



The Development of the African Centres for Lightning and Electromagnetics Network

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Abstract—The African Centres for Lightning and Electromagnetics Network (ACLENet) is a pan-African network of National Centres dedicated to decreasing deaths, injuries, and property damage from lightning. Established in February, 2014, it is organized as a not-for-profit organization and headquartered at Makerere University Business School (MUBS), Uganda. Patrons of ACLENet are the Uganda State House and Non-Aligned Movement Science and Technology Centre in New Delhi (NAM S&T). ACLENet is a multidisciplinary, soon to be multinational, organization with broad goals of education, research, and injury prevention. With the founding of its first national center in Zambia, the name was changed from ACLE to ACLENetwork (ACLENet). Currently, three more countries are in the process of forming national centers. Recently incorporated in the United States and registered in Uganda, ACLENet is now ready to solicit partnerships and funding to accomplish these goals.

Keywords—Lightning injury, lightning injury prevention, electromagnetic compatibility, lightning protection, property damage from lightning, education

I. INTRODUCTION

Global lightning occurrence maps routinely document some of the world's highest lightning densities in Central and East Africa with most of the continent at risk, including around Lake Victoria (Fig. 1).

One of the earliest reports of lightning injuries in Africa was in 1888 [Pasha, 1888]. Otherwise, few reports have

reached international attention until the broadcast of a soccer game in Africa in 1998, when lightning killed 11 players of a single football team in the province of Kasai in the Democratic Republic of the Congo [BBC lightning 1998]. The original news report (L'Avenir/Kinshasa) stated that more than 30 spectators received severe burns. Curiously, according to reports, no players of the other team were injured, leading to local speculation about witchcraft. While this peculiar incident is yet to be investigated scientifically due to civil unrest in the Congo, the incident fostered papers on the mechanisms of lightning injury [Anderson, 2001; Anderson et al, 2002]. With the broad availability of internet news coverage and internet search programs in the last decade, lightning incidents in African countries are now reaching a more international audience.

Unfortunately, most reports, while more readily available, remain weighted towards more spectacular or multiple casualty incidents so that national data that is usable for injury and property damage prevention is largely lacking [Blumenthal, 2005; Carte et al, 2002; Dlamani, 2008; Holle, 2016; Jandrell et al, 2009; Lubasi et al, 2012; Mary and Gomes, 2012 and 2014; Mulder et al, 2012]. Few of the newspaper and media reports, to date, have been investigated in depth to make conclusions regarding the injury mechanisms, accident locations, level of exposure of the victims, and other factors that could be useful in injury prevention education and lightning protection.

