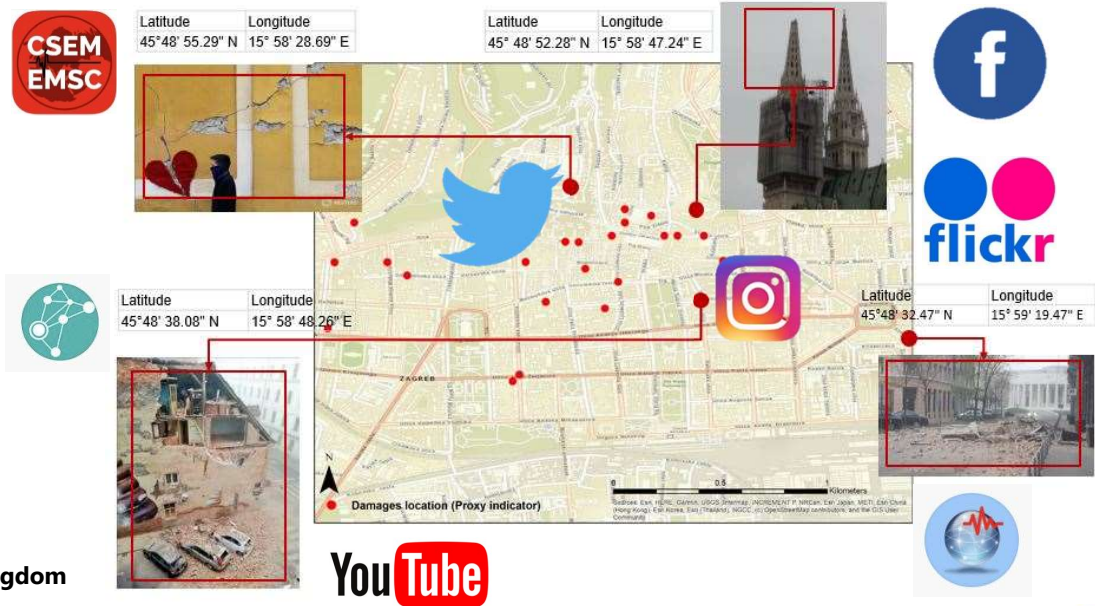


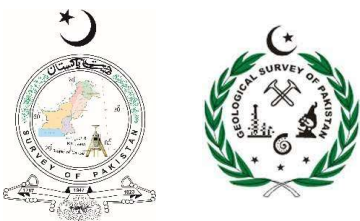
Social media and Crowdsourcing platforms in emergency management and post-disaster recovery assessment

ECO-SDI 2021
13 – 15 September 2021



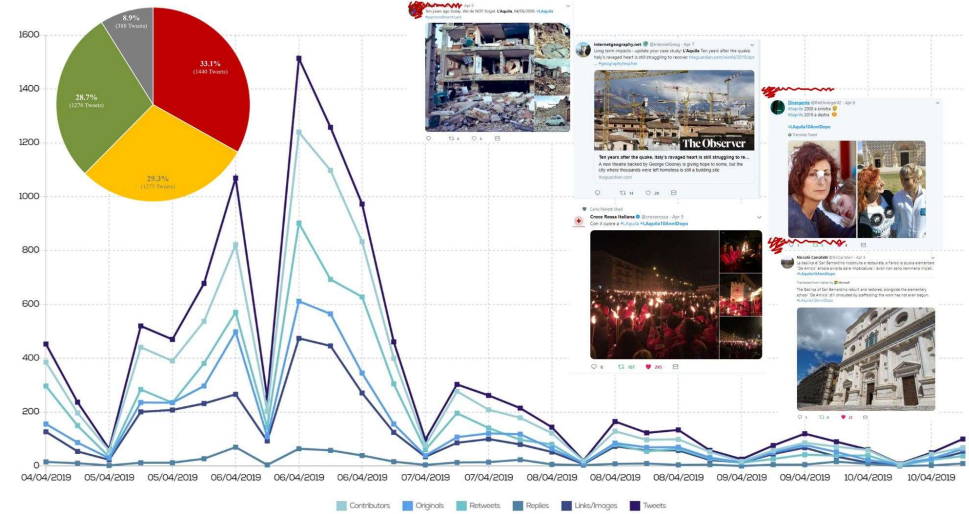
Dr Diana Contreras
Cardiff university, United Kingdom
contrerasmojicad@cardiff.ac.uk

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries
13 Sep -15 Sep 2021
Islamabad-Pakistan



Outline

- ❑ Background
- ❑ Objectives
- ❑ Methodology
- ❑ Case studies
 - ❑ Zagreb earthquake 2020
 - ❑ Aegean earthquake 2020
 - ❑ L'Aquila earthquake 2009 - 2019
 - ❑ Maule earthquake 2010 – 2020
 - ❑ Haiti earthquake 2010 - 2020
- ❑ Preliminary /Final results
- ❑ Conclusion
- ❑ Recommendations

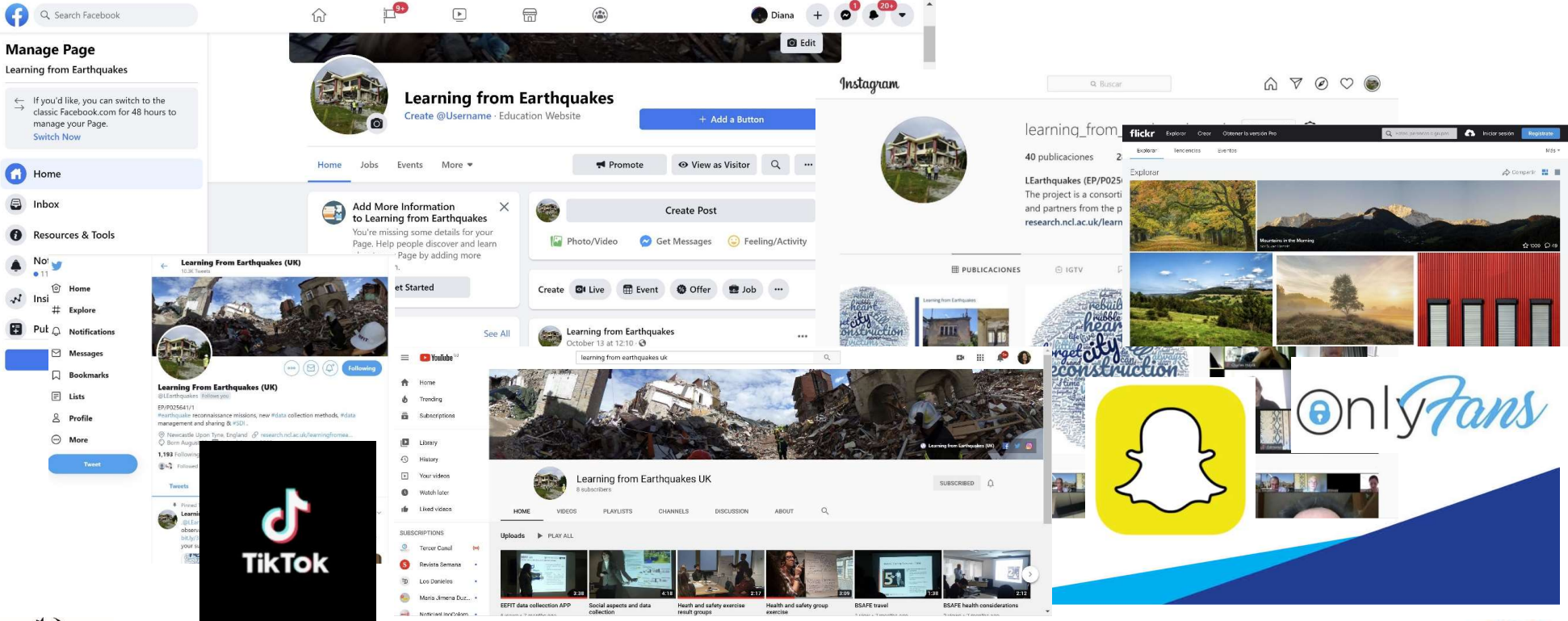


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



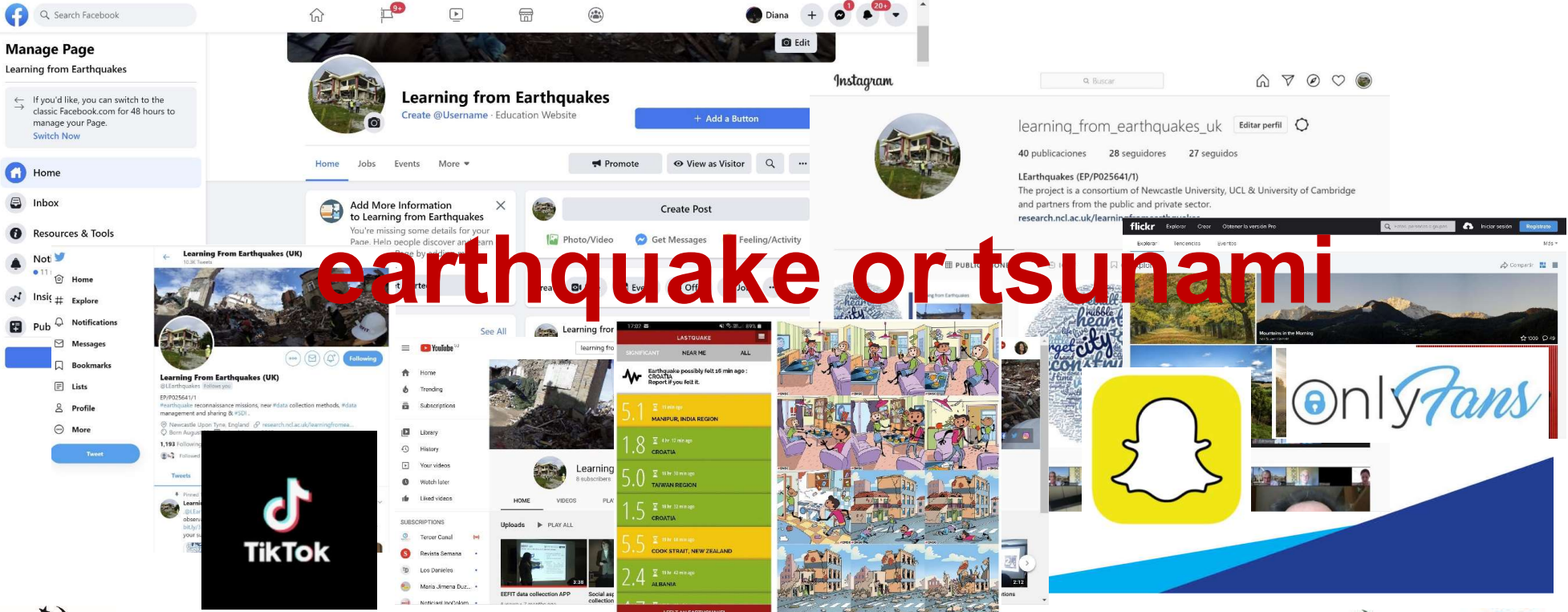
Background



**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries
13 Sep -15 Sep 2021
Islamabad-Pakistan**



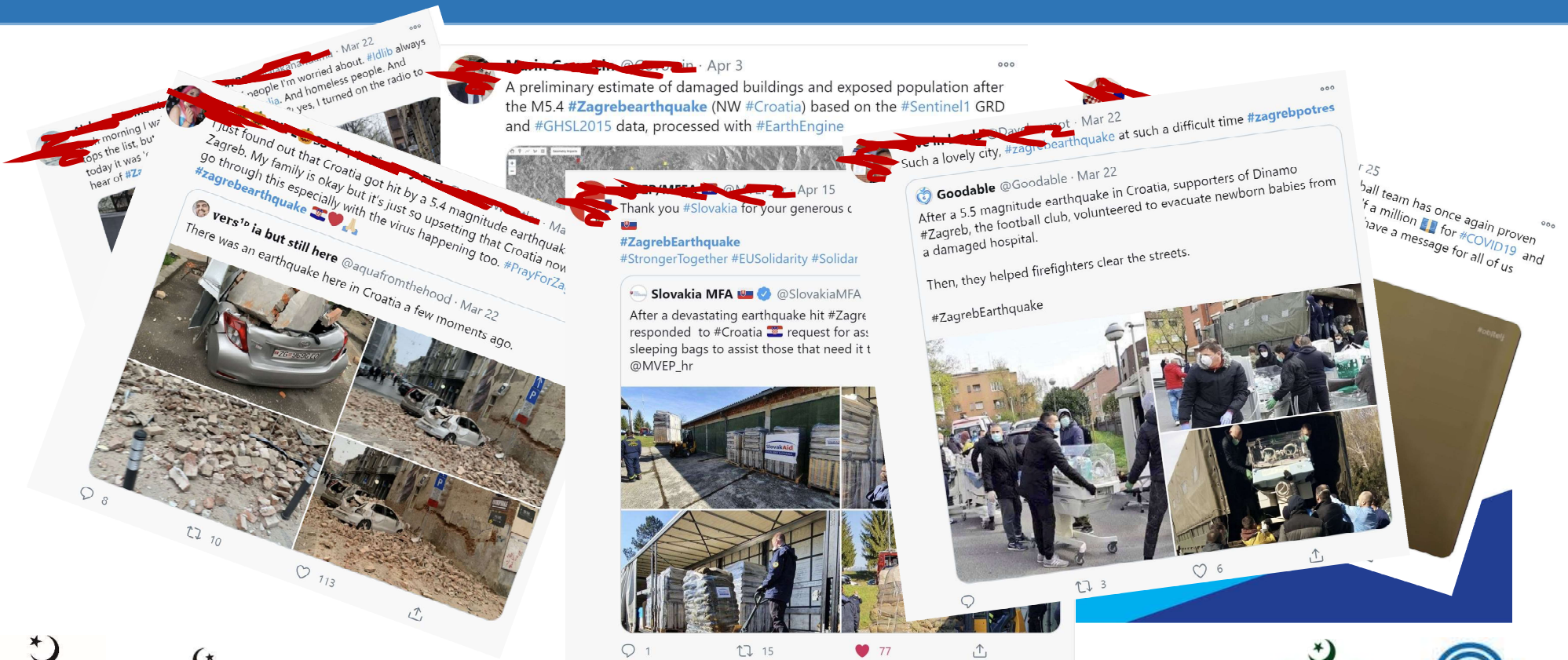
Background



**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries
13 Sep -15 Sep 2021
Islamabad-Pakistan**



Background



Virtual Capacity Building workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries
13 Sep -15 Sep 2021
Islamabad-Pakistan



Background

Is this data useful?

How?

Which one?

For what?

