

The Schuman Resonances Station in Mexico

ELF Electromagnetic Waves and Ionospheric Physics Seminar:
Development and measurements since 2014.

ELF Mexican Station, ERS-01 brief history and the team.

In 2011, a donation of three magnetometers promoted the design and installation of an ELF signals measurement and monitoring station.

In 2012, the UNAM provided funding and designated the location for the antenna's construction.

In 2013, the Schumann Antenna began operations under the supervision of Alexander Shvets.

The primary purpose was to study the effect of space weather on the SR measurements.



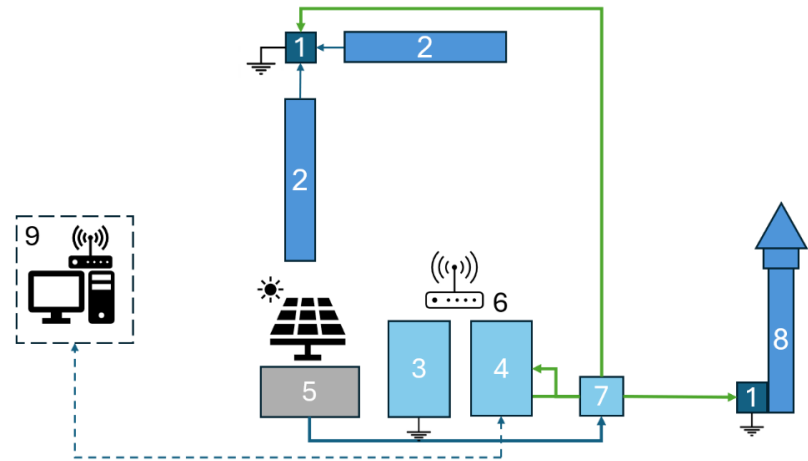
Location

- Coeneo, Michoacán. ($19^{\circ}48'19''$ N, $101^{\circ}41'39''$ W)
- Is part of to the National Laboratory of Space Weather.
- It is the only SR antenna in Mexico, Central America and Caribbean countries.

