Radio Frequency Sensor: 1.5 years of RF lightning detection from GEO

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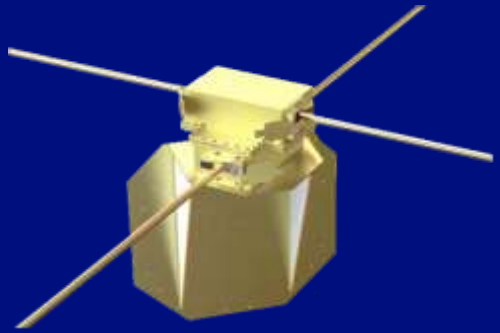
Radio Frequency Sensor : RF Lightning detection at GEO

- First time for RF lightning detection in GEO
- Launched 6 December 2021: Turn-on 15 January; Operational mode: 20 February 2022
- Hundreds of thousands of lightning events captured so far
- Triggers on broadband radio frequency transients from lightning
- Software-defined radio: FFT & manual triggering available
- Crossed dipoles, active antenna
- Waveforms of both polarizations (H & V) are transmitted to ground
- Two bands (10s of MHz of bandwidth each)
  - HF/VHF
  - VHF
  - Cross band triggering



RFS example waveforms

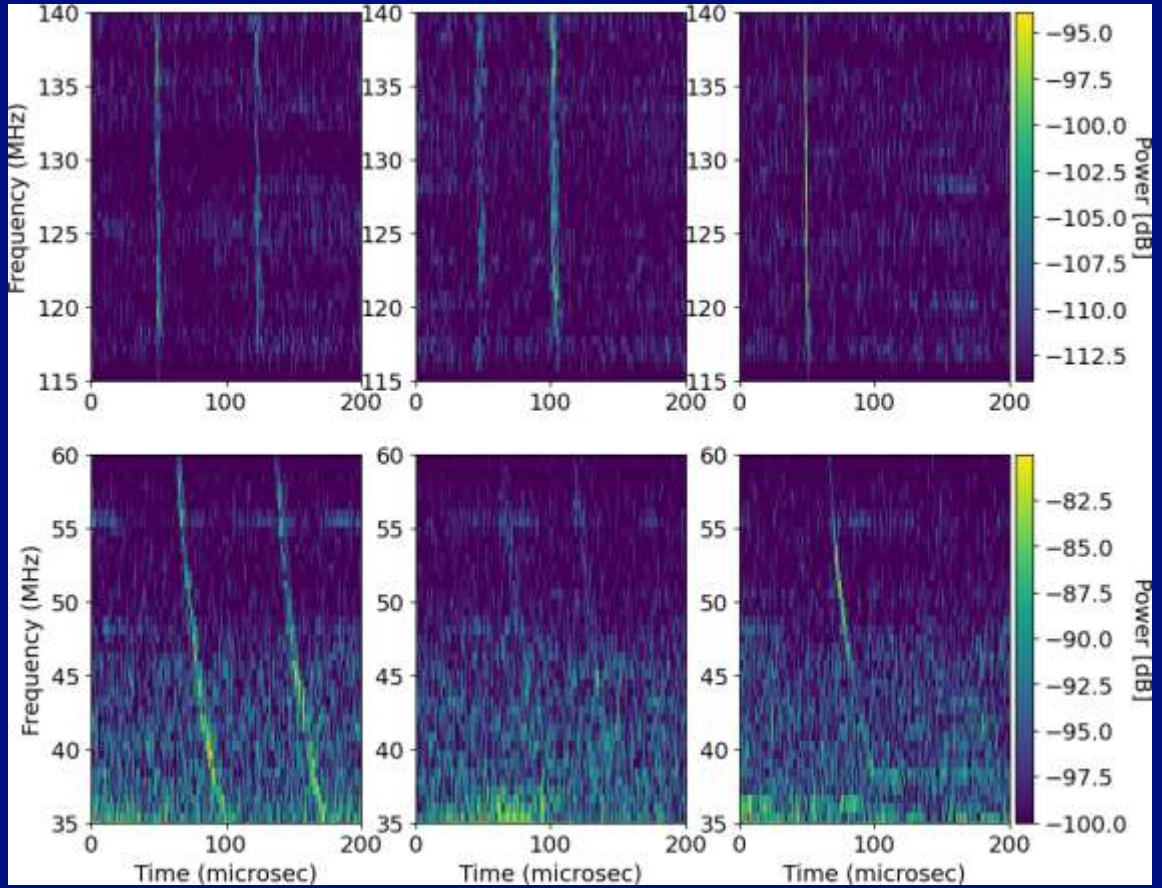
- Event 1:

  Transionospheric pulse pair (TIPP), equal power between pulses, 17.5 km altitude, strong lowband (LB)

- Event 2:
  - TIPP, second pulse has higher power, more polarized, weak LB, 12.5 km altitude

