

The African Lightning Injury Reports Database

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Abstract

The African Centres for Lightning and Electromagnetics Network, Inc. (ACLENet) has been collecting and reporting lightning injury and damage news reports in its monthly newsletter since 2018, posting each report by country and year on the website database for use by researchers. In six years, 898 reports have been posted covering 42 countries, making this the largest publicly available database on lightning injuries and damages for Africa. This paper discusses the history of the development of the database, sources, distribution of the reports, and illustrates how data can be summarized from any country using Angola as an example.

1 Introduction

The mission of the African Centres for Lightning and Electromagnetics Network, Inc. (ACLENet) is to reduce deaths, injuries, and property damage from lightning across Africa. An important component to accomplish the mission is through research. In order to bring about changes in the number of deaths and injuries, awareness is essential. The compilation of a database of lightning injury news reports is an essential resource that ACLENet provides freely for use by any researcher or lightning safety advocate who wishes to: 1) use the data to lobby their government for change; 2) find patterns of injury that can be the basis for public safety and lightning injury prevention education as well as other interventions, and application of lightning protection standards; and 3) monitor interventions [1].

1.1 Data sources

1.1.1 Developed Nations

In developed nations, nearly all lightning deaths and injuries can be found from one or more resources. These may be summarized in meteorological, natural hazard, medical, or demographic datasets [2-8]. For example, in the U.S., the National Weather Service has maintained a summary since 1959 of all weather-related deaths, injuries and major damages due to lightning, along with hurricanes, tornadoes, heat, cold, floods, and other phenomena. This archive is readily available online on a delayed basis of several months [9].

In other developed countries, lightning events may be embedded within other categories such as thunderstorms with multiple hazards. The data are not always available online or to the public, although researchers may be able to obtain

such information on request. Much of this capability is linked to the robust system of death certificates that include causes of death where lightning is coded in various ways, often using international standards [10].

1.1.2 Developing Nations

In many developing nations across Africa, death certificates may not be issued, making national sources of the causes of death unavailable or unreliable. There may be no central agency that collects or identifies lightning as a source of deaths. As a result, one is left to media reports and local official records such as military or police reports. With the mobile phone penetration and growing internet in many African countries, events are being reported more commonly. However, there is a bias towards multiple casualty events which are reported more frequently than events involving small numbers of casualties. Many reports can be found with such methods as Google Alerts. Reports of nonfatal injuries tend to be severely underreported.

Other limitations to data collection in Africa include low literacy levels and the large number of languages spoken. News reports could be in any of the national, regional, or local languages rather than the colonial tongues - there are at least 75 languages in Africa with more than one million speakers. African media reports in Arabic or one of several European languages and the reports are unlikely to cross over or be listed by search engines in other languages. Fortunately, ACLENet has several volunteers reporting events in languages other than English. With their help, we now have some information in real time about lightning deaths and injuries that we did not previously know.

In this paper, we will present how ACLENet and our volunteers have been collecting these reports and building the

new database. We will also show what the database looks like and how it can be used for research purposes.

2 Methodology

In January 2018, ACLENet began collecting and publishing reports of lightning injury and damage across Africa. These have been listed each month in the monthly newsletter ‘The African Flash’ and are posted on ACLENet’s website by country and year for easy retrieval. Older reports that come to our attention are also posted, but no attempt has been made to actively retrieve reports prior to 2018.

Reports come from hourly Google searches on the word ‘lightning’ that have been monitored by one of the authors in English since 2018. Other volunteers who monitor Google searches in Portuguese (since November 2018) and French (since March 2021) joined the team and periodically translate and mail the reports. Additionally, any observer is welcome to [report incidents](#) through our website or by email. A cadre of ‘citizen reporters’ from various countries has developed who send us reports, sometimes translating from their native language radio or newspaper reports that might never appear on Google searches or other online sources.

Nowadays, most reports are linked to online media sources rather than print. However, not all media have the resources to keep the reports online indefinitely, so each report is reformatted into a more permanent and standardized downloadable Word file that is posted to the ACLENet website. For easy searchability, the word reports contain the exact title, date and time of publication, source link, text, and name of the citizen reporter if one was involved. With each year, the volume of reports has grown as the number of volunteers helping with this effort has increased.

Occasionally, incidents may be reported by multiple media outlets with each reporting different details that may be of interest to researchers. If the reports are sufficiently different, more than one report may be included in the database. Some reports will be summaries of several days, weeks or months of lightning incidents, again offering duplicate reports and differing details. Others will include disasters such as floods or mudslides along with lightning.

ACLENet does not have the manpower to validate each report but posts them to be available for researchers to make their own decisions about the information included.

