Comprehensive authors' answer to the reviews by C. Jackson and B. Bartel regarding the paper "Rapid collaborative knowledge building via Twitter after significant geohazard events" by Lacassin R. et al., Geoscience Communication Discussion, 2019.

Our paper has now received two detailed reviews outlining that: "it will be an important contribution to the science communication literature" (Reviewer 2, Beth Bartel). We thank both reviewers for their thorough work that will help us to strengthen our presentation of results and our discussion.

Hereafter, in this comprehensive Author Comment, we answer to their detailed comments, explaining how we implement the related changes in our revised manuscript. Below, R1 and R2 respectively refer to comments by Reviewer 1, Christopher Jackson, and Reviewer 2, Beth Bartel.

R2 - Abstract - *A statement about the purpose of the analysis would be helpful.*

Answer: Agreed. We have added the following sentence to the abstract: "Social media is used widely by geoscientists, but there is little documentation currently available regarding the benefits of this to the scientist and the public, or the limitations."

R1 - L88 - *Could you perhaps provide an example or two of where this approach has been successfully used in another field? This type of analysis will be new to most (it certainly was to me). Note that your example need not be a STEM discipline.*

Answer: Agreed. There are many cases where social media posts are used to detect and locate hazardous events, such as flooding. We include a reference for this.

First two sentences changed to: "For around a decade now, scientists studying natural hazards have begun to use information extracted from social media, websites, or app earthquake reporting, to automatically detect and locate hazardous events, such as flooding (e.g. Jongman et al., 2015). Social media posts can also be used to locate earthquakes within tens of seconds of their occurrence time (Bossu et al., 2008, 2018; Earle et al., 2010; Steed et al., 2019)."

R1 - L105 - *How were the "most informative tweets" chosen? This sounds rather arbitrary, and my concern would be that such a subjective approach may, as the authors later go on to discuss, could exclude certain voices. Indeed, if voices are excluded, what impact might that have on the quality and robustness of the derived science? I think this needs discussing more; i.e. who is "in" and who is "out" when compiling your underlying data...*

Answer: Agreed.

We have changed "we compiled the most informative tweets" to "we compiled informative tweets". We recall that our objective is not to do a complete analysis of all tweets posted on the subject, but to use chosen tweets and tweet threads to illustrate how this way to spread and discuss scientific information is useful. We have also added the following sentences: "This list of tweets should not be considered exhaustive as it is strongly dependent on who we follow on Twitter and what is retweeted. We use it to illustrate how this way to spread information enhances the dissemination and discussion of scientific results."

R1 - L111 and L128 - *I strongly suggest you post all data underpinning your analysis on something like FigShare (https://figshare.com/). The data do not appear confidential, plus something like FigShare is a longer-lasting archive than someone's hard-drive. Plus people do not live forever...*

Answer: As suggested we put the pdf prints of the full threads on Figshare :
https://doi.org/10.6084/m9.figshare.11830809.v1 for the thread related to the Palu earthquake
https://doi.org/10.6084/m9.figshare.11830824.v1 for Mayotte
These links are now given in the text and in the section supplementary infos at the end.

R2 - Section 2, Studied Events and Methodology - *I would like more specific information on the Mayotte analysis. What did the analysis consist of? What were you looking for? Was the primary analysis the development of the word clouds? Or the exercise of organizing the discussion into three Twitter moments? Was it mainly looking through the tweets for themes? Was anything about it systematic? How would you describe it should you want someone to repeat it? (The same goes for Palu, but to a lesser extent.)*

R2 - Lines 128-130 - *seem to set the Mayotte analysis up as a contrast to the Palu analysis, but it appears from the list starting on line 130 that you are looking at the same things, possibly with the exception of the role of citizen scientists, which is not addressed in the Palu discussion.*

R2 - Line 133 - *The word "aims" is likely not the best choice here, as it implies that each thread had a different goal. Presumably commenters didn't start the threads with different goals in mind. Instead, I assume that you mean either that the aims of the analyses of each thread were different of that the nature or characteristics or circumstances of each thread were different. (I'm not italicizing to be a jerk, just to emphasize the words I think could be substituted.)*

Answer: We group these three comments by Beth Bartel as they are about the same issues: what are the differences between the Mayotte and Palu cases and related analyses? To address these issues, while keeping the text concise, we have implemented the following changes:

First, we have added the following sentence to the start of the first paragraph to show the contrasting nature of Mayotte compared to Palu: "In contrast to the Palu case, the case of Mayotte, in the Comoros archipelago between East Africa and Madagascar, represented emergent scholarly interaction over a much more protracted time period, without direct damage caused by the unrest, and which lacked initial responses from official government agencies".

Then we have modified the second part of this paragraph (from former L120 to L132). It now reads: "We do not analyse the full, >1 year long, Twitter activity related to the Mayotte seismic swarm, but we focus on a peculiar long-period seismic event […] The surge resulted in a complex and long (>200 Tweets) Twitter thread with many branches opening secondary discussions, more like a wild bush than a well-structured tree. To simplify it, our first aim was to select and regroup the most relevant and informative tweets linked to these discussions. We organize these selected tweets into three successive Twitter moments accessible online […] Our purpose is not to do the same timeline analysis than for the Palu earthquake, but to use the "Mayotte 11 November 2018 rumble event" example to outline the efficient knowledge-building dialogue between scientists trying to interpret a mysterious event and dealing with uncertainties about it. To illustrate the time evolution of ideas during this active dialogue, we generated two word clouds from the selected tweets. We also use the Mayotte case to outline the implications of citizen scientists at the start of the discussion, to discuss some pitfalls inherent to the informal use of Twitter as well as the opportunity to spread information toward more traditional print, broadcast and online media."

Last, we have also significantly modified the following paragraph (from former L133) which now writes: "The evolution of the two threads were quite different. With Palu, the scenario was quite well defined and occurred at a rapid pace over a short amount of time: an earthquake and tsunami, with the focus of scientists being on the key observations to explain what happened. With Mayotte, we knew very little at first apart from an initially innocuous seismic swarm followed by the detection of a long-period seismic signal. There was no accurate location and no idea about what the signal was. This resulted in the Twitter exchanges and thread on Mayotte being more chaotic and open than the more linear Palu thread. There were also very different societal impacts. The Mayotte earthquakes caused uncertainty, unrest, and stress

but there was no important damage, injury or fatalities. In contrast, devastation and death was immediately seen in Palu."

