# SeismoCitizen : A project combining seismology and human science approaches based on a deployment of a dense low cost seismic network hosted by citizens.

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Photography encouraged

Introduction

After a first deployment of 8 low cost seismic stations in 2017 around Strasbourg, we launched end of 2018 a multidisciplinary project of citizen seismology called SeismoCitizen. It associates Seismology with Social/Human science research. It is intended to build a real network of observation sites in urban and peri-urban areas, based on internet-connected stations hosted by volunteers citizens, who will also participate in a survey conducted by sociologists.
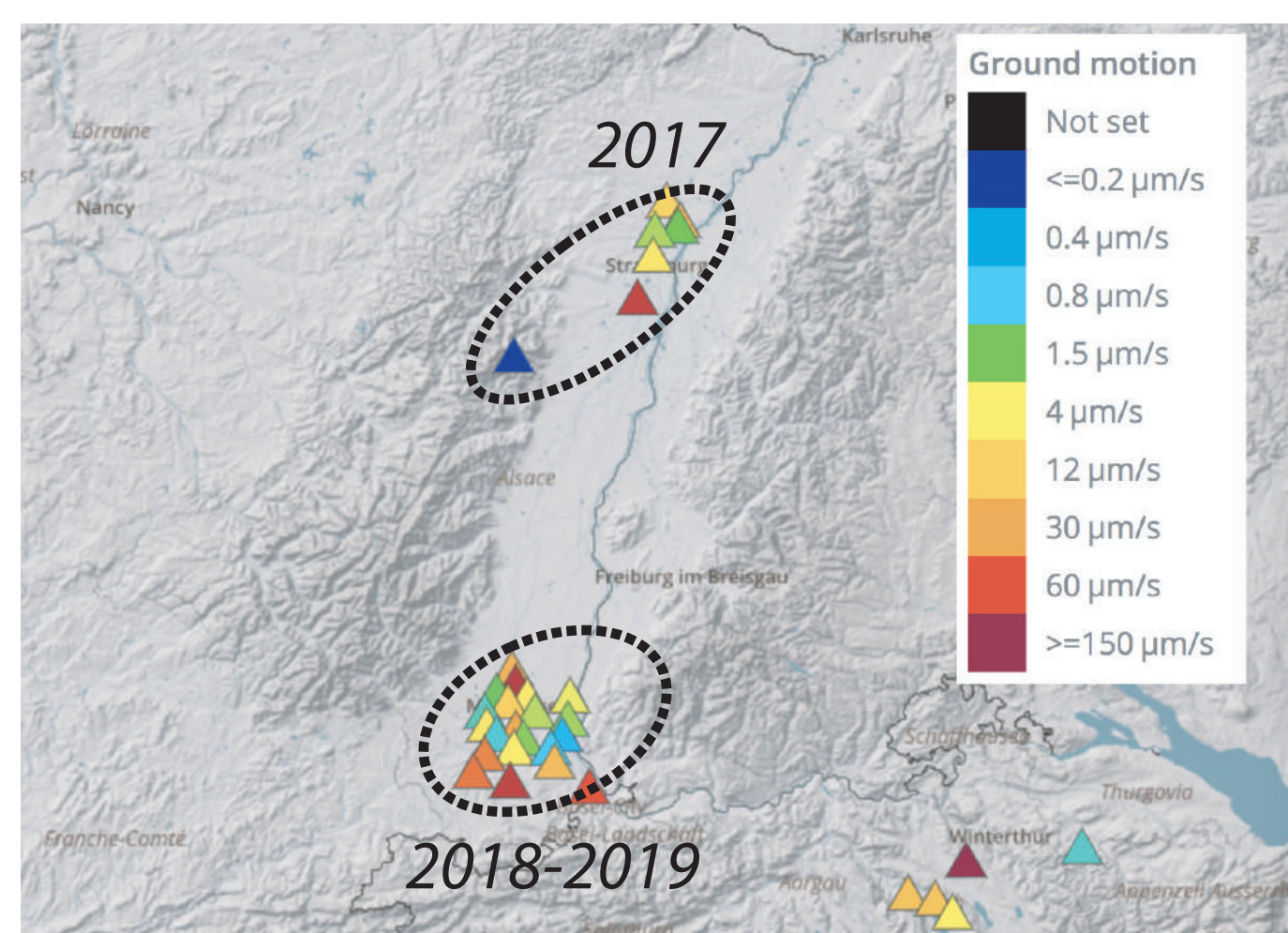
2017 and 2018-2019 low cost stations deployment

Construction of the SeismoCitizen sample

=> **Location of participants** imposed by seismotectonic criteria. **Profiles of participant** imposed by sociological criteria.

-=> **Call for applications**: Look for 20-25 individuals with diversified profiles, Use of the communication channels of town halls, associations + social networks, mailboxes, local newspaper ad

=> **About 80 responses**

Protocol

=> **November 2018**: definition of the strategy / drafting of the interview guide and communication documents / characterization of instrumental response of low-cost seismic stations.

=> **December 2018 - February 2019**: constitution of the sample & realization of the first set of interviews (T0) / installation of the low-cost station & integration of station data in near real time to BCSF-RENASS observatory activities.

=> **July 2019 - October 2019**: realization of the second set of interviews (T + 6/8 months)

=> **2019**: analysis of the results based on interview transcripts / analysis of instrumental data (quality, contribution to improve seismic observations, etc.) .

