NWS-TA-CR-89-1

CRH SSD
JANUARY 1989

CENTRAL REGION TECHNICAL ATTACHMENT 89-1

CONVECTIVE DEVELOPMENT OVER YELLOWSTONE FIRES

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1. Introduction

The summer of 1988 will long be remembered in Wyoming as the year the forests burned. On June 23, lightning started the Fan Fire in Yellowstone National Park and by July 20, 1988, the first of two record fires (the North Fork, followed by the Clover Mist) got underway. Other fires of similar magnitude burned around Wyoming throughout the summer, but none captured the interest of the public as those which seemed to devour the Nation's oldest national park.

At the start of the 1988 fire season the timber was already dry, and these conditions only got worse during the summer. A climatological comparison of Mammoth, Wyoming located in the far northern part of the park at 6,200 feet MSL indicated that June, July, and August, 1988 were, in total, the warmest on record dating back to the late 1880's. Moreover, in terms of precipitation, the season was the third driest with only 1.56 inches of rain recorded, a departure below normal of 3.31 inches. Another site, Lake Yellowstone, in the center of the park at 7,700 feet MSL, reported the fourth warmest season on record dating back to 1905; and the site also experienced the sixth driest three-month period of 2.44 inches, or 2.81 inches below normal.

In total, 1988 proved climatologically to be the warmest and driest combination on record for Yellowstone Park. At last count, the fires burned a total of 846,000 acres, or nearly 40 percent of the park.

2. Convective Turrets Over the Fires

As the fires raged, the warm and dry weather hampered all fire suppression efforts. September 5, 1988 typified the weather pattern experienced during the summer siege of forest fires. A ridge was positioned over the intermountain region with a migratory short wave slated to move through the area by mid-week. The resulting power and fury of the fires was captured dramatically in the satellite images on that day, as convective turrets developed over the fires.

Figure 1 shows the extensive cloud free western United States at 1846 GMT. By 2146 GMT, convective turrets could be seen just beginning to develop over the Yellowstone fires (Figure 2). A visual image taken at low sun angle (2231 GMT),

clearly showed an extensive blanket of smoke over much of Wyoming with strong convective turrets generated over the fire (Figure 3). An infrared image at 0001 GMT (Figure 4) indicated temperatures in the -30 to -40°C range over northwest Wyoming.

An especially striking feature of the convective turrets was fact that they formed in a relative dry environment. Both the Lander, Wyoming sounding (Figure 5) and the Boise, Idaho sounding (Figure 6) highlight the extremely dry conditions in place over the region. The substantial surface heating from the fires combined with normal solar insolation to produce spectacular results readily visible from the geosynchronous satellite.

Figure 7 shows convective turrets on the Clover Mist fire. Although the picture was taken in late July, it exemplifies the convective development which was typically associated with all of the Yellowstone fires.

The fires of Yellowstone will long be remembered, for the environmental and economic impacts which were produced for the state of Wyoming and nearby areas. The fires will also be remembered by those fire weather forecasters who worked long hours in the park, attempting to provide accurate, up-to-date, forecasts to aid the fire fighting effort. Even though by mid-September, hurricane Gilbert may have directed the Nation's collective attention away from the fires in Yellowstone, the memories of the fire season in Wyoming will be slow to fade.

3. Acknowledgements

Special acknowledgements goes to Jack Daseler (Lead Forecaster, WSFO Cheyenne) who worked up the climatological information relating to Mammoth and Lake Yellowstone, and to Ken Rizzo (DMIC, WSFO Cheyenne) for his excellent photography of the Yellowstone fire.

