

An Exceptional Positive Lightning Outbreak over Portugal on 4–5 November 2025

Cristian Iordache

Independent Researcher, São Domingos de Rana, Portugal

Email: cristian@cristianiordache.com

DOI: <https://doi.org/10.5281/zenodo.17538198>

Abstract

Between 4 and 5 November 2025, the IPMA lightning detection network reported an unusually high ratio of positive to negative cloud-to-ground (CG) flashes over mainland Portugal. In the initial 24-hour period, 23,080 positive and 11,574 negative CG flashes were recorded; by 23:45 UTC on 5 November, totals had reached approximately 37,000 positive and 18,000 negative flashes, yielding a positive-polarity fraction of $\approx 67\%$. This note documents the event and characterizes the environment using GFS 0.25° analyses, EUMETSAT imagery, and IPMA radar. Persistent deep-layer shear near 16–17 m/s combined with localized high instability suggests organized convection with extensive stratiform anvils and a dominance of positive CG. The magnitude and duration of the polarity imbalance appear unprecedented for the Iberian Peninsula.

1. Introduction

Positive CG flashes constitute a minor fraction of total lightning in most mid-latitude storms. Exceptions occur in stratiform regions of mature mesoscale convective systems (MCSs) or winter outbreaks. This study documents a rare two-day episode during which positive CG flashes dominated over Portugal.

2. Observations

Operational IPMA data indicated 23,080 positive and 11,574 negative CG flashes during the 24 h ending 05 Nov 08:34 UTC. Subsequent updates extended totals to $\approx 37,000$ positive and 18,000 negative flashes by late 05 Nov. Figure 1 shows polarity totals from the IPMA lightning page (rolling 24 h window). Screenshots and animations revealed strong electrical activity over the central coast and adjacent Atlantic.