R1 - L148 - *There seems to be some switching between passive and active voice. I would stick to one...preferably the latter...*

Answer: Agreed. Changed the sentence to be in the active voice.

R2 - Section 3.1: Lines 152-188 - *It would be helpful to call out who posted info on Twitter other than the monitoring agencies (since you do refer to them), to show who was contributing to the knowledge-building process. You don't need specific names, but it would be helpful to know: academic scientists? Researchers from other institutions? Other?*

Answer: this is an important and worth-studying subject. But our purpose here is not to do a detailed sociological study of people involved in the Twitter discussions.

To be more informative while remaining short we added the following sentence at the end of section 3.1 first paragraph: "After the initial tweets issued by responding agencies (e.g. USGS in the USA, BMKG in Indonesia), most of the exchanges we quote involved academic researchers from different countries and institutions (see Tables 1 and S1)."

R1 - L197 - "*...as good a way...*" *compared to what?*

Answer: our purpose is not to compare data sharing and social interaction via Twitter with other ways to discuss scientific information.

To clarify, we modified the sentence as: "Data sharing and social interaction via Twitter appeared as an effective way of getting prompt and diverse feedback from fellow researchers on early scientific ideas."

R2 - Line 198 - *It would be helpful to know more about the scientists, e.g., example institutions or at least institution types (as in comment above); all academics? From other agencies? You write later about the democratization of science, and about the diversity and subdisciplines of geoscience; this would be a good place to lay the groundwork for those statements by pointing out the diversity of voices in the conversation. (All seismologists, or various disciplines? Different data types being shared and considered together? Different career stages, nationalities, etc.?)*

Answer: As already said in a previous answer, such a sociological analysis would devote another study, and paper. This would be very interesting, but would complicate our purpose and lengthen a lot the paper. We acknowledge reviewer's suggestion but we prefer not implementing this in the present paper.

To clarify this point, we added a sentence at the end of the first paragraph of section 3.1, which now reads as follows: […] After the initial tweets issued by responding agencies (e.g. USGS in the USA, BMKG in Indonesia), most of the exchanges we quote involved academic researchers from different countries and institutions (see Tables 1 and S1). Note that we will not investigate the sociology of the people involved in the Twitter discussions, because out of the scope of the present study, but future work should address this critical subject.

R2 - Line 206 - *Regarding "creates": Be careful with the use of present vs. past. Present implies a general truth, in this case that Twitter creates the opportunity for developing new international collaborations. I think what you meant and what I think is appropriate in this section is that the Twitter interactions during the Palu event created the opportunity for developing new international collaborations. (In which case, use past tense, created.) This is an example of why defining your pronouns*

is also important (see General comments under Technical Corrections, below). If you want to make a general statement here, I suggest something like "Exchanges like this create the opportunity. . .."

Answer: Agreed. We have changed "creates" to "created"

R1 - L208 - *As written, this makes it sound like Twitter is not a social media platform. I would perhaps rephrase this sentence.*

Answer: Agreed. We have changed this part of the sentence to "… was enabled by videos posted on social media platforms such as Twitter and YouTube."

R2 - Lines 210-222 - *I recommend reworking this paragraph for clarification. It is worth expanding on this - don't be afraid to take up more space explaining the situation.*

R2 - Line 220 - *Wasn't the geometry of Palu Bay, not only the timing, part of the scientific discussion? If I'm remembering wrong, ignore. If this was indeed part of the discussion, consider bringing it in.*

R1 - L222 - *I would rephrase this sentence, as I am not sure "critical explanation" makes sense here in this context.*

Answer: We group these comments, and we agree with the suggestion to give more explanations about the "failed" tsunami alert.

The text now reads as follows: "Based on an Associated Press (AP) dispatch, on 1 October 2018, quoting some scientists (Wright 2018), there were inaccurate reports in international media outlets about a "failed" tsunami warning. According to these reports a network of tide gauges and buoys would have been able to issue an early tsunami warning after the earthquake, thus saving lives. The media were quick to blame the Indonesian authorities, saying that such a warning would have been impossible because the Indonesian buoy network was not well maintained. But geoscientists realised that there was not enough time to issue any warning given the very short distance between the earthquake source and the areas exposed to tsunami in the very narrow Palu Bay (Figure 3). As stated by Carjaval et al. (2019) "the most remarkable features of the tsunamis that devastated Palu were the very short, nearly instantaneous arrival times". The first tsunami waves indeed hit the coast between 1 and 2 minutes after the earthquake. After evidence-based explanation given by scholars on Twitter (Figure 3), the process of fact-checking by some journalists took only a few hours after publication of the AP dispatch."

R2 - Line 222+ - *This section would benefit from a short concluding paragraph.*

Answer: Agreed

We have inserted the following sentence at the end of this discussion: "As described above, the case of the Palu earthquake and tsunami provides an excellent example of how scholarly discussions on Twitter can provide initial and rapid scientific results, whilst also reinforcing local official authorities on-the-ground, and helping to guide journalistic outputs."

R2 - Lines 230-236 - *As I wrote in the margin, I think a shot of these early tweets would be a helpful figure.*

Answer: Agreed.

We added screenshots of these early tweets by citizen scientists as a new figure.

R1 - L240 - *See comment related to L105.*

Agreed. We have changed this part of the sentence to "…that regroup our compilation of tweets".

R2 - Line 241 - *I'm not convinced that this work is a contextual analysis. My impression is that it is another form of content analysis. I'm not an expert in this, however.*

Agreed. We have now stated that this is "a simple content analysis of the selected tweet…".

R2 - Line 253 - *An intro sentence would be helpful here.*

We've added the following sentence to the start of this paragraph: "The Twitter interactions on Mayotte brought the global geoscience community's attention to the event".

R2 - Lines 263-268 - *An intro and/or conclusion sentence with main point(s) would be helpful. Also, I don't find the SH tweet quote helpful, especially as he is an author (meaning you can just state that idea in your text as authors, rather than quoting the tweet). Here quoting these casual tweets is a little like saying "after this event, someone told me over coffee that ___." As in, it is not evidence of anything. You can make the arguments based on your analysis instead. I also don't find the corresponding figure helpful (Figure 4), especially in the absence of other tweet examples that would be more pertinent in this paper, such as the tweets that started the Mayotte conversation. I recommend either removing the figure or reworking this paragraph and the figure caption to justify including it.*

We agree that the screenshots displayed on Figure 4 were casual. We delete them, and we recall that we now provide screenshots of the tweets by citizen scientists that were at the start of the discussion.

