

Lessons learned for Space Weather after the Spanish power blackout

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The blackout: top news around the world

THE BLACKOUT

On 28 April 2025 at 12:33 CEST occurred a major power outage in Spain and Portugal. Spain's electrical grid was down for almost 23 hours before the systems were back up. Outage affected traffic light, streetlamps, phone network, domestic and international transport, etc.



Geographic area affected by the incident of 28 April 2025. Source: ENTSO-E (<https://www.entsoe.eu/>)

OVERCOMING THE BLACKOUT

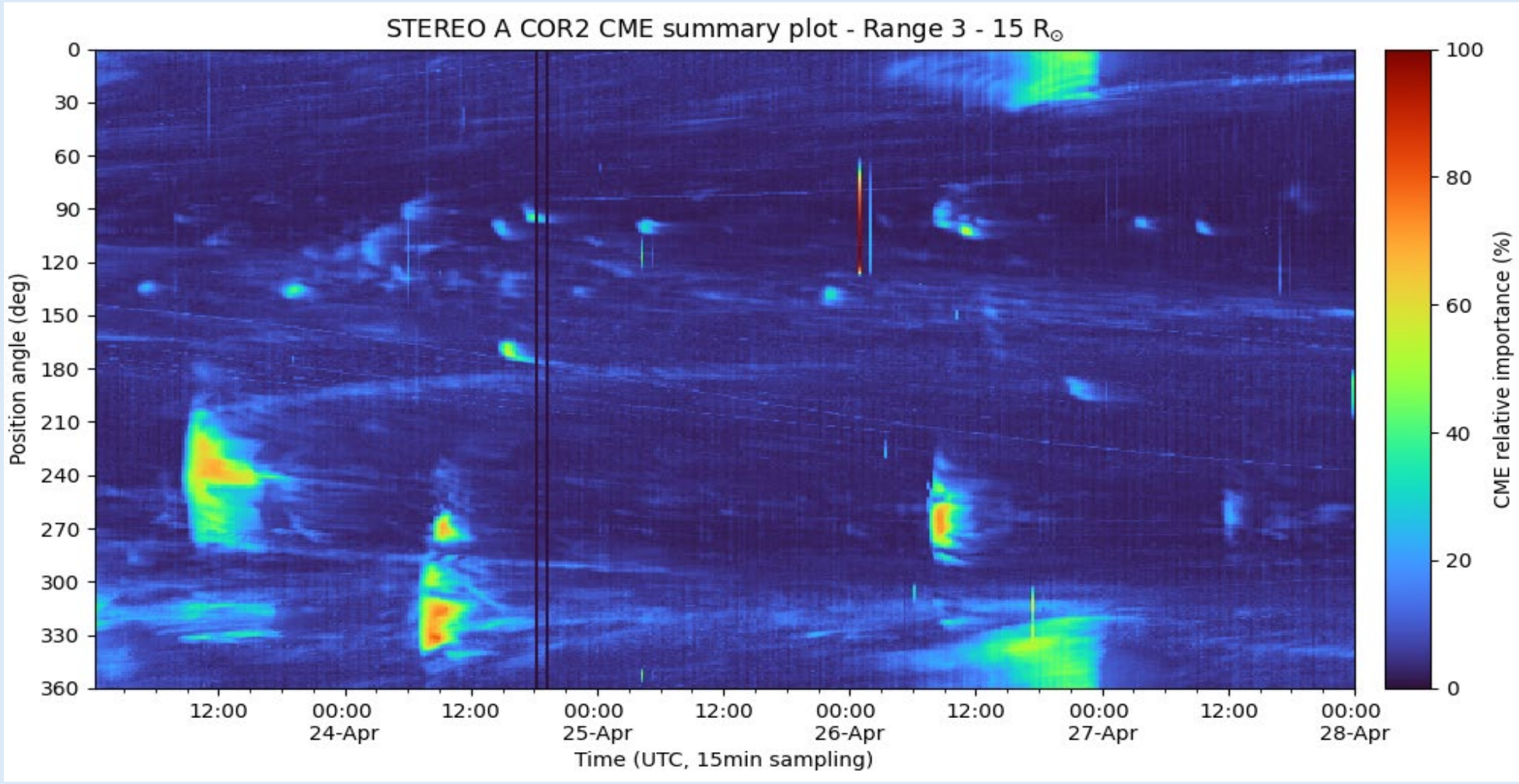
We spent the morning of April 29 trying to recover our servers that suffered problems due to the outage. Most of our instruments were resilient as they are connected to a generator to avoid power outages.



At about 14 CET on April 29 the situation fully returned to normal. All our equipment was restored, and we were providing all our products to the ESA SWE Portal and to the SeNMEs portal. Only those products relying in SFS observatory were not available because of a different problem.

REQUEST FOR INFO FROM THE SPANISH SPACE AGENCY

We were contacted by the Spanish Space Agency on the morning the day after the blackout asking to “urgently provide information or a graph of yesterday's solar activity to see if it could have had anything to do with the blackout that Spain suffered yesterday.”



Automatic CME Summarizer (ACME) product display on SeNMEs (www.senmes.es) showing the five days before the blackout.