Available literature and news articles also recount that large

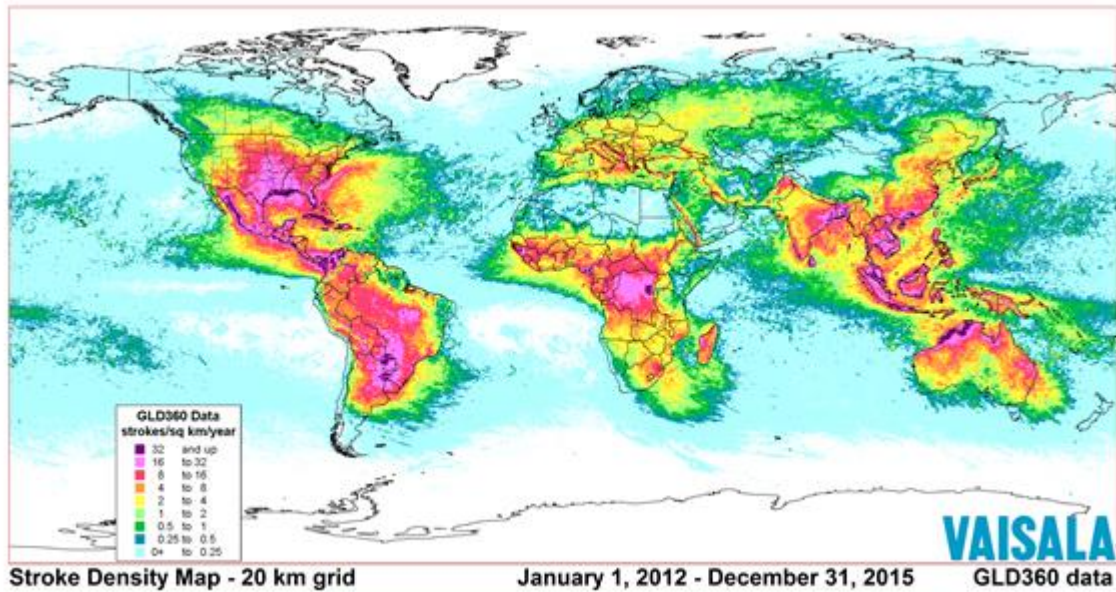


Figure 1. GLD360 lightning density map for four years. (Courtesy Vaisala)

numbers of livestock, the main source of income and wealth for most families in rural Africa, are killed by lightning every year. Except for a few studies done in South Africa and Zambia, lightning related property damage and economic losses have not been assessed in Africa, and it is estimated that the losses, both due to damage and downtime, will grow exponentially due to explosive spread of electronics usage, extension of national power grids into rural areas and mushrooming communication towers across the continent [Akello, 1996; Gijben, 2012 and 2014; Jandrell et al, 2009;

Lubasi et al, 2012]. For African countries pursuing rapid economic growth and industrialization, economic losses due to lightning provide an unacceptable burden, especially because much of this damage could be prevented with proper weather forecasting and lightning protection.

II. FOUNDING OF ACLENET

As a result of meetings held in Asia and Africa over the last decade, the high level of lightning injuries and damage in the developing countries was recognized. Table I documents the Resolutions that led to the founding of the African Centres for Lightning and Electromagnetics Network as well as some of the history of ACLENet [Colombo Declaration, 2007; Kathmandu Resolution, 2011; Uganda Resolution, 2013]. In March 2014, less than a year after the Uganda Resolution, ACLENet held the first African Meeting on Lightning Protection in Kampala, Uganda, with papers given by representatives from each major sector affected by lightning and attended by delegates from fifteen countries. The goals of ACLENet and the national centres are outlined in Table II.

TABLE I. HISTORY OF ACLENET

Year	Event
2007	Colombo, Sri Lanka, NAM S&T – Colombo Declaration
2011	Kathmandu, Nepal, NAM S&T – Kathmandu Resolution
2013	Kampala, Uganda, NAM S&T meeting - Resolution to Establish African Center for Lightning Information and Research (name changed to African Centres for Lightning and Electromagnetics) Mackerere University offers to host ACLE headquarters
2014	First Symposium, Entebbe, Uganda
2015	First national center, ACLE-Zambia, formed. Second ACLE symposium held in Lusaka, Zambia, August 2015. ACLE changed to ACLENet as the international parent organization, leaving ACLE-country/region for national or regional organizations.
2015	Award of United Nations Global Resilience Partnership grant for \$1,000,000 in partnership with four other organizations to bring Severe Weather Early Warnings to those living around Lake Victoria

III. NATIONAL AND REGIONAL CENTRES

ACLENet is one of the first international, multidisciplinary organizations to address lightning injuries and property damage. ACLENet was designed to be similar to the International Red Cross with ACLENet as the umbrella organization encouraging and supporting the formation of Centres in each country or region in Africa that have a significant risk of lightning injuries and damage. The first national center, ACLE-Zambia, was formed in 2015, led by Ms Foster Lubasi. In August, 2015, ACLE-Zambia was the host of the second ACLE Symposium, held in Lusaka, Zambia, and attended by delegates from seventeen countries.

