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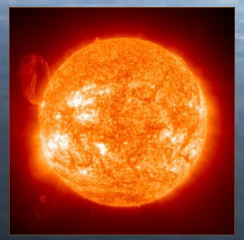
Institut royal d'Aéronomie Spatiale de Belgique (IASB)

Koninklijk Belgisch Instituut voor Ruimte-Aëronomie (BIRA)



The Radio Meteor Zoo - a citizen science project

https://www.radiometeorzoo.be

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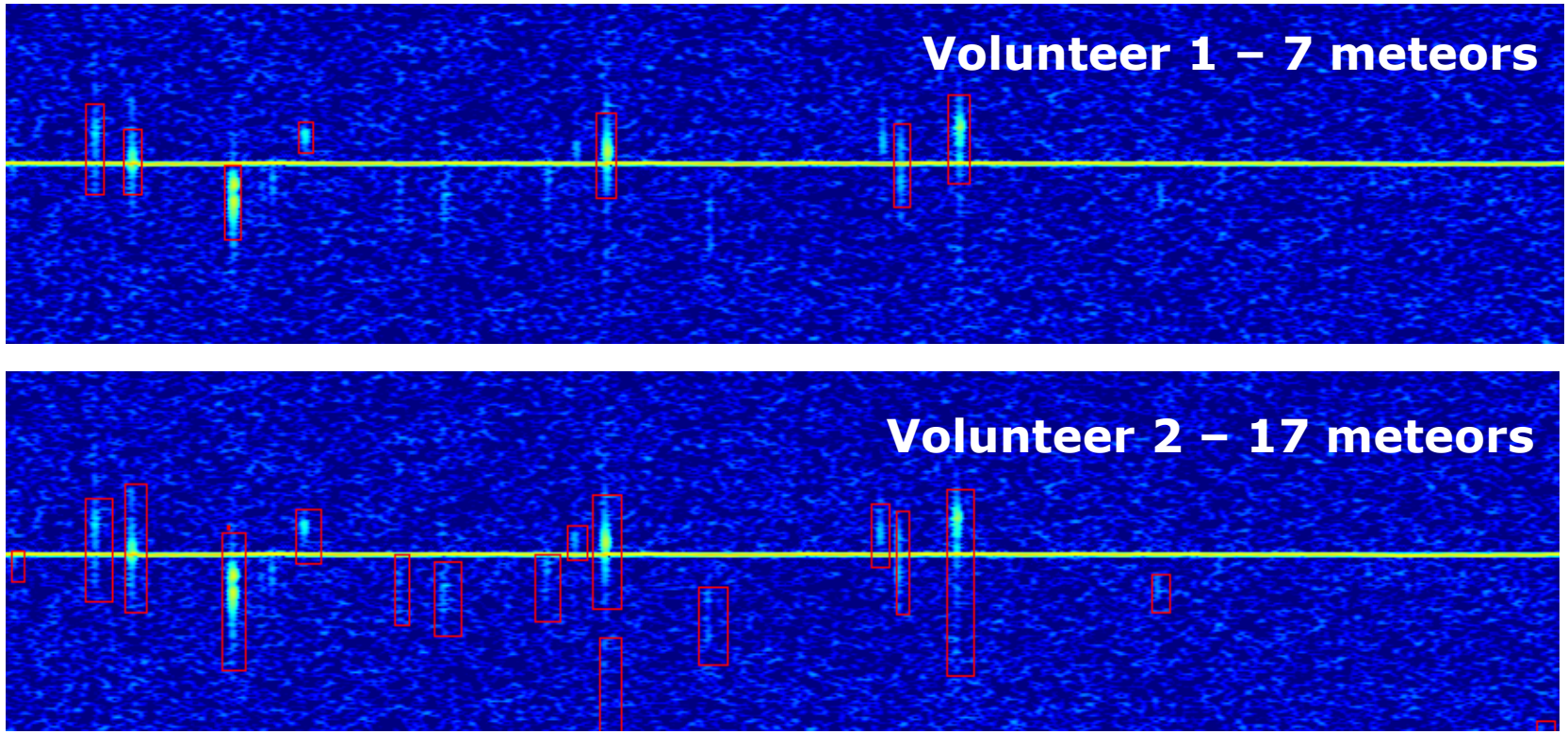
Radio Meteor Zoo

- In 2015, we did a call for volunteers to run a test on 12 spectrograms; 35 people responded