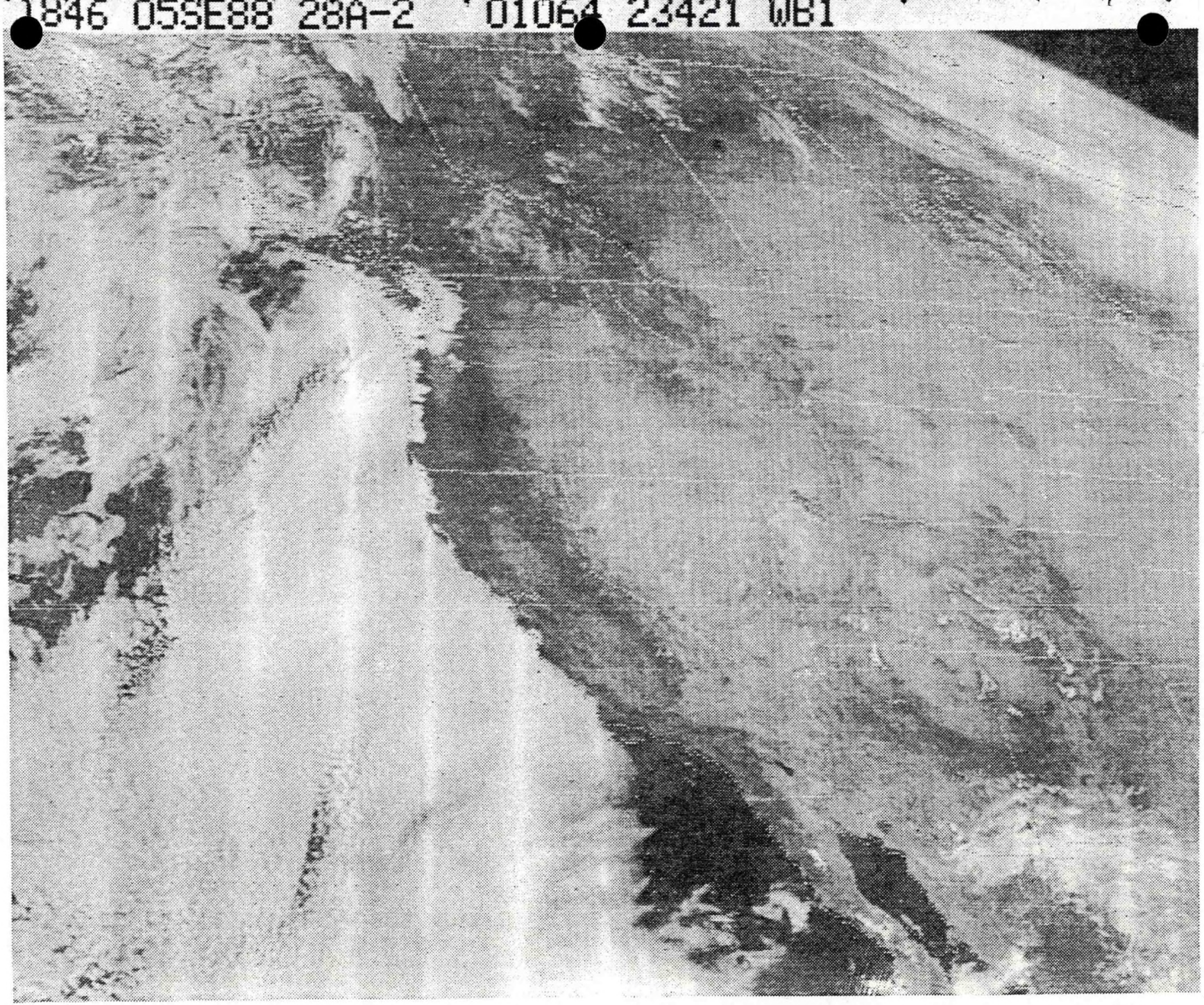

Fig. 1 Visible satellite picture for 1846 GMT, September 5, 1988, showing extensive dry environmental conditions over the western U.S.