Low-cost stations characterization

First, during November 2018, the instrumental response of the 27 Raspberry Shake station were simultaneously fully characterized in respect to a reference permanent BB station at the instrumental testing platform of EOST.
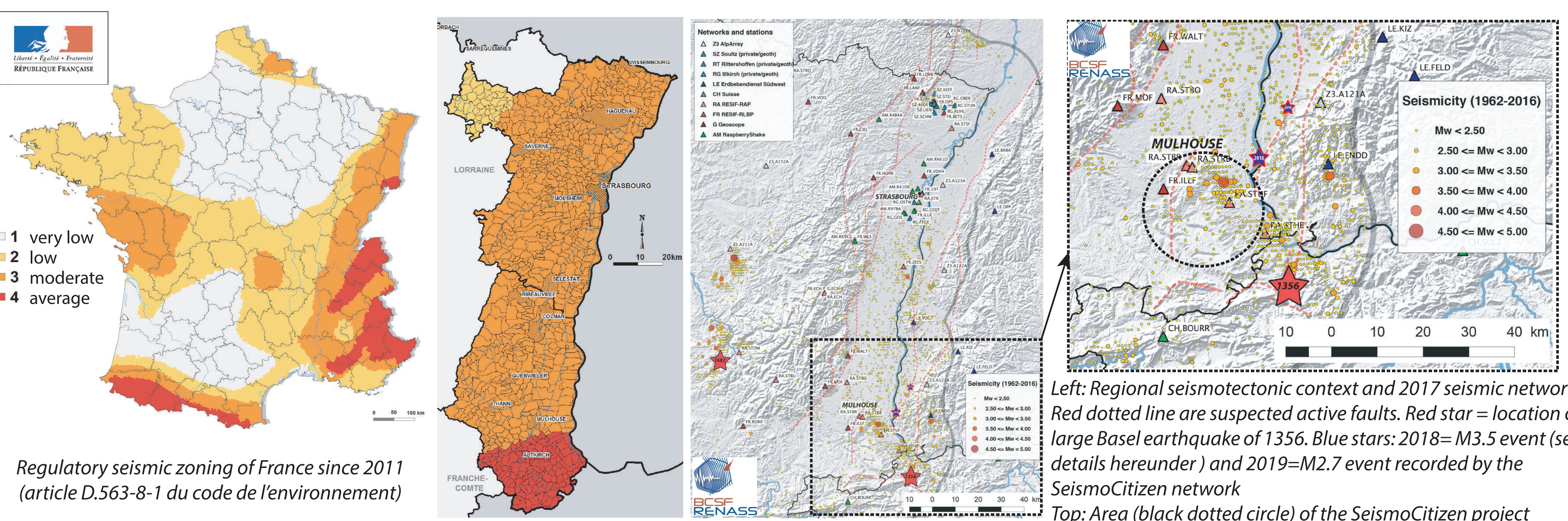(See EGU presentation BesDeBerc et al.).
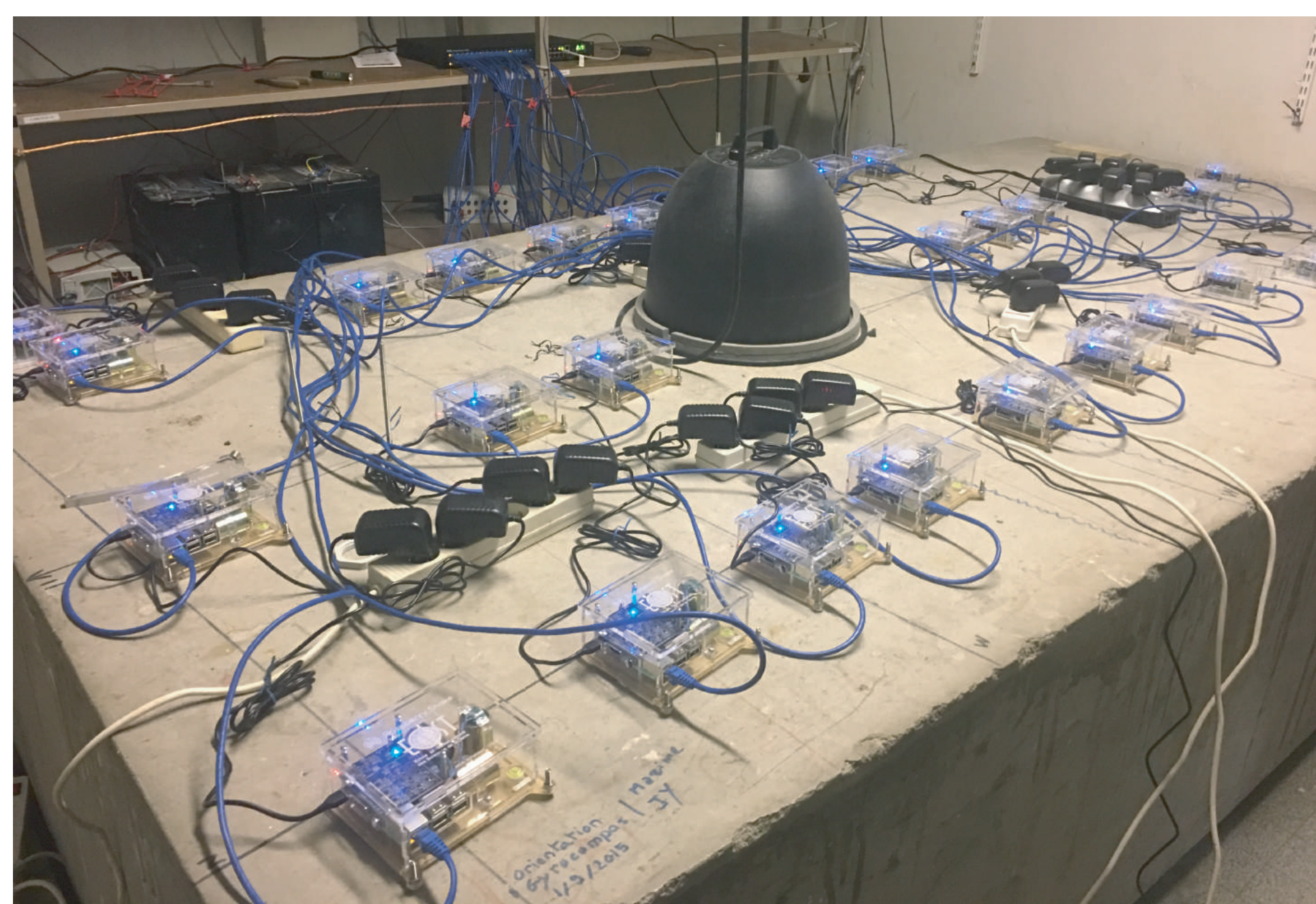
27 Raspberry Shake stations at the instrumental testing platform of EOST

Deployment in North-East France

Then the stations have been deployed during the winter 2018-2019 in a intra-continental region, Mulhouse at NE France, were the seismicity is moderate in terms of number and magnitude (the Sierentz earthquake in 1980, Mw 4.1 is the most recent one with Mw>4) but which has been the site of one of the largest event in western Europa, the Basel earthquake of October 1356 with a Mw estimated at ≈ 6.5. It is an intense industrialized region with high environmental potential impact.   It is also one of the French metropolitan regions where seismic hazard level, considered in the national regulation zoning, is the highest.

