The Key Role of Eyewitnesses in Rapid Impact Assessment of Global Earthquakes

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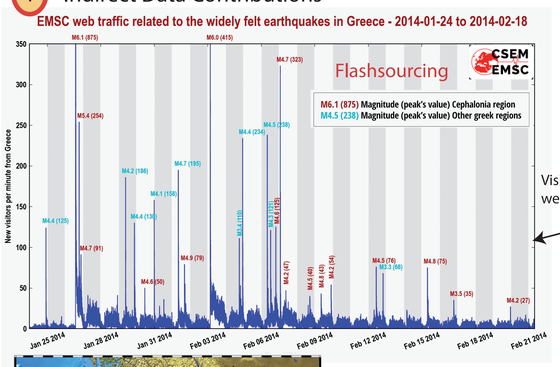
Uncertainties in rapid impact assessments of global earthquakes are intrinsically large because they rely on 3 main elements (ground motion prediction models, building stock inventory and related vulnerability) which spatial variations are poorly constrained. Furthermore, variations of location and magnitude within their respective uncertainty domain can lead to significantly different shaking level for centres of population and change the scope of the disaster.

This poster presents strategy and methods implemented at the Euro-Med Seismological Centre (EMSC) to rapidly collect in-situ observations on earthquake effects from eyewitnesses for reducing uncertainties of rapid impact assessment of global earthquakes. We show how Internet and new technologies are creating new potential for rapid and massive public involvement by both active and passive means. We underline the importance of merging results of different methods to improve performances and reliability. We then explore what could be the next technical development phases, driven notably by pervasive smartphones rapidly replacing traditional website for rapid earthquake information. Finally, we discuss how this approach not only augment data collection on earthquake phenomenon at little cost but also how they change the way we, as scientists, interface with eyewitnesses and how it pushes us to better understand and respond to public demands and expectations after earthquakes through improved information services.

1 Indirect Data Contributions

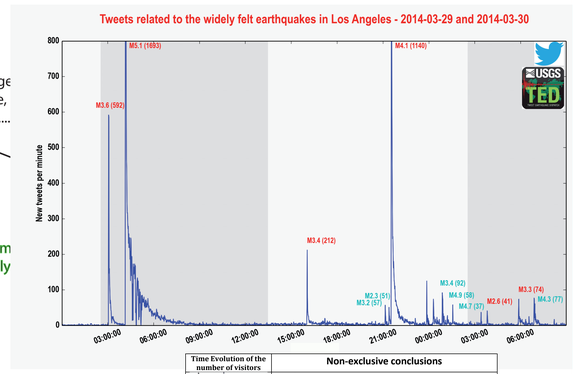


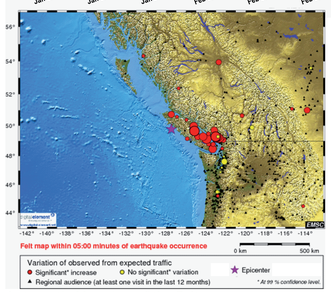
After feeling shaking, some people:

Begin sending public Twitter message including words such as, earthquake, terremotto, sismo, temblor, deprem.... to share their experience

Visit EMSC real time earthquake information website to identify the cause of the shaking

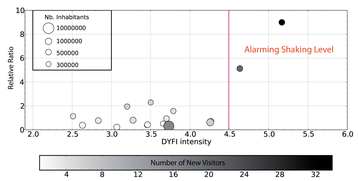
Both methods detect felt events in 1-2 m regardless their mag, and independantly any seismic data.
Faster than seismographic detections!





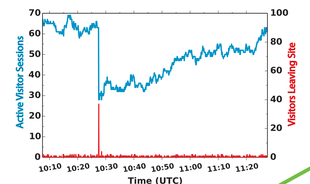
Automatic Mapping of the Felt area

Once a traffic surge is detected, IP addresses of visitors are located; Felt area is then mapped through localities exhibiting significant traffic increases. M6.5 April, 24th 2014



Discrimination of Alarming Shaking Level

Localities where shaking reaches level where structures make noises are characterised by a higher ratio of website visitors to number of inhabitants
M5.8 Virginia Aug, 23, 2011

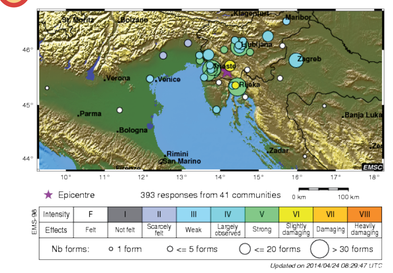


Detection of Network Failure or Damage

Severe damage or network disruption are detected through the concomitant loss of Internet sessions originating from the impacted region.
Detection of a power outage which affected part of Santiago Del Chile on March 6, 2014 at 10:27:30 UTC

Time Evolution of the number of visitors	Non-exclusive conclusions
	Not felt, or severe loss of Internet connectivity, or significant widespread damage, or severe perception of danger
	Felt and no significant loss of Internet connectivity and no significant damage
	Felt and, local or temporary, loss of Internet connectivity, or, locally significant damage or, locally severe perception of danger
	Felt and, local or temporary, loss of Internet connectivity, or, locally or widespread significant damage or, locally or widespread severe perception of danger
	Significant loss of Internet connectivity, or significant damage, or severe perception of danger

