New visualization and analysis tools for **3D Lightning Mapping Array** data

(and the new **MTG Lightning Imager**)

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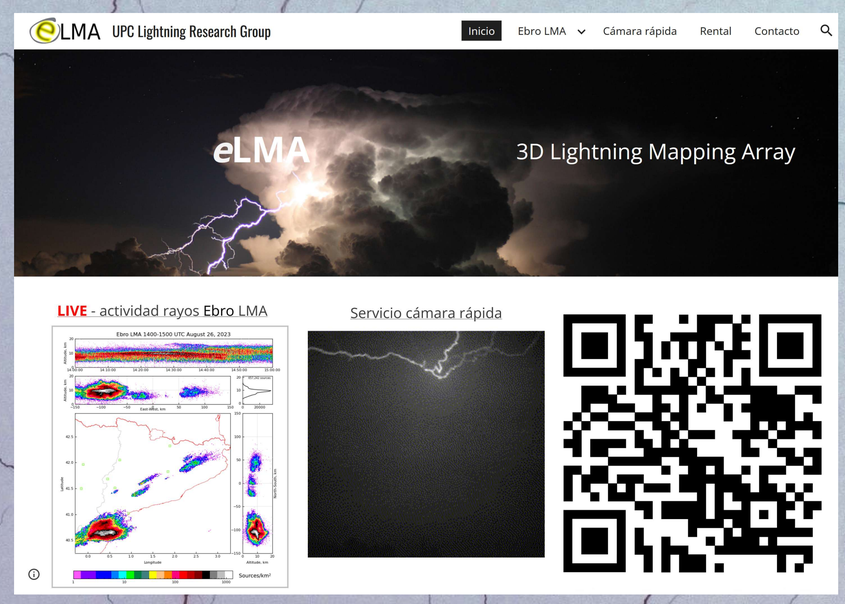
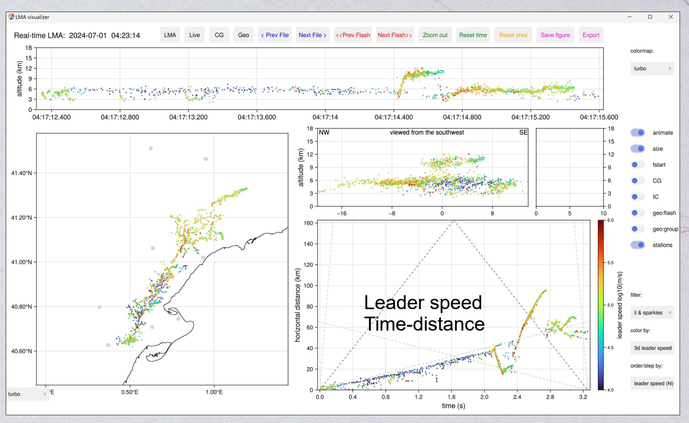