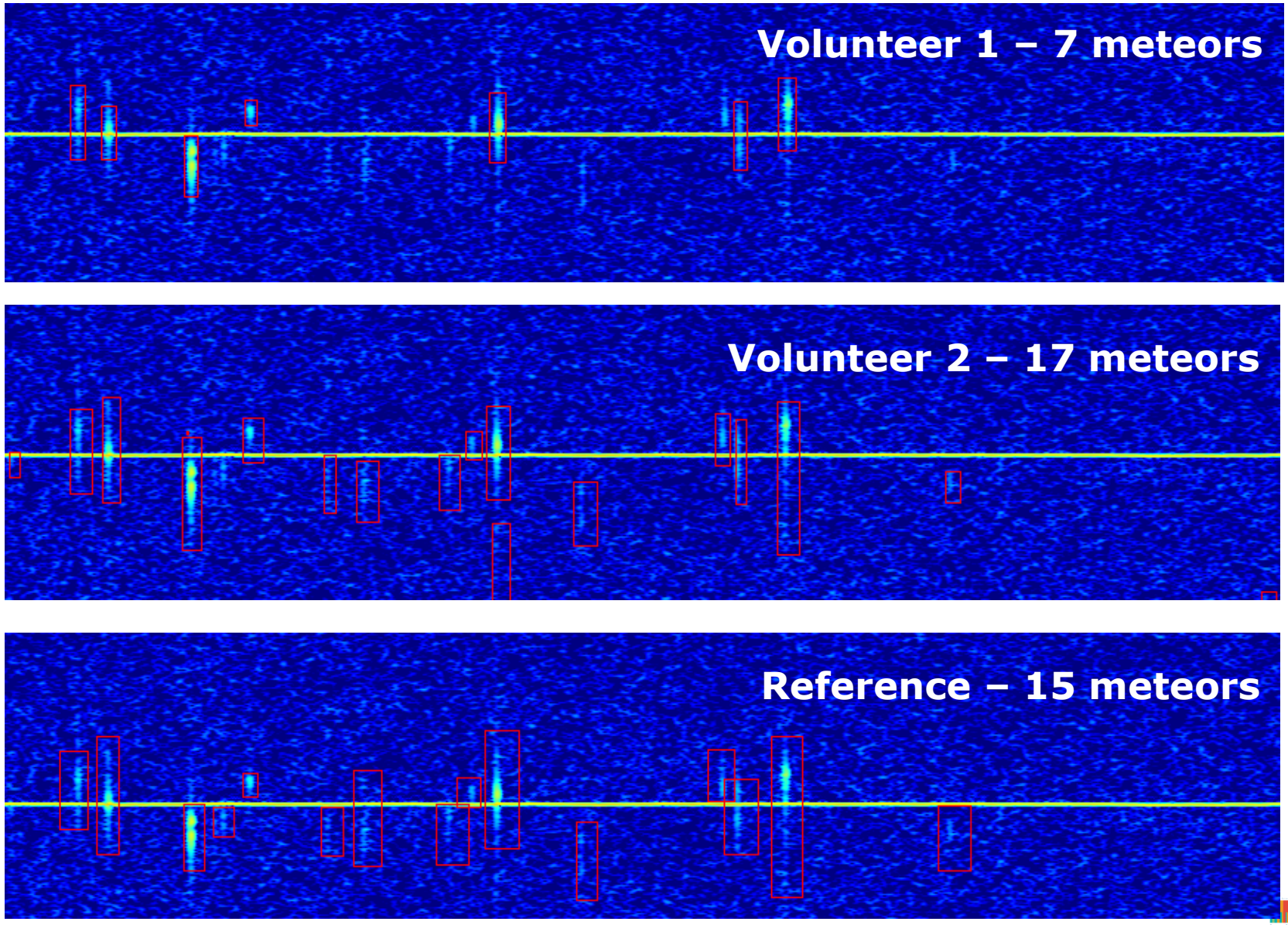
- Questions to answer:

1. In a given spectrogram, how can we accurately derive the number and position of meteor echoes based on individual contributions?
2. What is the minimum number of volunteers we need to inspect a given spectrogram such that we can statistically be confident in the results?

