EGU General Assembly 2023
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Possible Lithosphere Atmosphere Ionosphere Coupling before 19 September 2021 La Palma volcano eruption

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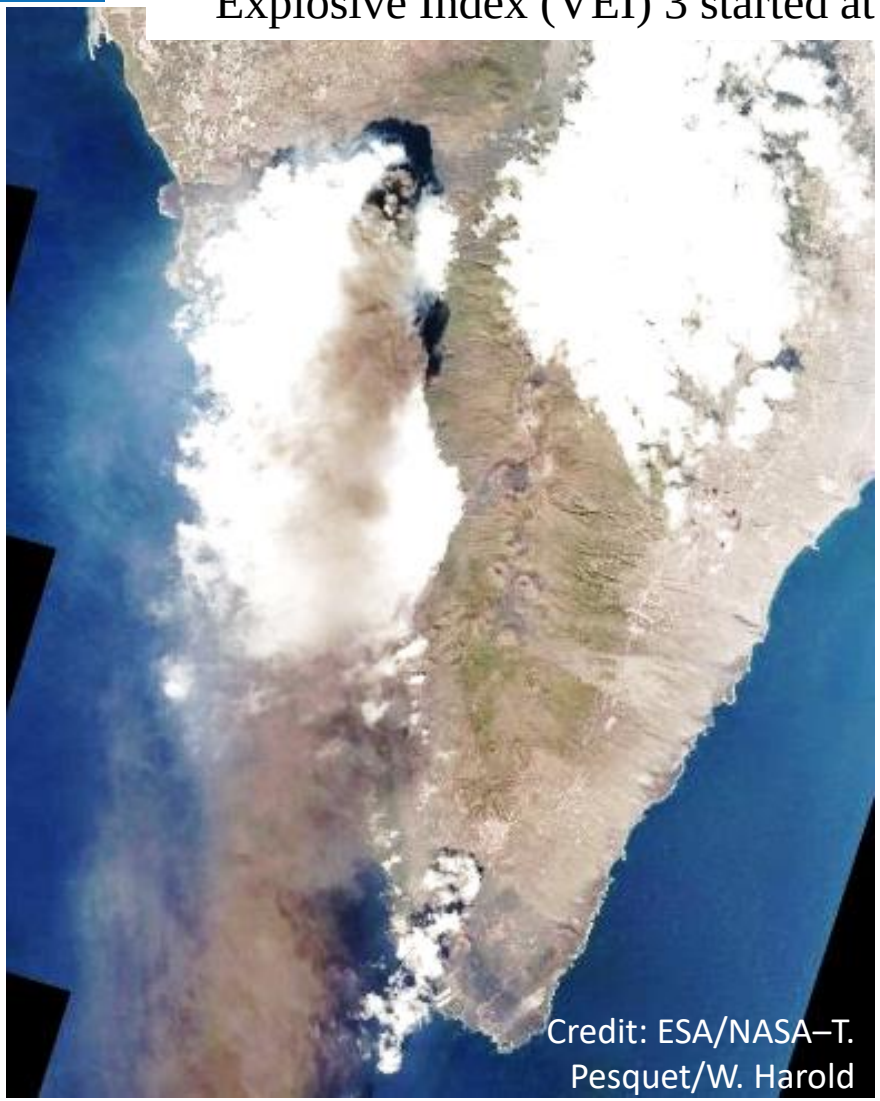
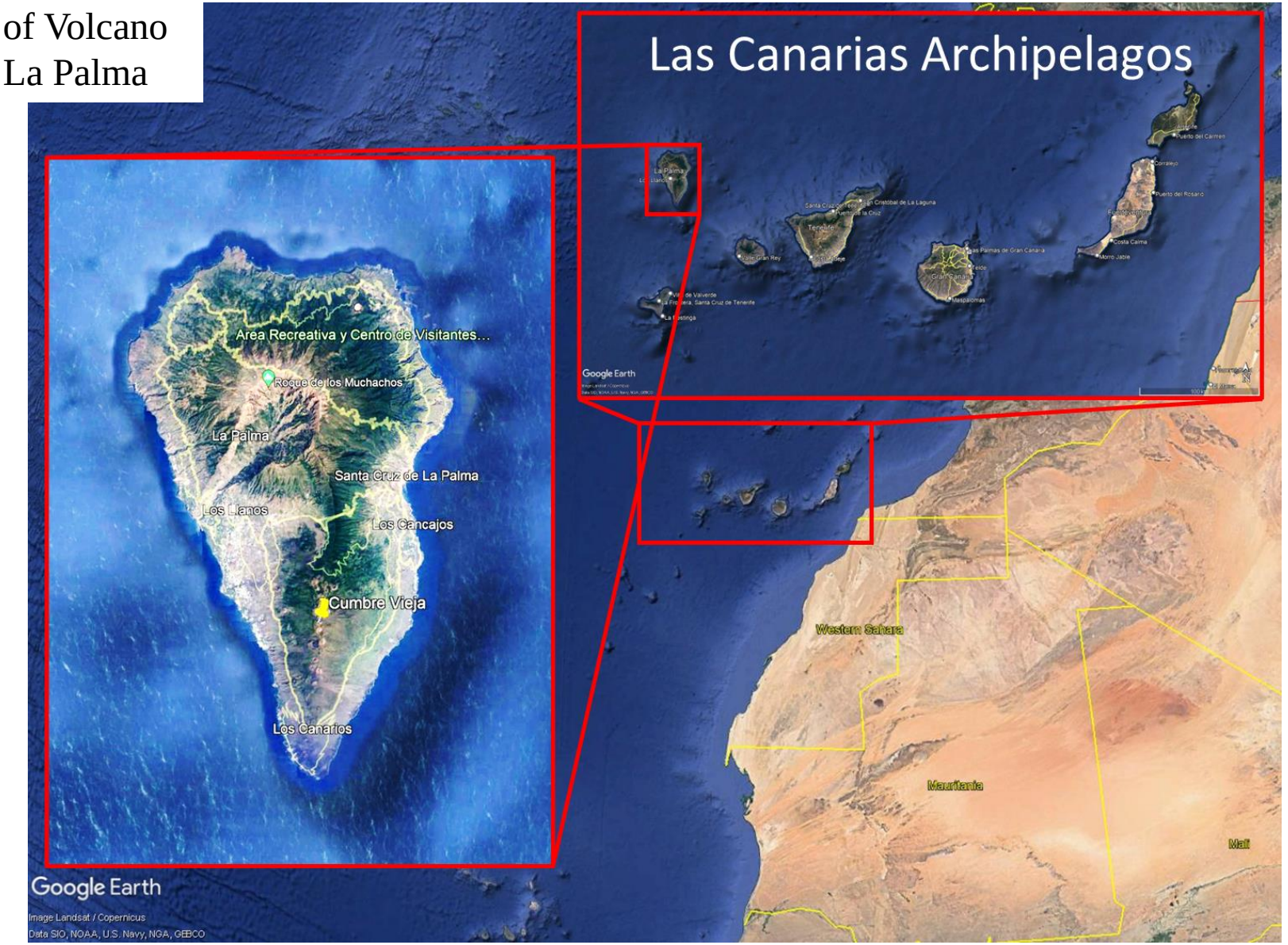
La Palma volcano location

