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Thundershower Activity over Southwestern B.C....A Case Study

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INTRODUCTION

On the evening of August 9, 1983, a significant area of thundershowers and lightning developed over the B.C. Lower Mainland. Numerous lightning strikes were recorded in the Greater Vancouver and Lower Fraser Valley areas (see Figure 1). This convective area continued expanding and proceeded to move rapidly northeastward before weakening over eastern sections of the Central B.C. Interior the following morning. Such a vivid thunder and lightning display is highly unusual in the Greater Vancouver area. Little or no indication of this summer severe weather was forecast. An attempt is made here to document the case.

THE SITUATION

A static 500 millibar pattern was in effect over B.C. and vicinity on the morning of Tuesday, August 9, 1983. A quasistationary upper low centre lay about 100 miles west of Vancouver Island with a trough extending southwestward and rotating eastward at 40 knots. A building upper ridge along the Rocky Mountains was nearly stationary. A vorticity centre and associated shortwave trough lay off the Oregon coast with a northeastward motion of 25 to 30 knots. A jet stream axis lay on a line through southern Vancouver Island with a second branch extending through northern Vancouver Island (refer to Figure 2).

DISCUSSION

Rapid convective development occurred in southwestern B.C. as can be seen by an examination of the 10/0145Z, 10/0445Z, and 10/0745Z satellite pictures (see Figures 3 to 5).

I. Why did this development occur?

1) An analysis of the tephigram for Quillayute indicates the presence of upper level potential instability (see Figure 6). This is also evident from the surface observations with frequent reports of altocumulus castellanus. Temperatures in Vancouver and Abbotsford reached the low to mid twenties with dewpoint temperatures climbing into the 14 to 16 degree range. Slight warm advection in the low levels was also discerned by an examination of the Quillayute tephigrams. The increase in low level moisture and instability appears to have played a significant role in the development.

2) A second factor was the progression of the shortwave trough through the Lower Mainland (refer to Figures 3-5). This shortwave, although weakening, provided much of the lift (upward vertical velocity) required.

3) High level wind maxima (jet stream) also appears to have had a major impact. A very strong jet is evident over southern Vancouver Island. The strength of the jet is supported by looking at the cloud associated with the shortwave (Figures 3-5). The higher cloud moves rapidly ahead of the low cloud and a change in the vertical structure of the system is apparent with the system subsequently weakening as a result. A split in the jet stream is present with a northern branch extending through northern Vancouver Island (Figure 2). This area of upper divergence also made an important contribution to development as it moved over southwestern B.C.

To summarize, the development of lightning occurred due to the convergence of the 3 above-mentioned factors.

II. Was the development forecastable?

A "cold low" off the southern B.C. coast with a southerly flow over the district frequently poses an instability problem in the weather for the Greater Vancouver area. Convective showers are often reported although thundershowers are usually much more isolated. An indication of this characteristic can be seen in the PWC progs (Figures 7-9).

The analysis of the major meteorological features was handled reasonably well on the satellite analysis charts (Figures 10 and 11). A calculation of stability indices based upon the 09/12Z tephigrams revealed only a chance or isolated thundershowers. The numerical progs also proved to be of almost negligible value in this case with no hint of any development. This is due largely to the development being on a subsynoptic rather than a synoptic scale.

The August 9 evening forecast issued by PWC mentioned no chance of precipitation in the Greater Vancouver area. This would seem due in part to the significance of the convergence of the 3 development factors not being recognized. However, little indication of the extent and intensity of the development could be discerned. Even if such development could be forecast, pinpointing the specific area to be affected would prove extraordinarily difficult. However, perhaps close attention to mesoscale features and physical parameters would aid in forecasting.

CONCLUDING REMARKS

This report has attempted to examine the intense and highly unusual thundershower activity that occurred in the Greater Vancouver area on the evening of August 9, 1983. A split in the jet stream flow coupled with an approaching shortwave trough and an increasingly unstable airmass were found to be the major driving forces for the development. Although a closer examination of the mesoscale features and physical parameters would have resulted in an improved forecast, pinpointing the severe weather area would be very difficult.

REFERENCES

Hammond, B., "Development of an Instability Line over the Northwest - A Case Study", Pacific Region Technical Note 79-026.