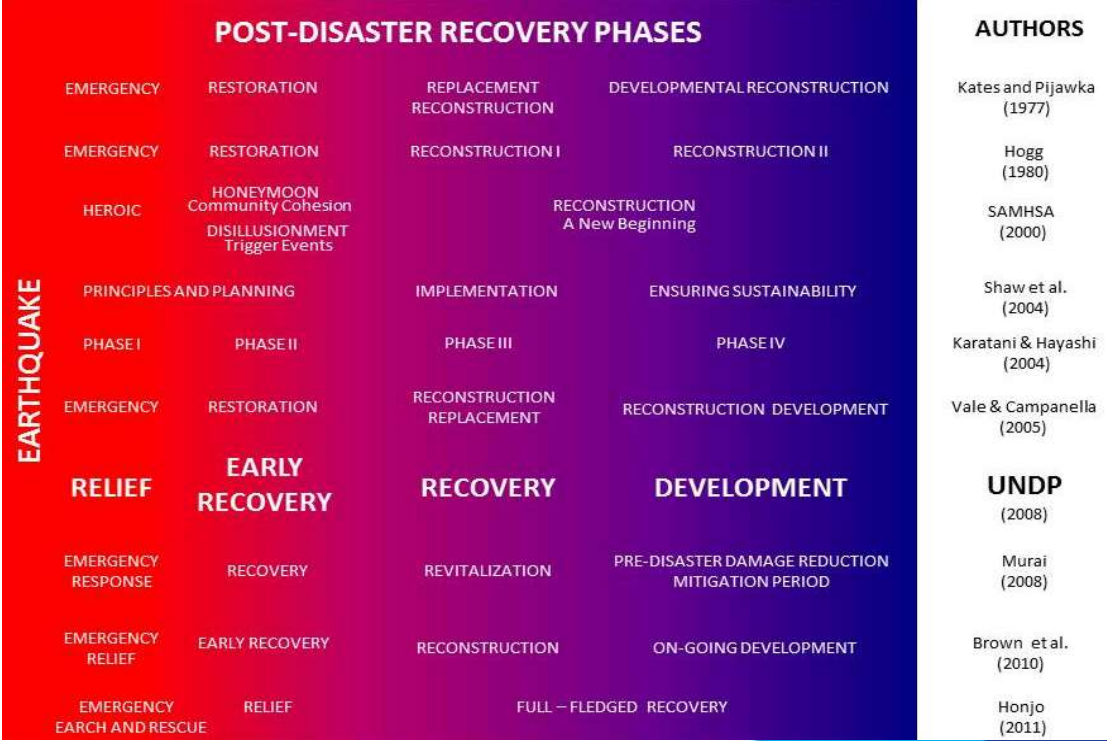
When?

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Background



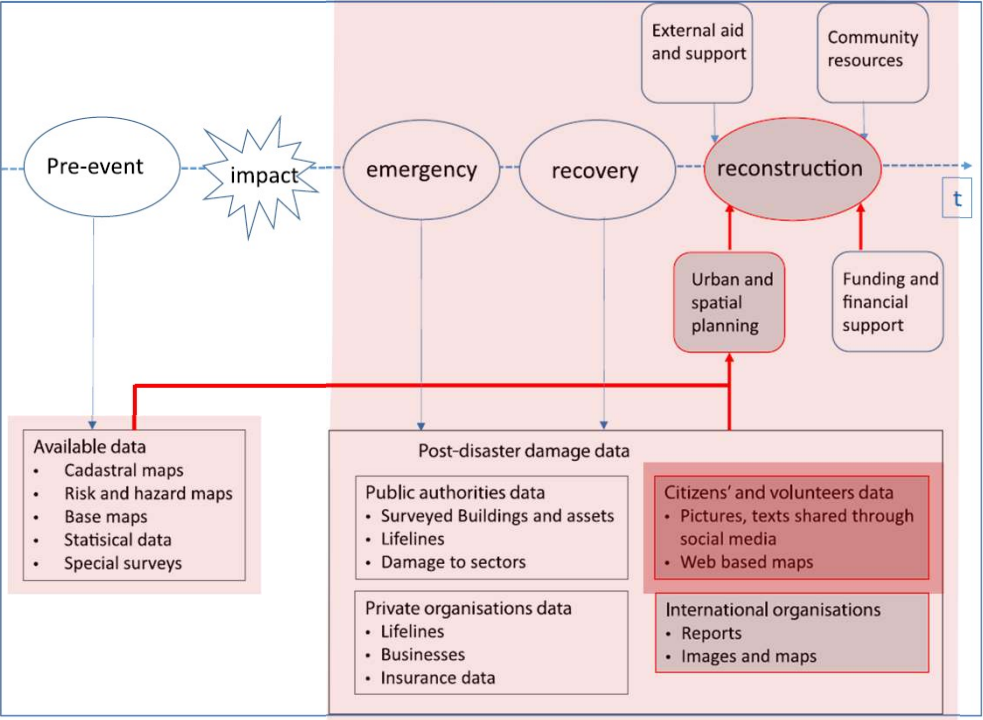
Contreras, D. 2016. Fuzzy Boundaries Between Post-Disaster Phases: The Case of L'Aquila, Italy. International Journal of Disaster Risk Science, 7, 277-292. Fig. 2. Pag. 279



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries
13 Sep -15 Sep 2021
Islamabad-Pakistan



Background



Adapted from: Mejri, O., Menoni, S., Matias, K., & Aminoltagheri, N. (2017). Crisis information to support spatial planning in post disaster recovery. *International Journal of Disaster Risk Reduction*, 22, 46-61. doi:<https://doi.org/10.1016/j.ijdrr.2017.02.007>. Fig. 2, Pag. 48.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Background

Image

Text

IMPACT INFORMATION

1183 houses collapsed, 558 apartment blocks and 5497 houses were heavily damaged in the November 26 earthquake in Albania earthquake Albania Albanian earthquake Extremely strong shake with the Bani collapsed...er strong 10 ...al... wa...hakir...st... and ...ng. We cannot get in touch with our other Ramazan Bal, since the earthquake ...t If somebody sees him or has any information about him, please contact us. My aunt, Tevhide Akkus, is under the debris in 283/1 Emrah apartment, 1st floor, please help.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Objectives

Emergency response



Firefighters assist a person affected by the earthquake in Zagreb, Croatia
<https://www.bibliatodo.com/En/christian-news/strong-earthquake-shakes-croatia-amid-quarantine-we-face-two-crises/>



PDNA

Earthquake reconnaissance



Christchurch, New Zealand
 Post-disaster recovery



Preparedness



Search and Rescue (SAR) training.
 Source: IDIGER



Temporary shelter in Bogota DC, Colombia. IDIGER



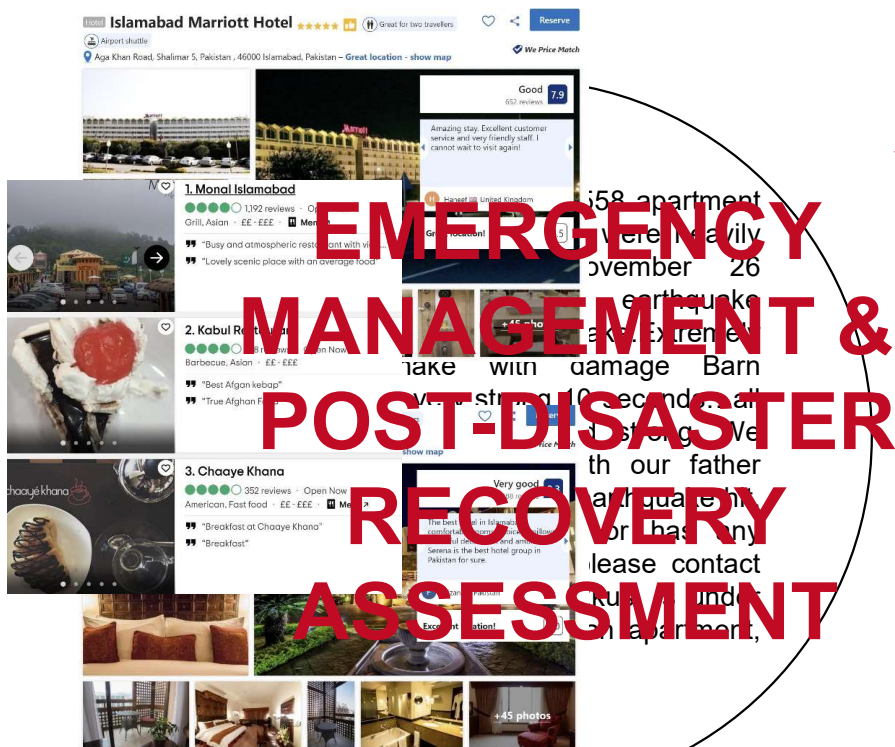
L'Aquila, Italy. Photo: Dr Diana Contreras

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

**13 Sep -15 Sep 2021
 Islamabad-Pakistan**



Methodology (Data & Methods)



Sentiment & Topic Analysis

← Analysis (SA)

→ Polarity

Positive ✓

Neutral ●

Negative ⚡

Unrelated

- Building damage
- Geotechnical effects
- Lifelines affected
- Injuries-casualties
- Emergency response
- Solidarity messages
- Preparedness
- Seismic information
- Intensity
- Early recovery
- Intensity
- Tsunami effects

- Reconstruction
- Memorial ceremonies
- Post traumatic stress disorder (PTSD)
- Emergency response
-

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)

Zagreb earthquake 2020

Emergency response and early recovery



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries
 13 Sep -15 Sep 2021
 Islamabad-Pakistan



Methodology (Data & Methods)



Hashtags Identification

- ~~#Croatia~~
- ~~#croatia~~
- ~~#croatiaearthquake~~
- ~~#CroatiaEarthquake~~
- ~~#CroatiaFullofLife~~
- ~~#CroatiaQuake~~
- ~~#disaster~~
- ~~#earthquakecroatia~~
- ~~#earthquakeinzagreb~~
- ~~#gradzagreb~~
- ~~#hrvatskapotres~~
- ~~#igerscroatia~~
- ~~#LoveZagreb~~
- ~~#potres~~
- ~~#potres2020~~
- ~~#potreszagreb~~
- ~~#potresZg~~
- ~~#PrayforZagreb~~
- ~~#quake~~
- ~~#solidarnostchrvatikom~~
- ~~#Terremoto~~
- ~~#volimhrvatsku~~
- ~~#Zagreb~~
- ~~#Zagabria~~
- ~~#ZagrebEarthquake~~
- ~~#zagrebeearthquake~~
- ~~#zagrebpotres~~
- ~~#ZagrebQuake~~
- ~~#zagrebquake~~
- ~~#ZagrebStrong~~
- ~~#zagrebstrong~~
- ~~#zagrebstaystrong~~

Hashtag Selection

- #Croatia
- #croatiaearthquake**
- #CroatiaFullofLife
- #CroatiaQuake
- #earthquakecroatia
- #earthquakeinzagreb
- #hrvatskapotres
- #LoveZagreb
- #potres
- #potreszagreb
- #potresZg
- #PrayforZagreb
- #Zagreb
- #zagrebeearthquake
- #zagrebpotres
- #ZagrebQuake
- #zagrebquake
- #ZagrebStrong
- #zagrebstrong
- #zagrebstaystrong

Data Collection

- Pictures
- Satellite images
- Newspaper articles
- Press releases
- Laws

60 tweets from citizens (28.30%)
152 tweets from public authorities (71.70%)
212 tweets

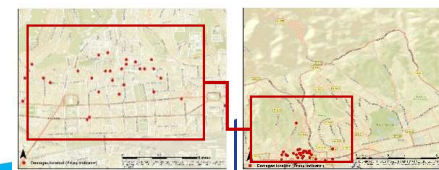
Data processing

- Translation to English
- Eliminate Twitter handles, emoticons and hyperlinks

Twitter accounts

- @AndrejPlenkovic
- @MilanBandicGZ
- @ecapannelli
- @VladaRH
- @MORH_OSRH
- @wwwzagrebhr
- @Zg_Holding
- @RavnateljstvoCZ

Maps

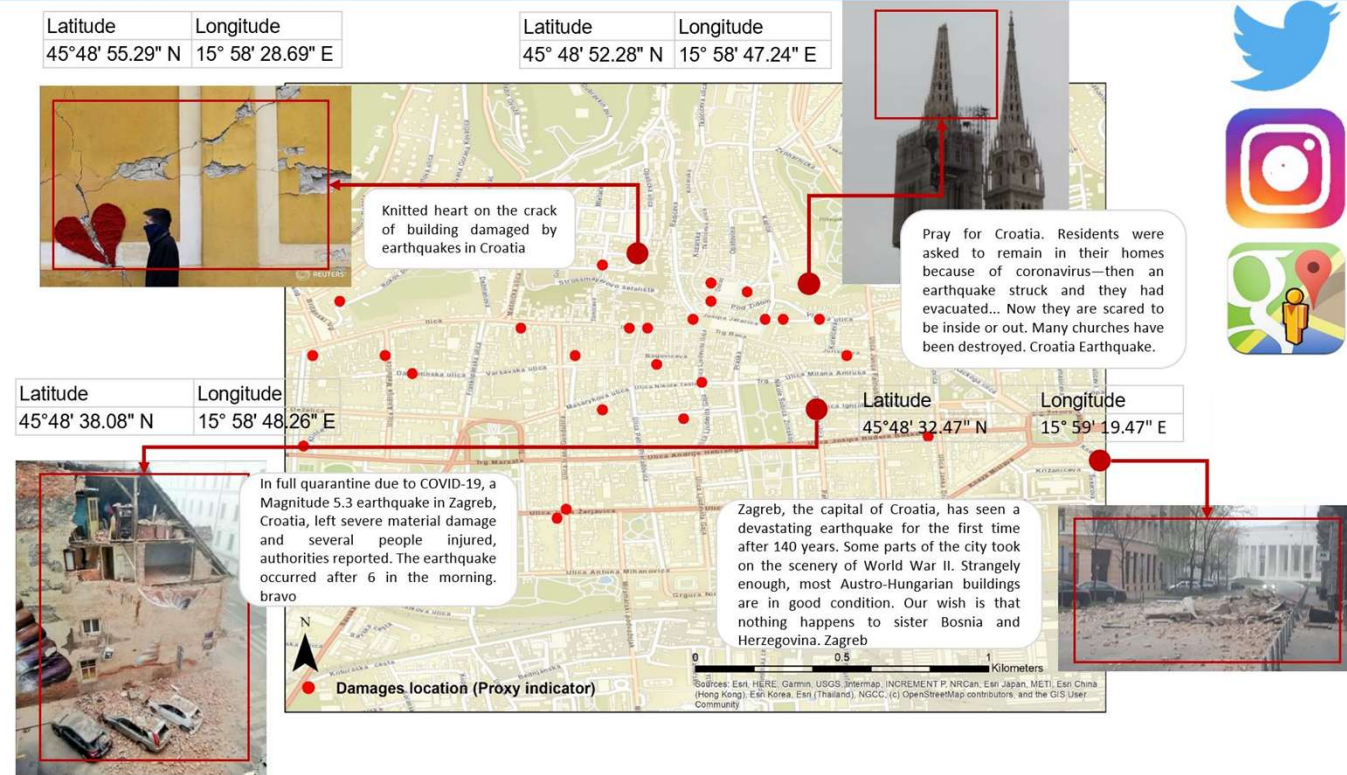


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methodology)



In the wake of the Zagreb earthquake, our thoughts are with the Croatian Meteorological and Hydrological Service. Their headquarters were damaged but thankfully the staff are all safe. National meteorological and hydrological services worldwide provide vital information for all and rise to the challenges they face.



Not only that you gave birth during COVID-19 but also earthquake happened and on top of it all it is winter time. Only love for all these brave women and Zagreb!

