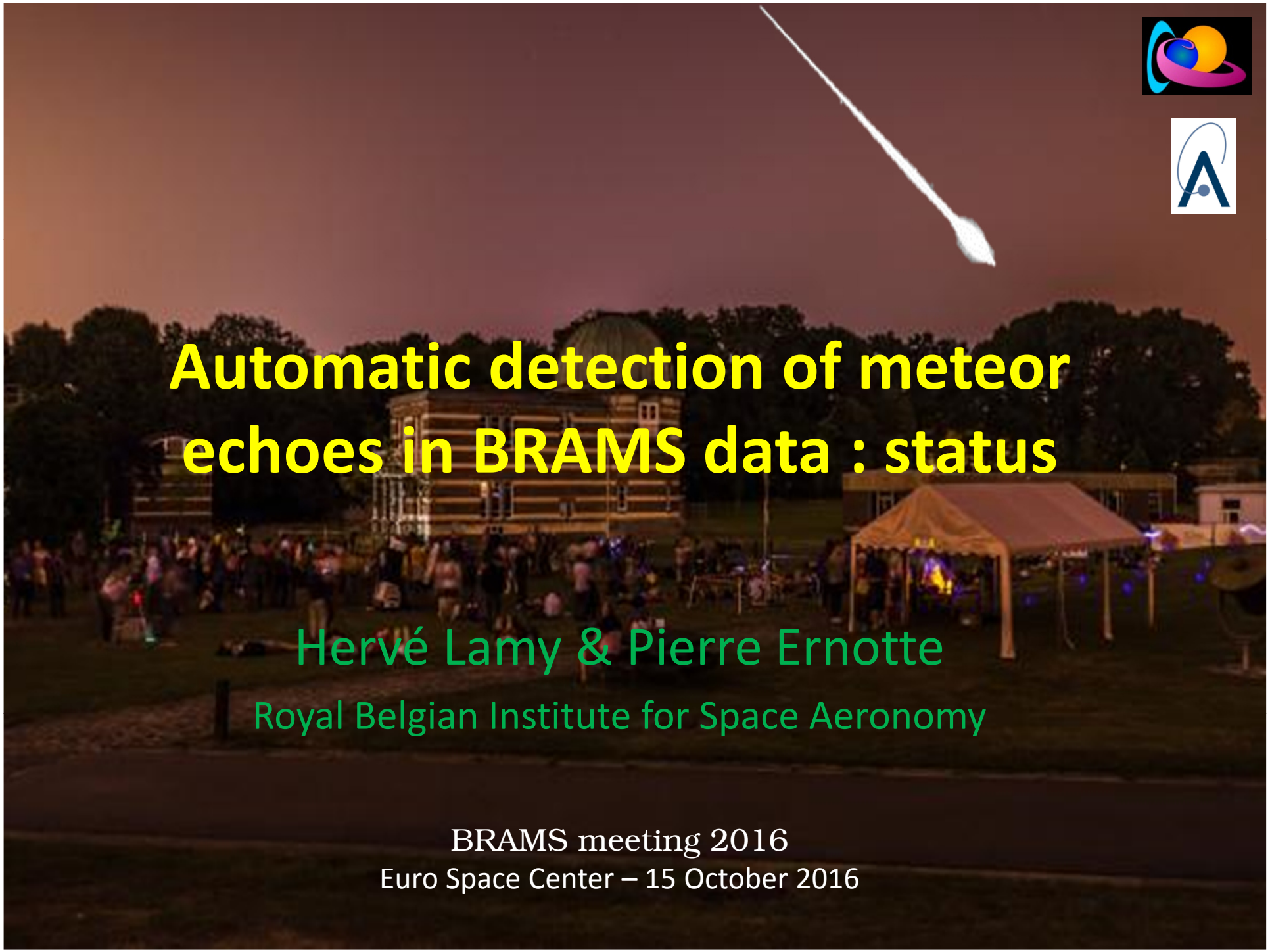


Automatic detection of meteor echoes in BRAMS data : status

Hervé Lamy & Pierre Ernotte

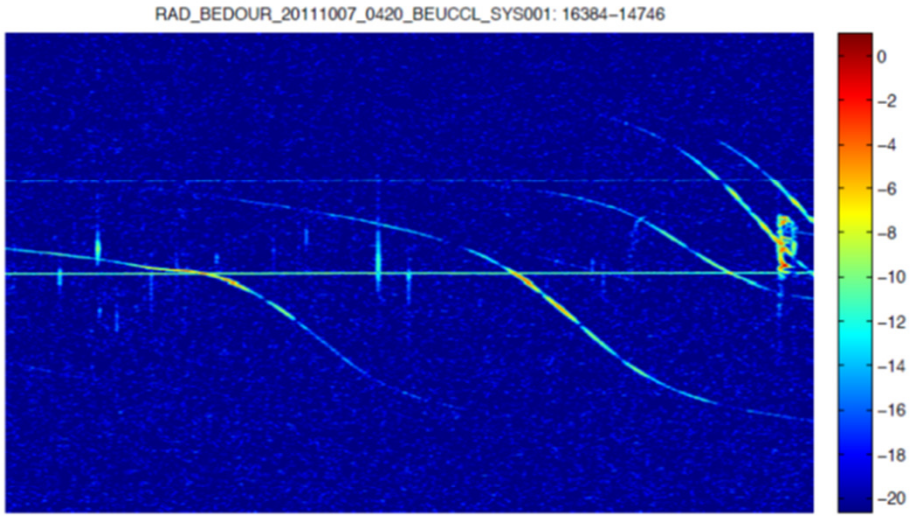
Royal Belgian Institute for Space Aeronomy

BRAMS meeting 2016

Euro Space Center – 15 October 2016