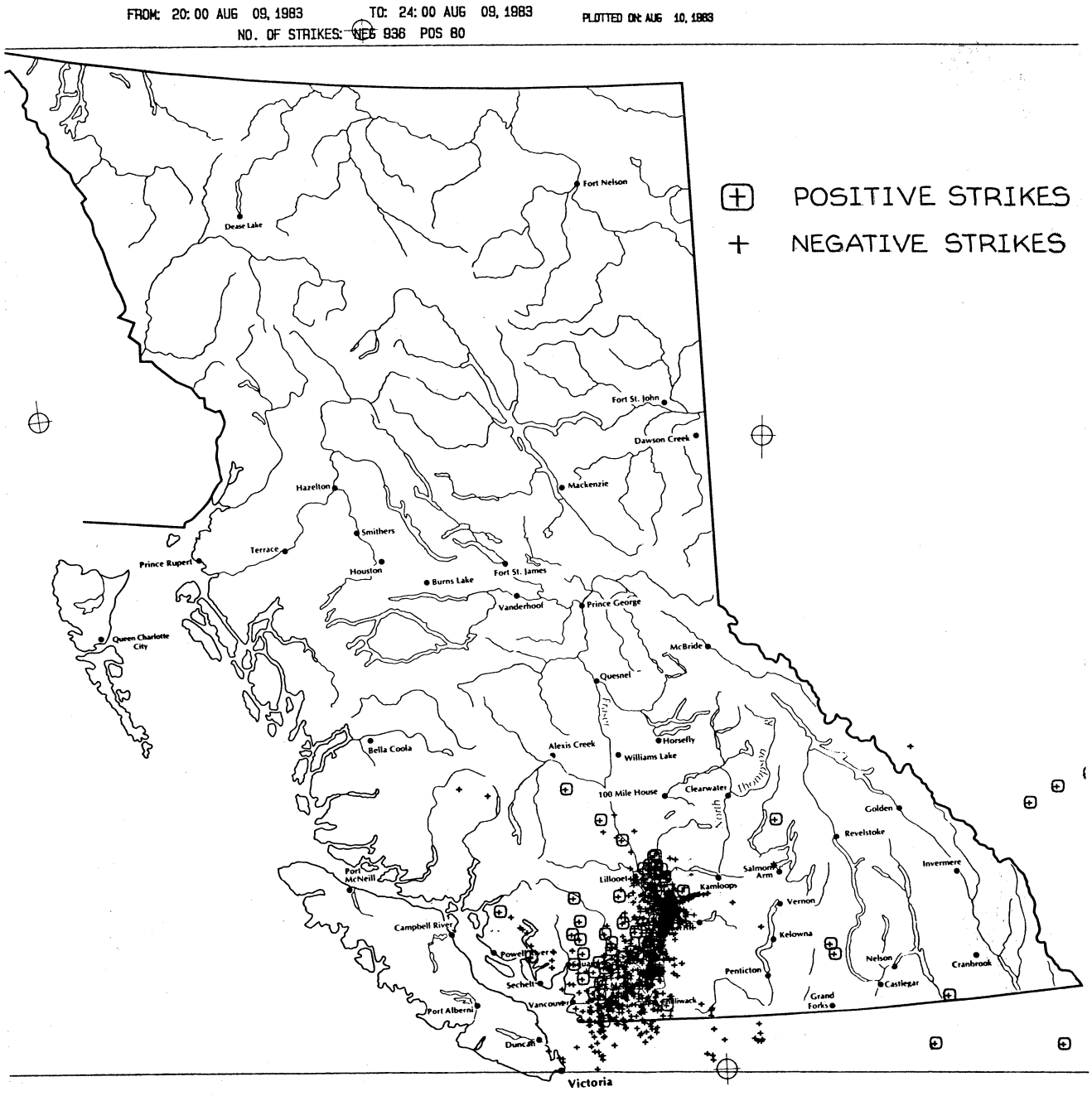

FIGURE 1. LIGHTNING STRIKE DATA 092000 - 100000 PDT

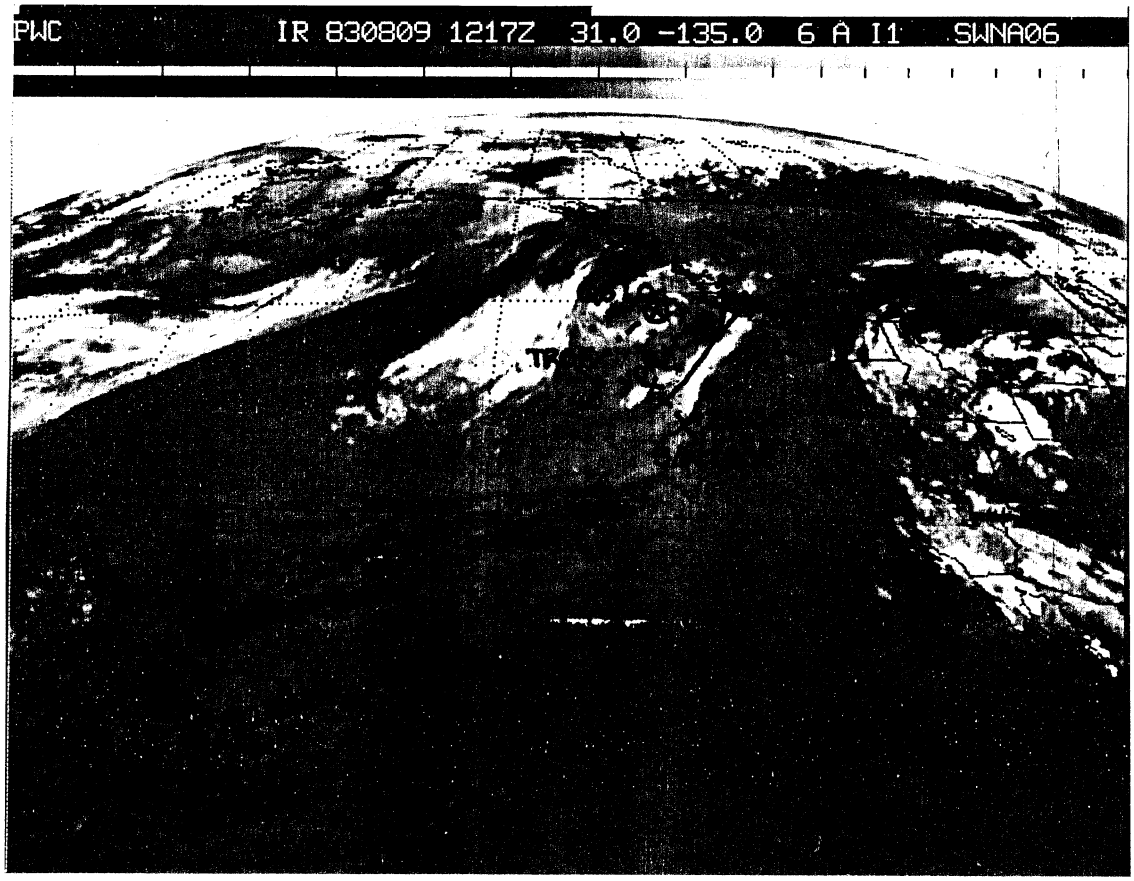