Statistical analysis



Statistical analysis



Statistical analysis

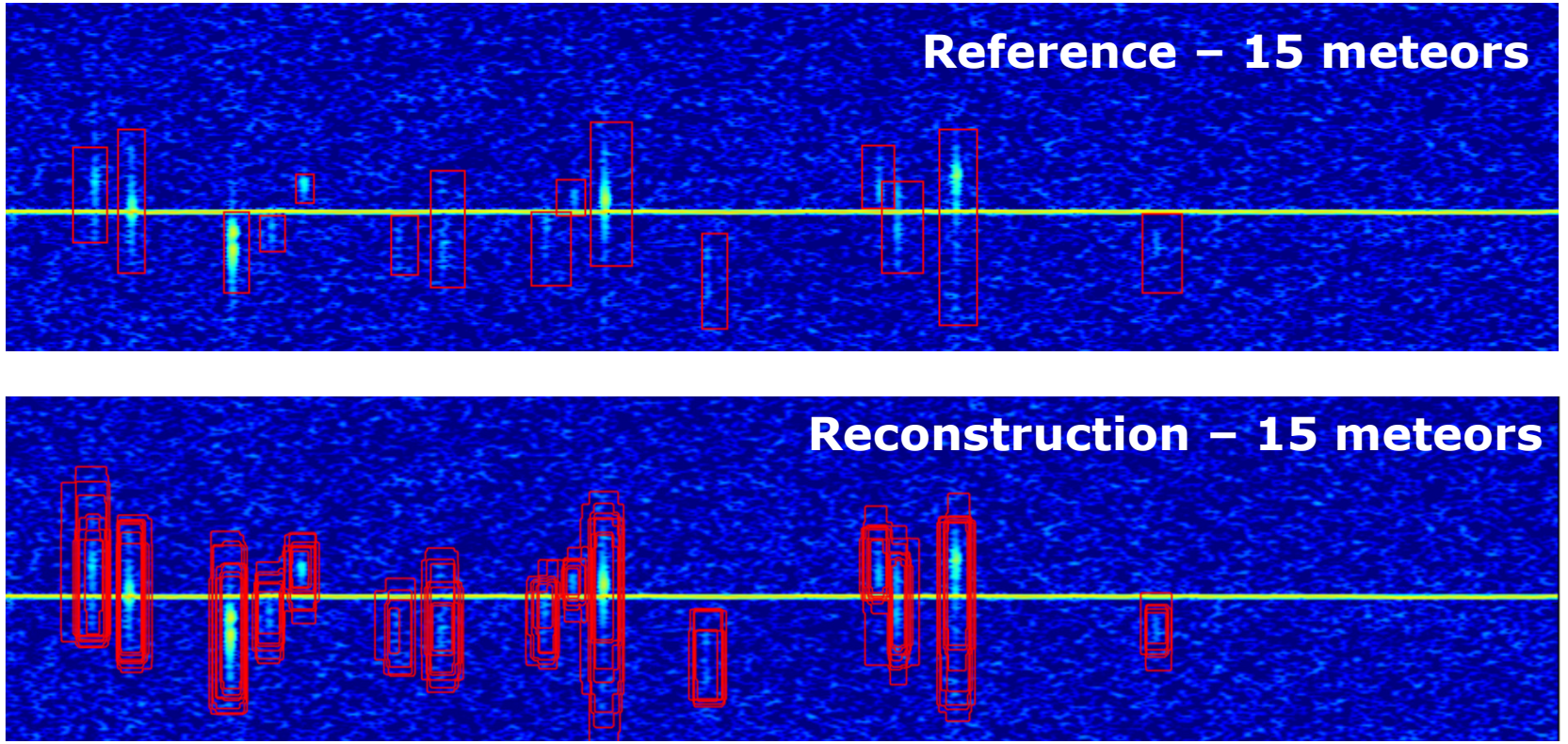
- Create a binary version of the spectrogram which has value 1 for pixels identified as a meteor pixel in the reference spectrogram, and pixel value 0 for all other pixels.

- Create a binary version of the spectrogram which has value 1 for pixels which were identified as a meteor pixel by at least i volunteers and pixel value 0 for all other pixels.

- Calculate the number D(i) of pixels for which the two binary images have different pixel values

- Repeat for each value of i between 1 and 35 and find the one that minimizes D(i)

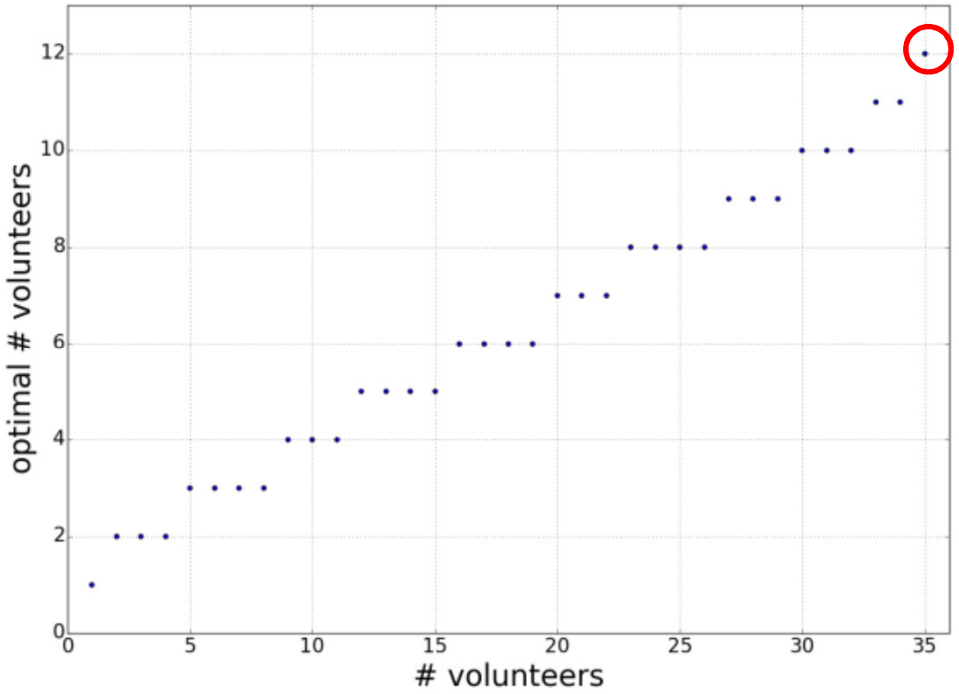
Statistical analysis



We got best results by assuming a spectrogram pixel belongs to a meteor if **at least 12 persons** have drawn a meteor box around that pixel.