Regulatory seismic zoning of France since 2011 (article D.563-8-1 du code de l'environnement)

1 very low
2 low
3 moderate
4 average

Left: Regional seismotectonic context and 2017 seismic network. Red dotted line are suspected active faults. Red star = location of large Basel earthquake of 1356. Blue stars: 2018= M3.5 event (see details hereunder) and 2019=M2.7 event recorded by the SeismoCitizen network
Top: Area (black dotted circle) of the SeismoCitizen project

The Social/Human Science study and interviews

It aims at observing and analyzing the effects of a citizen engagement in scientific research (via hosting a seismometer) on the perception and representation of seismology and micro-seismicity phenomena. Therefore the volunteer citizens will participate to 2 interviews: at the time of the installation and 6-8 months later.

Organisation of the first set of interviews

Objective:
=> to characterize the participants (sociological and cultural approach)
=> Sensitivity to the environment, industrial projects, science, seismology

Practical aspects
=> Possibility of answering alone or as a couple
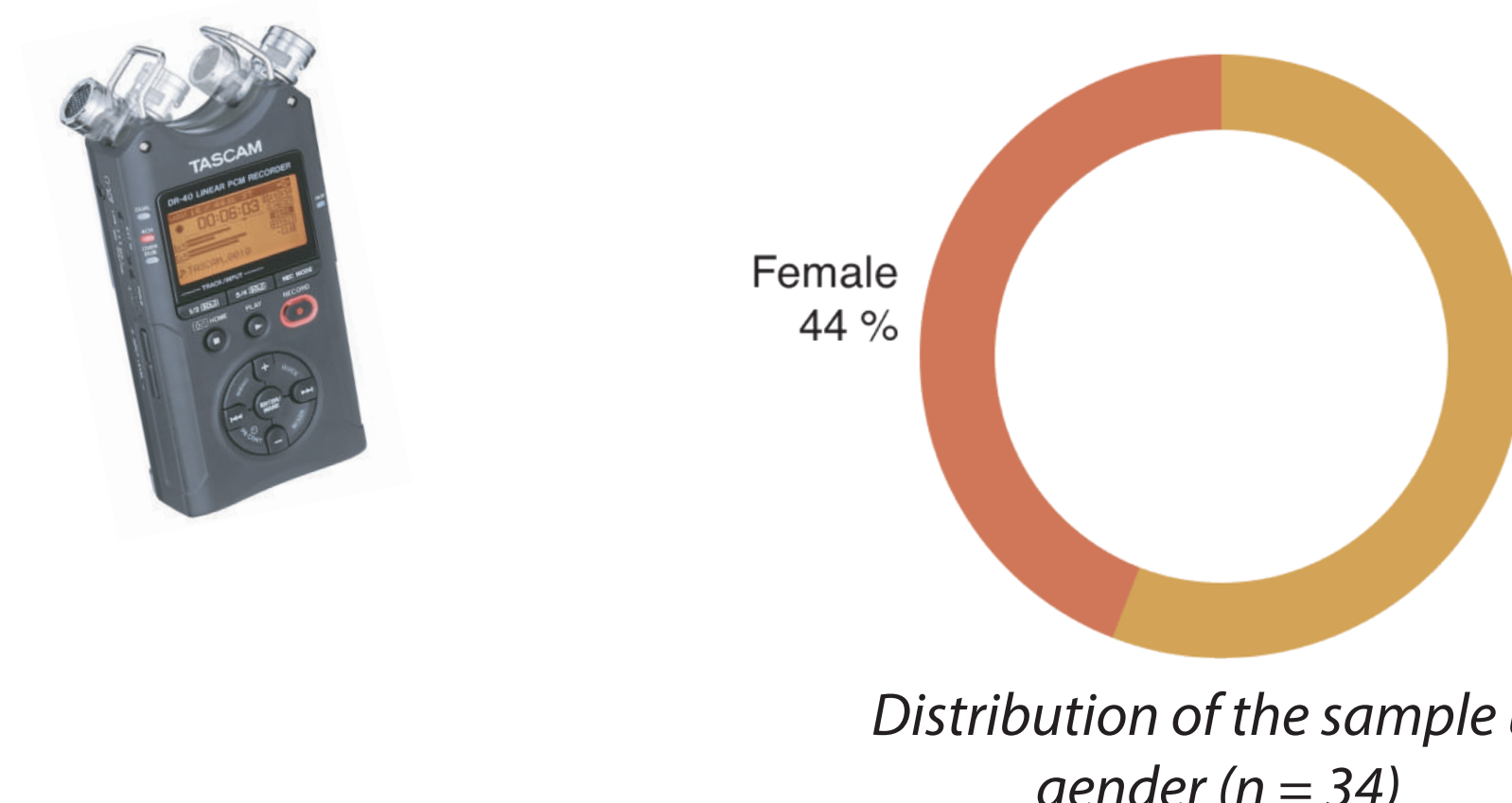=> Informed consent (ethics) / anonymity of respondents