On 19 September 2021, an eruption of Volcano Explosive Index (VEI) 3 started at La Palma





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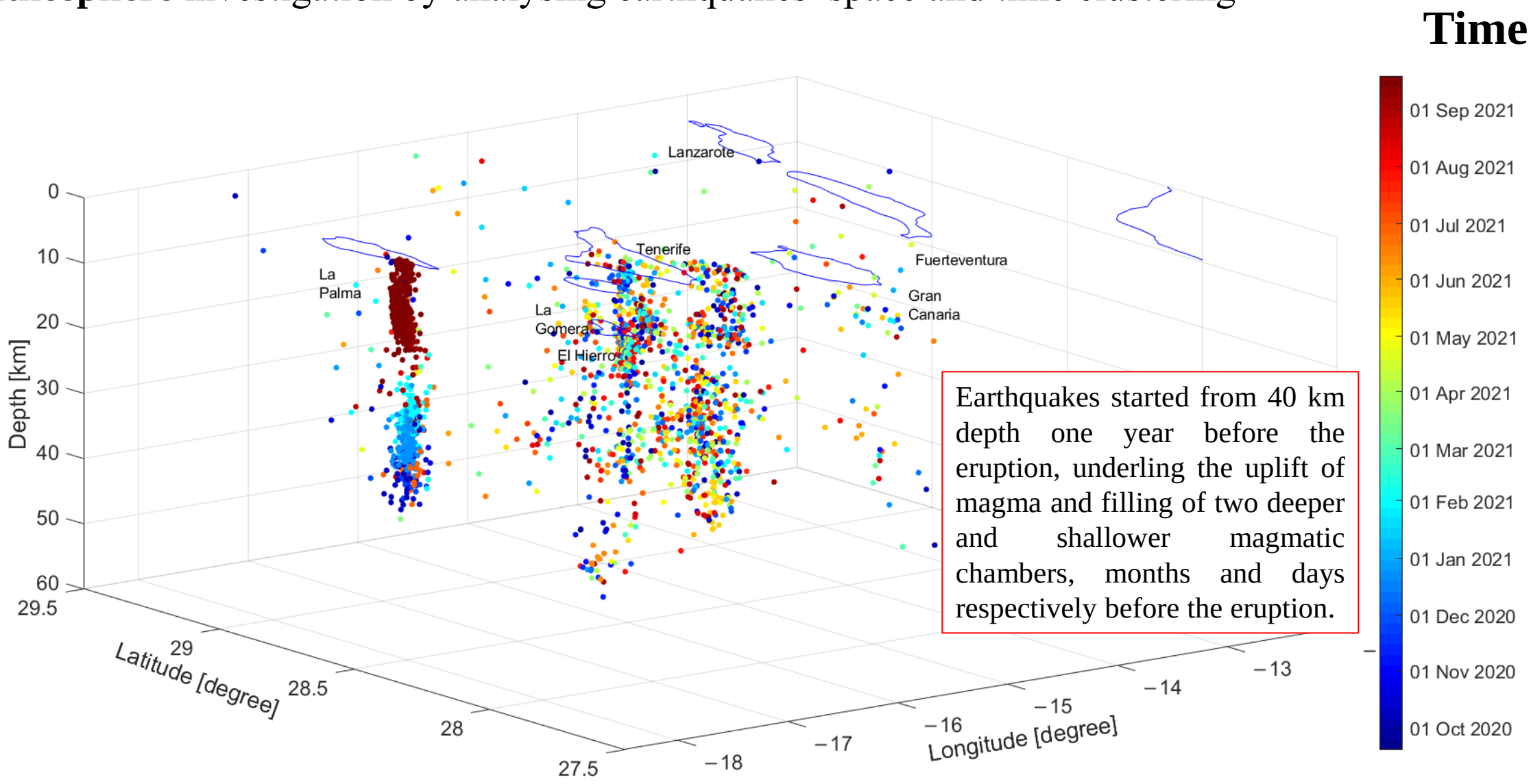
Lithosphere investigation by analysing earthquakes' space and time clustering



Earthquakes started from 40 km depth one year before the eruption, underling the uplift of magma and filling of two deeper and shallower magmatic chambers, months and days respectively before the eruption.

