

*PRELIMINARY REPORT
FROM
AWESOME VLF RECEIVER
SET UP IN ECUADOR*

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OUTLINE

- Set up Awesome VLF receiver
- Scientific interests
- Preliminary results
- Future perspectives

SET UP AWESOME VLF RECEIVER

- This presentation is devoted to present the preliminary report of the newly set up very low frequency (VLF) radio receiver observation station, at Quito latitude (**0° 12' 53.70" , S**).
- This station were set up by collaboration between the Quito Astronomical Observatory, Ecuador and Stanford University, USA under the International Heliophysical Year2007/United Nations Basic Space Science Initiative (UNBSSI) program.

Quito VLF station is part of Atmospheric Weather Electromagnetic System for Observation, Modeling and Education (AWESOME) network being operated globally to study the ionosphere and the magnetosphere, registering electromagnetic waves in extremely low frequency (ELF) and VLF bands.

This Quito station provides additional Facilities to study the VLF phenomena at low Latitudes which were not studied earlier.

Quito Astronomical Observatory

- **Latitude:**
0° 12' 53.70" , S
- **Longitude:**
78° 30' 9.20" , W
- **Altitude:**
2 818,05 m



Stablished in 1873

Quito Astronomical Observatory

Stablished in 1873



Crossed magnetic loop antennas



GPS Antenna

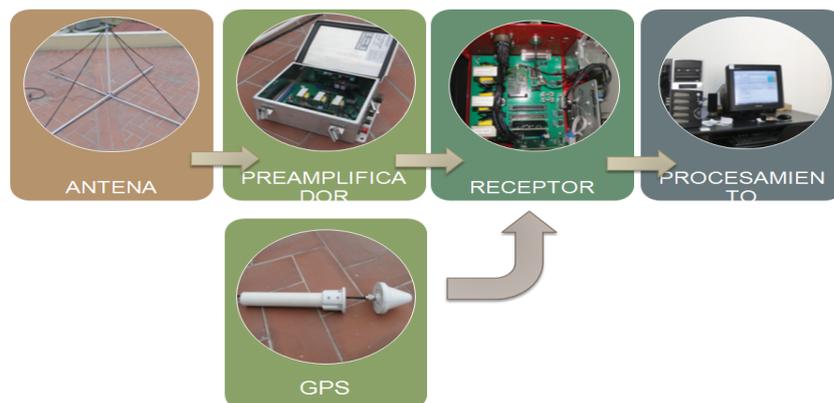


Pre-amplifier

Receiver



Data recording computer



SCIENTIFIC INTERESTS

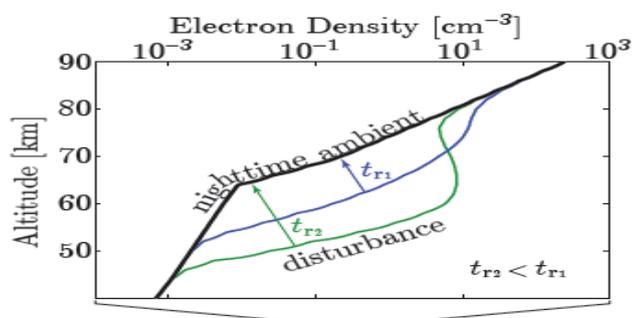
Waves vary over a wide frequency range:

- Ultra low frequency (ULF; 1–30 Hz),
- Extremely low frequency (ELF; 30–3000 Hz),
- Very low frequency (VLF; 3–30 kHz),
- Low frequency (LF; 30–300 kHz),
- Medium frequency (MF; 0.3– 3 MHz),
- High frequency (HF; 3–30 MHz) and
- Ultra high frequency (UHF; >30 MHz).

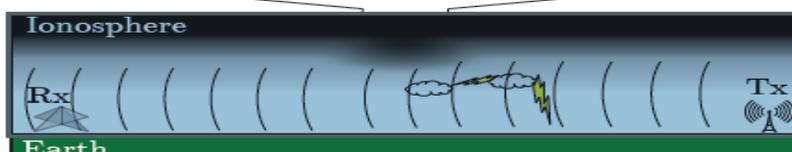
Maximum energy radiation is contained in the ELF/VLF band.