TABLE II – LONG AND SHORT TERM GOALS OF ACLENET

DONE	ACLENet Short Term Goals
✓	Formation of a multidisciplinary Executive Committee to manage and execute the proposed work plans of ACLENet - http://aclenet.org/executive-committee/
✓	Nomination of a team of international research advisers to establish solid research projects, supervise postgraduate students and enable the achievement of research, education, awareness and advisory excellence - http://aclenet.org/research-advisors/
✓	Adoption and recognition by a university or government office in Uganda.
✓	Development of website – www.ACLENET.org
✓	Support the formation of national centres of lightning research, education and awareness across Africa.
✓	Development of template documents for national centres
✓	Incorporation in the United States as a tax free (501c3 tax code reference) organization to enable solicitation of donations, grants and other sources of funding
	Registration as an NGO in Uganda and for each national centre as they are founded.
ACLENet Long Term Goals	
	Establish strong research teams to work on various aspects of physics, engineering and societal aspects of lightning and electromagnetics with scientific output at international levels of excellence.
	Support the development of national centres in the region in capacity building by transfer of knowledge, exchange of students and experts, channeling of possible funding and providing various other facilities
	Develop a robust African regional lightning safety awareness promotion network penetrating deep into rural high risk areas.
	Form a team of advisers and consultants with skills and expertise in design and installation of scientifically accepted lightning protection systems
	Commit itself to fulfil the other objectives included in the Declarations signed at Colombo, Sri Lanka (24th May 2007) and at Kathmandu, Nepal (14th October 2011) that were constructed by international stakeholders and attendees.

It is recognized that each National Centre will have unique priorities depending on the resources and institutional support available to them and the people in leadership roles (Table III). In the past and in many countries, individuals have worked for lightning safety in their communities, but have often worked nearly alone, and, lacking the support to move forward, many have become discouraged.

ACLENet recognizes that a ‘critical mass’ of individuals is necessary to form a productive team. It encourages National Centres to form multidisciplinary teams, can supply literature and templates of the necessary foundational documents that can be modified by each Centre, and provide moral support and guidance to the leaders of each Centre throughout development.

TABLE III. INTENDED SCOPES OF ACLENET AND NATIONAL/REGIONAL CENTRES

SCOPES OF ACLENet and National/Regional Centres - http://aclenet.org/aclenet-scope/
Conducting research related to meteorology, physics, engineering, health, education, environment and other societal impacts of lightning and electromagnetics
Developing and conducting PhD, MSc, Diploma level and short courses on electromagnetics, lightning and related subjects as well as collaborating to find funding when appropriate.
Working with Schools of Public Health and other agencies to research and educate populations vulnerable to lightning injury.
Training educators and trainers in lightning safety, healthcare and medicine with the aim of minimizing lightning accidents in Africa.
Collecting information on lightning incidents, injuries and damage in Africa and developing databases that are easily accessible to public.
Educating and training the engineering, technical & scientific communities in lightning protection through long term and short term courses.
Assisting in the initiation, enhancement and sustenance of other national lightning and electromagnetic centres in the region.
Assisting relevant authorities in the implementation of national/regional Standards in Lightning Protection, adoption of IEC or other internationally recognized standards at national/regional levels, and promoting the standards among the engineers and general public.
Working with government agencies to improve weather forecasting, injury prevention, and lightning hazard control.
Raising public awareness of the dangers of lightning. Educating the public about lightning protection, injury prevention and safety at the local and regional levels through seminars, workshops, demonstrations, meetings, media discussions, leaflets and booklets, posters, billboards, warning signs, and other appropriate and effective educational tools.
Educating medical professionals about lightning injury and injury prevention.
Capacity building and providing high voltage laboratory facilities for testing of lightning protection devices, electrostatic discharges and other related studies for manufacturers, vendors, researchers and university undergraduate/graduate programs in Africa.
Coordinating collaborative research between academicians and the industrial sector.
Collaborating with other agencies or organizations to promote and provide injury prevention information.
Searching for international funding on lightning protection and channeling the funds into regional research projects as appropriate.
Acting as the authoritative body for monitoring lightning protection equipment imported to the region.
Undertaking research and development of commercial projects for lightning protection.
Providing consultancy on lightning protection to the public.
Acting as the authoritative body for approving lightning protection systems installed at government institutions in the country.
Acting as the authoritative body for investigating and monitoring the adverse effects of lightning on surrounding communities by high rise structures such as communication and broadcast towers, storage tanks, tall buildings, etc.