FIGURE 2. 09 1200Z SATELLITE PICTURE
ILLUSTRATION OF FEATURES

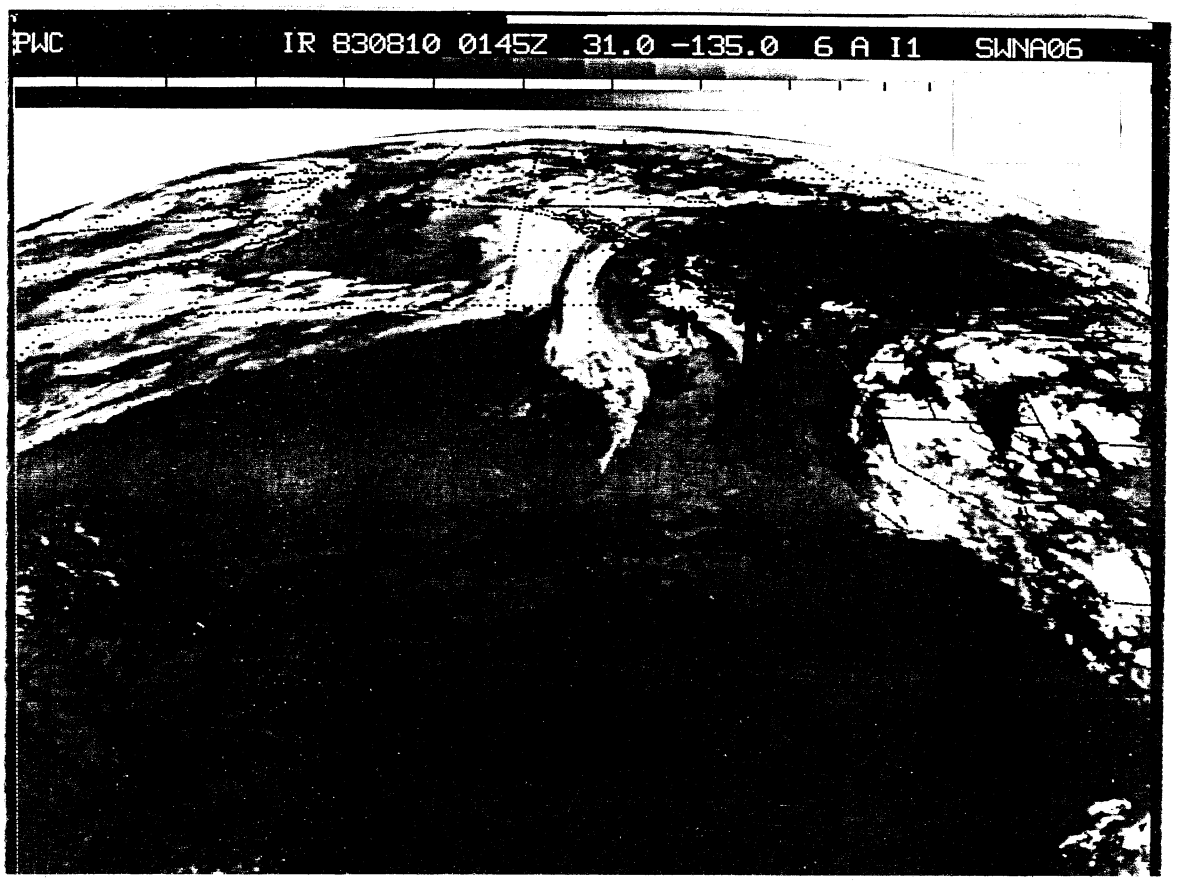

FIGURE 3. 100145Z SATELLITE PICTURE