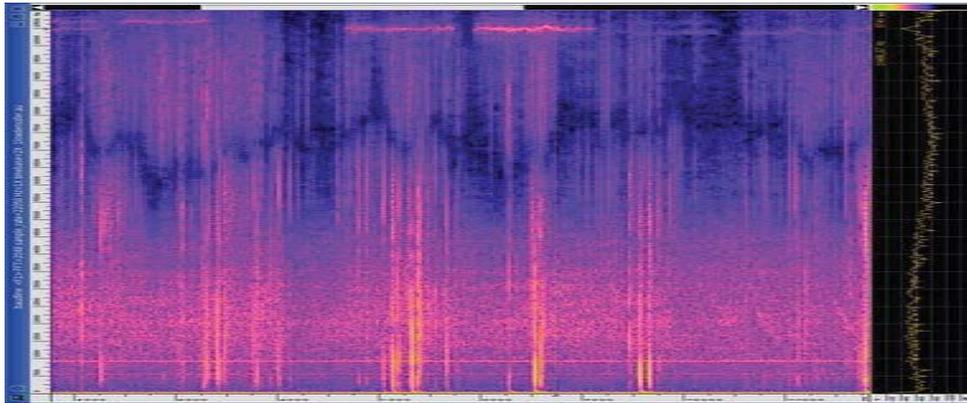
POWERFUL REMOTE SENSING TOOL

Atmospherics (sferics): Propagation of atmospherics traveling thousands of kilometres in the so-called earthionosphere waveguide (EIWG)



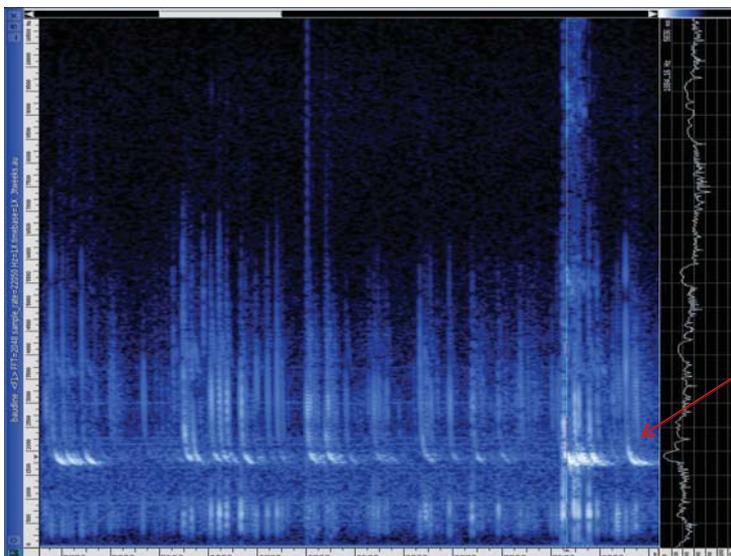
Little attenuation:
(~2–3 dB/1000 km)





- **Tweaks:**

Dispersion of signals except near the cut-off frequency of the waveguide . VLF/ELF bands do not exhibit any dispersion



