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GETTING READY FOR THE NEXT LIGHTNING SEASON

As we begin preparing for the 1987 lightning season in the West, we felt it would be appropriate to review the 1986 season and discuss the changes for 1987. First, a review of the last season.

1986 ALDS Season

The Bureau of Land Management (BLM) Automatic Lightning Detection System (ALDS) and the Western Region AOS hardware/software were both very reliable during the 1986 lightning season. There were no noticeable breaks in the BLM network and the AOS system was out for only a few hours, April through October. This marked the second consecutive year of almost continuous lightning strike coverage across the western U.S.

Over 2.3 million cloud-to-ground (CG) strikes were recorded April-October 1986. Figures 1-4 graphically summarize the seasonal lightning data. A strong diurnal tendency is depicted in Figure 1, indicating a maximum at 2200 UTC. August was, by far, the most active month with almost 900,000 CG strikes (Figure 2). An approximate state-by-state breakdown for the Western Region (Figure 3) shows that the inland states registered the bulk the lightning strikes. Not shown are the states of Wyoming, Colorado and New Mexico which, collectively, recorded over one million CG strikes. However, the data for these 3 states are included in Figures 1, 2 and 4.

The CG strike frequency distribution also shows a strong latitudinal dependency as depicted in Figure 4. Over 3 times as many strikes were registered south of 42 N in the Western Region, as compared to the area north of this latitude. There is nearly a linear decrease in the total strikes in Figure 4, from a maximum near 34 N to a minimum in the northern portions of the region. However, there also appears to be a secondary maximum centered near 45 N. The character of this frequency distribution is not too surprising if the climatology of convective activity in the Western Region is considered. During the most active convective months of July and August, the southern portions of the region are dominated by a monsoon-type circulation, characterized by a subtropical high near the Four Corners area, as shown in Figure 5. The greater insolation in these lower latitudes and the frequent influx of tropical moisture are conducive to increased convective activity. A decrease in thunderstorms in the northern portions of the monsoon circulation is not unexpected due to the less frequent intrusion of tropical moisture. However, in the latitudes between 42-50 N, the westerlies, although weaker, still dominate through the summer months. Migratory short waves in the westerlies provide dynamics that trigger episodes of increased convective activity, which is reflected in the secondary maximum noted in Figure 4.

Positive CG strike detection was another important aspect of the 1986 ALDS season. In the spring of 1986, the BLM replaced most of the direction finders (DF) with newer models which were capable of distinguishing between positive and negative CG strikes. The significance of positive strikes was detailed in WRTAs 86-17 and 86-18. A few of the important points are summarized below:

1. In the mid-latitudes, only 2-3% of the total CG strikes are positive.

2. Positive strikes generally have only one return stroke, but the transfer of current is much greater than in a negative strike.

3. Positive CG strikes occur most frequently in the latter stages of the thunderstorm cycle.

4. Positive CG strikes usually emanate from the mid to upper reaches of a thunderstorm, and track horizontally before striking the ground away from the storm center.

5. Preliminary investigations have shown that there is a higher percentage of positive strikes from cells developing in a moderately strong vertical wind shear. It has been observed that the percentage of positive strikes increases with increasing latitude, which may be related to the increasing westerlies (more vertical wind shear) at the higher latitudes.

Data from the Western Region during 1986 is in agreement with the above characteristics. Of the 2.3 million CG strikes recorded by the BLM network, only 2% were positive. A preliminary breakdown (not shown) by latitude revealed that the percentage of positive strikes was 1.5% south of 42 N and almost 3% north of this latitude. This is consistent with the latitudinal dependency discussed above.

Since positive CG strikes occur in the latter stages of thunderstorm development, the percentage of positive strikes should increase late in the day when convective activity is on the decline. This is supported in Figure 6 which shows the hourly frequency distribution for 1986 and the hourly percentage of positive strikes. The positive strike percentage begins to increase during the afternoon, peaking around midnight and reaching a minimum late in the morning.

The detection of positive strikes is important in the western states since it is believed they are responsible for many of the wildfires due to the higher current associated with positive strikes and since they characteristically strike in the drier areas away from the storm center. Relationships between positive CG strikes and storm severity are still being investigated.

1987 ALDS Season

The BLM has tentatively scheduled the start-up of the ALDS network for May 15. There will be several important changes this year:

1. The entire BLM DF network will be comprised of the newer DFs, capable of detecting positive strikes. The DF network is shown in Figure 7.

2. The transmission of strike data from the DFs to the position analyzer (PA) in Boise will be via satellite rather than landline.