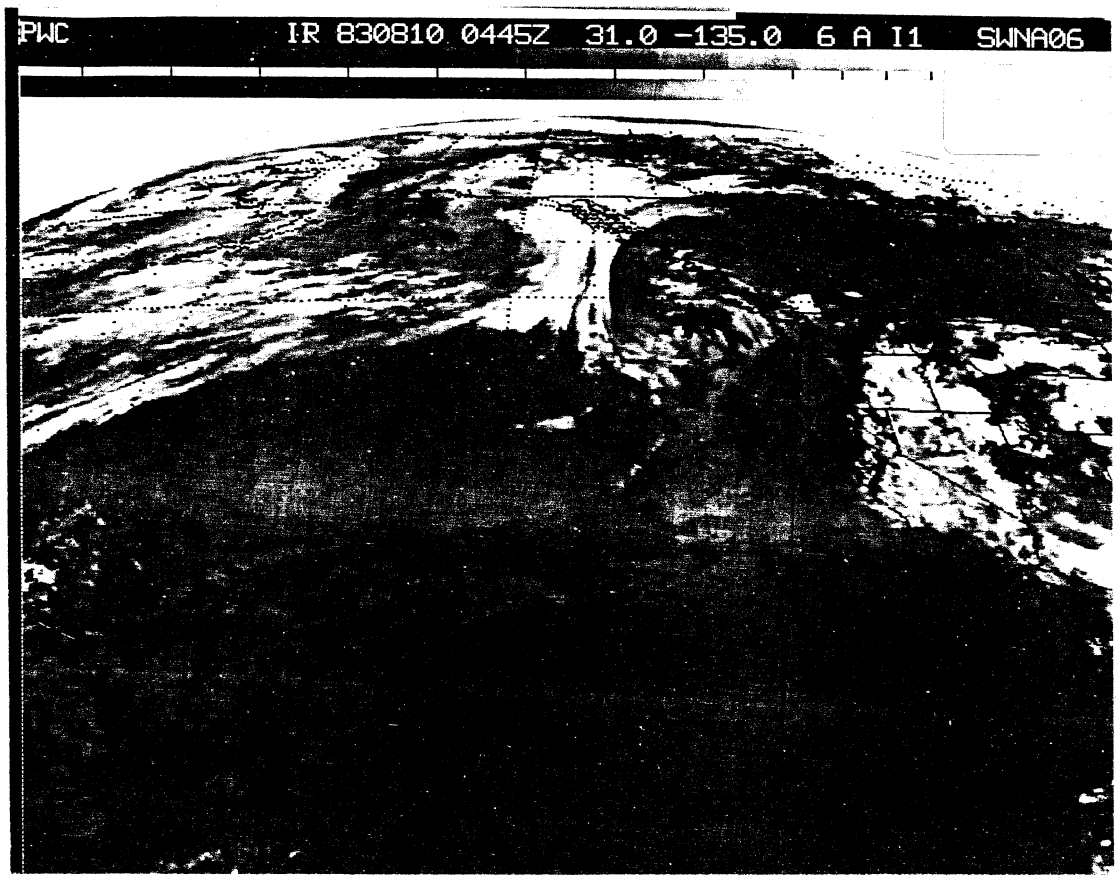

FIGURE 4. 100445Z SATELLITE PICTURE

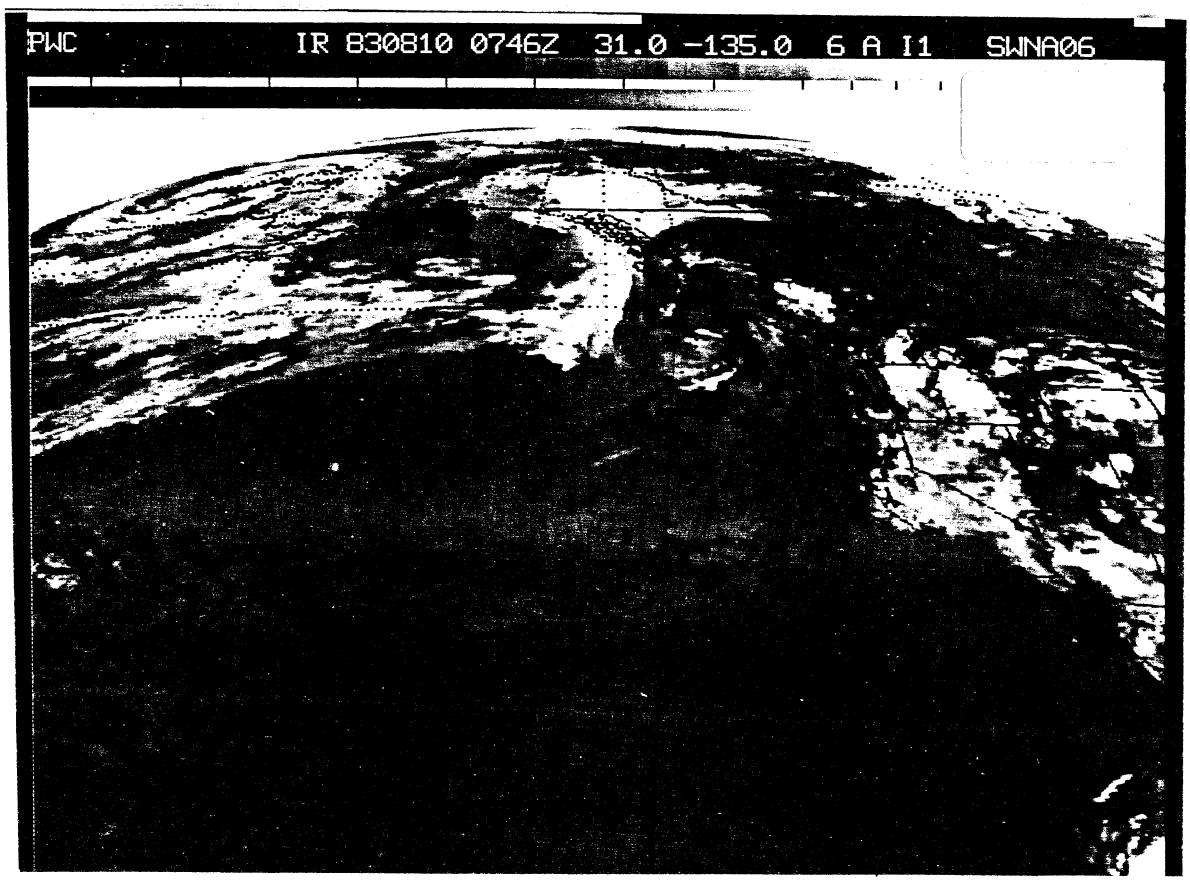

