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CHAFF IN THE VICINITY OF THUNDERSTORMS IN SOUTHERN CALIFORNIA ON 6 JUNE 1997

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Introduction

Thunderstorms, some severe, occurred over the mountains and deserts of southern California on 6 June 1997. During that afternoon, the U. S. Air Force released chaff, which could have potentially resulted in the issuance of a severe thunderstorm warning in an area where severe weather was not occurring. Military chaff had been released numerous times in the past, both in southern California and elsewhere in the United States. Two examples (Utah) and discussion of chaff can be found in Western Region Technical Attachment No. 97-02, "Chaff Mixed with Radar Weather Echoes" (Vasiloff and Struthwolf, 1997; http://www.wrh.noaa.gov/wrhq/97TAs/TA9702/ta97-02.html). Forecasters can usually identify chaff returns by using comparisons with satellite images and viewing the characteristics of the radar returns. The chaff echoes in this case showed extremely rapid development that a severe thunderstorm echo would have, but with slightly lower reflectivity values.

Case Example

Shortly after 1PM PDT on 6 June 1997, the Santa Ana Mountains WSR-88D (KSOX) detected rapidly intensifying radar returns near Edwards Air Force Base, in extreme southeastern Kern County (Fig. 1), as indicated by the "CHAFF" annotation. Thunderstorms were beginning to develop over the southern California mountains around this time, as predicted by the National Weather Service. As the Edwards AFB radar returns were beginning to drift southwestward toward Los Angeles County, the NWSFO office in Oxnard coordinated with Edwards AFB and learned that the Air Force had released chaff. The NWSO in San Diego learned about the chaff shortly thereafter by coordinating with Oxnard. These returns were approximately 50 dBz as their areal coverage increased and moved southwest into Los Angeles County during the next hour (Fig. 2). RAMSDIS satellite images showed scattered cumulus in the vicinity shortly before the chaff release. However, new images were unavailable for about one hour after the chaff release, and this interfered with the determination of whether returns were chaff or a building thunderstorm.

By 4PM PDT, the KSOX WSR-88D displayed numerous thunderstorms developing over San Bernardino and northern Riverside Counties (Fig. 3). Thunderstorms were also occurring further south outside of KSOX radar coverage. Dispersion processes allowed the areal coverage of the chaff to grow to more than 1000 square miles. Thunderstorm development was occurring just east of the chaff area over the mountains near the Los Angeles-San Bernardino county line. Figure 4 shows the southward progression of the chaff deep into Orange County by 6PM PDT as precipitation was merging with the eastern edge of the chaff over southwestern San Bernardino and western Riverside Counties. By 8PM PDT, most of the chaff exited Orange County, but the remnants of the chaff may have enhanced the return from thunderstorms near the Orange-San Diego county line (Fig. 5).

Discussion

The chaff returns in this case could have potentially misled forecasters using WSR-88D output into believing a new thunderstorm was developing. Worse, if chaff moved directly into a thunderstorm, the radar return intensities could be high enough to prompt a forecaster into issuing a severe thunderstorm warning, even though the thunderstorm may be below severe levels. On 7 May 1996, when chaff moved into precipitation in Utah, the WSR-88D hail detection algorithm computed a 60 percent probability of hail (Vasiloff and Struthwolf, 1997) even though only light rain occurred.

If chaff echoes are adjacent to precipitation echoes, the differentiation between the echoes is difficult. Three clues have been found that could help a forecaster differentiate chaff from precipitation. First, satellite images can be used to determine if clouds are consistent with the echoes; if not, the echoes are probably due to chaff. Second, during the first 30 minutes after the echoes first appear, if there is a rapid increase in the areal coverage of returns without an increase in the maximum reflectivity that a thunderstorm might have, the echoes could be due to chaff. More chaff cases would be needed to verify this. Third, as Vasiloff and Struthwolf (1997) found, chaff echoes have more vertical tilt than thunderstorm echoes, which are usually nearly vertically-stacked.