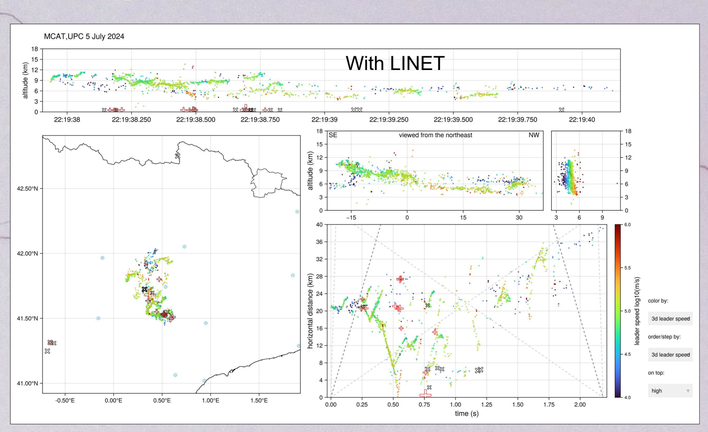
eLMA website: elma.upc.edu

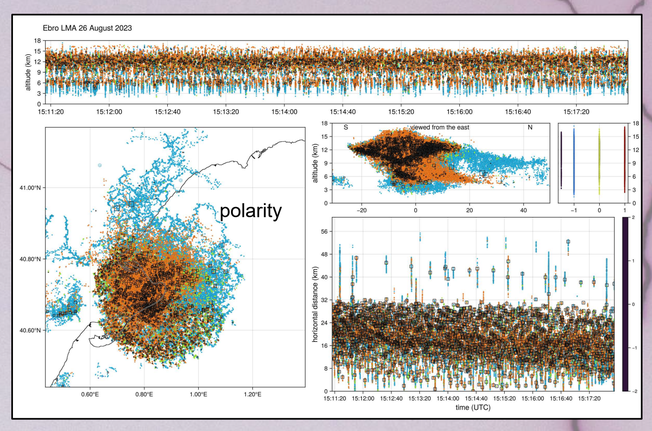
LMA and geostationary lightning data processing and visualization with julia

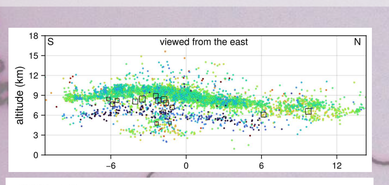
A new set of interactive visualization tools is programmed in the Julia language. Its native speed of processing and multi-threading allows various flash/sparkle/leader grouping procedures and 3D leader speed and polarity analysis to be performed in seconds, what may have taken minutes (or worse) in other languages, allowing an interactive experience. MTG-LI and GLM data is overlaid and linked automatically with LMA, matching the LMA flash location without the need for parallax shift assumptions. Data from regional or global cloud-to-ground networks can be loaded as well. Real-time LMA and MTG-LI data is downloaded and displayed directly from the GUI. The intention is to release it as a Julia package.

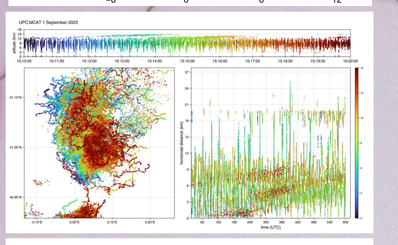
Leader speed, polarity, and sparkle detection in overshooting tops

