

# NOAA's Efforts to Reduce Lightning Fatalities through Public Education and Awareness

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**Abstract--**The goal of NOAA's Lightning Safety Awareness effort is to reduce the number of lightning deaths and injuries in the United States. To help accomplish this goal, NOAA has developed educational materials for both young and old to help them better understand lightning and the dangers it poses. These materials include web pages with animated graphics about the science of lightning and thunder, how people are struck by lightning, and information that provides answers to many frequently asked questions. In addition, animated PowerPoint slide shows were created to resemble books for school-aged children. All the animations can be captured or downloaded from NOAA's lightning safety website and adapted for use in other languages and countries.

In this paper, we review NOAA's and the NWS's educational and awareness efforts to reduce lightning casualties in this country. We also show some of the specific resources NOAA, the NWS, and NOAA's Lightning Safety Awareness Team have made available to the public and media.

**Keywords**—lightning, lightning safety, lightning education, lightning awareness

## I. INTRODUCTION

In 2001, the National Oceanic and Atmospheric Administration (NOAA) began a nationwide campaign to reduce the number of lightning deaths and injuries in the United States. For this effort, NOAA teamed up with non-governmental organizations and individuals to find ways to draw attention to the dangers associated with lightning [Jensenius and Franklin 2006, 2012]. NOAA's partners on the team included people that had worked on the lightning safety effort previously [Cooper, 2012].

Since 2001, NOAA's "Lightning Safety Awareness Team" has been working together to provide lightning safety information to local National Weather Service (NWS) offices, governmental agencies, broadcast and print media, non-profit organizations, and the public. The centerpiece of this effort is

NOAA's Lightning Safety web site, which serves as a clearinghouse for educational information and awareness materials on lightning and lightning safety. Also during this time, NOAA and the NWS have designated the last full week in June as Lightning Safety Awareness Week and have worked with organizations and agencies involved with outdoor activities and the media to help deliver lightning safety information. As a result of these efforts, lightning fatalities in the United States have declined. In fact, at the start of 2011, lightning had dropped to the third greatest storm-related killer in the U.S., falling below tornadoes. During 2011, lightning deaths in the U.S. fell to 26 nationwide, the lowest level ever recorded at that time. The 2011 record was eclipsed in 2013 when only 23 lightning deaths were recorded in the U.S.

## II. NOAA'S LIGHTNING SAFETY WEB SITE

[NOAA's Lightning Safety web site](#) provides information that can help people understand lightning and the danger it poses. The information available can be divided into four somewhat overlapping categories: documentation, education, awareness and resources. The documentation category includes both lightning strike data and lightning casualty data. The education category includes materials designed to educate people on thunderstorms and lightning. The awareness category includes materials that will help people recognize dangerous or potentially dangerous situations. Finally, the resources category includes a variety of downloadable materials.

### A. Lightning and Lightning Casualty Documentation

NOAA's Lightning Safety web site contains historical documentation of both lightning and lightning casualties. Lightning flash data is from the National Lightning Detection Network which is operated by [Vaisala, Inc.](#) This information includes [maps of lightning strike density per square mile](#) and [per square kilometer](#) (Fig. 1) across the U.S. and [tabular data giving lightning strike data by state](#). This information is often used by reporters writing stories for their local area.

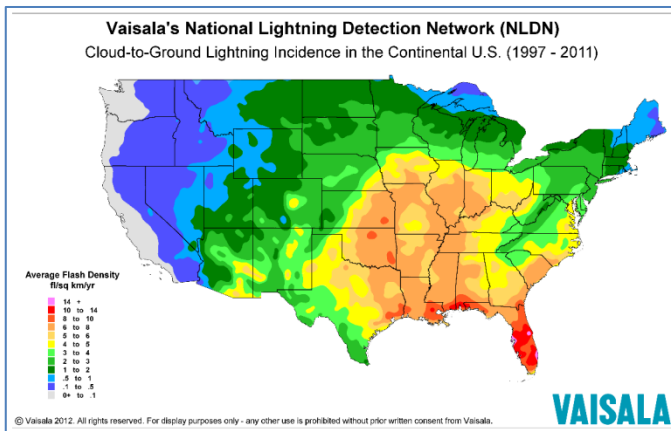


Fig. 1. Map of lightning strike density across the United States.

Lightning fatalities in the United States have been documented [since 1940](#). Since 1959, the [StormData publication](#) has been the official National Weather Service record of weather-related deaths and injuries in the U.S. While StormData continues to be the official record of all weather-related casualties, a new online database [Roeder and Jensenius, 2012] was begun in 2006 to provide accurate, more timely, and more detailed information on lightning fatalities. The online database contains information for the [current year](#), as well as data for prior years [back through 2006](#). In StormData, lightning fatalities are generally documented approximately 60 to 90 days after the incident. In the new online database, fatalities are typically documented within a day or two of the death. While both databases contain information on the age and gender of the victim, as well as the date and the location where the incident occurred, the online database also includes information on the activity which led to the incident.