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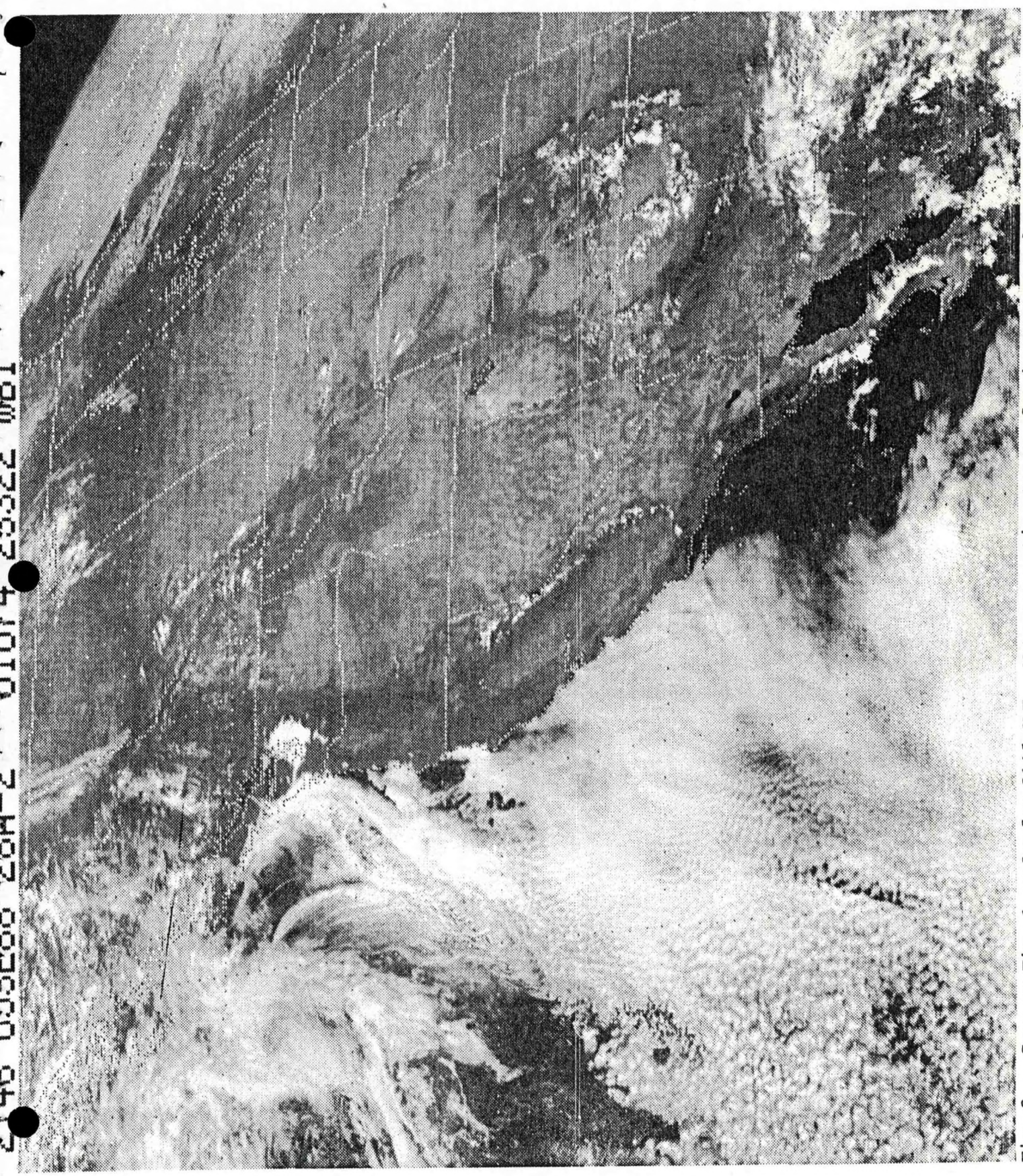

Fig. 2 Same as Fig. 1, only for 2146 GMT. Note convective turret forming over northwest Wyoming.

