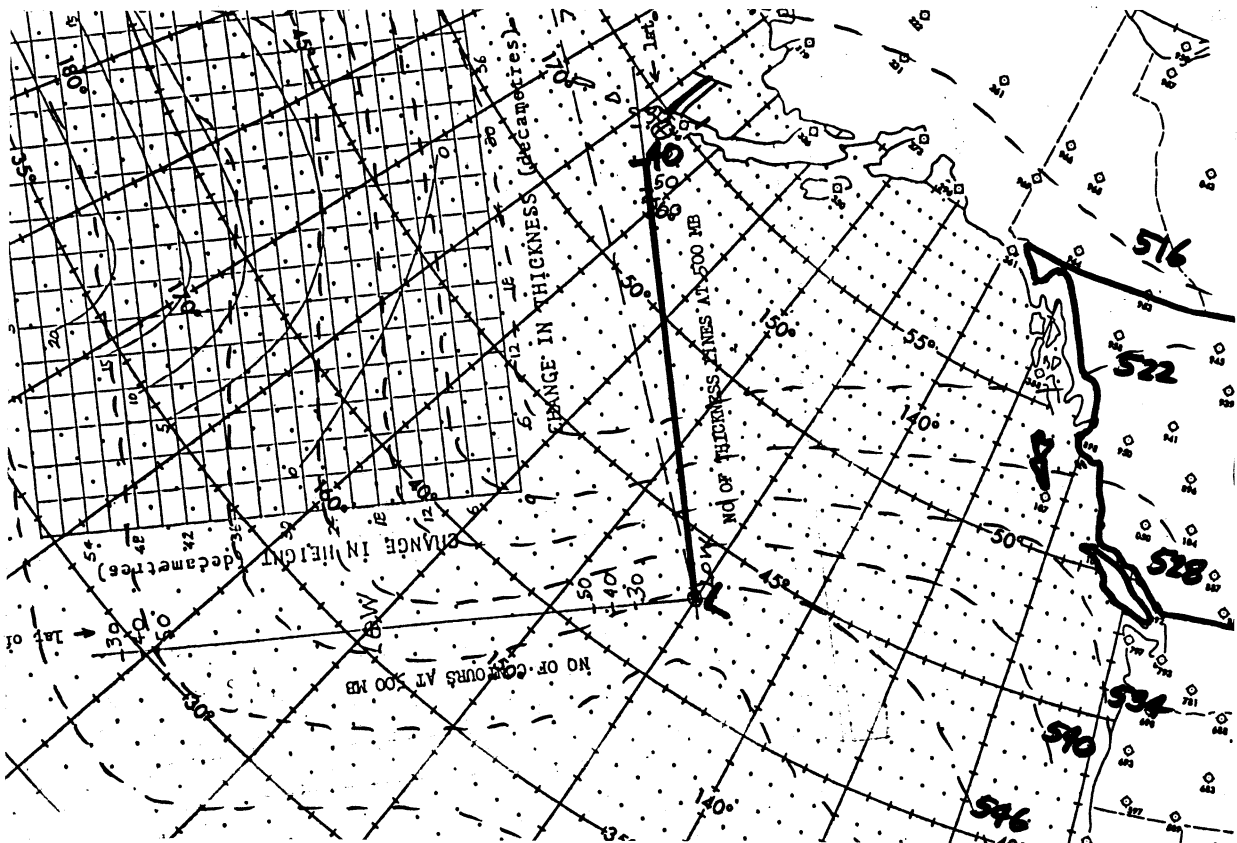
FIGURE 2

Use of the overlay to compute the 500 mb height difference
within 7½° latitude either side of the surface low.