Method using the time signal

See Roelandts (2014)



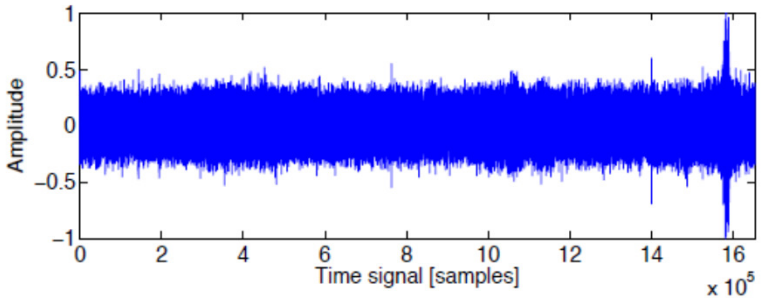


Figure 2: Amplitude of original signal.

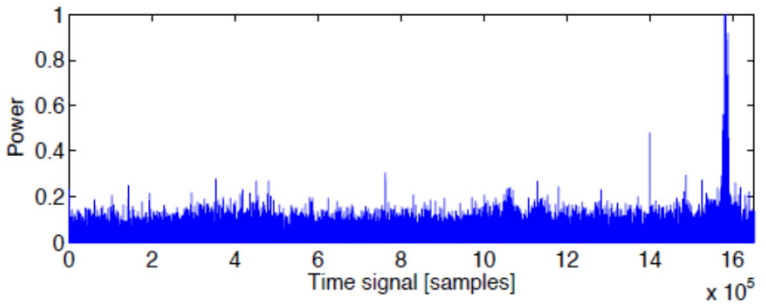
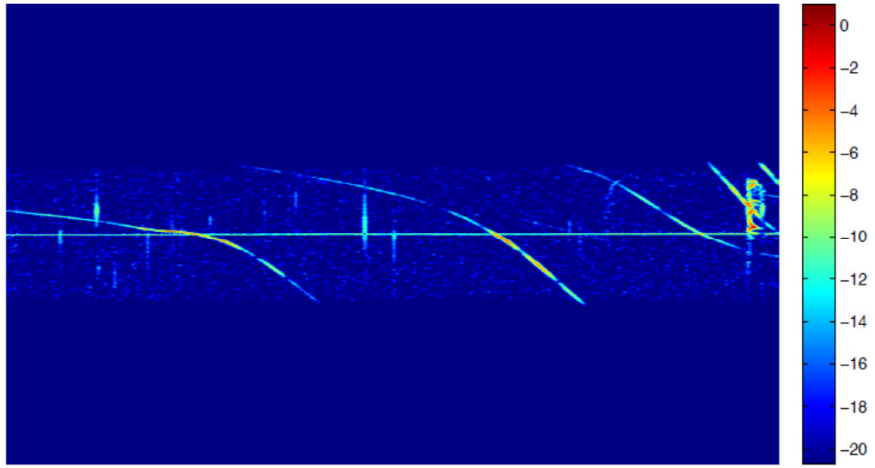
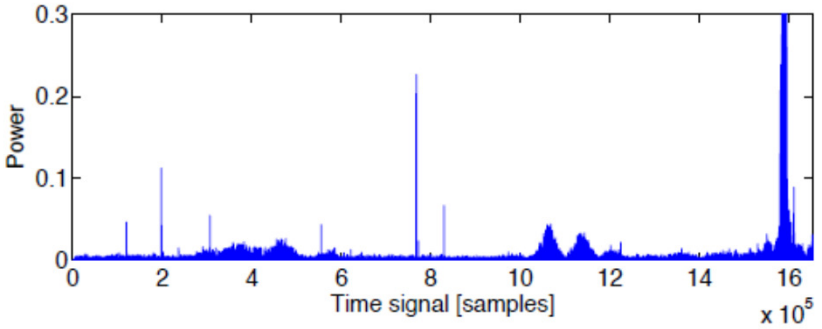