FIGURE 5. 100745Z SATELLITE PICTURE

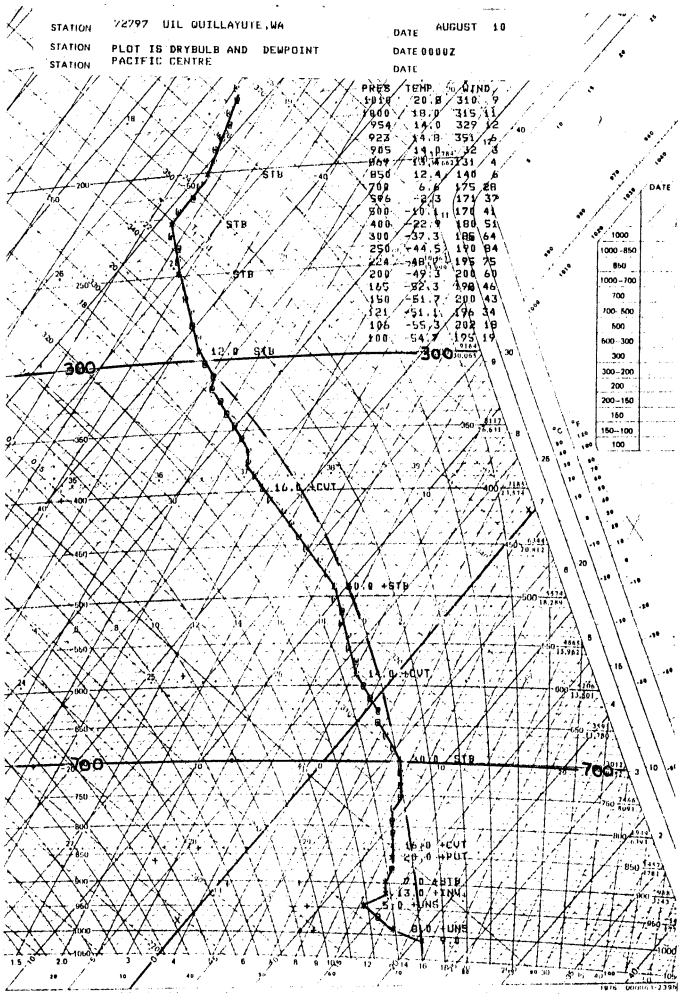

FIGURE 6. QUILLAYUTE TEPHIGRAM 1000002

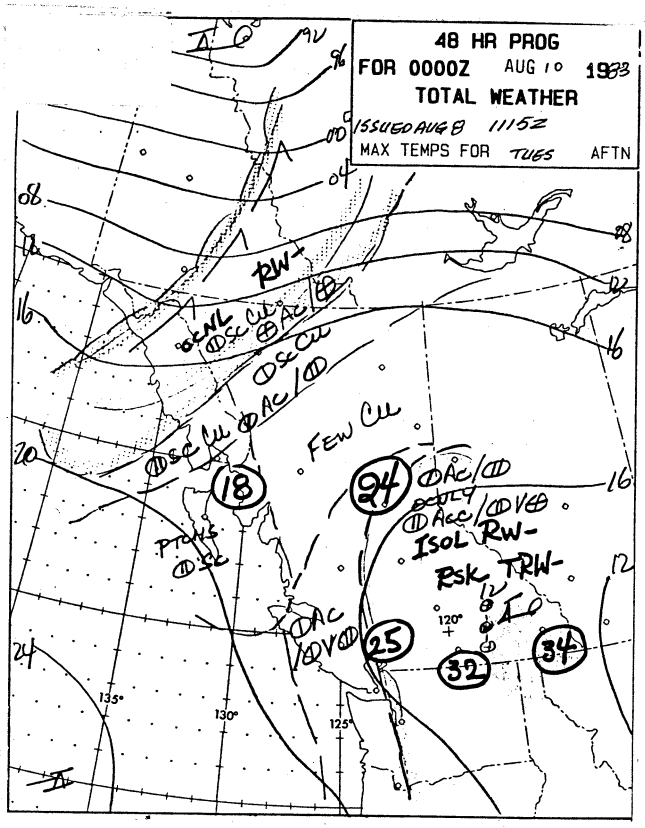