Results:
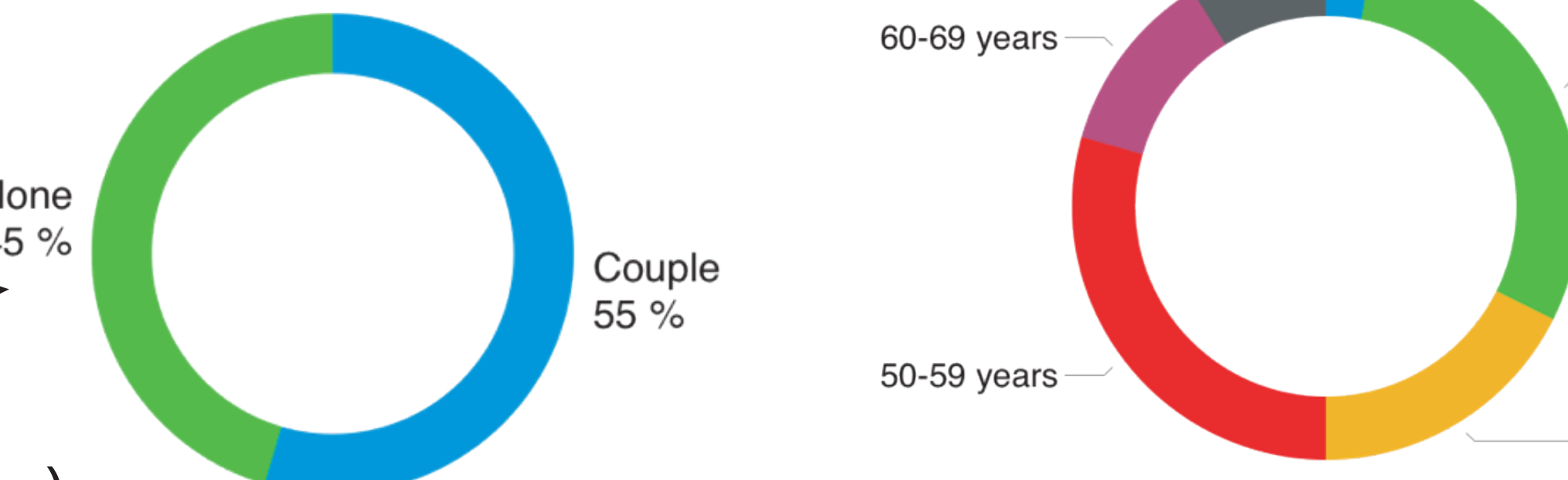=> 22 interviews carried out (at end of February)
=> Duration: 30mn to 1h30
=> More than half responded as a couple

Word-to-word transcription and Analysis (coming soon)

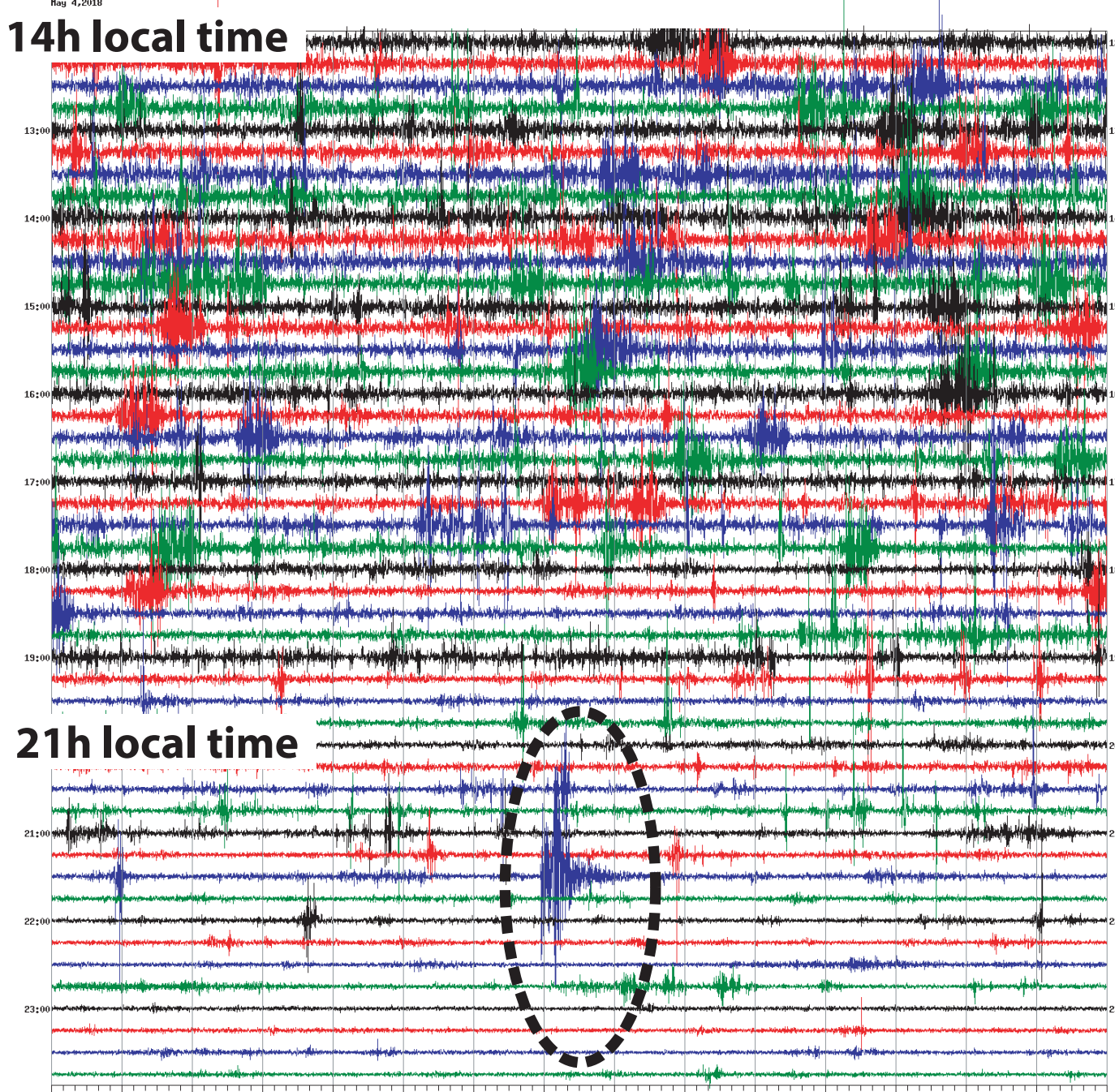Distribution of the sample by gender (n = 34)
Female 44 % Male 56 %
Alone 45 % Couple 55 %
Distribution of the sample by age group (n = 34)

Interview guide (a main question + several reframing questions per theme)

Issue 1. Knowing you better: Can you tell us a little bit about you? (academic and professional background / associative affiliation / digital equipment)

Issue 2. Territory perception and interest in environmental & industrial issues: Have you the feeling to be an Alsatian person? (time spent in the region / what best characterizes this region / what you do not like in this region / interest in industrial heritage and environment)

Issue 3. Perception of science: What is science for you? (part plays by science in society / name the the most scientific discipline / place of science in your school and professional career).