Figure 3: Power of original signal.

Method using the time signal



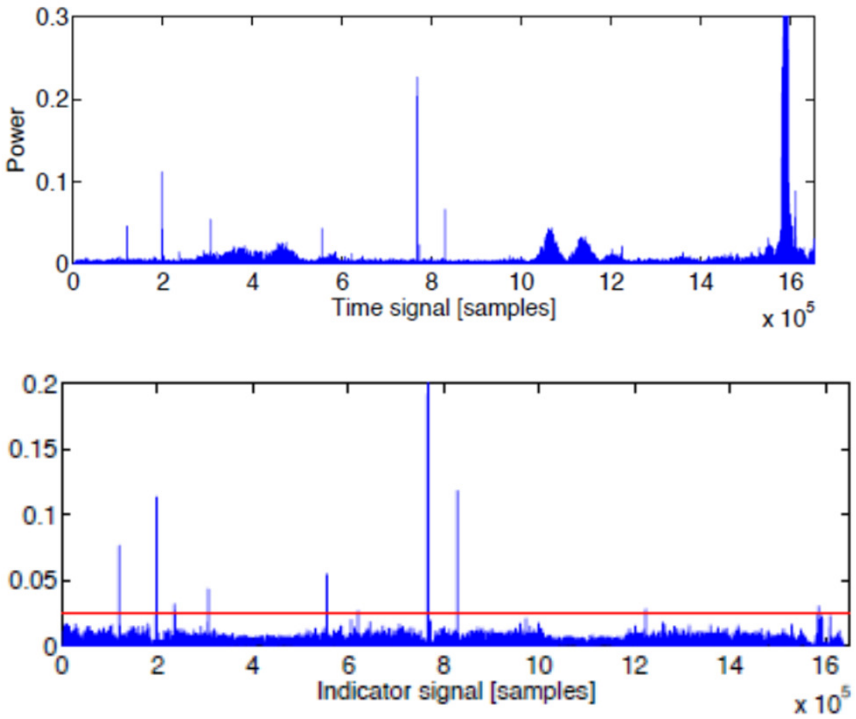


Band-pass filtered signal to remove noise / possible parasitic signals

Method using the time signal

Indicator signal $I[n] \equiv \frac{E_S[n]}{E_L[n]}$.