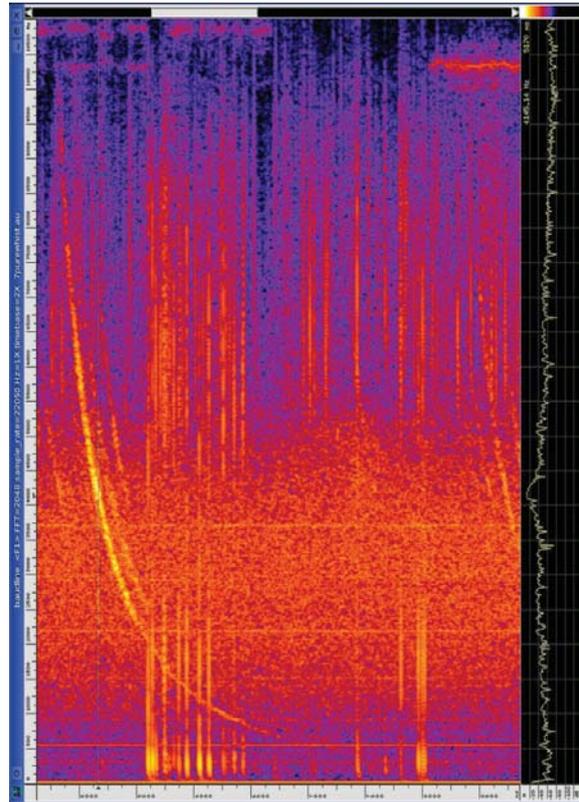
Spectral hook: 1.7 to 1.9 KHz.

- **Whistlers:** Produced by lightning strikes (mostly intraclouds):
- **ULF:** 1–30 Hz with a maximum at: 3 to 5 KHz

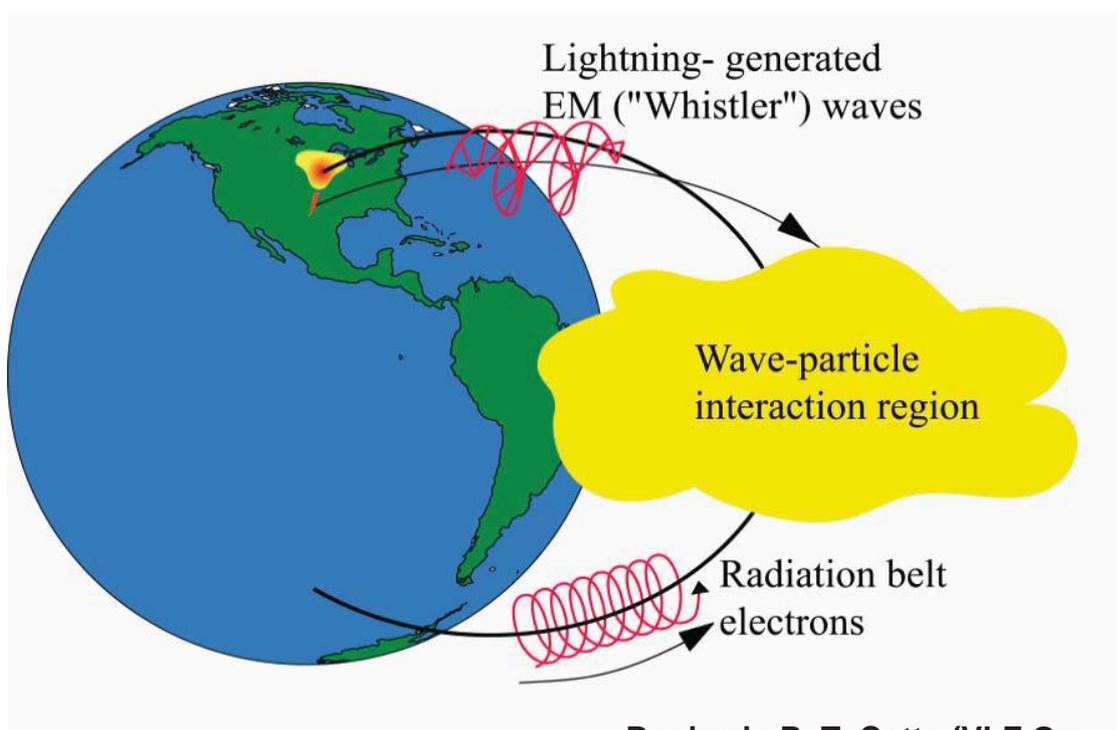


Is essentially a sferic that traveled an even longer distance than a Tweek.

More dispersion!