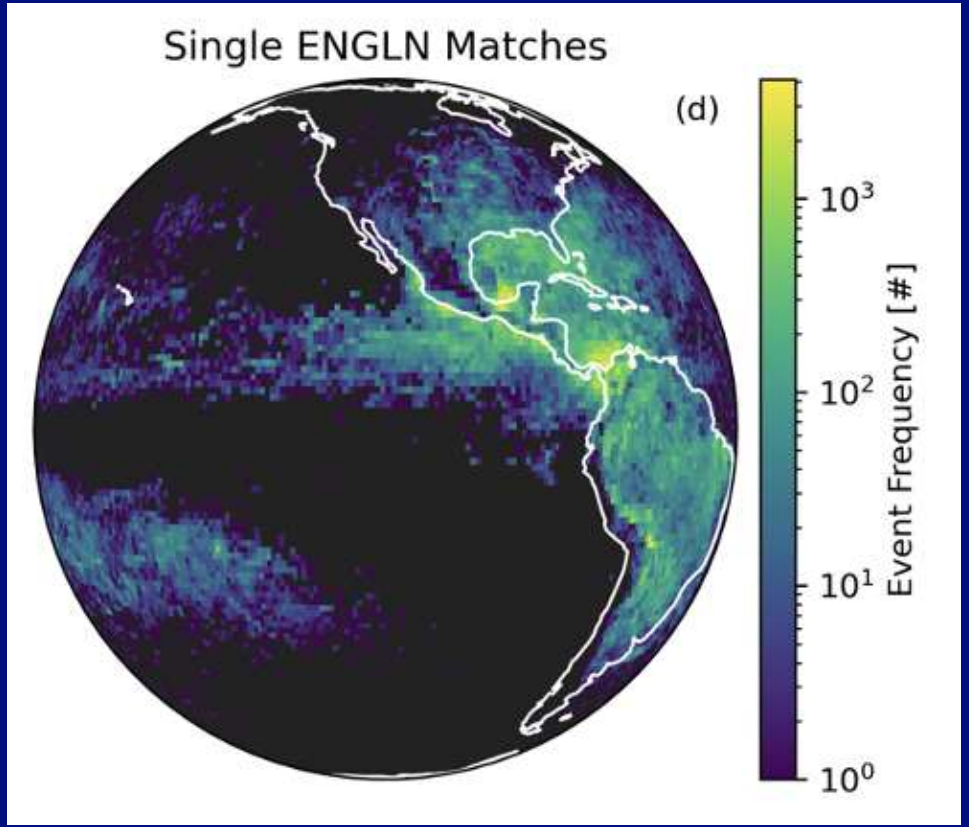
- Event 3:

  -CG seawater attachment, highly polarized, strong LB (45-55 MHz)



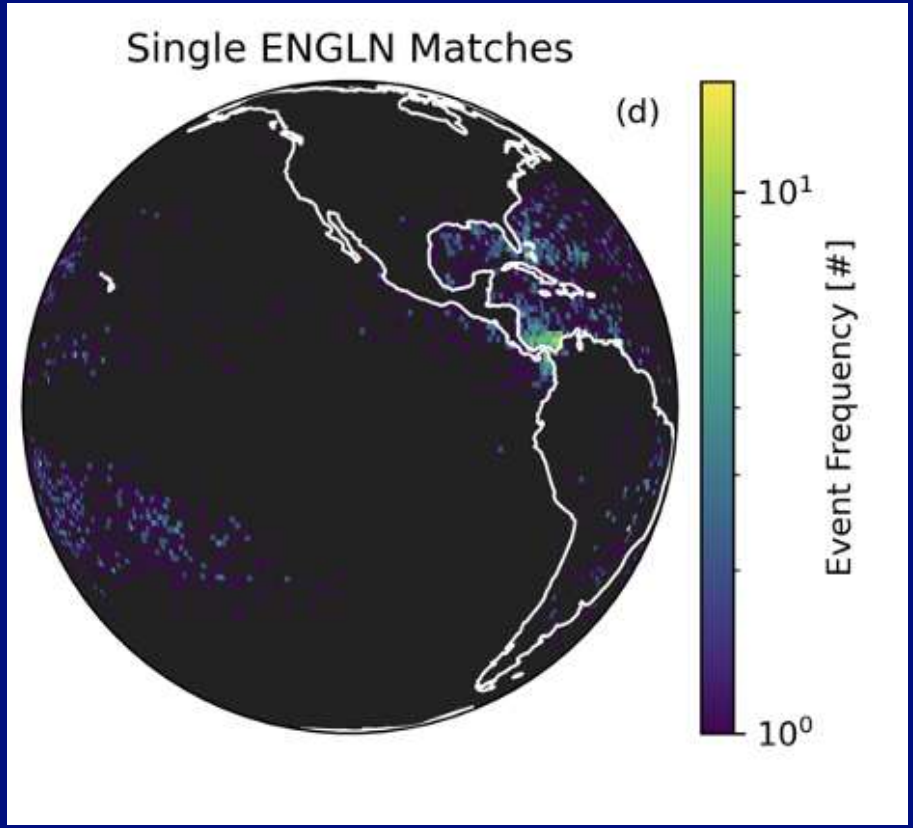
Locations of RFS/ENGLN matches

- 1 March 2022 – 1 March 2023
- 82% of RFS events matched an ENGLN detection (and therefore geolocated)
- 41% of RFS events matched a WWLLN detection (most overlapped with ENGLN)

