PACIFIC REGION TECHNICAL NOTES

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An Example of a Classic Mode of Cyclogenesis

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INTRODUCTION

This Note is a description of the "classic" or "meridional trough" type of cyclogenesis. The event occurred over the northeast Pacific during the 16th to 17th of September, 1981.

DOCUMENTATION

To facilitate the description, a sequence of the following set of fields at 12 hour intervals will be presented:

(a) surface pressure analysis with 1000-500 mb thickness isopleths
(b) 500 mb analysis with absolute vorticity isopleths
(c) 250 mb height analysis
(d) an infrared satellite image

The charts were redrawn from the CMC analyses.

CASE STUDY

(a) Figure 1 illustrates the initial state. An old weakening low centre is located near southern Alaska. A baroclinic zone lies across northern B.C. The pattern shown resembles a typical situation. The baroclinicity at the surface is quite strong and the temperature advection is probably the main factor of development.

A series of shortwaves are moving along the baroclinic zone. The one associated with the coming storm is still on the west side of the 500 mb trough. Since a continuous layer of cirrus is not present along the jet stream, the cloud patterns associated with the short waves are easily identified on the satellite images. A weak low pressure center near 38N 155W is already evident at the surface. At the same time the vorticity and PVA fields at 500 mb are weak.

(b) Figure 2 shows the main shortwave approaching the "bottom" of the 500 mb trough. The low centre is starting to deepen. The satellite image does not show much change in the pattern.

(c) In figure 3, the development is well underway. The low pressure centre is "deepening" significantly. The vorticity pattern is becoming more intense. A closed circulation in the wind field has reached the mid-atmospheric levels. The short wave is now on the east side of the 500 mb trough. The cloud pattern now becomes typical of a mature storm. There is a well developed cirrus cloud layer associated with the jet stream. A "comma" shaped cloud system is now evident. Low level frontal clouds extend to the southwest. The head of the comma is covered by cirrus and a well defined line is visible along the deformation zone.

(d) At the valid time of figure 4, the low centre is still deepening but at a slower rate. The large surge of cold air is invading the northern sector of the system. This usually indicates that the low pressure system has reached its lowest value. A closed circulation is probably established at the high levels of the troposphere. Note that the CMC 250 mb analysis does not show a closed centre. Also, the 250 mb trough is tilted along a NW-SE line from its original N-S orientation.

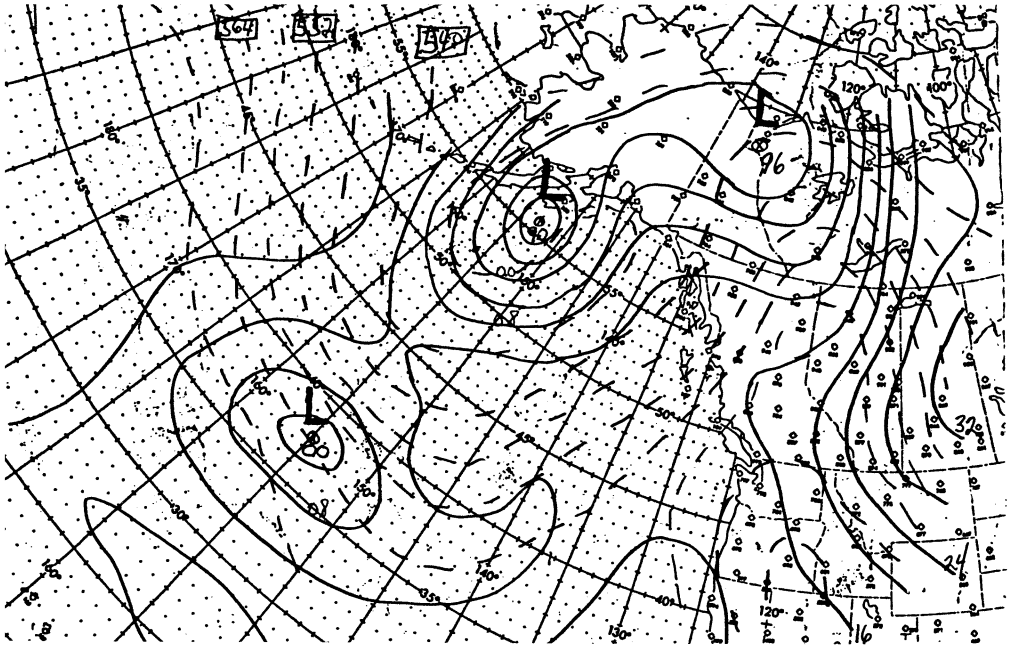
(e) At the time of figure 5, the low centre has reached its deepest value and is now "occluding". The baroclinicity at the surface is weakening, while the vorticity pattern is strong at 500 mbs. The frontal clouds are moving away from the low centre. At the same time the shape of the cloud bands indicate the closed circulation at high levels.

CONCLUDING REMARKS

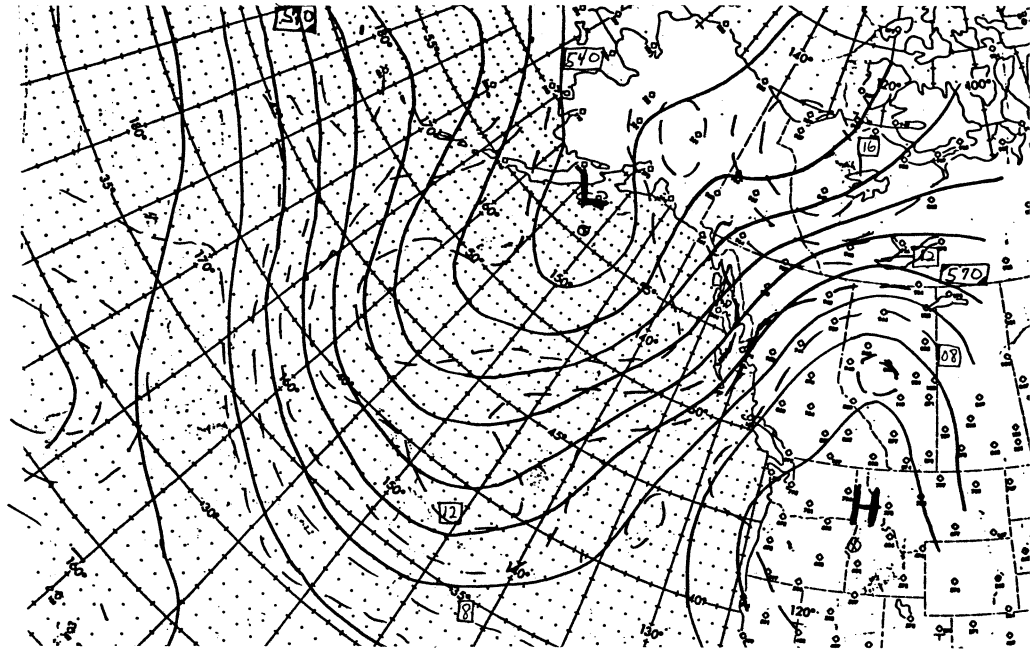
The "classic" or "meridional trough" type of cyclogenesis, as described in this note, is a relatively common occurrence over the eastern Pacific. The warning signs and stages to maturity are fairly evident. The case described in this note is quite typical.