2 Indirect Data Contributions: Crowdsourcing

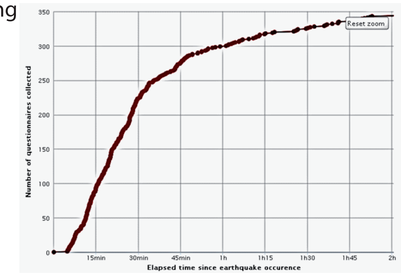


Online Questionnaires in 32 languages

Collect eyewitnesses' testimonies and convert them automatically in a map of effects and shaking levels.
M4.5 earthquake, Slovenia, April 22, 2014

Collection of Comments

M6.1 Kephalonia, Greece earthquake, Jan. 26, 2014, 2013



Fast Data Collection

2/3 of the testimonies collected within 30 minutes of the earthquake
M4.5 earthquake, Slovenia, April 22, 2014

Collection of Geolocated pics

M7.1 Bohol, Philippines earthquake, October 15, 2013

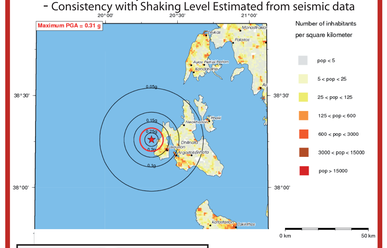
3 Data Reliability Assessment

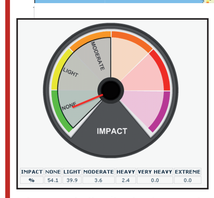
Indirect Data:

- Difficult to trick (large data volume immediatly after shaking)
- Statistical Analysis

Crowdsourced Data:

- Statistical Analysis
- Consistency with Shaking Level Estimated from seismic data



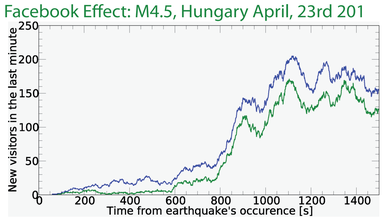


Automatic Qualitative Impact Assessment

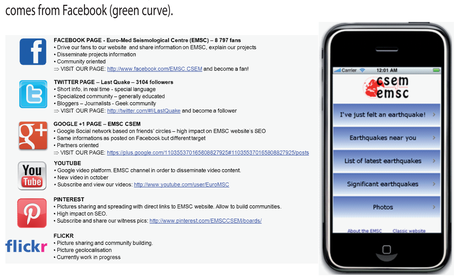
Even isolated observations can reduce loss assessment uncertainties by excluding some of the scenarios

4 Key Roles of Mobile Devices, Social Networks, and Improved Earthquake Information Services

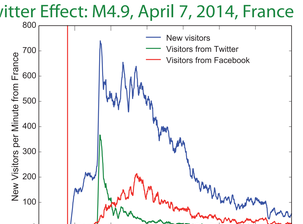
Facebook Effect: M4.5, Hungary April, 23rd 201



In Hungary, a country of low seismic activity, EMSC is poorly known. The vast majority of Hungarian visitors reachning our website within 25 min of the event's occurence comes from Facebook (green curve).



Twitter Effect: M4.9, April 7, 2014, France



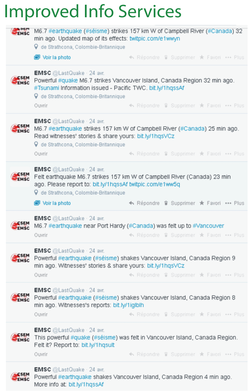
Smartphones & Tablets represents only a fraction of the total number of visits but up to 50% of the early visitors after a felt event

They require dedicated, simplified websites.
Example (left) for EMSC website where questionnaires have been replaced by thumbnails (below)

Citizens' participation allow fast detection of earthquakes and timely information on their effects

It feeds a Quakebot which automaticaly publish earthquake information on Twitter (@LastQuake) Example above for M6.5 April 24, 2014 Vancouver Islds earthquake

Improved Info Services



4 Next Steps and Concluding Remarks

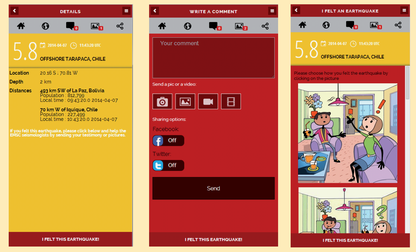
- Citizen operated seismic networks being deployed in Patras & Thessaloniki (Greece) to engage with Citizens and augment ground motion collection in urban regions

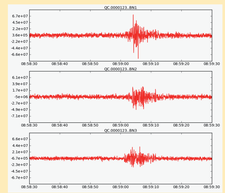
- A smartphone app. focusing on earthquakes that matters to the public & optimise pics and videos collection to be released in June

100€ MEMS USB sensor (above) and first record (below)

- Thanks to IT, eyewitnesses can provide direct and indirect timely information to constrain rapid impact assessment and in turn improve response

- Tailored earthquake information are essential to attract and engage with eyewitnesses to optimise data collection





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EMSC wants to thank its members for their support and data contributions which are at the base of its Real Time Earthquake Information Services with a special thank to its host, CEA DASE and its staff for their essential and long-term support.

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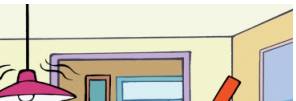

Ouvrir Répondre

EMSC @LastQuake · 24 avr.
Powerful #earthquake shakes Vancouver Island, Can
More info at: bit.ly/1hqssAf

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