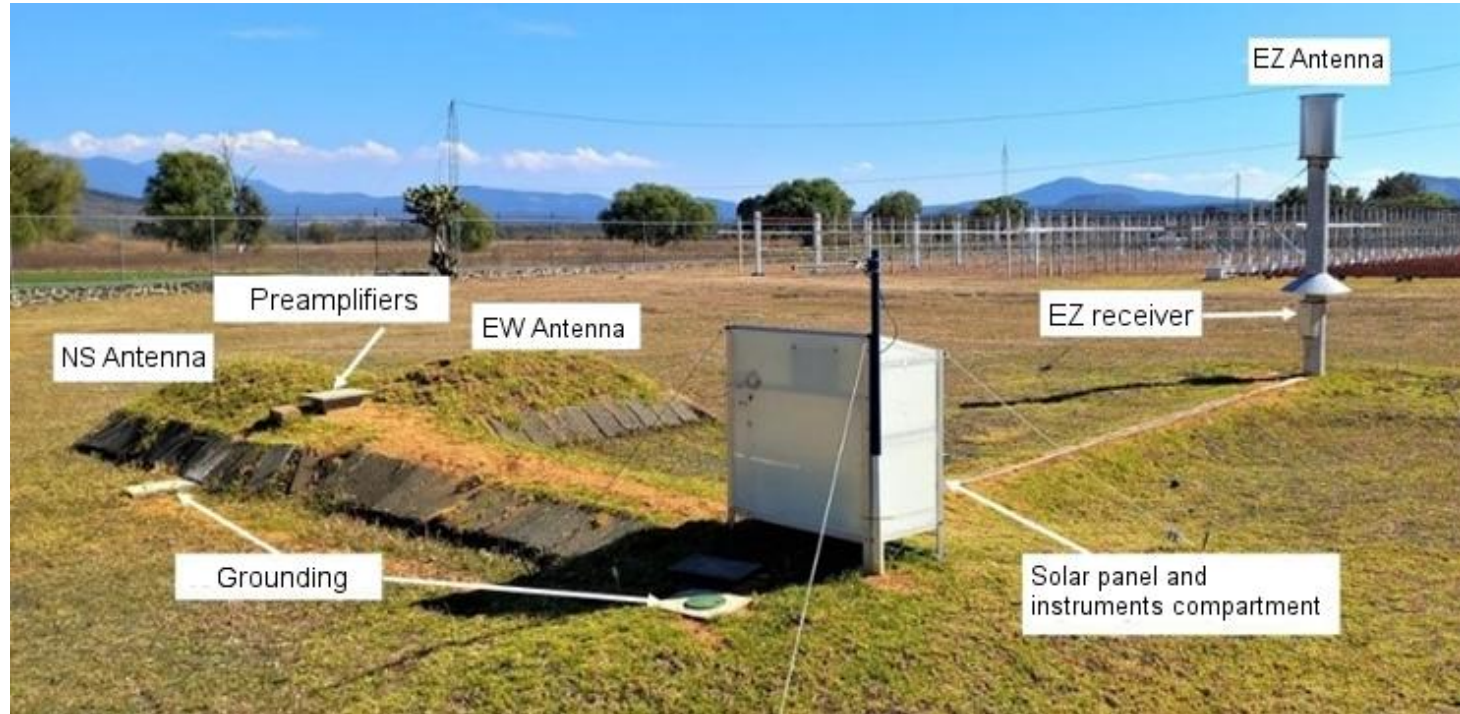


Main characteristics

- Two inductive antennas for the N-S and E-W horizontal components of the magnetic field detection.
- One capacitive antenna for vertical electric field detection.
- 1) preamplifiers; 2) magnetic antennas; 3) receivers; 4) 4-channel Analog-Digital Converter; 5) 12-volt solar panel battery, controller, and voltage regulators; 6) Wi-Fi transmitter; 7) distribution power; 8) Capacitive antenna; 9) Wi-Fi receiver, automatic signal processing, and data storage.