FIGURE 7. PWC 48HR PROG VALID 1000002

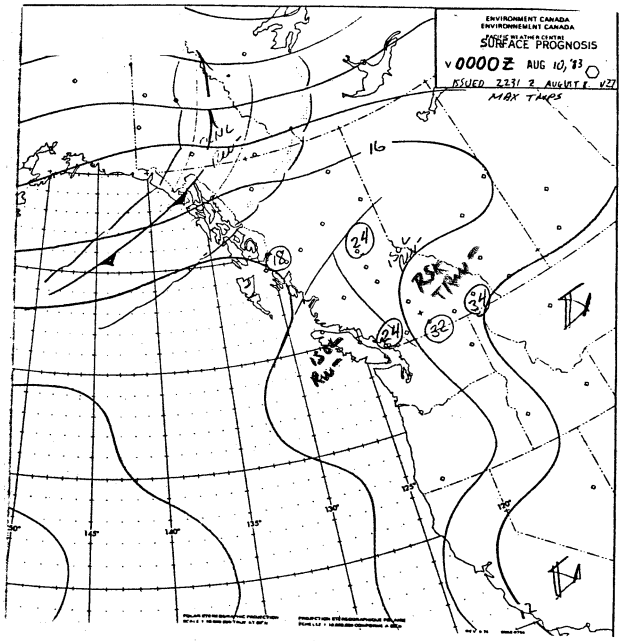

FIGURE 8. PWC 36HR PROG VALID 1000002