FIGURE 3

Use of the overlay to compute the thickness from the surface low
to the coldest air within 15° latitude to the north of the surface low.
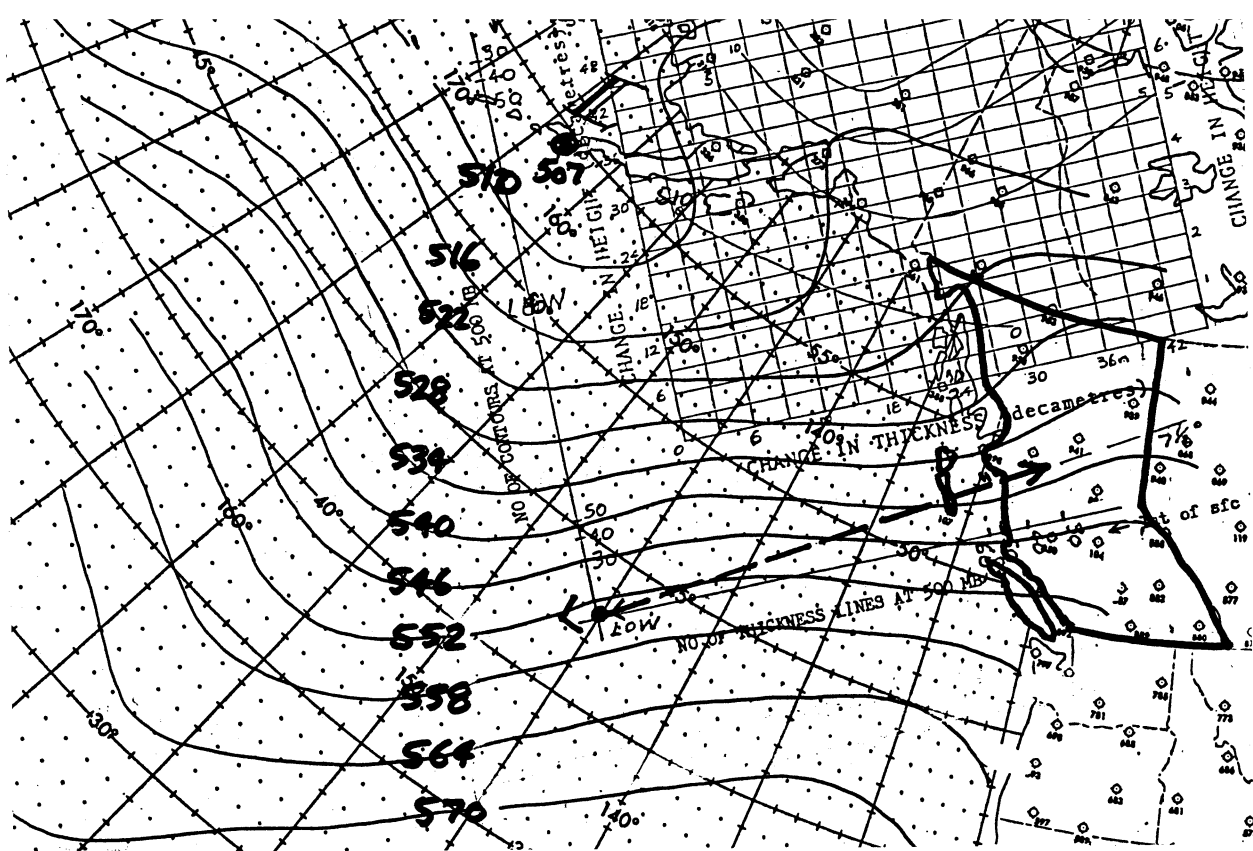
FIGURE 4

Use of the overlay to determine the direction
of the surface low over a 24 hour period

