

WESTERN REGION TECHNICAL ATTACHMENT
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LEE CIRRUS -- SOMETIMES

On November 7th, an approaching trough sent the jet level winds across the Sierra Nevada Mountains and the Colorado Rockies producing exactly opposite results. Figures 1 and 2 are the visible and infrared satellite photos near midday. In the lee of the Sierra,, there is a distinct cloud free area while in the lee of the Rockies, there is an equally abrupt area of cirrus.

A good explanation of lee waves may be found in An Introduction to Dynamic Meteorology by James Holton [1]. Figure 7 from Holton is a schematic diagram of the stream lines over a mountain barrier. Note the westward tilt with height of the lee wave. This tilt results in lower tropospheric air sinking just in the lee of the mountains while directly above this spot the upper tropospheric air is rising. Thus in the region directly down wind of a large mountain barrier, the low level air is drying as it sinks and warms adiabatically, and the upper level air will move closer to saturation as it rises and cools adiabatically.

So why is there cirrus downwind of one range and clear air downwind of the other? The answer may be found in examining the 250 mb analysis found in Figure 3. The jet is nearly perpendicular to the mountains in both California and Colorado, and the wind speeds are nearly identical. The most noteworthy information is the difference in the dewpoint depression at Oakland and Grand Junction or Denver. Although the temperature at these three sites is the same, the amount of moisture to be lifted is lower upstream of the Sierras than over the Rockies.

The 12Z soundings at Vandenberg, Oakland, and Denver are presented in Figures 4, 5, and 6. The upper levels of the California soundings are quite a bit dryer than at Denver. This is particularly true of Vandenberg. (There are some bad data between 500 and 600 mb at Vandenberg).

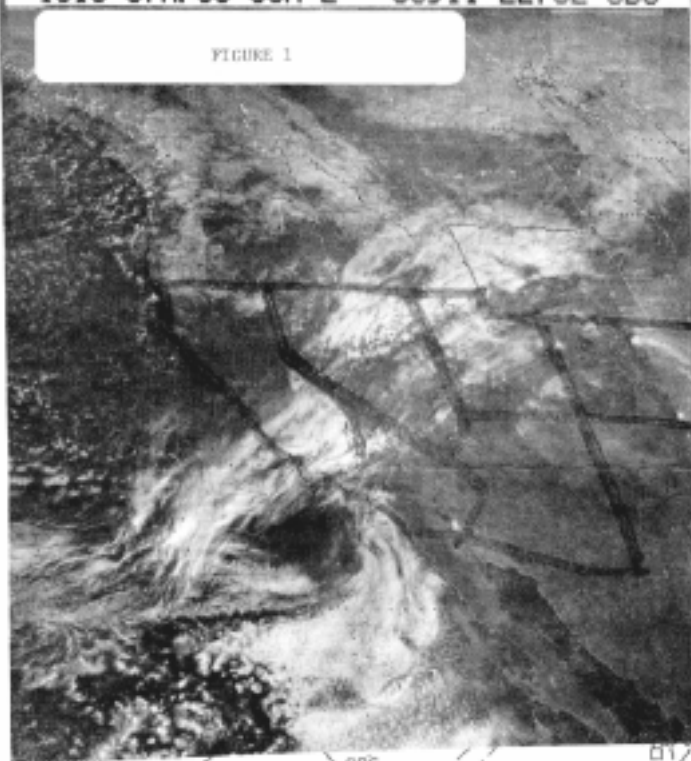
Thus although the air motions in the lee of both mountain ranges were probably very similar, the amount of moisture was insufficient to produce lee cirrus downstream from the Sierra Nevada Mountains.

Reference:

- [1] Holton, J.R,: An Introduction to Dynamic Meteorology, Second Edition, 1979, pp. 164-165.