The benefit of collecting fatality data is that they can be analyzed to determine information about lightning victims, such as [location within the U.S.](#) An additional benefit of the new database is that the “activity” data can be analyzed to determine the activities that put people most at risk. While the simple answer may be because victims were outside when there was a thunderstorm in their area, more detailed information is needed to understand why the victims were outside and what can be done to prevent future incidents. For example, Jensenius [2013, 2014] analyzed these data to determine that most lightning victims are involved in some sort of leisure activities prior to being struck. In particular, fishing was the activity with the greatest number of fatalities.

A second important benefit of the online database is that it provides the media with information about recent lightning fatalities. Reporters are often looking for the most recent information when writing articles on lightning incidents or lightning safety. Often, they want to know how many fatalities have occurred in the country so far in that particular year and information about fatalities in their particular region or state.

## B. Educational Materials

NOAA’s web site contains a wealth of educational materials to help people understand lightning and lightning safety. The site also provides answers to the many questions that people have about lightning. The overall goal of these materials is to provide information so people can make smart and informed decisions when thunderstorms threaten. Specifically, NOAA wants people to know that there is no safe place outside when a thunderstorm is in the area, and that they need to get inside immediately if they hear thunder.

Within the past two years, a number of educational web pages have been added to NOAA’s web site. In particular, NOAA added a series of web pages containing animated graphics which explain the [science of lightning](#) (Fig. 2), [how people are struck](#), and answer many frequently asked questions such as [what happens to cars struck by lightning](#), [what happens to planes struck by lightning](#), and [what happens to fish when lightning strikes water](#).

The web site also provides information on how much [power is in a flash of lightning](#), how [hot the air gets](#) when lightning passes through it, why some lightning is more likely to [cause fires](#), and how [lightning rods](#) work. In addition, the web site provides information to dispel myths, for example, such as [“heat lightning.”](#)

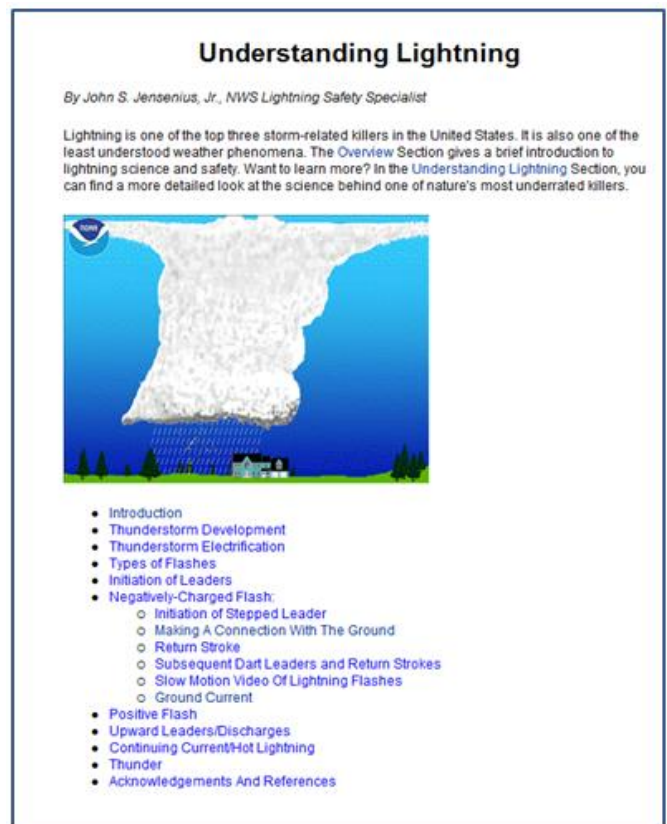


Fig. 2. NOAA’s “Understanding Lightning” section of the Lightning Safety web site.

For mid-level students, the web site has “Dr. Lightning Animated PowerPoint Books.” These include an [introductory book](#) (Fig. 3), as well as books on [science](#), [safety](#), and [victims](#).

For younger children, NOAA has a Leon, the Lightning Safety Lion [coloring book](#) (Fig. 4), and various games and activities available from the “[Kids Corner](#)” web page.

### C. Awareness Efforts

Every year during the last full week in June, the National Weather Service conducts a nationwide Lightning Safety Awareness Week. National Weather Service Offices across the country work with local officials, organizations, and the media to promote stories on lightning and lightning safety. In addition, NOAA’s public affairs office issues a national media release designed to draw attention to our efforts at the national level. The release often focuses on a specific targeted audience, such as fishing. Each year, NOAA also creates a [web message](#) (Fig. 5) targeting various outdoor activities, and

develops various graphics and informational messages for social media.