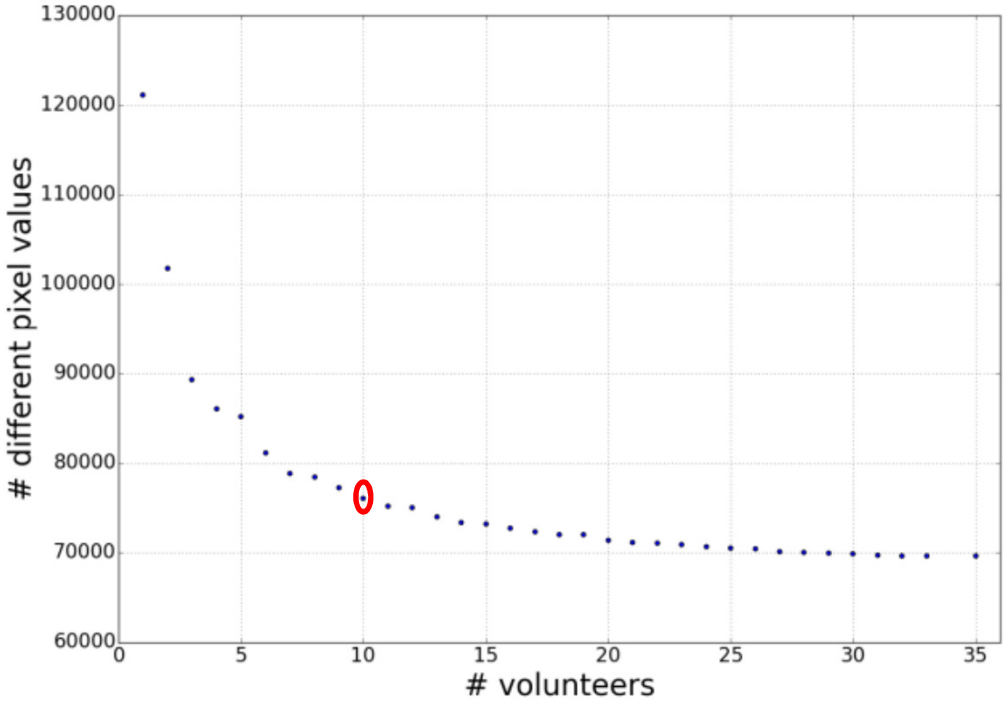
Statistical Analysis

- So for n=35 volunteers, i=12 is the optimal value to reconstruct the spectrogram
- For the RMZ, we need a lower value of n (>>12 spectrograms)
- Same simulations for each value of n=1,2, …, 35. For every n, we randomly select 1000 combinations of n volunteers among 35.



Statistical Analysis

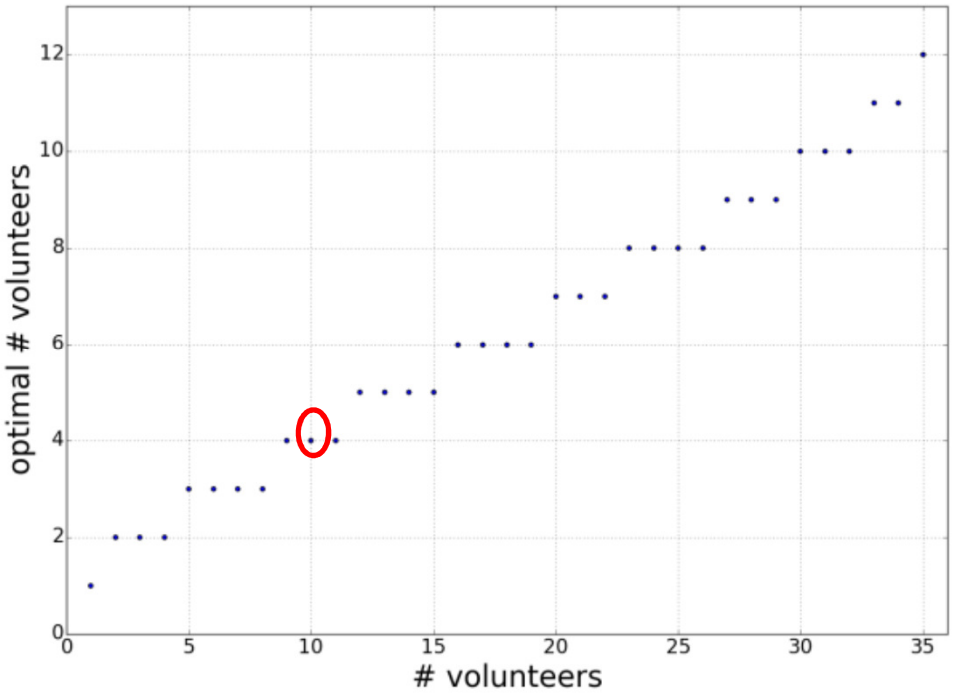
D(i)



Size of a spectrogram in the 200 Hz range = 595 x 864 pixels.
Total for 12 spectrograms > 6 × 10^6 pixels

