

DETECTING WHISTLERS WITH A VLF ANTENNA LOCATED IN HUMAIN (BELGIUM)

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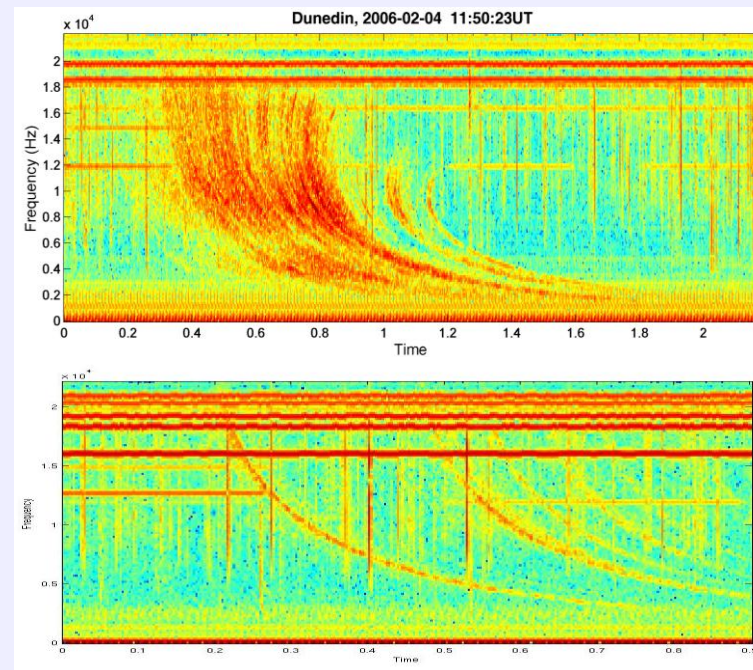
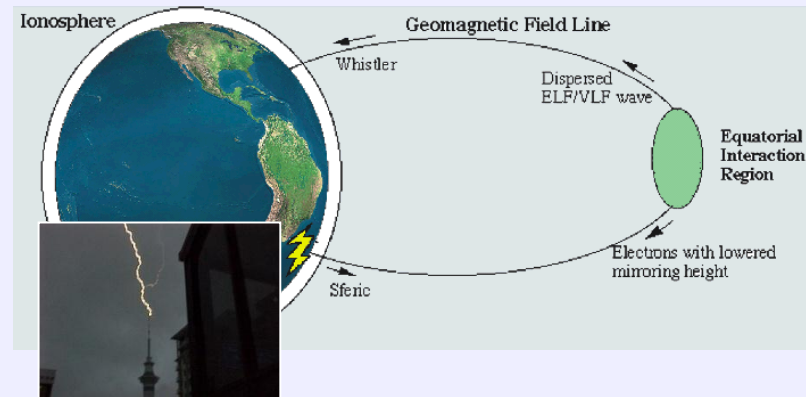
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Whistlers

- Whistlers are VLF (3-30 kHz) emissions initiated by lightning, propagating along magnetic field lines, observed on ground and in space
- Whistlers have particular frequency-time characteristics acquired as they propagate through the magnetospheric plasma
- Propagation time delay of whistlers depends on plasma density along propagation paths
 - ⇒ Possibility to derive plasma density (in plasmasphere) from whistlers measurements



