



Symposium on Lightning and Lightning Safety Awareness



19-20 May 2021

1400 - 1730 UTC

Lightning Safety and Injury Prevention Programs Worldwide (also – Lessons Learned)

Mary Ann Cooper, MD

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National Lightning Safety Council

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Thanks

WMO and CMO for their sponsorship

Speakers from lightning safety advocacy

Colombia, USA, National Lightning Safety Council

Attendees



Speakers

Ron Holle - How big is the problem?

MAC - Lightning safety history / worldwide

Norberto Navarrete-Aldana - Medical aspects

John Jensenius - Impacts of a lightning safety program

Kim Loehr - Building a lightning safe community

Daniel Esteban - Where lightning fits in disaster preparedness

Katie Flanagan - Lightning safety standards for sports

Chris Vagasky - Unique applications of lightning data



History

1980's Nobu Kitiwawa et al - Japan

1998 - Ad Hoc meeting at AMS → *Lightning Safety Guidelines*

Introduced lightning safety/injury prevention to US NWS, intl conferences

NOAA Lightning Safety Awareness Week - 2001-15 →

National Lightning Safety Council

2007 - present - International support from NAM S&T (India)

Work with other countries on lightning injury studies, lightning detection - writing foundational papers, helping develop programs



Lightning Safety Advocates

COUNTRIES:

Uganda, Zambia, South Africa, Malawi, Rwanda,
Colombia, Brazil, Bangladesh, Nepal, India, Sri Lanka,
Malaysia, Thailand, China - more

PEOPLE INVOLVED:

Lightning protection, detection, medical,
meteorologists, physicists, engineers, media, survivors,
teachers, more



2021 Lightning Safety Conferences

11-12 May - South Africa - International Roundtable on Policy

19-20 May - Caribbean-Latin America - WMO/CMO Symposium

27-28 May - Preparing for ILSD2021 - networking opportunity for
advocacy people/programs

<https://aclenet.org/preparing-for-ilsd2021-registration.html>

International Lightning Safety Day - 28 June 2011



International Lightning Safety Day - 28 June



Tenth Anniversary of
18 children killed
38 injured
by
one lightning strike
Runyanya School, Uganda
28 June 2011

[https://www.telegraph.co.uk/news/weather/8606238/
Lightning-strike-kills-18-children-in-Uganda.html](https://www.telegraph.co.uk/news/weather/8606238/Lightning-strike-kills-18-children-in-Uganda.html)

ACLENet Mission and Activities

ACLENet is dedicated to decreasing deaths, injuries and property damage from lightning across Africa