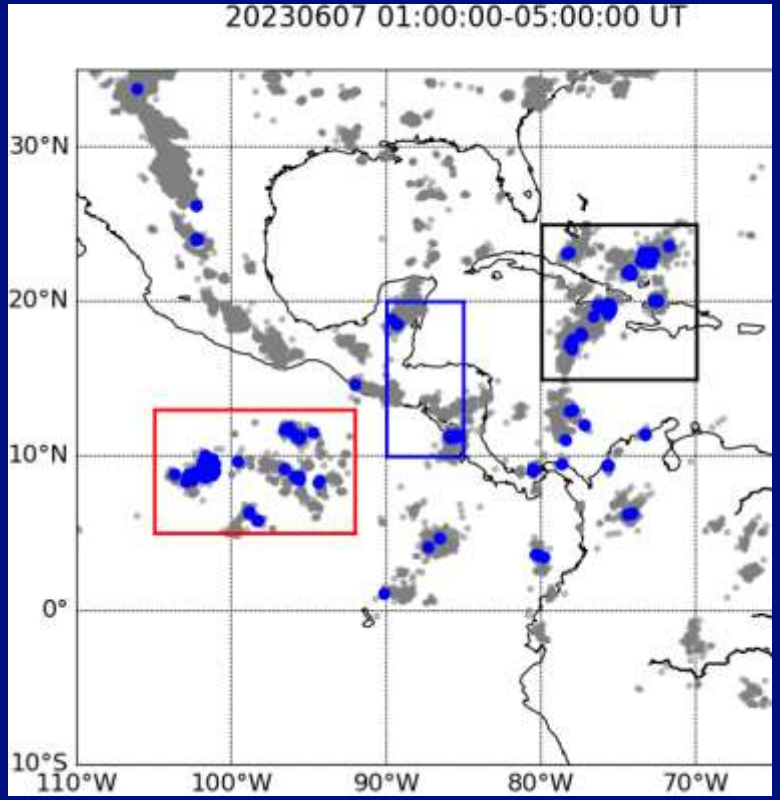


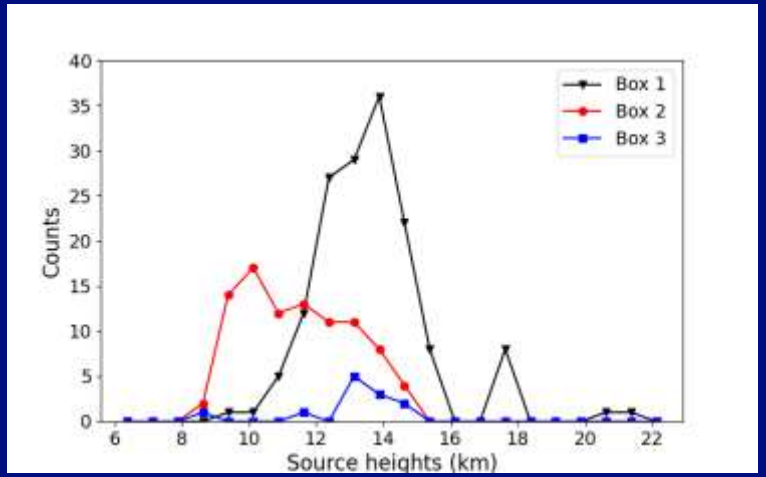
Locations of RFS/ENGLN polarized matches

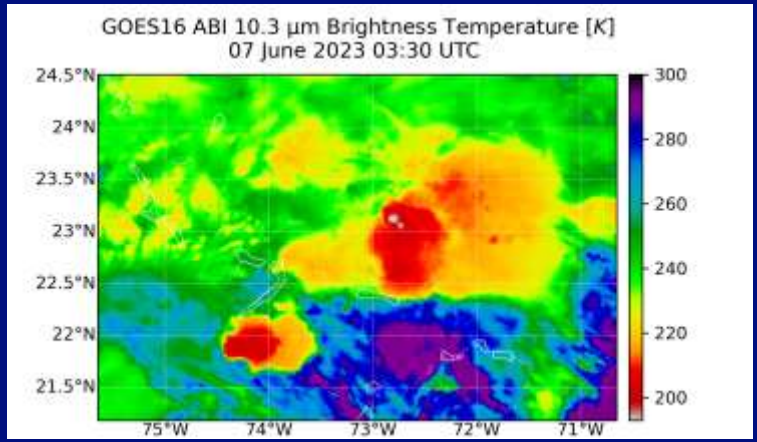
- 1 March 2022 – 1 March 2023
- <1% of RFS lightning events are highly polarized
- Most of these are over water



Case study, 06/07/2023







Work in progress

- General data processing pipeline
- Data products for public release
- Automated TIPP-finding algorithm with pulse time difference
- Differentiating types of TIPPs and their associated storms
- Comparisons with BLUEs (337 nm) – waiting for ASIM to point nadir (early 2024)
- Studying the most powerful lightning (RF and Optical)
- Collaboration with ground-based campaigns