ACKNOWLEDGEMENT

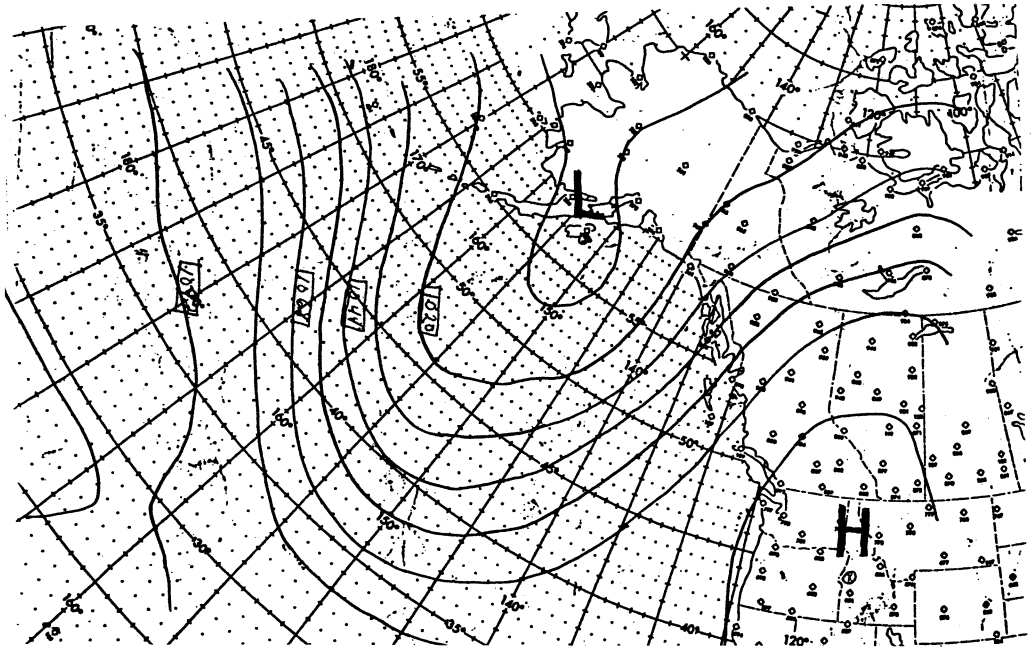
Thanks to J. Spagnol for his review of this short note.



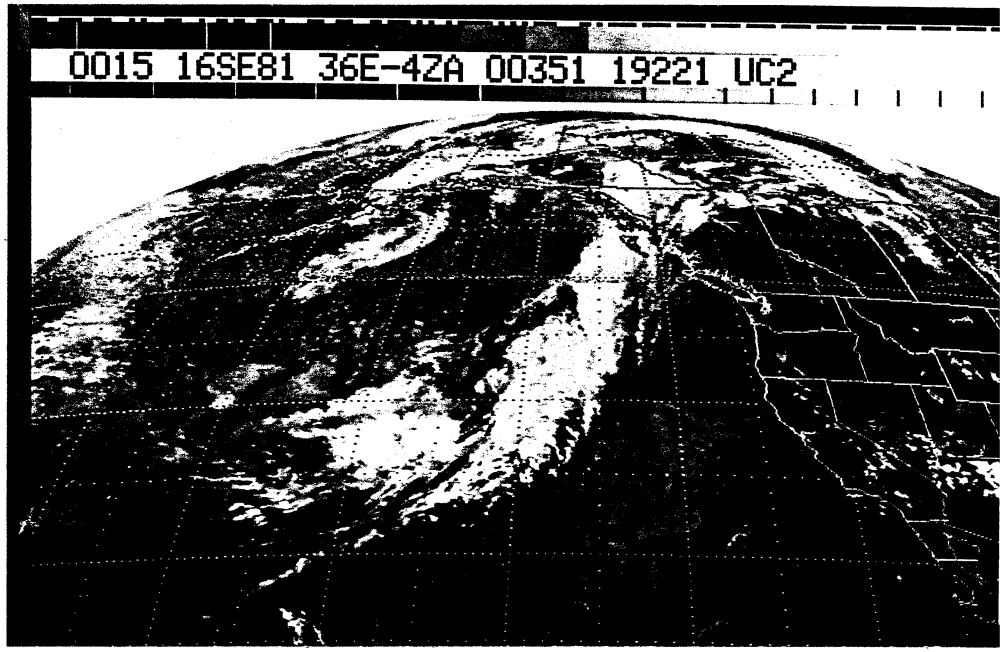
(a) Surface pressure analysis with 1000-500mb thickness isopleths valid 0000Z Sept 16, 1981