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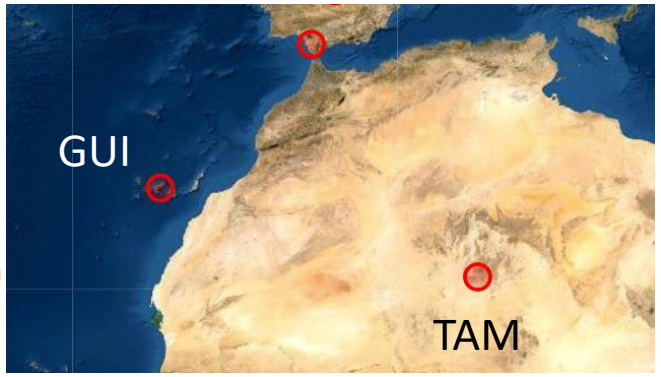
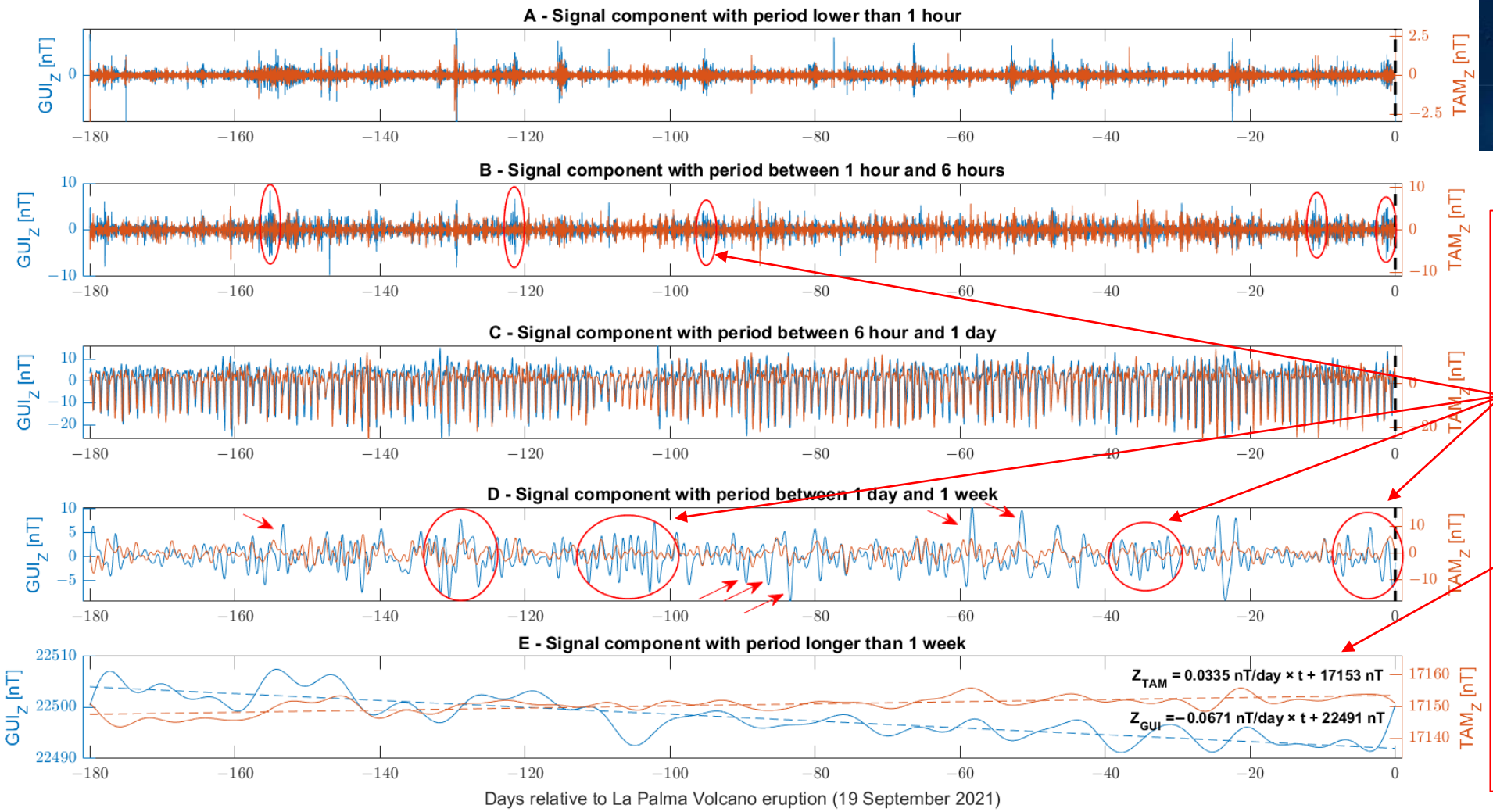
Geomagnetic field ground investigation of possible lithosphere activity





Ground geomagnetic data of an observatory (GUI) close to the volcano has been compared with another one far (TAM).

- Several **disturbances** have been recorded only close to volcano and maybe induced by the **magma uplift**.
- A **decrease of vertical magnetization** has also been recorded, and it could be due to <u>demagnetization produced by the increase of lithospheric temperature.</u>

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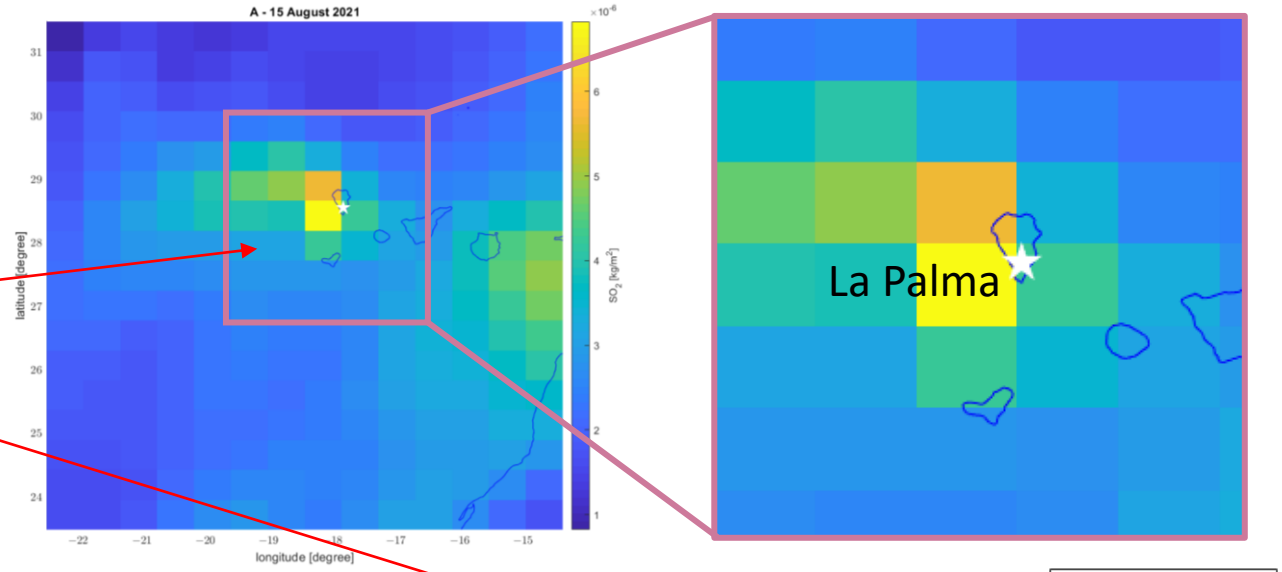
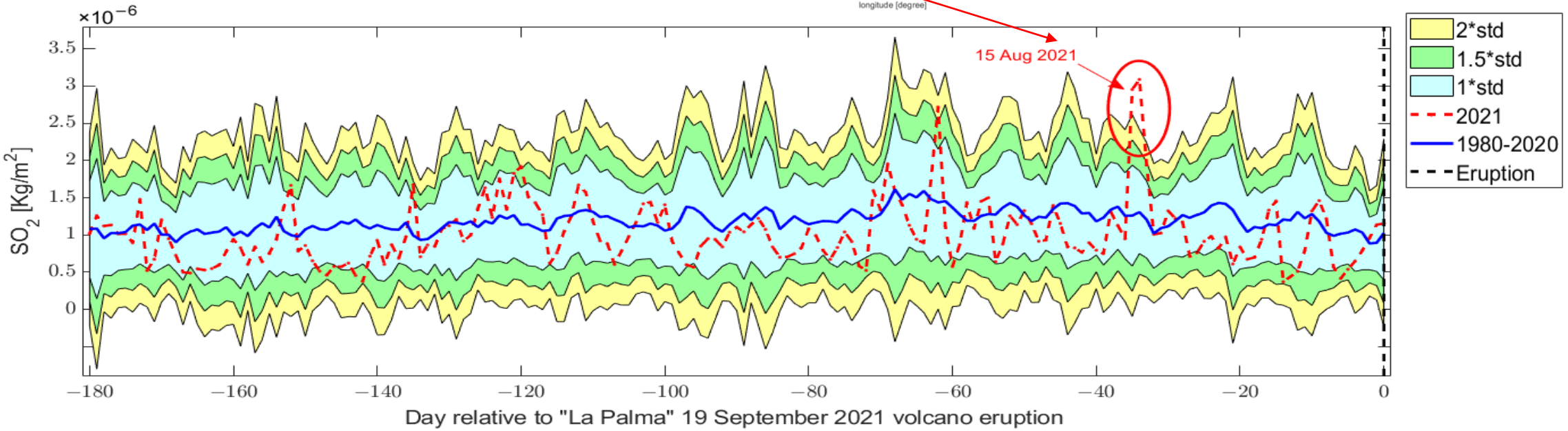
Atmosphere investigation of SO_2 time series 6 months before the eruption