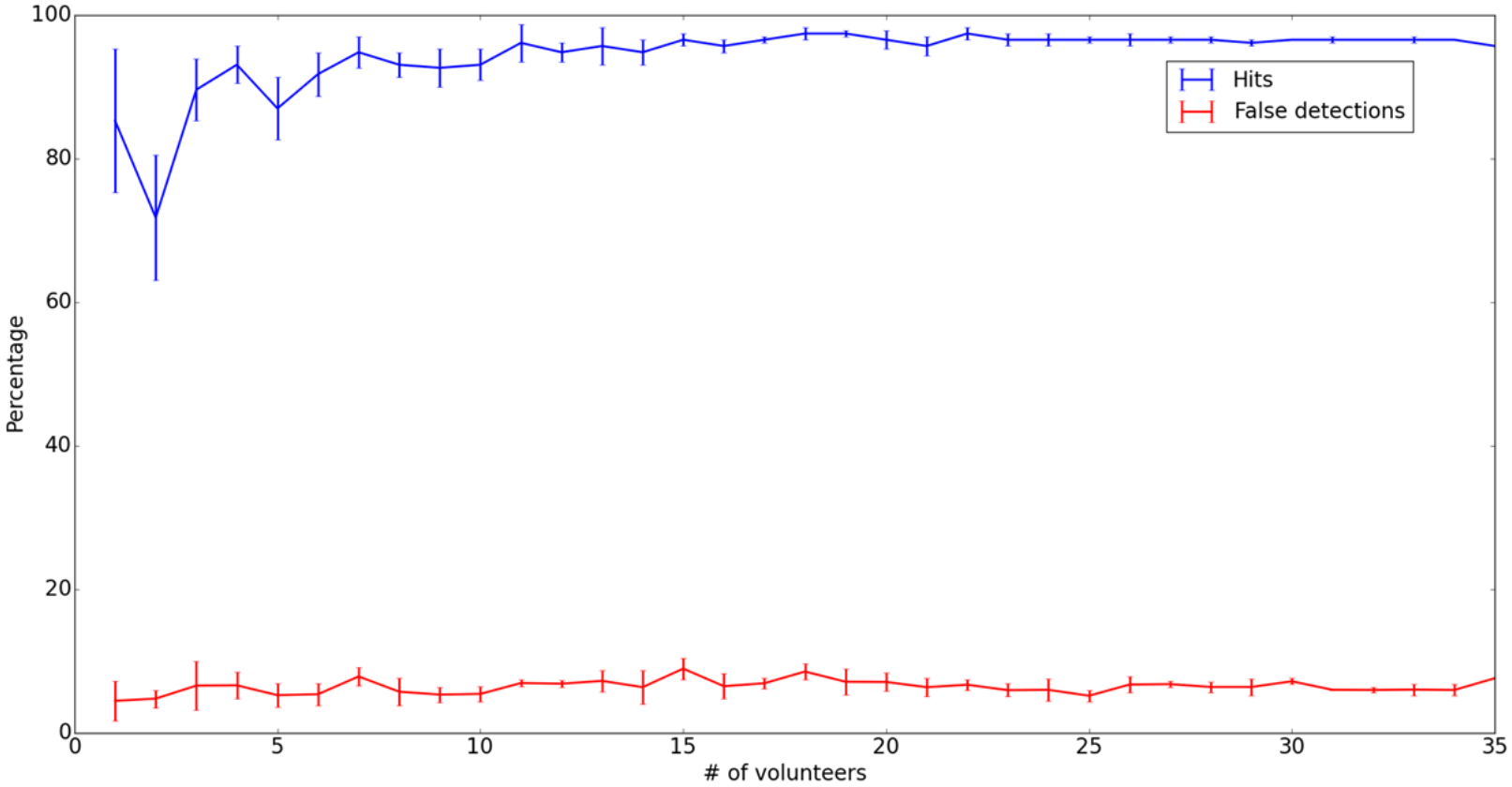
For n=10, D(i) is only 9% larger than for n=35