Protecting schools

Public, Professional and International Education

Research and Documentation



Homes and businesses in Africa 2013-15



Zambia



Uganda
countryside
and market

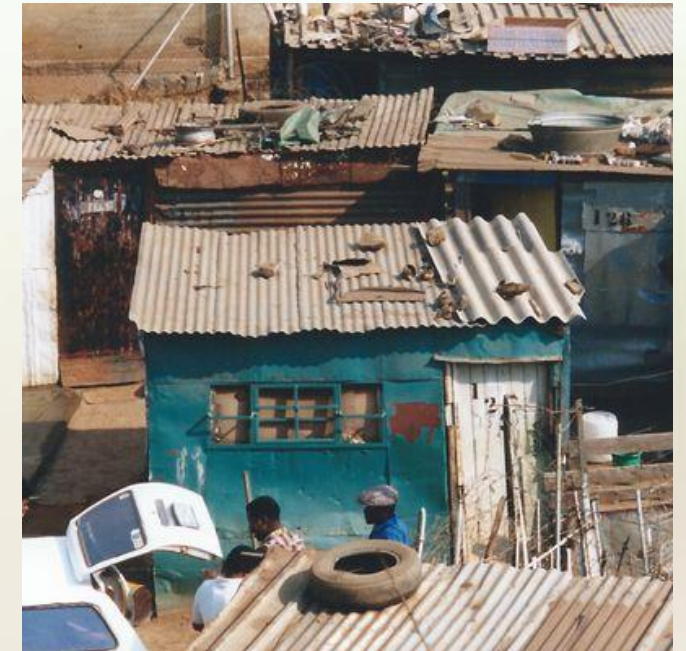


Photos by Mary Ann Cooper



Lightning Protection Challenges in Africa

Even
'city dwellers' may
not have lightning
safe dwellings



Soweto, South Africa - home to over 1 million people

Photo courtesy Derek Elsom



LP Challenges in Other Developing Countries



India
2011 MA Cooper



Nepal
2011 MA Cooper



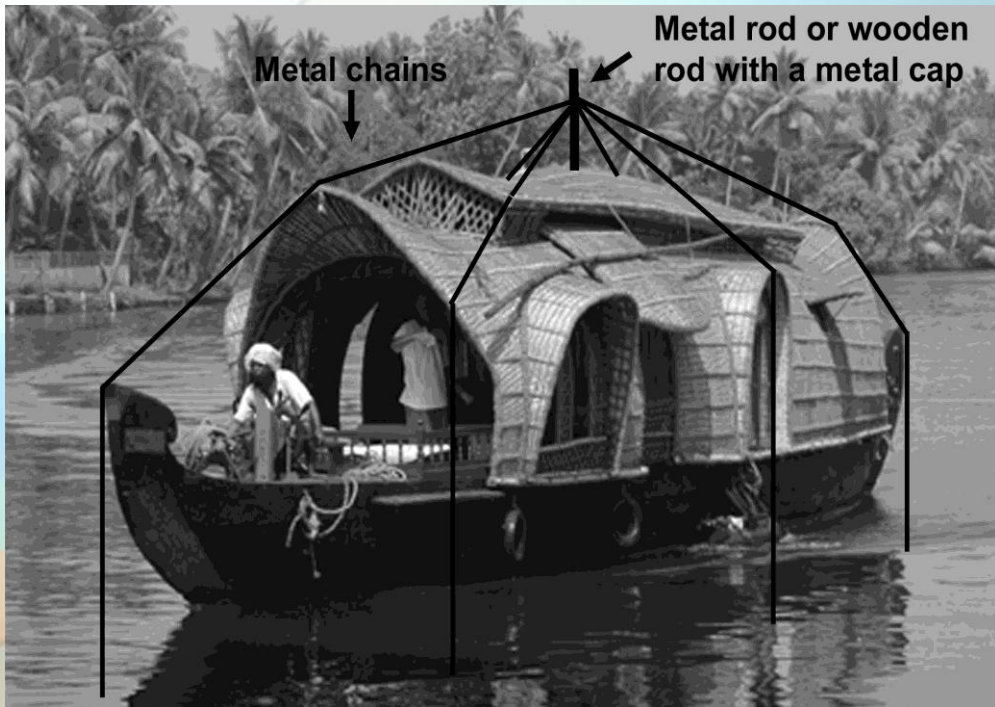
Caribbean Island
South America





Sierra Nevada, Colombia 7 Oct 2014





Boats that are homes

Uru Floating Reed Island, Lake Titicaca, Peru



Not just people at risk

Loss of livestock can be a major economic loss for families who measure wealth in animals.



Cattle, South Africa
courtesy Ian Jandrell



173 sheep
Jakarta



71 goats
Namibia





School children are the most frequent victims of lightning in Uganda

Schools not properly protected from lightning
50 children to a classroom - ground current?

AMS101 - 2021

Holle, R.L., K.N. Gassert, M.A.
Cooper, R. Tushemereirwe, R.
Said, 2021: Lightning Occurrence
and Casualties in Uganda, 10MALD

Nation	Date	Killed	Injured	Location
Tanzania	1 October 2014	0	17 children	SCHOOL
Uganda	28 September 2014	3 children		House
Uganda	11 September 2014		12 students, 3 teachers	SCHOOL
Uganda	24 July 2014	8 students	23	SCHOOL
Malawi	29 December 2013	8	'many'	Church
Uganda	27 June 2011	18 students, 1 teacher	38 hospitalized	SCHOOL
Ethiopia	July 2011	25 in one month	?	?
Kenya	July 2011	20 in one week (8 from one family)	?	?
Nigeria	29 June 2011	19	?	?
Rwanda	28 June 2011	3 children	10	'Outdoors'
South Africa	4 January 2011	15 in one weekend	?	?
Sudan	17 August 2010	7 children		SCHOOL

Of all events

Schools	55
Home	17
Under trees	6
Church	4
Tending animals	4
Funeral	3
Playing	3
Soccer	3
Collecting rainwater	2
Inside bar (hut)	2
Other single events	<u>13</u>





Additional Reasons to Protect Schools

Schools are the most substantial building in most communities.

Center of activities - 'community center'

Provides lightning safe place for other community members.