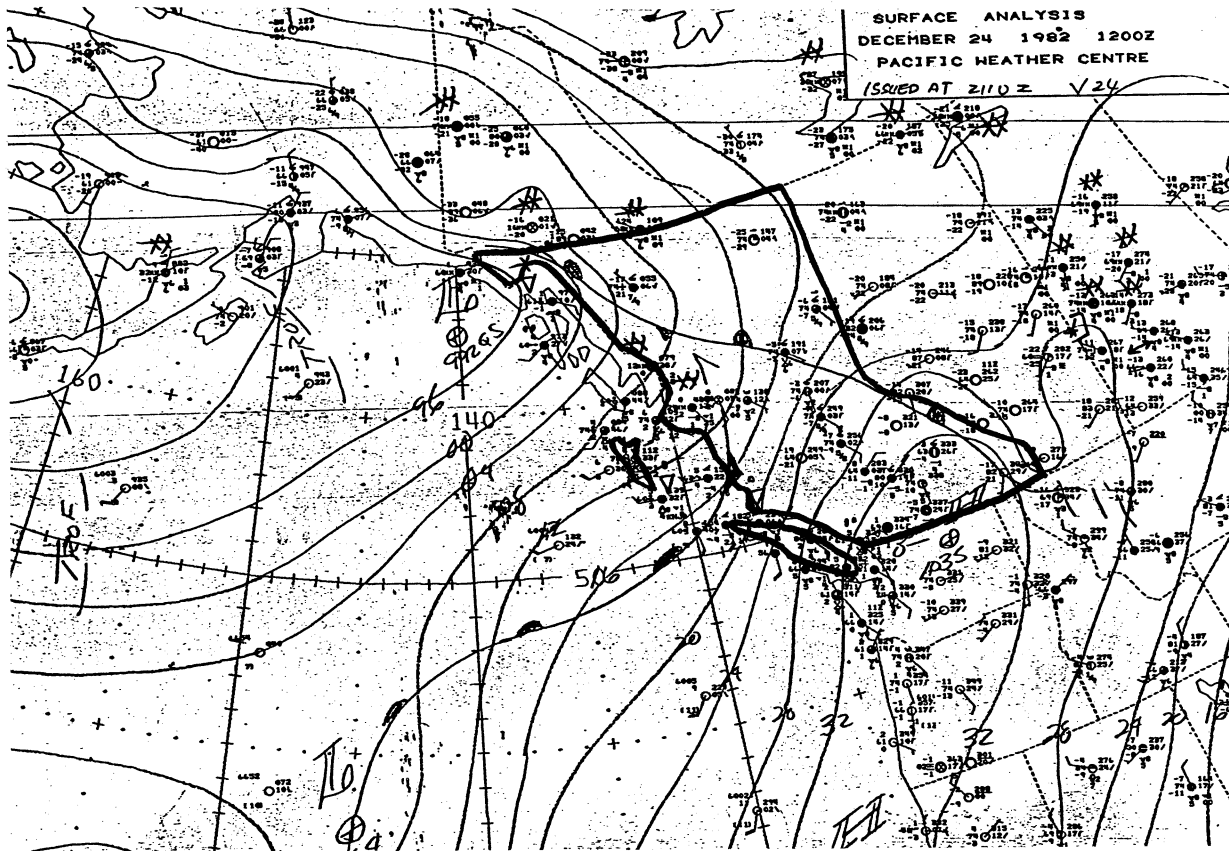FIGURE 5

Surface analysis for December 14/12Z

DEEPENING PREDICTION GRAPH FOR
THE EASTERN PACIFIC (mb per 24 hrs)

CHANGE IN THICKNESS (contours)

CHANGE IN HEIGHT (decametres)

CHANGE IN THICKNESS (decametres)

NO OF CONTOURS AT 500 MB

CHANGE IN HEIGHT (contours)

