UDC 551.558.21:551.576.11:551.507.362.2 (084.1) (265.24) (265.51) (798) "1969.11.03"

PICTURE OF THE MONTH

ESSA 8 APT Shows Lee Waves Near Aleutian Islands

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At 2100 GMT on Nov. 3, 1969, ESSA 8 APT took a picture (fig. 1) of the Gulf of Alaska and the Aleutian Islands with its subpoint at 51.0° N., 162.4° W. Clearly shown in the photo south and west of Cold Bay, Alaska, are lee or mountain wave clouds (Fritz 1964). The mountain peaks on the Aleutian Chain upstream and to the north of these wave clouds range from 4,000 to 10,000 ft.

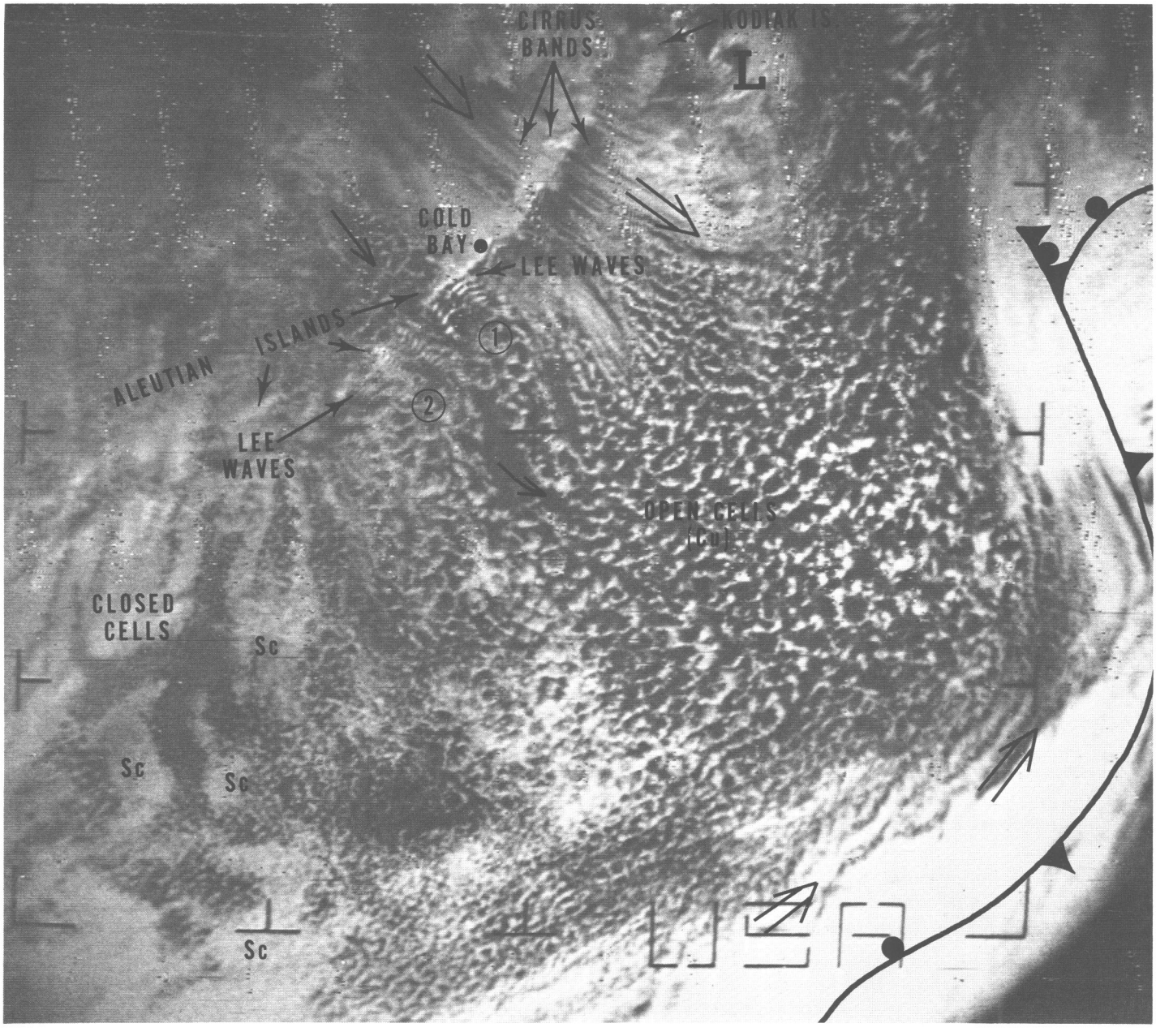

FIGURE 1.—ESSA 8, Orbit 4057, view (51.0° N., 162.4° W.) on Nov. 3, 1969, at 21:04:35 GMT. The open arrow represents high-level wind; the solid arrow represents the gradient wind.