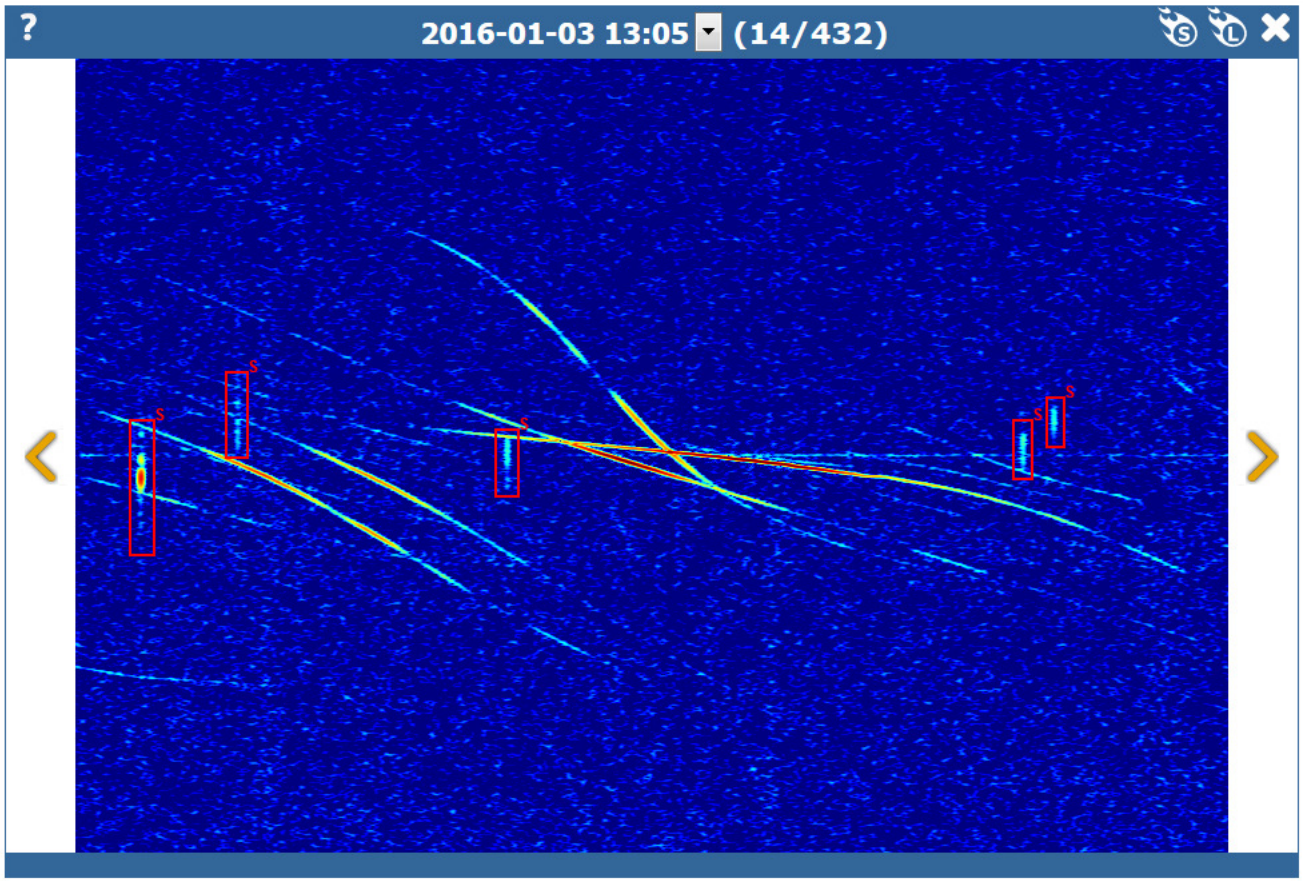
Ratio of energy content in a short window (101 points ≡ 101/5512 ~ 0.018 sec) and in a large window (30001 points ≡ 30001/5512 ~ 5.44 sec)



3 parameters :

- Short window length
- Large window length
- Threshold

Test of the method : manual counts



Fichier csv with coordinates of all the rectangles

E. Gamby

Comparison manual – automatic counts

- Detection: everything detected by TR method
- Manual: everything manually counted (lines of the CSV files)
- TRUE POSITIVE: TR method detects something which falls into a rectangle
- FALSE POSITIVE: TR method detects something else than a meteor echo
- FALSE NEGATIVE: TR method misses a meteor that was manually counted