Coordination between the military and the National Weather Service about chaff is very important so that the forecaster can make a quick decision when attempting to distinguish chaff and precipitation. When an NWS forecaster contacts the military about chaff, sometimes the military will not release the information. The preferred case is for a National Weather Service office to have a reliable contact within the military with whom the forecasters can discuss these releases or, better yet, coordinate before chaff releases occur.

Reference

Vasiloff, S. and M. Struthwolf, 1997: Chaff mixed with radar weather echoes. Western Region Technical Attachment WRTA 97-02, 10 pp.

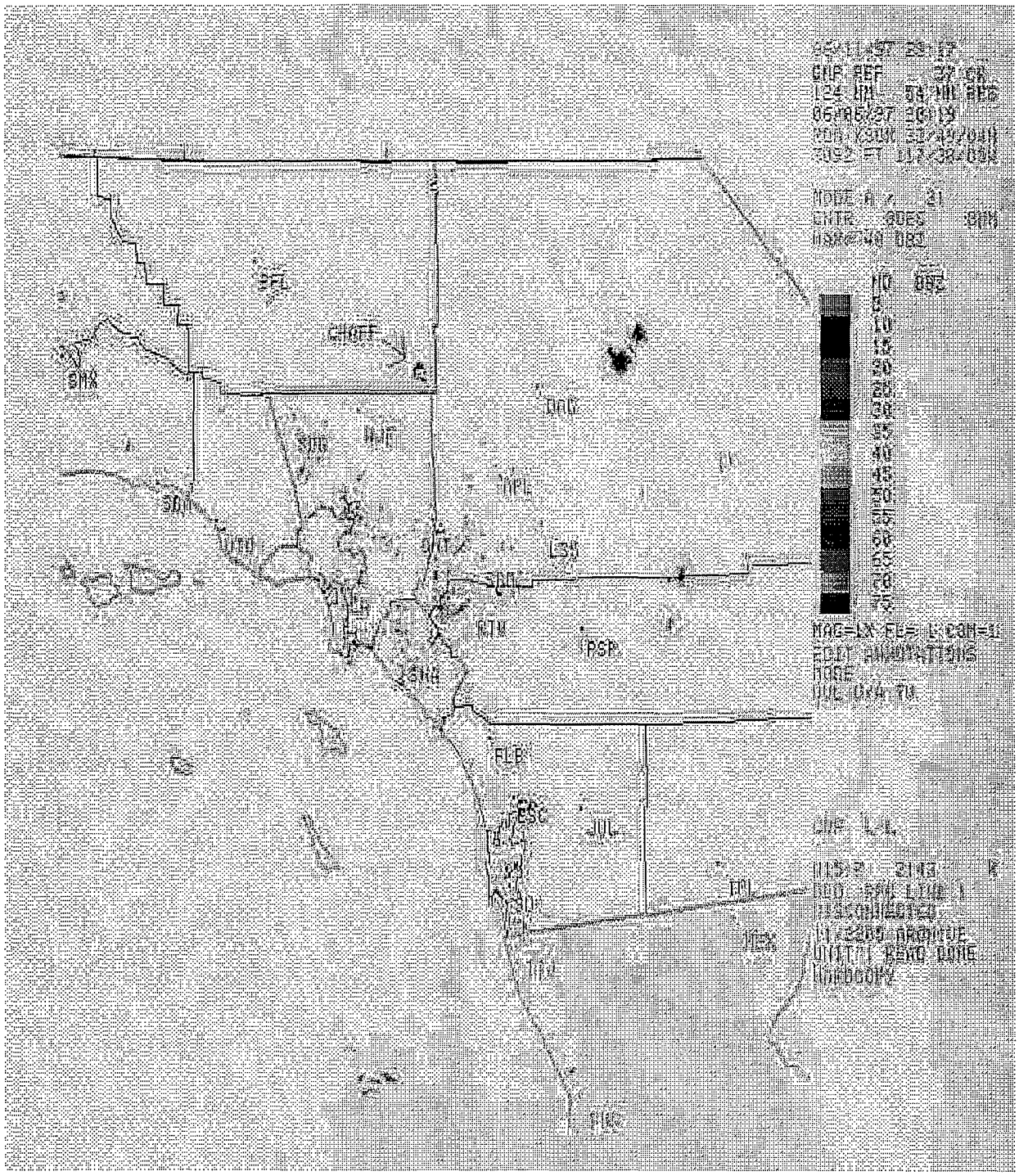

Fig. 1

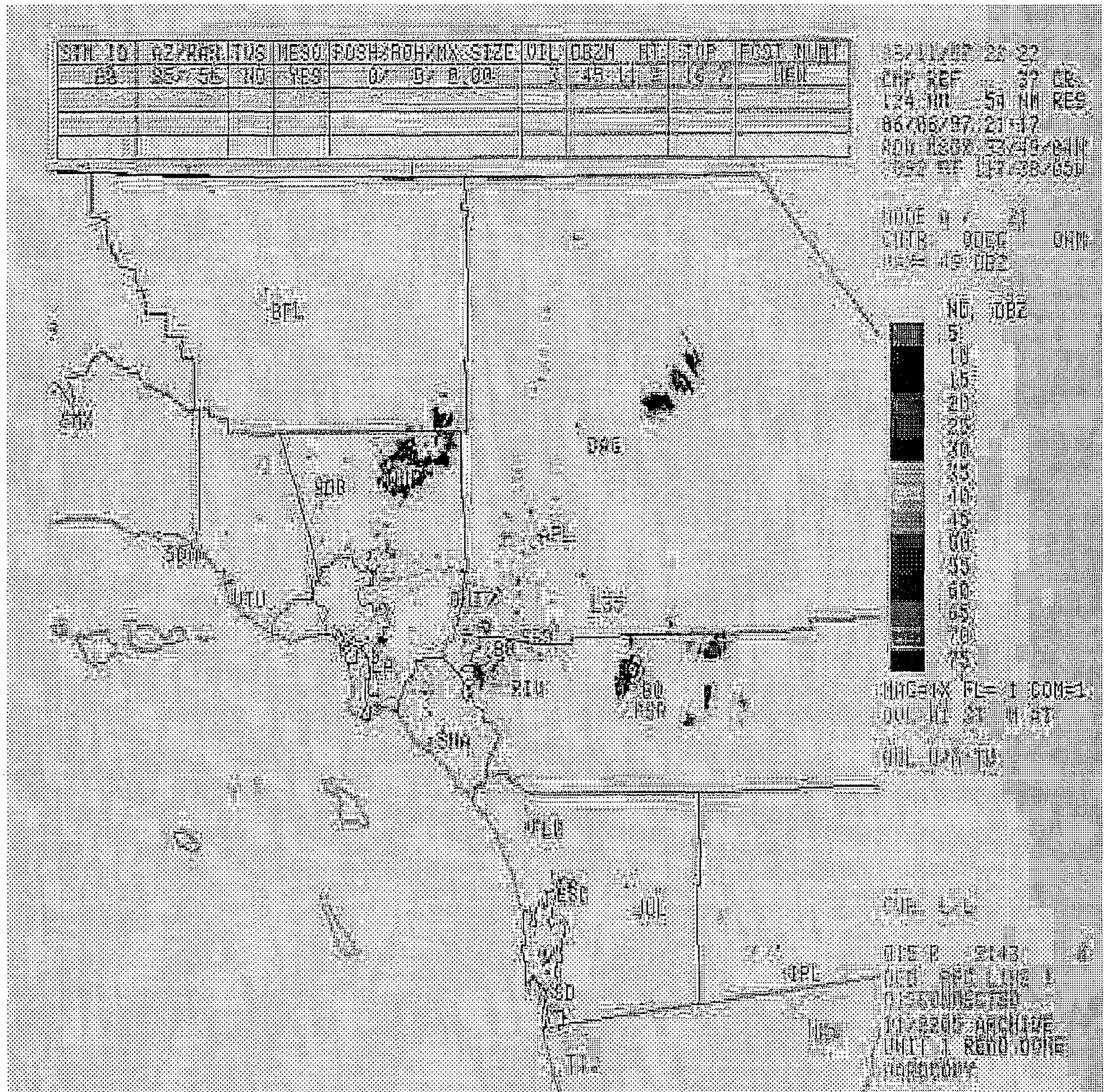

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Fig. 2

