Using lightning data for nowcasting : performance & evaluation

Stéphane SCHMITT – METEORAGE

3rd European Nowcasting Conference

24 - 26 April 2019

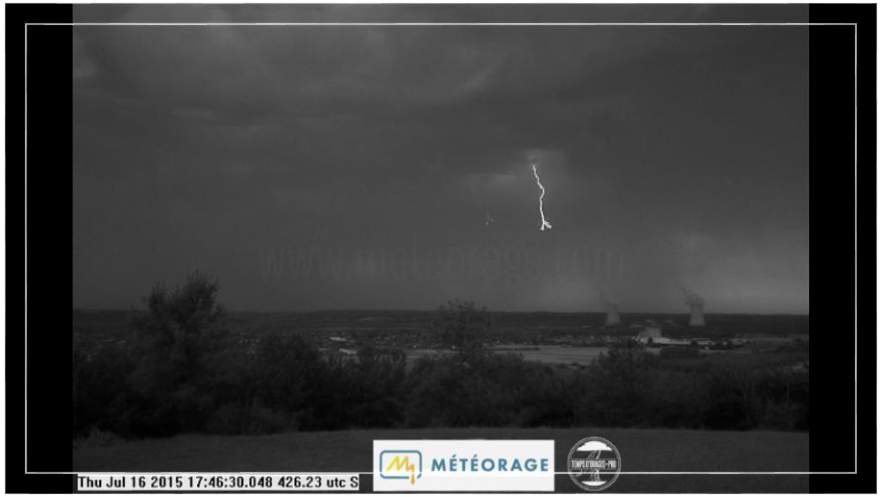
ENC 2019 European Nowcasting Conference

AEMet Agencia Estatal de Meteorología

Madrid, Spain

MÉTÉORAGE

LIGHTNING INFORMATION AND SOLUTIONS



Context

- Lightning locating systems (LLS) can provide data in real time (typically 10 seconds after a flash occurs), with a high level of performance (detection efficiency >96% and location accuracy ~100m for Euclid). 1
- They have also proven their capabilities to provide efficient warnings with a probability of detection (POD) of a thunderstorm before a fatal threat, higher than 96%. In addition, the lead time is higher than 20' (POD20') for more than 92% of the cases in Western Europe. 2
- Those values were based on the calculation of the time difference between the first flash occurrence within a monitoring area (typically 20 km radius around a target), and the first lightning flash detected on the target (typically 2 km radius around it).
- This approach provided a theoretical efficiency because each lightning flash in the vicinity of a target is not always responsible for a damage or an incident.
- To measure fact-based performance, we collected reports on personal accidents and computed the same indicators.
- Beyond the technical performance, we also sought to better understand the behaviour during these accidents in order to enhance public awareness.

1. Schulz et al. (2015), The European lightning location system Euclid – Part 1. Performance validation, journal of the European Geosciences Union, NHESS.
2. Schmitt, S. (2016), Thunderstorm warning systems : why lightning detection networks should be considered as one of the most relevant solution in Western Europe, paper presented at International Lightning Detection Conference, San Diego, USA, and Schmitt, S. (2017) "Thunderstorm warning systems applied to the wind energy domain : Evaluation of a TWS based on Lightning Locating Systems ", poster presented during WindEurope Conference, Amsterdam, The Netherlands.