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ACLENet - Its Role in Mitigating Human Loss

Lightning Protection Working Group - design team

World class LP experts - international standards committees

ALL Volunteers - South Africa, Denmark, USA, Uganda

Working together since Nov 2018

Addressing LP problems no one else has ever looked at

Local materials when possible

Eventual aim: design 'templates', influence standards


AMS101


Cooper, M.A., R. Tushemereirwe, M. Guthrie, and R.L. Holle, 2021:
Lightning Protection Challenges in the Developing World. 10MALD





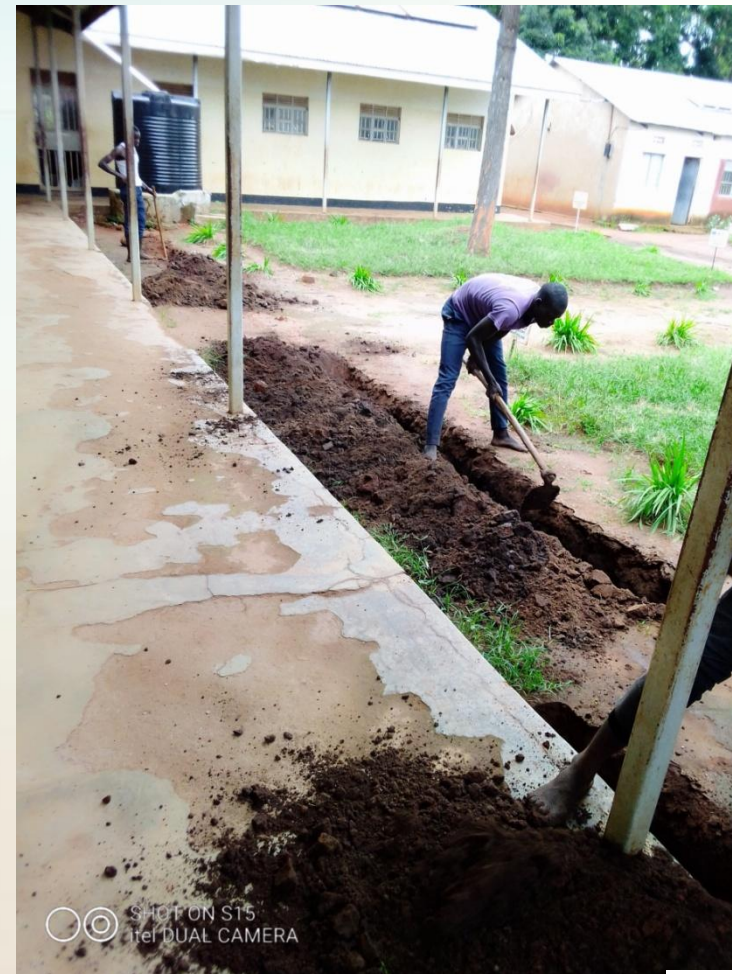
Status of school projects

-  Completed with DEHN-Africa
-  Completed, funded by Ludwick Family Foundation
-  Pending
 Mongoyo: Private company donating materials and installation
 Location TBD – Cape Electric, India donating materials and customs import fees

 Large urban area of Kampala and Entebbe where schools are more likely to be protected from lightning



Community Involvement



Education seminars given to teachers, school district officials, and community leaders



Focused Public Education

February 2019 Advisory



CORRECTING THE MISINFORMATION AND MISREPRESENTATIONS ON LIGHTNING PROTECTION IN THE PUBLIC DOMAIN

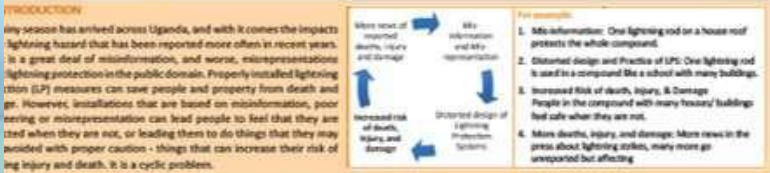


Figure 5. Cycle of misinformation

THE MYTHS (MISINFORMATION)
 Incompetently advised. This is dangerous as it pushes the lightning hazard into the superstitious domain, making us think we can do nothing about it except hire its powerful witch and Sangoma or use a mask!