Main characteristics



Electronics

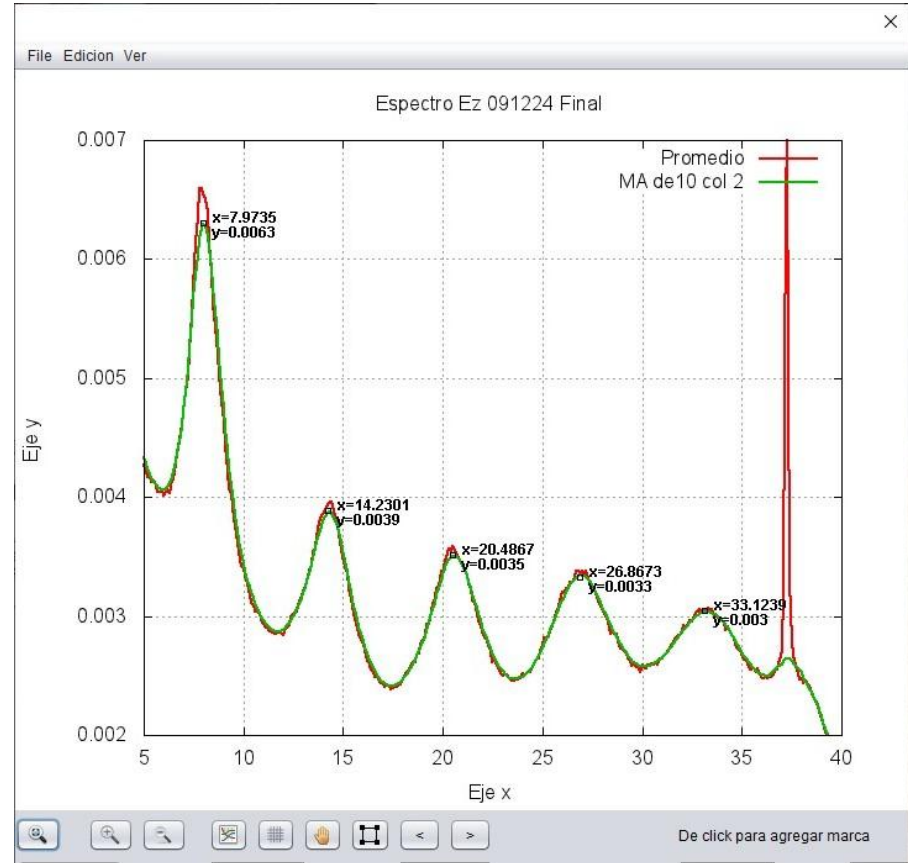


Data

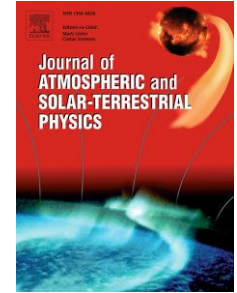


Data logging at station ERS-01, Coeneo, Mich. March 26, 2025. 7:06 UTC

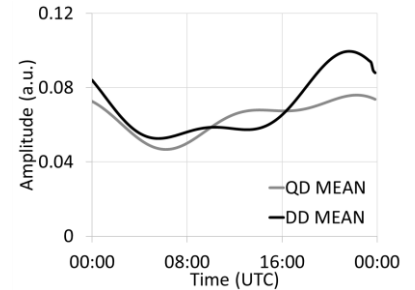
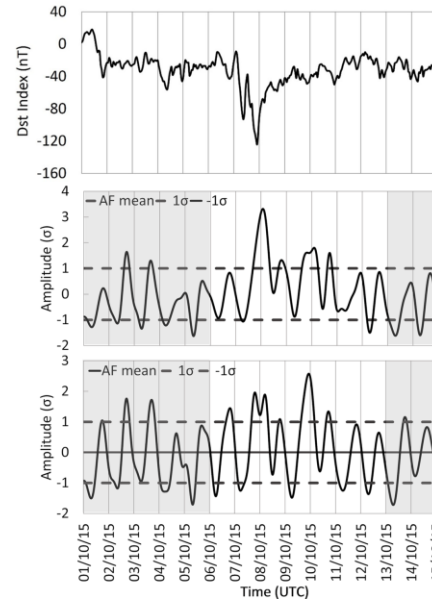
- In the time domain, the electrical and magnetic signals produce a constant background signal, which is the superposition of individual pulses of about 50 rays per second occurring around the world.
- The time series are processed by applying the fast Fourier transform (FFT) where the four main modes (8, 14, 20 and 26 Hz) can be observed.



Study of the effect of space weather on Schumann resonances



- The amplitudes of the SR were analyzed in periods of 14 days when a geomagnetic storm (GS) occurred in two channels of the station in Mexico.
- It is observed that amplitudes increase on days disturbed by GS.
- The average number of days of the diurnal variation also has an increase.

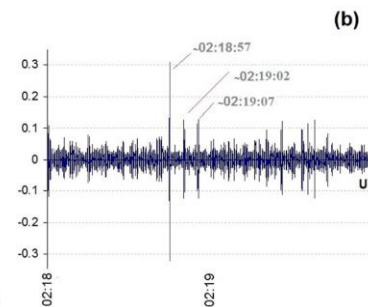
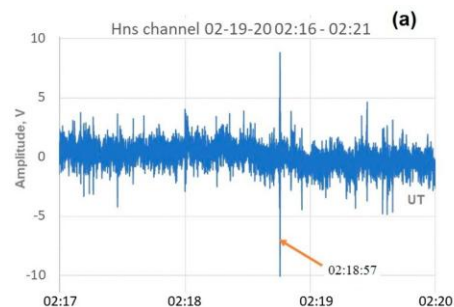
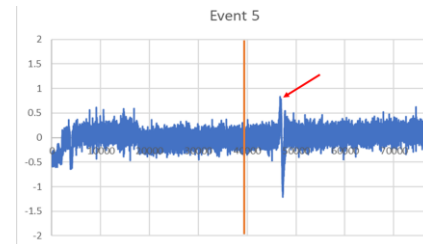
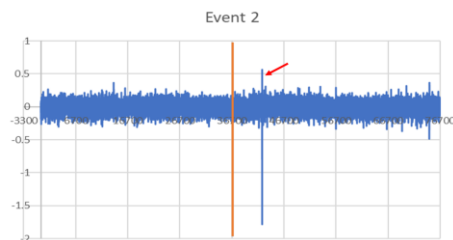


Pazos, M., Mendoza, B., Sierra, P., Andrade, E., Rodríguez, D., Mendoza, V., & Garduño, R. (2019). Analysis of the effects of geomagnetic storms in the Schumann Resonance station data in Mexico. *Journal of Atmospheric and Solar-Terrestrial Physics*, 193, 105091. <https://doi.org/10.1016/j.jastp.2019.105091>

Sensitivity of the SR waveguide to meteorite entry into the atmosphere.