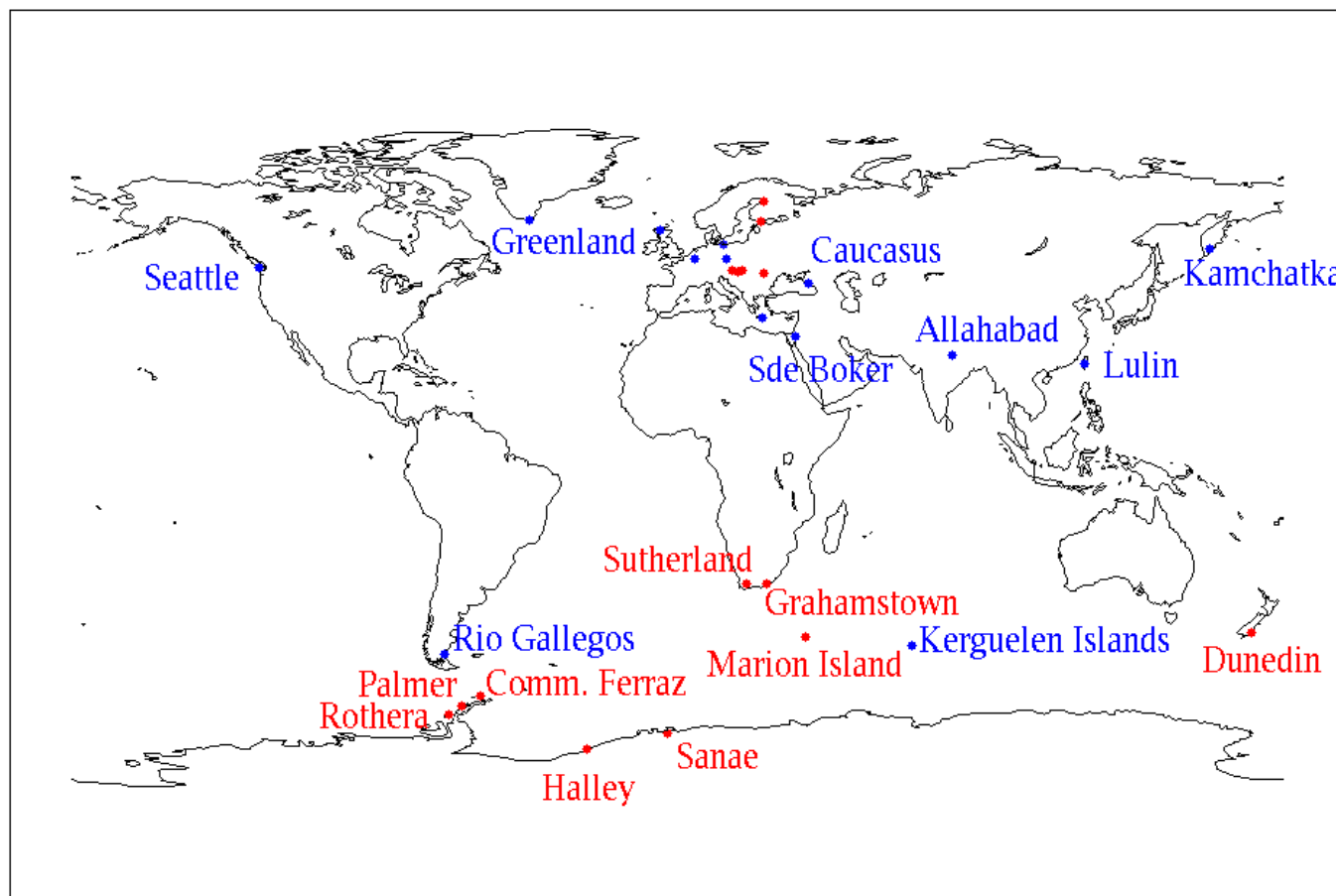
AWDANet in Europe

- AWDANet = Automatic Whistler Detector and Analyzer systems' Network
- Network of AWDA systems covering low-, mid- and high (magnetic) latitudes since 2002 including conjugate locations
- Network initiated by J. Lichtenberger from Hungary
- Same type of antennas with same data analysis software
- In Europe, 7 antennas **in operations** and 4 antennas planned or in preparation