R2 - Lines 274-278 - *Valid points, but they need back-up. They seem speculative. The comments on the people living in Mayotte are also potentially demeaning, and I recommend more careful wording here. What was the mention of the "sea monster"? Please clarify context.*

Can you comment on how the pitfalls with Mayotte compare to the Palu example? Were they absent from the Palu case? (Aside from the bushy nature of the thread, which you have made a clear case for already.)

Answer: The argument about animism belief and 'sea monster' is not central to the paper and would open avenues for another debate. We now focus the paragraph more on the specific nature of the bushy discussion in the case of Mayotte and the difference with Palu. And we deleted the final sentences about animism belief and 'sea monster'.

The paragraph now reads : "The long thread about the Mayotte 11 November seismic event reveals the efficiency of knowledge-building via scholarly online interactions, but it also outlines some pitfalls that are inherent to the informal aspect of exchanges via Twitter. While after the Palu earthquake and tsunami geoscientists were posting solid observations (i.e. "knowns"), for Mayotte they were trying to understand a peculiar event with large uncertainties thus opening many secondary discussions about unknowns. The resulting "bushy" nature of the thread makes it difficult to follow and apprehend in real time; and summarising it *a posteriori* is challenging. Also, some of these secondary discussions were casual or humorous and were at risk of being seen as insensitive and taken out of context by the general public. We infer that scientific Twitter exchanges dealing with uncertainties and unknowns, as for Mayotte, are more prone to such pitfalls than those sharing knowns."

R1 - L298 - See comment related to L105.

Answer: Agreed. We have changed this question to "How do we judge who is qualified to speak?". We also added a further question: "How do we ensure that the most qualified comments receive the most attention?"

R1 - L299 - *How do you define a "reputable academic institution" or "credible scientist" (L301)? My concern here is that such definitions are rather poorly defined, and could potential lead to the exclusion*

of particular voices not known by the 'in-crowd' who are driving the scientific discussion. Now, I am not accusing you of this, but I think this manuscript would be a good place to explore this problematic issue.

Answer: Agreed. But our paper is not about reputability and credibility in Science, and we cannot explore this subject in more detail. To clarify we have added the following sentence: "Whilst scientific credibility is important, it is not straightforward to make such a classification, particularly for members of the public not part of the scientific community."

R2 - Section 4.1 Lines 302-305 - *I don't see two of the ideas stated here clearly stated in and supported by the analysis (noted in the margins). Specific quotes or figures in the analysis to support these ideas would be helpful.*

Answer: Agreed, our text needed clarification and simplification.

To clarify our point we changed the paragraph as follows: " Even if a long practice of research allows scientists to estimate the quality of a dataset or of a methodology almost immediately (if not intuitively), it does not substitute peer review as a process to check the validity of a result and 'establish' knowledge. A question therefore arises over the credibility and legitimacy of the knowledge built rapidly and without peer-review via Twitter: can it be believed? on what ground? The fact that the author of a tweet comes from a recognized expert institution increases his/her credibility. But this is not enough to ensure the scientific quality of his/her tweet. And the reverse is also true. As shown in the Mayotte example, non-practising researchers and "hobby scientists" can develop a good scientific understanding and be fully legitimate to discuss these topics (Figure 4). The question that arises is thus the following: how can we ensure that the most qualified comments receive the most attention? " In this revised paragraph we refer to the new version of Figure 4 that now shows screenshots of the tweets by citizen scientists at the start of the discussion about the 11 Nov event.

R2 - Lines 310-315 - *This is an important discussion. You may want to clarify a bit: Are you referring to use of open access data, or people using info posted by agencies on Twitter, or. . .? If I understand right, you are referring to researchers (not at the responding agency) using tweets, blog posts, and media releases posted by the responding agency to further their own science without collaboration with the responding agency scientists, and faster than the responding agency scientists can publish.*

R1 - L312 - *Please cite the "early publication" mentioned here, otherwise this comments sounds too anectodal (when it need not).*

R1 - L314 - *What precisely do you mean by "some caution"? More specifically, what guidance would you provide people regarding their engagement with scientific discussions on Twitter? I know such guidelines might be hard to define, but some comments here would be useful.*

Answer: we regroup these comments as they are about the same paragraph and discussion. We agree that this discussion needed some clarifications.

We clarified the sentences about NZ case which now read as follows: "Elements of such a scenario unfolded following the 2016 Kaikōura earthquake in New Zealand, when tweets, blog posts and media releases by the responding agencies were an important information source for an early publication by researchers without collaboration with the responding agency scientists. This publication (Shi et al. 2017) predated, by several months, publications of field observations and analysis by teams on the ground."

We now cite the related paper (Shi et al. 2017).

We have elaborated and changed the last sentence to "This example raises questions about the ownership of scientific knowledge that is shared in the public domain, and suggests that some scientists may choose

to completely restrict, or be more selective about, publicly posting their scientific analysis into the public domain."

R2 - Section 4.2 - Line 320 - *Who was already in the discussion, and was it already international? It would be helpful to know more about the discussion the Indonesian scientists "joined." (Noting that they, too, are part of the international scientific community – you may want to reword to make this clear.)*

Answer: agreed. We added some details.

The corresponding sentence now reads as follows: "In the case of the Palu earthquake, most of the early exchanges involved non-Indonesian academic researchers; then Indonesian geoscientists joined the discussion and provided data that could only be acquired locally (e.g. field observations about the earthquake rupture or liquefaction induced landslides). "

We also changed "discussion with members of the international scientific community" to "discussion with other members of the international scientific community"

R1 - L326 - *What are "validated language elements"?*
R2 - Lines 325-328: *What are the implications? Problem? Limitations? And what specifically happened with Mayotte in May 2019? And does it relate to / show up in your analysis?*

Answer: We regroup these comments by both reviewers. Discussing this point, and communication issues following the discovery of the undersea volcano in May 2019, would be another subject. We deleted this sentence and keep the discussion more general.

The paragraph now ends: "Also, scientists from local monitoring organisations or universities may have strict social media usage and communication policies"

R1 - L365 - *I remove "rigourous" from here, given this is not always the case. In fact, this is something you yourselves go on to say...*

Agreed. Removed.