A **persistent anomaly** appeared for 2 consecutive days 34 days before the eruption and it was located at the same location as the volcano



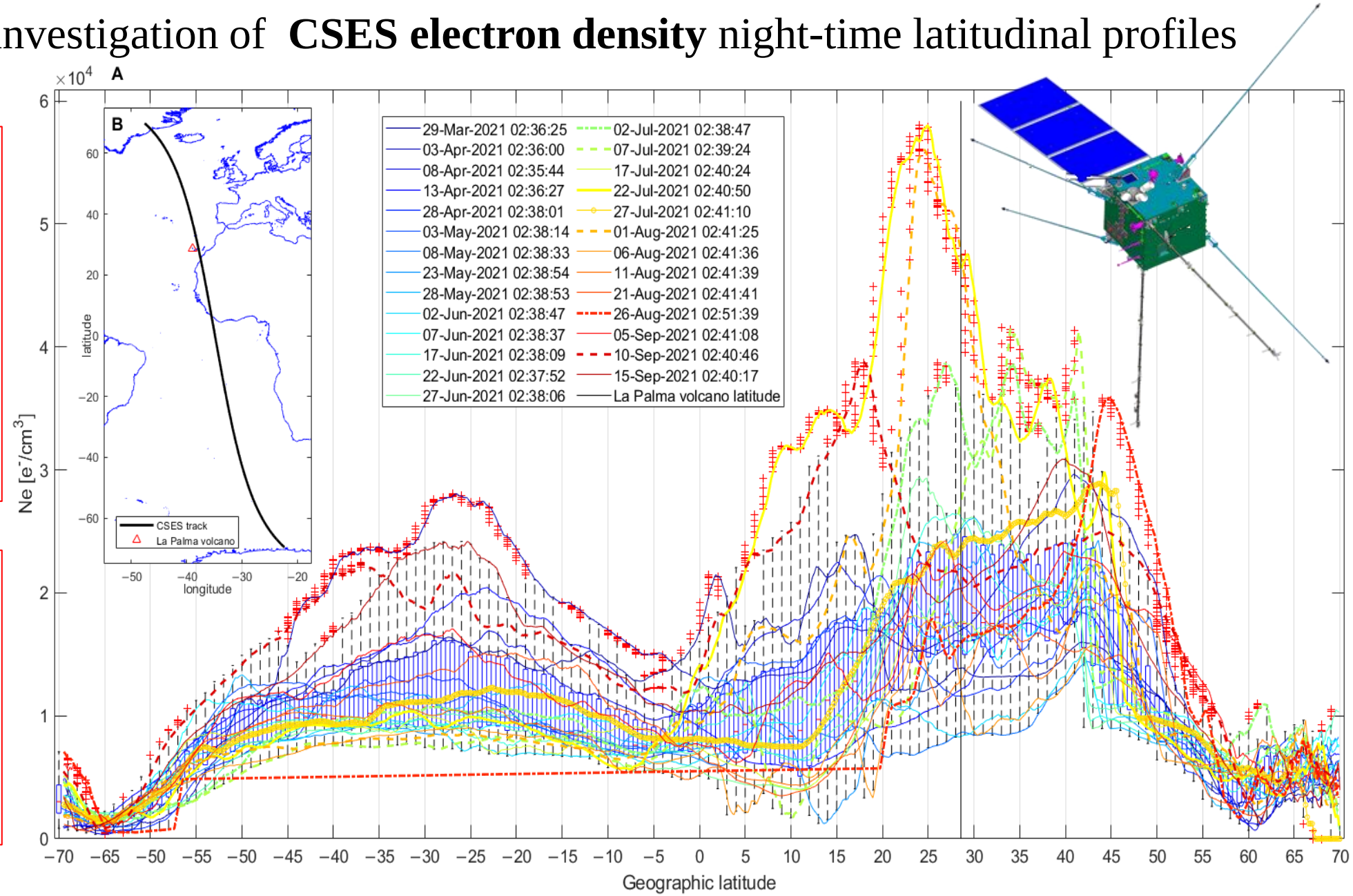


Ionospheric investigation of **CSES electron density** night-time latitudinal profiles

Sharing is encouraged

Method:
Comparison of the same nighttime orbit (every 5 days) of CSES Ne. Only tracks in geomagnetic quiet time (|Dst|≤20 nT and ap≤10nT) have been considered.

The track of 1 August 2021 presents a particularly high value of electron density. TEC data from GIM confirmed the measurements of CSES.