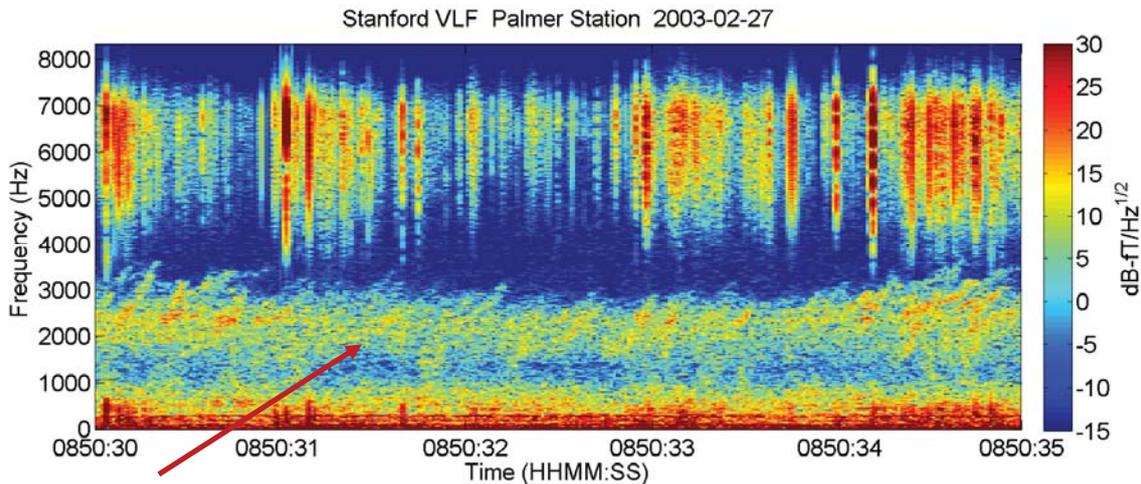
Whistler waves:



Benjamin R. T. Cotts (VLF Group)

Clorus:

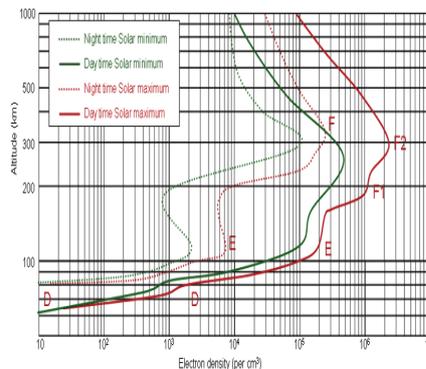
Unexplained phenomenon at sunrise, due to electrons from de Van Allen belts fall to the earth surface as audible radio waves.