Good morning Zagreb
Hrvatska Croatia Earthquake
Zagreb Earthquake

Earthquake in Zagreb this morning. Coronavirus, mums with their newborns on the streets. It just started to snow. What is happening with the world? Pray for Croatia



This morning, Croatia was hit with several earthquakes in the midst of the COVID-19 pandemic. We hope all of you are okay! Thankfully, our staff and their families are. Please stay safe everyone! Croatia Zagreb COVID-19

In full quarantine due to COVID-19, a Magnitude 5.3 earthquake in Zagreb, Croatia, left severe material damage and several people injured, authorities reported. The earthquake occurred after 6 in the morning. bravo



Zagreb, the capital of Croatia, has seen a devastating earthquake for the first time after 140 years. Some parts of the city took on the scenery of World War II. Strangely enough, most Austro-Hungarian buildings are in good condition. Our wish is that nothing happens to sister Bosnia and Herzegovina. Zagreb



Georeferenced pictures from Twitter and Instagram

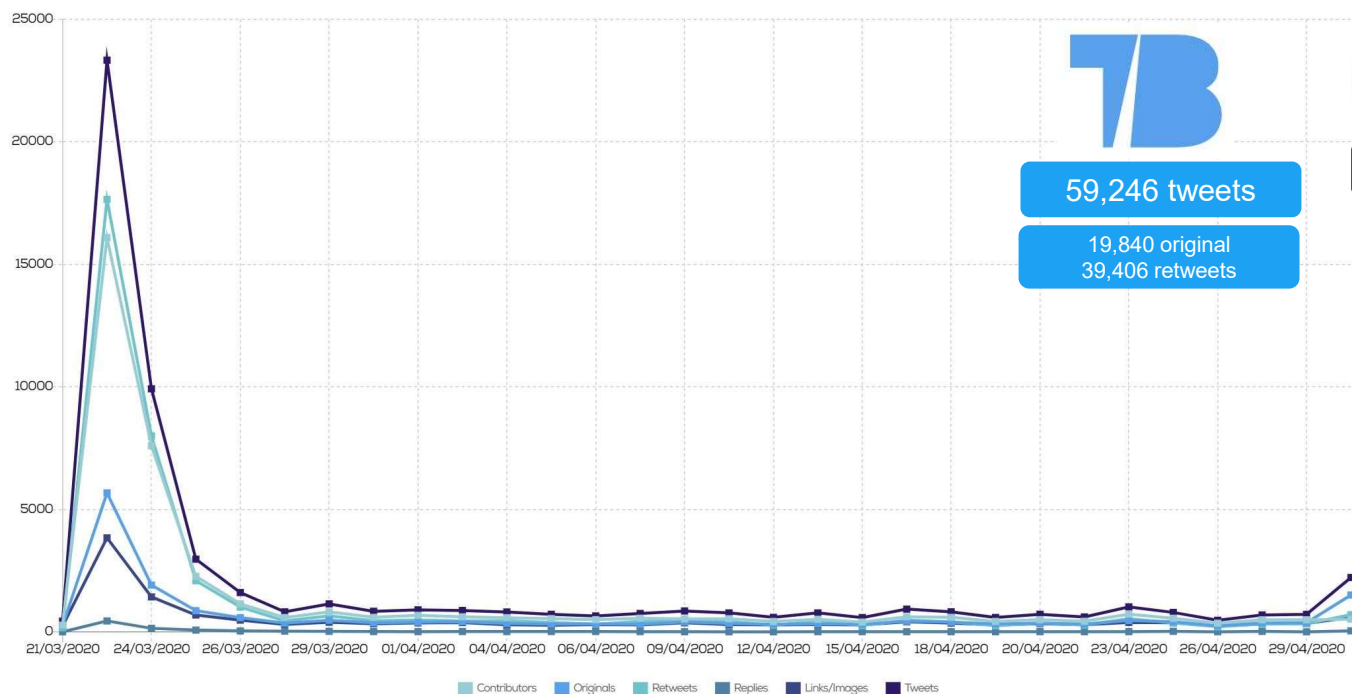
Sample of georeferenced pictures uploaded by Twitter users the day of the 22nd March 2020 earthquake

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



TB

59,246 tweets

19,840 original
39,406 retweets



31,911 reports



Twitter activity between the 20th March and 30th April 2020, related to the earthquake in Zagreb. Source: TweetBinder

**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries**

**13 Sep -15 Sep 2021
Islamabad-Pakistan**



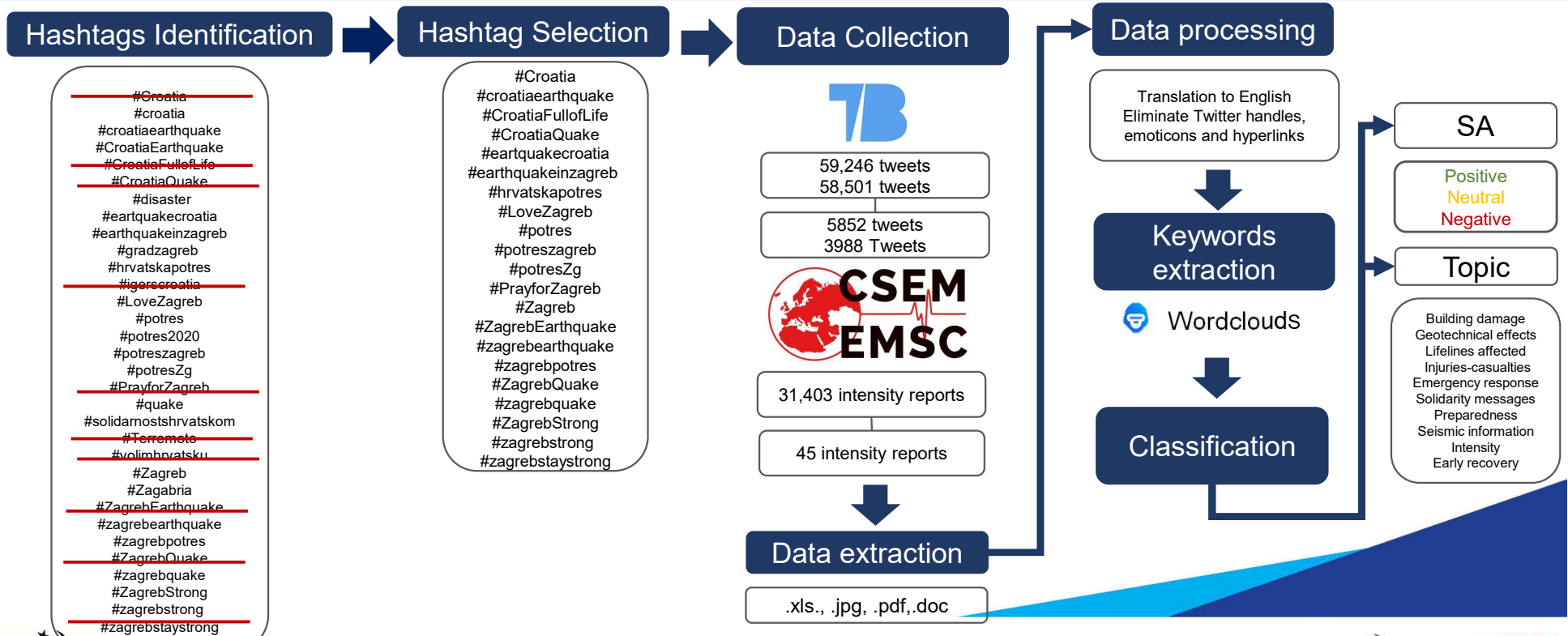
Methodology (Data & Comments)

Examples of pictures and comments done by users at University Hospital Centre in Zagreb. Data Source: EMSC
Virtual Capacity Building Works for Sustainable National Spatial Infrastructure (SDI) in Earthquake Prone Areas

**13 Sep -15 Sep 2021
 Islamabad-Pakistan**



Methodology (Data & Methods)

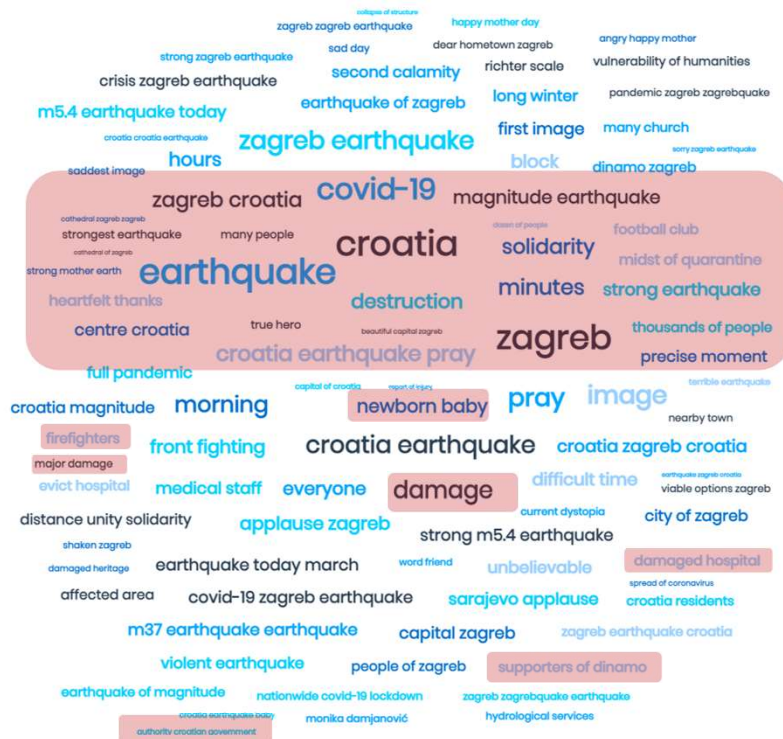


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results



word	count	relevance
earthquake	1609	0.677
croatia	1479	1
zagreb	1281	0.695
covid-19	561	0.113
image	282	0.158
pray	281	0.08
zagreb earthquake	269	0.258
croatia earthquake	251	0.304
damage	206	0.088
morning	174	0.128
minutes	147	0.077
croatia earthquake pray	144	0.996
zagreb croatia	129	0.198
solidarity	123	0.102
destruction	108	0.099
hours	104	0.091
magnitude earthquake	85	0.387
newborn baby	84	0.387
everyone	82	0.084
front fighting	81	0.374
applause zagreb	81	0.374
block	81	0.074
croatia zagreb croatia	72	0.498
difficult time	71	0.323
strong earthquake	71	0.281
strong m5.4 earthquake	62	0.429
earthquake today march	62	0.429
m5.4 earthquake today	62	0.429
first image	62	0.286
unbelievable	62	0.11
covid-19 zagreb earthquake	61	0.422
medical staff	61	0.281
sarajevo applause	61	0.281
m37 earthquake earthquake	59	0.408
centre croatia	59	0.272
capital zagreb	58	0.198
city of zagreb	54	0.374
earthquake of zagreb	54	0.374
long winter	53	0.244
full pandemic	53	0.244

Keywords extraction using word clouds

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

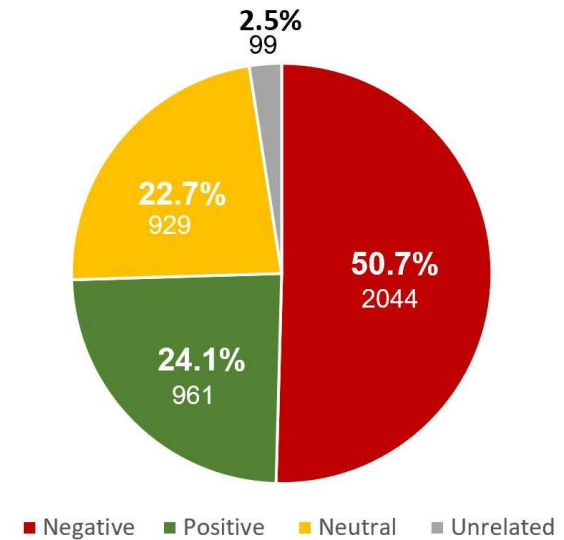
13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results

Polarity classification

Polarity	Twitter & Instagram	LastQuake app	Total	Percentage
Negative	2011	33	2044	50.7
Positive	961	0	961	24.1
Neutral	917	12	929	22.7
Unrelated	99	0	99	2.5
Total	3988	45	64	100

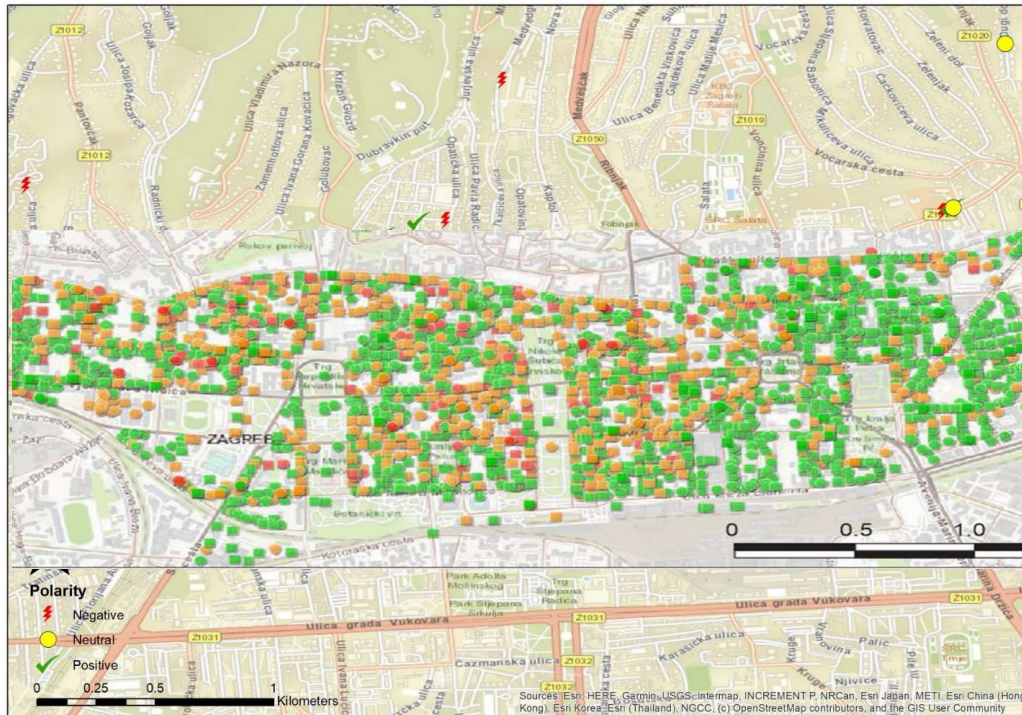


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results



Building usability in the Lower Town: green-usable; yellow temporarily unusable and red-unusable (GIS BUD 2020).
 Source: Atalić, J., Uroš, M., Šavor Novak, M., Demšić, M., & Nastev, M. (2021). The Mw5.4 Zagreb (Croatia) earthquake of March 22, 2020: impacts and response. *Bulletin of Earthquake Engineering*. doi:10.1007/s10518-021-01117-w
 Page 15, Figure 12

Polarity tweets and LastQuake app comments

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
 for Sustainable Development in ECO Countries

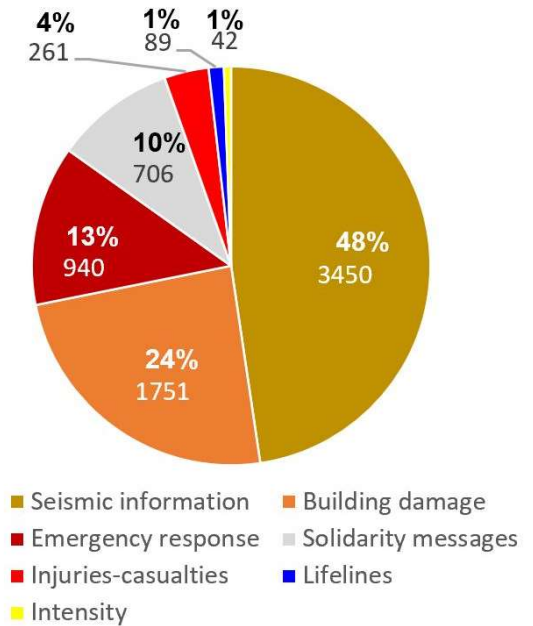
13 Sep -15 Sep 2021
 Islamabad-Pakistan



Preliminary results

Topic classification

Topics	Twitter & Instagram	LastQuake app	Total	Percentage
Seismic information	3450	0	3450	48
Building damage	1726	25	1751	24
Emergency response	940	0	940	13
Solidarity messages	706	0	706	10
Injuries - casualties	261	0	261	4
Lifelines	89	0	89	1
Intensity	12	30	42	1