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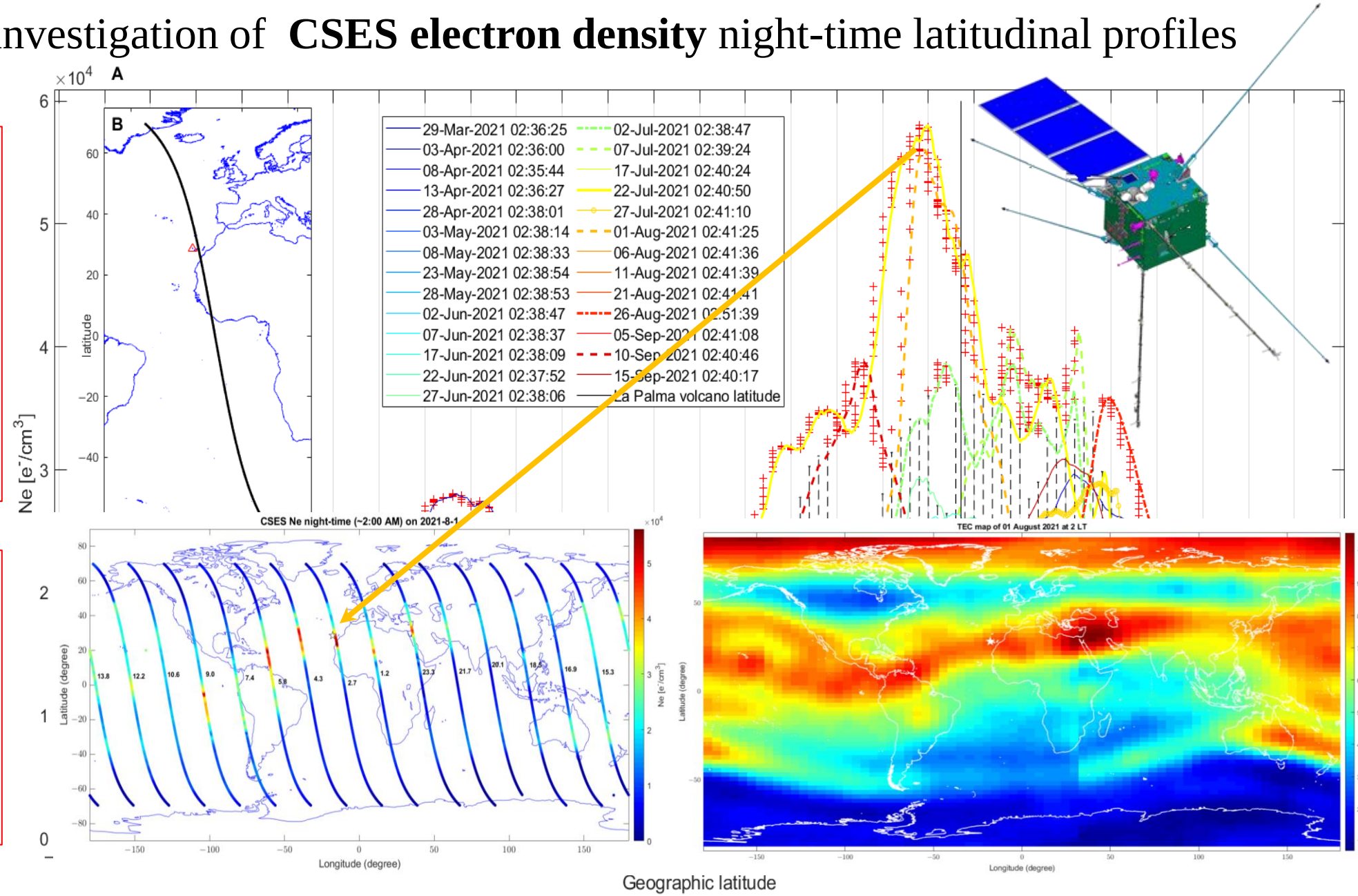

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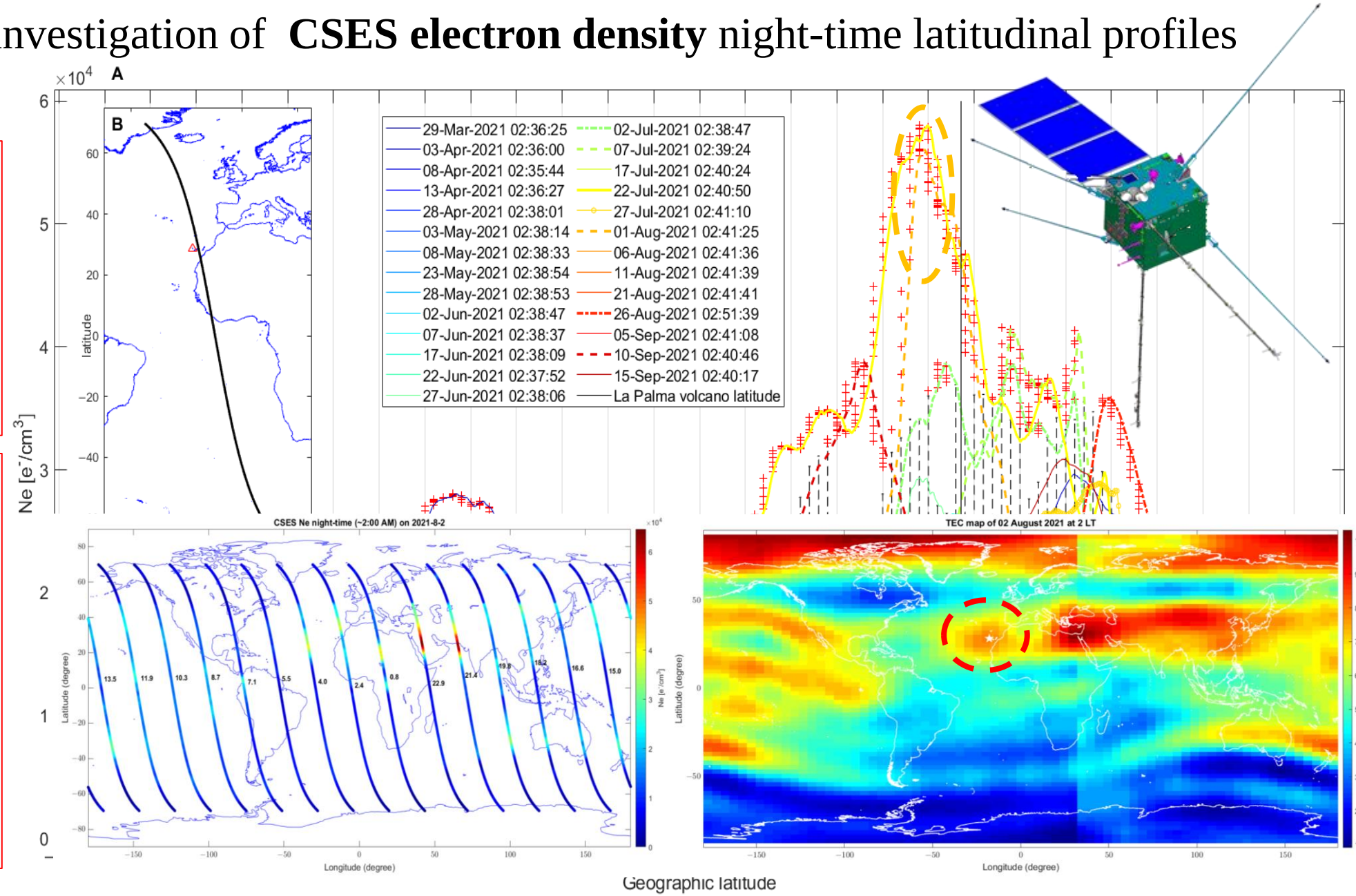
CSES electron density increase is also visible in **TEC** data with enhancement very localised **above La Palma** volcano, suggesting that it was a Lithosphere-atmosphere-ionosphere **coupling induced by the volcano**.