IV. ACLENET PROJECTS

Along with encouraging the founding of National Centres and other ongoing projects, ACLENet is currently involved in two major projects:

- A. *Severe Weather Early Warning System - Lake Victoria and Cattle Corridor, Uganda*

In cooperation with four other organizations, ACLENet has been awarded a two year grant for \$1,000,000 in the first round of the new United Nations Global Resilience Partnerships (GRP) grant program to bring Severe Weather Early Warnings to Ugandan fishermen who work on Lake Victoria and Lake Kyoga as well as those living around the Lakes and in the ‘cattle corridor’ [Tushemereirwe et al, 2016]. It is estimated that nearly 5000 fishermen on Lake Victoria lose their lives by drowning each year from sudden storms [Mary and Gomes, 2014]. Components of the grant include installation of weather measurement equipment (Trans-African Hydro-Meteorological Observatory, TAHMO), lightning detection (Earth Networks, EN), improvement of forecasting and warnings (Uganda National Meteorological Authority, UNMA), delivery of messages via cell phone (Human Networks International, HNI), and involvement of the farming community (Climate Change Adaptation and Internet Communication and Technology, CHAI) in addition to the fishermen and those living around the Lakes.

B. ‘Lightning Kills! Save a Life in Africa’ – School Protection

The ‘Lightning Kills, Save a Life in Africa’ school protection campaign was announced during a Special Session at the 32nd ICLP in Shanghai in 2014 (Fig. 2). Over half of the news reports of injuries in Africa are to school children, often with multiple deaths in each incident. While ACLENet can do little to change the infrastructure of Africa, where 90% of the housing in sub-Saharan Africa is not lightning safe, schools tend to be the most substantial buildings in many communities. The campaign is designed to provide lightning protection to individual schools, starting in Uganda.



Figure 2. Logo for ‘Africa Kills! Save A Life in Africa’ campaign

ACLENet is happy to announce that four schools, all with prior injuries and deaths from lightning, have been protected by Dean-Africa’s gracious contribution and hard work in piloting this project. Because the weather stations for the Global Resilience Partnership grant are to be primarily at schools, ACLENet personnel will accompany the installers to survey the schools, measure soil resistivity and other parameters to provide information for the design of lightning protection for those schools. Teacher training and formation of local Weather Clubs at each school are planned. As ACLENet constructs more ‘school portfolios’ containing school information and site surveys, ACLENet plans to solicit funds for protection of each of the schools.

Similar to what the United States Lightning Safety Week team found over their first decade of teaching lightning safety, ACLENet anticipates that over time, as parents learn about lightning safety from their children, community thinking about lightning risk and safety will also change [Cooper and Holle, 2012].

V. SUMMARY

ACLE was established to address the grave situation of lightning deaths, injuries, and property damage from lightning and electromagnetic incidents that occur in Africa. As a young organization, ACLE needs the support of the international community to achieve its goals of decreasing deaths, injuries and property damage across Africa from these hazards. Many have stepped forward to help, and ACLE has recruited the expertise and commitment of a strong international leadership team, who are highly regarded experts in their fields. Now, ACLE is seeking funds to facilitate data collection, support students for postgraduate studies, develop infrastructure and research facilities, develop public education, and organize conferences for information dissemination about lightning and electromagnetics risks, injury and damage prevention, especially in Africa.

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