← lat of sfc low
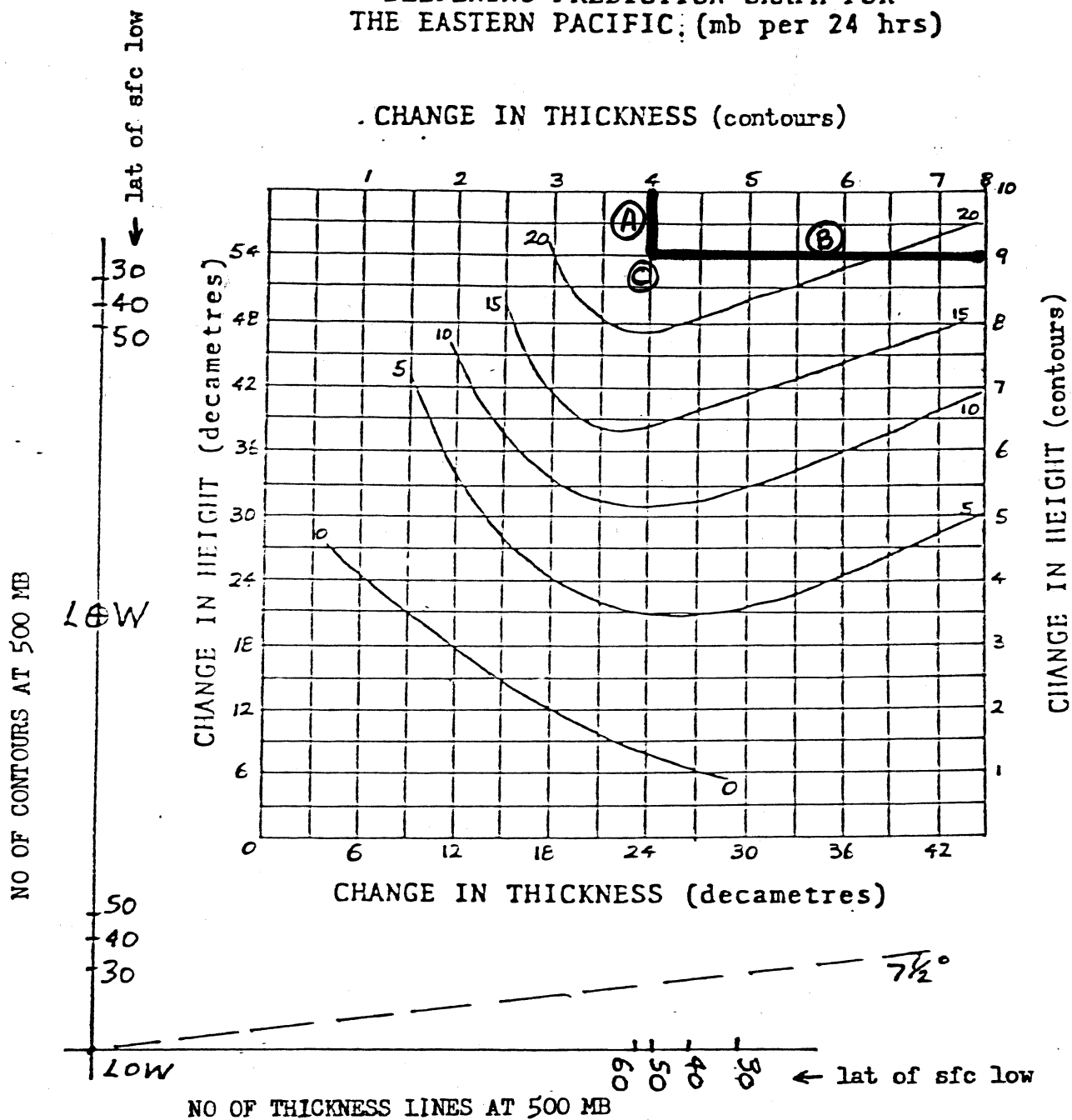
NO OF THICKNESS LINES AT 500 MB