3 Content of Reports

The lightning injury and damage database for Africa currently contains 898 original reports covering 42 countries with more than six years of reports from 2018 through 2023. Some original reports might have additional cases mentioned that were not found in other reports (see details in Section 4).

Information available in each report varies and depends completely on the reporter, who is unlikely to know anything about lightning or lightning injuries. Most reports include the year, date, sometimes the estimated time of the event, the number of fatalities and injuries, gender and age of the casualties, a brief description of what happened and some other information. Some reports have more information but some less.

An example of an original report from Kenya is shown in Figure 1. This report contains much of the information mentioned above with a title, date, link to the original post, a brief description of the event. Please note that the date posted in the sample report is the news posting date, instead of the event date. In some reports, only the news posting date is given, but the event date is unknown.

Two footballers die after being struck by lightning during match in Kenya	Title
3 March 2023 16:30 (UTC +04:00)	Date
https://apa.az/en/africa/two-footballers-die-after-being-struck-by-lightning-during-match-in-kenya-398599	Web address
Lightning has killed two football players during a friendly match at Manyansi area, in Kitutu Chache North Constituency, Kisii County, Kenya, APA reports citing Tori News .	Text
Police from the area, however, said they were yet to be briefed of the tragedy.	
Speaking to Citizen Digital on phone, Evans Akanga, Kitutu Chache North Football Kenya Federation chair said the players were struck dead during the friendly tournament.	
Two other players are nursing injuries at Nyamira Teaching and Referral Hospital where they were rushed to for emergency treatment.	

Figure 1 A sample report from Kenya

4 Results

4.1 Database

Table 1 and Figure 2 summarize the total number of reports collected for each African country. Countries with no data or very few reports are mostly located in the northern and central portions of the African continent, but this is to be expected as there is little or no lightning in Saharan countries and in many Mediterranean countries.

Map of the number of reports per million population or each African country is shown in Figure 3. Overall, the pattern is similar to the report count map in Figure 2. The northern and central portions of the African continent have lower numbers of reports per million population, whereas the northern portion has higher numbers. Note that reporting rate is not based on population but language, media coverage, and stability of the country. Some countries such as Namibia had a higher number of reports per million population (9.2) but did not have as many reports (24). The reports per million population are dependent on many factors, but it is a measure that has been used for decades. It is a useful data point for each country that may change over time with interventions such as working with the media, awareness programs, more volunteer reporters, etc.

Table 1 Total number of reports by country as of 31 December 2023

Country	Total (as of 31 Dec 2023)
Angola	38
Benin	4
Botswana	2
Burkina Faso	2
Burundi	1
Cameroon	7
Central African Republic	1
Chad	1
Dem Rep of the Congo	31
Egypt	1
Eswatini	3
Ethiopia	4
Gambia	3
Ghana	11
Guinea	14
Guinea-Bissau	1
Ivory Coast	6
Kenya	52
Liberia	5
Madagascar	3
Malawi	68
Mali	3
Mauritania	1
Mauritius	1
Morocco	4
Mozambique	19
Namibia	24
Niger	2
Nigeria	33
Rwanda	57
Sao Tome/	1
Senegal	27
Sierra Leone	1
Somalia	1
South Africa	124
South Sudan	5
Tanzania	30
Togo	1
Uganda	152
Yemen	12
Zambia	38
Zimbabwe	104
Total	898

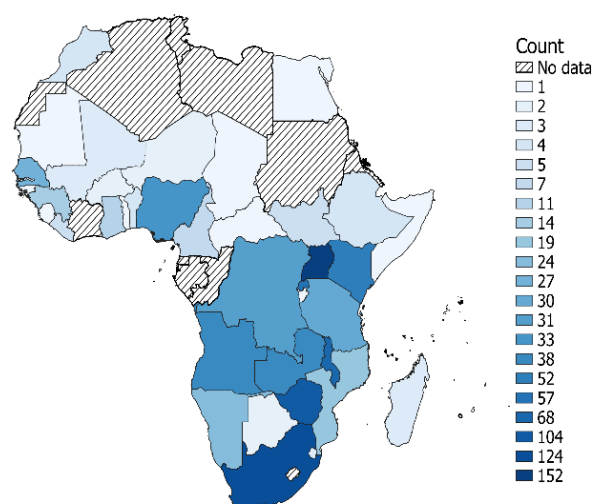


Figure 2 Map of total lightning injury and damage reports for each Africa country as of 31 December 2023. QGIS was used to create this map utilizing Africa boundary data by the ArcGIS Hub [11].

