NOTES AND CORRESPONDENCE

Comments on "Lightning Ground Flash Density in the Contiguous United States—1989"

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There are two issues concerning the data presented in Orville (1991, hereafter referred to as O91) that bring into question the validity of some of the conclusions regarding the annual lightning flash density for the contiguous United States in 1989.

First, confusion arises from what is meant by "complete coverage of the contiguous United States" with respect to the combined lightning detection networks operated by the Bureau of Land Management, the National Severe Storms Laboratory, and the State University of New York at Albany. Normally "complete coverage" would signify that if cloud-to-ground lightning were to occur anywhere within the contiguous United States, it would be detected by the network. In the analysis section, however, it is stated that the relatively low flash density extending into Louisiana (Fig. 4 of O91) may be the result of not having a direction finder in that state. If it were true, this suggestion would contradict the claim of complete coverage.

Second, and perhaps most important, a cursory examination of Fig. 4 of O91 shows a pronounced local minimum in density covering most of the High Plains, including eastern Colorado, a region well known for thunderstorm activity (see, e.g., Fig. 1 of O91). López and Holle (1986) found maximum flash densities in northeastern Colorado to be comparable to those observed in central Florida, which is not at all the case in Fig. 4 of O91. While the author points to the apparent discrepancy between the flash densities in northern Arizona (Fig. 4 of O91) and mean annual thunder days for that region (Fig. 1 of O91), no mention is made of the similar discrepancy over eastern Colorado. *Storm Data* (NOAA 1989a) for Colorado documents 70 days during 1989 when at least one report of thunderstorm-related severe weather was compiled. Of this total, 12 were tornado days. The 1953–90 mean number of tornado days for Colorado is also 12. In Florida, 125 severe days (157 if ocean waterspouts are included) were reported. These values appear to be consistent with the mean annual number of thunder days and do not indicate that 1989 was a below-average convective year in Colorado. An examination of both Colorado climatological (NOAA 1989b) and crop (NOAA 1989c) data also supports this conclusion. Table 1 lists the first 19 states in terms of the total number of lightning-related deaths and injuries in 1989 (also from *Storm Data*). Since this number is a function of the population density, one may define a lightning-hazard index that is simply the total number of reports divided by the population density of each state considered. We have computed such an index for 1989 (Table 2). With the exception of Colorado, the rankings appear to be representative of the spatial variations in flash density shown in Fig. 4 of O91.

Thus, several independent data sources suggest that the low annual flash density in eastern Colorado was probably not representative of the actual number of

TABLE 1. Annual lightning deaths and injuries—1989. From *Storm Data* (NOAA 1989a).

State	Deaths	Injuries	Total
Florida	9	41	50
Virginia	0	39	39
New York	4	31	35
Illinois	2	22	24
Colorado	4	18	22
North Carolina	4	16	20
Arkansas	2	17	19
South Carolina	2	17	19
Michigan	4	14	18
Ohio	2	12	14
Kansas	5	7	12
Tennessee	2	10	12
Wisconsin	0	10	10
Alabama	2	6	8
Iowa	2	6	8
New Mexico	3	5	8
Kentucky	6	1	7
Mississippi	3	4	7
Texas	2	4	6

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TABLE 2. Annual lightning hazard index—1989.

State	Index*
Colorado	709
New Mexico	666
Arkansas	422
Kansas	400
Virginia	275
Florida	255
Michigan	189
South Carolina	174
North Carolina	159
Iowa	153
Wisconsin	137
Mississippi	127
Illinois	119
Tennessee	105
New York	102
Alabama	101
Texas	97
Kentucky	75
Ohio	58

* Index = $\frac{\text{(total number of deaths and injuries)}}{\text{(population per square mile)}} \times 100.$

Population per square mile: (Rand McNally 1987)

cloud-to-ground lightning strokes that occurred and, therefore, of the lightning hazard that existed.

In the Conclusions section of O91, the author implies that the technique for producing annual flash-density maps is a sound one and that 10 years of data would be sufficient to arrive at a climatological map of flash density. However, it appears that a significant flash detection problem may have existed in 1989 over eastern Colorado. The ability of the National Lightning Detection Network to produce climatologically useful data for Colorado therefore would appear to be uncertain.

REFERENCES

López, R. E., and R. L. Holle, 1986: Diurnal and spatial variability of lightning activity in northeastern Colorado and central Florida during the summer. *Mon. Wea. Rev.*, **114**, 1288–1312.

NOAA, 1989a: *Storm Data, 1989.* Vol. 31.

——, 1989b: *Climatological Data, Colorado, 1989.* Vol. 94.

——, 1989c: Weekly Weather and Crop Bulletin, 1989. Vol. 76.

Orville, R. E., 1991: Lightning ground flash density in the contiguous United States—1989. *Mon. Wea. Rev.*, **119**, 573–577.

——, 1987: World Political Information. *Rand McNally World Atlas,* Rand McNally, 256 pp.