← lat of sfc low

FIGURE 6

Overlay with calculation of deepening expected
for surface low over a 24 hour period.
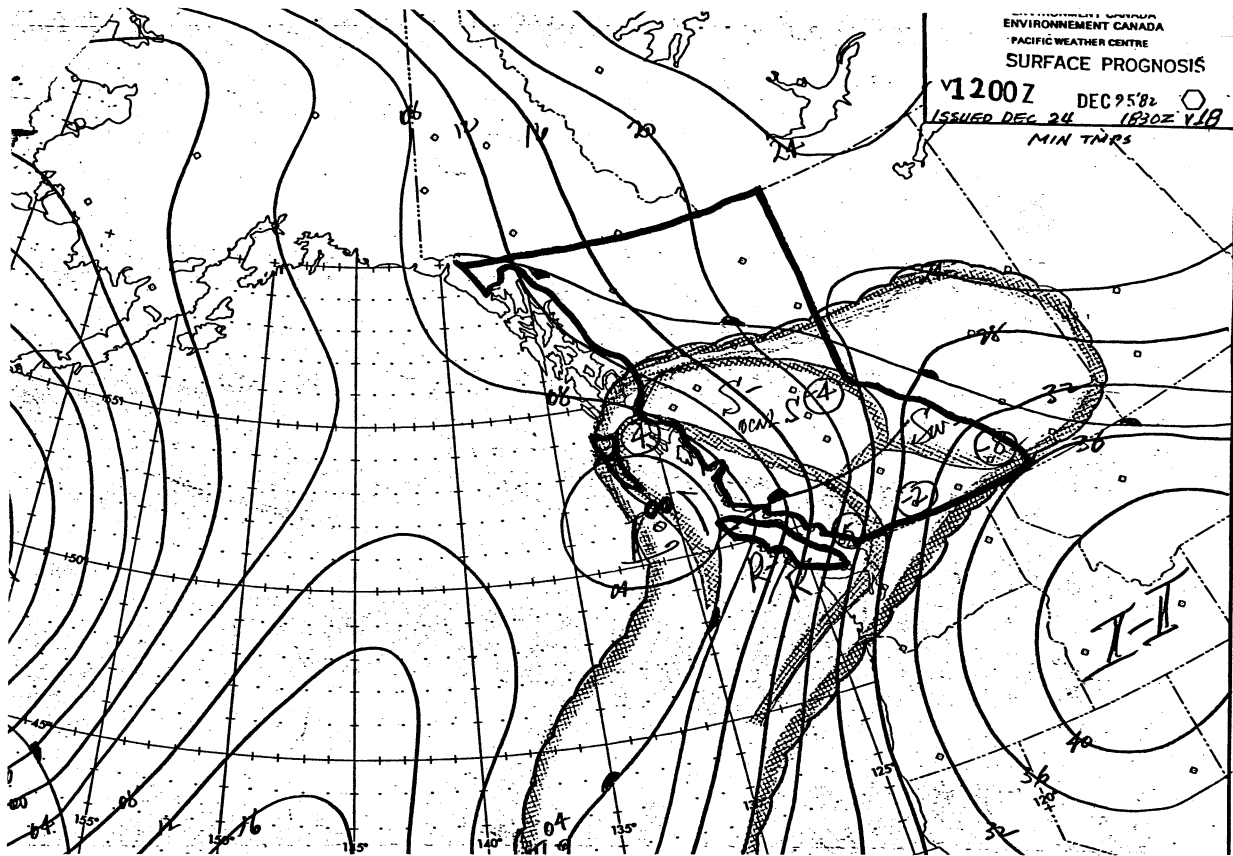
FIGURE 7