At the national level, the NWS has also worked with major sports organizations and venues to develop lightning-safe policies ([Woodrum and Franklin 2014](#)). These efforts have received considerable visibility during the past year as several nationally-televised games were delayed, postponed, or cancelled due to lightning threats. These highly visible delays, postponements, and cancellations set a great example for smaller and more local organizations and decision-makers.

Although Lightning Safety Awareness Week serves as a focus for our national efforts, NWS Weather Forecast Offices work throughout the year with various outdoor and sports organizations to promote lightning safety.

### D. Resources

NOAA’s web site contains a wealth of information and materials on lightning and lightning safety. In addition to the



Fig. 3. NOAA's animated PowerPoint Books on lightning science and safety available from the lightning safety web site.





Fig. 4. Leon, the Lightning Safety Lion coloring book.

resources included in the sections above, the web site has printable [brochures](#) (Fig. 6), [stickers, posters, and signs](#), [multimedia files, photos, etc.](#) There are also [toolkits for schools, communities, and organizations](#) to use to help develop lightning safety plans and procedures.



Fig. 6. NOAA's Lightning Safety for You and Your Family brochure (also available [in Spanish](#)).



Fig. 5. NOAA's annual lightning safety message.

### III. IMPACTS OF THE U. S. LIGHTNING SAFETY EFFORTS

Fig. 7 shows the average number of yearly lightning fatalities in the U.S. since 1970, averaged over 5-year periods. Fatalities for 2011 through 2013 were averaged over the 3-year period. Despite a rising population, the number of lightning fatalities continues to decrease. In 2011, the 26 recorded lightning fatalities set a new record low for the United States. This record was subsequently broken in 2013 with a total of 23 fatalities.

The continuing downward trend in lightning fatalities is very promising, but there is still work to be done. Although the number of lightning deaths is rather small compared with other deadly hazards, there are still more than 200 people injured by lightning each year. Based on the fatality analysis, most lightning victims are involved in unorganized leisure activities.

For anyone outdoors, there is a balance between the risk of being struck by lightning and the inconvenience needed to be safe. Because many people lack sufficient knowledge on the

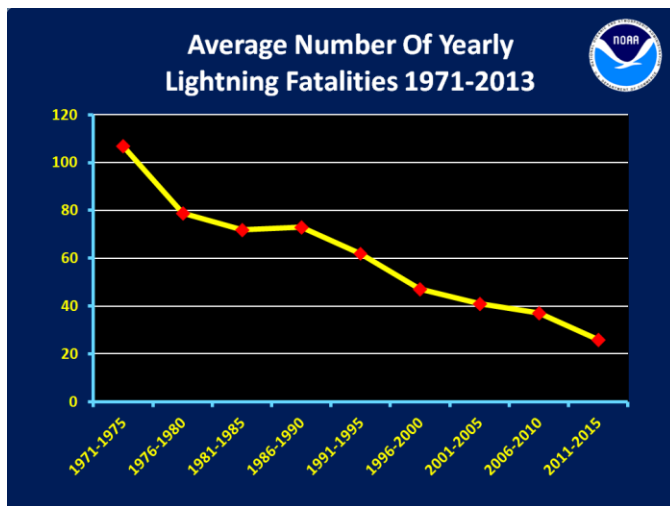


Fig. 7. Number of yearly lightning fatalities in the U.S. averaged over 5-year periods.

danger associated with lightning, they tend to underestimate the threat it poses. This may be especially true since people often make decisions based on past personal experiences that may include many instances where they engaged in unsafe activities without being struck.

While difficult to document, the authors are aware of an increasing awareness and concerns regarding the dangers of lightning. In particular, an increasing number of sports and recreational organizations have adopted lightning safety policies consistent with NOAA's recommendations.

#### IV. CONCLUSIONS

NOAA's efforts over the years to draw attention to the dangers of lightning appear to be working. In addition to the lower fatality rate, the effort to get accurate information out through the media is also working well. Most media stories reference information provided on NOAA and National Weather Service web sites. In addition, we've noted a significant change in the safety policies related to organized outdoor recreational activities. Many schools and organizations now require an event to be stopped immediately when lightning is seen and thunder is heard. This provides for the safety of those at the event and also teaches a valuable lesson; that is, that it is simply not safe to be outdoors when thunderstorms are in the area.

Continued efforts to inform and educate the public are needed to keep the number of lightning casualties low. Personal experience and a lack of knowledge often give people a false sense of safety. This perception, combined with the desire to not be inconvenienced, can lead people to engage in unsafe behavior when thunderstorms are nearby. Education is the most powerful tool we have for decreasing lightning casualties. People who understand the dangers of lightning and know what actions to take when lightning threatens will make better decisions for themselves and those around them. Without continued lightning awareness efforts, lightning casualties would likely increase.

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