Statistical Analysis



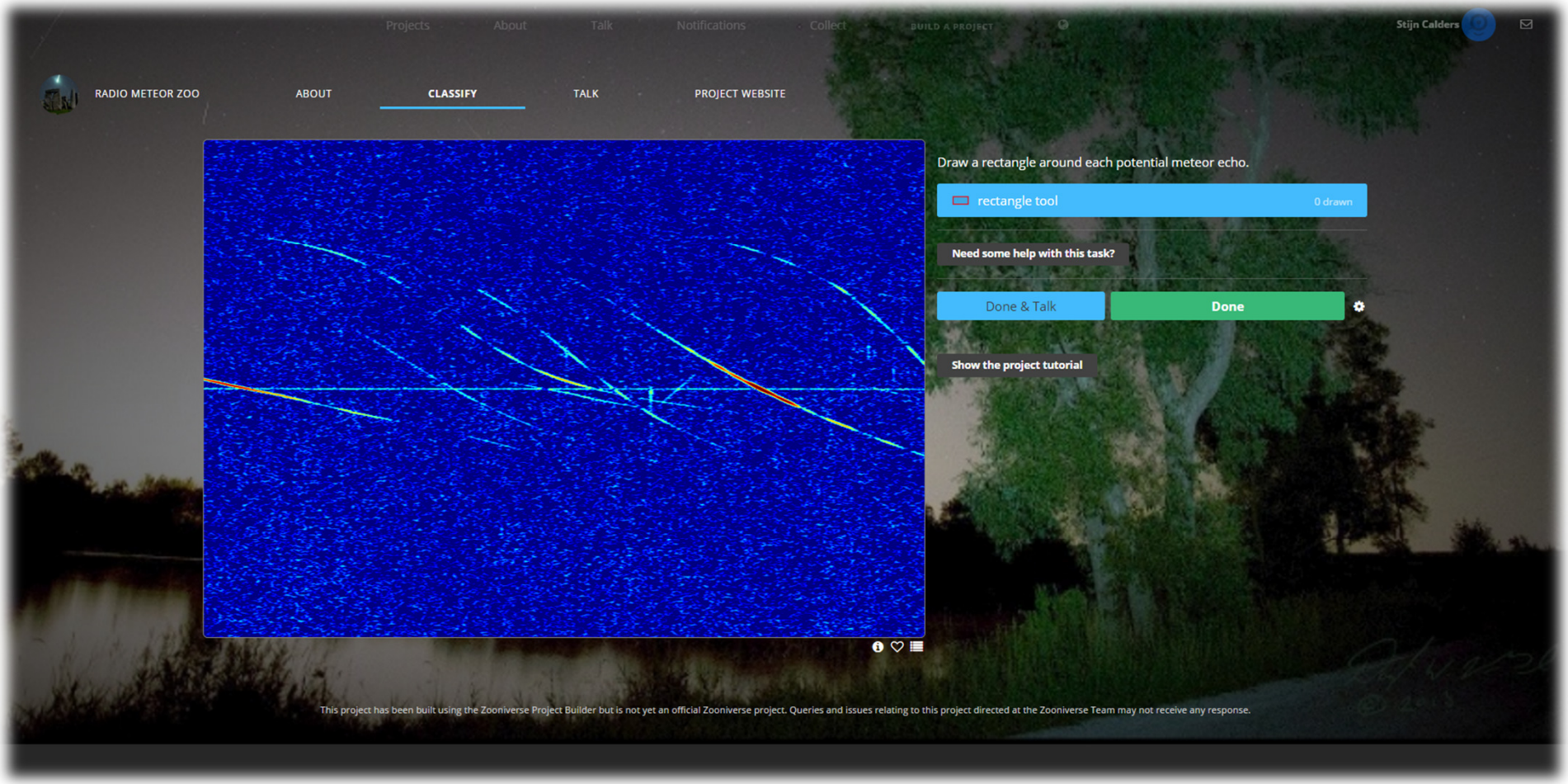
For n=10, the optimal value of i for reconstruction is equal to 4

