

## Response to review of R. Bossu

- *The authors have been using “Did you Feel it ?” not only to present the tool developed and operated by the USGS but also more generally for “Internet macroseismic data”. (One should note that the title do use the latter). I find this confusing. I believe this distinction should clearly appear in the text. DYFI was the very first online macroseismic tool, several institutes have implemented the same questionnaires, but others have developed their own approach.*

We agree with this comment. To clarify the text we now only use ‘DYFI?’ if we specifically refer to the USGS macroseismic inquiry. Reference to any other questionnaire is made by using “internet macroseismic data”, such as indicated in the title.

- *My second issue is about the description of the data used. I believe that a description of the methodology for each data provider (perhaps in appendix) would be useful.*

We agree that this comparison was overdue. We added a table (see below, will be added as a Supplement) with comparison of the different questionnaires used in this study to the supplementary data. In this table, we checked which question (40!) in the different questionnaires of the seven institutes (BGS, ROB-BNS, NRW-GD, BSCF, EMSC & USGS) do (not) overlap. The table is interesting: most questions are rather similar (i.e. person’s situation, perception and experience of the earthquake) but each questionnaire does have its specifics and no two questionnaires are completely alike. This table also revealed why the NRW-GD has no intensity I values in their database: they don’t have a Q13: “have you felt the earthquake”.

- *Is it a questionnaire (or thumbnails),*

Only the EMSC and BSCF currently provide thumbnails.

- *How are the locations determined (zip code, geocoded full address, nearest city which was an option at EMSC when eyewitnesses declined to provide their full address)*

At the end of the comparison table we added the locations procedure (if known).

- *and how the intensity is assigned.*

We cited to the proper references in case the intensity algorithm is known and mention them in section 4 in the data description.

- *The paper makes a very strong assumption (last sentence of page 2) that intensities may slightly differ from one country to the other (due to differences in questionnaire and/or intensity assignment procedures). Some of the data presented in this paper contradict this statement: the EMSC macroseismic data derived from questionnaires had to be excluded because they differ too much from the other datasets. (For information, these excluded intensities had been assigned by an algorithm developed by one of the father of the EMS98 scale). What I want to stress here is that there is no reference to such a statement and my own experience, or recent by Hough, Martin et al comparing macroseismic datasets for Ghorka earthquake do not support it. This is probably too much work to fully address this issue, but the assumption that differences in intensity from one country to another are slight should be made clear and explicit. A consequence of the previous point is that the methodology is about the spatial grouping of different Internet macroseismic data only.*

We agree with this comment and reformulated the text in the introduction and in sections 2 and 4. The comparison table that is added to the Supplement shows substantial differences between the questionnaires. This comment **is one of the key points of the paper**: namely that a profound review of all questionnaires and their impact on the intensity scale is needed in Europe. Currently, the intensity determination procedures are not always transparent, leading to different results for the same area. This is the painful truth in Europe.

To explore the influence of the questionnaire, we generated institutional IARs through the datapoints for the Goch and Ramsgate earthquakes (see review De Rubeis). Some institutional IARs (ROB-BNS, BSCF, USGS, EMSC questionnaire) are rather similar despite the different questions. Other (NRW-GD, EMSC thumbnail) differ strongly from the main IAR. We added this observation to the discussion and to the perspectives at the end of the paper, rather than including it as an observation. Currently, the intensity procedures are not always known, leading to different results in the same area.

We changed section 4.2 as follows:

*“The tradition of collecting macroseismic data in an organised way is old and rich in European countries. Table S1 (Supplement) compares all questions in the different institutional questionnaires. The questions concern typical effects on the person’s situation when the earthquake occurred, the perception and experience of the earthquake and earthquake effects on furniture, buildings and the environment. Each questionnaire originates from an historical form developed for a local intensity scale or is modified after the pioneering online questionnaire of Wald et al. (1999). Notwithstanding much overlap between the questions, no two questionnaires are alike. The impact of these differences*

on the intensity scale is unknown and might be present, such as recently shown by Hough et al. (2016) on macroseismic datasets for the Nepal Ghorka earthquake.”

- *In the second paragraph of the introduction, the EMSC is presented alongside the national institute while it works similarly to the USGS “Did you feel it”. This seems to indicate there is no transfrontier and international internet macroseismic data collection in Europe or that EMSC works at national level, which is not the case.*

This was a mistake. EMSC has now been added to the international institutes

- *EMSC does not request not felt response from volunteers. The LastQuake app send notification after felt earthquake to people in the area and some of them may react to this notification by sharing their testimony*

Ok, this sentence has been modified adding the information above.