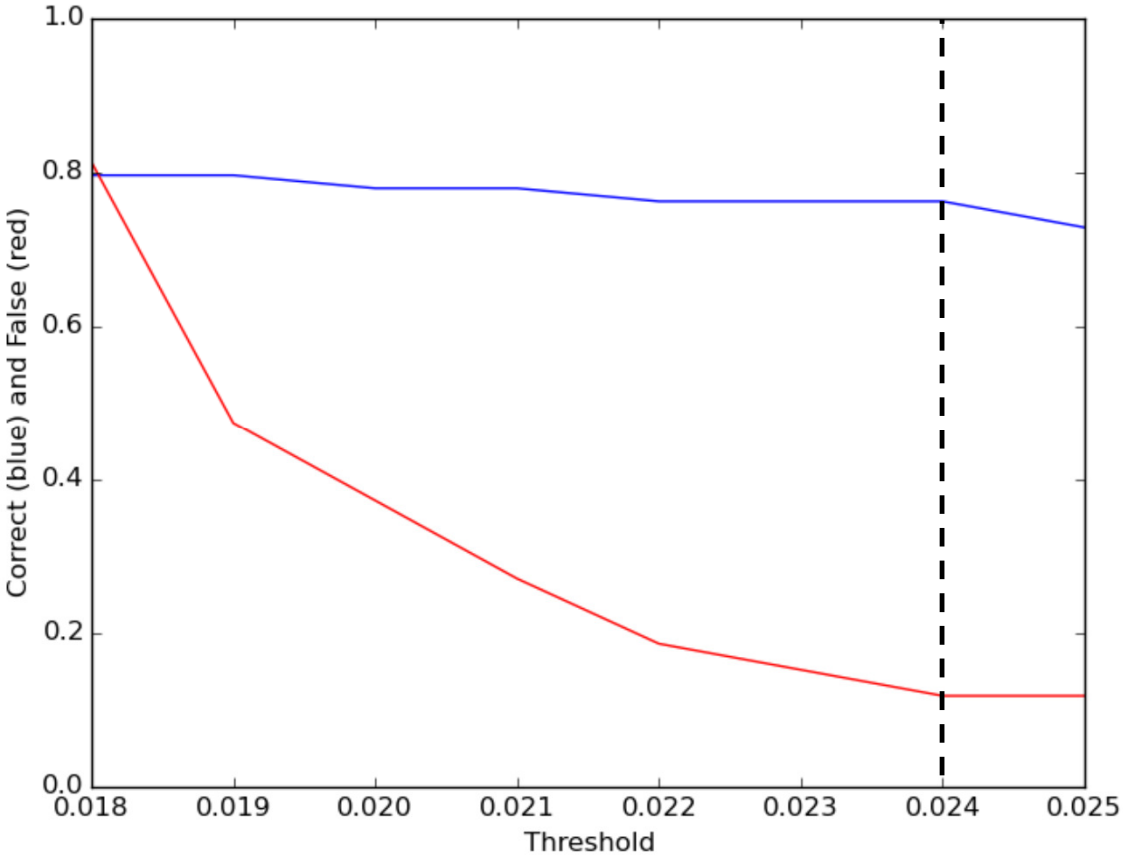
$$Detection\ rate = \frac{Detection - FP}{Manual}$$

$$\%\ false\ detections = \frac{Detection+FN}{Manual} - 1 = \frac{Detection-TP}{Manual}$$

Problems

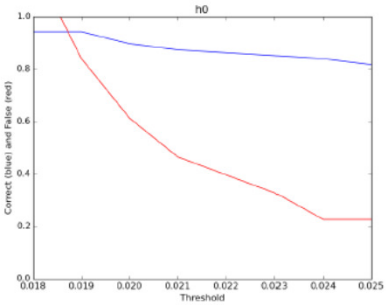
- Time delay introduced by filtering. Not corrected so slight temporal shift between peak detected by TR and position of meteors manually counted (~center of the rectangles). Currently compensated empirically. Should be corrected.