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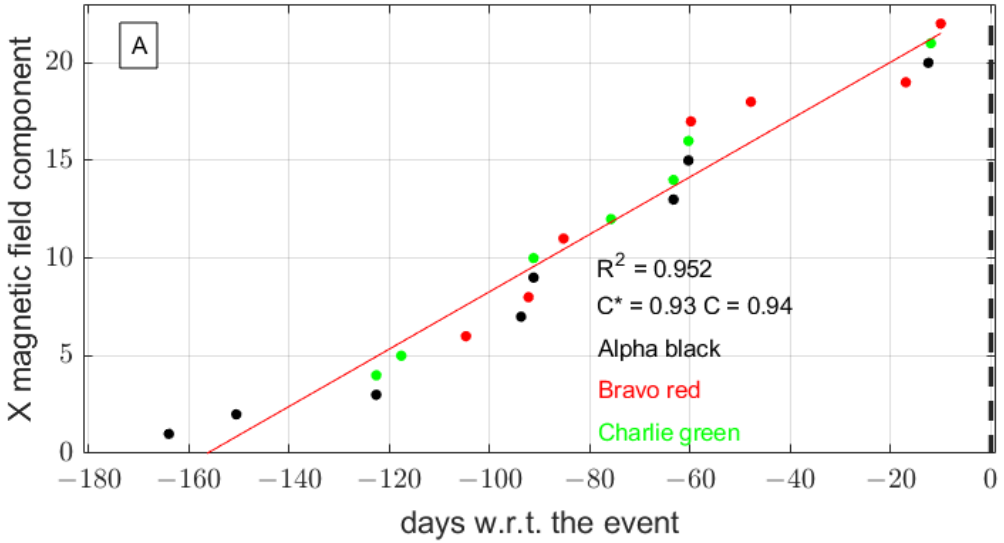
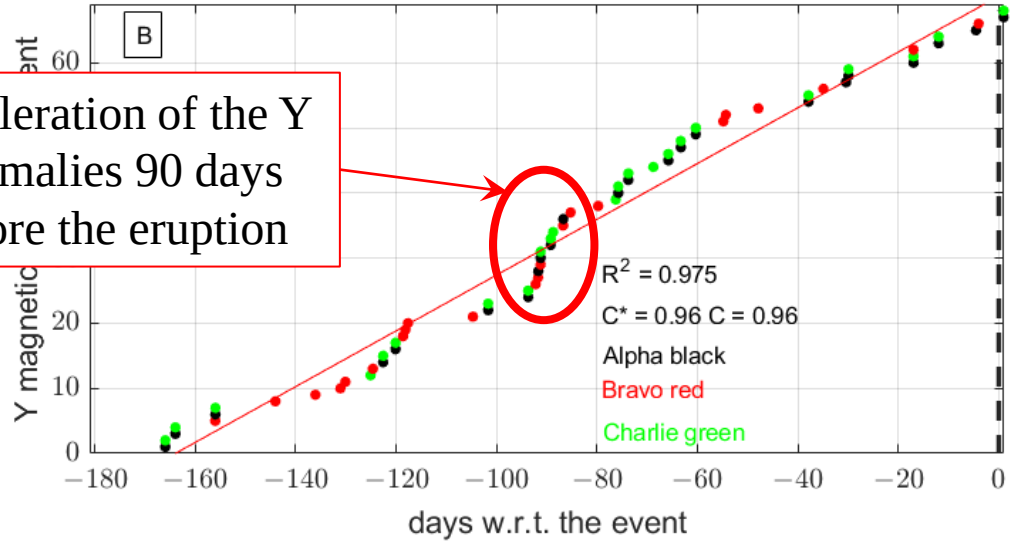
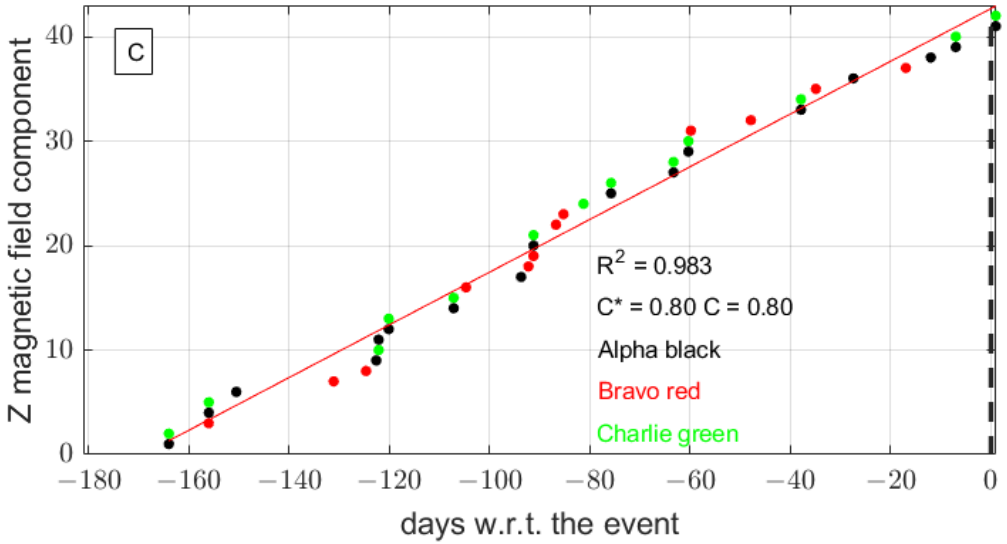
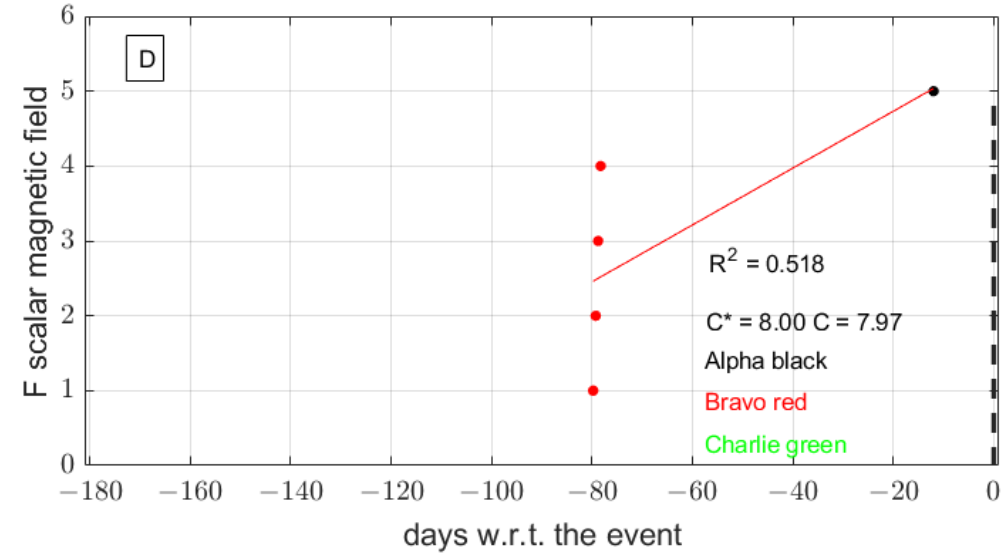
Ionosphere: cumulative number of **Swarm magnetic anomalies** above La Palma volcano