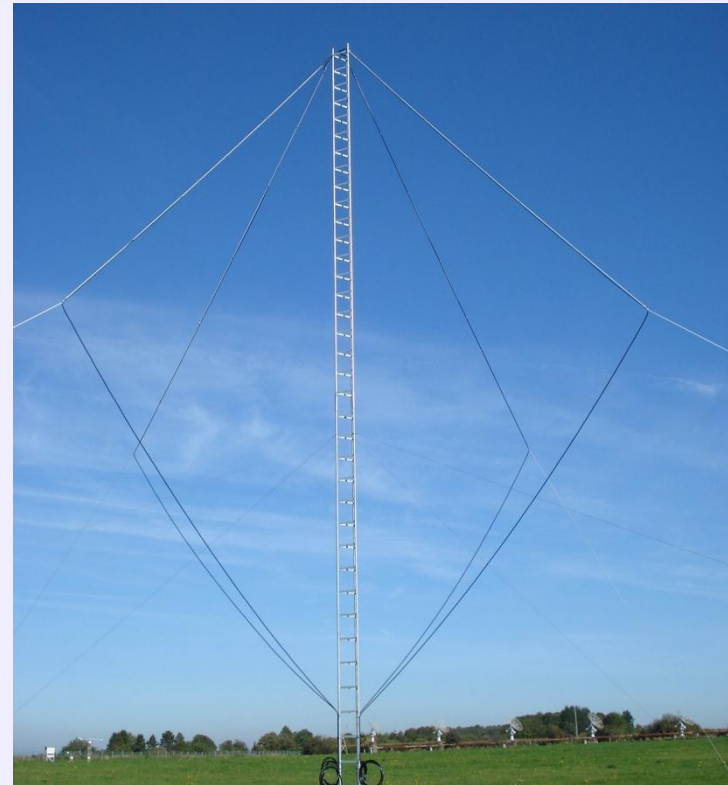
AWDANet in the World

- In World except Europe, 9 antennas **in operations** and 9 antennas **planned or in preparation**
- Particular search of locations at conjugate points of Europe antennas



VLF Antenna in Humain

- Selection of the site in March 2010
- Final installation of the setup in April 2011
- Antenna : 2 perpendicular magnetic loops in diamond shape , N-S, E-W orientation, 12 m mast, 50 m² each (half of normal AWDANet antennas)



First results 1/2

- First data in April 2011
- Automatic pre-detection + manual selection
- Spectrograms (0-20 kHz ; 10 seconds)

• Perturbations :
fixed freq.: e.g. 16, 18 & 20 kHz
(military transmitters or parasitic sources)

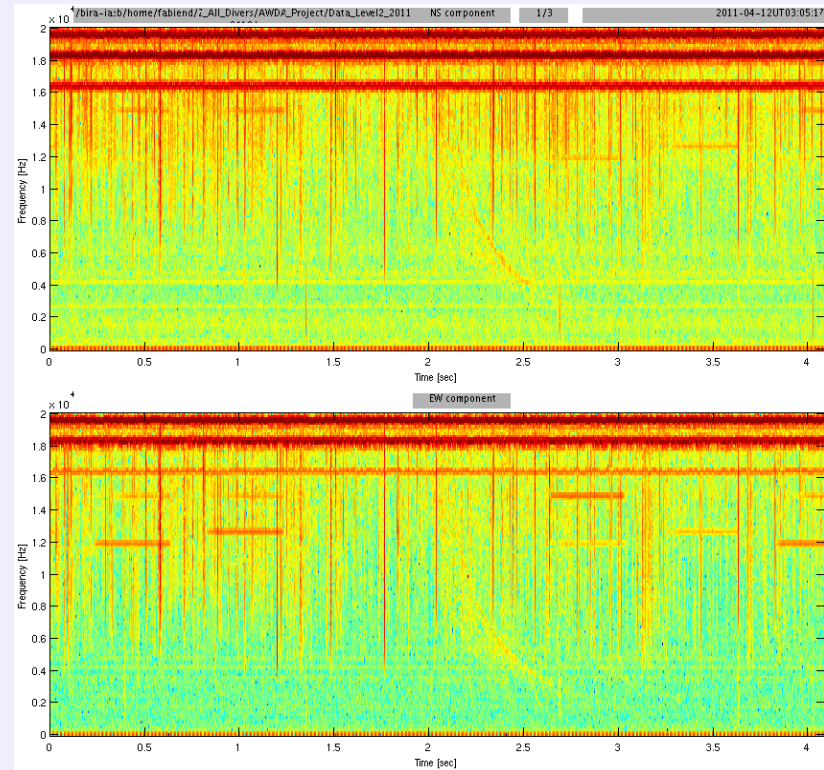
Fixed duration (~ 0.5 s), regular, high
freq. (e.g. 12 & 15 KHz)