Issue 4. Perception of seismic hazards and seismology : Have you ever felt any seismic activity? (how are you sure that it was a seism / search for information about this seism / is this a worrying topic)

Contribution expected from low-cost stations to BCSF-RENASS seismic observatory activities and seismologists

This dense low cost seismic network makes it possible to densify the mesh of the permanent French institutional observation network (RESIF). Thus it improves the French monitoring activities of BCSF-RENASS (characterization of the seismicity as location, depth, discrimination) and products like "shakemap".   They will be helpful also for the seismic risk assessment and the data, available for researchers, could also be used to improve the seismological imaging, in particular by passive methods based on the analysis of seismic noise.
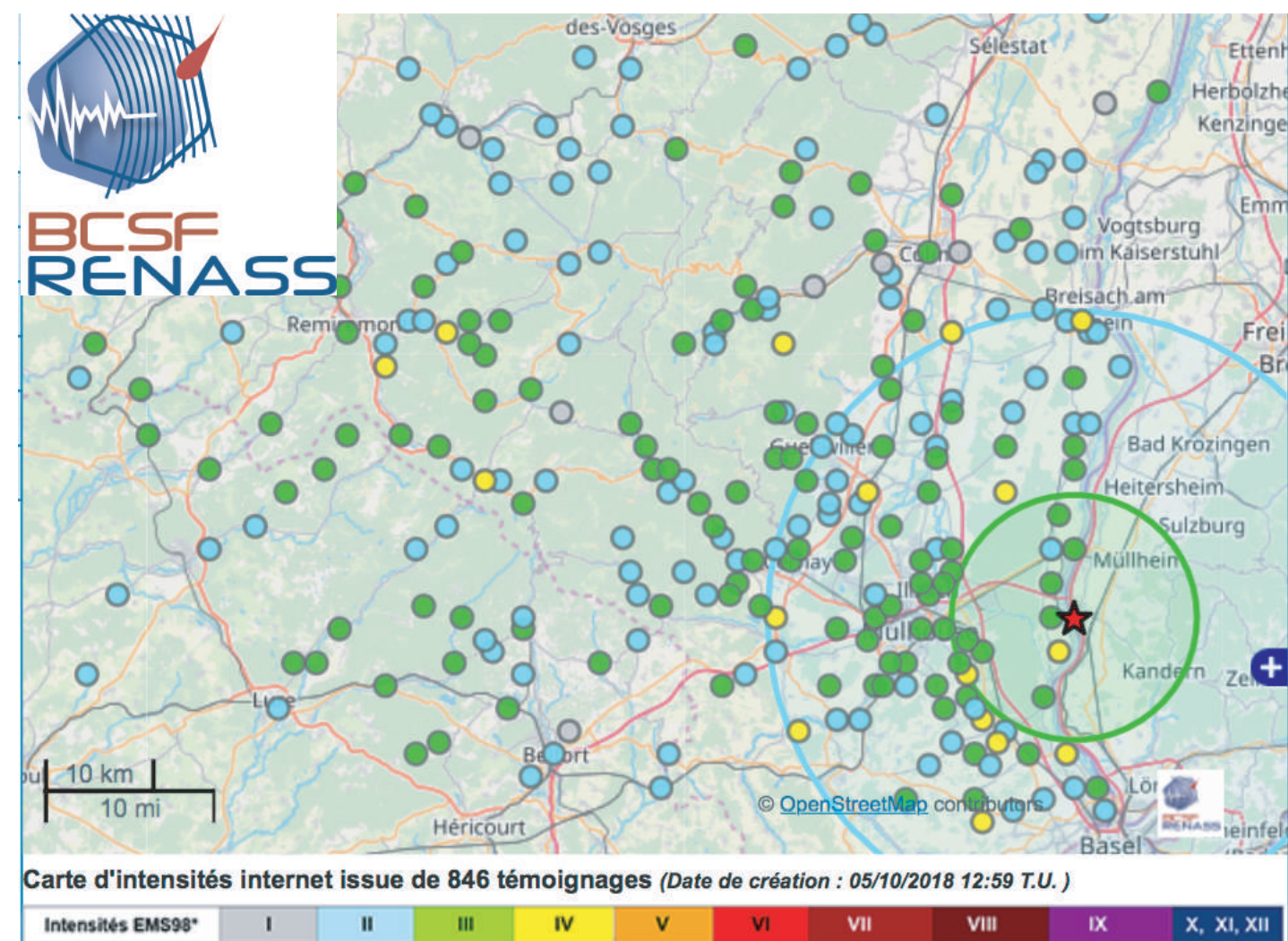
Example of observations based of a ML=3.5 (2018-05-04) before deployment of the SeismoCitizen stations in Mulhouse region.