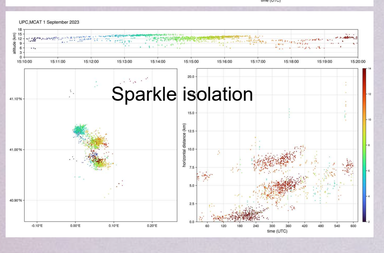




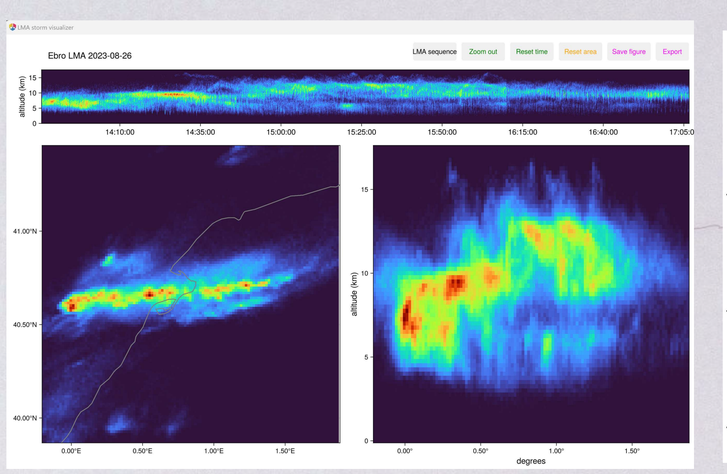


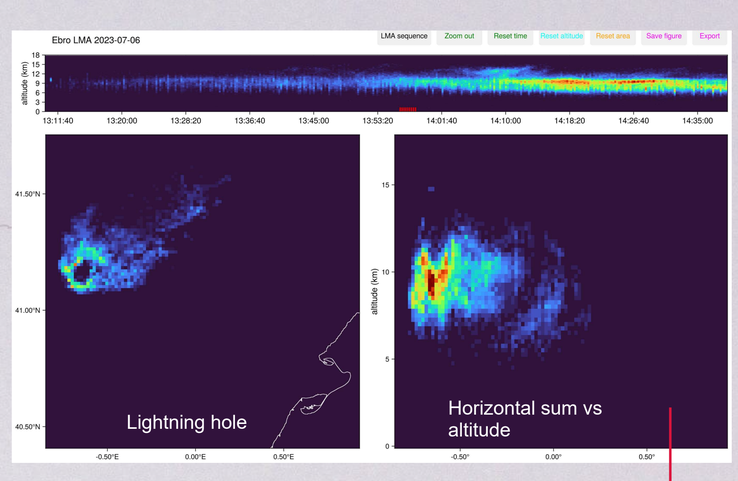


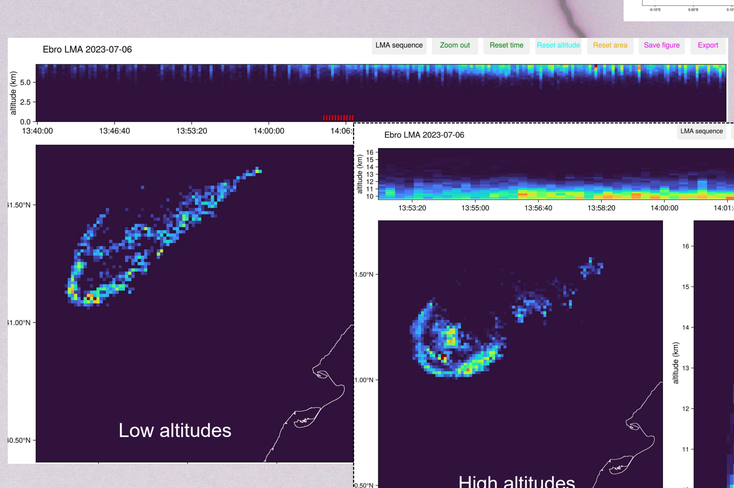




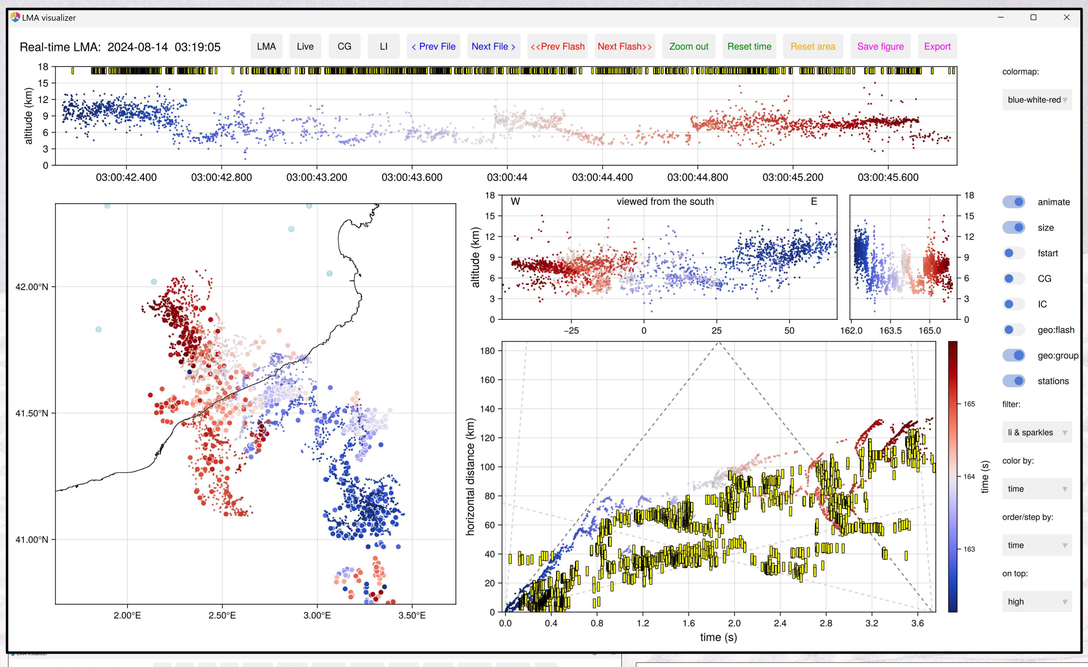
Storm structure and activity evolution by layer