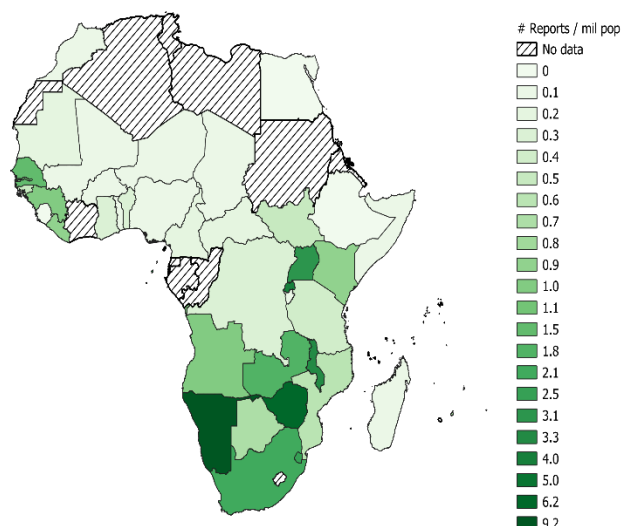


Figure 3 Map of number of reports per million population for each Africa country in 2023. QGIS was used to create this map utilizing Africa boundary data by the ArcGIS Hub [11].

4.2 Example of Database Application

The database can be used on a country basis. For instance, Angola, has a total of 38 reports in our collection period, with three additional cases from the earlier reports that were discovered from existing reports since 2009. The monthly distribution of the number of cases in Angola is in Figure 4. There were no reports during May, June or July, which is the early part of the dry season in Angola. However, 71% of the cases occurred in the months of March, April, November, and December during Angola's rainy season. According to the GLD360 data (Figure 5), most of

Angola has a total lightning density of 12-64 events per kilometer squared. Although, most of the reports did not mention the local time when the tragedy happened, from the reports that did, most happened in the afternoon or night and most frequently during 15-1700 local time.

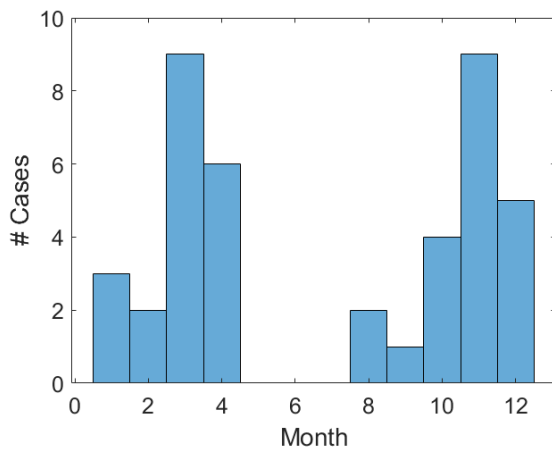


Figure 4 Number of cases in Angola by month

A closer look at these 41 reports suggests at least 114 deaths and 55 injuries including 24 male and 35 female (Figure 6). Among all, 44 were children (younger than 18 years old). Note that the gender presented here was not separated by deaths or injuries. Most casualties are teenagers and young children, but this is to be expected as the median age in Africa after the HIV epidemic is about 15-17.

The U.S. lightning safety slogan “When Thunder Roars, Go Indoor” does not apply for countries like Angola. In fact, most of the tragedies occurred in the homes. Of the 33 cases that had locations reported, 15 of them occurred inside the victim’s home, seven were outside, three were in a grass-covered hut or house, three were in work-related activity, two under the trees, one in the backyard, one in the marketplace, and one on the roof (Figure 7). This is very different from the situations in the U.S., where most of the buildings and homes are lightning safe and widely available within walking distance. People staying at home during thunderstorms, therefore, would be safe. However, in countries like Angola, people can be injured by lightning when they stay at home because of their home is not lightning safe or lacks a well-maintained lightning protection system that meets international standards [12]. In addition, lack of knowledge of lightning injury avoidance behaviors may be a contributing factor to many lightning fatalities and injuries.

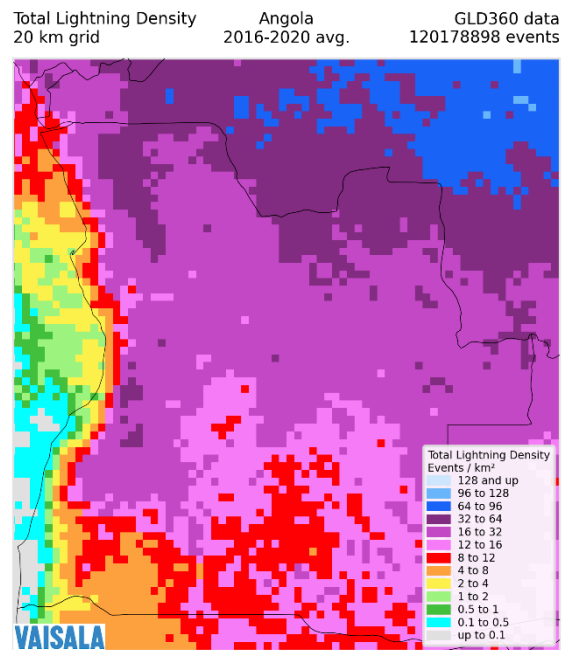


Figure 5 Total lightning density map of Angola from 2016 to 2020 based on Vaisala’s Global Lightning Dataset GLD360 network.