(b) 500mb height analysis with absolute vorticity valid 0000Z Sept 16, 1981

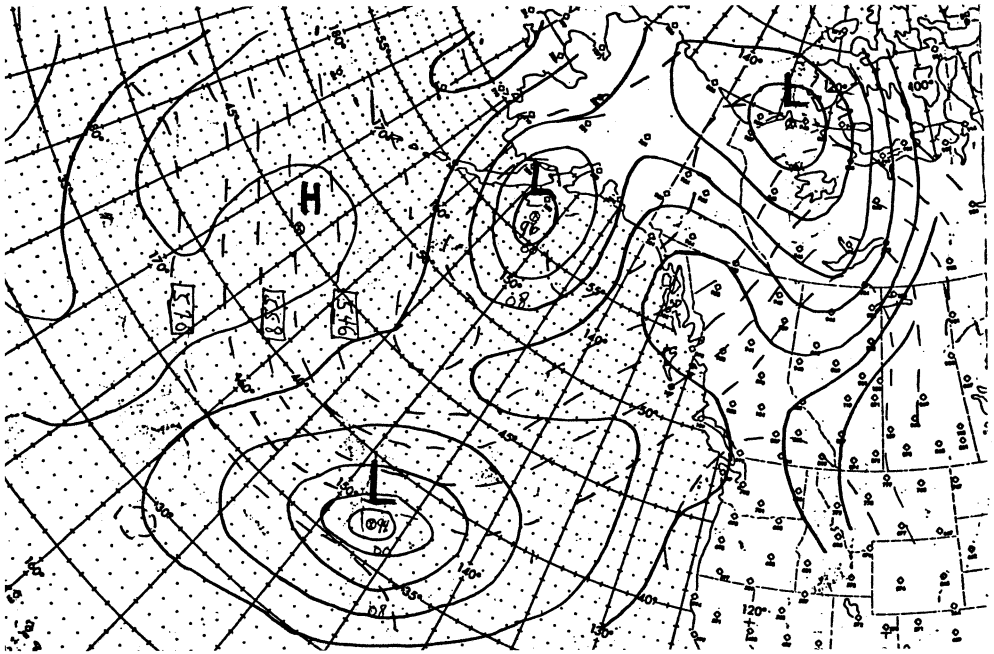


(c) 250mb height analysis valid 0000Z Sept 16, 1981

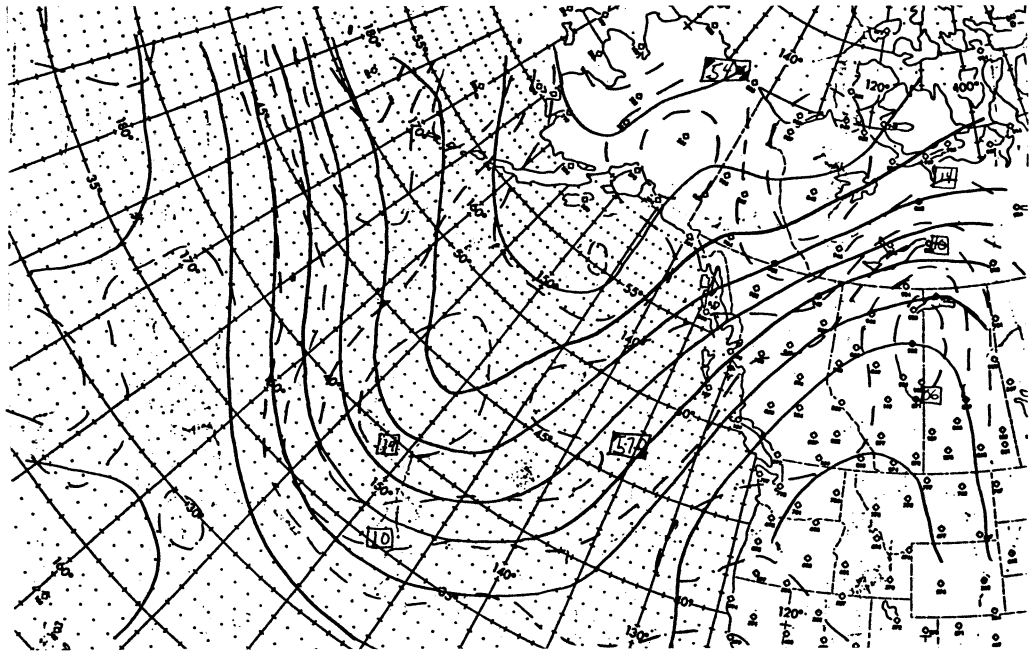


(d) Infrared satellite image valid 0015Z Sept 16, 1981

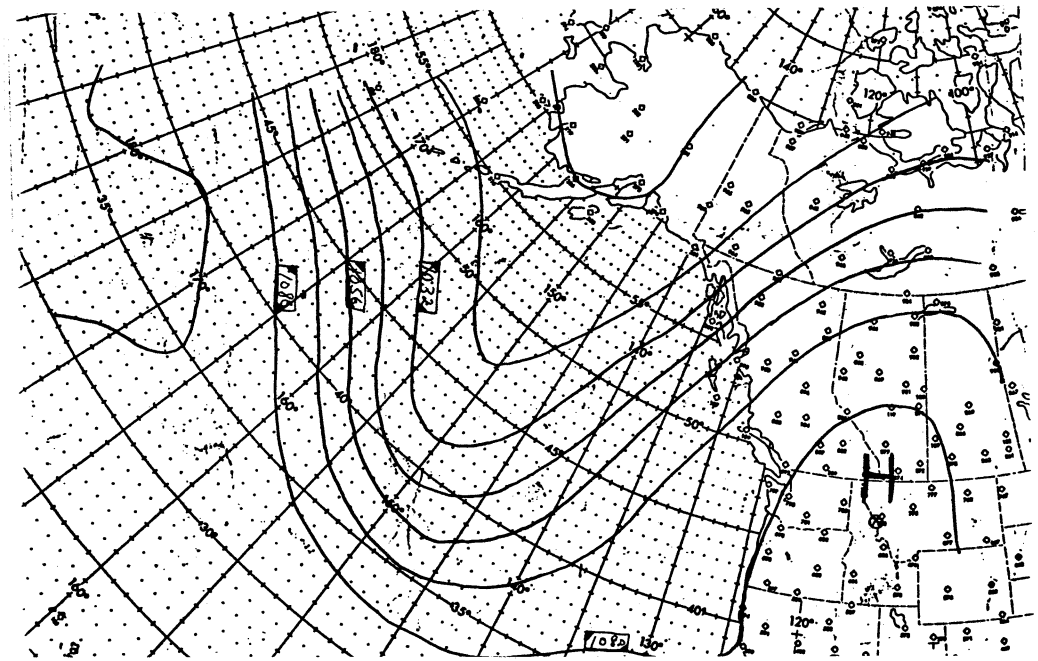
FIGURE 1.