Acceleration of the Y anomalies 90 days before the eruption



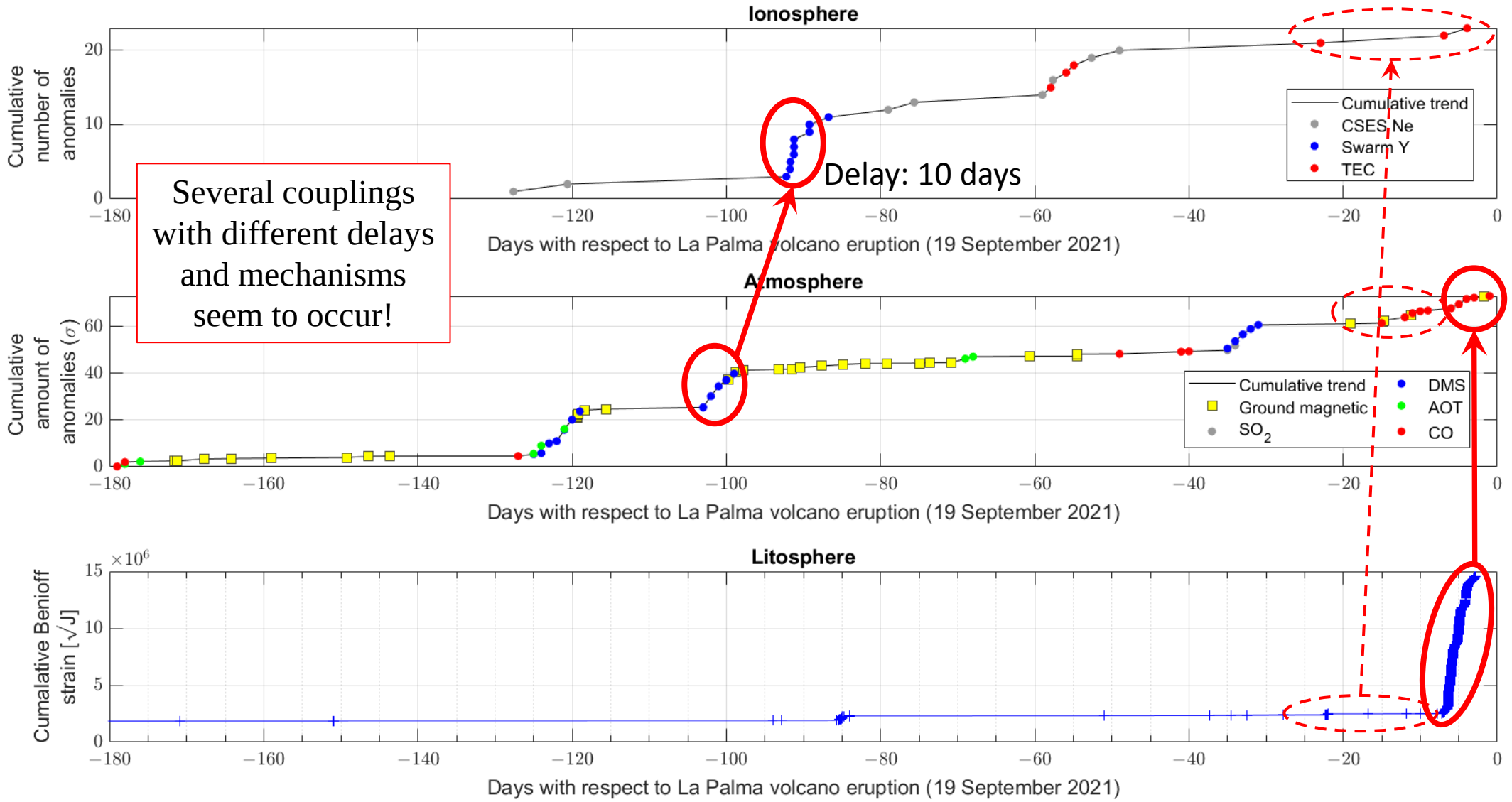


Possible **Lithosphere – Atmosphere – Ionosphere couplings -** Summarised common view