- We study the effect of meteoroids that have entered the Earth's atmosphere at high speeds reported by CNEOS-JPL-NASA and by the one recorded in Mexico in 2020.
- We analyze the effect of the disturbance at the level of the ionosphere that could have a temporary effect on the cavity of the Earth's ionosphere where the Schumann resonance propagates.

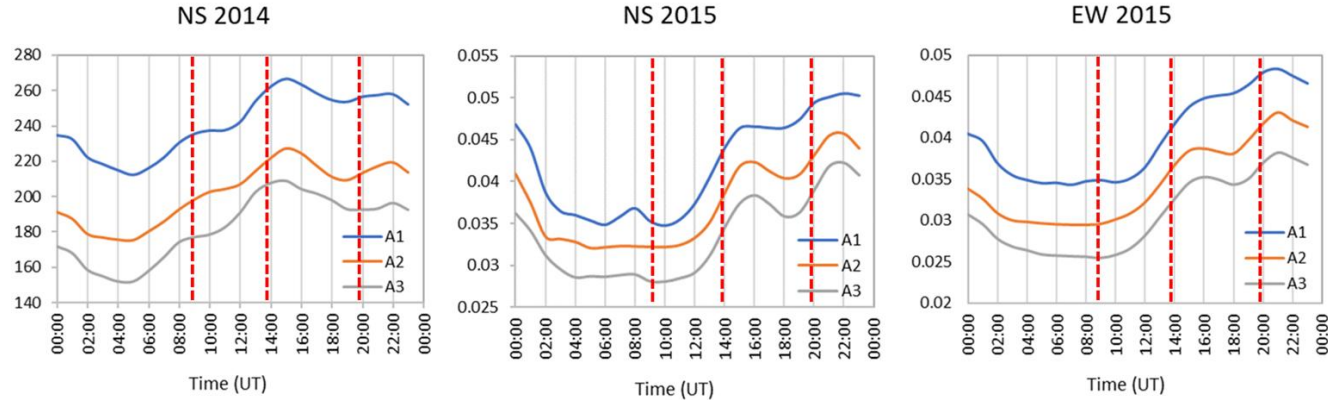


Sergeeva, M. A., et al. (2021). Assessment of Morelian Meteoroid Impact on Mexican Environment. *Atmosphere*, 12(2), 185.
<https://doi.org/10.3390/atmos12020185>