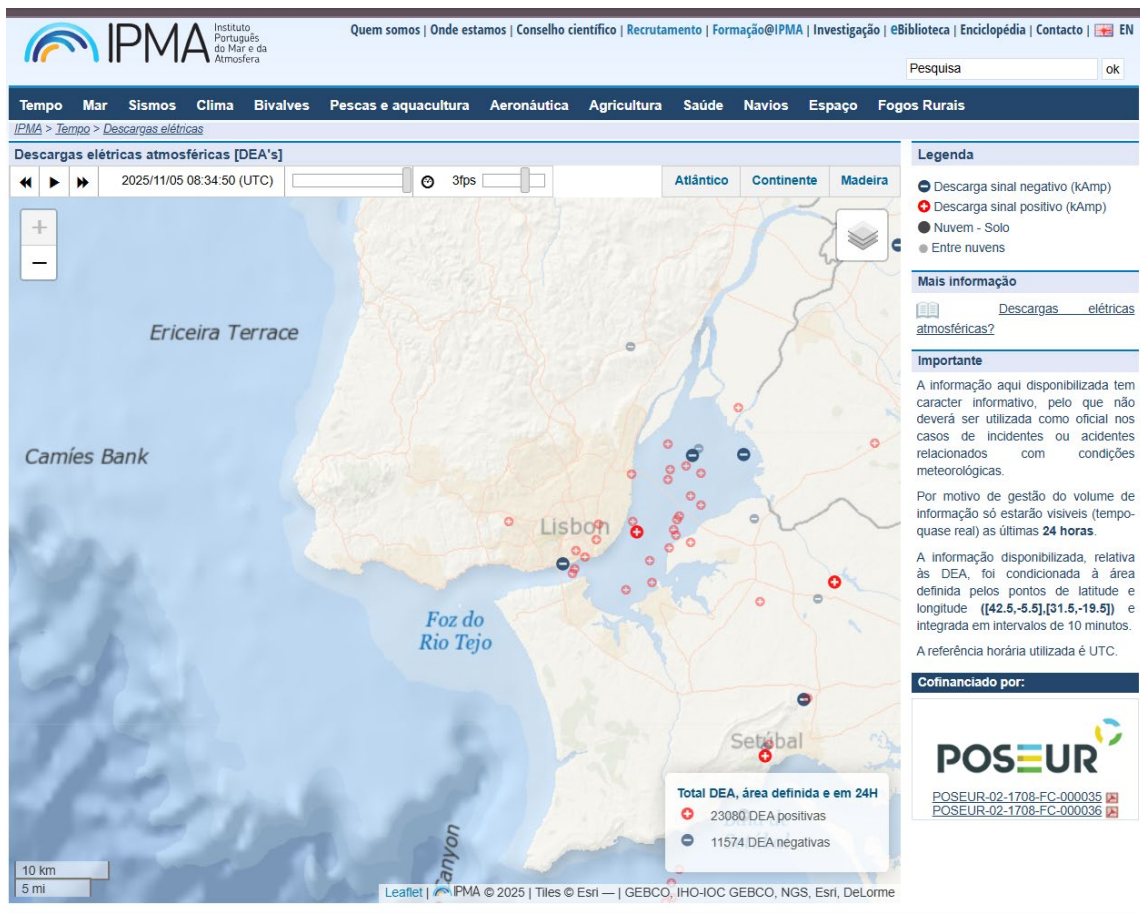


Figure 1 – Polarity totals from IPMA lightning data (24 h window ending 05 Nov 2025 08:34 UTC).

3. Environmental context

NOAA GFS 0.25° analyses at 00/06/12/18 UTC on 4 Nov and 00/06 UTC on 5 Nov showed deep-layer (0–6 km) shear ≈ 16 –17 m/s and CAPE values of 50–60 J/kg (mean) with local maxima >2000 J/kg. Figure 2 illustrates the shear and CAPE time series. EUMETSAT infrared imagery and IPMA radar (Figure 3) indicate organized convection with extensive stratiform cloud shields. A planned additional map (Figure 4) will depict the spatial distribution of positive and negative flashes once IPMA provides coordinate data.

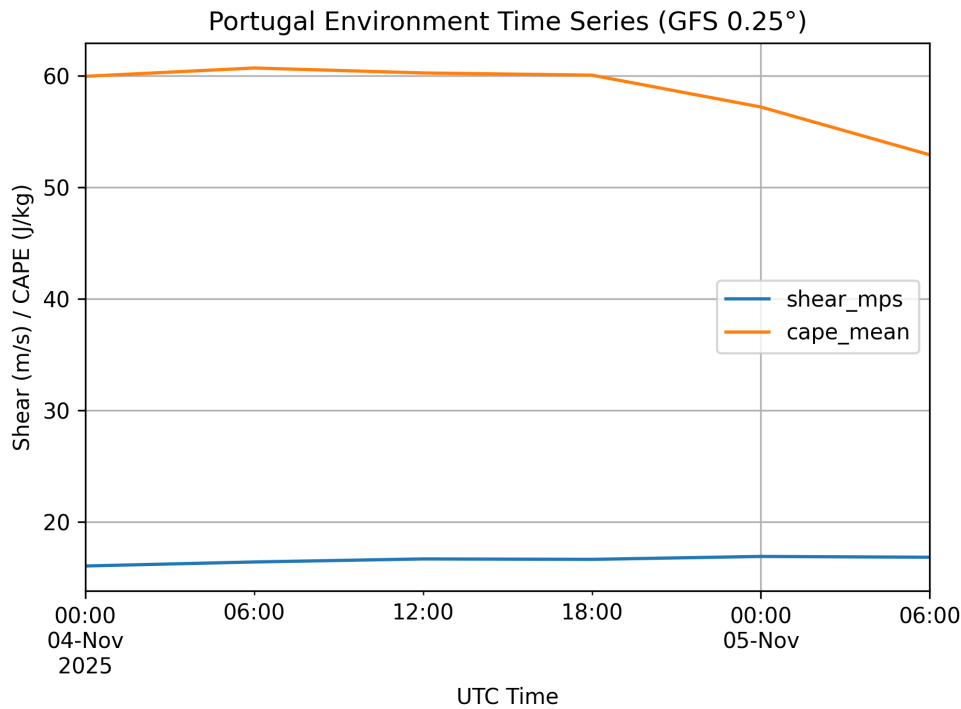


Figure 2 – Time series of 0–6 km wind shear and mean CAPE from GFS 0.25° over Portugal.