1815 07N 83 38A-2 00911 22752 SB6

FIGURE 1



1845 07N 83 38E-22A 00904 22752 SB6

FIGURE 2

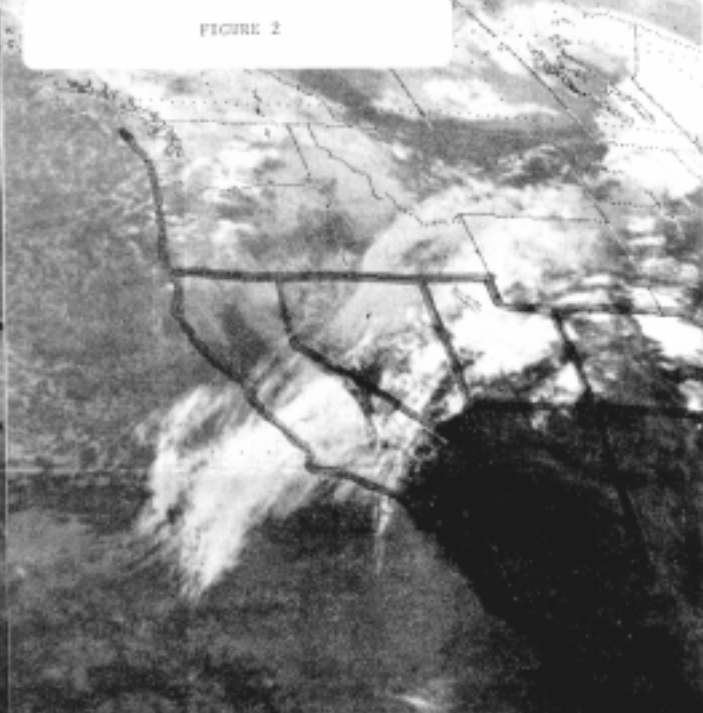
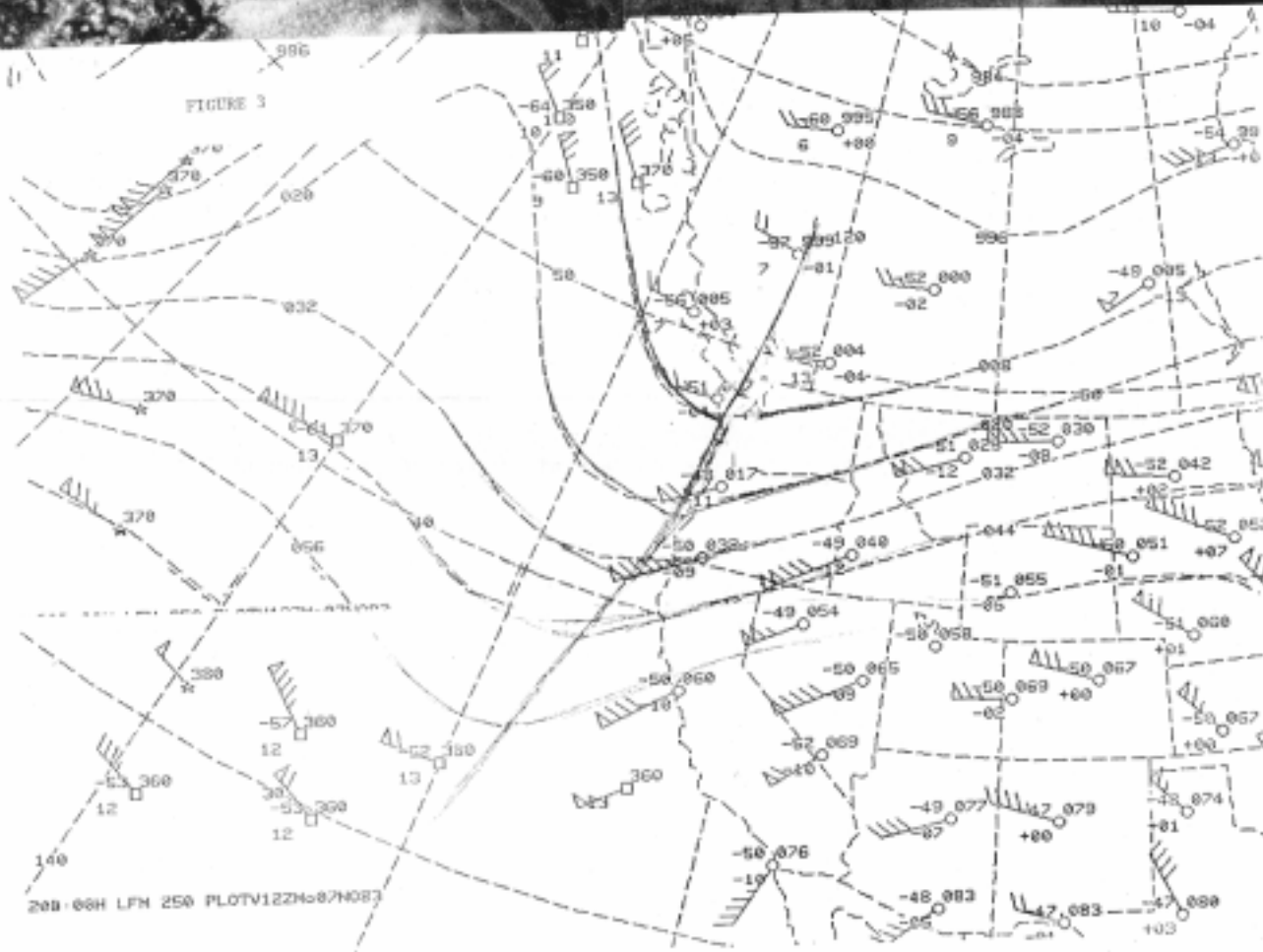