R2 - Section 4.4 - *You may be able to combine or reorganize some of the sections, for example 4.1 with 4.4.*
R2 - Lines 367-371 - *This mixes peer review (process) and publications (output). These should be considered separately. This may also fit into section 4.1, as noted above.*
R2 - Lines 374-375 - *How does this relate to social media? This seems an argument for open-access journals.*
R1 - L375 - *Twitter-based discussions and data generation may potential offer a route for the scientific community to better value the data itself. Too often we are concerned with the paper narrative, and not the fundamental quality and quantity of the data underpinning it.*

Answer: Agreed. We regroup these four comments about the same discussion (former section 4.4). We have removed former section 4.4. We simplified this discussion, and combined aspects of it into Section 4.1

Corresponding paragraph, now in section 4.1, reads as follows: "Rapid dissemination of early scientific analysis products (for example using up-to-date remote sensing data) to scientists working in the field is another aspect of using social media platforms. This use of social media is similarly to modern trends in using preprint servers for early sharing of scientific results. Twitter interaction now is also forming the basis of collaborations, leading to the development of ideas and subsequent co-writing of papers within

diverse, multi-disciplinary teams (e.g., Hicks et al., 2019; Ulrich et al., 2019 included coauthorships that were instigated from Twitter discussions). By widening stakeholder interactions, such open discussions may also help to enhance the scholarly value of open datasets."

*R2 - **Section 4.5 Lines 380-381:** Justification or citation? Lines 382-383: Justification or citation?*

Answer: we have deleted these sentences.

***R1 - L386 -** What is the difference between "issued" and "released"?*

Answer: Our wording was misleading, as "released" should have been "cancelled". Changed.

***R2 - Section 5:** Concluding remarks. I suggest focusing this section first on the benefits of using social media to rapidly characterize geophysical events, which is your main point (and what your analysis is focused on) throughout the rest of the paper.*
You bring up other important discussion points, not all of which are addressed directly by your analysis. Since you are using this space to remark on the nature of science and science communication beyond your analysis, make this clear somewhere, such as at the end of the first paragraph. Use examples, describe the experiences of authors or at least state whether the statements are based on the experiences of authors, or use citations where possible. At the very least, set the expectations of readers by letting readers know that you are diverting from your analysis-based conclusions.

Answer: As suggested by the title "Concluding remarks" our aim here is to broaden the discussion using the result of this study but also our own experience. Giving examples and more details about these experiences would lengthen a lot this conclusion. To clarify our objectives we added the following explanations:

Added the following sentence to the end of the first paragraph in Section 5: "In these concluding remarks, we combine the results from the present study with our own experience on social media to throw up some interesting questions and implications for modern scientific methods and communication."

Added "Our analysis has shown that Twitter discussions …" to the start of Paragraph 2.

Added "Based on our experiences" to the start of Paragraph 4.

***R1 - L438 -** Although 'science in the open' could be risky for the reason you state, I see absolutely nothing good coming from the opposite; i.e. 'closed science', in which the process and critique of science is done behind closed-doors, potentially by people with vested interests and/or conflicts-of-interest.*

Answer: Agreed. To further enhance this conclusion we added the following sentence: "Overall, opening up the scientific processes and involving the general public as stakeholders should help to improve trust in experts"

R2 comments about FIGURES and TABLES:

***Figure 1:** Needs a legend. What does red mean, what does blue mean? Also, curved line to the right of the circles is a nice idea but could be removed - it tricked me into thinking there were a lot of points stacked on one another. Reword the text for consistency in format. You may try changing all statements to read as though they end in "posted," since this is a timeline of information as it appears on Twitter, not as it is produced. Modify the caption to reflect this. "Polemics about a "failed" tsunami warning is vain." – I recommend a reword. Polemics is not common enough, vain is not quite right here. Edit this also in other appearances in the manuscript.*

Figure 2: *I would like to see an example of knowledge-building as the first figure of tweets, since that's what the paper most focuses on. Then, I would like to see figures showing examples of the other points you would like to make - e.g., interactions with journalists, correcting misinformation, transfer of knowledge/information to non-geoscientists, peer review process online, and/or contributions of non-geoscientists to the scientific discussion.*
Please include a more descriptive figure caption for Figure 2..

Former Figure 3: *More descriptive figure caption. Include a sentence on the implications of the word clouds (you can repeat from the main text). Do this for all figure captions. A reader should be able to read the figure caption to get the point of the figure without having to go back to the text. (This will increase the reach of your ideas - think of the people who are only going to read the abstract, intro, figures, and conclusions!)*

Answers: Following reviewer's recommendations we have significantly changed and improved the different figures and their captions as follows:

- **Figure 1** (Palu timeline) and its legend has been improved as recommended.
- **New Figure 2** now shows screenshots of tweets chosen to illustrate how geoscientists spread and explained context and observations regarding the Palu earthquake and tsunami.
- **New Figure 3** shows screenshots illustrating discussions about the "failed" tsunami warning and related explanations by geoscientists. It also shows an example of geoscientists engaging discussion with local people.
- **New Figure 4** regroups screenshots of selected early tweets at the start of the Mayotte 11 November event discussion. It now outlines initial citizen scientist implication and ensuing exchanges between researchers.
- **Figure 5** (former Figure 3) caption has been improved as recommended.
- **New Figure 6** now outlines interaction with journalists.

We append the new Figures (Figs 2, 3, 4, 6) to this author's comment together with their captions. See below.

Table 1: *I think these tables are key to understanding your analysis. I recommend at least Table 1 in the text rather than having them as a supplement.*

Answer: Agreed. Former Table S1 was too wide to fit in main text page format. We simplified it, removing the column with the links to relevant tweets, and put it in the paper as Table 1. We keep the complete table in supplements (Table S1)

Table 2: *Table 2: The link to Ken's doesn't work*

Fixed.

Both reviewers made handwritten annotations directly on hardcopies of the paper, recalling the different points already discussed above plus suggesting minor typo or formal changes. We implement the majority of these minor changes in our revised manuscript.