Ionosphere

Atmosphere

Lithosphere



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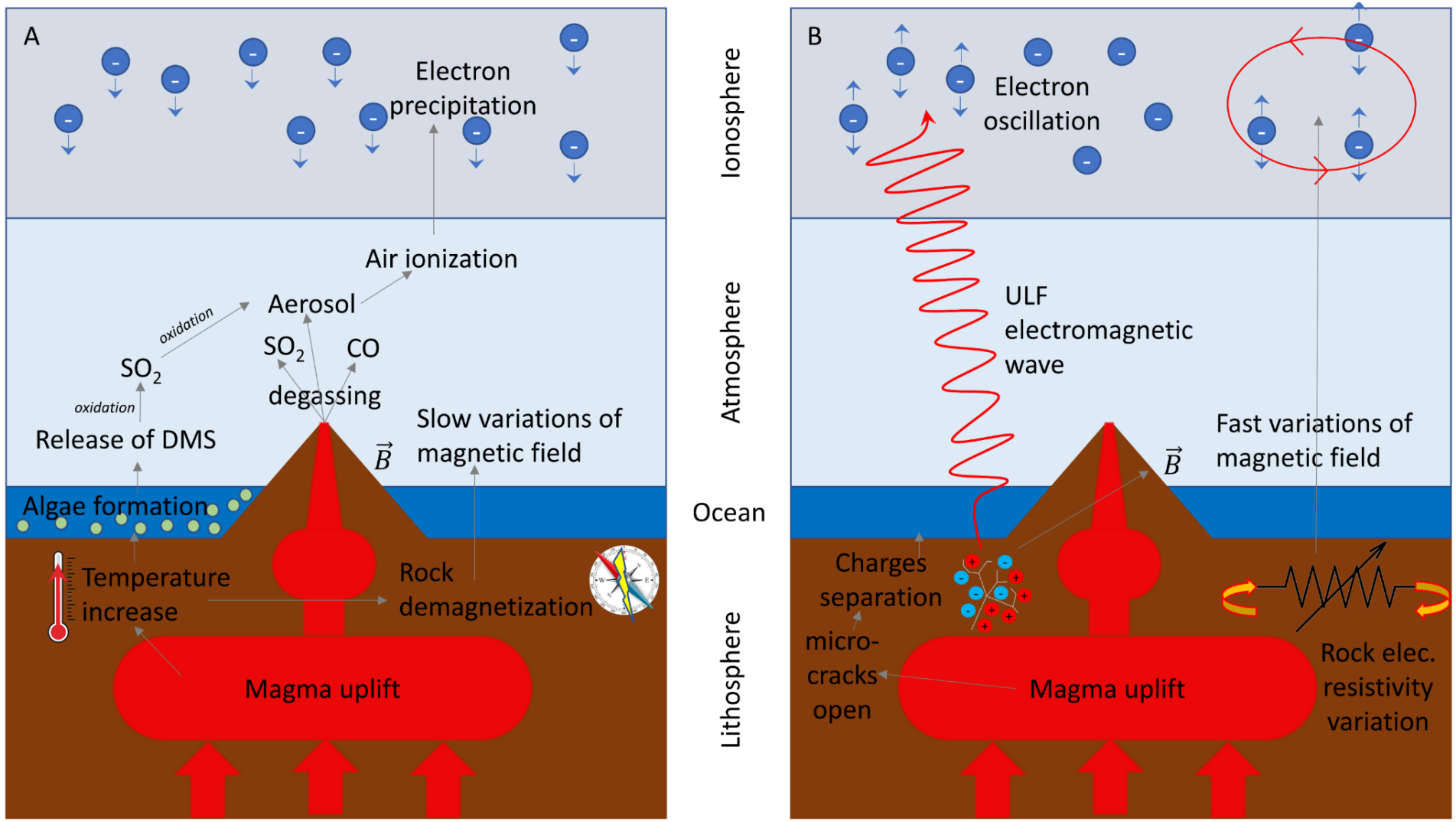
Lithosphere –atmosphere – ionosphere bottom-up coupling (LAIC) models

Chain of processes



Electromagnetic coupling

Different couplings can reflect **several processes** of the preparation of the volcano eruption driven by the **magma uplift**!

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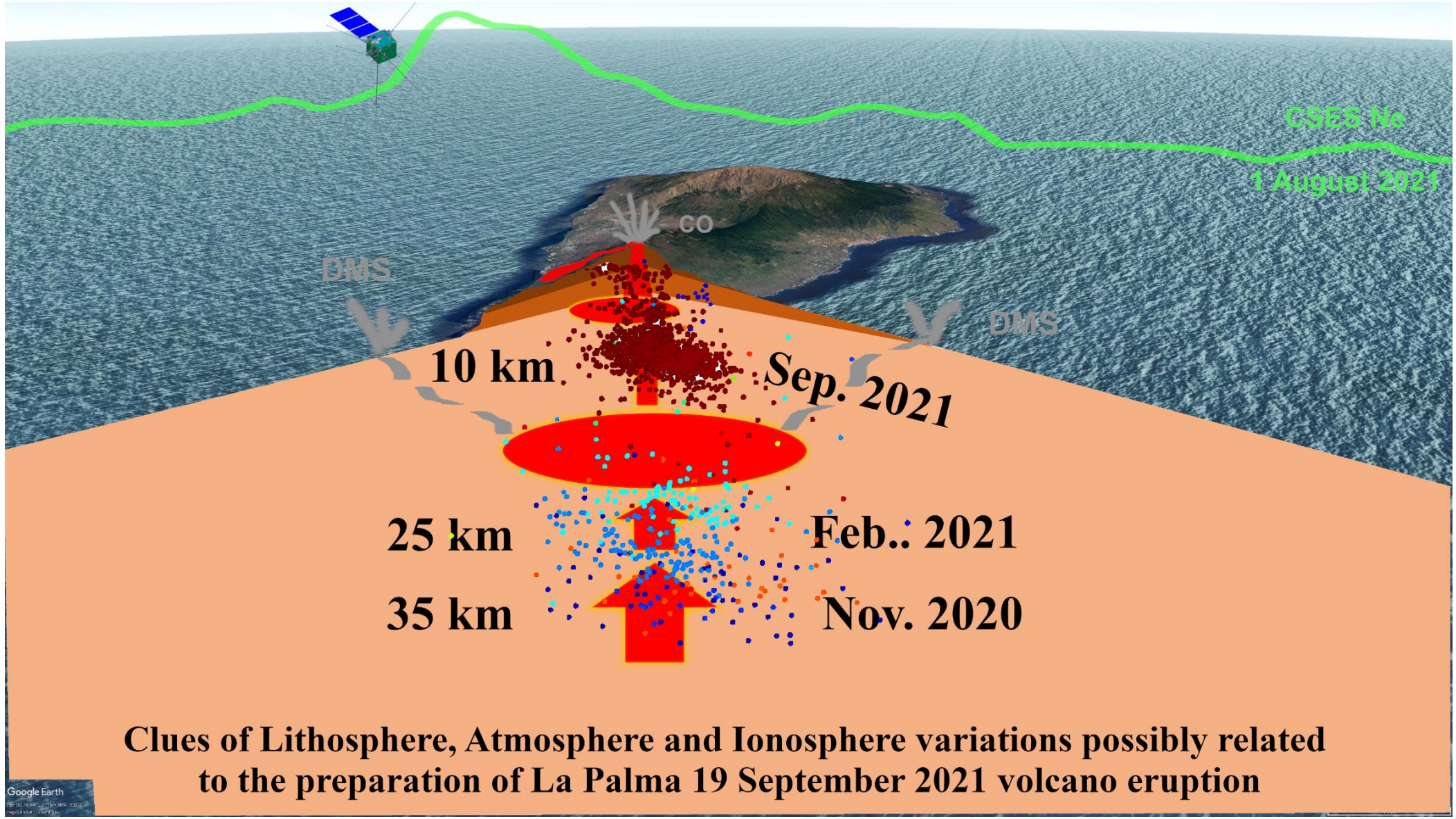
Graphical abstract

These results were published in Remote Sensing: www.mdpi.com/2072-4292/14/19/5001



Thank you very much for your attention!

Invitation to submit papers on Lithosphere Atmosphere Ionosphere Coupling in the occasion of earthquakes:

- **Already 8 published papers and several planned**

Invitation to read:

- **Zhang Yiqun et al.**
  Are There One or More Geophysical Coupling Mechanisms before Earthquakes? The Case Study of Lushan (China) 2013
  published in this Special Issue of Remote Sensing on 10-03-2023

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