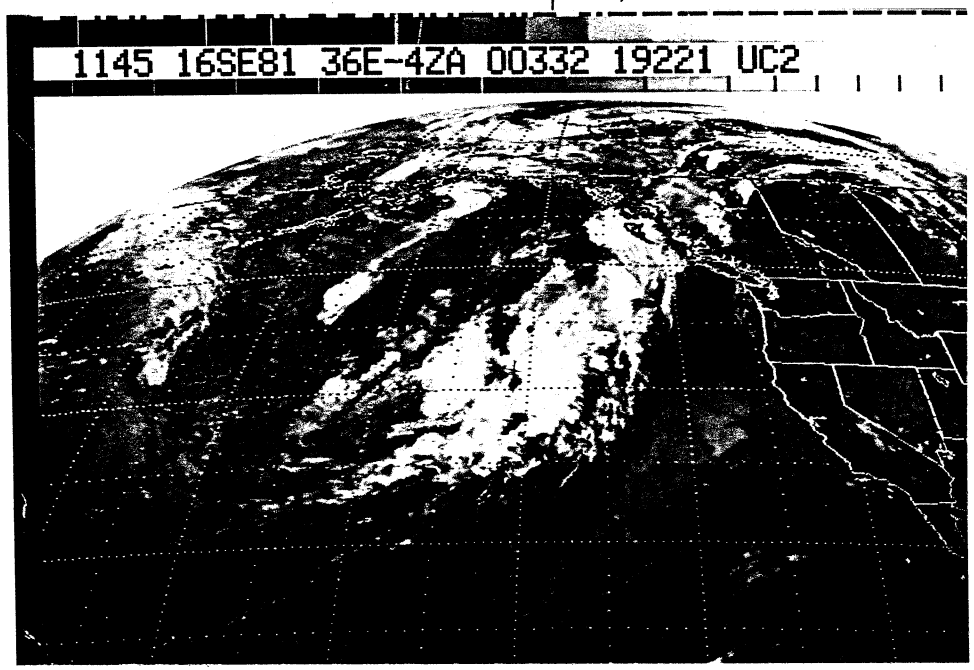
(a) Surface pressure analysis with 1000-500mb thickness isopleths valid 1200Z Sept 16, 1981