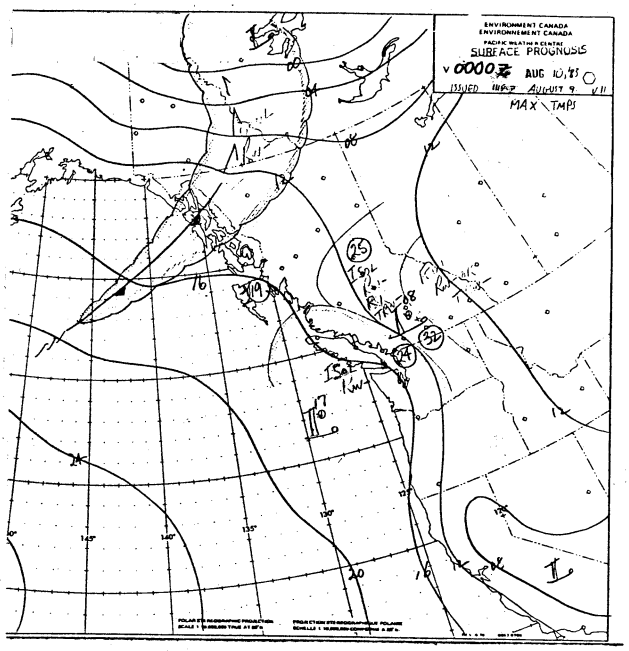

FIGURE 9. PWC 24HR PROG VALID 1000002

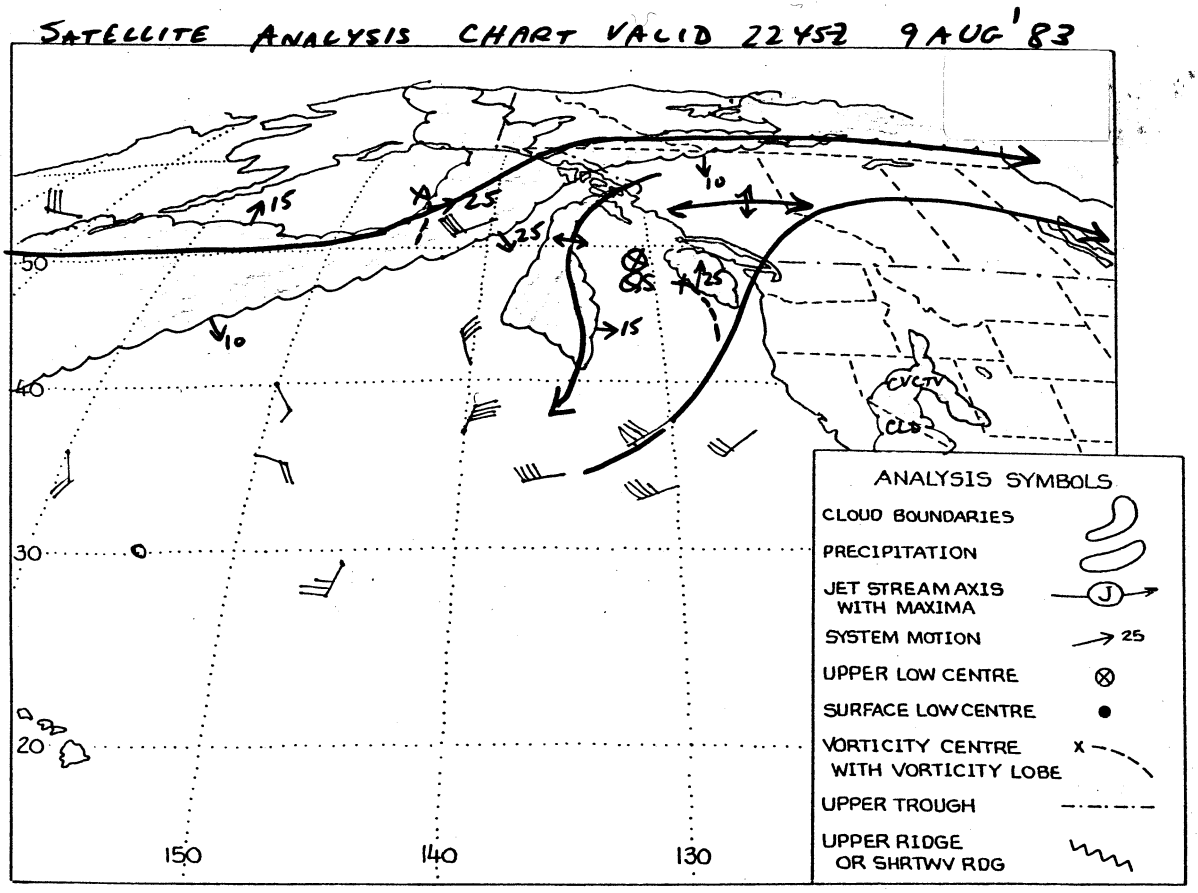