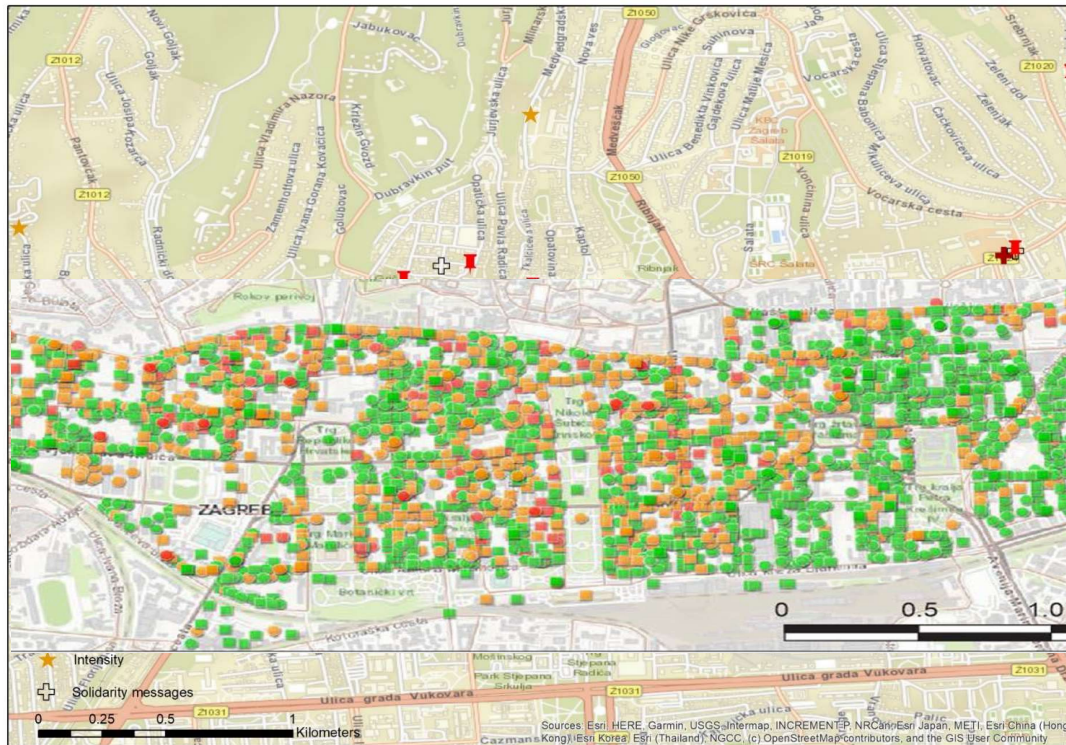


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results



Building usability in the Lower Town: green-usable; yellow temporarily unusable and red-unusable (GIS BUD 2020).
 Source: Atalić, J., Uroš, M., Šavor Novak, M., Demšić, M., & Nastev, M. (2021). The Mw5.4 Zagreb (Croatia) earthquake of March 22, 2020: impacts and response. *Bulletin of Earthquake Engineering*. doi:10.1007/s10518-021-01117-w Page 15, Figure 12

Topics addressed in tweets and LastQuake app comments

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

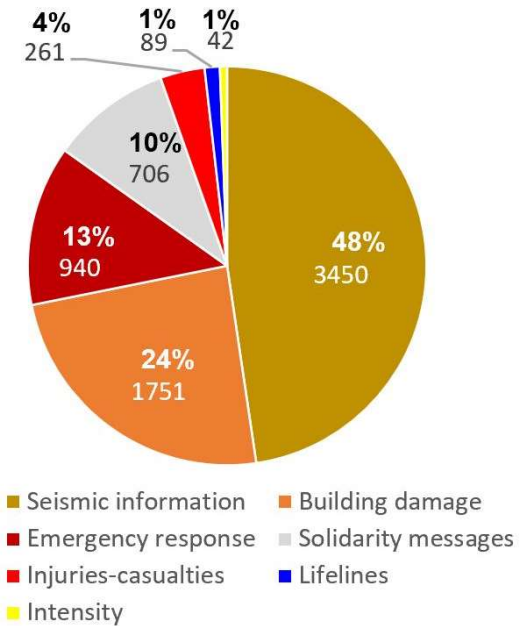
**13 Sep -15 Sep 2021
 Islamabad-Pakistan**



Preliminary results

Topic classification

Topics	Twitter & Instagram	LastQuake app	Total	Percentage
Seismic information	3450	0	3450	48
Building damage	1726	25	1751	24
Emergency response	940	0	940	13
Solidarity messages	706	0	706	10
Injuries - casualties	261	0	261	4
Lifelines	89	0	89	1
Intensity	12	30	42	1



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

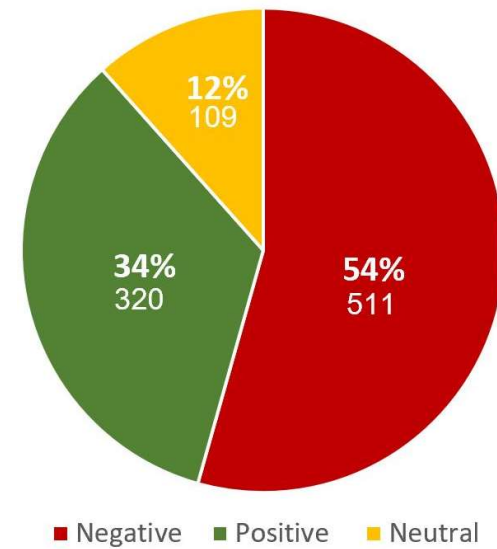
13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results

Emergency response assessment

Polarity	Twitter & Instagram	LastQuake app	Total	Percentage
Negative	511	0	511	54
Positive	320	0	320	34
Neutral	109	0	109	12
Total	940	0	940	100



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results

DATASET

Contreras, D., Wilkinson, S., Fallou, L., Landès, M., Tomljenovich, I., Bossu, R., . . . James, P. (2021). **Supervised polarity and topic classification of LastQuake app user's pictures with comments – Zagreb 2020 earthquake**. Retrieved from:

https://data.ncl.ac.uk/articles/dataset/Supervised_polarity_and_topic_classification_of_LastQuake_app_user_s_pictures_with_comments_Zagreb_2020_earthquake/14687163

DOI: <https://doi.org/10.25405/data.ncl.14687163.v1> .v1



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)

Aegean earthquake 2020

Emergency response and early recovery

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



2,371 app – 123 mobile phone - 24 Desktop



> **LastQuake app – EMSC**
 3,028 Users reports
 2,546 Users reports
 2,518 Users reports

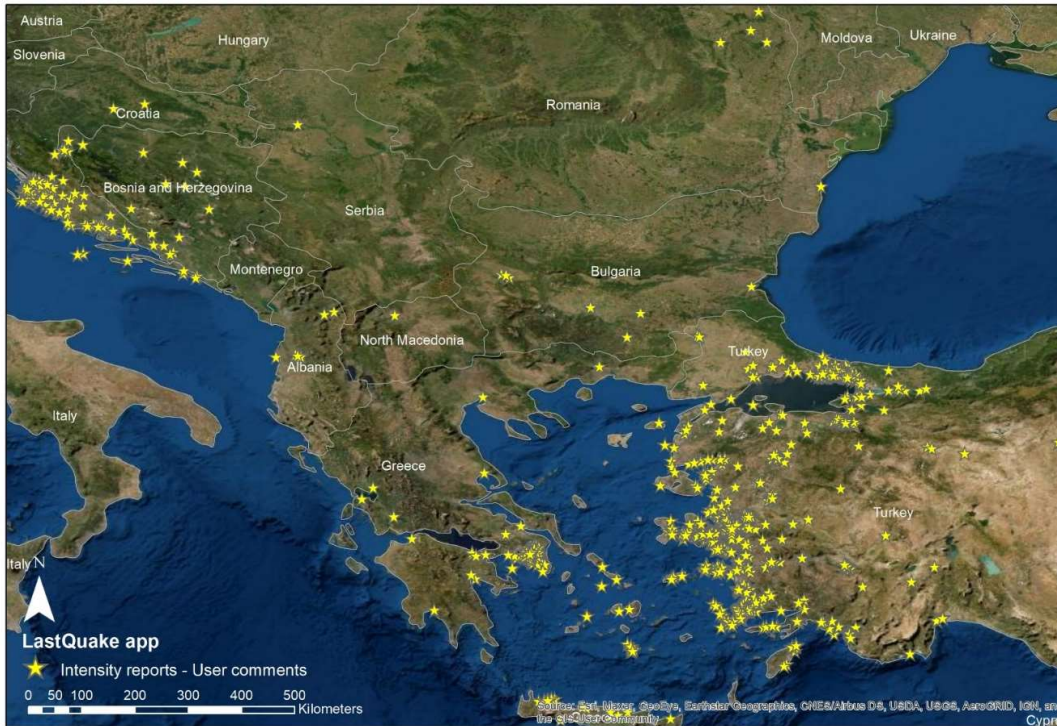


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
 for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



LastQuake users reports location. Data source: EMSC

Languages	Number	Percentage
Turkish	1264	50%
English	898	36%
Croatian	255	10%
German	20	1%
Bosnian	11	0%
Slovenian	10	0%
Punctuation marks	10	0%
Albanian	9	0%
Numbers	9	0%
Romanian	7	0%
French	5	0%
Greek	4	0%
Italian	4	0%
Undefined	3	0%
Bulgarian	2	0%
Arabic	1	0%
Azerbaijani	1	0%
Czech	1	0%
Hungarian	1	0%
Latvian	1	0%
Polish	1	0%
Slovak	1	0%
Total	2518	100%



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



Georeferenced Pictures with comments taken by LastQuake app users. Data source: EMSC

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



Modified Mercalli (MM)
Intensity scale



	10 Extreme	1
	9 Violent	4
	8 Severe	12
	7 Very strong	36
	6 Strong	116
	5 Moderate	188
	4 Light	417
	3 Weak	981
	2 Weak	618
	1 Not felt	146

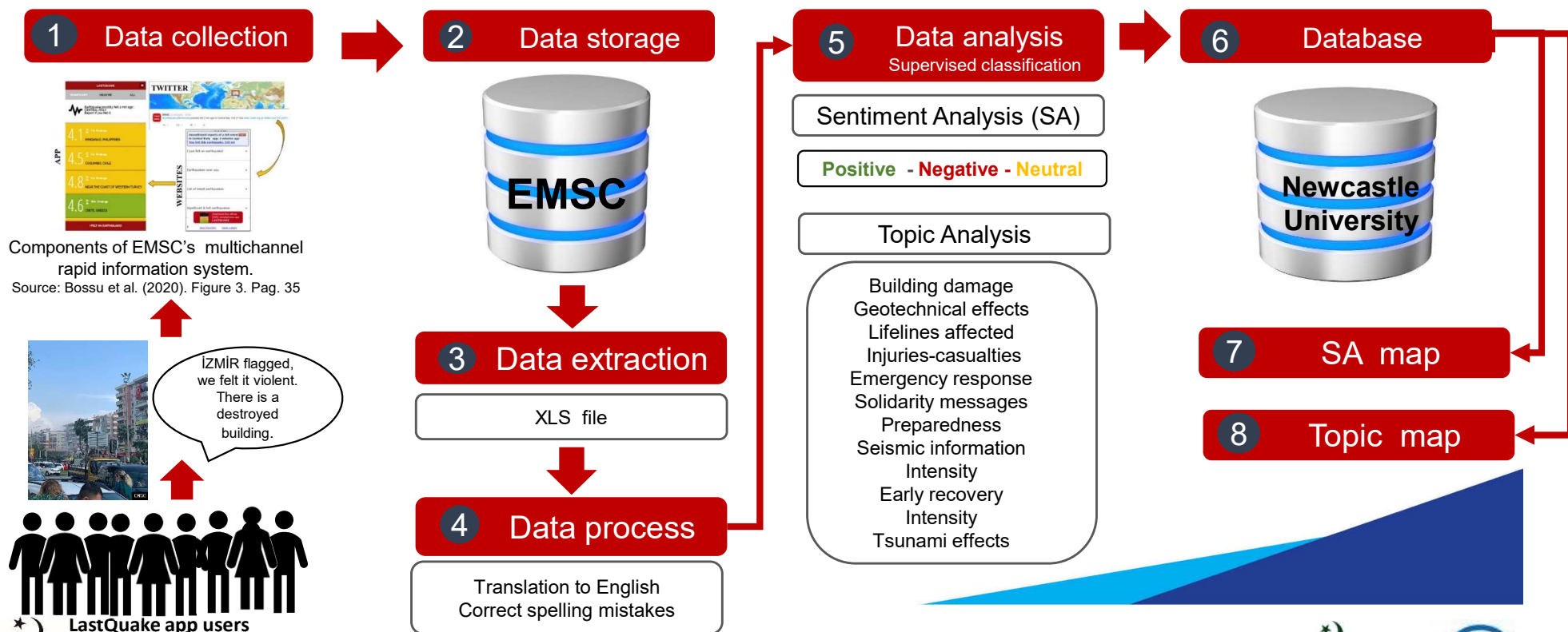
Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

32



Methodology (Data & Methods)



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)

Rules

Polarity	Rules
Positive	<ul style="list-style-type: none">▪ Reports of light intensity▪ Reports of short seismic movements▪ Reports of slight shakes▪ Supporting and solidarity messages▪ Emergency response messages▪ Preparedness measures
Negative	<ul style="list-style-type: none">▪ Reports of long seismic movements▪ Reports of strong shakes▪ Reports of strong intensity▪ Reports of aftershocks▪ Report of damages in buildings and/or lifelines▪ Reports of injuries and/or casualties▪ Reports of fear and anxiety
Neutral	<ul style="list-style-type: none">▪ Seismic information

Rule-set for polarity classification of text data produced by LastQuake app users.



**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries**

**13 Sep -15 Sep 2021
Islamabad-Pakistan**



Methodology (Data & Methods)

Positive

- 'Low damage'
- 'We felt it, but it was short'
- 'Everybody should respect and act according to scientific rules and regulations. Otherwise, everybody will lose'

Negative

- 'Everything rattled for a few seconds. The cracks in our walls are getting bigger'
- 'Chios, Vrontados. Very strong shake, ground floor, cracks in walls objects fell.'
- 'I felt that earthquake when I was in school in Athens. The floor was moving and the walls too. It was very scary because it happened so suddenly!'