3. The two DFs in northern Utah, near Lakeview and Dugway, will not be part of the ALDS network, at least in the beginning. Both of these units are owned by the U.S. Army and will not be fitted with satellite uplinks. Landline transmission

of their data to the BLM at Boise is being negotiated. Additionally, these two DFs represent the older model and are not capable of distinguishing positive strikes. The absence of these DFs from the ALDS network may have a detrimental impact on detection efficiency in Utah and southwestern Wyoming.

4. The PA software will have new "strike fitting" algorithms. In previous years, if 3 or more DFs detected the same strike, the two DFs which received the stronger signal were used to triangulate strike location. Starting this year, all the DFs that detect a strike will be used to determine the "best fit" location. This should improve accuracy and reduce anomalous strikes.

5. Two DFs, previously located near Cottage Grove, Oregon, and Wenatchee, Washington, have been moved to Eugene, Oregon and Omak, Washington, respectively. This will have little impact on the network.

6. An additional DF, belonging to the BLM, has been installed on Site C of the Las Vegas Nuclear Support Office test area. This DF is located 60 miles east-northeast of Tonopah, Nevada (circled in Figure 7). This should greatly improve detection efficiency in central and southern Nevada.

7. The BLM ALDS network will operate year-around from now on.

Western Region SSD is not planning any changes in the product generation software for AFOS, RTA, or dial-in users this year. A complete list of products and their schedules can be found in the 1986 ALDS Users Guide.

We are looking forward to another successful ALDS season. If there are any problems with the network, such as anomalous strikes, please document with supporting data and send to SSD.

References:

1. Mathewson, M., 1986: Automated Lightning Detection System User's Guide. April, 86 pp.

2. NOAA, 1986: Characteristics of Lightning, Part I - Electrical Fields and Charge Separation. Western Region Technical Memorandum No. 86-17, April.

3. NOAA, 1986: Characteristics of Lightning, Part II - The Discharge and Its Relationship to Thunderstorm Characteristics. Western Region Technical Memorandum No. 86-18, April.

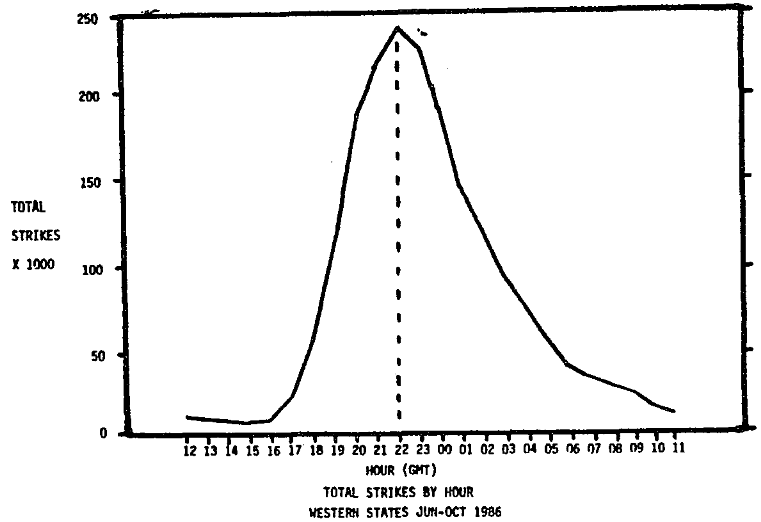


FIGURE 1.

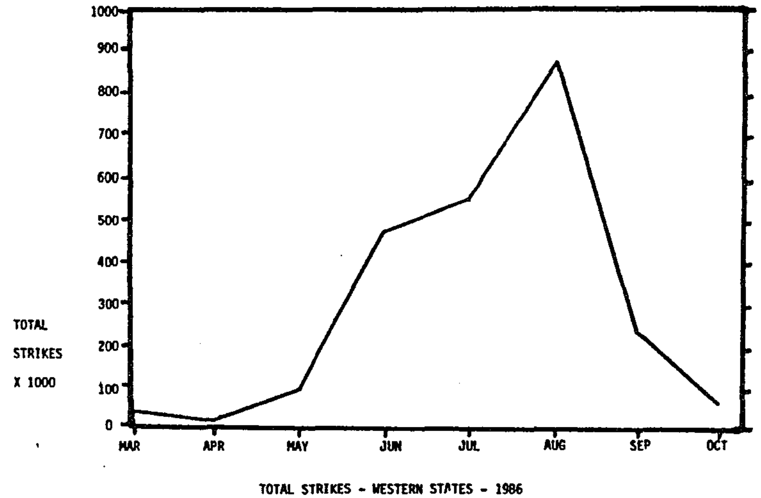


FIGURE 2.