(b) 500mb height analysis with absolute vorticity valid 1200Z Sept 16, 1981

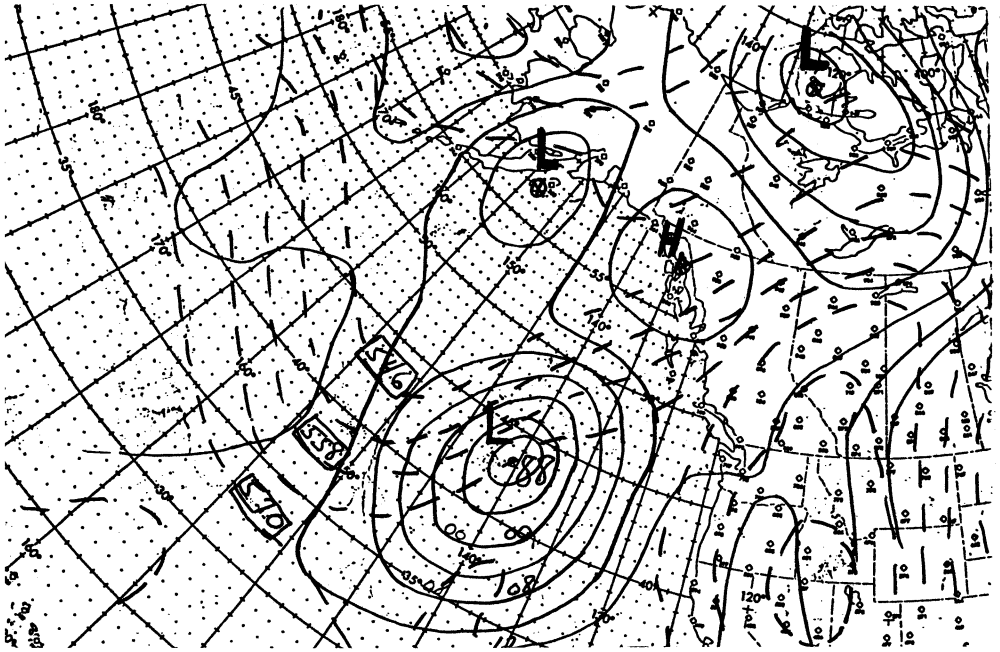


(c) 250mb height analysis valid 1200Z Sept 16, 1981

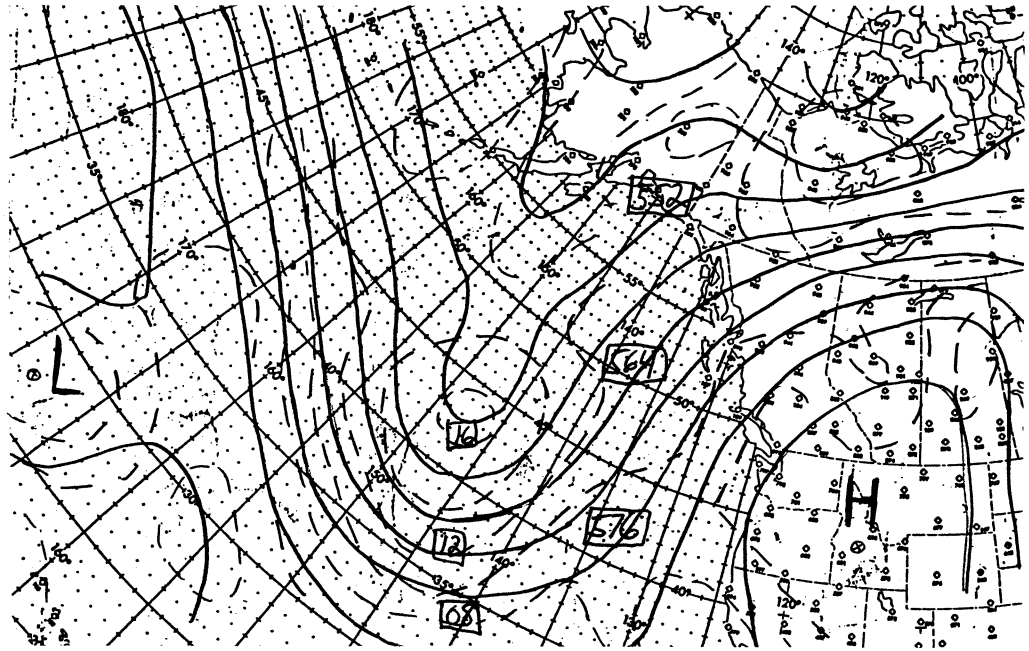


(d) Infrared satellite image valid 1145Z Sept 16, 1981

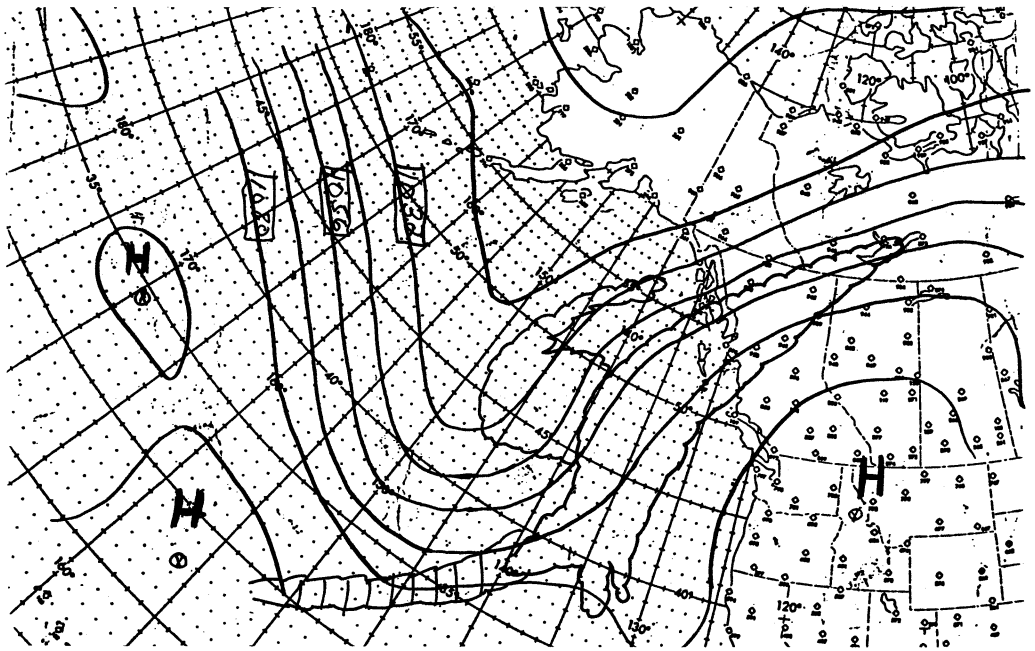
FIGURE 2.



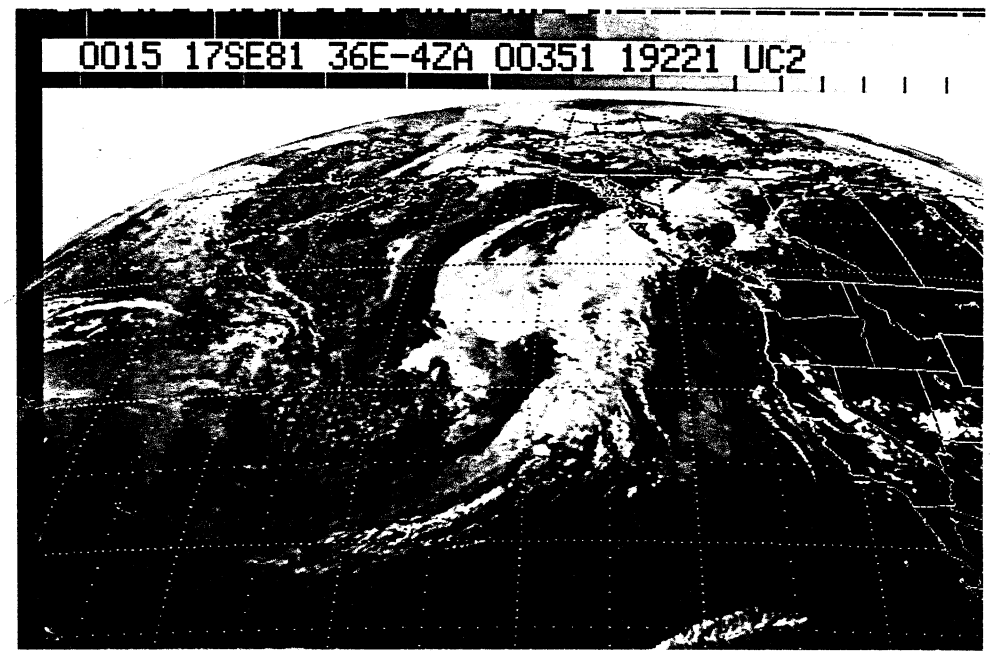
(a) Surface pressure analysis with 1000-500mb thickness isopleths valid 0000Z Sept 17, 1981



