NOWCASTING COMBINING RADAR AND LIGHTNING DATA

Rigo, T., C. Farnell, A. Del Moral, N. Pineda
Introduction
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Life cycle of a severe thunderstorm

Vertical cross section of the thunderstorm from the point of view of radar

- Total lightning flash rate

- Max hail size: 7 cm
- Max wind gust: 18.6 m/s

LJ warnings
- Strong wind gusts
- Hail size

Total lightning flash rate
Relationship between radar and lightning: tracking severe thunderstorms
Tracking severe thunderstorms

2 considerations:
- Good correlation between lightning and radar paths (GREEN ELLIPSE)
- Excepting for anomalous propagation of cells (RED ELLIPSE)
Tracking severe thunderstorms

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- Good correlation between lightning and radar paths (GREEN ELLIPSE)
- Excepting for anomalous propagation of cells (RED ELLIPSE)
Part I: nowcasting using weather radar
Anomalous motion of severe thunderstorms

Identification of anomalous motion of thunderstorms using daily rainfall fields

Anna del Moral\textsuperscript{1,4}, María del Carmen Llasat\textsuperscript{4}, Tomeu Rigo\textsuperscript{5}

\textsuperscript{1}Department of Atmospheric and Oceanography, University of Barcelona, c/Deiters 38, E-08038 Barcelona, Spain
\textsuperscript{4}Meteorological Service of Catalonia, c/Berbòlic, 58-70, E-08025 Barcelona, Spain

2017-03-27 10:12 UTC
Anomalous motion of severe thunderstorms

Identification of anomalous motion of thunderstorms using daily rainfall fields

Anna del Moral a, b, María del Carmen Llasat a, b, Tomeu Rigo b

a Institute of Astronomy and Meteorology, University of Barcelona, c/Gran Vía 55, 08028 Barcelona, Spain
b Meteorological Service of Catalonia, c/Onze de Març, 38-40, 08025 Barcelona, Spain
Part II: nowcasting using lightning data
Lightning Jump

Adding total lightning information to radar

Lightning jump as a nowcast predictor: Application to severe weather events in Catalonia

C. Farnell*, T. Rigo, N. Pineda
Meteorological Service of Catalonia, C/Blai, Barcelona, 38-48, Spain
Lightning Jump

Good correlation between LJ warnings and severe weather occurrence
Lightning Jump

Lead time

20 min - 1h  30 min
Lightning jump

Definition

☐ LJ is a sudden increase of the total lightning activity
☐ Associated with strong updrafts, this is, «powerful» charge separation (Williams 2001).
☐ Predictor of severe weather, defined as: Hail > 2 cm, downbursts, strong wind gusts, and tornadoes/waterspouts
☐ TOTAL Lightning is necessary: Cloud-to-ground (CG), plus Intra-cloud (IC)
☐ IC are essential (IC/CG is 1:10 in ordinary cells, 1:100 in severe)

(2006 – 2013) Only CG CG+IC (TL)

Nº warnings 6 630

Pineda et al. 2016
Part III: combining both nowcasting techniques
Merging radar and LJ

Improving nowcasting: radar animation (two examples)
Merging radar and LJ

Improving nowcasting: LJ, radar, and area affected

Lead time in both cases of ~ 2 h, distance LJ SevWea ~ 100 km
Merging radar and LJ

Improving nowcasting: radar reflectivity «trajectory»

High values of reflectivity in a large path, more or less wide
Merging radar and LJ

Improving nowcasting: past (dark) and post (light) areas

A straight path is not always observed!
Conclusions
Conclusions

- Radar and the nowcasting algorithm allows identifying past track and probable future directions…
- However, most of severe thunderstorms have anomalies in their trajectories (del Moral et al.)
- On the other hand, LJ algorithm has revealed as a good forecaster of severe weather with a lead time of 2 hours in some cases (Farnell et al.)
- The combination of both techniques seems to provide more information to forecasters
- In any case, the complete automation of the new technique is not recommended, suggesting the expertise of the human contribution
Hail campaign in Catalonia

Envie'ns una fotografia amb el #meteocatpedra

A través de les XOSSE amb el #meteocatpedra
Per WhatsApp al telèfon 611901992
Enviad un correu eлектrònic a xosse@meteo.cat

Qué cal incloure a la fotografia?

Geolocalització:
On s'ha fet

Referència de la mida:
Mesura-la o compara-la amb alguns objectes

Data i hora de quan s'ha preso l'imatge

Servei Meteorològic de Catalunya
Generalitat de Catalunya
Universitat de Barcelona
gencat.cat
Lightning jump

How it works

- Punctual observations converted to raster.
- Pixels with only one flash are removed
- Grouped by proximity, identified as «cells»

- Tracking of the «cell» position for the last 14 minutes (cell identified each minute)
- Tracks are reliable, because of the high time resolution
Lightning jump

Real examples