A RaspberryShake in the living-room connected at the Internet Box.
We add a heavy stone on the top of the station to improve the stability and the contact with the floor.
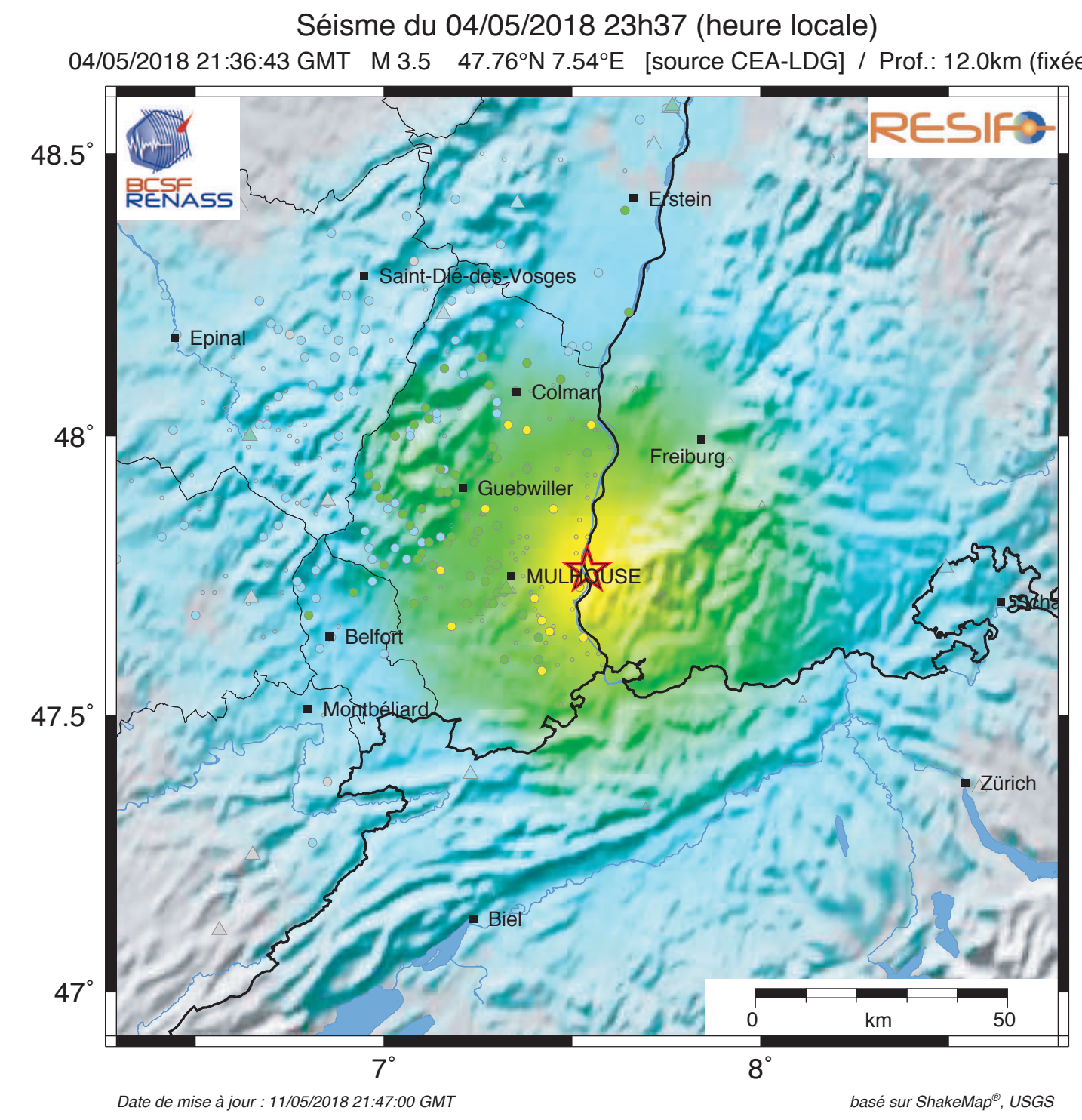
12h of records of a RaspberryShake with direct access by the host - SeismoCitizen through personal computer. Black dottel line = record of a M_L=3.5 located at 87 km.
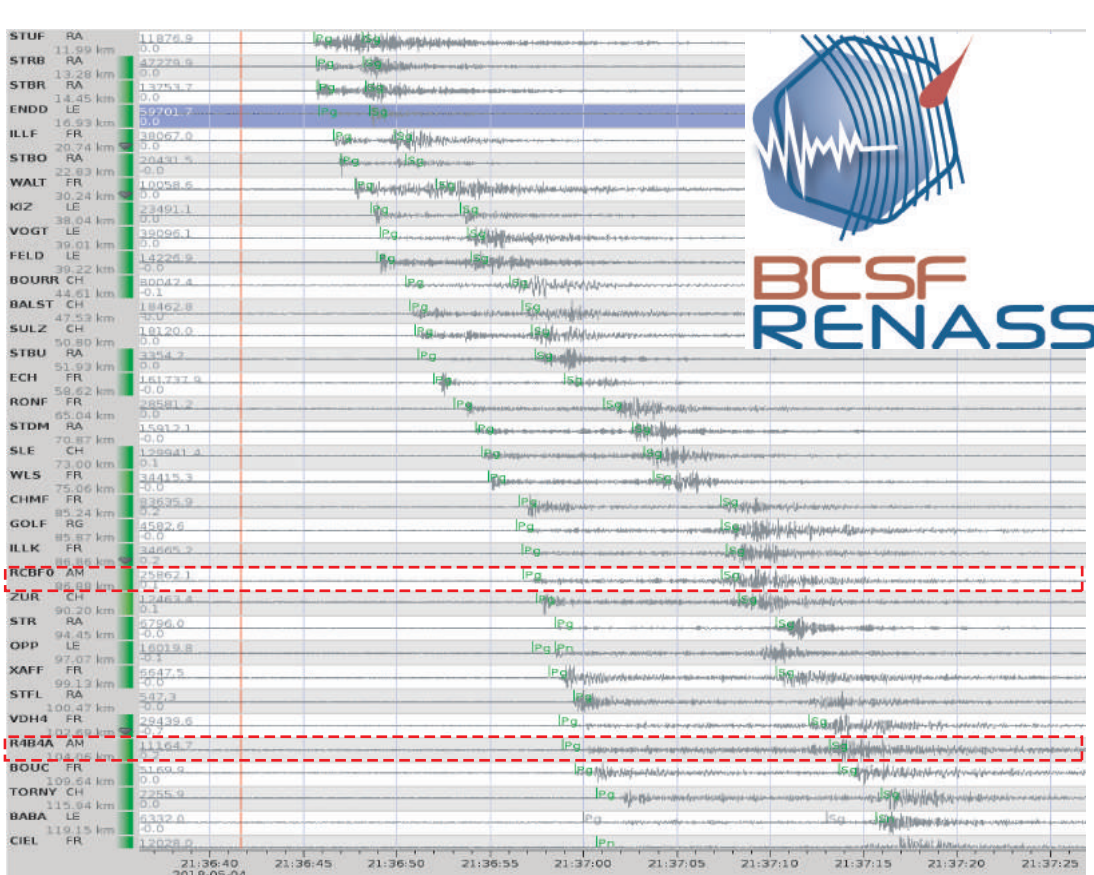
Red dotted boxes highlight the traces recorded by 2 low-cost RasperryShake stations located at 87 and 104 km of the M_L=3.5 and part of the BCSF-RENASS seismic bulletin.