Following pages: New or updated figures with related captions (see comments above)

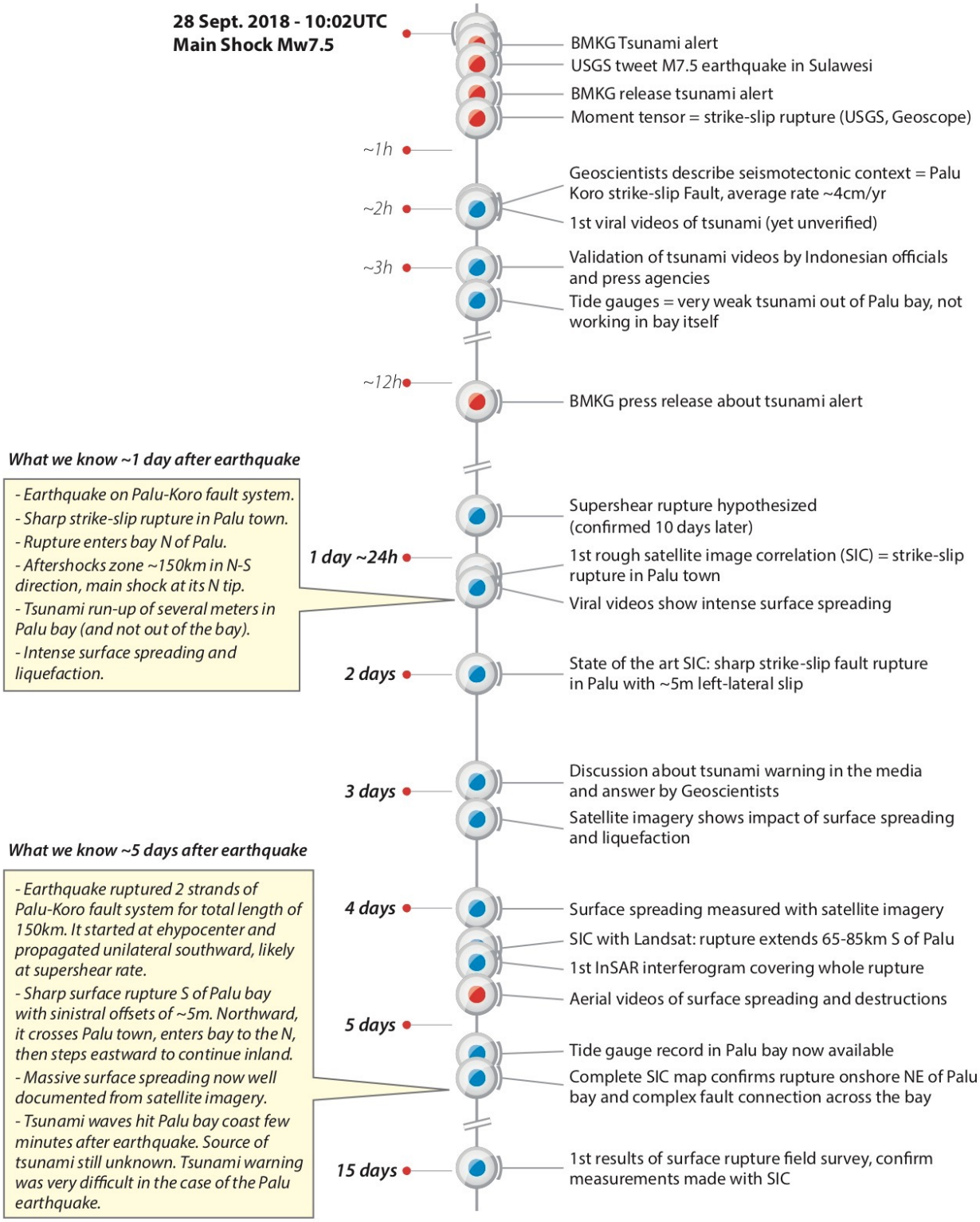

Figure 1: Timeline of informations posted on Twitter in the hours and days following the Palu earthquake and tsunami of 28 September 2018. The timeline illustrates the acquisition and dissemination of observations regarding geophysical events, and the progress of knowledge building via Twitter. See Table 1 for detailed informations on the timing, and Table S1 for links to relevant tweets and twitter accounts. See examples of tweets posted by geoscientists on Figures 2 and 3. Red dots correspond to information posted by responding agencies, blue dots to observations and discussions posted by researchers from different countries and institutions.