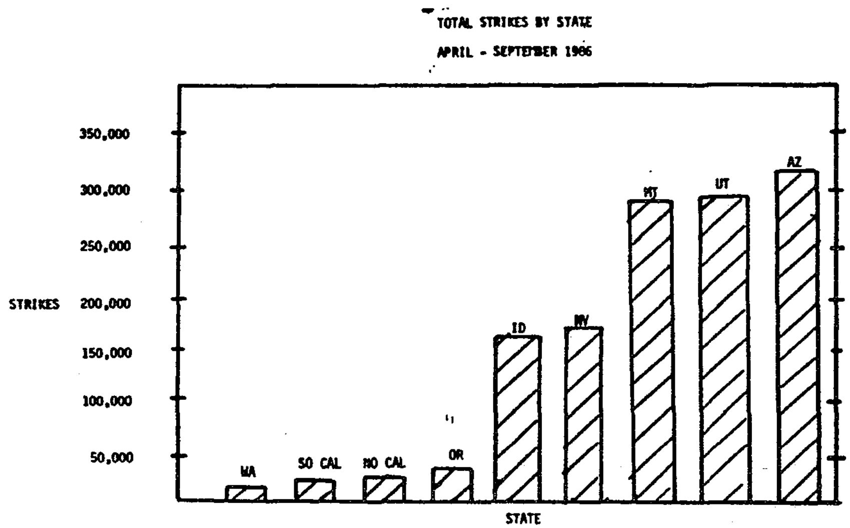


FIGURE 3.

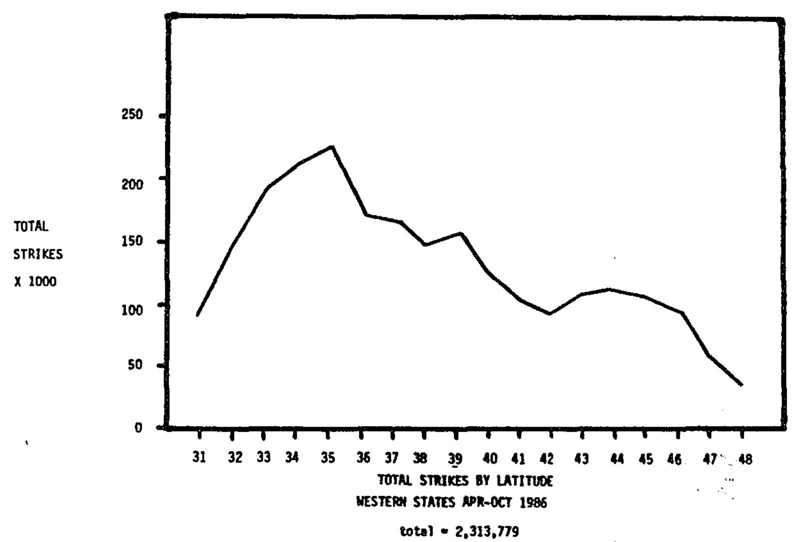


FIGURE 4.

