



# **Narrowband and Wideband Channel Sounding of an Antarctica to Spain Ionospheric Radio Link**

**M. Hervás, R.M. Alsina-Pagès,**

**F. Orga, J.L. Pijoan and D.Badia**

**GR-SETAD La Salle, Universitat Ramon Llull**

**D. Altadill**

**Observatori de l'Ebre, (OE), CSIC - Universitat Ramon Llull,**

*(mhervas@salleurl.edu)*

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## Antarctic Project

Long-haul link between Antarctica to Spain to transmit data from remote sensors.

Oblique Ionospheric Sounder

**12.760Km**



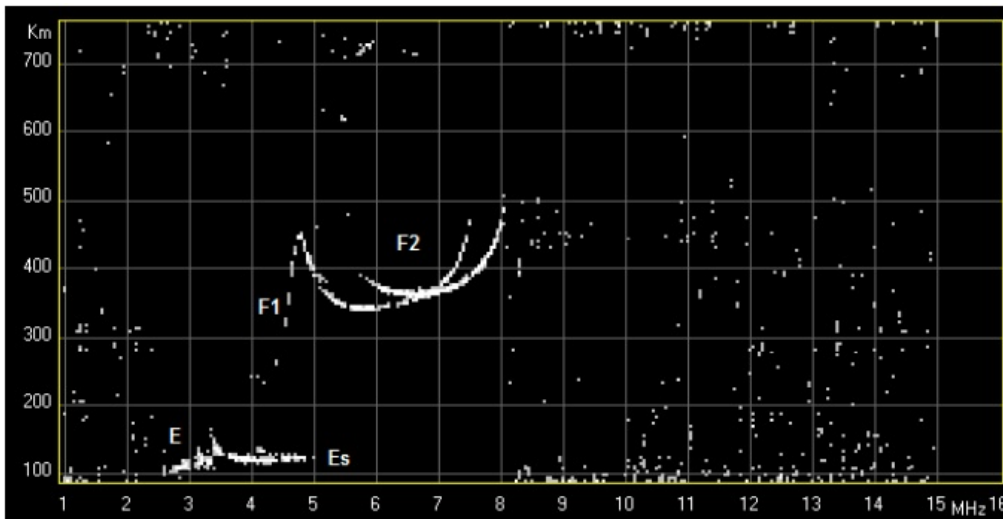
## 2. Measured Parameters

### Geomagnetic Parameters



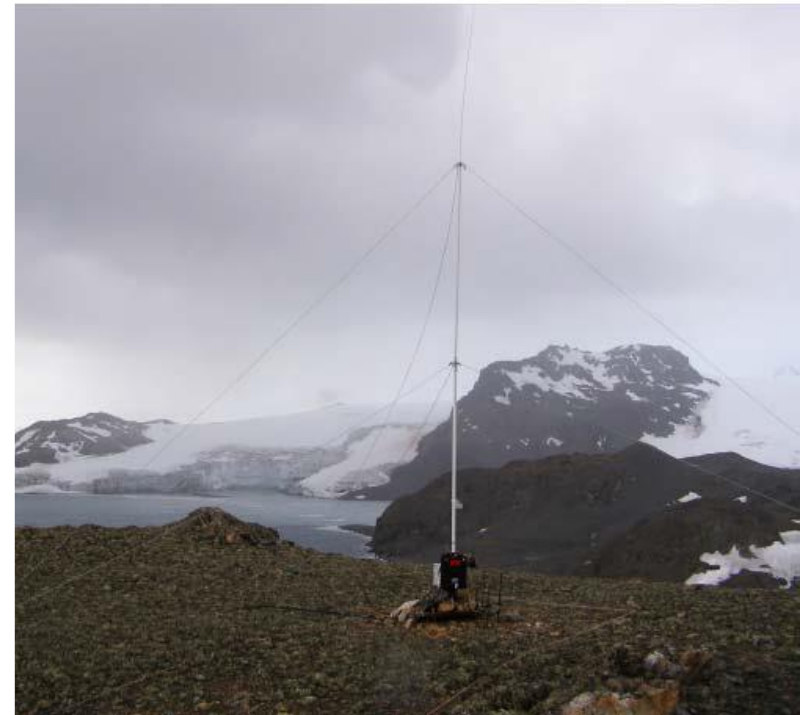
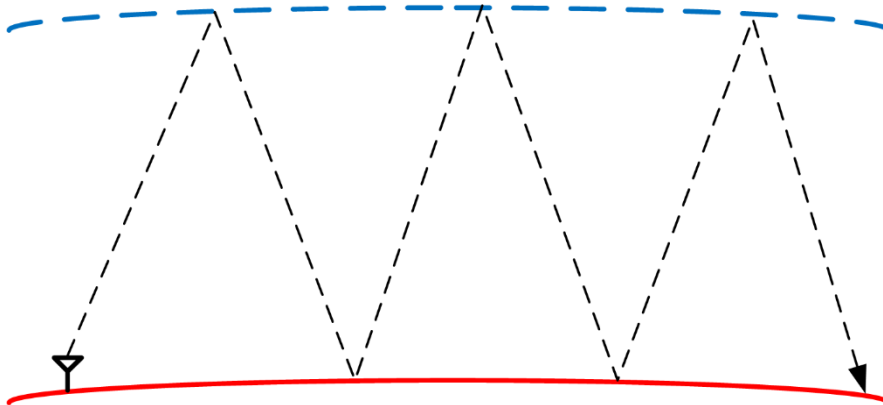
## 2. Measured Parameters