Variation of the threshold

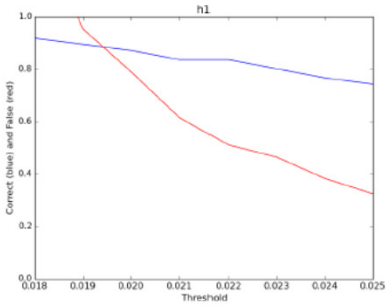


BEUCCL : 0H00 – 0H55 ; 04/01/2016 1hour

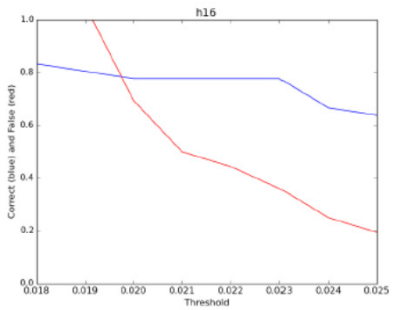
Variation of the threshold



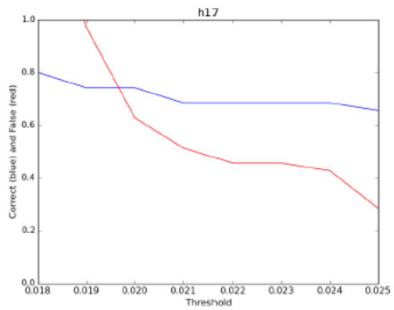
(a) 00 :00-00 :55



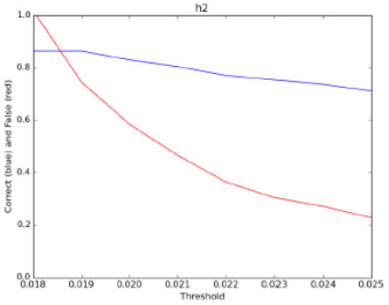
(b) 01 :00-01 :55



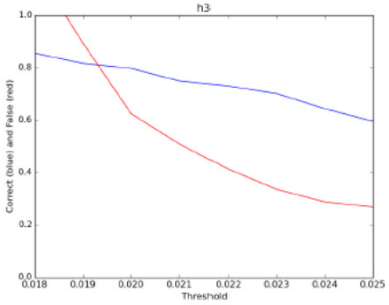
(e) 16 :00-16 :55



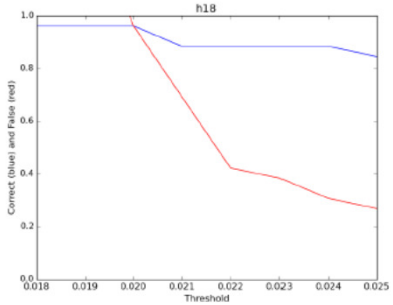
(f) 17 :00-17 :55



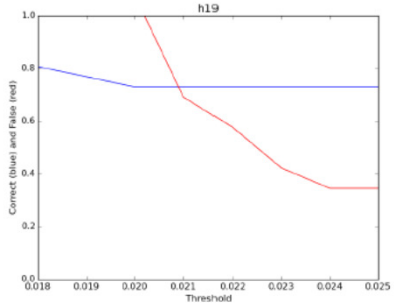
(c) 02 :00-02 :55



(d) 03 :00-03 :55



(g) 18 :00-18 :55



(h) 19 :00-19 :55

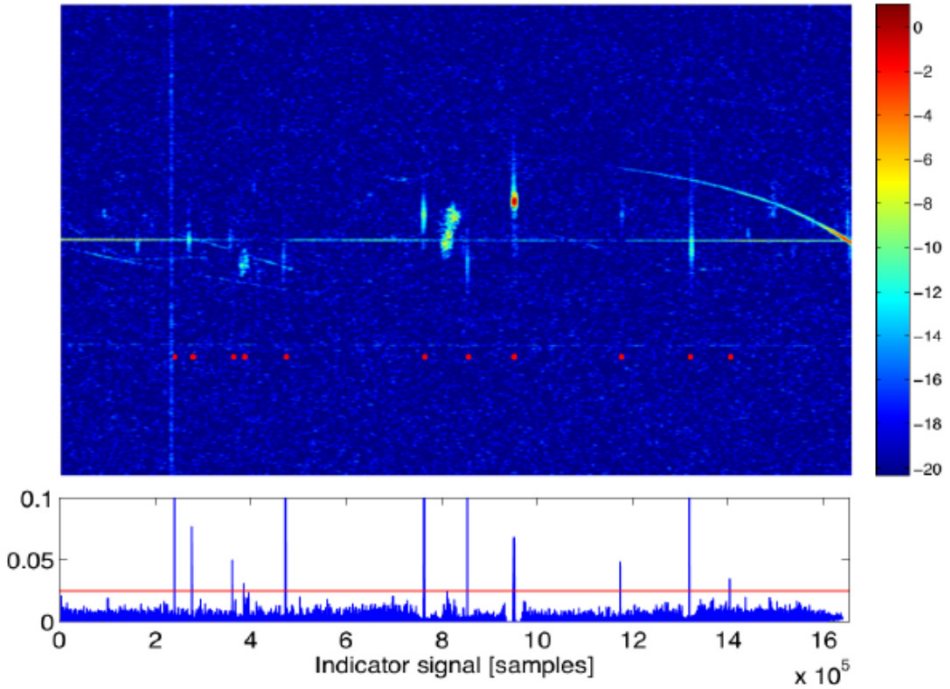
BEUCCL : 04/01/2016

Goal : check if threshold varies during the day