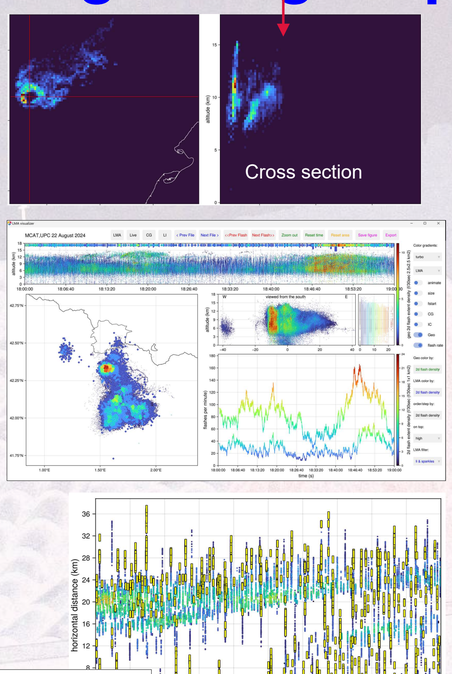


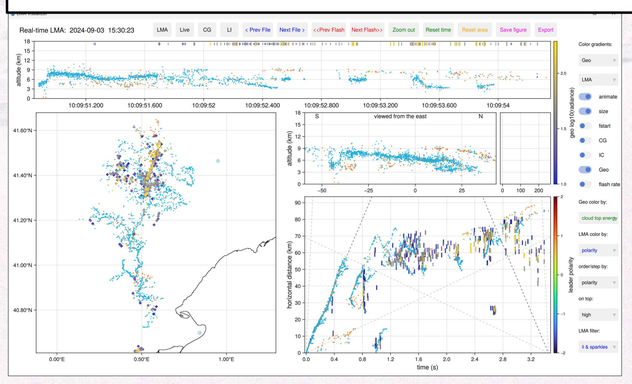


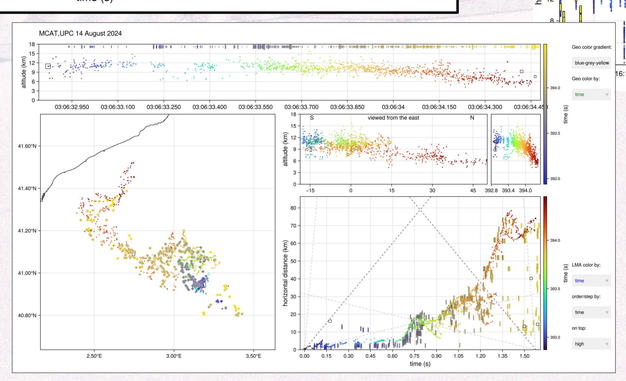


MTG-LI: a first comparison with the Lightning Mapping array









Large 3D Lightning Mapping Array in Spain (20-30 operational stations)

n 2011, the UPC Ebro 3D Lightning Mapping Array was the first LMA to be installed outside the USA, consisting of 13 stations in 2012-2014 and was subsequently split in half in 2015 to facilitate a LMA in Colombia. It has gathered a **database of 12 years** in the Ebro Valley in Spain.

A 3D Lightning Mapping Array (LMA) detects lightning pulses in the 60-66 MHz band. The pulses are timed by GPS. Time-of-arrival reconstruction results in 3D pulse locations, revealing the lightning leader channels inside the cloud and toward ground. The detection range of a sensitive network can reach over 250 km from the center. **LMAs are used for lightning science, nowcasting of severe weather, airspace safety and calibration / validation of space instruments.**

The system was upgraded in 2023 with up to 15 new stations operated on solar power, producing data that can be watched in real-time. Additionally, the Meteorological Service of Catalonia started installing their 15-station LMA network in 2024. The **UPC-SMC collaboration** allows data from both networks to be combined to offer the best spatial coverage and resolution, with real-time lightning monitoring.

See **elma.upc.edu** for data/campaign services!

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