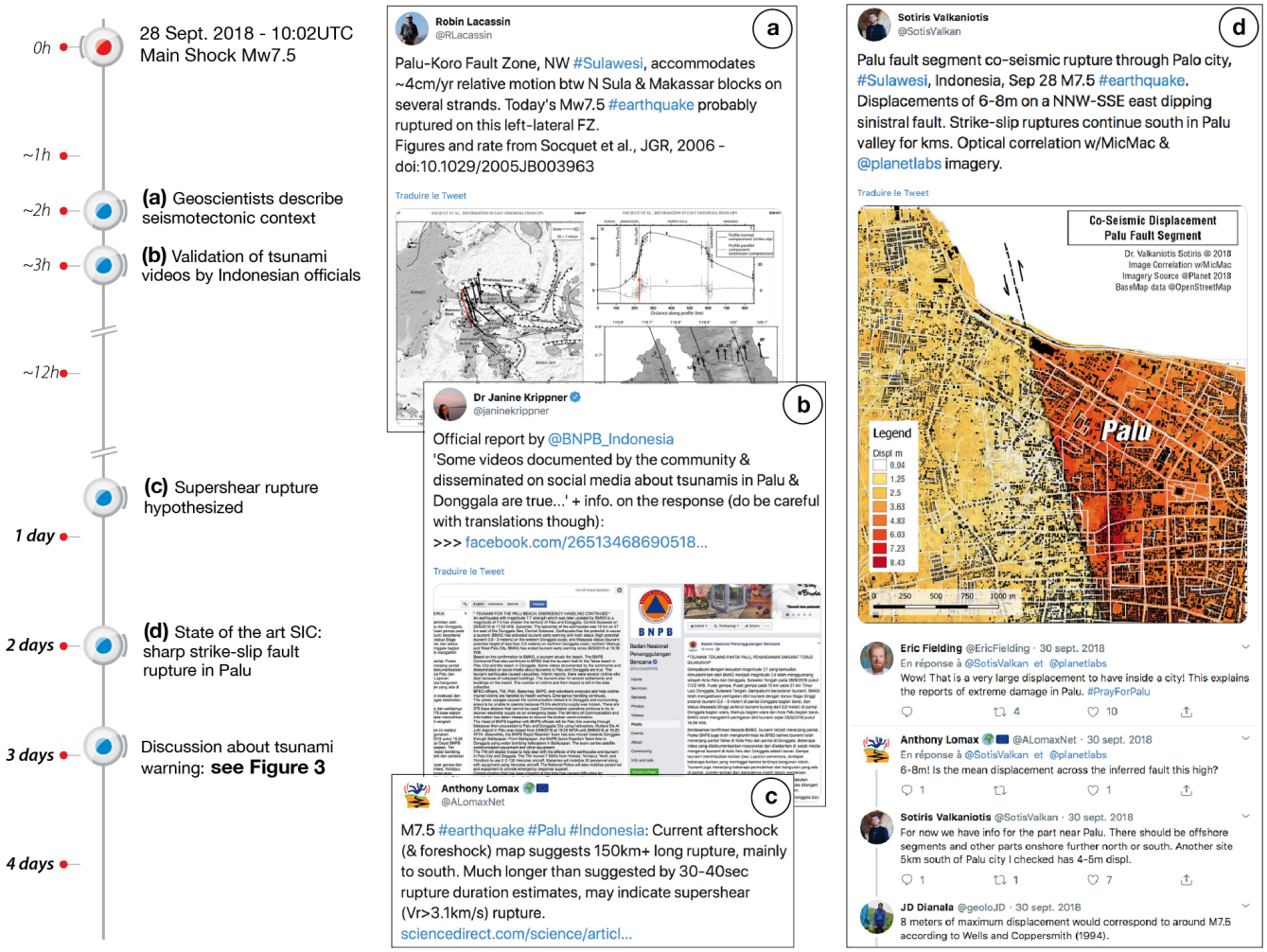

Figure 2: Screenshots of tweets chosen to illustrate how researchers shared and explained observations regarding the Palu earthquake and tsunami of 28 September 2018. Simplified timeline (from Figure 1) is shown on the left for reference. (a) within 2 hours geoscientists described the seismotectonic context of the earthquake. (b) geoscientist shared and translate official validation of viral videos about the tsunami in Palu. (c) researchers hypothesized supershear rupture. (d) geoscientist shared satellite image correlation results showing sharp rupture with 5m left-lateral offset across Palu town, and other researchers started to discuss these results. Refer to Figure 3 for tweets about the tsunami warning.

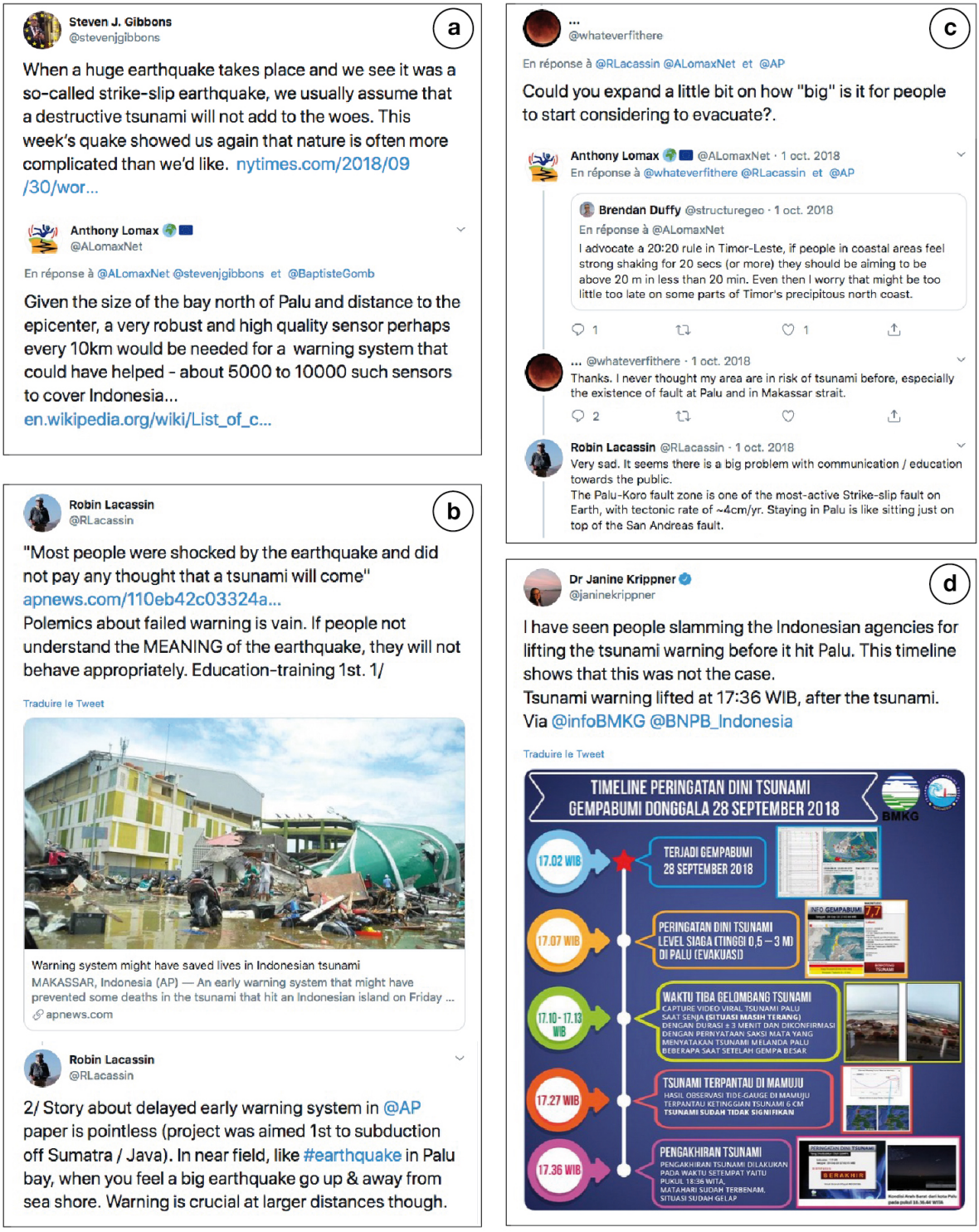

Figure 3: Screenshots of selected tweets about tsunami warning in the case of Palu. (a-b) geoscientists quote media articles regarding a possibly "failed" tsunami warning, and explain that such warning was extremely difficult in the case of the Palu earthquake (see text for more explanation). (c) example of geoscientists engaging discussion with local people. (d) geoscientist reports that Indonesian agencies issued an alert in due time and cancelled it only after the tsunami hit Palu.