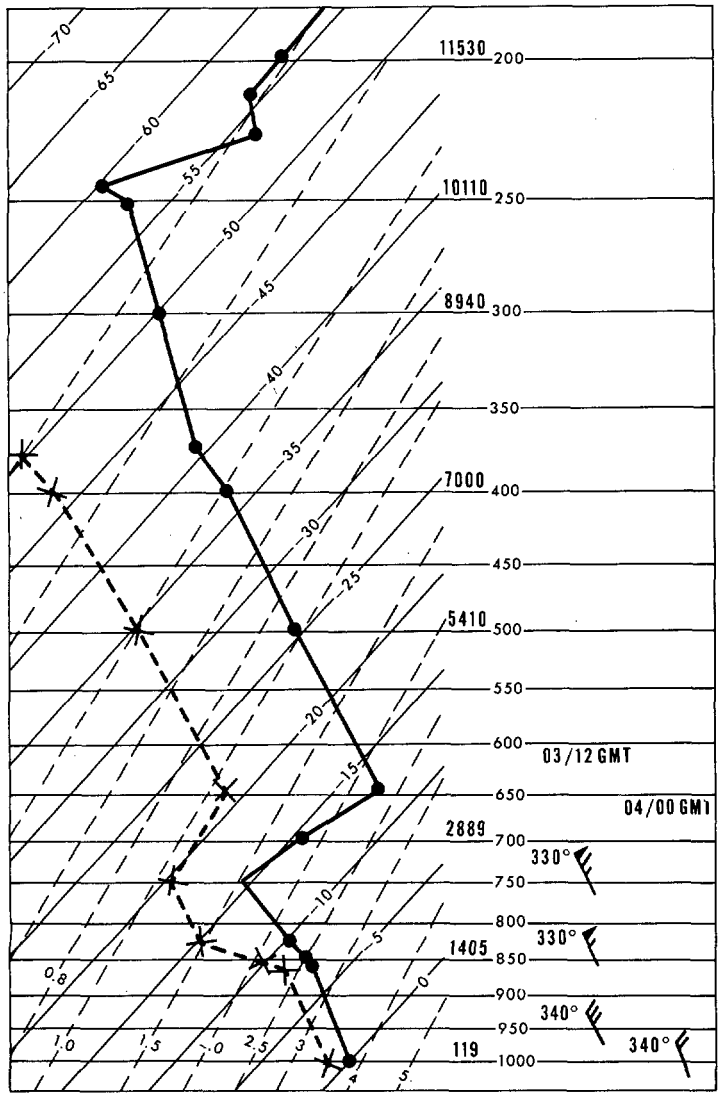

FIGURE 2.—Cold Bay, Alaska, sounding at 04/0000 GMT on Nov. 4, 1969.

For wave clouds to form, the following criteria must be met:

1) Wind direction should be nearly perpendicular to the mountains.

2) Wind speed should increase with height.

3) The atmosphere should be stable.

4) Winds at mountain-top level should be blowing at a minimum of 20 kt.

The sounding for Cold Bay (70316) taken 3 hr after photo time is shown in figure 2. The above criteria are confirmed. Unfortunately, no upper wind data were obtained from the rawinsonde at 04/0000 GMT; however, the wind profile at 03/1200 and 04/1200 GMT showed northwest winds increasing with altitude. The 03/1200 GMT wind data are plotted on figure 2.

A scrutiny of areas 1 and 2 with a magnifying glass reveals shorter wavelengths of the clouds in area 2. With the aid of a set of dividers, the wavelength (λ) for area 1 was found to be equal to 10 n.mi., and the wavelength for area 2 was found to be equal to 8 n.mi. Some observational evidence of the relationship between the wavelengths of lee waves and a mean layer wind speed (including cases observed by TIROS) has led to the following approximate relationship: $U=6\lambda+12$, equation (1) from Corby (1957), where U is the mean wind speed in knots between 850- and 200-mb levels and λ is the observed spacing in nautical miles between the wave crests as depicted by the spacing of the cloud lines.

The mean wind speed (U) equals 72 and 60 kt for area 1 and 2, respectively, according to equation (1). Comparing area 1 with the Cold Bay sounding and 300-mb map, U (72 kt) compares quite favorably (within 10 kt). The speed at the stable layer (9,000 ft) also is in good agreement with the 72-kt value for area 1. (See fig. 2, 03/1200 GMT wind profile.)

In conclusion, the usefulness of APT in estimating the mean wind speed when mountain waves appear in the picture is shown.

REFERENCES

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