Method

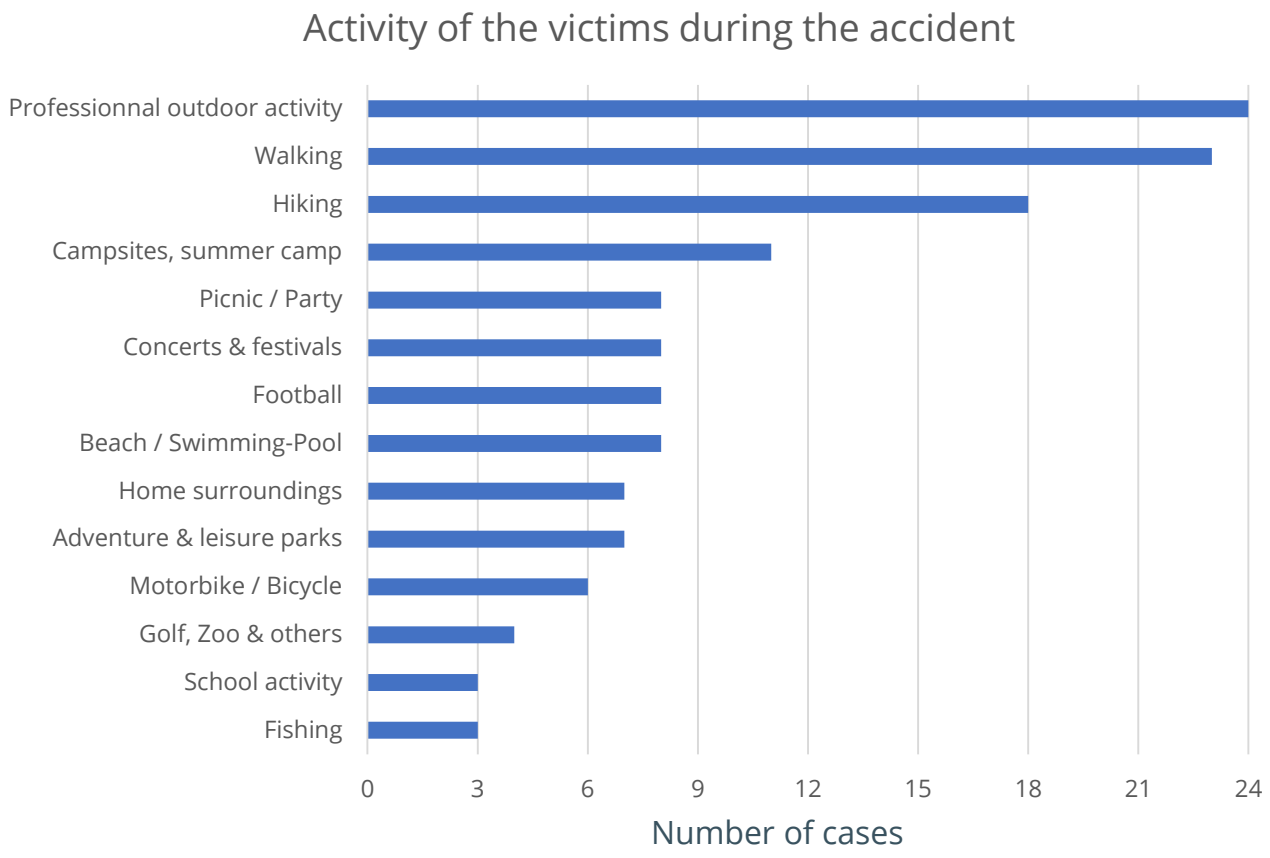
- We analysed 138 cases during the 2010-2018 period, obtained via a press alert or the European Severe Weather Database.
- For each of them, our study consisted in :
  - Correlating the localisation of the victim and a cloud-to-ground stroke (CG)
  - Considering the closest CG as being responsible for the accident, checking the compatibility of the schedule with the accident report
  - Checking whether a previous lightning flash had been detected within a 20 km area to determine the POD or the failure to warn (FTW)
  - Calculating the time difference between the first lightning flash detected within a 20 km area and the CG considered as being responsible for the accident, to determine the lead time.

Example :

Report incident datation	Dating and distance of the closest CG		Dating of the first flash within a 20km area	Lead time		Activity of the victims	GPS coordinates		Press article
16h45	0,1	16h44	14h57	>1 heure	France	Promeneur/badaud	43,95	4,85	https://www.20minutes.fr/faits_divers/2275515

