

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1
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Comment on nhess-2022-258

Anonymous Referee #1

Referee comment on "Seismic background noise levels in the Italian strong-motion network" by Simone Francesco Fornasari et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2022-258-RC1>, 2022

The article under review cover an interesting topic and present some unprecedentedly published results, for these reasons I would be in favour for publication. Unfortunately, the manuscript does not fit the standard for publication and It requires, in my opinion: a deep review for different reasons:

- the text is in some part confuse, with a lot of repetitions and for the reader (at least for myself) it is difficult to distinguish between original results, hypothesis from the authors and previously published results. It emerges clearly that this is the manuscript from a newbie researcher and I would encourage him to rephrase many sentences and drain the text as much as possible, to ease the readability and comprehension.
- a clear description of the methodology is missing. I understand that PSD is a standard but how PSDs were computed should be described, otherwise the results would be difficult to be reproducible. The authors do not mention is disturbances to the noise (e.g. earthquakes) are removed to the dataset.
- Section results does not analyse in depth the results, e.g. figure 3 that contains the substance of the paper (PSD for single station, difference between the different months and years but it is not discussed at all.
- In Section Discussion I would suggest that the authors at first present their results and then they discuss them in the context of previous study. figures are difficult to be read. Italy is long and narrow and the authors are evaluating +500 stations that means +500 colored symbols placed in the map.

We are at the end of 2022 and the authors during the review phase will have the full 2022 year available. I encourage them to use that dataset to provide a much comprehensive analyse for a complete year for which a lot of stations should be available. and eventually to consider the option of dropping data from 2019 that could become less relevant.

Moreover:

L.20 To complete the thought I would suggest to add that in this case earthquakes are considered as disturbances in the signal.

L.21 Since the authors made a distinction, we now need a definition of what, for the case of this paper, is noise.

L.25 I would suggest to add also the scattering at shallow layers that e.g. generates the so-called Newtonian Noise (e.g. Harms et al. 2009.)

L42 "away from anthropogenic noises", I would say "far from any source of noise", usually seismometers are buried to prevent thermal fluctuation, and so on.

L.44 Since the argument is faced in a general perspective, I would say that seismic stations are placed where it is appropriate for the purpose of the project itself. VBB stations are in remote places far from anything, accelerometer for site effects and strong motion are placed at the study site and so on.

L.50 I would suggest to extend this sentence. It would be difficult to understand why pandemic reduced the noise. Eventually including the citation of some of the paper on this topic as Lecoq et al, Piccinini et al, Poli et al.

L.54 "section 3 section" is a mistake

L.57 Please note that covid and COVID-19 are the same thing, same for "covid lockdown" and "COVID-19 lockdown". please fix it using one name over the whole manuscript

L.62 at line 46 RAN was called in a different manner "Integrated Italian Accelerometric Network" In my view things should be called consistently along the manuscript

L.63 At line 47 the contributors are differently described. If there is the need to repeat it,

please be consistent.

L.65 "in the South" and "in the North East" please specify of what, South of Italy I suppose.

L.66 I am getting confused, The authors use RAN as the acronym for the Integrated, then they write that the RAN is made by three networks. And one of the three is the RAN.

L.68 Again there is some redundancy in the description, the fact that some of them have been converted to continuous was already mentioned about.

L.71 Third time the migration to continuous was mentioned.

L.73 at line 59, it is written that, for simplicity The authors will call it just lockdown.

L.75 Piccinini et al, proved that this was not true at national scale.

L.79 Question: data from 2021 would not be useful to integrate the dataset?

L.87 I would suggest to add a sentence describing the workflow to go from data (continuous time series) to PSD. e.g. data have been corrected for the response? How the spectrum was computed is not mentioned.

L90 I am not english mother tongue, but I feel that it is more appropriate to write "data" in place of "the data". Please check.

L.104 better to say "described" if the author extend it, as suggested above, to a full description.

L.104-105 figure 3 is not discussed although it contains THE RESULTS of the analysis. The reader cannot understand where the considered few stations are located and why they differ in noise level.

L.105 This sentence is not clear, results are shown in fig.3, what is then in fig.4?

L.107 I am feeling pedant but is RAN stands for Rete Accelerometrica Nazionale, then it is not necessary to follow it by network.

L.107-116 t the authors move from periods to frequency and backward. I understand that this is a common practice but, in a paper it is more appropriate to stick on one choice, otherwise the reader gets confused.

L.120 RAN stations at touristic sites can experience the opposite, quiet in the weekdays and noise in the weekend. Anthropic noise is very local. Did the authors consider it?

L.122 this is a repetition of line 119

L.123 english unclear to me

L.125 "very long period" please give the period band since for some seismologists this would be tens and even hundreds of seconds

L.133 Since the author proved that a seasonal variation and a weekday/weekend variation exist, I wonder if they considered it when comparing lockdown and no-lockdown. I mean that, to be consistent and to catch only the lockdown effect, the comparison should be done only with the same time span of 2019 and 2022.

L.140-143 Sentence is too vague

L.144 and following, Since the effect is local, did the authors consider the eventual presence of Wind Farms, or other facility that could produce anthropogenic noise at longer periods?