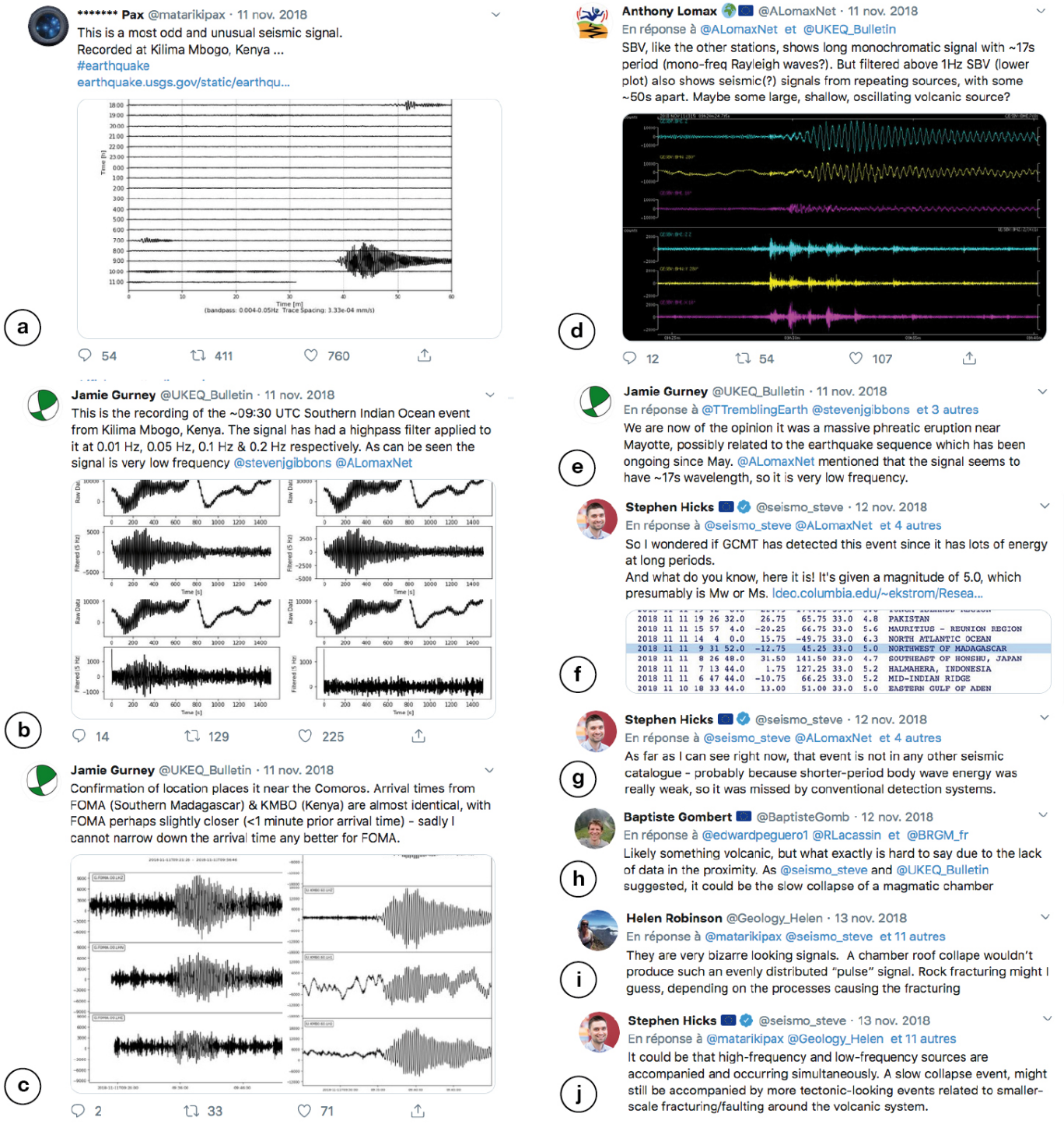

Figure 4: Screenshots illustrating early Twitter exchanges about the very long period seismic signal near Mayotte on the 11 November 2018. The selected screenshots shows that Twitter discussion was initiated by citizen scientists (a-c), then progressively involved academic researchers (d-f). Those researchers then started an active discussion about the seismic signal and its possible origin (e-j).