(b) 500mb height analysis with absolute vorticity valid 0000Z Sept 17, 1981

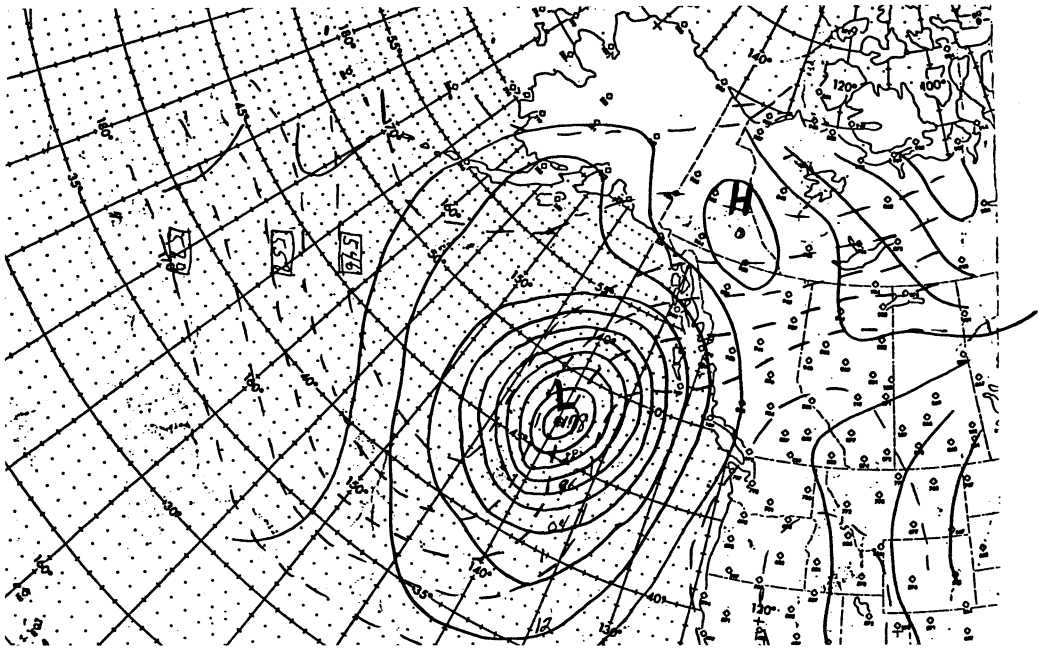


(c) 250mb height analysis valid 0000Z Sept 17, 1981

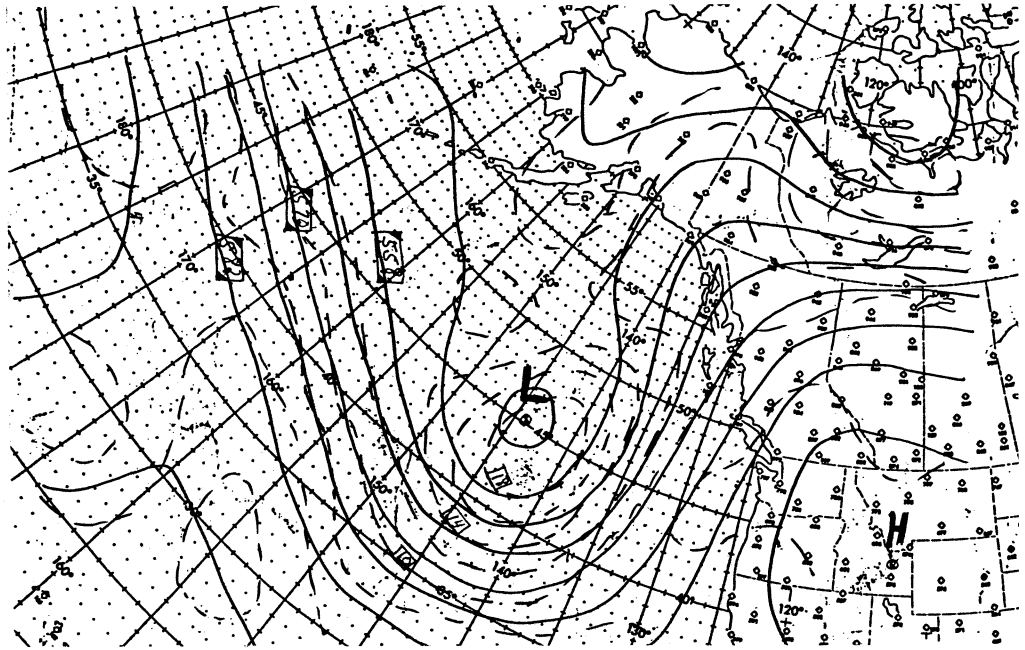


(d) Infrared satellite image valid 0015Z Sept 17, 1981

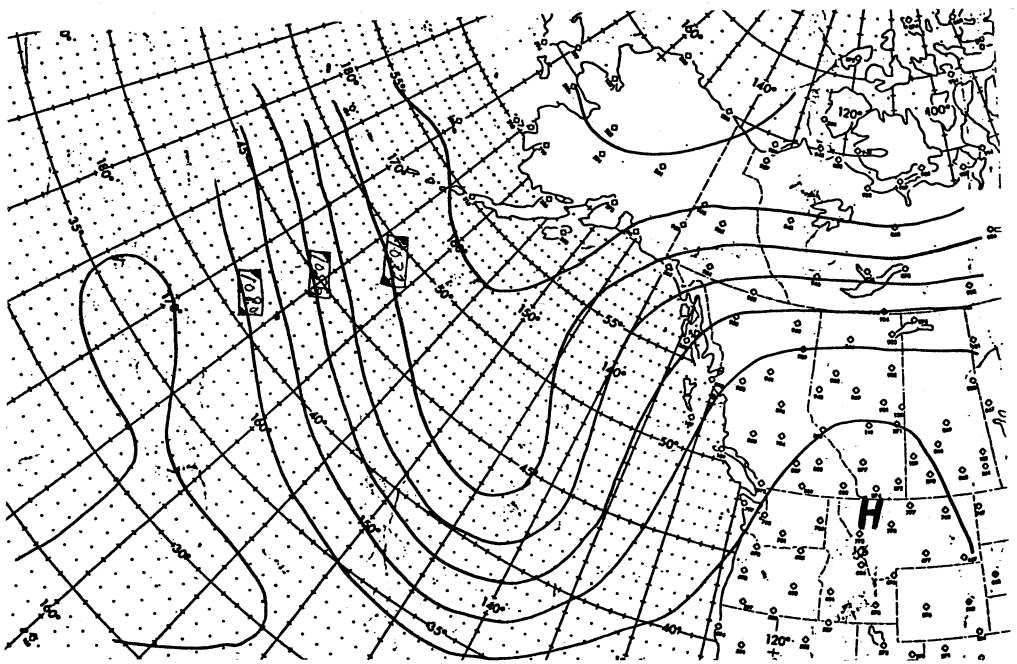
FIGURE 3.