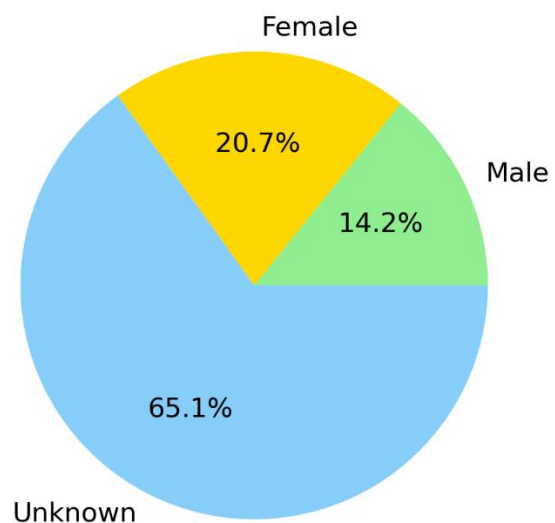


Figure 6 Angola casualties by gender

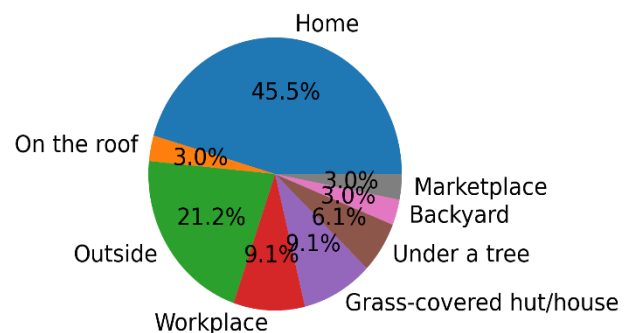


Figure 7 Angola casualties by locations/activities

In addition, most cases involved more than one casualty and these casualties were usually from the same family. One report relates that two sisters were killed walking to a neighbor's home for better shelter because they were afraid of the thunderstorm at their own home.

5 Discussion

This collection of lightning incident reports is the largest and most complete publicly available database for Africa to our knowledge. The database grows each month, is free for any researcher to use, and can be used in teaching demographic research as shown by the Example of Database Application (Section 4.2). No attempt has been made to validate each report. The quality of the reports and the details included depends on many factors that are beyond our control. There are undoubtedly many unreported injuries and missed reports, but this database is a beginning. We continue to welcome volunteers for other languages and citizen reporters translating from native languages, noting down radio reports and other sources of reports.

The large variability between the report numbers per country may be due to a variety of factors, some of which include:

- The population of very small countries such as Ghana, Gambia, and Guinea-Bissau in French West Africa may be too small to generate many injuries or injury reports.
- Native beliefs may keep people from reporting injuries. Some of these include beliefs that:
 - a) talking about lightning can bring evil or bad luck down on your family.
 - b) lightning is a punishment for sins, leading families to fear that they will be shunned by their communities, lose their livelihood or employment, and be driven out of their village.
- The risk of lightning may be low due to low flash density such as along the Mediterranean coast and Sahara. For instance, Egypt has a large population and surface area and a relatively sophisticated press, but almost no lightning, with only one report collected over the years.
- Additionally, we have only recently added reports in Arabic, so reports can be missed due to languages that we have no ability to monitor.
- The press may not be stable, literate, or strong enough to investigate or publish reports due to civil unrest, drug trafficking, Ebola, or other civil factors.

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Additionally, language and cultural barriers between tribal groups may inhibit press reports.

- The press may not consider lightning injuries an important topic to report.
- The risk may be mitigated by widespread knowledge of lightning safety behaviour when there is ready availability of lightning-safe buildings and vehicles.

6 Conclusions

The lightning injury database that ACLENet has compiled to date has become the largest database that is publicly available for Africa, containing 898 reports from 42 countries as of 31 December 2023. It is available to the public for collecting data about their own country or for other reasons. We continue to welcome citizen reporters, volunteers who will monitor Google reports in more languages, and to serve as resources to the press. Although far from perfect, the database is a beginning and an example of what can be done with sustained volunteer effort.

7 Acknowledgements

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8 Literature

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