Myth can strike the same place twice. It is dangerous because people in these areas think they are safe when they may be. Any place that is prone to lightning will remain prone to it – tall buildings in many times a year. No one can predict lightning will strike, but scientists know that things that are tall, isolated or red are more likely to be hit by lightning.

Myth of someone killed by lightning and others – whoever touched it will be struck by lightning. This is dangerous to use people who could have given first aid or other aid may be too afraid to do so in the person who will be injured. A myth to do this is that people who have been by lightning can be dangerous because they hold an electrical charge – also false. Being hit only a few milliseconds of a second is gone from both the person and the surroundings. They are safe to touch. Lightning can occur and injure at this location.

Myth: three spikes can stop lightning. This is dangerous because it offers a false sense of security to anyone who places their house close to these supposedly safe trees. A tree shows more damage than others struck by lightning. However, since trees are tall, isolated and pointed, the type to be struck is not matter with respect to being hit.

3. LIGHTNING PROTECTION
 Lightning Protection is a very specialized field. The most qualified are electrical engineers who have never had training in it. Most of the training is done by the 'trades' from others, although more African countries are developing standards and certification for lightning protection designers and installers.

The simple truth is that nothing has been proven to be safer than the original Franklin rod (often called an arrester in Africa), invented by Benjamin Franklin in the 1700s. Arrestors do NOT attract lightning nor do they dissipate it, weaken it or 'filter' it away. Properly designed and installed, a lightning protection system (LPS) intercepts lightning that was going to hit the structure and channels it harmlessly to the ground. Franklin rods are not grounded by string or heavy – but they are reliable and effective. Nothing has been shown to be more effective than the simple Franklin rod or a properly designed and installed LPS. This conclusion is based on multiple independent testing and research studies that have been done over the last 30 years around the world.

A lightning protection system of a building is made up of four parts:

- Arresters (usually Franklin rods) should be placed on buildings to intercept the lightning as it comes down from the cloud to the ground.
- Down conductors – a minimum of two for every building. These take the energy captured by the arrester harmlessly down to the earthing system.
- Earthing or grounding systems – these may be several long metal pipes that are pounded deeply into the ground. It may be easier to dig a trench around the building and lay a ring of wire that is bonded to the down-conductors.
- Bonding or separation between the parts shown.

For buildings that contain expensive electrical systems, electronic, and equipment, a fourth part may be needed for protection. This is called surge protection.

Large protection, properly selected and installed, could protect only your electrical and electronic appliances, but not your building from direct lightning strikes.

3.1 MISREPRESENTATION AND MISUNDERSTANDING OF LIGHTNING PROTECTION
 Unfortunately, because few have been studied or understood what is required for proper lightning protection, many misrepresentations and resulting fraudulent claims have arisen.

A primary false claim is that 'if one pole (Franklin rod) is good, then 5 or 10 or 20 poles must be 5 or 10 or 20 times more effective.' This has been shown to be false in all reputable scientific studies. Nevertheless, ACLENet uses multi-pointed arrestors on nearly every school where we install a lightning protection system (Figures 2 and 3). To take this to an extreme, some will try to sell 'lightning dissipators' that look like ladders or spike-down towers as shown in Figures 4 through 7.

Whether it is a multi-point or single point or dissipation, the effect is similar. The multiple points are more of a marketing tool than scientific.

Figures 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

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ACLENet Advisory Board

Mary Ann Cargan, President of ACLENet

Richard Tshewarweza, Vice President of ACLENet

Sam Ndlovu, Research Consultant at ACLENet

Dr. Peter Mubumba, CEO of UNCST



Figure 5. Another lightning arrester with the brand name blocked.



Figure 6. Or you can have four of these!

For over two hundred years, scientists have been making all sorts of modifications, adding glass balls, cylinders or odd shapes of alloy brass or steel, or using pretty colors, in addition to making more points (Figure 7). They look impressive, but NONE of these are any better than the plain, original, simple Franklin rod – yet they are usually MUCH more expensive than the Franklin rod. Most of these alternative arrester fail under the same of Early December storms, also known as DE's. There are many other claims to be wary of, and cause great concern for their false claims:

- An electrical charge is attracted from the terminal with a 'pronged' shaft. Obviously the engineer had fallen for the ESE claim. Lightning protection is a very specialized area and a tiny part of most engineers' experience. It is no wonder many of them do not know the codes that specify the design techniques for proper lightning protection. It is important that African electrical engineers/technicians become educated about lightning protection. Proper lightning protection that is done (IEC 62305) compliant starts with design. We should start to recognize the critical importance of qualified expertise in lightning protection.