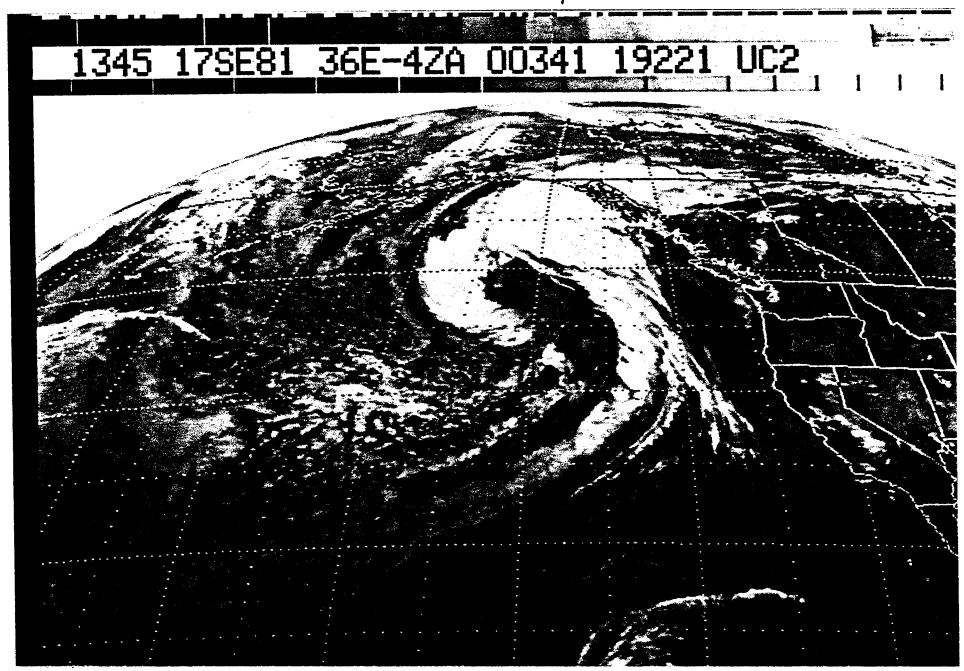
(a) Surface pressure analysis with 1000-500mb thickness isopleths valid 1200Z Sept 17, 1981