Detection and false detection rates



Conclusion: with **10 volunteers** we get 95% hits and 6% false detections

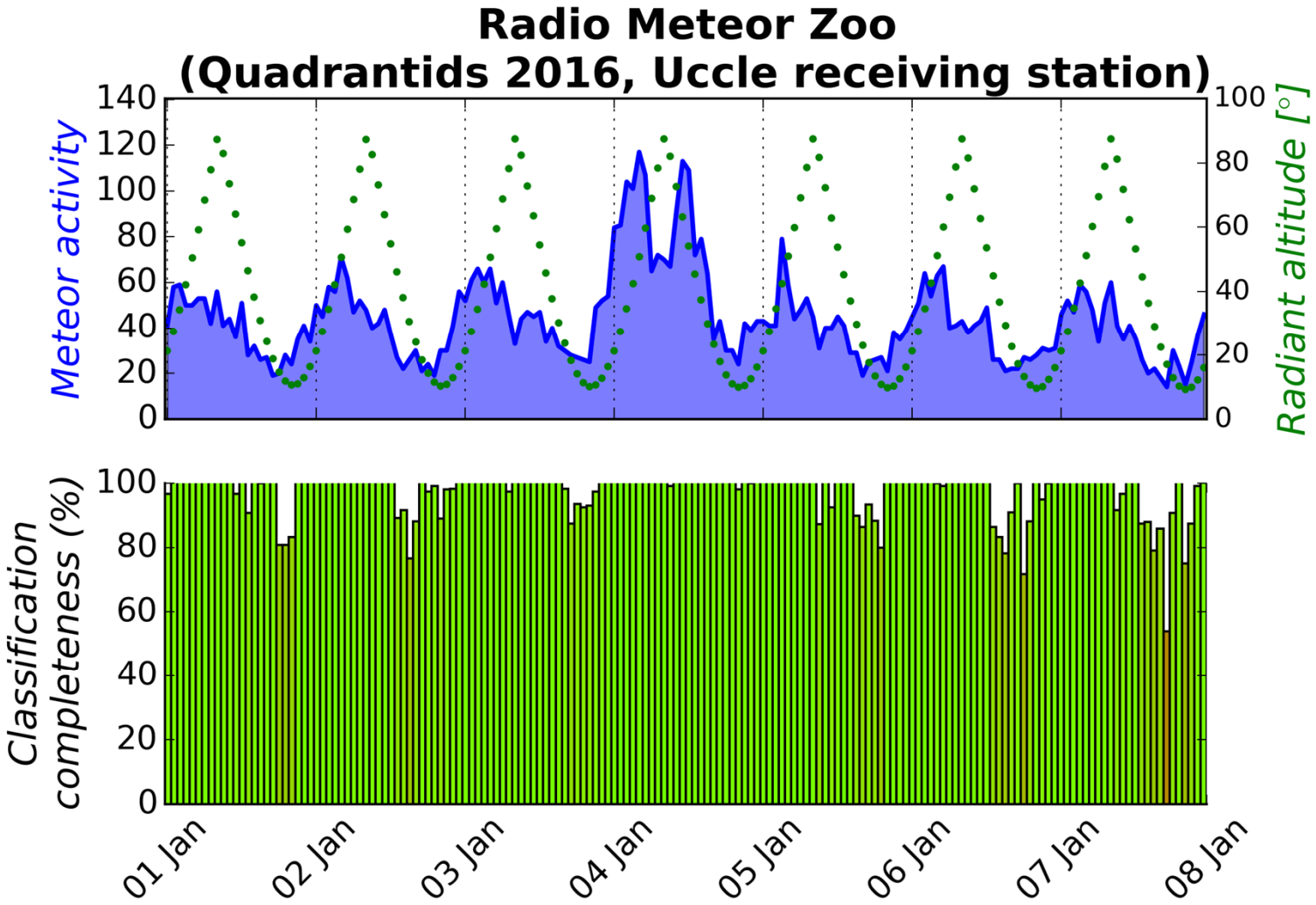
12 August 2016: official launch



Some numbers

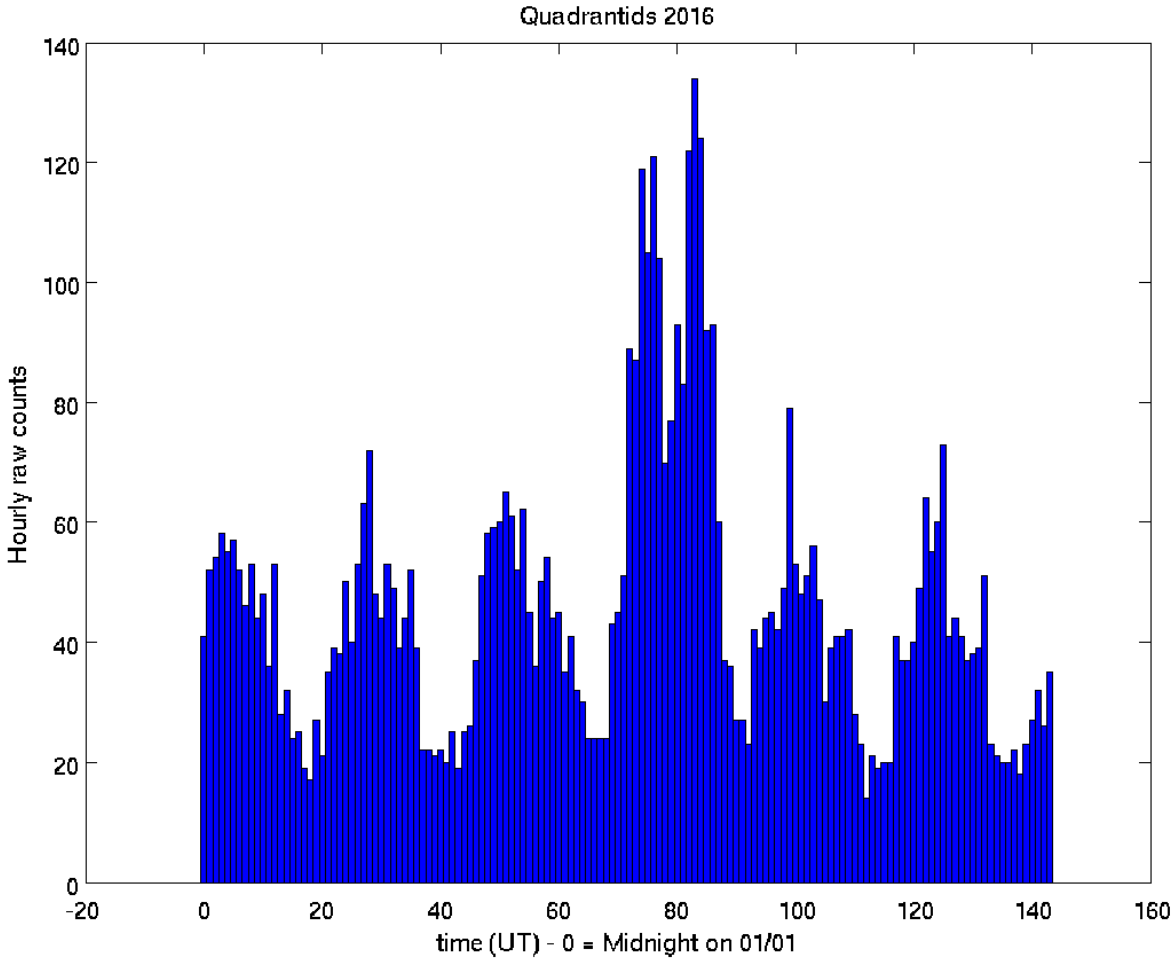
- 2276 volunteers
- 106.383 classifications
- 19.739 images
- Processed stations:
  - Humain
  - Ottignies
  - Overpelt
  - Uccle