### Vertical ionosonde



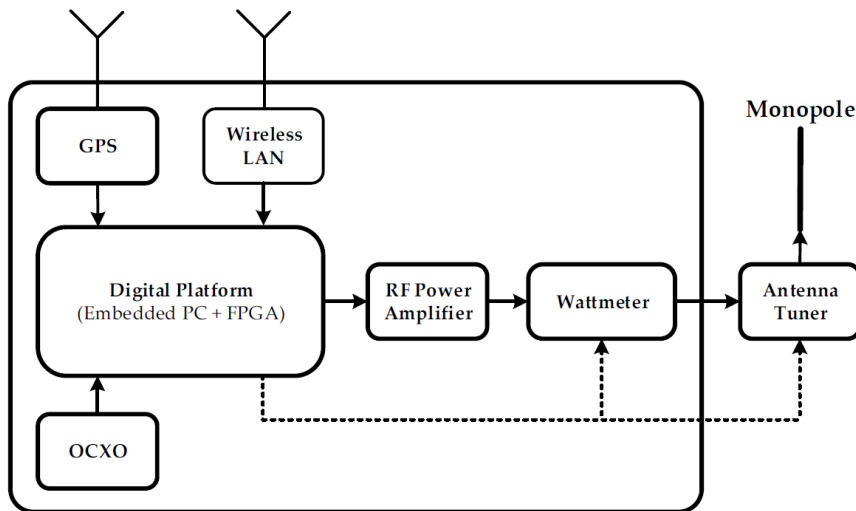
## 2. Measured Parameters

### Oblique ionosonde

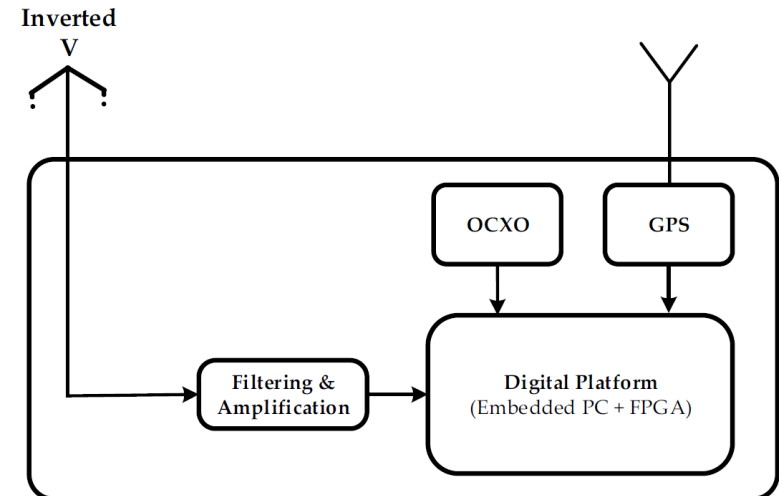


# 3. System Description

## Transmitter



## Receiver





# 4. Data Analysis

## Narrowband

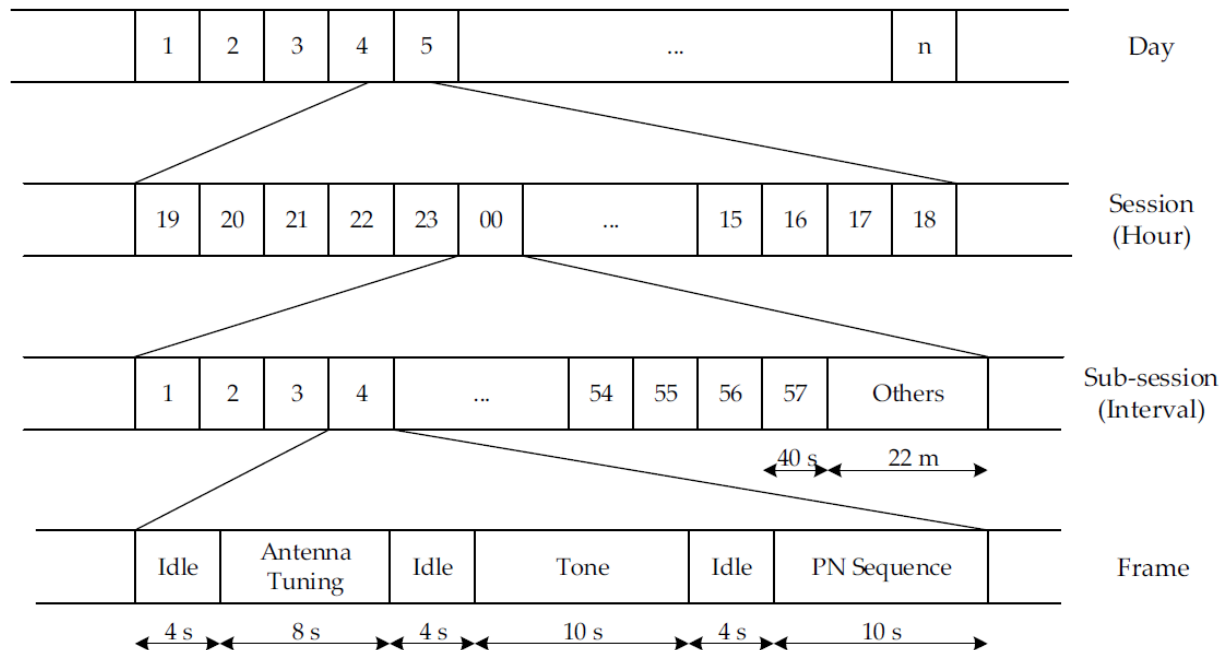