L.149 "is assumed" It is not an assumption, it is an observation from data and from road traffic data, mobility from mobile phone records and so on. There is plenty of data showing that human activity is reduced.

L.153 "trend" I would say pattern.

L.153 "of" typo?

L.155 "if a station is located in a settlement" I would expect that this is one of the result of this study, not and hypothesis within the discussion section. is this observed in data or not?

L.158-160 Again, do the authors observe what described by other authors in their analysis? This is not a review paper but a scientific one.

L.169 "stations start". Start means that there is a variation to me, when do they start? No clear.

L.175 If the last sentence applies, that implies that stations are blind in this range of period. I do not understand why discussing the source of noise when in this frequency band accelerometers just measure the self noise of the instrument. Moreover the self noise can be computed and measured. It is not a matter of believing. Am I wrong?

L.179 Again the authors discuss something that they cannot observe. I suspect this depends on the fact that they are using accelerometers and D'alessandro et al. (2021) used velocimeters.

L.185 "period periods" repetition

Lines 185-189, in summary:

- human activity dominate noise in this freq band.
- high noise can be linked to activities
- less human activities less noise.

Do we need a scientific study and a paper to state this? Different is when this is a direct observation from data. but this is not what the authors write in these 2 sentences.

L.190-194: Covid reduced human activity, ok. Human activity influence seismic noise. Noise is higher in populated areas and near buildings. A dozen of paper noted such a reduction. The authors too. OK, what is the added value of this study for the Covid-19 lockdown ? It is not clear to me.

L.215 "are" should be "is"

L.216 "at" should be "in"

L.222 "dates" ??? I presume median of the PSD noise.

L.223 "are more dominant" could be "prevail"?

L.233 I miss to understand how this paragraph, at the end of section discussion is linked to the rest of the study. It would make sense at the beginning of the analysis when authors tackle the problem of distinguishing between different source of noise and of characterize their frequency content.

L.235-237 I suggest to rephrase the sentence.

L.240 "manually" "by hand", As I mentioned, I am not english mother tongue. But to me, this sentence means that somebody was checking the passage of cars using his own hands. Not that, as I suppose, somebody visually inspected seismic data and searched for the effect of the passage of the cars and manually marked it on the seismic trace.

L.247 "is" should be "are"

L.254 the assertion "capable of providing" Is a qualitative speculation not based on true values. can the authors give some estimate of the miminum magnitude that can be detected at local distance by high noise and normal noise accelerometric stations?

L.256 "...but also the small ones" This sounds a bit obvious and not very useful without, as above, an estimate of the detection capability. Big and small are always relative to something.

L.258 "they" I cannot understand who is the subject: Selection criterion for what?

L.259 "Some of the stations" How many? again description of data and of result is too vague for a scientific paper

L.260 "(528...) whereas some of them" In the data description it is written that the study is based on 528 stations. If 528 are in settlement, how can be that some of them are away from settlement?

L.263 "in the short period" could be "in the short period band"?

L.273 and following. This is a repetition of line 172 and following

L.281 ".. is applied" not clear

L.296 Anthony et al 2021 was published in 2022.

Figure 1, I was surprised to see that Anthony et al. (2021, actually 2022) report info for only such narrow band and I checked the paper where for example I read (last paragraph, second column, pag 648) that noise in the band 0.0625-1 second contains cultural noise. So the narrow band should be as large as covering the entire band. Please check also the other.

Figure 2a, by placing the closeup box over Sardinia, the reader misses to appreciate the network coverage in that portion of the study area that is the whole Italian country.

Figure 2, I wonder if there is a reason to plot stations with reverse triangles while in Figure 4 are not.

Figure 2 caption, the color coding of the figures is not descriptor. Moreover I do not understand what (RF) stands for.

Figure 2 palette: I I read PSD database completeness does this means that the authors counted the expected number of PSD for e complete time-series and then computed the

ration of available ones?

Figure 3, caption says "several stations" while in the manuscript I read few stations and actually there are a very small fraction of 528.

Figure 4, in the caption the authors use "Power Change" while in the caption and at line 113 I read "noise". Since "power change" is introduced in the discussion and not in the caption I do not understand what figure 4 display.

Figure 8, seasonal variability. In the manuscript it is mentioned that: 1) seasonal variability is studied only for year 2019 and it makes sense since data coverage for 2022 is limited to January-April. It is also mentioned that data analysis is limited to stations with completeness above 90% and it also make sense. In figure 8 I see only two triangle in Pianura Padana and one of them in figure 2a is colored in green that means ~40% to my understanding. Apparently something is not correct. I wonder is this applies also to other stations.

Figure 12, the authors did not provide indication of where Trieste is.

Figure 13, If I interpet correctly this figure line for 00:45 \pm 45 (purple with dots) has high noise at .1 seconds, while line for 23:15 \pm 45 (red without dots) has low noise. How can be midnight much noiser than 11pm? This contractics expectation described in the manuscript. Am I wrong?

Figure 14, "demonstrated" better to say locatized?

Table 1, It confuses me. Since the total of stations gives 715 but the authors used only 528 of them. Is it revenant this table ?