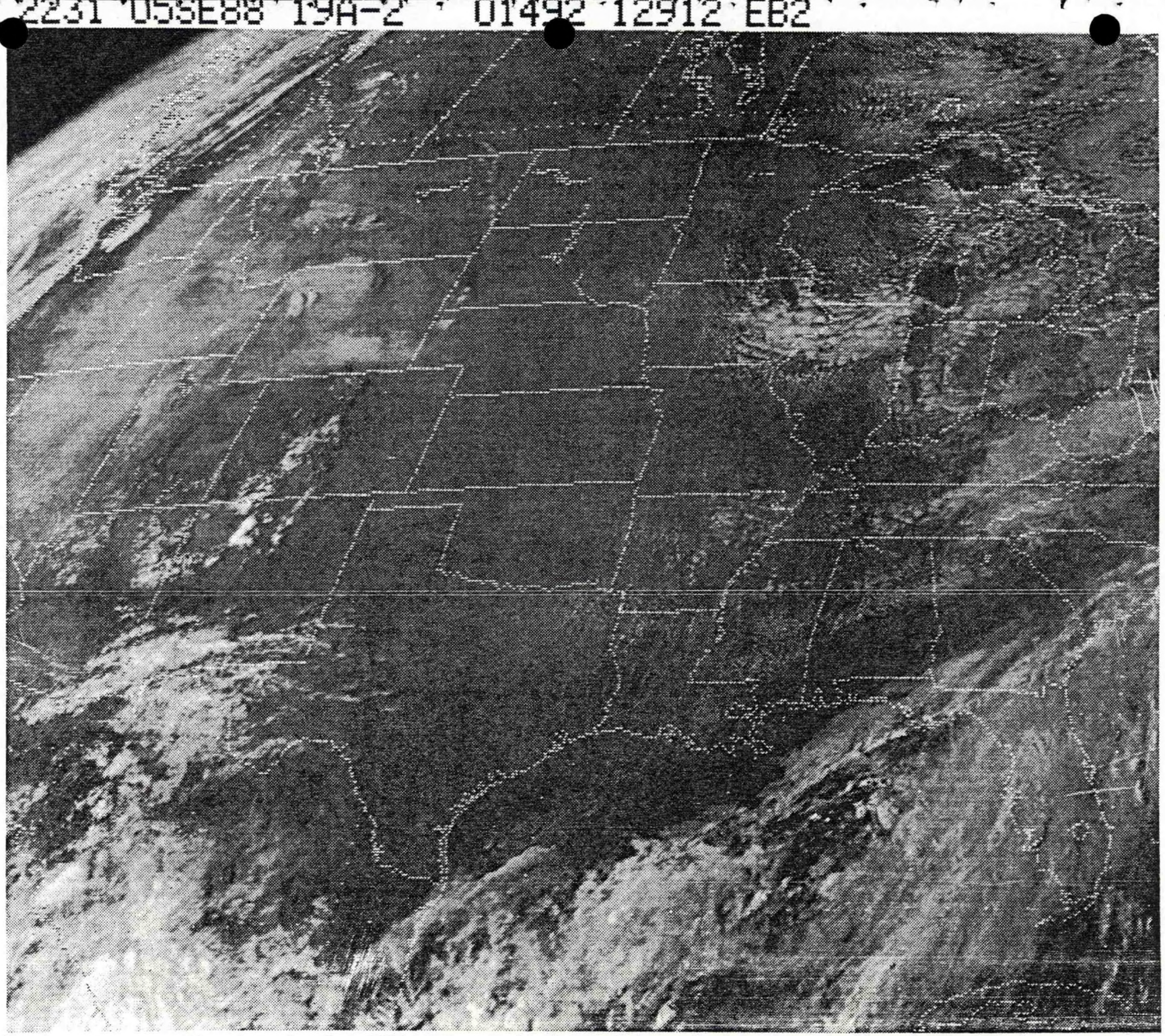

Fig. 3 Same as Fig. 1, only for 2231 GMT. Smoke is visible and covers most of northwest Wyoming.