- *First sentence of the conclusion is inaccurate. Transborder macroseismic maps exist in Europe at EMSC. The challenge is to create a denser and possibly more accurate one by merging national datasets.*

Ok, this sentence has been modified

- *Third paragraph of the conclusion: the paper does not demonstrate “strongly improves the quality of real time intensity evaluation of individual agencies”. Neither intensity assignment nor real time processing is covered in this article*

Although we do not cover any real-time processing, the work in this paper aims to set an example how data **could** be shared in Europe in quasi real-time. Hence, any statements on “real-time” processing have been deleted from the paper but we want to stress in the conclusions that generating dense transfrontier maps using national macroseismic data in Europe stays problematic. Only after a careful analysis of the different available questionnaires and their impact on the intensity scale, we can exchange and process intensity data in real-time.

COMPARISON OF MACROSEISMIC QUESTIONNAIRES USED IN VAN NOTEN ET AL. (2017), Solid Earth

Nr.	Questions	Possible answers	ROB-BNS	BCSF	KNMI	NRW-GD	BGS	EMSC	USGS	
1	Date and Time		yes	yes	yes	yes	yes	yes	yes	
2	Street, Address		yes	yes	yes	yes	yes	yes	yes	
3	Zip code, City, Country		yes	yes	yes	yes	yes	yes	yes	
<b>PERSON'S SITUATION WHEN THE EARTHQUAKE OCCURRED</b>										
4	How many times have you felt an earthquake ?	1st, few times, often	no	no	no	no	no	yes	no	
5	What was your situation during the earthquake?	No answer / Inside / Outside / In a stopped vehicle / In a moving vehicle / other	yes	yes (less precise)	yes	yes	yes	yes	yes	
6	What was your situation during the earthquake?	Other: church tower / electricity mast / scaffolding	no	no	no	Yes	no	no	no	
7	If you were inside, please select the type of building or structure	No building, Family home, Apartment building, Office building/school, Mobile Home with permanent foundation / Trailer without foundation	yes	yes	yes	Partly	yes	no	no	
8	At what floor where you?	Floor number	yes	<2, 2/3, 3/4, >=5	yes	No	1,2,3,4-8,>8	no	no	
9	Type (wood, brick, etc.) of the building	wood / brick / concrete / loam / ...	yes	yes	yes	yes	Yes	no	no	
10	Height (in floors) of the building	specify	yes	yes	yes	no	no	no	no	
11	Type of activity during event	Standing, sitting, lying, walking, kneeling, sleeping	no	yes	no	yes	yes	yes	no	
12	Swinging effect of the respondent	Standing up, swaying, fell	no	yes	no	yes	no	yes	no	
<b>PERCEPTION OF THE EARTHQUAKE</b>										
13	Did you feel the earthquake?	no / yes	yes	yes	yes	no	yes	yes	yes	
14	Were you asleep during the earthquake?	no / yes, didn't get up / yes, did get up	yes	yes	yes	yes	yes	yes	yes	
15	What best describes any sound you heard?	no sound / rumbling / roaring / explosion	no	yes	no	yes	yes	yes	no	
16	Did you hear a noise? How loud?	no / yes, slight, loud noise	yes	yes	no	no	yes	yes	yes	
17	Did you hear church bells?	no / yes	no	no	no	yes	no	yes	no	
18	Did other persons nearby feel the earthquake?	I don't know, nobody nearby/some felt it, others not/most felt it, others not/(almost) everyone felt it	yes	no	yes	yes	yes	yes	yes	
19	Have you felt shocks before or after, if so how long/many	Specify	no	YES (last case observations)	no	yes	no	no	no	
<b>YOUR EXPERIENCE OF THE EARTHQUAKE</b>										
20	How would you best describe the ground shaking?	weak / mild / moderate / strong / violent	yes	yes	yes	no	yes	yes	yes	
21	How would you describe the earthquake shaking	vibrating / trembling / swaying / impact / rolling	no	yes	no	yes	yes	yes	no	
22	About how many seconds did the shaking last?	Specify	yes	no	yes	yes	no	no	no	