Figure 7. Multiple varieties of 'innovative' lightning arrestors.

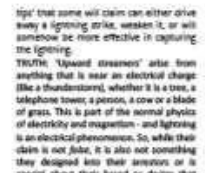


Figure 8. Close-up view of Franklin rod versus the multi-pointed 'arrestor'.

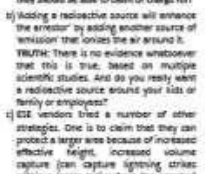


Figure 9. ESE dissipation-type lightning arrester (Franklin rod) installed on perimetric wall protecting points. Their claimed ability to reduce the 'captured' lightning current by 50% has been disproven by scientists.

Part 1 - Risk assessment
 This part presents the analysis making it possible to calculate the risk for a structure and to determine the various protection scenarios in order to permit technical and economic optimization.

Part 2 - Physical damage to structures and its repair
 This part describes protection from direct lightning strikes, side flashes, step potential, and touch potential by including the air-termination, down-conductor, earthing, and equipotential bonding/minimum separation as an integrated system.

Part 3 - Electrical and economic systems within structures
 This part describes protection from the indirect effects of lightning, including the protection system by Surge Protection Devices (SPD Types 2 and 3), cable shielding, surge protection for IT, etc. This series of standards is supplemented by:

- The IEC 62305 series of standards for the definition of SPDs
- The IEC 60364-4-41-5 series of standards for application of the products in LV electrical installations.

However, IEC 62305 is not well represented in Africa. Indeed, there are many European/American/Chinese based products that violate IEC Standards and are flooding into the African market. These products have been banned throughout by those who are involved about standards compliance because they make claims which cannot be scientifically justified. For example, ESE and SLE products claim that they emit energy to 'attract' incoming lightning. This is simply NOT TRUE and can be dangerous as well because they offer a false sense of security.

ESE and SLE manufacturers have dominated the African market with their propaganda and have ignored IEC standards concerning lightning protection. This has misled engineers installing these fraudulent products without questioning the validity of claims on efficiency or potency. This is dangerous.

Part 4 - PROPER LIGHTNING PROTECTION
 The most comprehensive guideline in lightning protection is the internationally recognized standard IEC 62305 by International Electrotechnical Commission for all Science and Technology advice. Internationally, ACLENet has organized a pool of internationally recognized research advisors and lightning protection experts who are proud to be contributing their time and expertise for the public good in Africa. There are many long-held cultural beliefs about lightning, such as stories that your grandmother and great-grandmother told you every time a thunderstorm occurs. These beliefs may have started with a grain of truth but, as they are re-told countless times, they become more and more distorted and often have a little with each telling. They may cause much many generations, even before the scientific (industrial) revolution. Many are stories that cause no harm, but a few can cause behavior that can be dangerous to the individual and sometimes to friends and family.

Part 5 - WHO IS RESPONSIBLE, IN GOVERNMENT, FOR ADDRESSING THE LIGHTNING HAZARD?
 The government of Uganda has assigned the responsibility of standards in Lightning Protection to the Electricity Regulatory Authority. This is on the right assumption that lightning is natural electricity. ERA also includes specific engineers and technicians otherwise called electrical installers. But have these been educated on IEC 62305 and its implementation?

The responsibility (mandate) for alerting the public about lightning and thunderstorm risk with the Uganda National Meteorological Authority (UNMA). However, when lightning strikes, killing or injuring people, or destroying property and infrastructure, the responsibility lies with NEMCO (National Emergency Coordination Centre) under the Ministry of Disaster Preparedness and first responders in Uganda Police Force.

The biggest challenge in propagating proper lightning protection is the misinformation and misrepresentations in the public domain even among the educated classes of people. The other challenge is the dominance of ESE products, with false claims, in the African market.

ACLENet FIELD WORK
 ACLENet has continued to lead by example. Schools and partners have helped us to install proper lightning protection wherever we could, such as the current school projects in Uganda shown in Figure 13. This also serves to demonstrate code [IEC 62305] compliant LPS so that when we advise, we have practical examples. Demonstrating practicality is the reason we have spread our reach in every corner of Uganda.

Figure 13. Current school lightning protection projects within Uganda with involvement of ACLENet.