Neutral

- 'The epicentre is in Samos, Greece, not in Western Turkey'.
- 'Moment intensity VI'
- 'It is not Dodecanese islands. It is North Aegean Samos island'

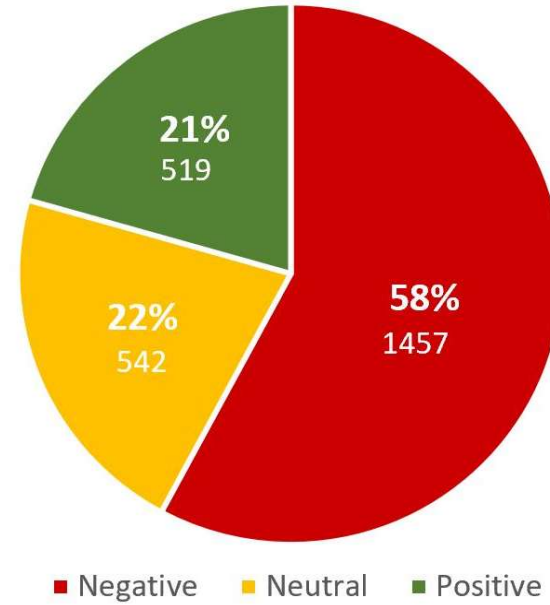
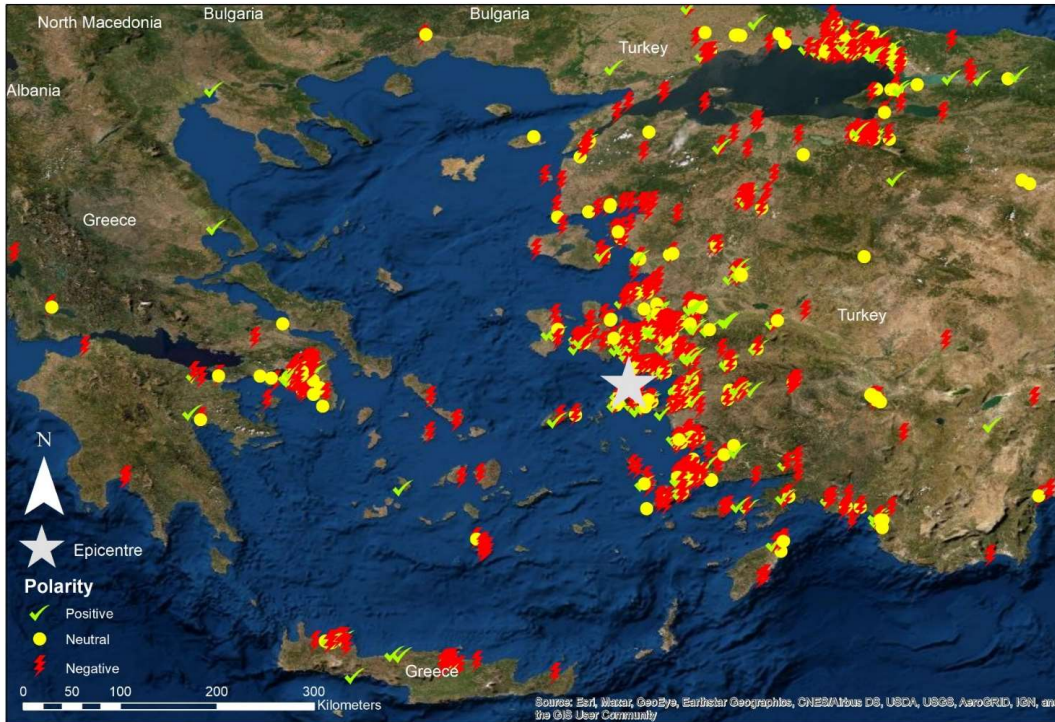


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results



Location of LastQuake app users comments polarity. Data source: LastQuake app

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results



Topic	Number	Percentage
Intensity	2283	90.67
Seismic information	87	3.46
Solidarity messages	39	1.55
Emergency response	39	1.55
Unrelated	27	1.07
Building damage	24	0.95
Tsunami effects	9	0.36
Preparedness	5	0.20
Lifelines affected	3	0.12
Geotechnical effects	2	0.08
Total	2518	100

Location of LastQuake app users comments polarity. Data source: LastQuake app

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

37



Final results

Buildings damaged

- 'There are buildings destroyed in different districts of Izmir. We shook so violently. The items in the house were overturned. Earthquakes still continue. May God help us. Get past us all'
- We were caught in Atasehir in my 12-floor house. I said everything is over. We waited for the building to come out. All flats in the building have cracks and collapse in the plaster'

Lifelines affected

- 'It was the first time I saw the .300-ton transformers shaking like a cradle, which was shifted in Aliagada. God bless us all'.
- 'Very powerful and long lasting. All neighbours are on the street. No visible damage although telephone poles sway and a line broke. Many smaller quakes within the last 45 minutes or so'.

Tsunami

- 'The sea rises here and falls again so you can say it rises if I can estimate that by 50 cm and 2 minutes later it goes down again'
- 'I was in the tsunami, 1 meter the sea could go to the stairs of the bank. Car with water but started, got the hell out of there...pfff'



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

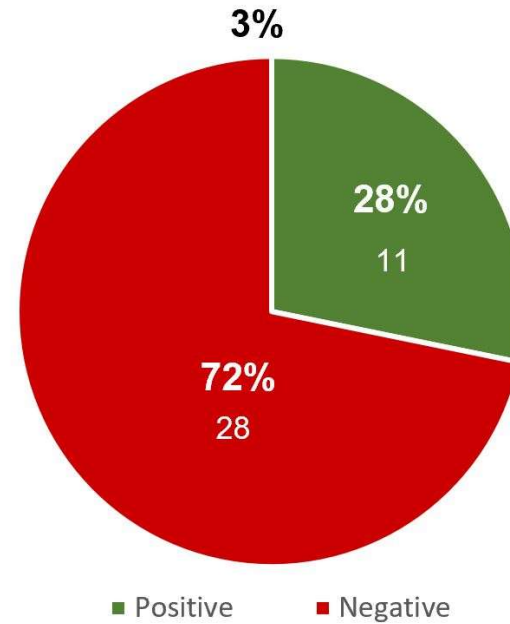
38



Final results

Emergency response assessment

Polarity	LastQuake app Comments Number	Percentage
Negative	28	72
Positive	11	28
Total	39	100



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results

Negative

- 'A boom like someone dropped something upstairs. My husband asked what was that and I said 'maybe an earthquake?' and then suddenly there was obvious shaking with rumbling sound that lasted 5 to 10 seconds. It was enough to make us head for the front door. It stopped so we did not open the door. I still fell 'shaken up' over it'.
- 'We felt the earthquake in Izmir excessively, we are in the skyscraper, the highest floors are very afraid call for help'.

Positive

- 'I was in bed with a mob in my hand and a shaking device, I shivered and quickly got out of the house'.
- 'Independent mine workers are trying to reach people who are under the rubble'.



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results

DATASET

Contreras, D., Wilkinson, S., Fallou, L., Landès, M., Bossu, R., & Aktas, Y. (2021). **Polarity and topic supervised classification of LastQuake app user's comments - Aegean 2020 earthquake**. Retrieved from:

https://data.ncl.ac.uk/articles/dataset/Polarity_and_topic_supervised_classification_of_LastQuake_app_user_s_comments_-_Aegean_2020_earthquake/14604354

DOI: <https://doi.org/10.25405/data.ncl.14604354.v3>



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Conclusions

- The **users of social media and crowdsourcing platforms** have **different profiles**.
- **Twitter and Instagram** users share data from **seismic information, building damage, emergency response, solidarity, injuries-casualties, lifelines and intensity**
- **LastQuake app** users focus their comments on **intensity and seismic information**
- **Comments with negative polarity include more data** than the comments in other polarities
- The **spatial distribution of negative polarity** is a proxy indicator of the **location of damages**
- **Citizens** as sensors should be **trained to provide** more useful **data**



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)

L'Aquila earthquake 2009 – 2019

Post-disaster recovery
10th anniversary

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



Church Santa Maria del Suffragio.

Photo: Prof. David Alexander

L'Aquila location: (a, b) location of the case study area: L'Aquila, Italy and (c) restricted zone in L'Aquila after the earthquake on 6 April 2009.

Source: Contreras, D. (2016). Fuzzy Boundaries Between Post-Disaster Phases: The Case of L'Aquila, Italy. *International Journal of Disaster Risk Science*, 7(3), 277-292. doi:10.1007/s13753-016-0095-4. Figure 1. Page 278.

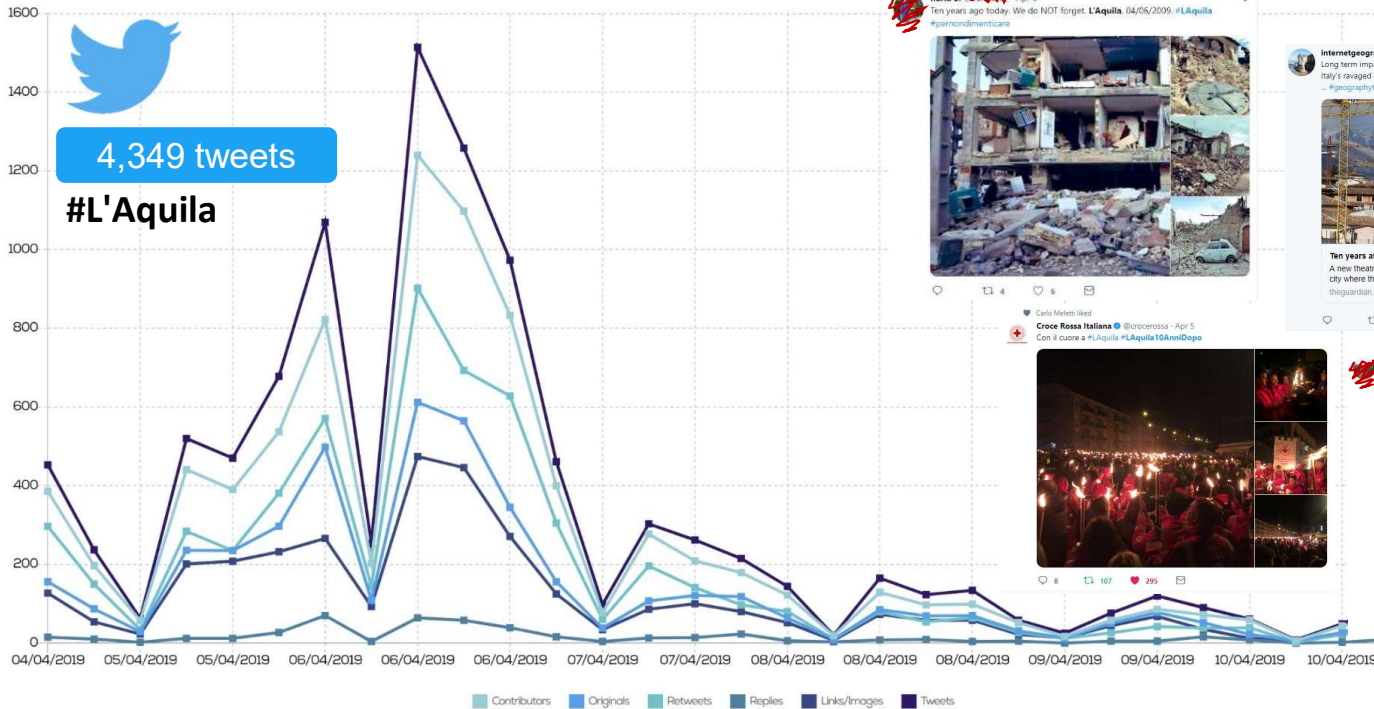


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



The 6th April 2009 to 2019



Twitter activity from the 4th to 10th April 2019.

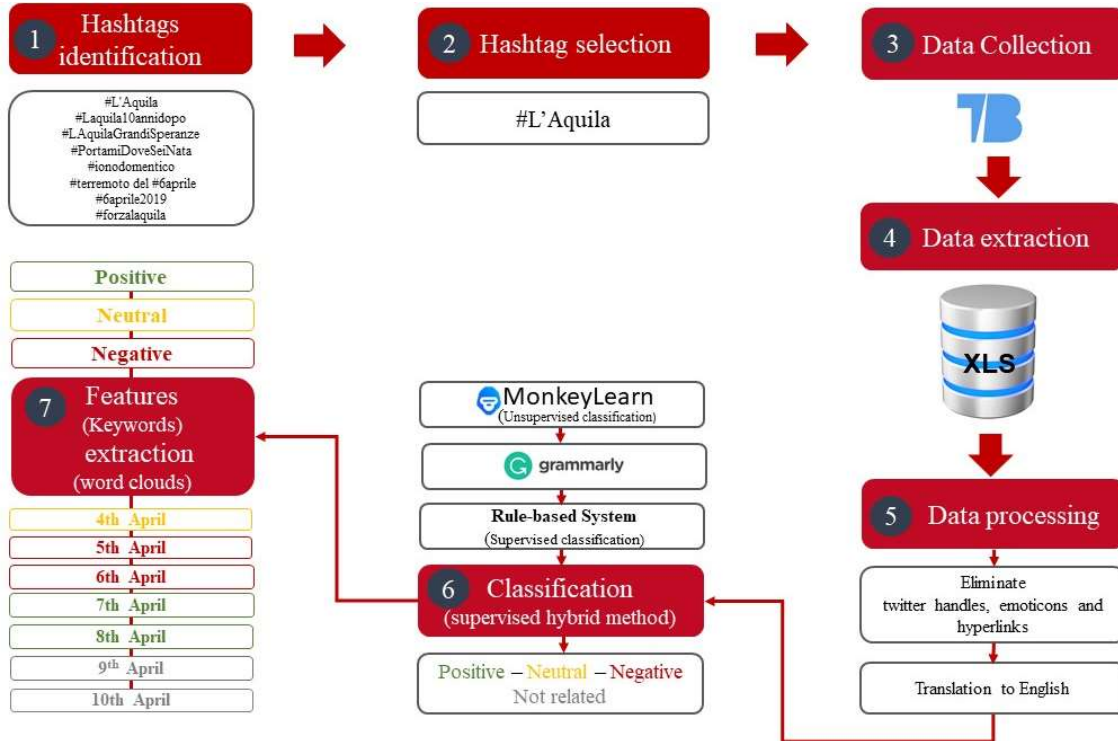
Source: Contreras et al. (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. *Earthquake Spectra*, 0(0), 87552930211036486. doi:10.1177/87552930211036486. Figure 6. Page 13.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

**13 Sep -15 Sep 2021
Islamabad-Pakistan**



Methodology (Data & Methods)

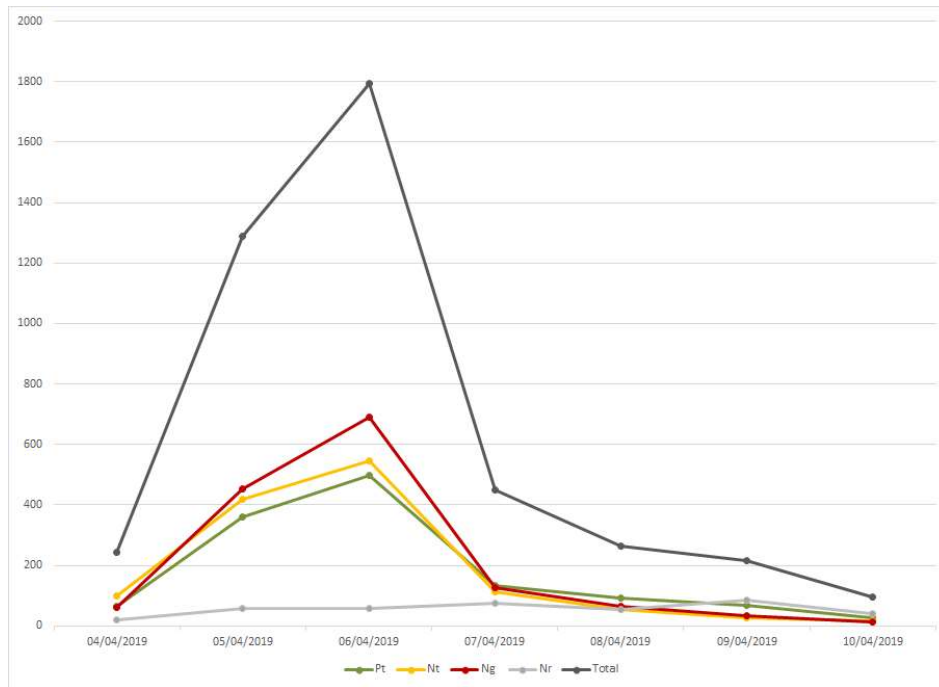


Methodology.
 Source: Contreras, D., Wilkinson, S., Balan, N., & James, P. (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 0(0), 87552930211036486. doi:10.1177/87552930211036486. Figure 5. Page 13.

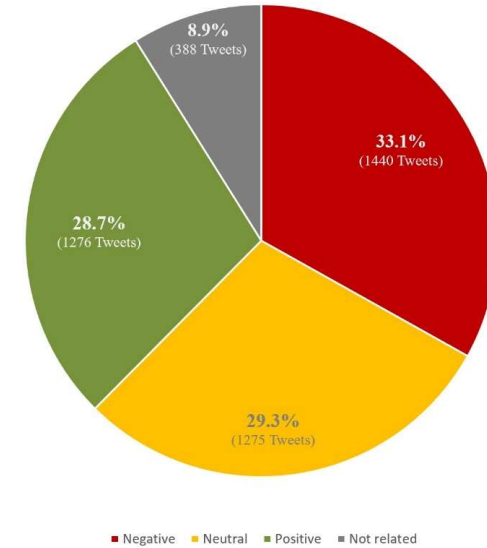
Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries
 13 Sep -15 Sep 2021
 Islamabad-Pakistan



Final results



The trend distribution of the polarity of the tweets with the hashtag: #L'Aquila during the observation period. Source: Contreras et al (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 0(0), 87552930211036486. Figure 9. Page 17.