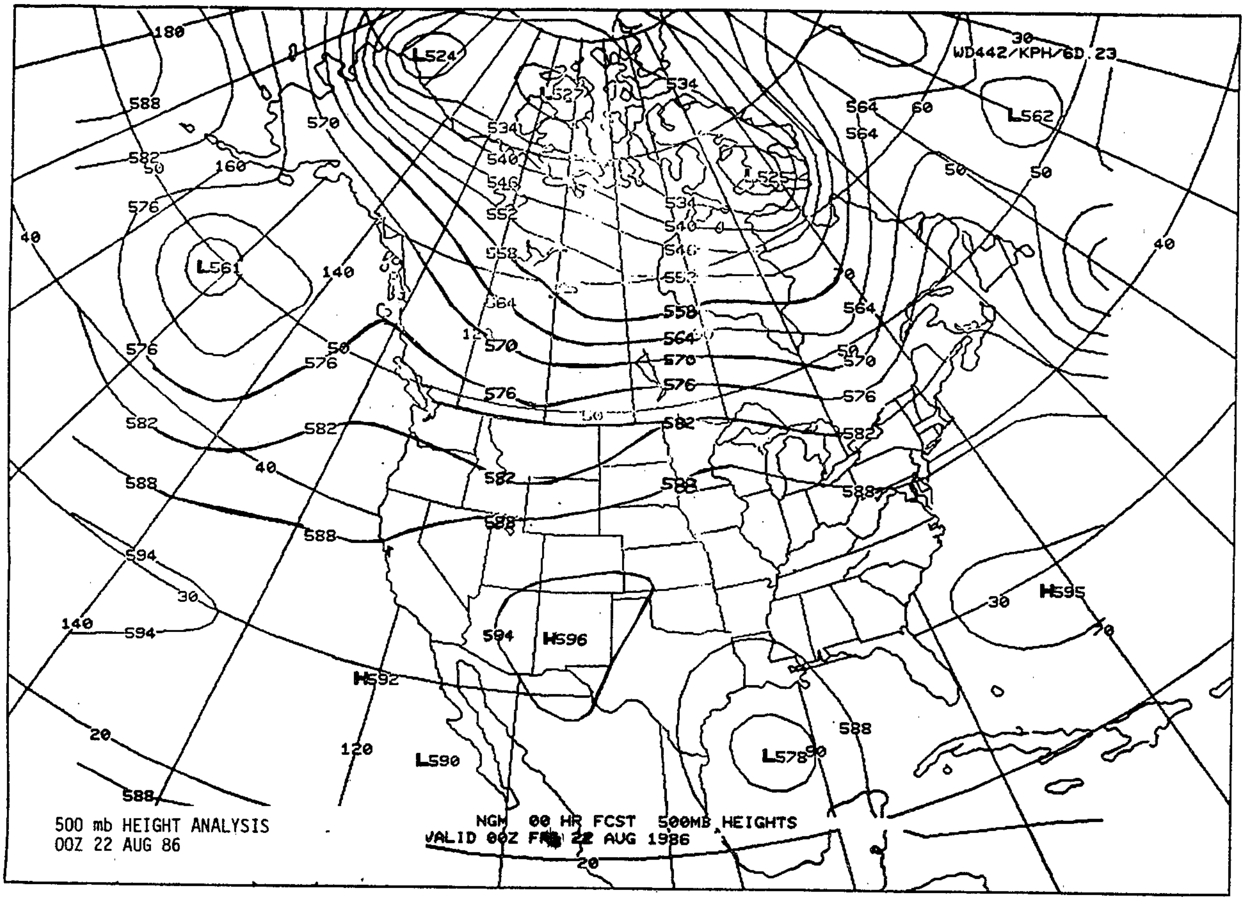


FIGURE 5.

