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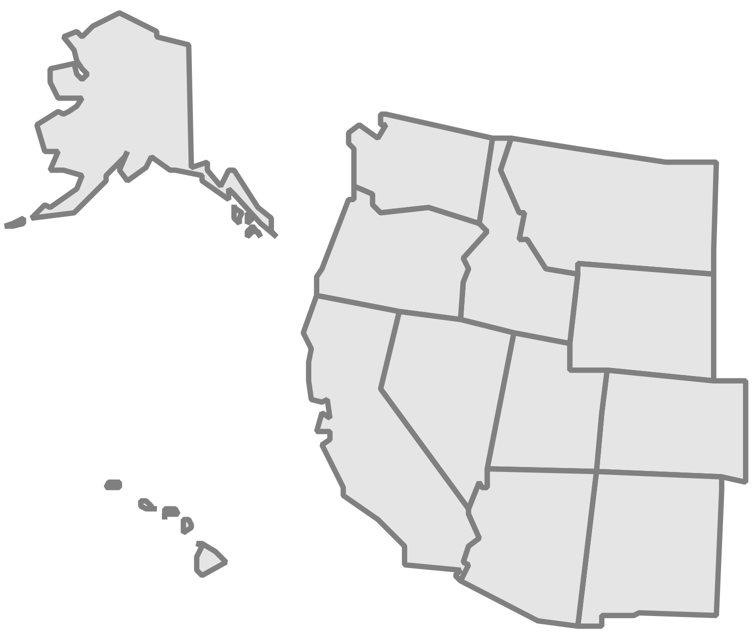
Nevada ALDS Lightning Climatology

Hourly Mean Counts and Frequencies

Project Report

May 1997



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Forward

This report summarizes a component of the Cooperative Program for Operational Meteorology, Education, and Training (COMET) project "Integrating Weather and Climate Variables for Improving Outlooks and Forecasts During the Nevada Fire Season". Results of this project can be found at the Program for Climate, Ecosystem and Fire Applications web site (www.dri.edu/Programs/CEFA) or through the Western Regional Climate Center homepage (www.wrcc.dri.edu). Correspondence and web address information have been updated in the PDF version of this report.

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Nevada ALDS Lightning Climatology
Lightning Strike Hourly Mean Counts and Frequencies

COMET Subaward No. UCAR S96-73662
Cooperative Agreement No. NA57GP0576
Integrating Weather and Climate Variables for Improving Outlooks and Forecasts
During the Nevada Fire Season

by

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This product, developed for the Reno National Weather Service Forecast Office (NWSFO), is based upon results obtained from the COMET Partners project "Integrating Weather and Climate Variables for Improving Outlooks and Forecasts During the Nevada Fire Season". It includes the climatology of cloud-to-ground lightning strikes from the Automated Lightning Detection System (ALDS) for the period April 1985 through November 1996 for an area including and immediately surrounding the state of Nevada. This area covers all of the Reno NWSFO forecast zones and adjacent area.

The data were extracted from the Western Regional Climate Center's (WRCC) ALDS database. The sensors comprising the ALDS network detect strikes which have an electromagnetic waveform characteristic of cloud-to-ground strikes. Optimization and triangulation are the two primary methods used to determine the geographical location of the strike. These methods require that at least 2 and 3 sensors detect a lighting strike within 3 milliseconds of each other, respectively. Lightning Location & Protection Inc. (LLP), the manufacturers of the lightning sensors, claim an effective accuracy of a direction finder to be ±1° of arc which is equivalent to a ±1 nautical mile (1.15 statute miles) error at 60 nautical miles (69 statute miles) from the antenna. The Bureau of Land Management considers a usable distance from the direction finders to be 225 miles which could cause a random error in strike location positioning of up to 7 nautical miles (8 statute miles). According to LLP, there is a 15% chance of a cloud-to-ground lighting strike being missed by the sensors due to 1) a large amount of electrical activity by either multiple strikes or electrical noise preventing the sensors from discriminating individual strikes, 2) interfering electromagnetic waveforms that would prevent the sensors from determining cloud-to-ground lighting status, 3) a cloud-to-ground discharge of multiple channels causing a sensor to register only one of them, 4) oversaturation of signals due to the strikes occurring too close to a sensor, or 5) the threshold setting on the sensor is set too high in order to avoid picking up surrounding electrical noise causing weak lightning strikes to be missed.

Two main products were created from the ALDS data set including hourly average number of lightning strikes by month and the relative frequency of lighting strikes for each hour by month. Both products are presented in contour plot form. Shaded contours highlight regions of equal value, and labeled contours are overlaid for shading identification. All graphical displays were made using the Grid Analysis and Display System (GrADS) from the University of Maryland's Center of Ocean-Land-Atmosphere Studies.

Hourly statistics were computed using a 0.5° grid generated over Nevada and extending approximately one degree spatially beyond the state boundaries (Figure 1). Mean hourly values were calculated by summing all strikes for each hour within each grid cell, then dividing by the total number of years (i.e. 12 for months April through November and 11 for months January through February and December). For example, if a grid cell for 02Z August had a total of 960 strikes from all 12 years, then the average would be 960 divided by 12, or 80 strikes. Relative frequencies were calculated by taking the sum of all strikes for each hour within each grid cell, then dividing by the grid cell sum of all strikes for that particular month. For example, if a grid cell for 02Z August had a total of 960 strikes for all 12 years, and the total number of strikes over all 24 hours within that grid cell equaled 10,000, then 02Z would have a relative frequency of 960 divided by 10,000, or 9.6%.

Each map that follows represents an hourly climatology for a given month (e.g., 00Z, July). Both average number of hourly strikes and hourly relative frequency are included in each Figure. Given 12 months and 24 individual hours averaged over all days of the month, there are 288 plots total.