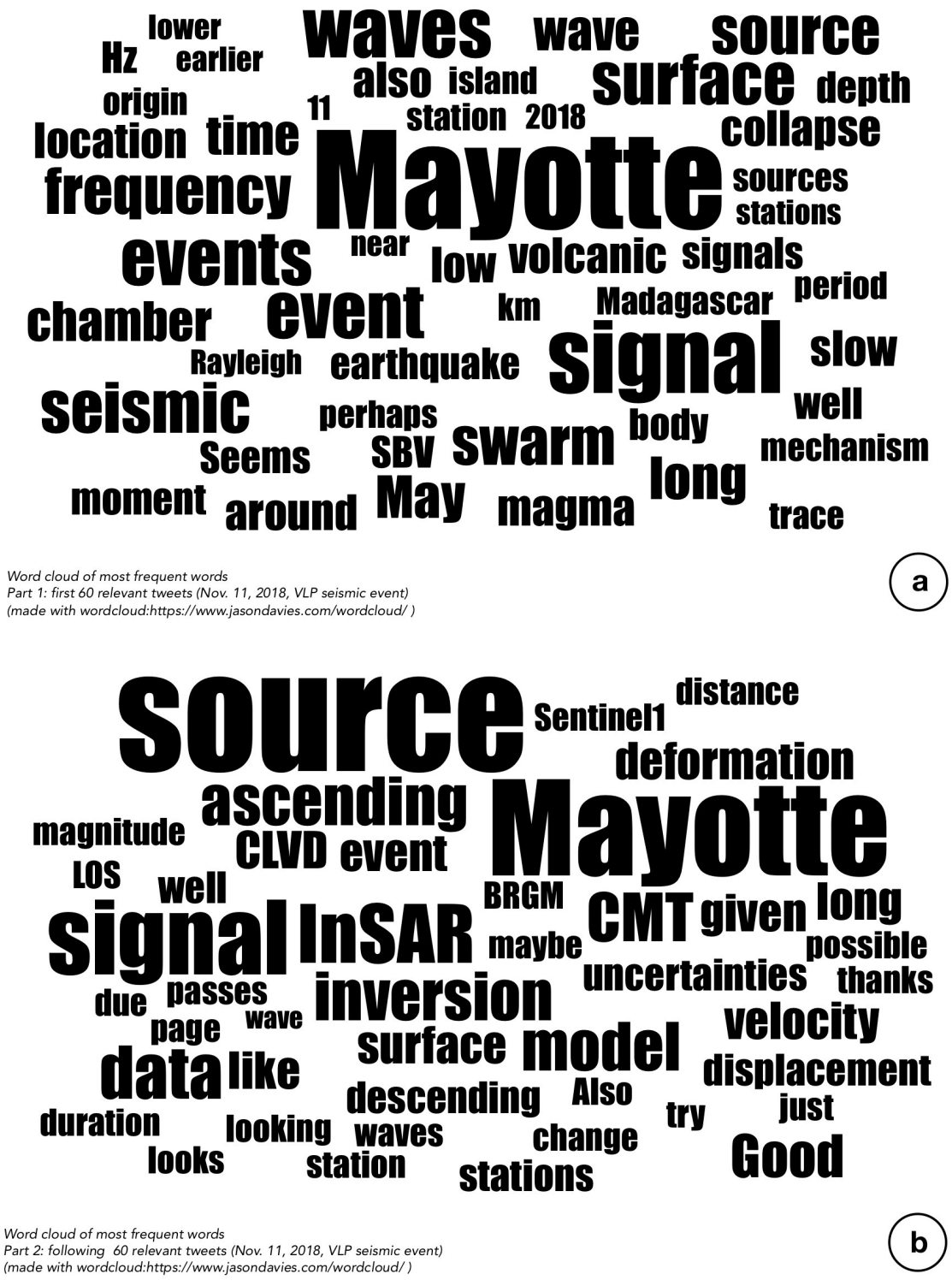

Figure 5: Word clouds illustrating the evolution of topics discussed on Twitter after the Mayotte 11 November 2018 very long period (VLP) seismic event. Top word cloud (a) illustrates first 60 tweets of the selected Twitter moment with most frequent words about the VLP signal (signal, event(s), wave(s), seismic, frequency) and its geographic origin (Mayotte, location). The bottom one (b), which corresponds to the following 60 tweets, shows a discussion more focused on the geophysical source of the VLP event (source, signal, CMT, CLVD, deformation) and data processing (data, model, InSAR, inversion).

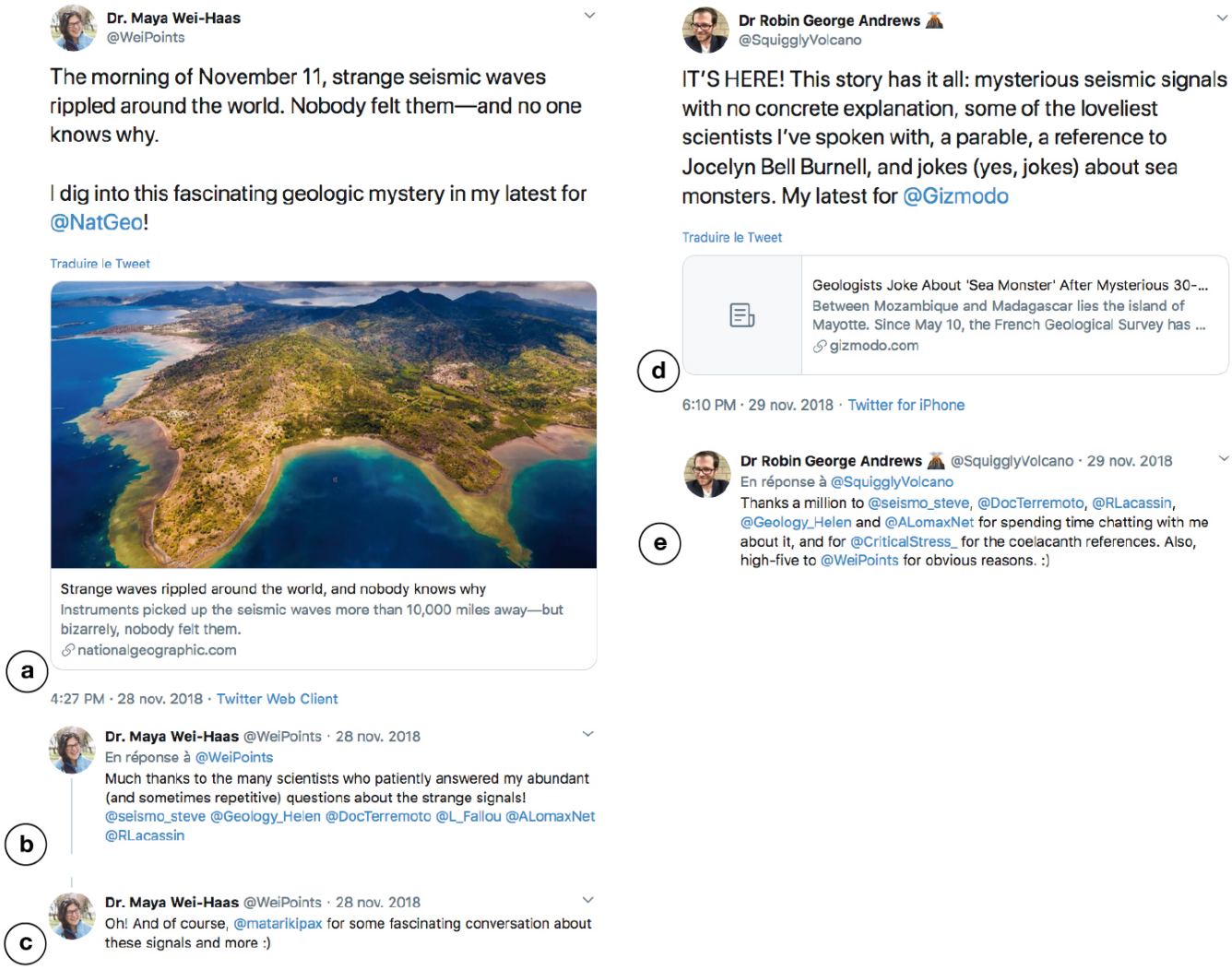

Figure 6: Screenshots of tweets by journalists Maya Wei-Haas and Robin George Andrews. After promoting their media article on the Mayotte 11 November 2018 event (a, d), journalists acknowledged academic researchers who were first identified and contacted via Twitter, then interviewed via email or phone (b, c, e).