Clorus at 1 to 3 KHz

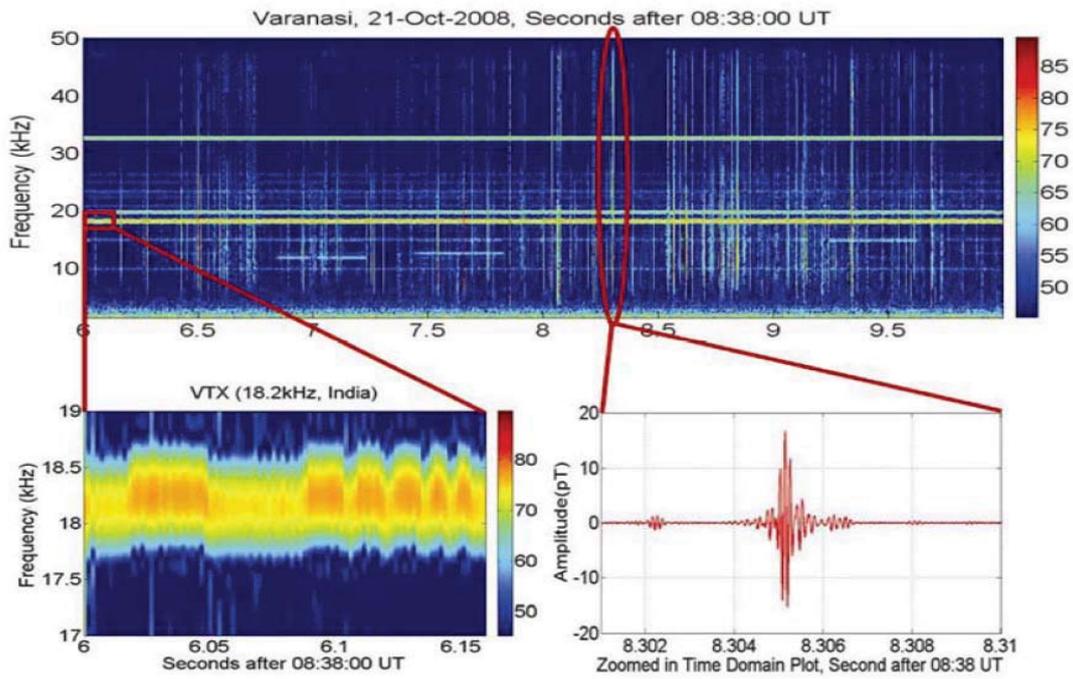
D-REGION IONOSPHERE

- ELF/VLF waves can be used for the study of D-region ionospheric disturbances, caused by various geophysical phenomena:
 - solar flares
 - lightning induced electron
 - precipitations (LEP's)
 - cosmic gamma ray flares
 - effect of geomagnetic storms
 - earthquake precursors, etc.