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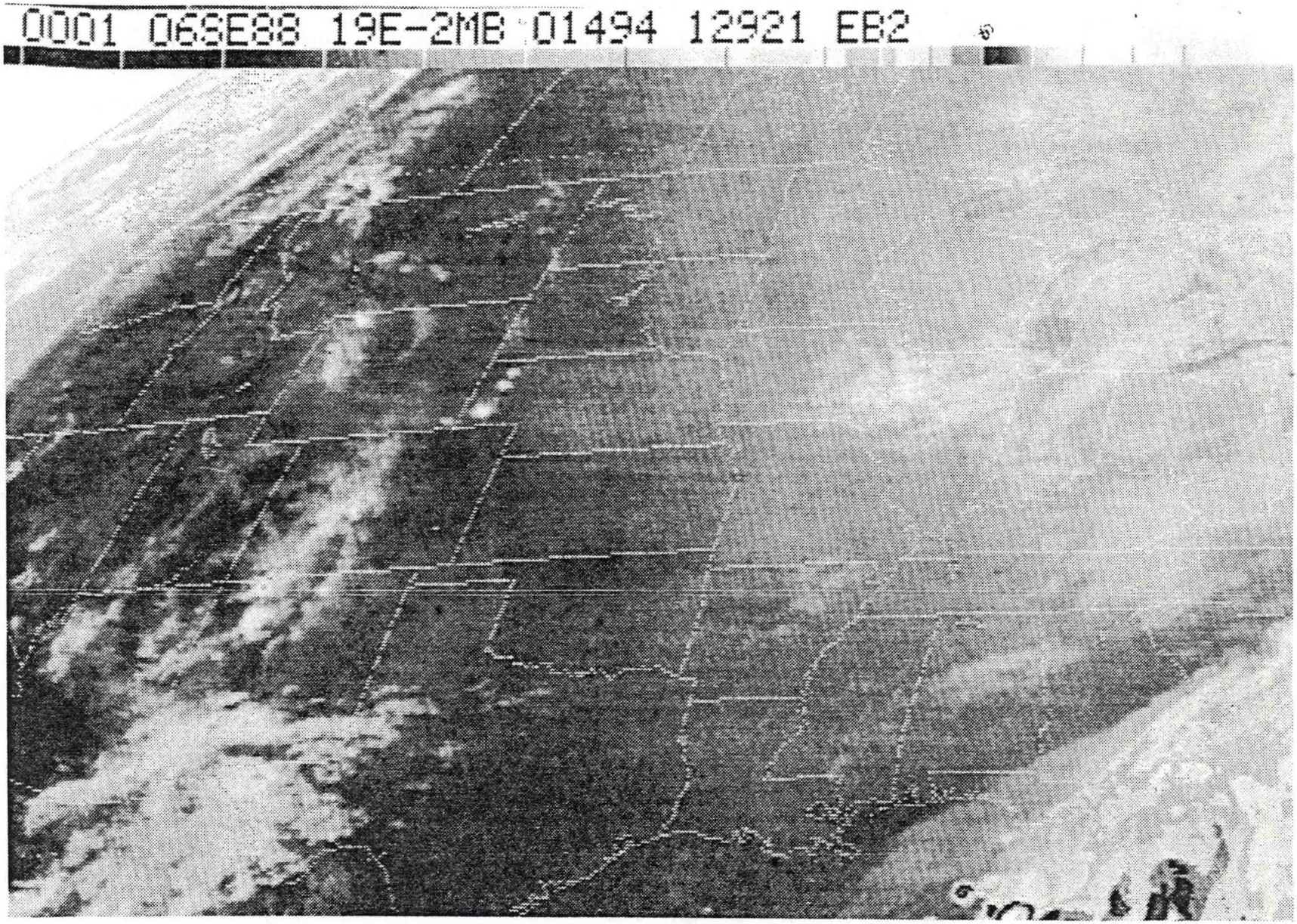

Fig. 4 Infrared satellite picture for September 6, 1988, 0001 GMT.