SNR

Availability

## Wideband

Doppler Spread

Multipath Delay Spread



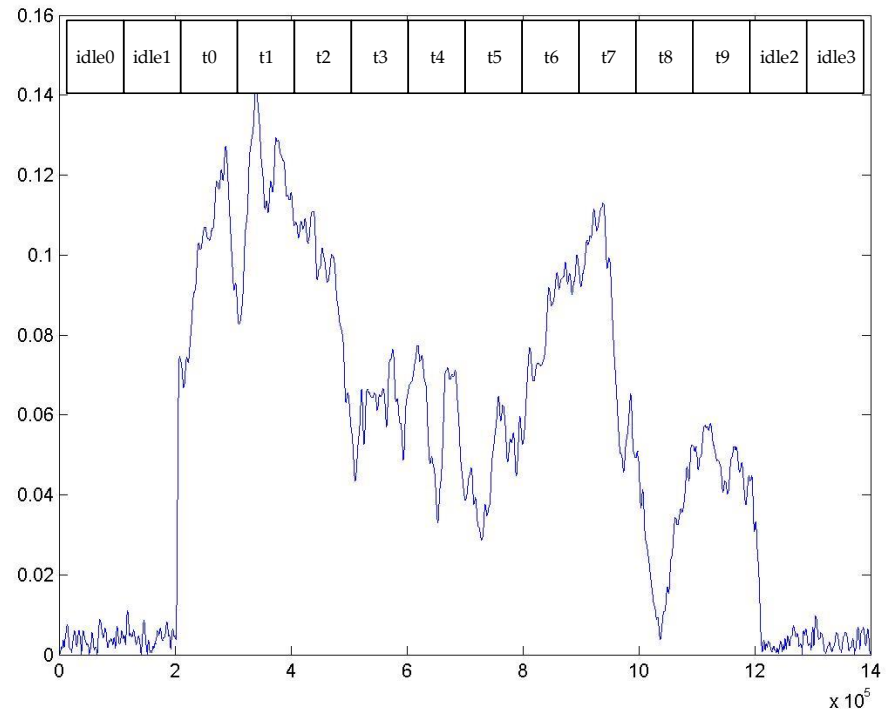
# 4. Data Analysis

## Narrowband sounding

Kaiser windowing of 10 Hz of BW

Signal is measured in 10 slot t0-t9