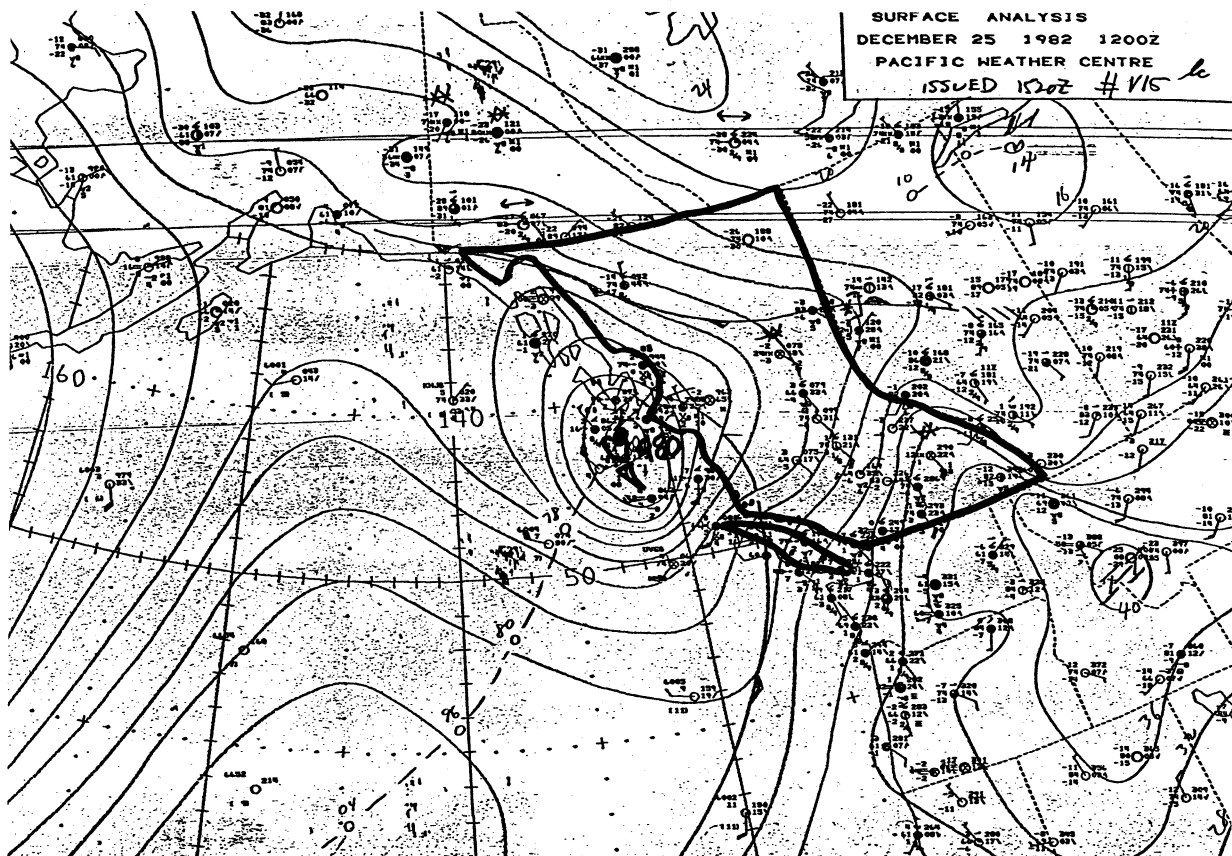PWC 24 hour surface prog valid 1200Z, December 25, 1982.

FIGURE 8

Surface analysis for 1200Z, December 25, 1982.

Example calculation for use of overlay

Figure 2 shows the extracted 500 mb heights for December 24/12Z, 1982.

Figure 3 shows the extracted 1000-500 mb thickness for Dec 24/12Z, 1982.

Figure 5 is the surface analysis for December 24/12Z, 1982, which shows a 1004 mb surface low near 43°N 145°W moving in a northeasterly direction.

Figure 2 shows that there are 9 contour lines at 500 mb spaced 7½° latitude either side of the surface low for a low near the 40° latitude. This value is entered on the insert graph as line B on Figure 6.

Figure 3 shows that there are 4 thickness lines from the surface low to the coldest air to the north of the low within 15° latitude of the low. This value is entered on the insert graph as line A on Figure 6. Where the lines intersect (at point C) a deepening rate of approximately 24 mb over 24 hours is calculated. Using this value we get a 24 hour value of 980 mb (1004-24 mb) for the surface low.

Figure 4 indicates the low moving through the southern end of the Queen Charlotte Islands.

Figure 8 shows the low 24 hours later at the northern end of the Queen Charlotte Islands with a central value of 980 mb, 20 mb deeper than predicted but exactly equal to what the graph predicted.

Concluding Remarks

The PWC surface prog was better than any of the numerical models. The use of the overlay to calculate the low centre in this example took less than 60 seconds. Considering the results obtained versus the PWC prog, the overlay should serve as a quick and easy check for the deepening rate of surface lows.