FIGURE 10. PWC SATELLITE ANALYSIS CHART VALID 092245Z

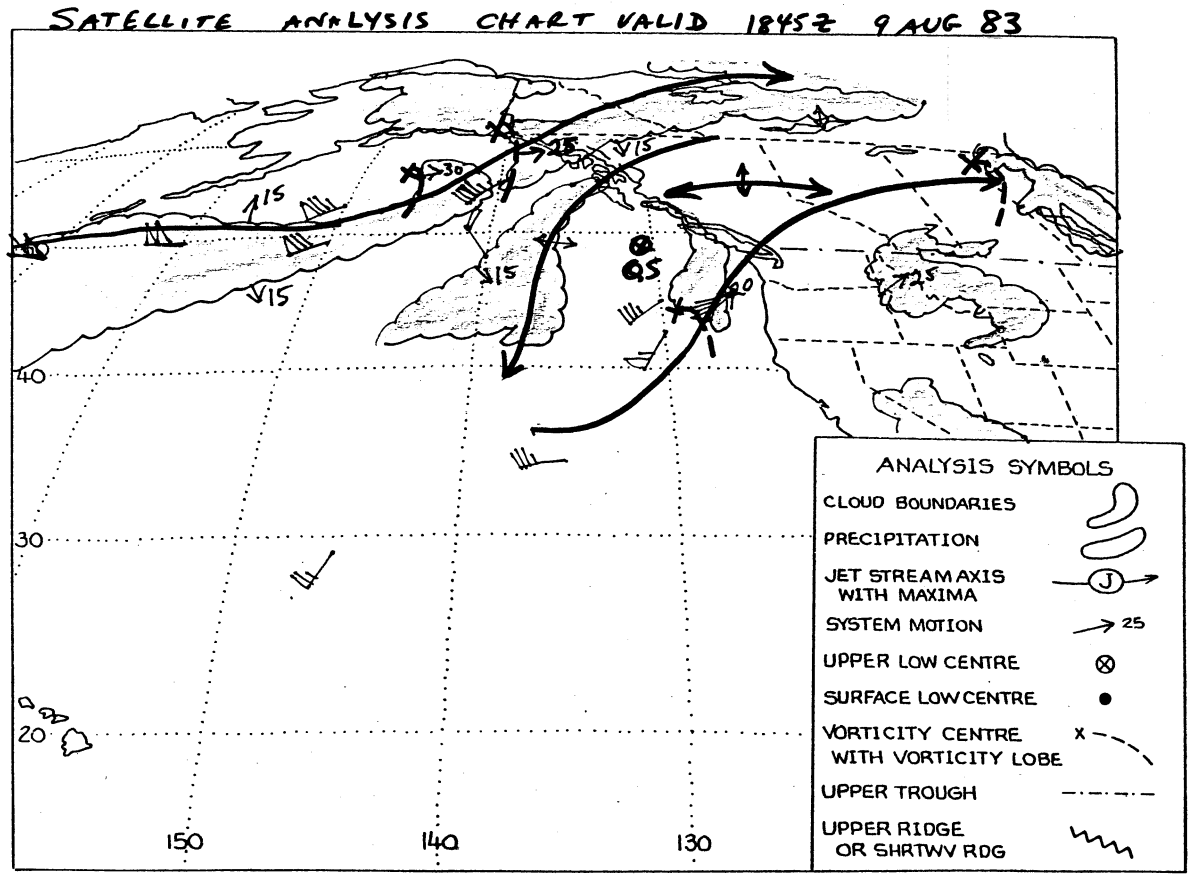

FIGURE 11. PWC SATELLITE ANALYSIS CHART VALID 091845Z