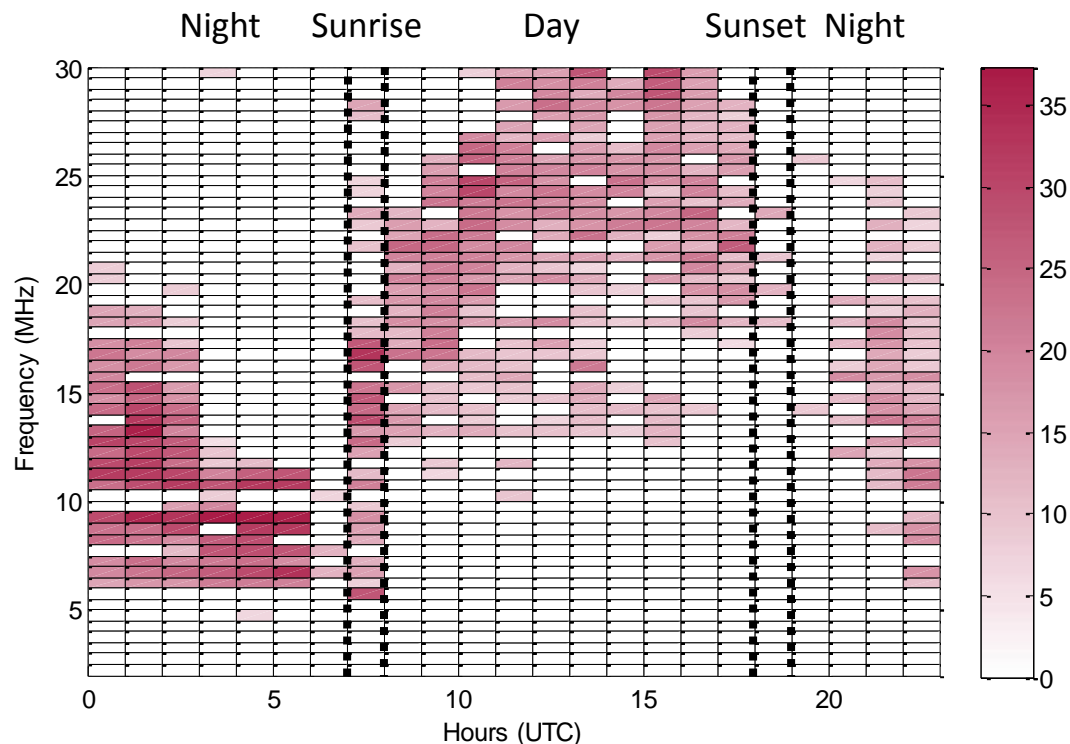
Noise is measured in 4 idle slots



# 4. Data Analysis

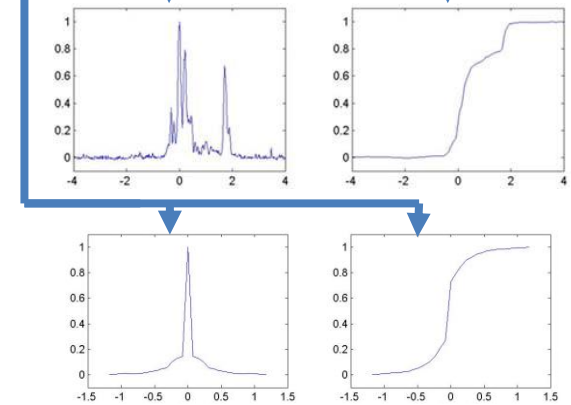
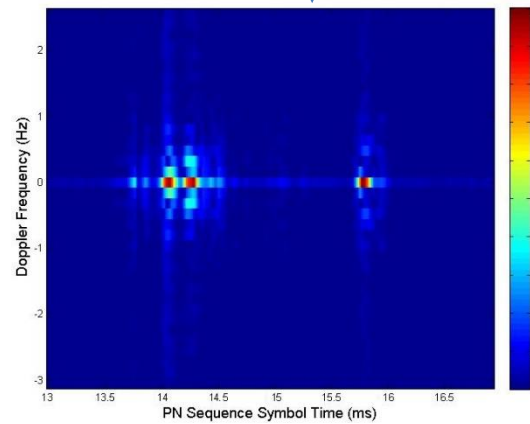
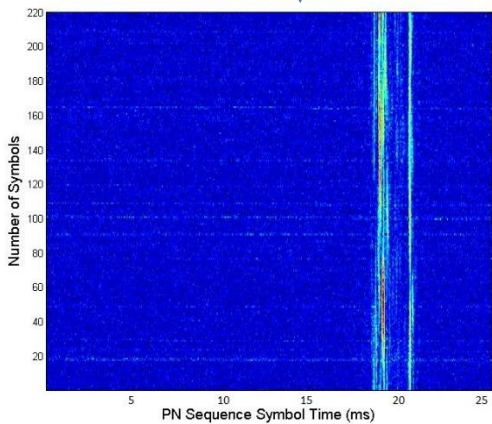
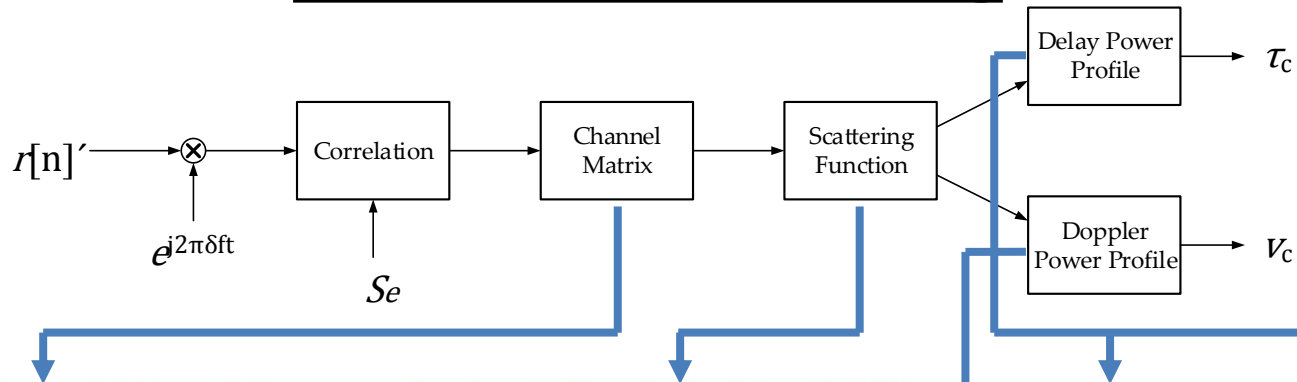
## Narrowband sounding