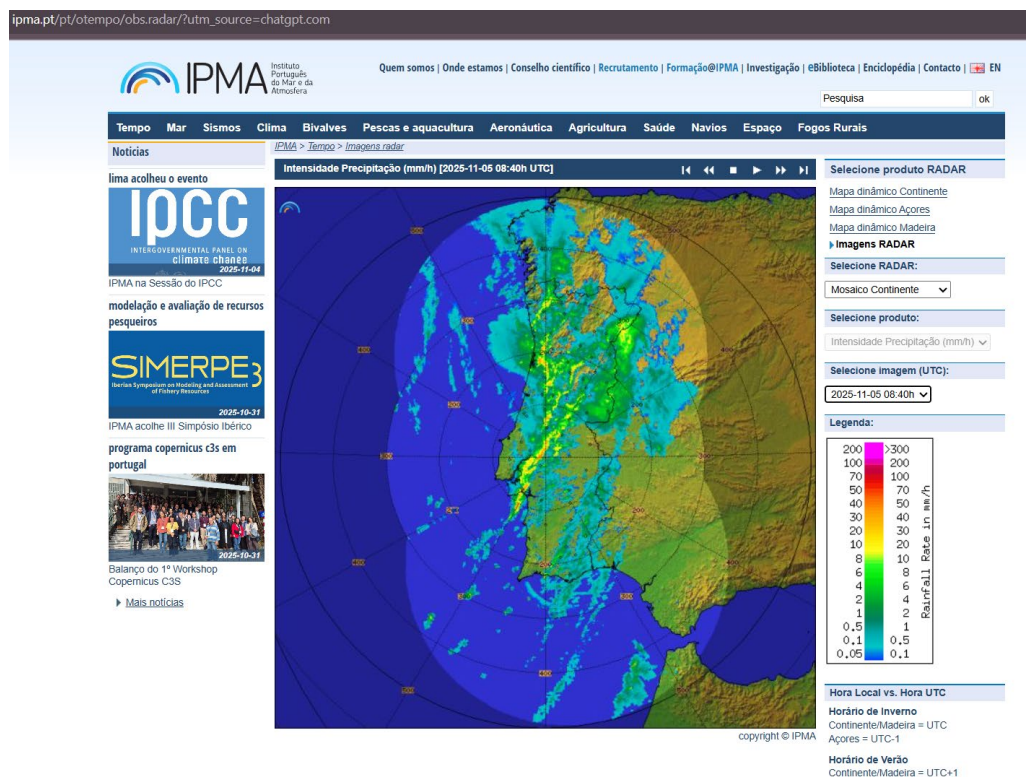


Figure 3 – Satellite or radar snapshot showing the convective system over mainland Portugal on 4–5 Nov 2025.

Figure 4 – Planned: Spatial distribution of lightning polarity across Portugal (pending IPMA data).

4. Discussion

The persistence of strong shear with modest but focused instability favored long-lived convective systems with elevated charge centers. Such environments promote inverted charge structures and positive CG dominance. The polarity ratio observed (>65%) is far above climatological values (<20%) for Western Europe, suggesting either unique microphysical conditions or synoptic-scale forcing that maintained inverted fields over 48 hours.

5. Conclusions

This event represents an exceptional instance of positive CG dominance over Portugal, with more than 37,000 positive flashes in 48 hours. Ongoing collaboration with IPMA and ERA5 reanalysis will permit a quantitative link between storm structure and polarity ratio. Results warrant documentation as a reference case for European lightning climatology.

Acknowledgements

The author thanks the Instituto Português do Mar e da Atmosfera (IPMA) for public data access and cooperation regarding additional lightning records.

References

- Rakov, V. A. (2003). A review of positive and bipolar lightning discharges. *Bull. Amer. Meteor. Soc.*, 84, 767-776.
- Pineda, N., and Montanyà, J. (2010). Lightning in the western Mediterranean during winter storms. *Atmos. Res.*, 96, 389-404.
- Williams, E. R. (2001). The positive charge reservoir for sprite-producing lightning. *J. Atmos. Solar-Terr. Phys.*, 63, 1447-1455.

Preprint submitted to *Weather – The International Journal of Meteorology (RMetS)*, November 2025.