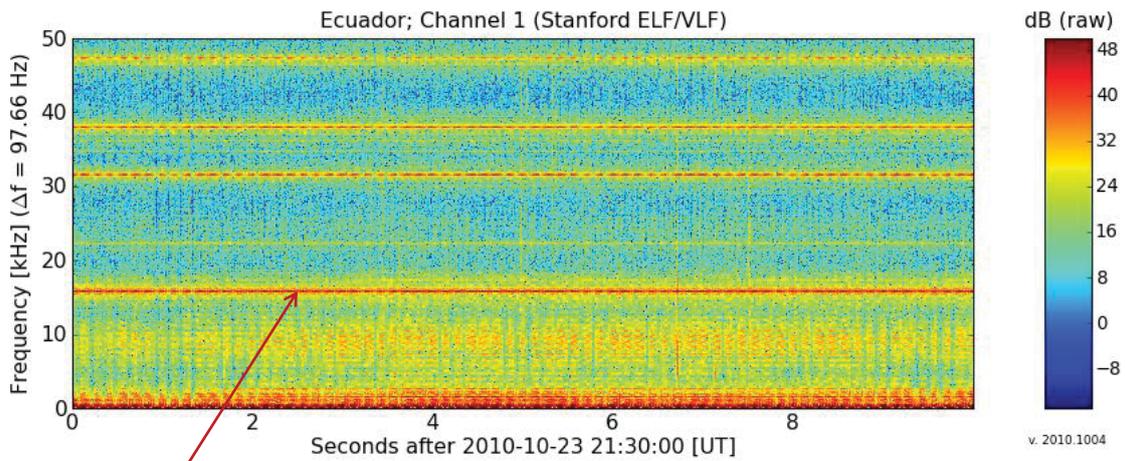


VLF signals are extremely important

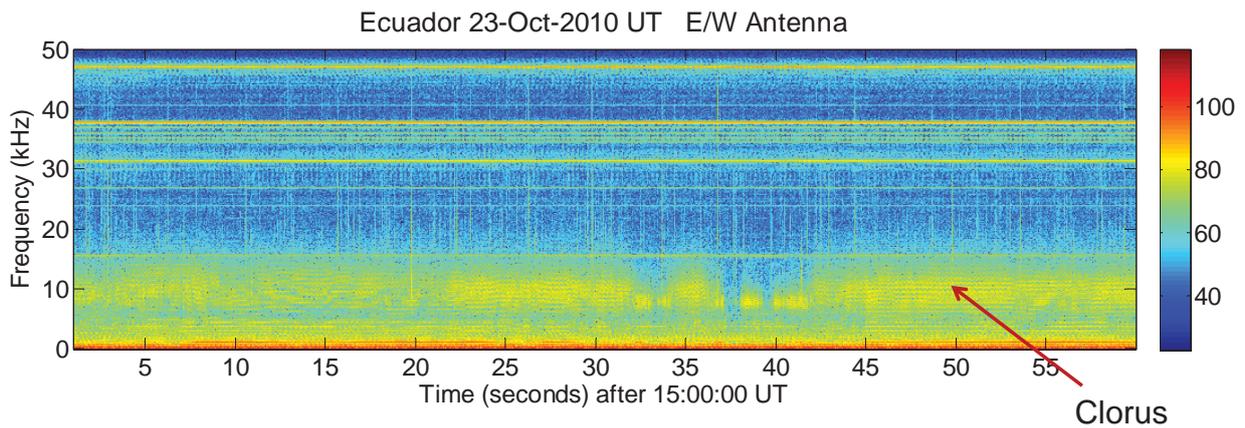