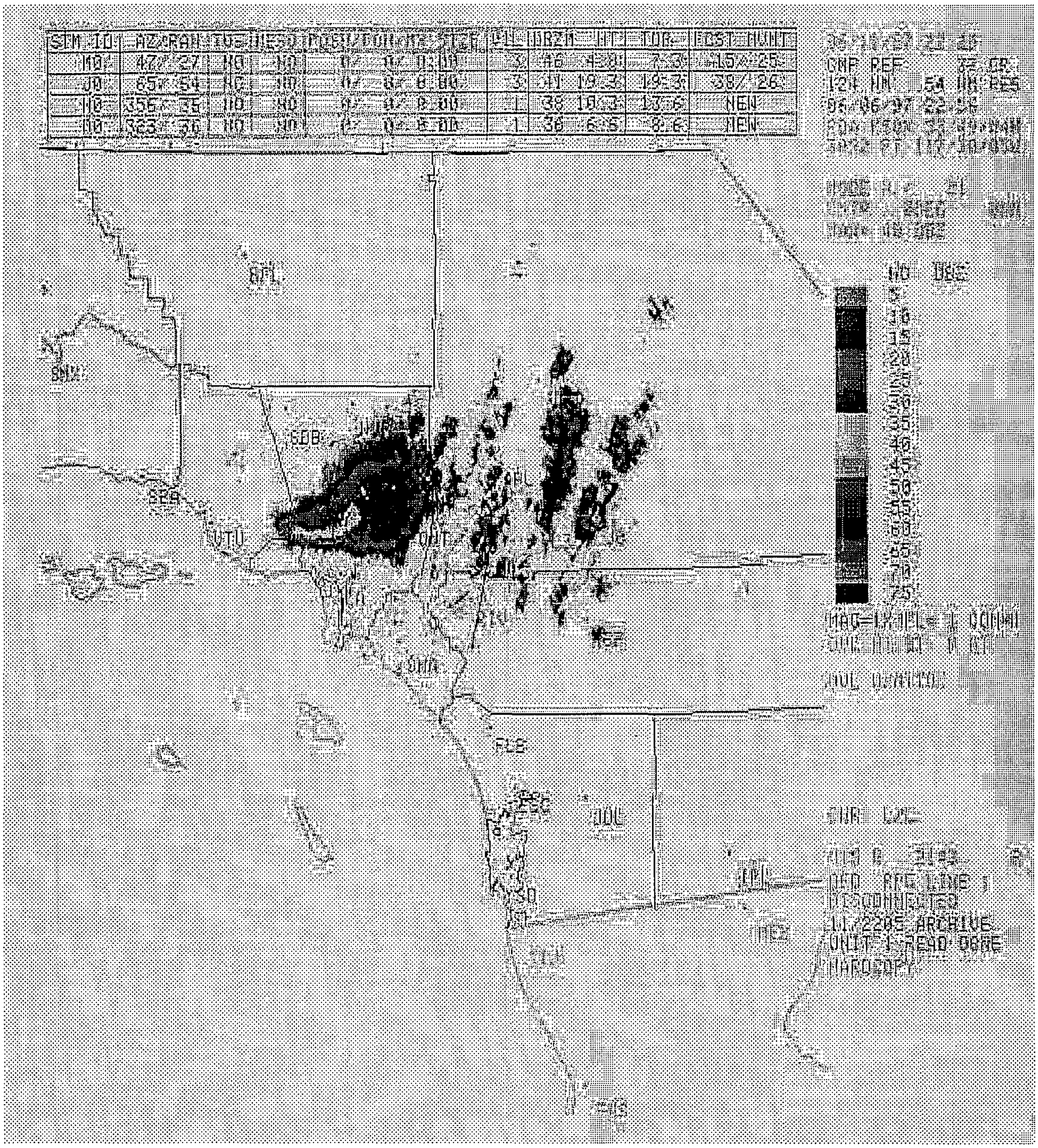

Fig. 3

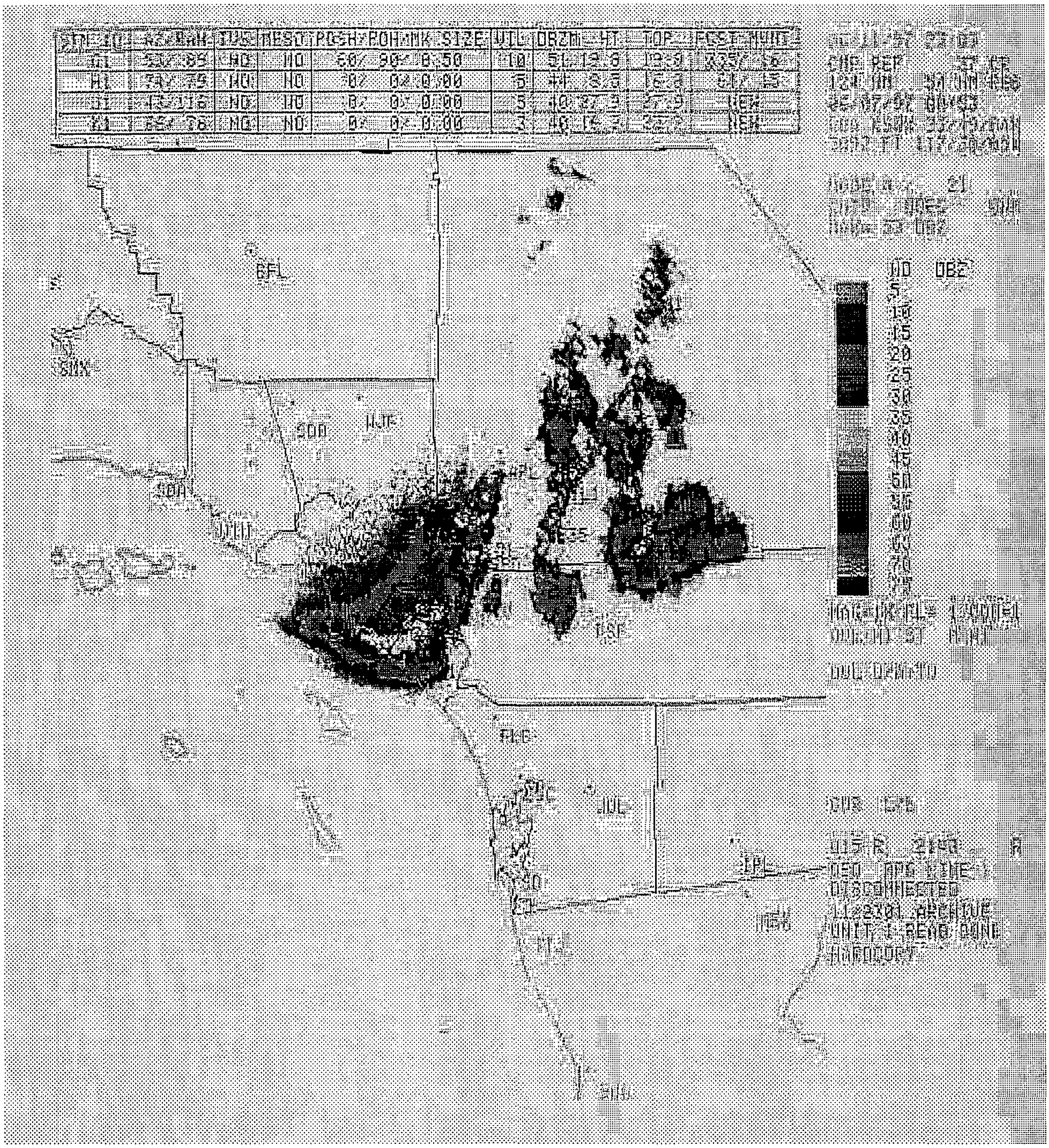

Fig. 4

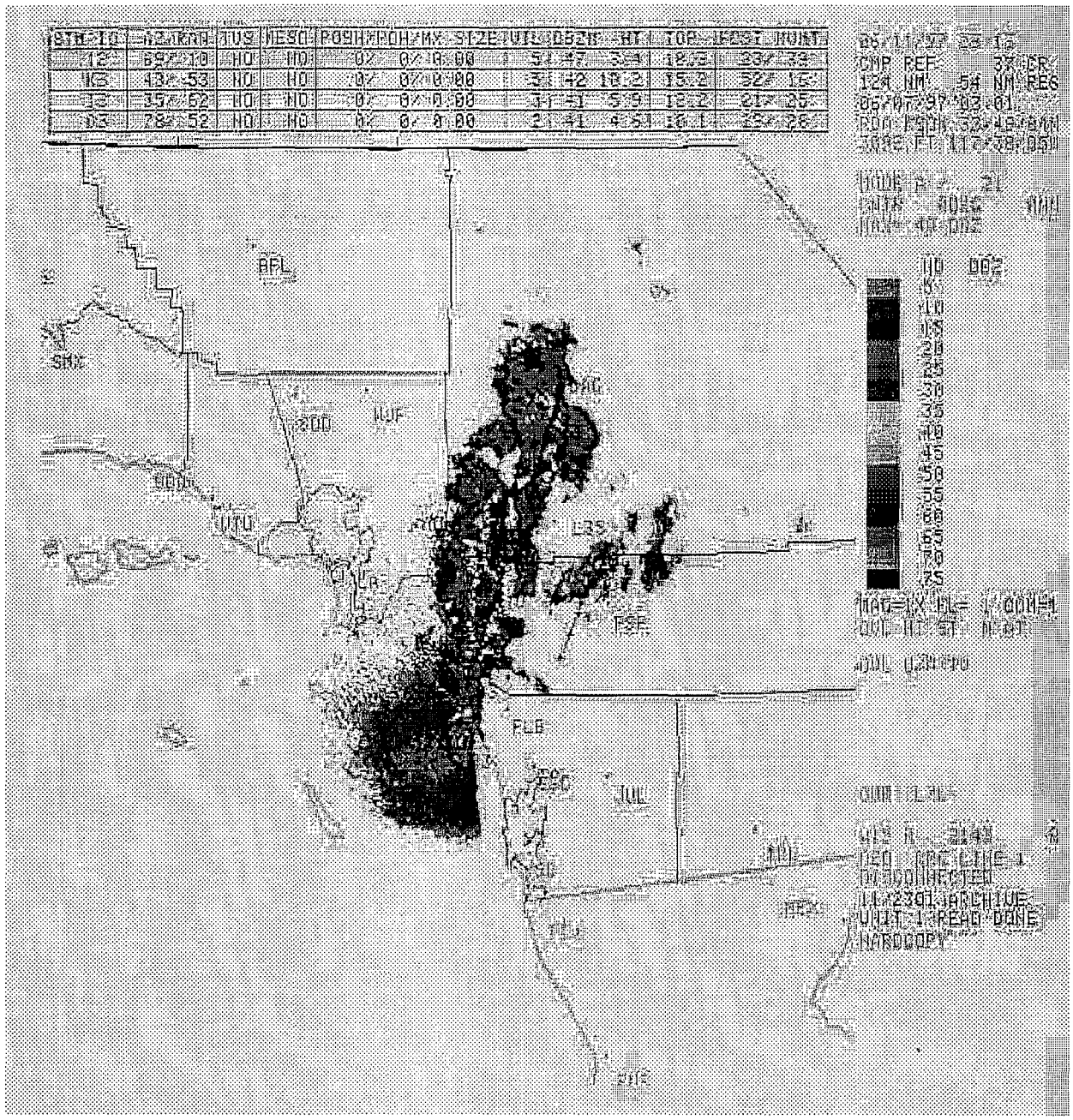
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Fig. 5