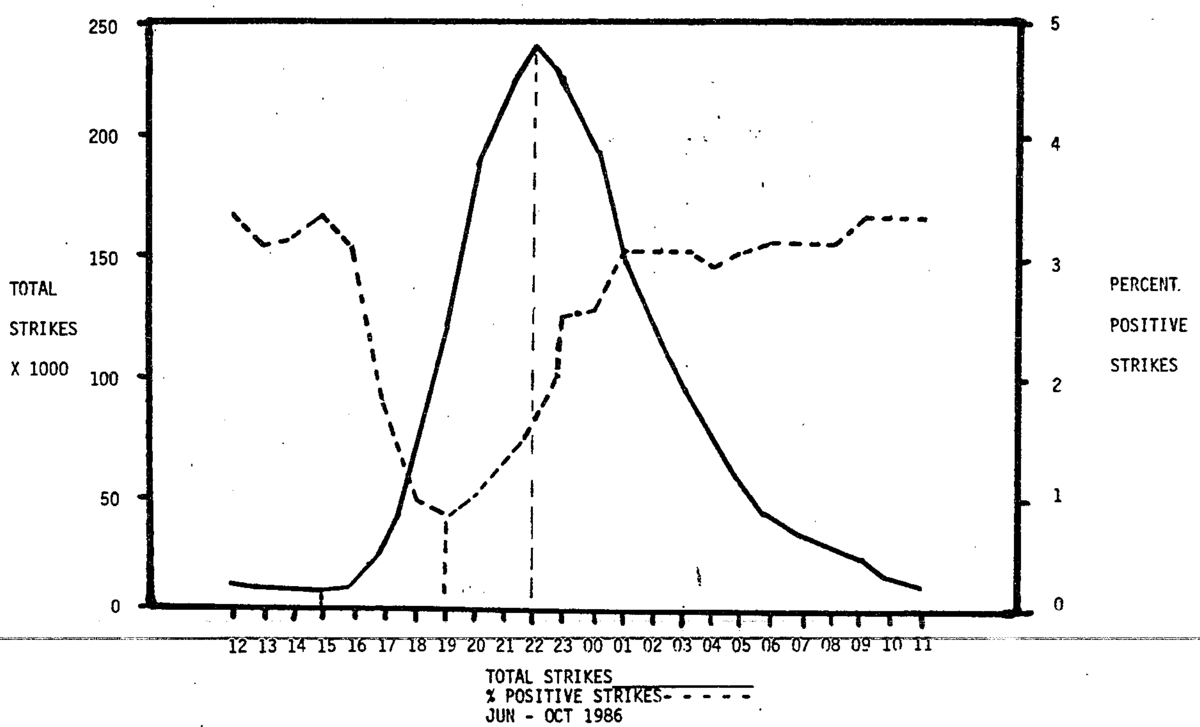
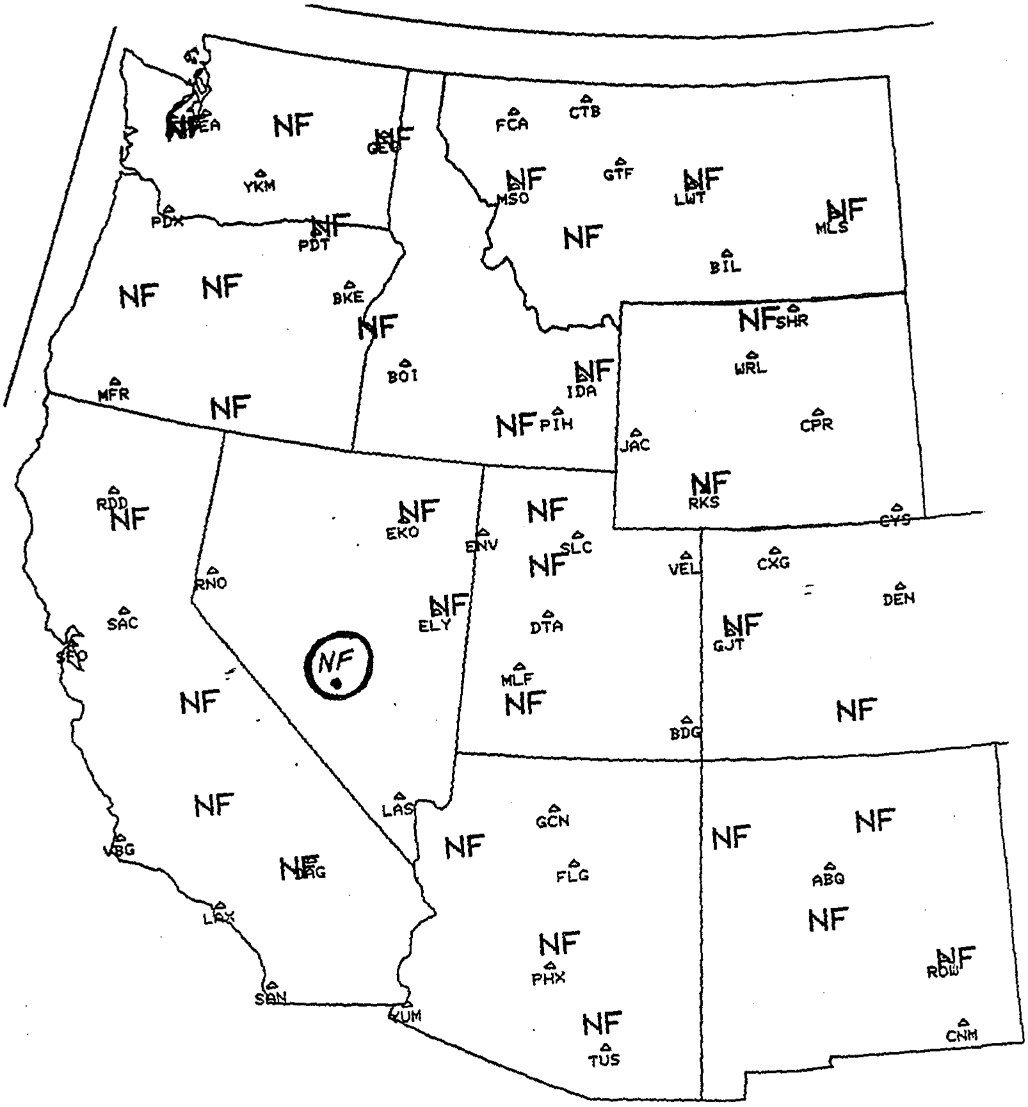


FIGURE 6.



NF = Direction Finder

FIGURE 7.