Map of preliminary intensities based on 846 testimonies collected at www.franceseisme.fr for the M_L=3.5. Each dot corresponds to a city and the value is the average of all testimonies. Red star = epicenter

Shakemap based on prelimary intensities (numerous observation for France territory) and instrumental data (27 at less than 100 km).
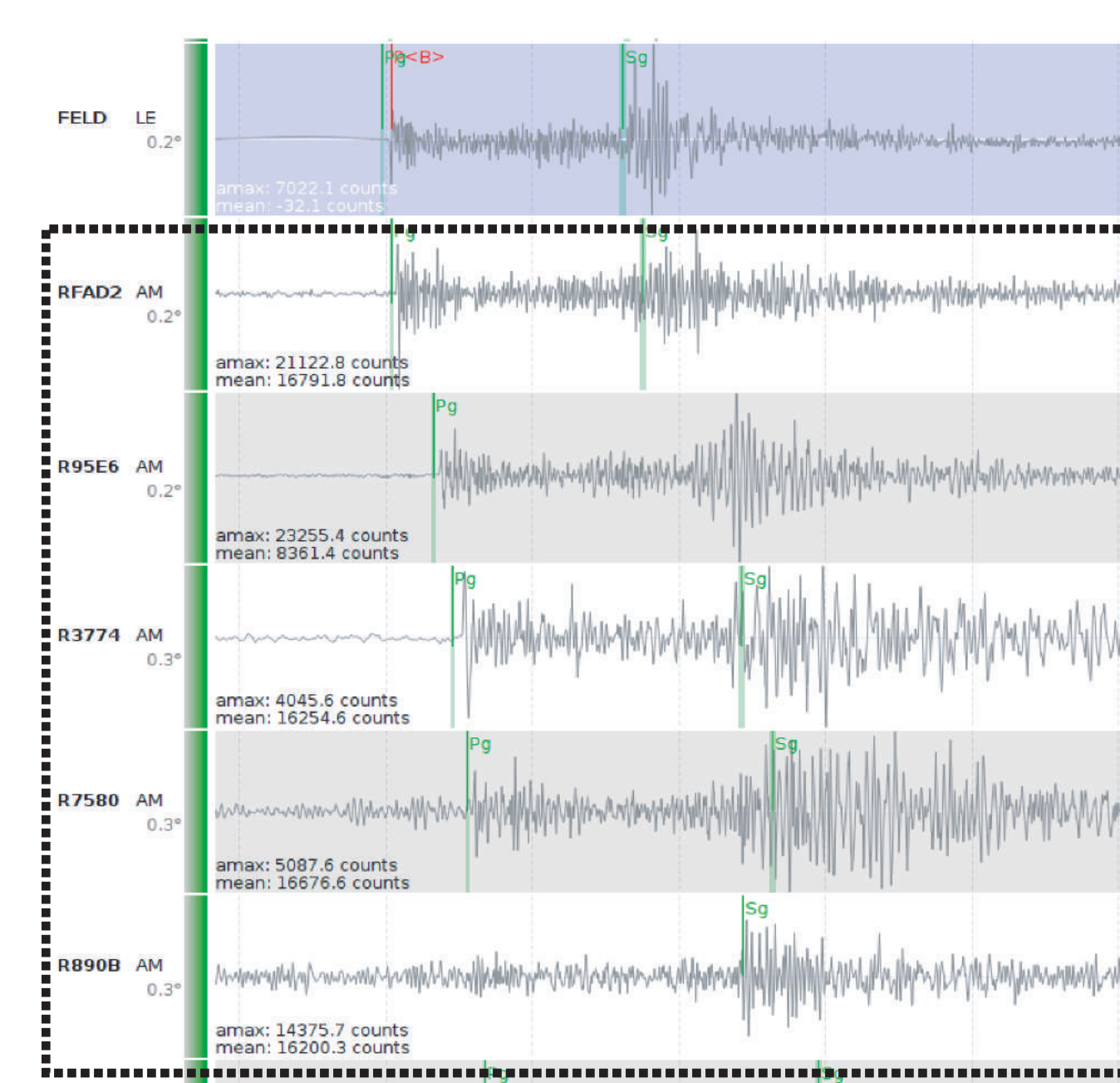
First analysis of the seismic data
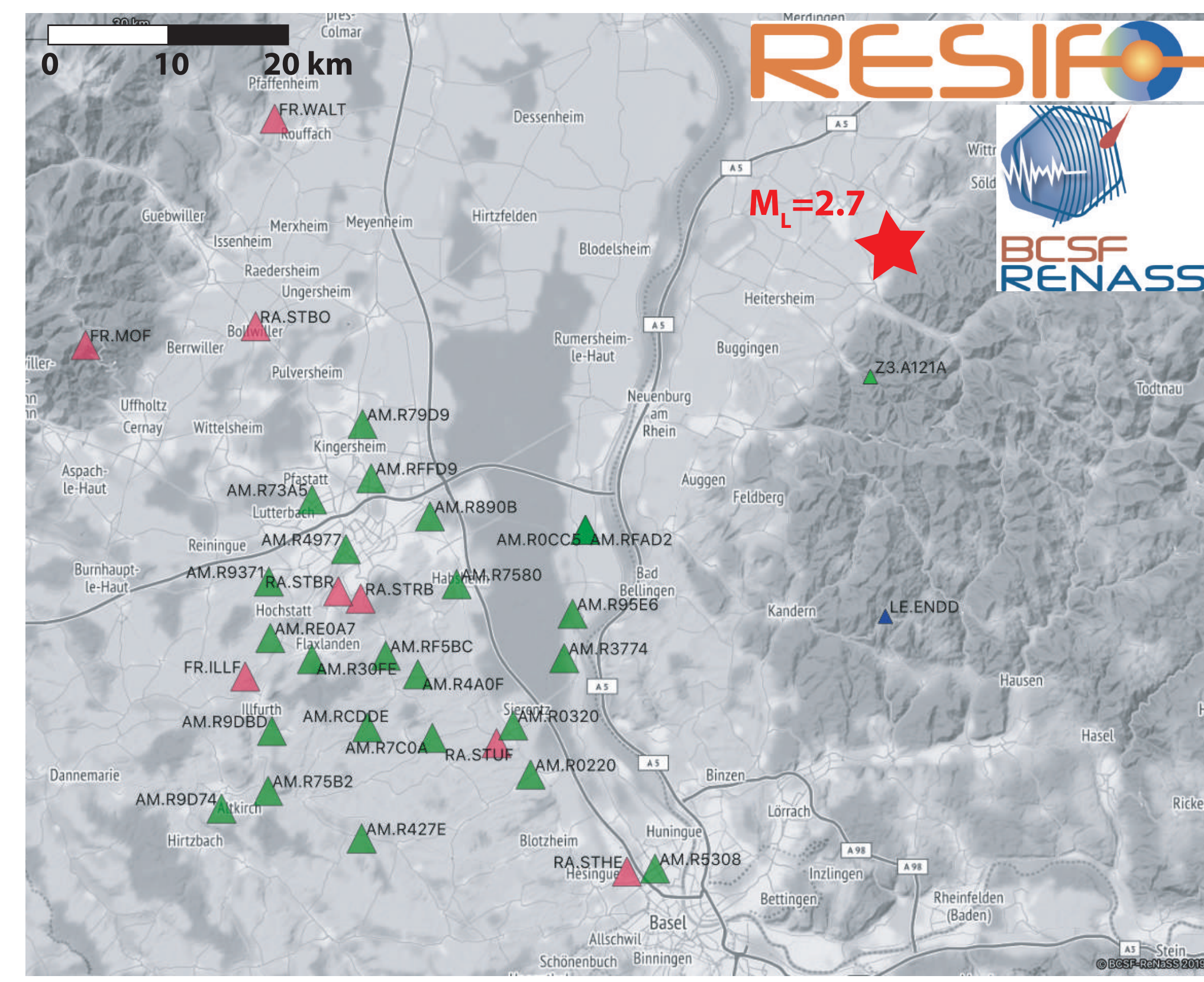
M_L=2.7