Polarity of the tweets with the hashtag: #L'Aquila. Source: Contreras et al (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 0(0), 87552930211036486. doi:10.1177/87552930211036486. Figure 7. Page 14.

**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries
13 Sep -15 Sep 2021
Islamabad-Pakistan**



Final results

Negative

'Another interesting and very **painful** report on nine. "L'Aquila - 10 years later. I would recommend to many politicians to look at it..and to be **ashamed** to think of the **poor** people who still live among the **rubble**. The **Red zone**'.

Neutral

'L'Aquila earthquake the comparison between 2009 and 2019'.

Positive

'I saw on TV .. the **rebirth** of L'Aquila, of what in 10 years has been **restored** and the great **commitment** of all those **beautiful** people to rebuild (bricklayers/engineers/carpenters/restorers/architects/carpenters, etc.). I am touched'

Not related

'L'Aquila, weekend in the sun and scattered rains'.

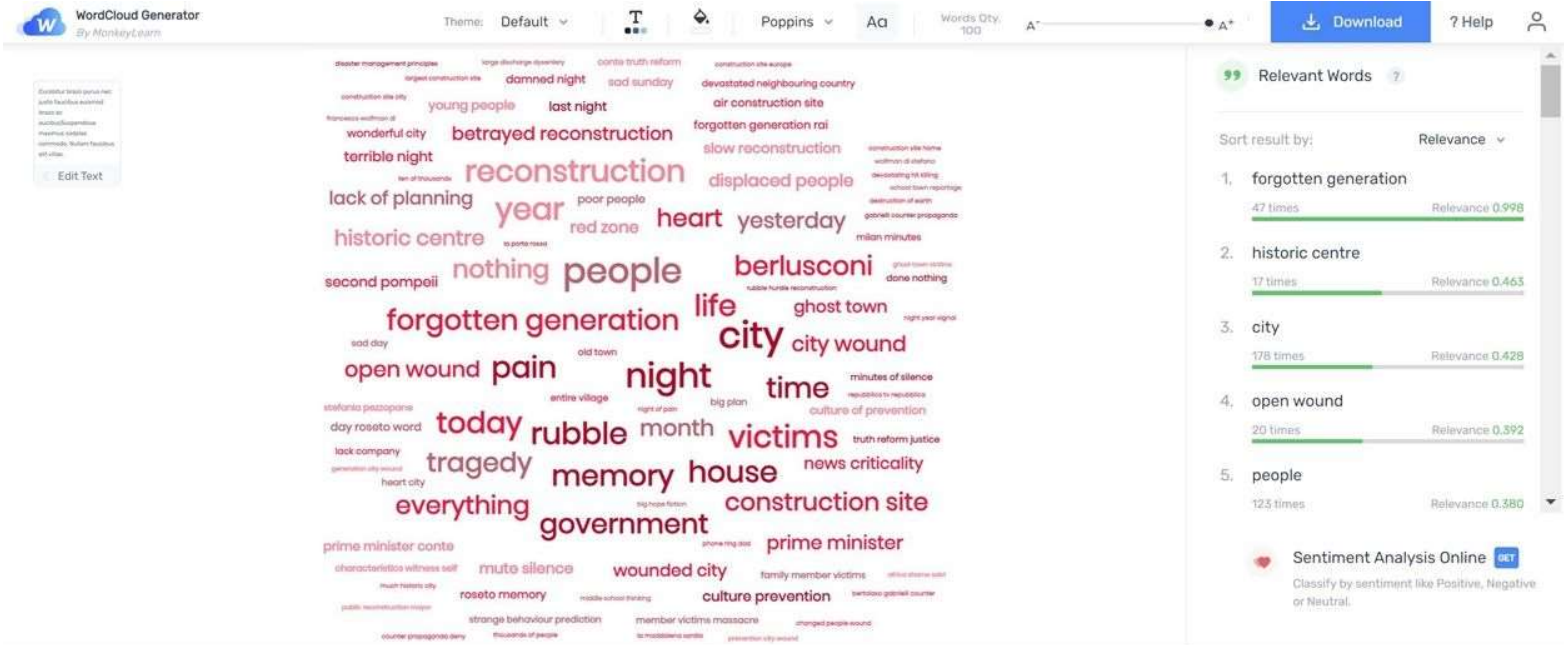


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results



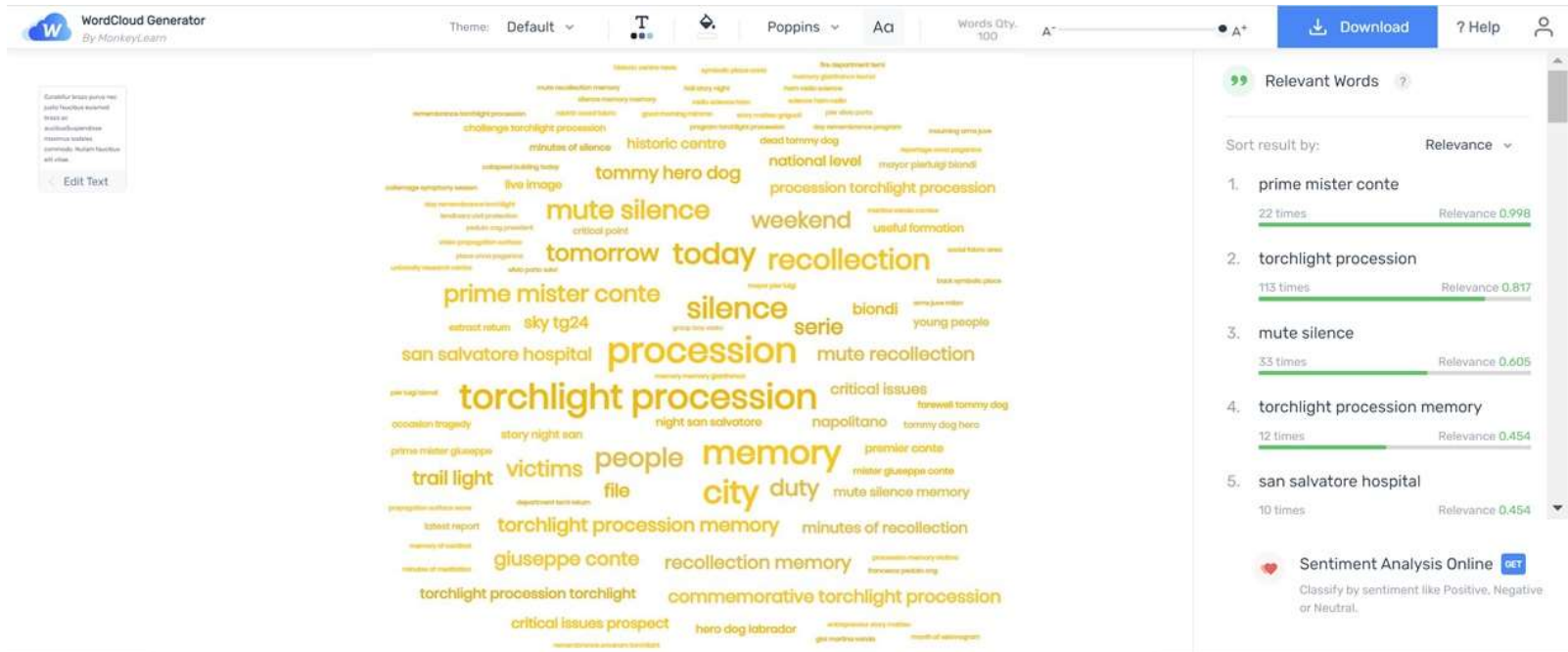
Keywords extracted from tweets with negative polarity using word clouds. Source: Contreras et al (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 0(0), 87552930211036486. doi:10.1177/87552930211036486. Figure 10a. Page 18.



**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries**
13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results

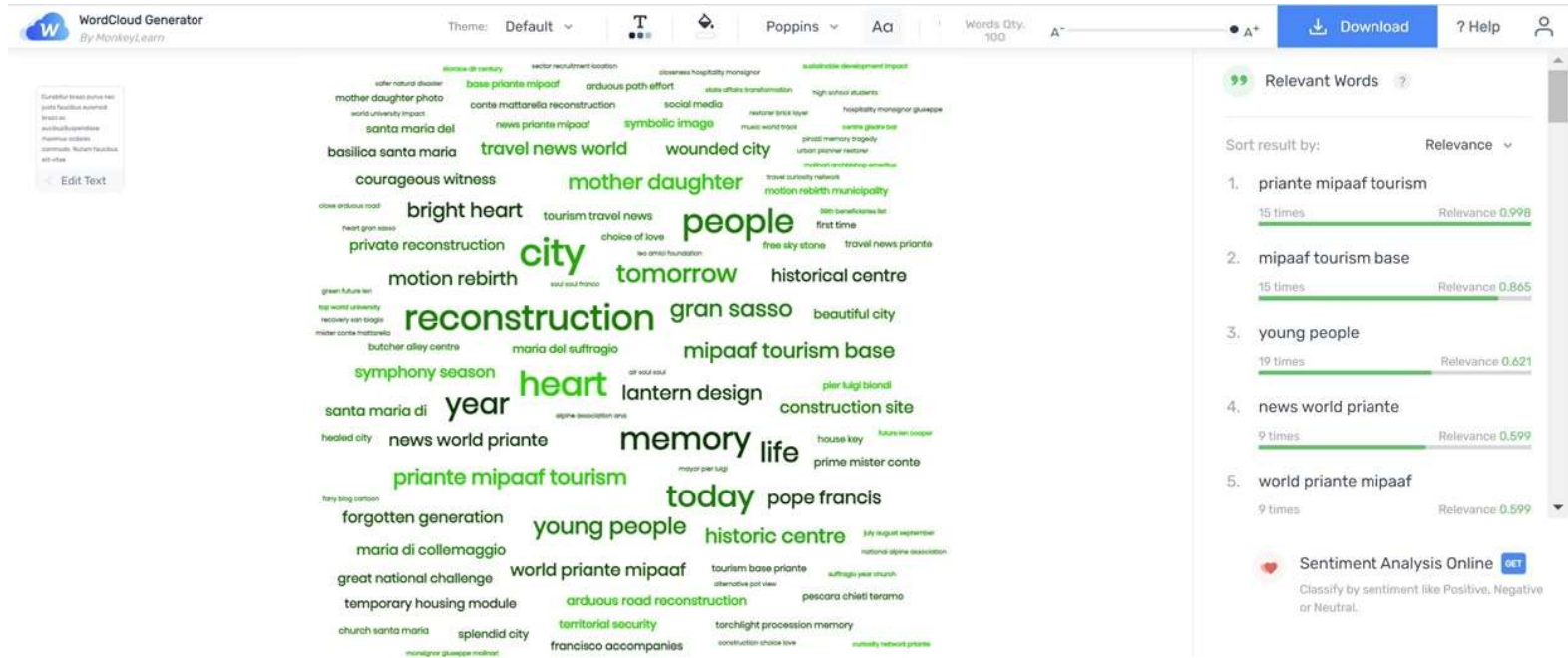


Keywords extracted from tweets with neutral polarity using word clouds. Source: Contreras et al (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 0(0), 87552930211036486. doi:10.1177/87552930211036486. Figure 10b. Page 18.

**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries**
13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results



Keywords extracted from tweets with positive polarity using word clouds. Source: Contreras et al (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 0(0), 87552930211036486. doi:10.1177/87552930211036486. Figure 10c. Page 18.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

**13 Sep -15 Sep 2021
Islamabad-Pakistan**



Final results



Feature extraction based on relevance using word clouds.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

52



Final results

DATASET

Contreras, D., Wilkinson, S., Balan, N., & James, P. (2021). **Polarity supervised classification of Twitter data related to the 10th anniversary of the L'Aquila 2009 earthquake.** Retrieved from:

https://data.ncl.ac.uk/articles/dataset/Polarity_supervised_classification_of_Twitter_data_related_to_the_10th_anniversary_of_the_L_Aquila_2009_earthquake/14579196

DOI: <https://doi.org/10.25405/data.ncl.14579196.v1>



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)

Maule earthquake 2010 – 2020

Post-disaster recovery
10th anniversary

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

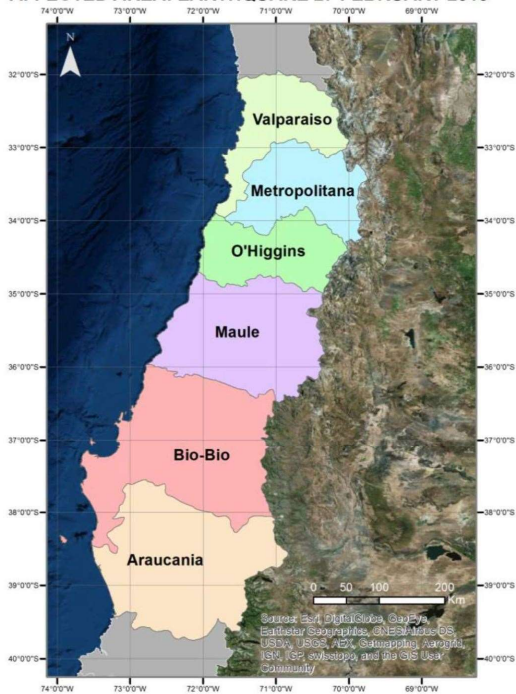
13 Sep -15 Sep 2021
Islamabad-Pakistan

54

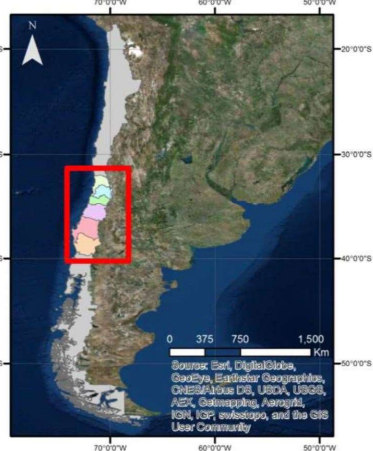


Methodology (Data & Methods)

CASE STUDY AREA AFFECTED AREA: EARTHQUAKE 27 FEBRUARY 2010



CHILE



Source: Lubkowski, Z., D'Ayala, D., Crewe, A., Manafpour, A., Grant, D., Lloyd, T., ... Novelli, V. (2010). *EEFIT Mission Report: The Mw 8.8 Maule, Chile Earthquake of 27th February 2010*. Retrieved from <https://www.istructe.org/!structE/media/Public/Resources/report-eefit-maule-chile-20190814.pdf>

