

## Rikitake Law, relating precursor time and earthquake magnitude, confirmed by Swarm satellite data

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...the ideal continuation of a recent published paper in Scientific Reports





## **Rikitake law (1987)** $\Rightarrow$ Log $\Delta T(days) = a + bM$

ΔT: precursor timeM: earthquake magnitude

log(ΔT)=-2 (±1)+0.8 (±0.2)M

4.0



Anomalies of **Swarm satellite magnetic field** detected analysing the first differences during **quiet magnetic periods** ( $|Dst| \le 20$  nT and ap  $\le 10$  nT) when the **rms** of the considered window is larger than 2.5-3 times the **RMS** of the whole satellite track





# What type of satellite magnetic anomaly is satisfying the Rikitake law? Some examples for different bands of magnitude.



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\*This event is a part of a cluster whose equivalent magnitude is 7.1 and the cluster epicenter is 0.47°N 79.68°W



### Then

For each magnetic anomaly in the selected maximum concentration we extract the following information:

- Period of the anomaly (in seconds)
- Duration of the anomaly (in seconds)
- rms/RMS

and look at their possible relationship with the corresponding associated EQ.

In general, we found that the period (about 10 sec.) is almost independent of the earthquake magnitude,

while Duration and rms/RMS depend significantly on the earthquake magnitude.





## **Duration**



Duration has no evident correlation with magnitude. When corrected by the longitude difference w.r.t. EQ epicentre the correlation improves and becomes significant ( $p \le = 0.05$ ).



## rms/RMS



### **Future possibilities** (Science–fiction or reality?)

In principle, once an anomaly is detected over a seismogenic region we could predict magnitude from duration and rms/RMS ( $M_{dur}$  and  $M_{rms}$ ). If both estimated values almost agree ( $M_{dur} \sim M_{rms}$ ), applying the Rikitake law, we could also predict the estimated time of EQ occurrence, completing the prediction.



other satellite and ground data!