Choice of the threshold

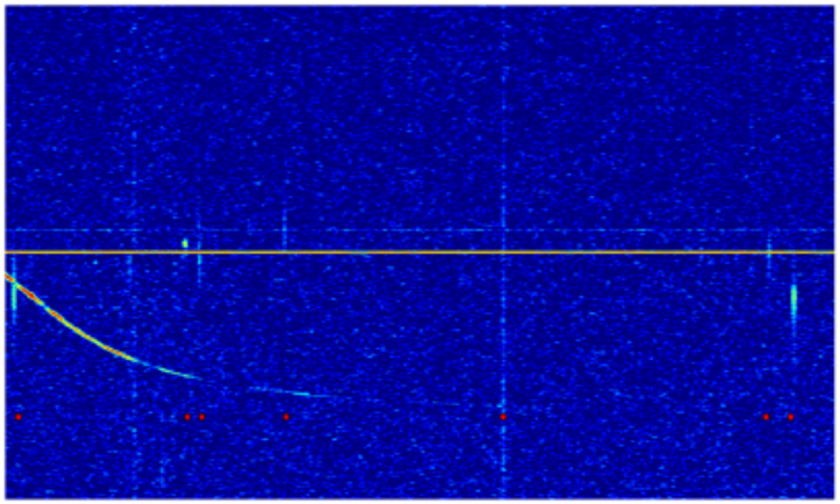
- Varies from station to station
- Does not seem to vary significantly during one day
- Difficult to define a simple criterion to select it, so mostly chosen empirically so far.

Interferences

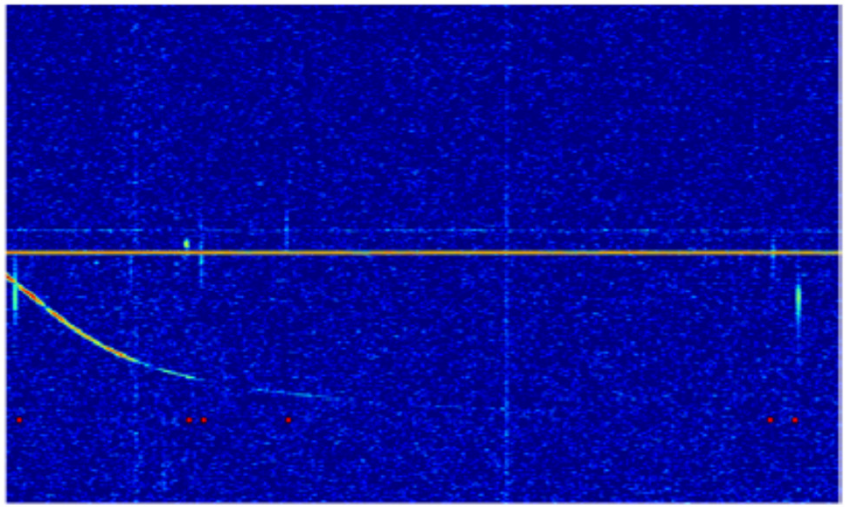


- Visual inspection of the FP reveals that 30-40 % of them are due to broad-band interference
- Some may be weak and barely visible
- Easy to remove a posteriori by summing the columns of the spectrograms outside of the 200 Hz range where meteor / airplane echoes occur

Interferences



(a) Sans traitement



(b) Avec traitement