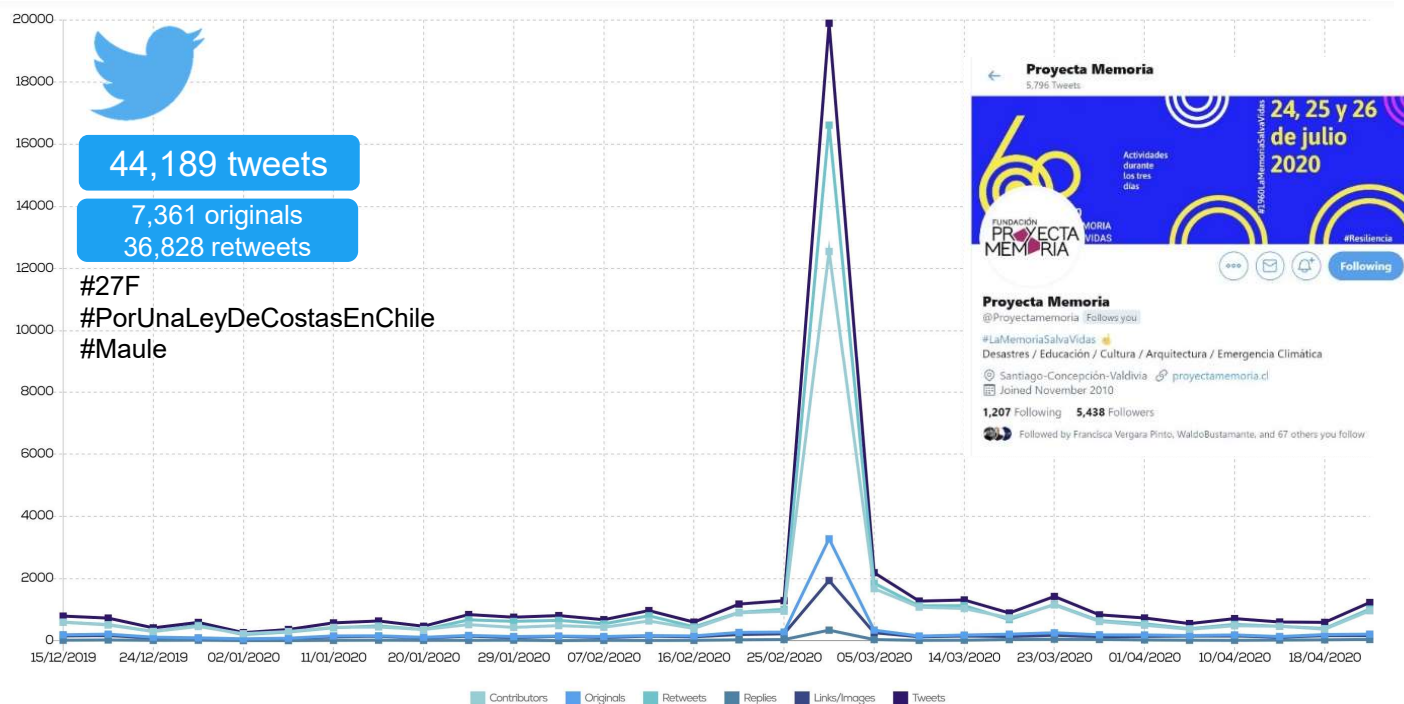
Zone of catastrophes in Chile after the earthquake on the 27 February 2010.
Source: Contreras, D., & Shaw, D. (2016). *Disaster Management and Resilience in Electric Power Systems: The Case of Chile*. Paper presented at the IDRC Davos 2016, Davos.
Figure 1. Page 152.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



The 27th de February 2010 to 2020

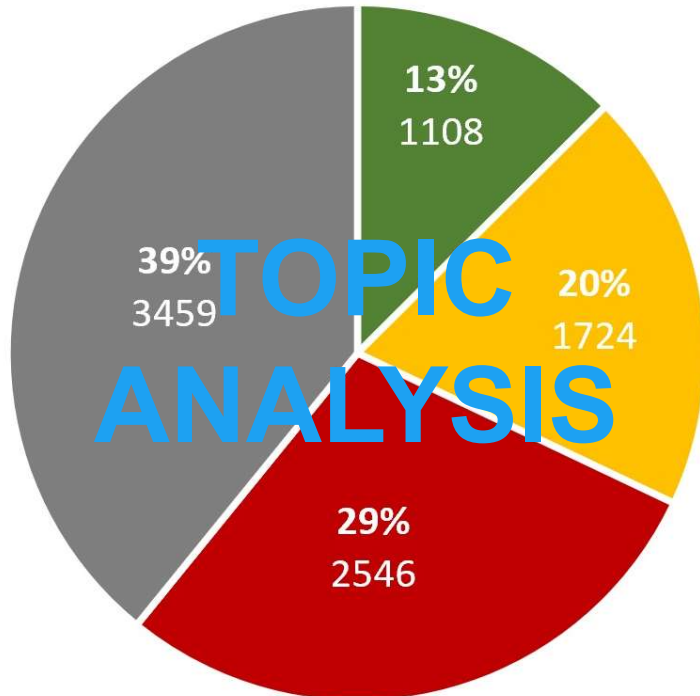


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results



Sample

8,837 tweets
20%

#27F

- The Dominican Republic independence
- The 'Caracazo'
- Birth of José Vasconcelos, Mexican educator and philosopher (1882); José Antonio Meade Kuribreña (1969), Mexican politician and economist; and Elizabeth Taylor (1932)
- Mauricio Garcés, Mexican actor died (1989)
- 2 years and 10 months of the dead of Eyker Rojas Gil (27/04/2017)
- 2 years and seven months of the dead of Leonardo González el 27/07/2017
- International polar bear day

■ Positive ■ Neutral ■ Negative ■ Not related

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)

Polarity

Positive

'After 27F the State took measures to improve the ability to react to the earthquakes. One of them was the alliance between the National Office of Emergency of the Interior Ministry (ONEMI) Chile and the National Seismological Centre of the University of Chile. We believe that collaborative alliances foster local development through appropriate and decentralized solutions'.

Negative

'10 years ago Michelle Bachelet and Carmen Fernández, former director of the National Office of Emergency (ONEMI), they told Chile that there was no tsunami, an announcement that cost 156 Chileans their lives, 82 men and 74 women + 25 missing ...Do not forget 27F earthquake'.

Neutral

'Seismic Ephemeris a day like today on February 27, 2010 the earthquake of the Maule occurred. At 03:34 am local time, a magnitude 8.8 (Mw) earthquake shook the south-central area of Chile, affecting about 80% of the population and producing a very destructive tsunami'.

Not related

'27th to 31 years of the caracazo popular rebellion against the economic package imposed by the neoliberal system that the government of Carlos Andrés Pérez tried to impose.
Trump the threat is you'.



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Preliminary results

Topic analysis: Recovery

Negative

'Only in the Biobio Region 29 public schools continue in cargo containers.27F 10 years after the earthquake and tsunami we are still waiting for reconstruction and justice'.

Positive

'The 27F affected more than 230 communes in seven regions of the country. In four years we reconstructed Chile and today more than 224,000 families have a definitive housing solution. Together with the Minister Cristián Monckeberg and undersecretary Guillermo Rolando. We are better able to face catastrophe. Strength.'

Positive

'This afternoon we shared **valuable experiences**: we learned the stories of improvement of the young people of Talcahuano, Dichato and Concepción 10 years after the 27F and the tremendous work in the House of Culture of Hualpén where classes of Mapuche weaving are taught. Ministry of Social Development and Family (MDSF) Biobío'.



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Final results

DATASET

Contreras, D., Wilkinson, S., Hervas, J., Balan, N., & James, P. (2021). **Polarity supervised classification of Twitter data posted in English related to the 10th anniversary of the 2010 Maule earthquake in Chile.** Retrieved from:

[https://data.ncl.ac.uk/articles/dataset/Polarity supervised classification of Twitter data posted in English related to the 10th anniversary of the 2010 Maule earthquake in Chile/15081795](https://data.ncl.ac.uk/articles/dataset/Polarity%20supervised%20classification%20of%20Twitter%20data%20posted%20in%20English%20related%20to%20the%2010th%20anniversary%20of%20the%202010%20Maule%20earthquake%20in%20Chile/15081795)

DOI: <https://doi.org/10.25405/data.ncl.15081795.v1>



**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries**

**13 Sep -15 Sep 2021
Islamabad-Pakistan**



Methodology (Data & Methods)

Haiti earthquake 2010 – 2020

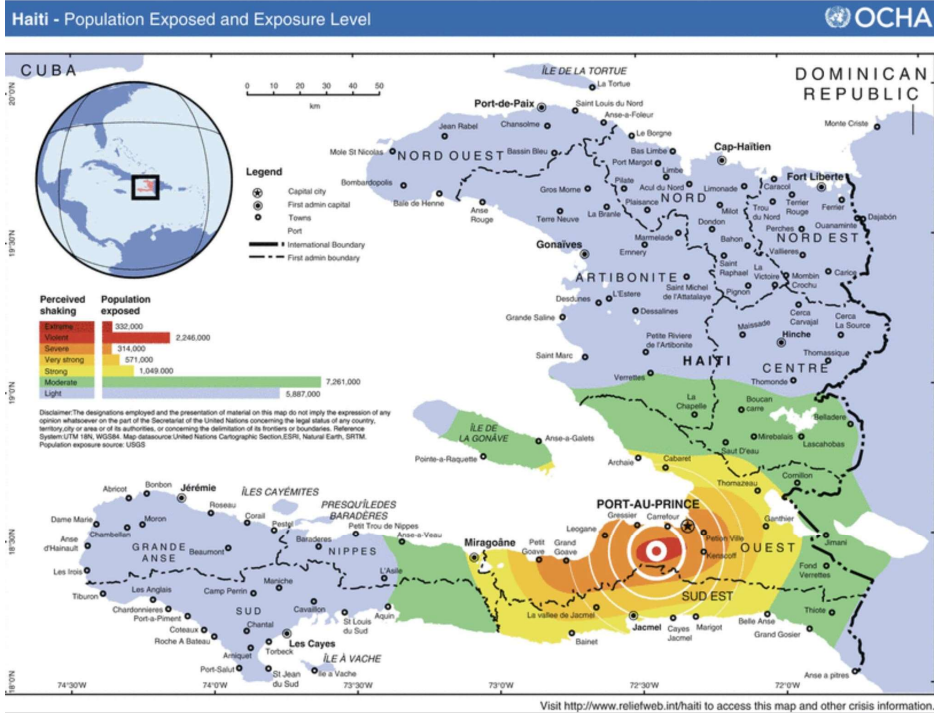
Post-disaster recovery
10th anniversary

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



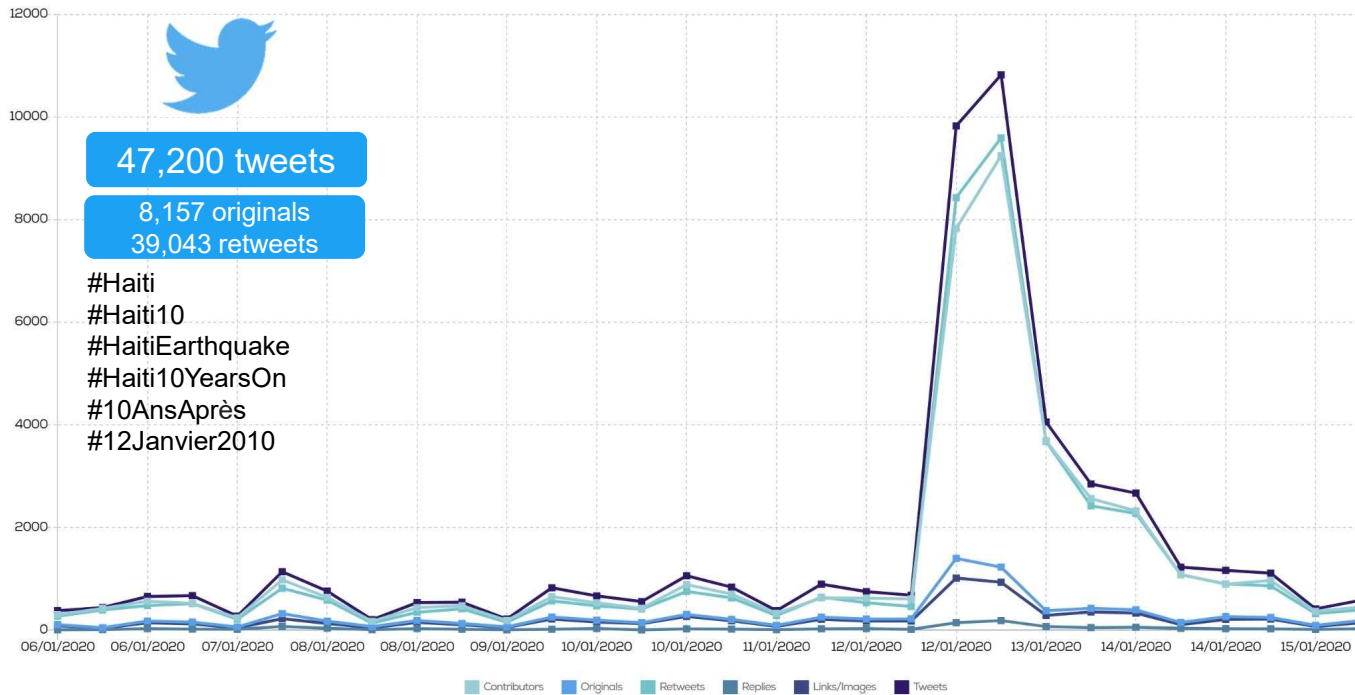
Cathedral of Port-au-Prince destroyed after the earthquake.
Source: <https://twitter.com/AC360/status/1216888960720478209/photo/1>

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Methodology (Data & Methods)



The 12th de January 2010 to 2020



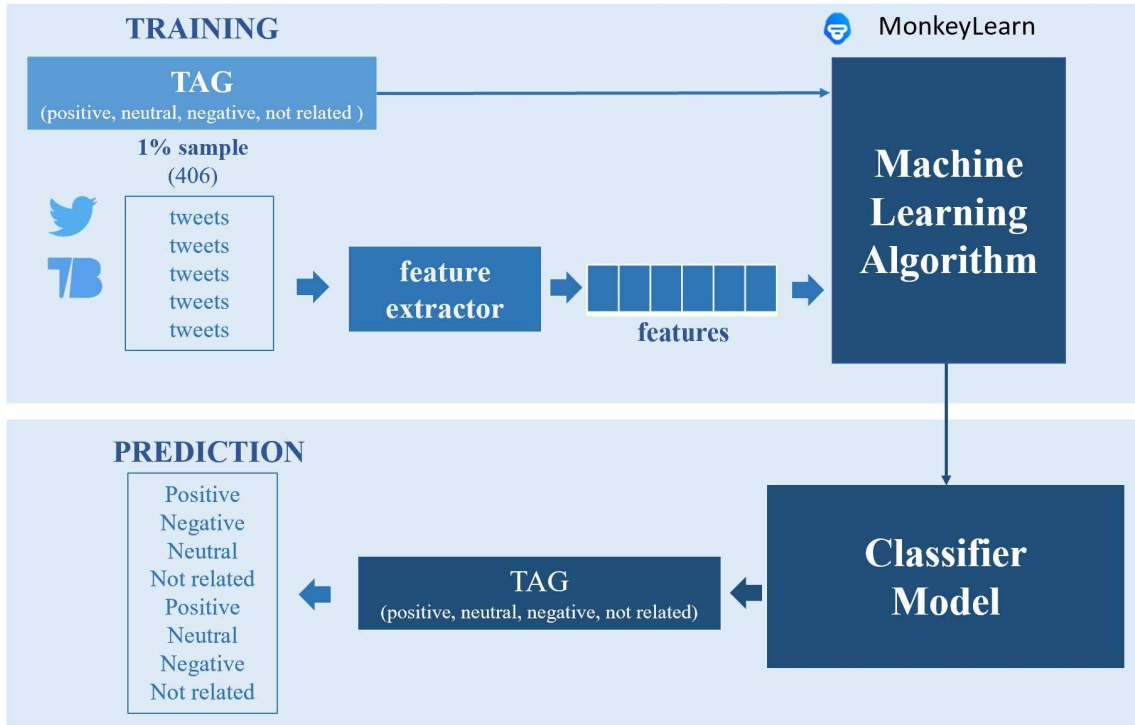
Twitter activity from 6th January 2020 to 15th January 2020. Source: TweetBinder