SNR (dB) of February 17<sup>th</sup> (in dB) over a bandwidth of 10 Hz



# 4. Data Analysis

## Wideband sounding

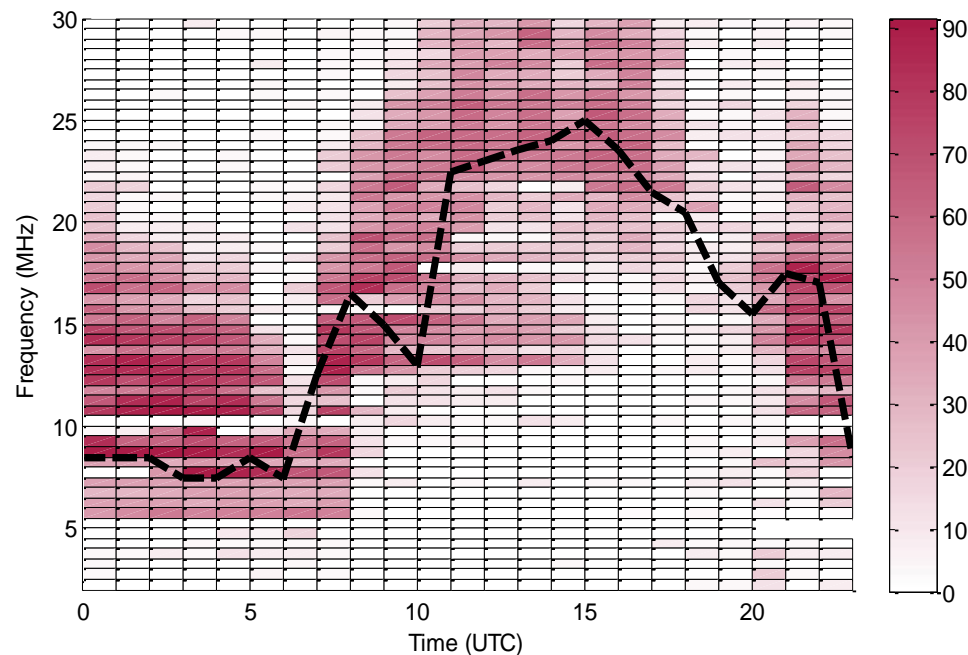


# 5. Results

## Narrowband sounding

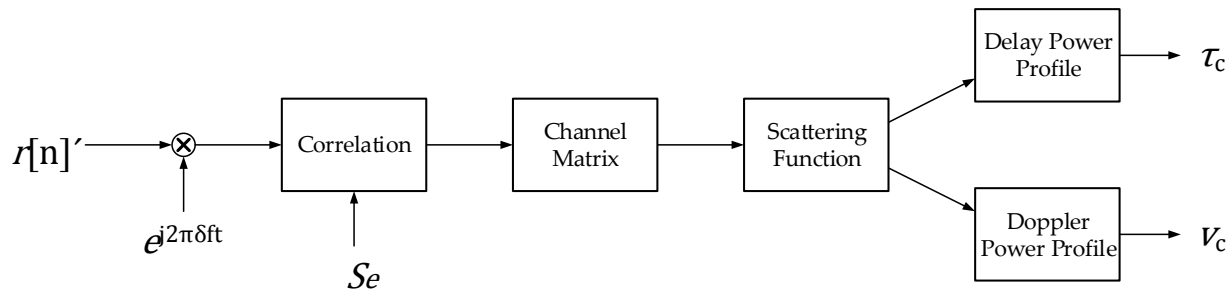
Availability (%):

if  $SNR > 3\text{dB}$  over the 70% of time or if  $SNR > 6\text{dB}$  over the 50% of time

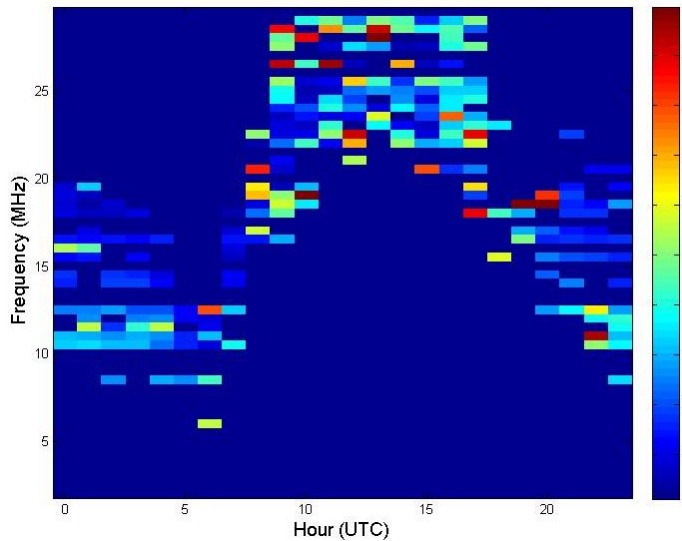


# 5. Results

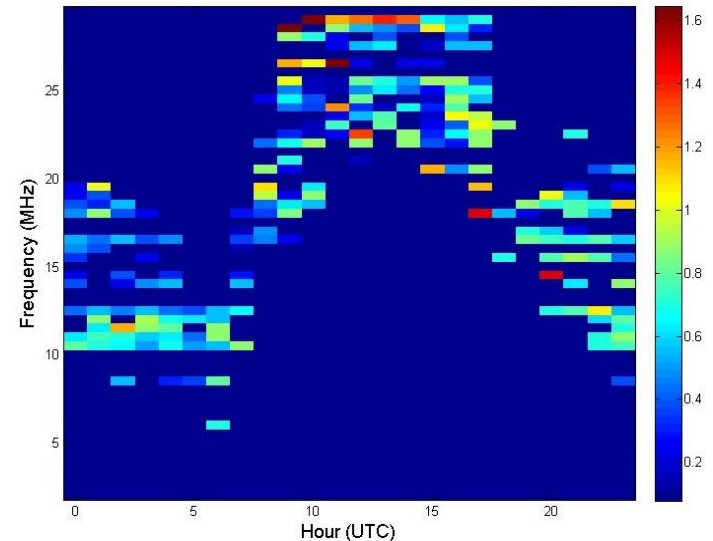
## Wideband sounding



Mean value for Delay Spread in ms



Mean value for Doppler Spread in Hz



# 5. Conclusions

## This paper presents

Narrowband: SNR and availability.

Wideband: Time and Doppler scattering.

This allow us to define fully the physical layer: Robust and high throughput mode.

## Future work

Study the historical series for the entire solar cycle.

End the design of the HF modem: modulation, coding and interleaving

Finally

laSalle

Ramon Llull University

**Thank you for your  
attention**