Map of the seismic stations in operation around Mulhouse including the low-cost RasberryShake deployed (green triangles) and the RESIF permanent stations (pink triangles).
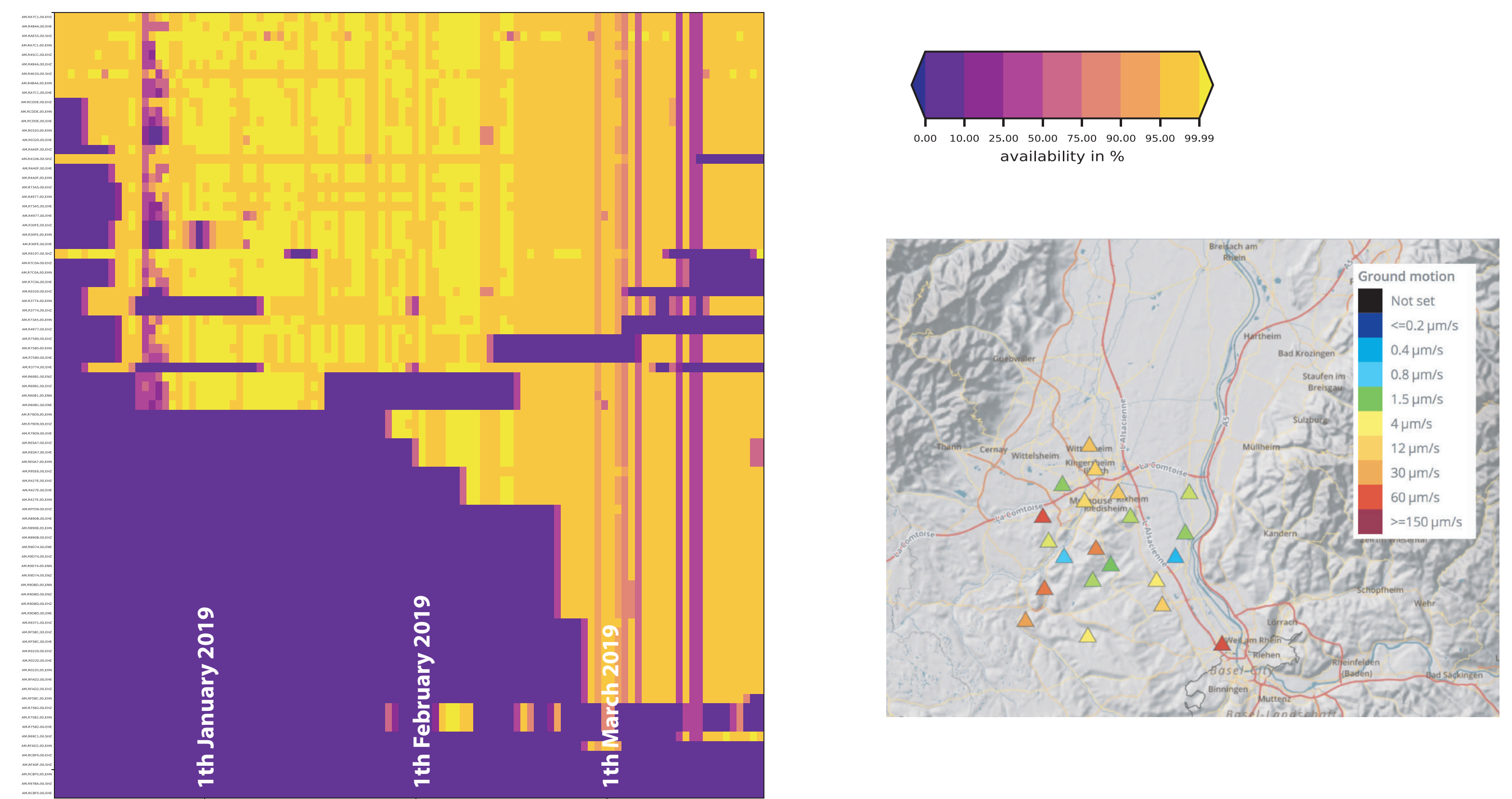
Example of a M_L=2.7 event (red star at left) located at > 35km from the stations. Black dotted box highlights the traces recorded by some of the low-cost stations and part of the BCSF-RENASS seismic bulletin.

(Left) Data availability of the low-cost stations deployed by EOST (each line is a station component): most of the time > 95%. Vertical lines show transmission difficulty on whole network. Blue boxes are either before deployement or due to voluntary power cut at host home or lost of Internet connection. (Right) Example of noise level for the SeismoCitizen stations (at about 22h local time)