**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries**

**13 Sep -15 Sep 2021
Islamabad-Pakistan**



Preliminary results

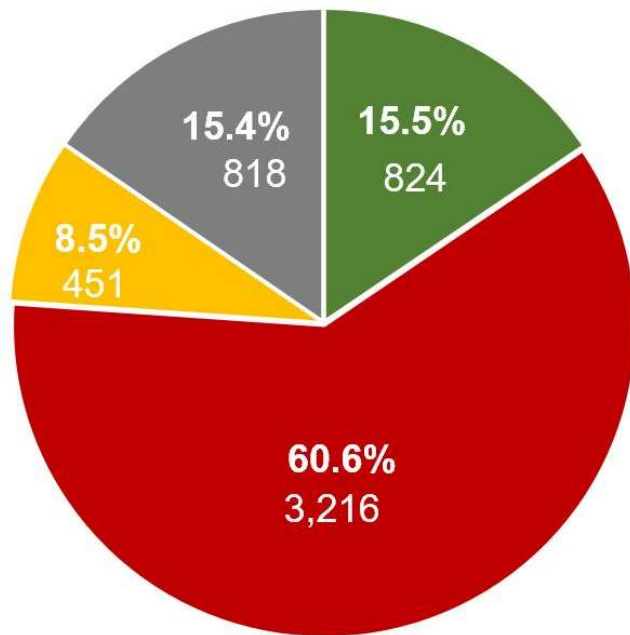


Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Sentiment Analysis (SA) result
Islamabad-Pakistan



Methodology (Data & Methods)



■ Positive ■ Negative ■ Neutral ■ Not related



Sample

5,309 tweets
11%

Polarity

Negative

'Haiti earthquake is trending because 10 years ago yesterday was the earthquake that lasted 30 seconds, but a decade later they have **still not recovered and rebuilt**. It is incredibly sad that this could be Puerto Rico if they face more natural disasters without help to build'.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Conclusion

- **The tweets regarding the memorial of disasters are not necessarily trending topics** like the tweets related to the disaster itself
- There are more related tweets in the days before the anniversary of the earthquake than after, with **the critical day to collect most of the data being on the day of the anniversary.**
- **Tweets from the citizen and news agencies are more reliable to assess post-disaster recovery.** Official sources are more likely to focus on positive achievements.
- **Sentiment analysis is a suitable method for post-disaster recovery assessment**
- The **pre-defined model** of SA had an **ACC of 53%**, but **the customised model 63%**



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



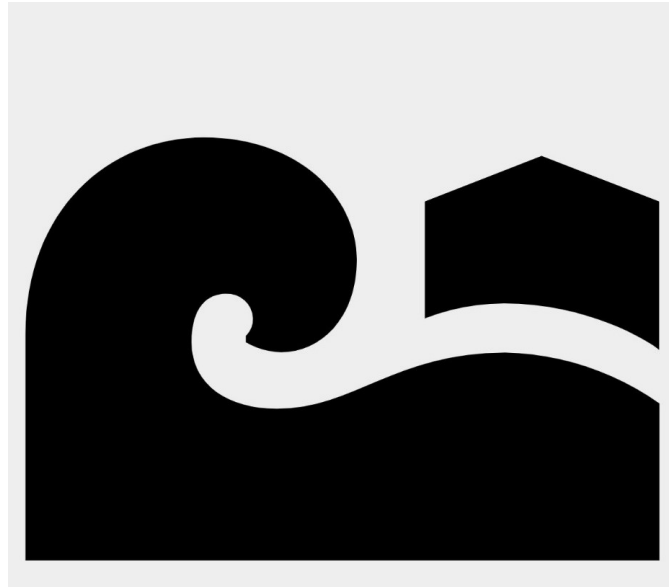
Recommendations

When an Earthquake or Tsunami strike....



Earthquake

https://www.guemil.info/2020/48_earthquake_v15/



Tsunami

https://www.guemil.info/2020/47_tsunami_v15/



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

67



Recommendations

Keep you safe !!!



Protection

https://www.guemil.info/2020/10_drop_cover_hold_v15/



Horizontal evacuation

https://www.guemil.info/2020/11_evacuate_vertical_v15/



Vertical evacuation - Tsunami

https://www.guemil.info/2020/11_evacuate_vertical_v15/



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

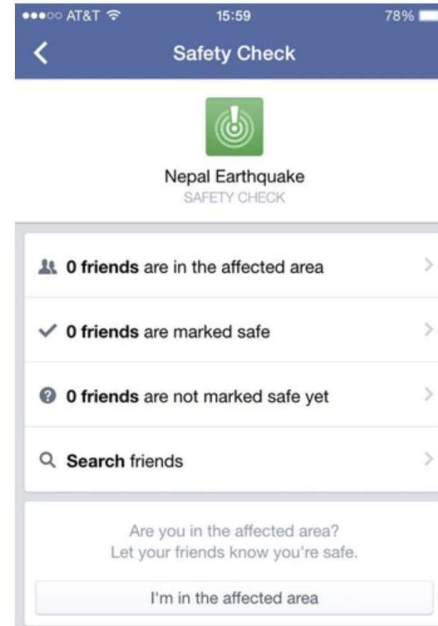
13 Sep -15 Sep 2021
Islamabad-Pakistan

68



Recommendations

Report that you are safe !!! and...



A screenshot of Safety Check

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

69



Recommendations

Take pictures !!!



Faculty of social and political sciences – Tadulako University (Indonesia)
The 17th November 2018



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

70



Recommendations

Take pictures !!! and



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

71



Recommendations

Upload pictures to....



Components of EMSC's multichannel rapid information system.
Source: Bossu et al. (2020). Figure 3. Pag. 35

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Recommendations

Support SAR activities....



4264 Retweets

283/1 Emrah apartmanı 1.kat teyzem enkaz altında tevhide akkuş lütfen yardımcı olun #deprem #izmirdeprem

My aunt, Tevhide Akkus, is under the debris **in 283/1 Emrah apartment, 1st floor**, please help #earthquake #izmirearthquake



3377 Retweets

Mansuroğlu mahallesi 283/13 Sok Rıza Bey apt No 2 kat 4 Daire 16 Bayraklı izmir enkaz altında 3 kişi var 1 anne 2 küçük çocuk Emine Yücel Toklu acil yardım için lütfen #Deprem #depremitizmir #Tsunami <https://t.co/cMM2eZ4Wsu>

Mansuroğlu Neighborhood 283/13 Street Rıza Bey Apt No 2 floor 4 Flat 16 Bayraklı Izmir.

There are three people under the wreckage: a mother, Emine Yücel Toklu, and two small children. Retweet please #Earthquake #earthquakeizmir #Tsunami

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

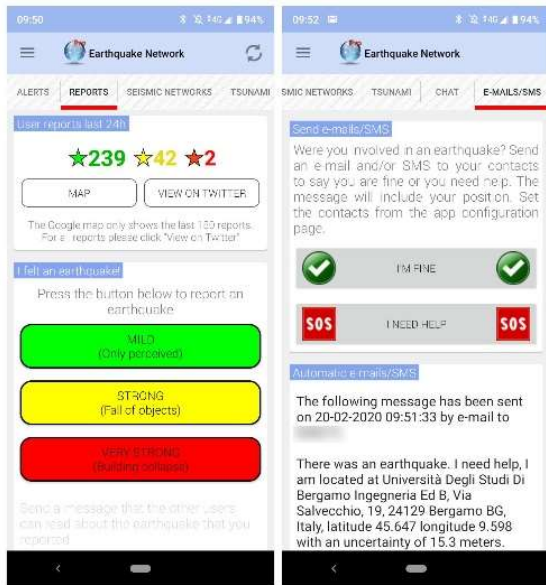
13 Sep -15 Sep 2021
Islamabad-Pakistan

73

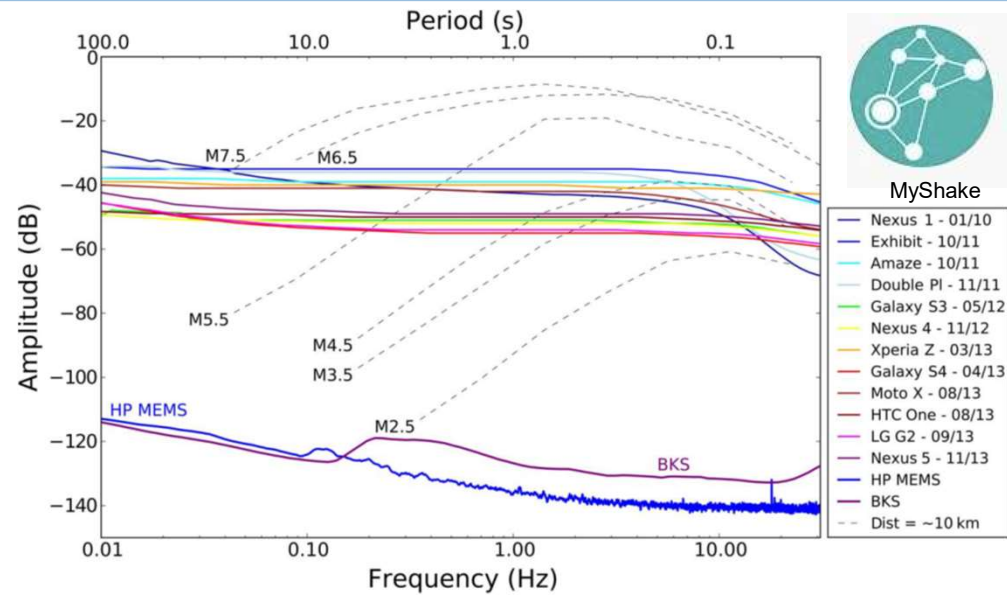


Recommendations

Download....



Earthquake network



Noise floor of the phones. Noise floors of the smartphones color coded by the phone release date (also shown in the legend as MM/YY). Dashed black lines are typical ground motion amplitudes of earthquakes 10 km from the epicenter for various magnitudes. Noise floor for high-quality MEMS sensor (HP MEMS, blue) and a typical force-balance accelerometer from a regional network (BKS in northern California, purple) are also shown.

Source: Kong, Q. K., Martin-Short, R., & Allen, R. M. (2020). Toward Global Earthquake Early Warning with the MyShake Smartphone Seismic Network, Part 2: Understanding MyShake Performance around the World. *Seismological Research Letters*, 91(4), 2218-2233. doi:10.1785/020190178 Page 2. Figure 1.

User interface of the Earthquake Network app for sending felt reports (Left) and for asking help if involved in an earthquake (Right). Source: Finazzi, F. (2020). The Earthquake Network Project: A Platform for Earthquake Early Warning, Rapid Impact Assessment, and Search and Rescue. *Frontiers in Earth Science*, 8(243). doi:10.3389/feart.2020.00243 Figure 3, page 5.

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI) for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



Recommendations

Follow us....

Learning from Earthquakes



[Home](#) [About us](#) [News & Events](#) [People](#) [Outputs](#) [Partners](#) [Contacts](#) [Resources](#)



Project: Learning from Earthquakes

<https://research.ncl.ac.uk/learningfromearthquakes/>
[@LEarthquakes](#)

https://www.instagram.com/learning_from_earthquakes_uk/

https://www.youtube.com/channel/UCQf--IBG9fWqNHWimrcXE1w?view_as=subscriber

<https://www.facebook.com/Learning-from-Earthquakes-110392457215986>



Dr Diana Contreras

<https://www.cardiff.ac.uk/people/view/2534179-Contreras-Mojica-Diana>

<https://www.ncl.ac.uk/engineering/staff/profile/dianacontreras-mojica.html>

[@DianaContrerasM](#)

https://www.instagram.com/diana_contreras_mojica/

<https://www.facebook.com/diana.m.mojica.50/>

Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan



References

- Aktas, Y.D., et al., The Aegean earthquake and tsunami of 30 October 2020 (on writing), A.f.r.b. EEFIT, Editor. 2021: London, United Kingdom p. 150.
- Bossu, R., et al., LastQuake: From rapid information to global seismic risk reduction. *International Journal of Disaster Risk Reduction*, 2018. **28**: p. 32-42.
- Bossu, R., et al., Rapid Public Information and Situational Awareness After the November 26, 2019, Albania Earthquake: Lessons Learned From the LastQuake System. *Frontiers in Earth Science*, 2020. **8**(235).
- Contreras, D., Wilkinson, S., Balan, N., & James, P. (2021). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. *Earthquake Spectra*, 0(0), 87552930211036486. doi:10.1177/87552930211036486
- Contreras, D., Wilkinson, S., Fallou, L., Landès, M., Tomljenovich, I., Bossu, R., . . . James, P. (2021). Assessing Emergency Response and Early Recovery using Sentiment Analysis (SA). The case of Zagreb, Croatia Paper presented at the 1st Croatian Conference on Earthquake Engineering (1CroCEE) 2021, Zagreb, Croatia. <https://crocee.grad.hr/event/1/contributions/186/>
- Contreras, D., et al. Assessing Post-disaster Recovery Using Sentiment Analysis. The case of L'Aquila, Haiti, Chile and Canterbury in 17th World Conference on Earthquake Engineering (17WCEE). 2020. Sendai, Japan.
- Contreras, D. (2016). Fuzzy Boundaries Between Post-Disaster Phases: The Case of L'Aquila, Italy. *International Journal of Disaster Risk Science*, 7(3), 277-292. doi:10.1007/s13753-016-0095-4
- Contreras, D., & Shaw, D. (2016). Disaster Management and Resilience in Electric Power Systems: The Case of Chile. Paper presented at the IDRC Davos 2016, Davos.
- Fallou, L., et al., Citizen Seismology Without Seismologists? Lessons Learned From Mayotte Leading to Improved Collaboration. *Frontiers in Communication*, 2020. **5**(49).
- Lubkowski, Z., D'Ayala, D., Crewe, A., Manafpour, A., Grant, D., Lloyd, T., . . . Novelli, V. (2010). EEFIT Mission Report: The Mw 8.8 Maule, Chile Earthquake of 27th February 2010. Retrieved from <https://www.istructe.org/IStructE/media/Public/Resources/report-eefit-maule-chile-20190814.pdf>
- Ragini, J. R., Anand, P. M. R., & Bhaskar, V. (2018). Big data analytics for disaster response and recovery through sentiment analysis. *International Journal of Information Management*, 42, 13-24. doi:<https://doi.org/10.1016/j.ijinfomgt.2018.05.004>
- Shibuya, Y., & Tanaka, H. (2019). Using Social Media to Detect Socio-Economic Disaster Recovery. *IEEE Intelligent Systems*, 34(3), 29-37. doi:10.1109/MIS.2019.2918245
- So, E., et al., The Zagreb Earthquake of 22 March 2020 2020, EEFIT Newcastle, UK. p. 94.
- MonkeyLearn, Topic Analysis, in MonkeyLearn. 2020.
- Roldós, I., Best Word Visualization Tools to Create Your Own Word Cloud, in MonkeyLearn Blog, MonkeyLearn, Editor. 2020, MonkeyLearn.
- Wilkinson, S. S., H; D'Ayala, D; Verrucci, E; James, P; Rossetto, T; So, E;. (2018). How can new technologies help us with earthquake reconnaissance? Paper presented at the 11th National Conference on Earthquake Engineering., LA, USA.
- Wolff, R., Visualize Sentiments in A Word Cloud - Free Tools & Tutorial, in MonkeLearn Blog. 2020, MonkeLearn.
- Yan, Y., Chen, J., & Wang, Z. (2020). Mining public sentiments and perspectives from geotagged social media data for appraising the post-earthquake recovery of tourism destinations. *Applied Geography*, 123, 102306. doi:<https://doi.org/10.1016/j.apgeog.2020.102306>
- Zucco, C., et al., Sentiment analysis for mining texts and social networks data: Methods and tools. *WIREs Data Mining and Knowledge Discovery*, 2020. **10**(1): p. e1333.



**Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries**

**13 Sep -15 Sep 2021
Islamabad-Pakistan**



HVALA VAM

MAURURU

CHALTU

GRAZIE

MERCI

Thank You

YUSPAGARA

TEŞEKKÜR EDERİM

شکریہ

MĚSI

Gracias

Questions?



Virtual Capacity Building Workshop on Regional Spatial Data Infrastructure (SDI)
for Sustainable Development in ECO Countries

13 Sep -15 Sep 2021
Islamabad-Pakistan