Results: Quadrantids 2016

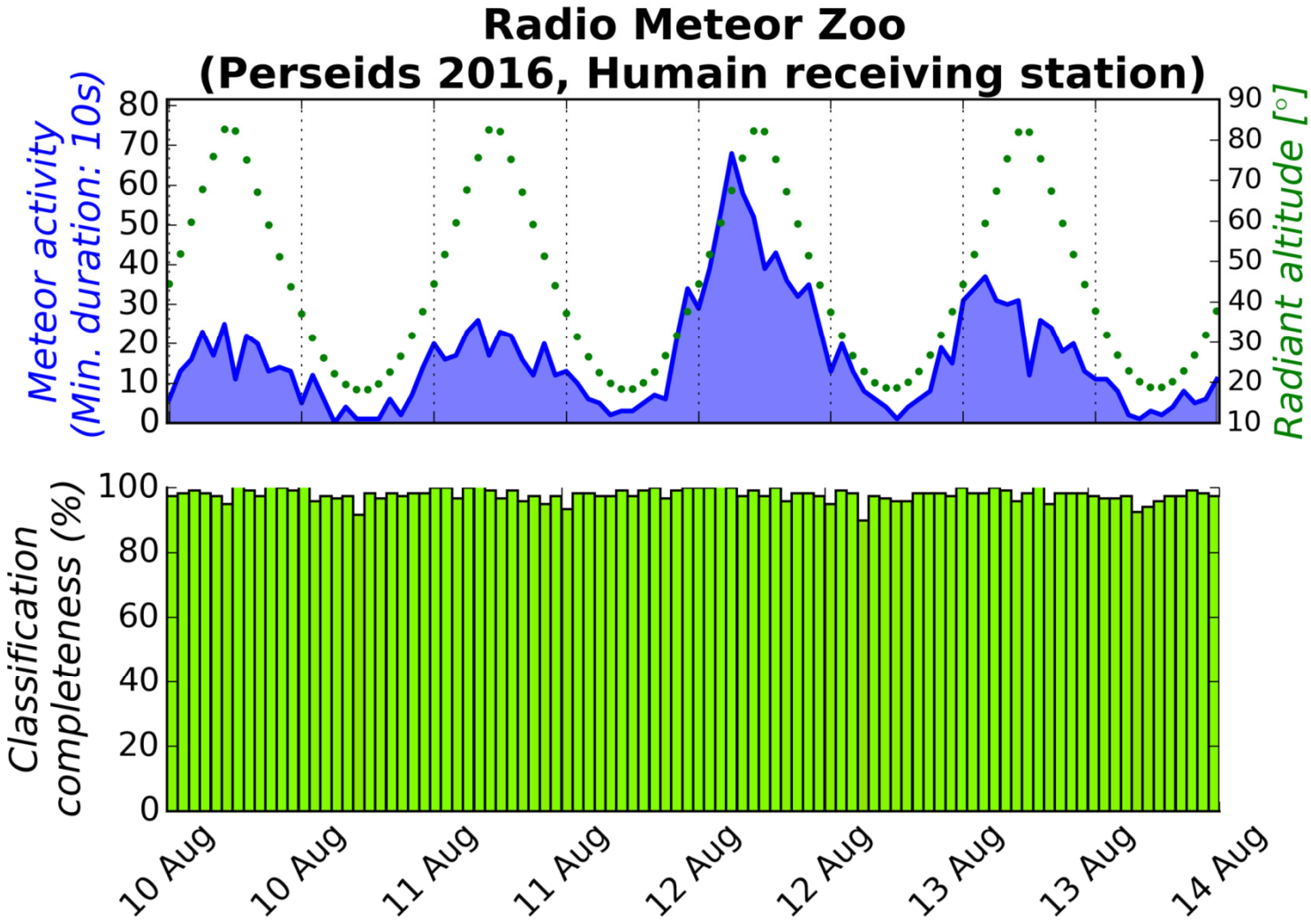


Beta phase

Results: Quadrantids 2016



Results: Perseids 2016



Perspectives

- More data to analyze
- Aggregate method for rectangles okay during quiet periods. Underestimate number of meteor echoes when they overlap (case with many overdense echoes close to the activity peak)
- Give weights to users
- Next call during the Geminids

Thank you for your attention!

http://www.radiometeorzoo.be

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