Short duration, wide bandwidth

⇒ Whistlers still detectable

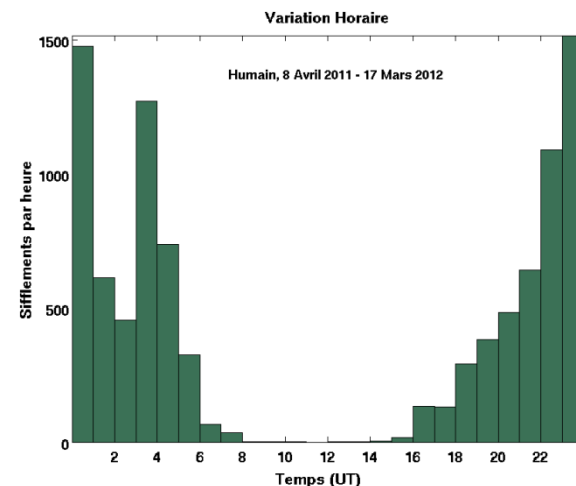
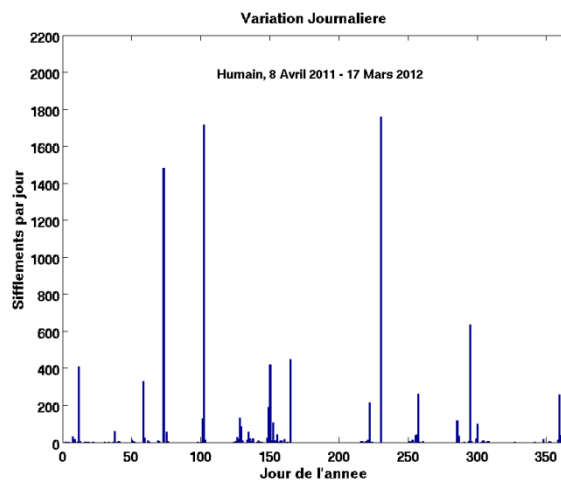
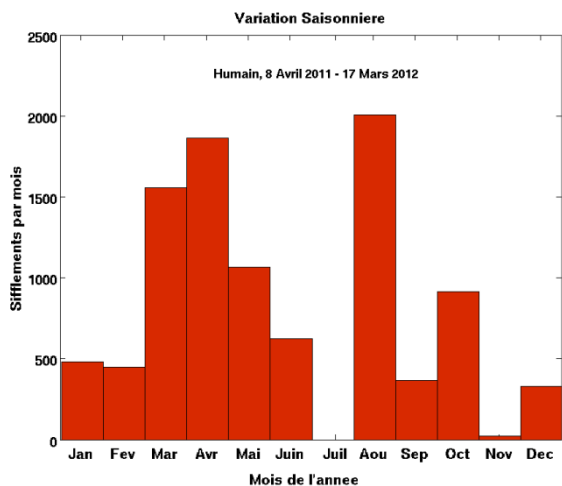
Example

- | | | | |
|---|--------|--------|--------|
| • L (radial distance) [RE] | 2.32 | 2.18 | 2.41 |
| • N_{eq} (equatorial density) [cm ⁻³] | 2470.7 | 2702.7 | 2455.8 |
| • F_{req} (equatorial gyro frequency) [kHz] | 69.85 | 83.9 | 62.08 |



First results 2/2

- ~1 year of data: 8 April 2011 - 17 March 2012
No data : 15 April - 5 May, 16 June - 31 July, 1 week end of Sept., 8 - 23 Nov., 1 week beginning of December: **Total ~ 3 months**
- Globally, less whistlers than at other AWDANet stations nearby (Tihany)
 - Missing data
 - Antenna area / preamp. gain
 - Investigation of thunderstorm activity at conjugate point
- Whistlers detected mainly during night, especially ~ 22:00 - 01:00 UT as reported in other studies
- Max. in spring: thunderstorm activity in south hemisphere
- Max. in August: requires further investigations



Future

- Perform consistent statistical analysis
- Derive plasma density from whistlers observations
- Compare studies with other antennas of AWDANet
- Perform conjugated analysis with in-situ measurements of plasma density in plasmasphere