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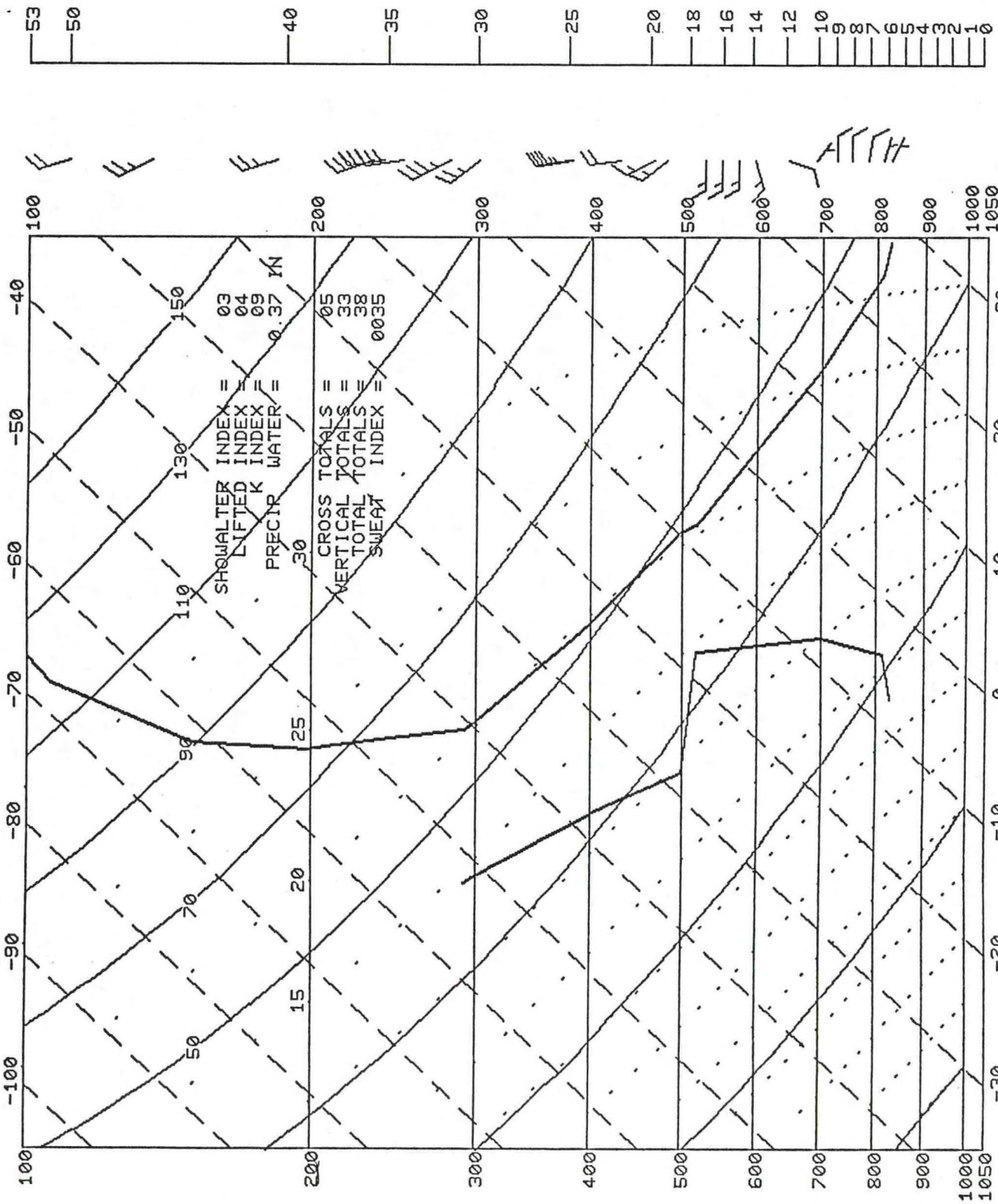

Fig. 5 Sounding data for Lander, Wyoming at 00Z, September 6, 1988. Bold right hand line represents temperature. Bold left hand line represents dew point temperature.