(b) 500mb height analysis with absolute vorticity valid 1200Z Sept 17, 1981

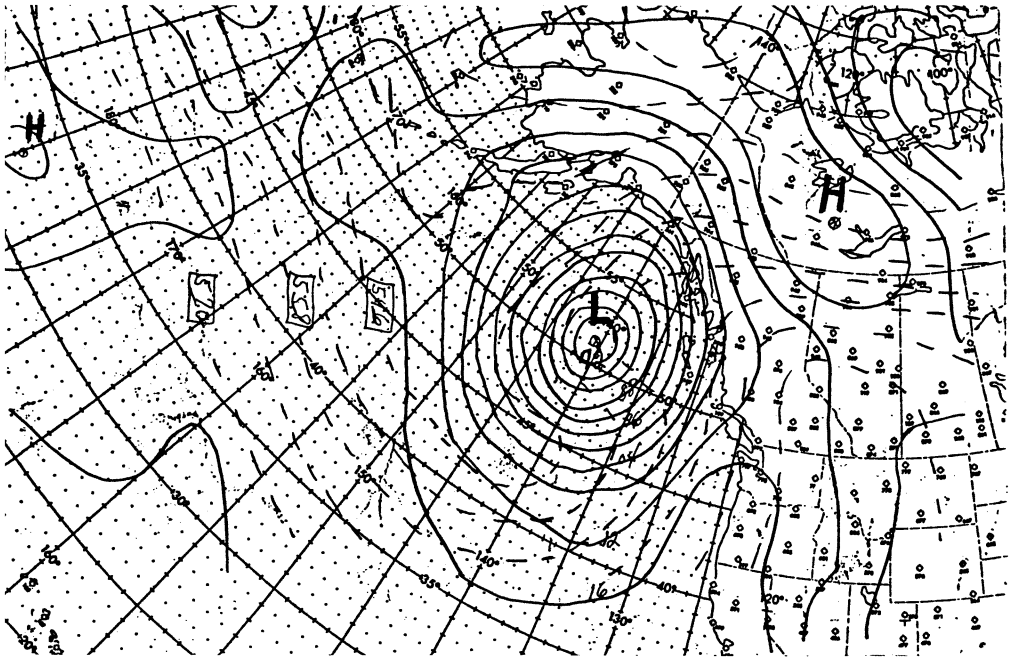


(c) 250mb height analysis valid 1200Z Sept 17, 1981

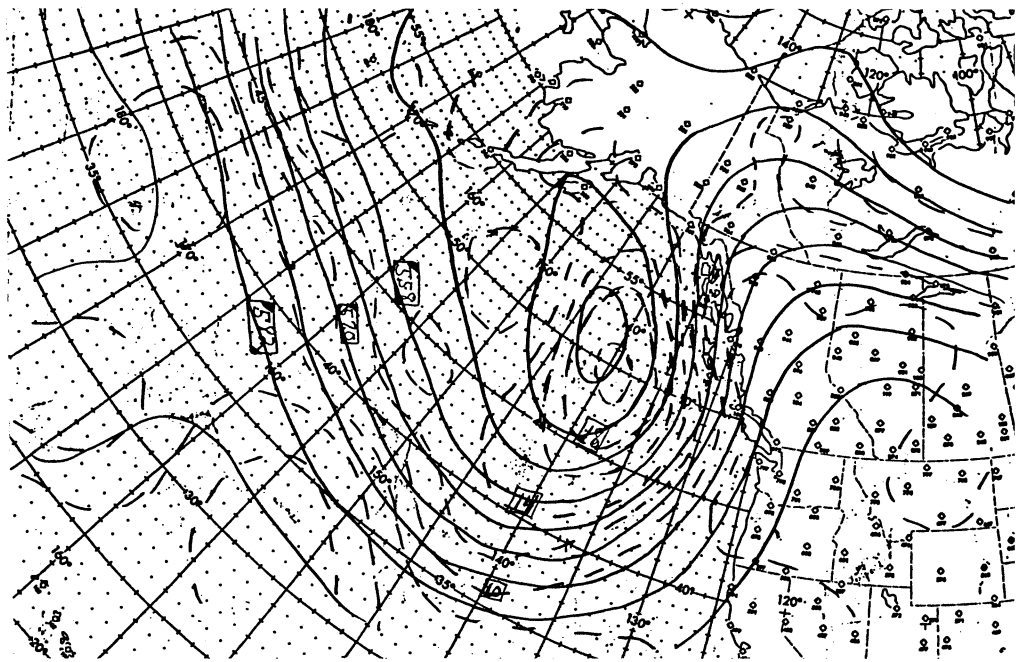


(d) Infrared satellite image valid 1345Z Sept 17, 1981

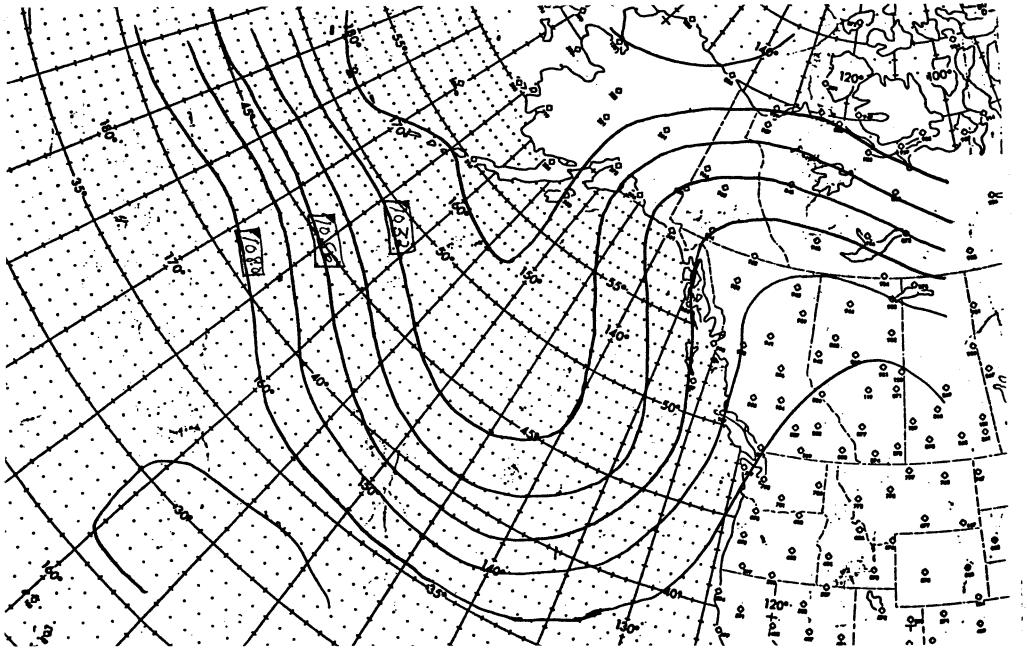
FIGURE 4.



(a) Surface pressure analysis with 1000-500mb thickness isopleths valid 0000Z Sept 18, 1981



(b) 500mb height analysis with absolute vorticity valid 0000Z Sept 18, 1981



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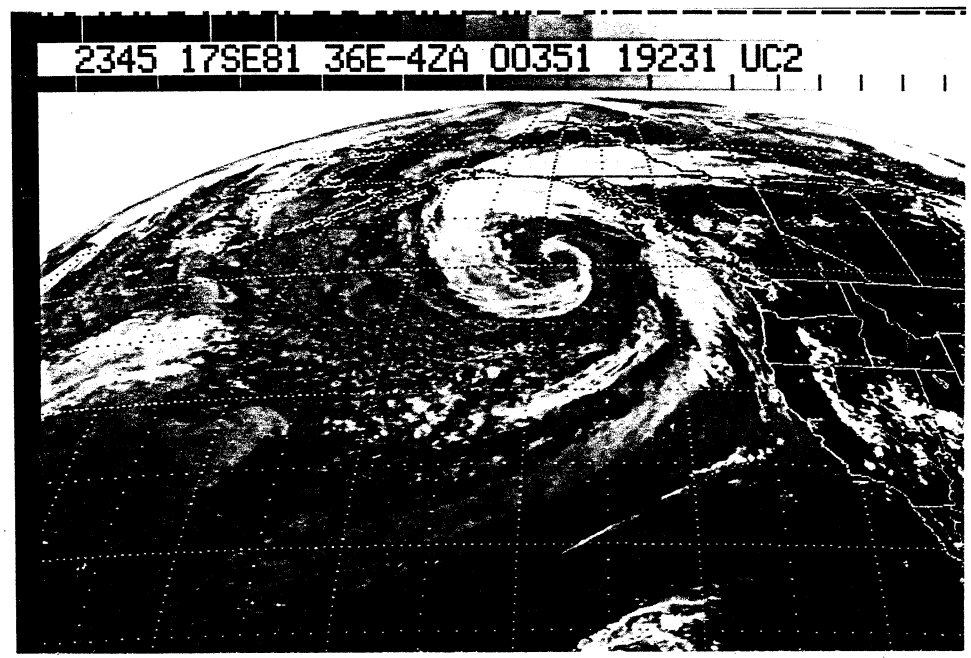

(d) Infrared satellite image valid 2345Z Sept 17, 1981

FIGURE 5