23	How would you best describe your reaction?	no reaction / very little reaction / excitement / (somewhat, very, extreme) frightened	yes	yes	yes	partly	yes	yes	yes	
24	How did you respond?	No action / moved / cover / ran outside	yes	yes	yes	yes	yes	no	yes	
25	Was it difficult to stand or walk?	no / yes (difficult, fallen, forcibly thrown)	yes	yes	yes	no	no	no	yes	
26	Did you notice the swinging or swaying of doors, windows or free-hanging objects?	No answer, did not look / yes (slight/violent swinging)	yes	yes (only objects)	yes	Yes, only checkbox	yes	yes	yes	
27	Did you notice creaking or other noises?	No answer, paid no attention / yes (slight/loud noise)	yes	yes	yes	Yes, only checkbox	no	no	yes	
28	Did objects rattle, topple over, or fall off shelves?	No answer, no shelves / Yes: slight/loud rattle - few toppled - few/many/everything fell off	yes	yes	yes	Yes, only checkbox	yes	yes	yes	
29	Did pictures on walls move or get knocked askew?	No answer, no furniture / no / yes	yes	yes	yes	Yes	yes	yes	yes	
30	Did any furniture or appliances slide, tip over, or become displaced?	No answer, no heavy appliance / no / yes, some contents fell, shifted few cm, shifted a foot (30 cm), overturned	yes	yes	yes	Yes, only checkbox	yes	yes	yes	
31	Was a heavy appliance (refrigerator or range) affected?	No answer, no furniture / no / yes	yes	yes	yes	no	yes	no	yes	
32	Moving fixtures, oscillation / overturn or tilting in level	no / yes / don't know	no	yes	no	yes	yes	yes	no	
33	Did trees / bushes swing?	no / yes / don't know	no	no	no	yes	yes	yes	no	
34	Were free-standing walls or fences damaged?	No answer, no walls / no / yes, some were cracked/partially fell/completely fell	yes	no	yes	no	no	no	yes	
35	If you were inside, was there any damage to the building? Check all that apply:									
	No damage		yes	no	yes	no	yes	yes	yes	
	Hairline cracks in walls		yes	yes (+ quantity)	yes	Yes, only checkbox	yes	not specified	yes	
	A few large cracks in walls		yes	yes	yes	checkbox	yes		yes	
	Many large cracks in walls		yes	yes	yes	checkbox	yes		yes	
	Ceiling tiles or lighting fixtures fell		yes	yes	yes	no	no		yes	
	Cracks in chimney		yes	yes	yes	yes	yes		yes	
	One or several cracked windows		yes	no	yes	yes	yes		yes	
	Many windows cracked or some broken out		yes	yes	yes	yes	yes		yes	
	Masonry fell from block or brick wall(s)		yes	yes (+ quantity)	yes	no	yes		yes	
	Old chimney, major damage or fell down		yes	yes, but without age distinction	yes	Yes, no age distinction	Yes, no age distinction		yes	
	Modern chimney, major damage or fell down		yes	yes, but without age distinction	yes	Yes, no age distinction	Yes, no age distinction		yes	
	Outside wall(s) tilted over or collapsed completely		yes	yes (+ quantity)	yes	no	no		yes	
Separation of porch, balcony, or other addition from building		yes	no	yes	no	no	yes			
Building shifted over foundation		yes	no	yes	no	no	Yes			
36	Did the roof collapse?	Total / part (quantity)	no	yes	no	yes	House partly or completely collapsed?	no	no	
	Did any poles or storeys collapse?	yes / no	no	yes	no	no	checkbox	no	no	
	Cracks at joints, poles, wall corners?	specify	no	yes	no	no	checkbox	no	no	
	Did parts of walls or the facade collapse?	yes / no	no	yes	no	no	checkbox	no	no	
37	Environmental effects	Ground cracking / landslided / waving ground movement	no	no	no	yes	yes	yes	no	
38	Unusual animal behaviour	No / Yes, pets, farms animals, no animals nearby	no	no	no	yes	yes	yes	no	
<b>Are THUMBNAI LS provided?</b>			no	yes	no	no	no	yes	no	
<b>Type of intensity maps?</b>	Zip code map		yes	yes	yes	yes	yes	yes	yes	
	Geocoded "boxes" maps		yes	no	no	no	no	no	yes	
	Nearest city maps		no	no	no	no	no	yes	yes	