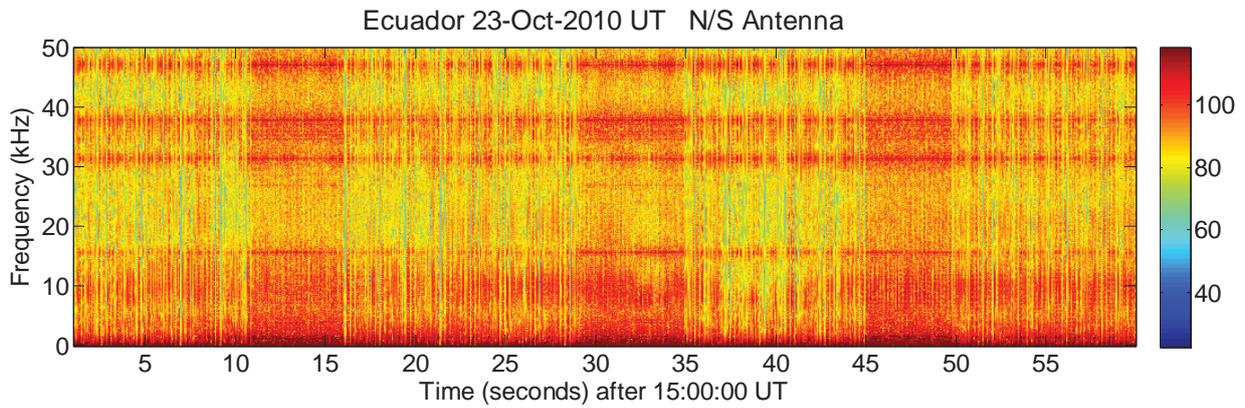
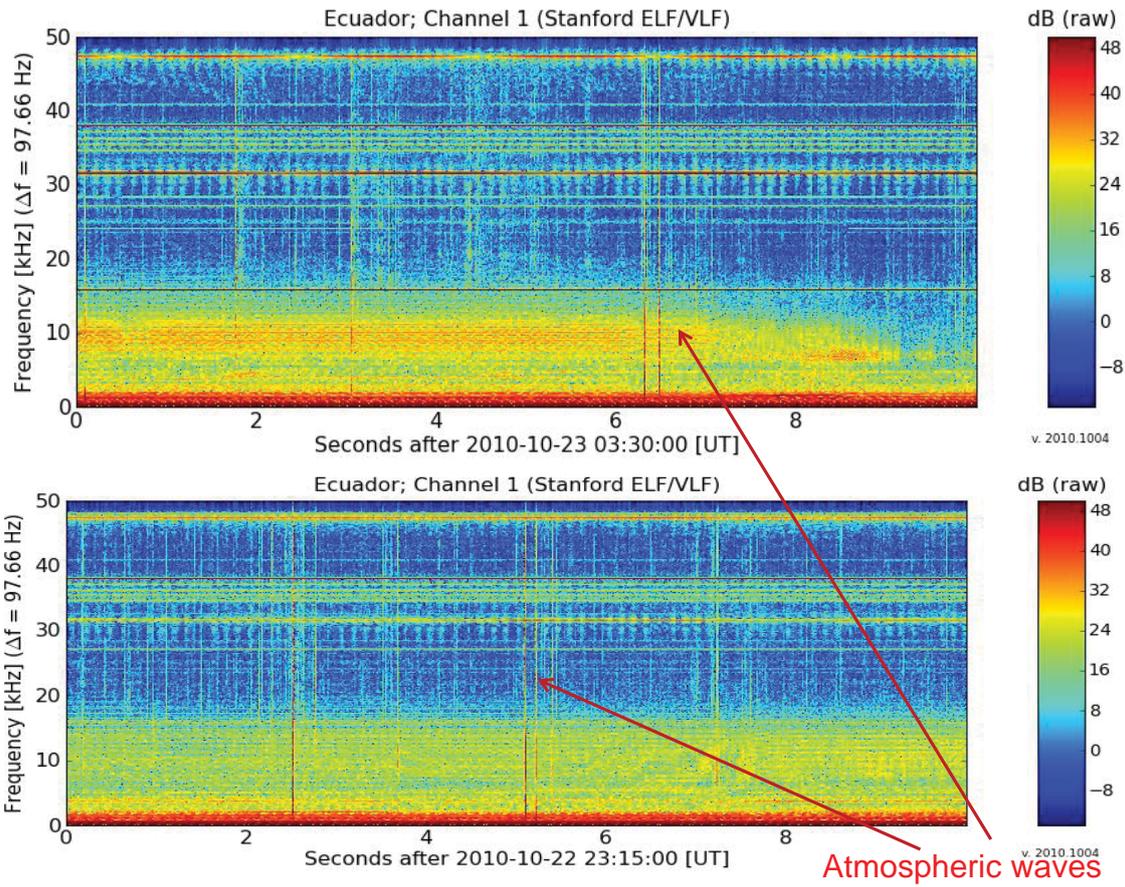
PRELIMINARY RESULTS