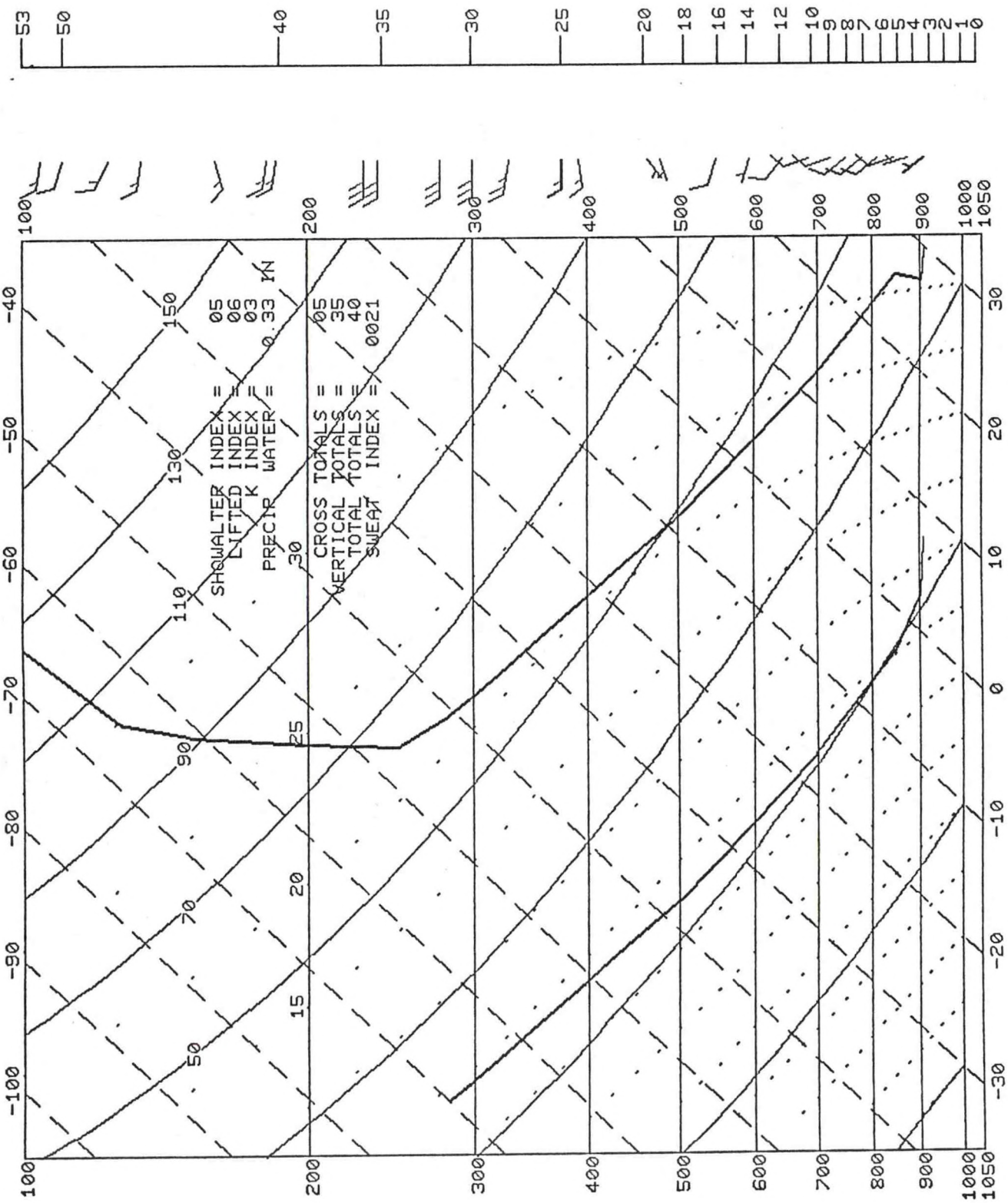

Fig. 6 Same as Fig. 5, only for Boise, Idaho.