ACLENet, the African Centers for Lightning and Electromagnetic Networks, is dedicated to reducing deaths, injuries and property damage from lightning across Africa. Part of their work is to put right this misinformation and misrepresentation in Uganda. ACLENet works with the Uganda National Council for Science and Technology (UNCST) as the central point for all Science and Technology advice. Internationally, ACLENet has organized a pool of internationally recognized research advisors and lightning protection experts who are proud to be contributing their time and expertise for the public good in Africa. There are many long-held cultural beliefs about lightning, such as stories that your grandmother and great-grandmother told you every time a thunderstorm occurs. These beliefs may have started with a grain of truth but, as they are re-told countless times, they become more and more distorted and often have a little with each telling. They may cause much many generations, even before the scientific (industrial) revolution. Many are stories that cause no harm, but a few can cause behavior that can be dangerous to the individual and sometimes to friends and family.

Part 1 - General information
 This part presents general information on lightning and its characteristics and general data, and introduces the other documents.

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Newspaper Inserts #1

Feb 2019 - 33,000

Lightning protection and safety

#2

Dec 2019 - 45,000


Lightning science/detection

Distributed to schools



International Education

[View this email in your browser](#)




The African Flash

Vol. **December 2019-12**

Update on Activities

Continuing and Expanding the School Protection Program

1. This December, School Lightning Protection Systems (LPS), funded by grants, donors and multiple generous volunteers from across the world, and especially in Uganda, have been installed at [Rock View school in Tororo](#), Palabek secondary school and Shone school in Kyankwanzi. Photos below of Rock View installation and students.
2. Meeting with [Kenya National Academy of Sciences](#) in Nairobi to discuss bringing similar life saving programs to Kenya. Photo below.



Monthly Newsletter

Worldwide distribution
Information and education
Fundraising

English, French versions
-- soon Portuguese



Professional Education

Teachers - Training regional science teacher-trainers to:

- Train district teachers in lightning science and safety
- Dispel harmful traditional beliefs in witchcraft and curses
- Gather data on local injuries to improve injury database

Engineers, architects, LP designers and installers -

- Working with existing Lightning Protection On-Line Programs to make them available at reduced cost or free to Ugandan engineers, architects, LP designers and installers
- Improve lightning protection designs and installations



RESEARCH - Injury Reports Database Development

Uganda Reports for 2019

[Lightning kills child, scores displaced by heavy rains](#)

[Lightning kills six, injures 25](#)

[Lightning strikes Nile vocational institute in Masaka](#)

[Bushenyi lightning kills one again, three hospitalized](#)

[Shock As 4 More People Are Struck By Lightning In Bushenyi](#)

[Lightning kills three pupils in Kibaale](#)

[Lightning strikes Kibaale School, severely injures pupils, teacher](#)

[Son killed in Kidepo National Park](#)

[Student found dead on her bed hit by lightning](#)

[Lightning strikes kill four people in southwestern Uganda](#)

[Lightning kills one, six hospitalised](#)

[Lightning Tragedies over time - Uganda New Vision](#)

[Lightning kills funeral guests in Uganda](#)

[Lightning strikes two children dead](#)

<https://aclenet.org/news-publications/country-news/>

The most extensive on-line publicly available database on lightning injuries

Entries for 33 of Africa's 55 countries

Media reports and 'citizen reporters' Google monitors in other languages



RESEARCH - Investigation of lightning injuries and deaths

- Multidisciplinary team sent to scene to
 - Interview victims, parents, teachers, local officials,
 - Examine survivors
 - Examine and photograph scene and damage
- Larger incidents first
 - Mongoyo Primary School, 3 deaths, 72 injuries October 2018
 - Arua - 10 boy spectators at soccer game killed - investigated, data being analyzed
- New insights into multiple injury incidents and injury prevention

AMS101

Tushemereirwe, R. and M.A. Cooper, 2021: Investigation of Lightning Mass Casualty Incident at Mongoyo School, Uganda. 10MALD



Lessons Learned

There is no lightning safety without safe structures/lightning protection

There are good hearted people everywhere -

contact advocacy programs around the world - SHARE

Funding is hard to find - use volunteers, 'borrow' resources

Multidisciplinary teams work best - energy, learning from each other,
each person contributes, one carries the load when another can't

Keep working till the government notices you!

Continue to 'cast your seed' till it finds fertile ground

Educate children, not adults - use parents because of concern for kids

Nurture the MEDIA - they spread the word faster than any other group