FIGURE 3



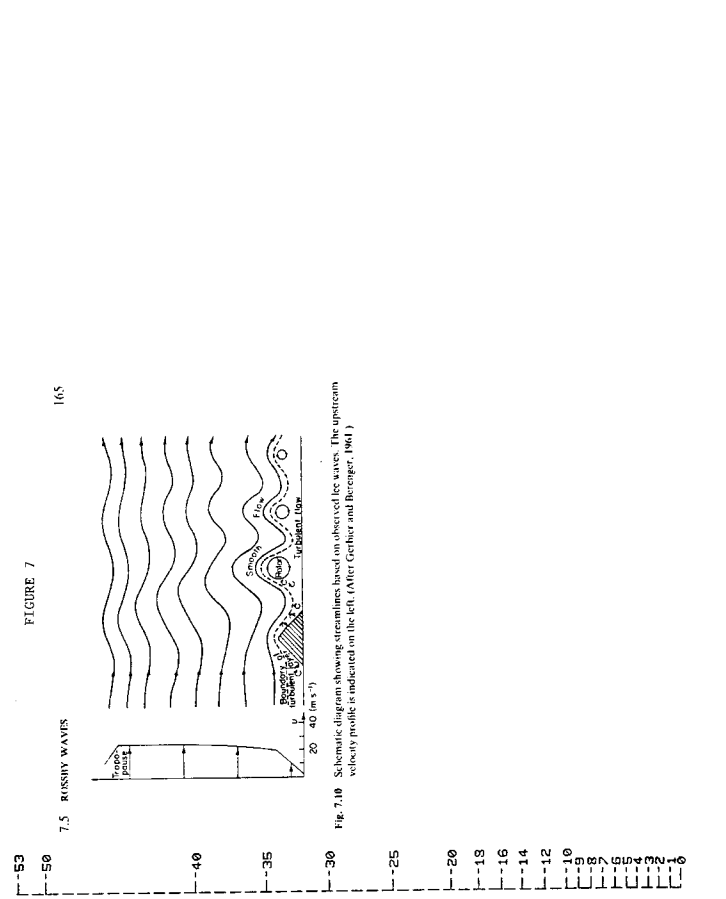
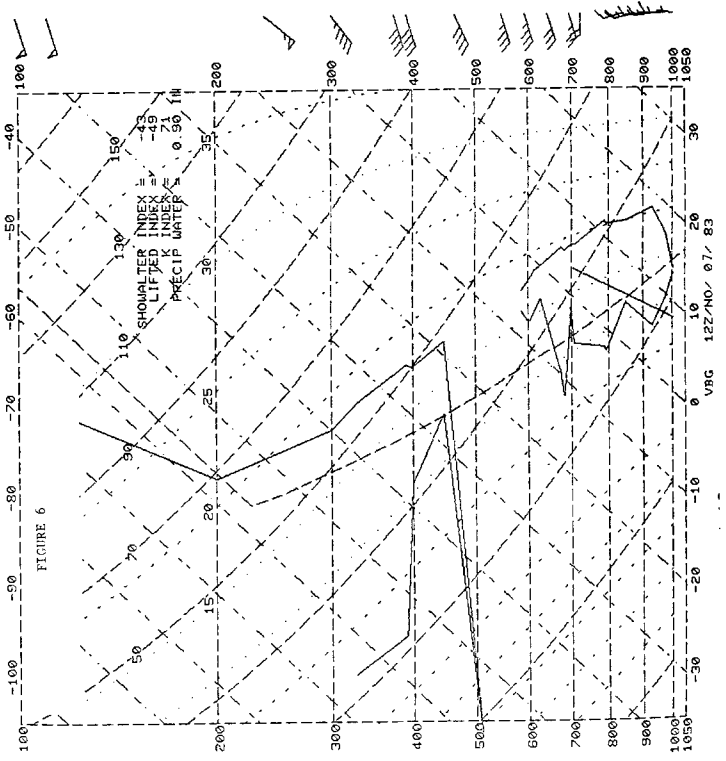
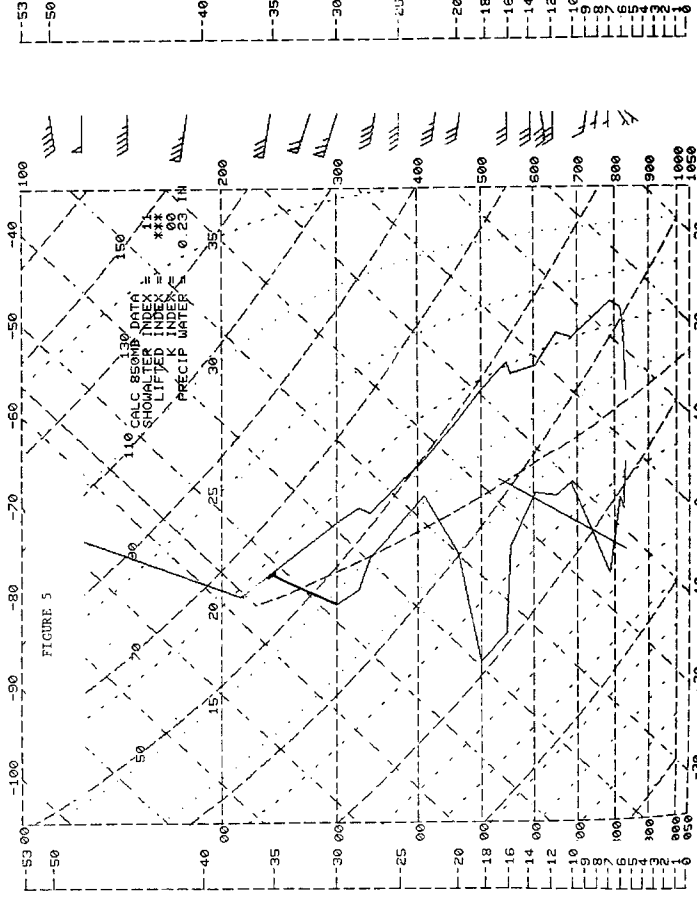
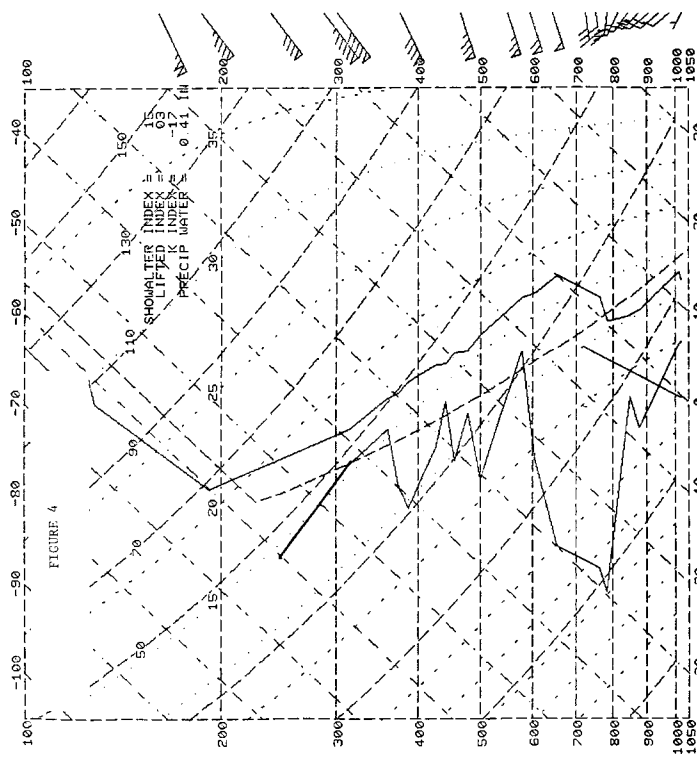


FIGURE 7
165
Fig. 7.10 Schematic diagram showing streamlines based on observed flow waves. The upstream velocity profile is indicated on the left. (After Gerber and Bergquist, 1961.)