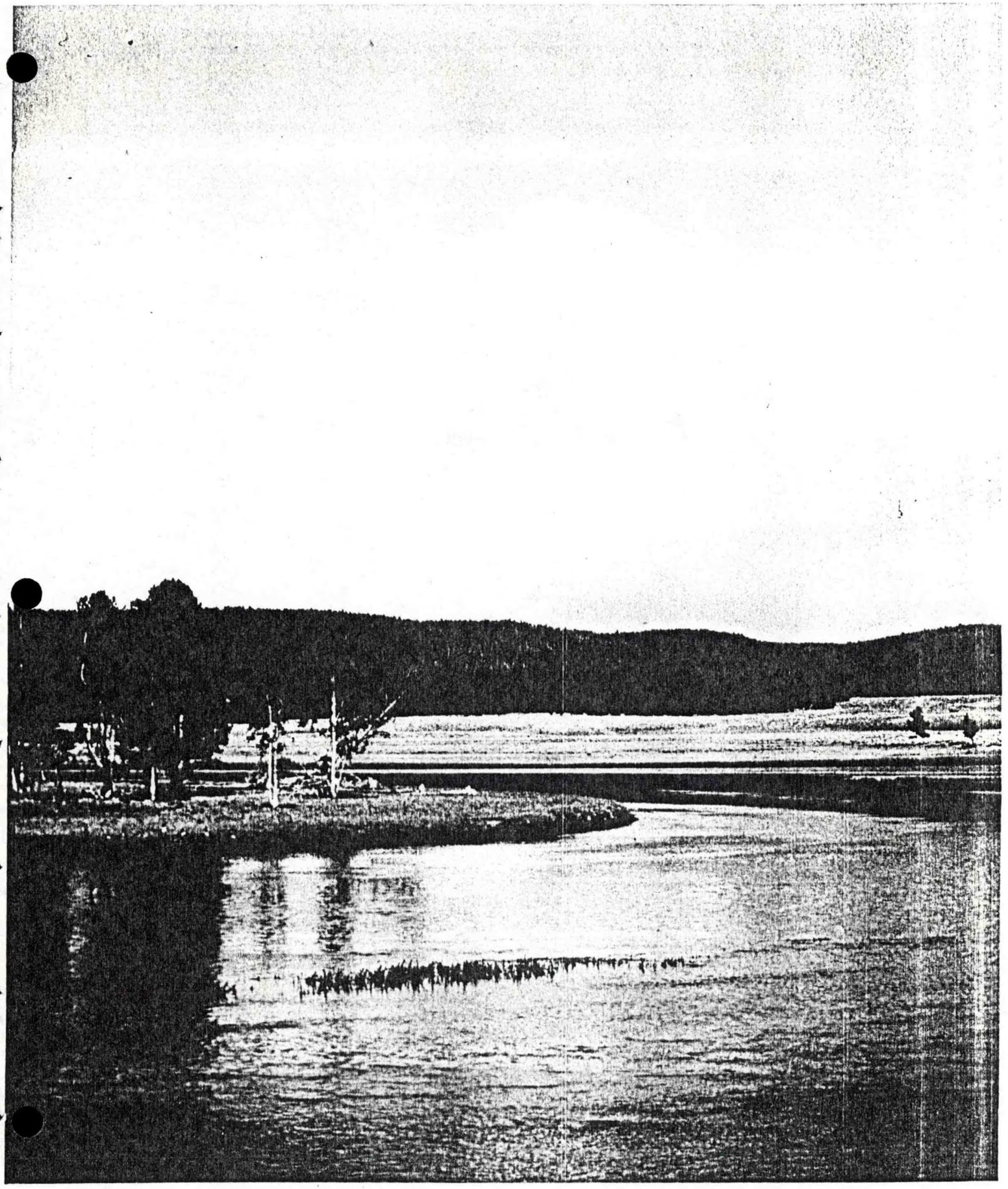

Fig. 7 Photograph of Clover Mist fire showing typical convective development associated with most of Wyoming forest fires.