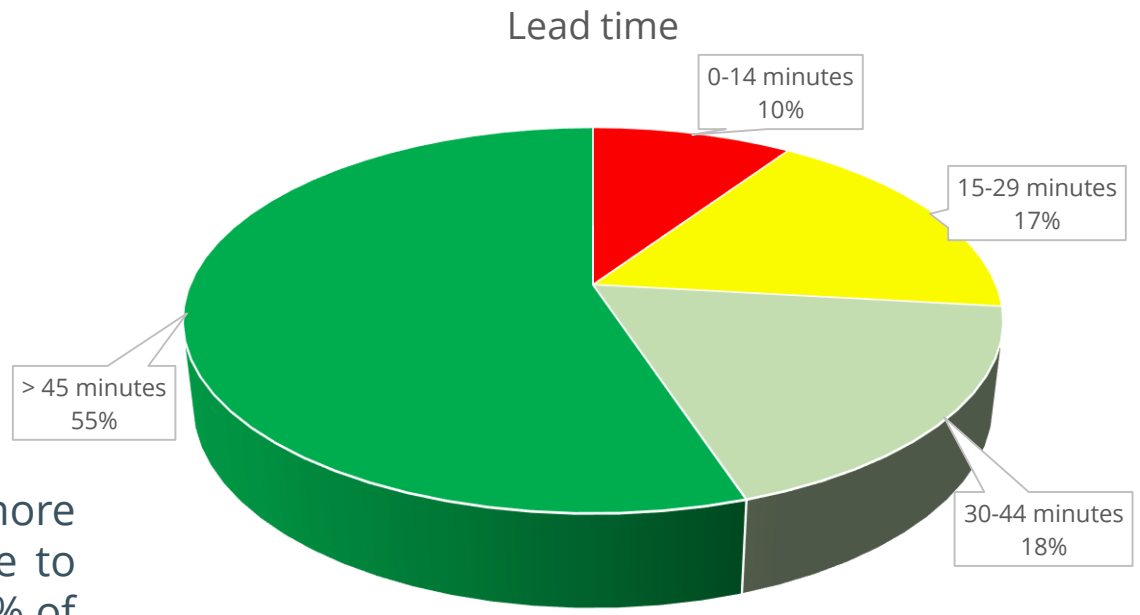
Additional information on the cases

- 41 fatal injuries on the 2010-2018 period
- 607 injured people (80 on one single event)



Results

- A confirmation of the predictive figures based on real situations with :
  - 130 of the 138 cases for which the Euclid network had detected the thunderstorm before the accident : a **94% POD**, and a **83% POD20'**
- Several lead times were calculated :
  - 44% POD60'
  - 73% POD30'
  - 90% POD15'



It means that LLS are able to give warnings 1 hour or more in advance in almost half of the situations and are able to anticipate the risk more than 15' before the threat for 90% of the situations.

Additional results

A more detailed analysis revealed disturbing lessons.

- Our intention is not to incriminate the victims, and in some cases the benefit of the doubt is also possible (e.g. : localisation and configuration of storms making them difficult to hear, and situations where there is not always an escape).
- Nevertheless many situations highlight an underestimation of the danger and/or a lack of knowledge of some basic safety rules :
  - Maintaining an outdoor activity when access to a nearby shelter is available
  - Staying in the vicinity of trees or taking refuge under them (20% of the cases) or wooden shelters, when an alternative solution seems also possible
- Many post-accident statements are usually eloquent :
  - “Apart from a few thunderclaps in the distance, there was nothing to suggest what happened“
  - “The storm had been announced, but did not seem violent”
  - “There was a mild storm with only a few thunderclaps”
  - “If the storm would have presented a danger to the spectators, the show would have been cancelled”
- …but also excessively fatalistic :
  - “ The event was completely unpredictable” : in reality, this event had started more than 3 hours before and moved straight towards the victims

Conclusion

- Currently, the existing weather warnings are not adapted to provide an efficient information to help people make the best decisions about their outdoor activity planning (in 80% of the analysed cases in France, the weather awareness level was “yellow”)

- Real-time information and nowcasting can contribute to reduce the human fatalities during thunderstorms, and LLS have proven their high level of efficiency in this domain : 94% of the situations we surveyed were foreseen, and in most cases with enough time for people to seek shelter.

- Reducing the number of fatalities by a factor of 3 is then technically possible, but we must also increase the public awareness if we want to succeed in thunderstorm risk mitigation.

Thanks for your attention

Follow us on :

+ 33 (0) 5 59 80 77 30
communication@meteorage.com
www.meteorage.com