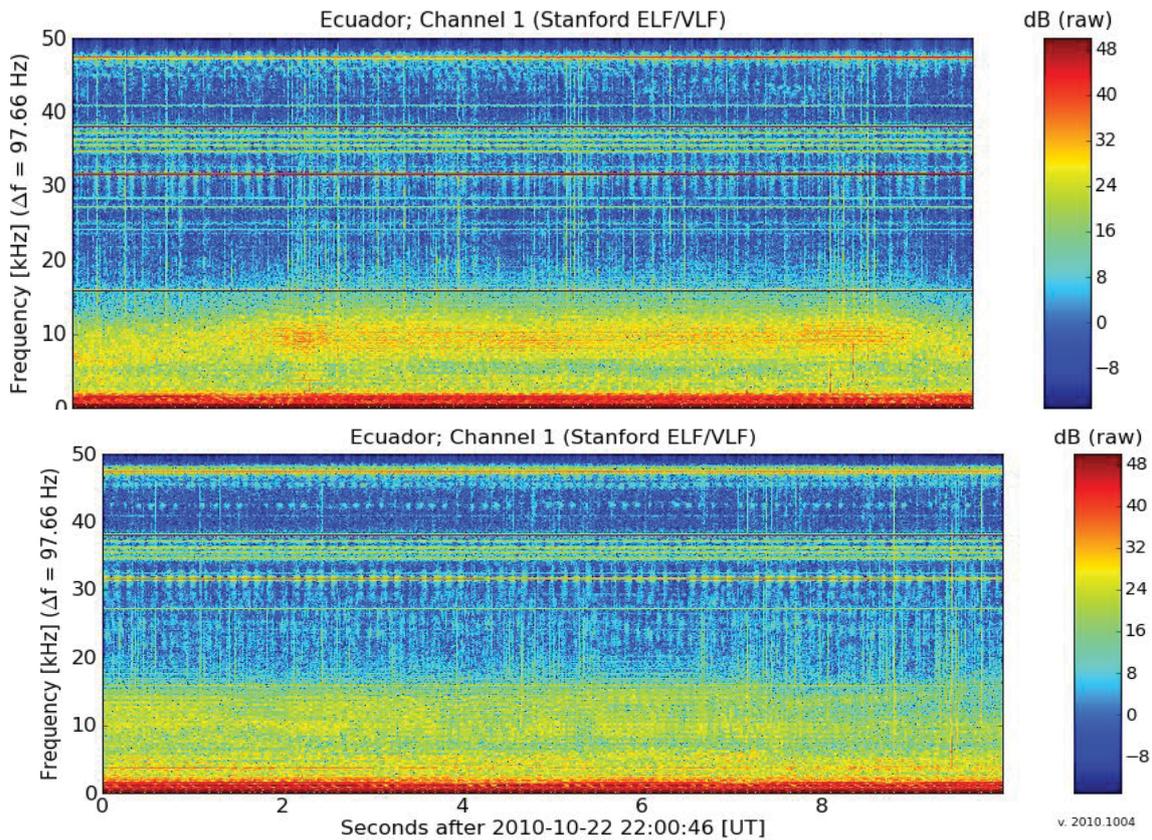


DYNAMIC SPECTRA QUITO STATION



VLF transmitters operating globally





FUTURE PERSPECTIVES

- Improve the reduction and analysis process of the obtained data for publication of scientific papers.
- Increase the number of installed AWESOME instruments.
- Incorporating to the space science station new instruments like: SAVNET, CALLISTO, GPS, MAGDAS and so on.

*Third ISWI
2012 UN/ECUADOR Workshop
on Basic Space Science,
Quito, Galápagos.*

*Observatorio Astronómico de Quito
Quito, Ecuador*

HOST INSTITUTION:
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Quito Astronomical Observatory

Stablished in 1873



REPÚBLICA DEL ECUADOR

Escuela Politécnica Nacional

"E SCIENTIA HOMINIS SALUS"

140 años



140 años

El bienestar del hombre proviene de la ciencia





It is a [UNESCO World Heritage site](#): wildlife is its most notable feature

The Galápagos Islands are the **Galápagos Province** of Ecuador and part of the country's national park system



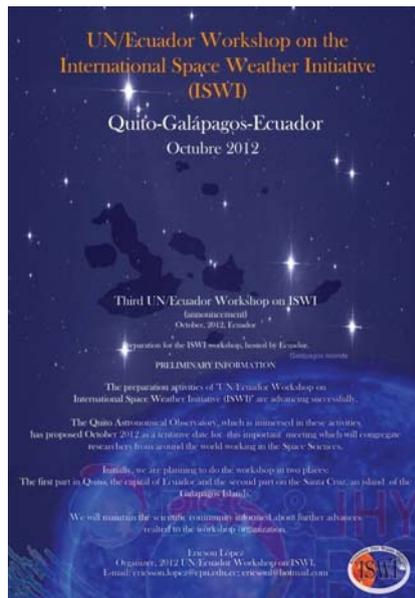
INVITATION

- **TO ENTER IN COLLABORATION** with us for the installation of equipment and scientific instruments right on the equator:
- GPS SYSTEMS
- AWESOME RECEIVERS
- MAGNETOGRAPHS
- SOLAR RADIATION MONITORING EQUIPMENT
- and so on...

Space Science Division of Quito Astronomical Observatory

Coordinates: $0^{\circ} 12'$
 $38''$ S
 $78^{\circ} 29'$
 $20''$ O





YOUR ARE WELCOME TO 2012 UN/ECUADOR WORKSHOP IN ISWI IN ECUADOR