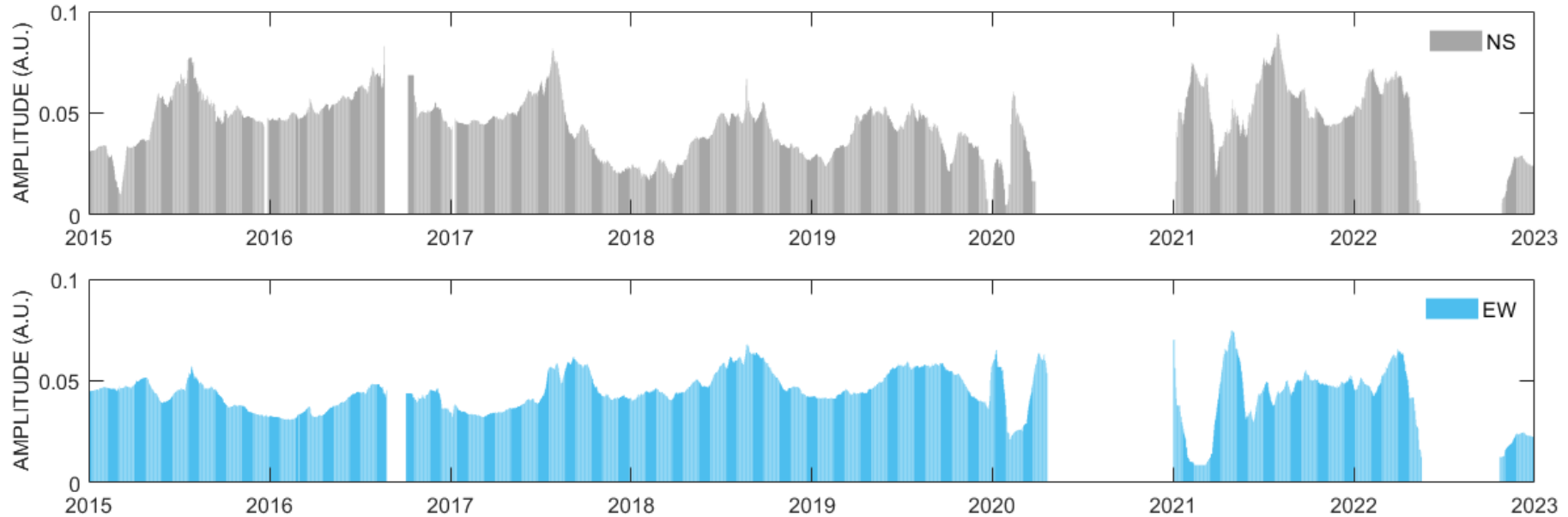
atmosphere

Identification of global thunderstorm activity in Schumann resonance recordings in Mexico.



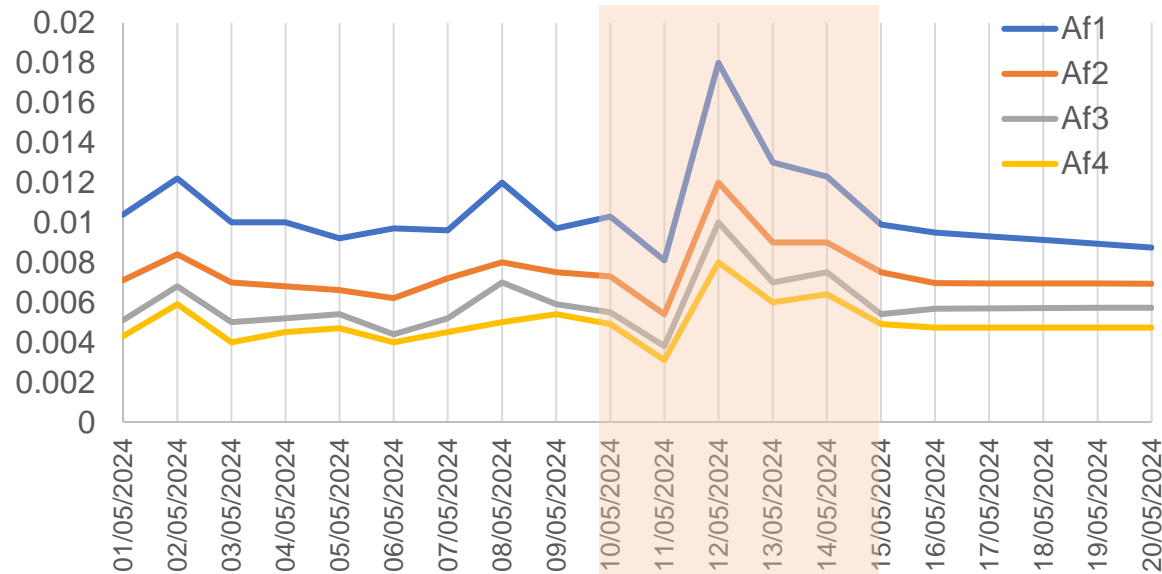
- In the three components of an ELF station it is possible to identify the maxima of global thunderstorm activity in the amplitude of the RS.
- The three dominant maxima are observed in all four seasons, although their amplitude varies throughout the year.
- Around 9 TU is the busiest in Asia, at 14 TU in Africa and at 20 TU in America.

Monitoring global thunderstorm activity over the long term



Pazos M. et al. (2024) (under review).

The Mother's Day geomagnetic storm on May 10, 2024.



J Americo Gonzalez-Esparza, et al. (2024) The Mother's Day geomagnetic storm on May 10, 2024: Aurora Observations and Low Latitude Space Weather Effects in Mexico. Space Weather, 22, e2024SW004111.
<https://doi.org/10.1029/2024SW004111>

A conceptual image featuring a white diamond-shaped kite flying in a dark, stormy sky. A bright, jagged lightning bolt strikes the kite. The kite's string is visible, ending in a large, ornate metal key. The text "Thank you!" is centered in the middle of the image.

Thank you!