Considering our most recent products on solar activity (see, for example, ACME product), our prompt response was conclusive:

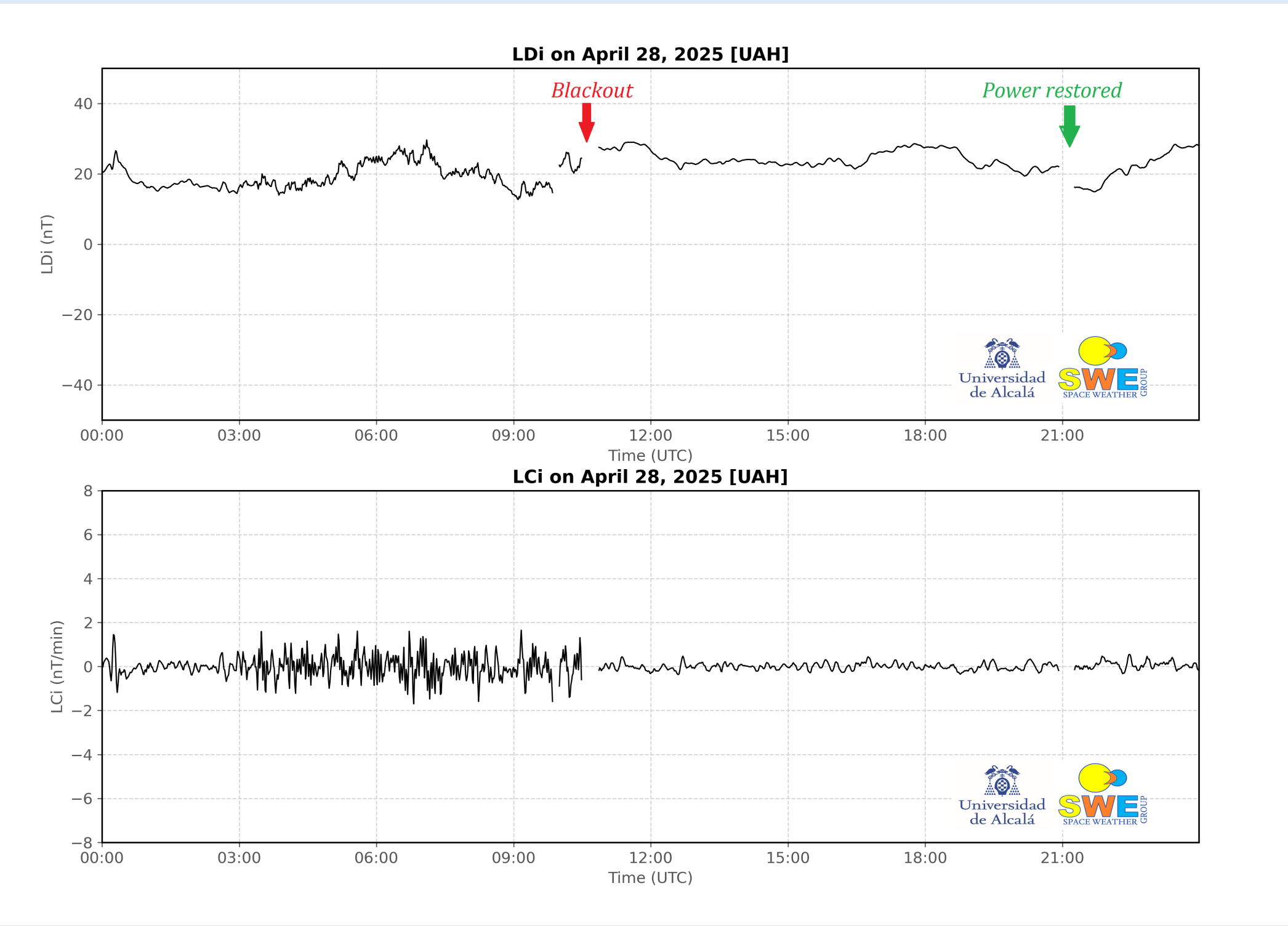
“Definitively, the outage is not related to the Sun”

REQUEST FOR INFO FROM ESA

ESA made us a double request on April 29:

- Whether we report, by any way, that the Sun was responsible for the blackout (somebody was blaming the Sun on 29 April)
- To provide a graph with the products LDi-UAH (G.172) and LCI-UAH (G.173) recorded on 28 April. At that time the products based on SFS were not available.

LDi-UAH and LCI- UAH, in the format of G.172 and G.173, appear in graphs extending for a period of 5 days. These graphs showed some data gaps along April 29 due to our interventions in equipments close to the UAH magnetometer. Indeed, we decided to preventively remove those data to avoid confusion with some spikes. Trying to be more helpful, we prepared a zoomed-in graph using only data from April 28. We added some arrows to indicate the time of the blackout and when the power was restored.



The figure prepared ad-hoc for reporting showing LDi-UAH (G.173) and LCI-UAH (G.173)

Our answer to 1) was definitive: **“We can confidently assure you that the Sun had nothing to do with yesterday's blackout. This was our message to everybody contacting us.”**

However, regarding the graph, **the typical daily disturbances in LCI-UAH**, due to the proximity of the UAH magnetometer to the railway, **were considered by some users as a posible trigger for the blackout.** Indeed the disturbances stopped with the blackout and did not appear after because the trains were stopped. Of course, we clarified this misunderstanding to ESA, but we learned a lesson for the next time.

CONCLUSIONS

- We declare the Sun fully innocent of the blackout, but continuous monitoring is a must
- Despite our servers being affected by the outage, local magnetic records at UAH were collected during the outage and accessible through a local computer, even during the blackout, due to the connection to a generator

LESSONS LEARNED

- We need to ensure that we can warn all parties if space weather might be creating a major impact → local instruments connected to generators are a must to ensure resilience
- Users should properly understand our products just with a quick view (and some users are not able to understand our graphs!!) → new graph design proposed to ESA for products G.132 and G.133

