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SISMOCOM SMARTPHONE APPLICATION: CITIZENS AS MAJOR CONTRIBUTOR TO EARTHQUAKE OBSERVATIONS.

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The macroseismic observations are still the only high-density data that can be collected near the epicentre after a large event, particularly in Europa thanks to the density of cities, as the number and the distribution of seismic sensors are limited. These are also the only observations that directly link the level of shaking (Intensity) with the observed effect over large areas.
The precise location and density of observations are of first importance to study the local variation of ground shaking and the associated effects, and therefore seismic risk. Macroseismic observations can also be combined with local geophysical characteristics, geology or be used to validate 3D high-resolution site effect modeling for large events.

BCSF (Bureau central sismologique français - French Seismological Central Office), in charge of the acquisition of macroseismic observations and Intensity assessment in France, constantly updates its procedure to maximize the density of observations and rapidly collects field information about seismic effects using any available approach. One of them is to consider that citizens are primary observers and can be major contributors to and primary stakeholders in earthquake impact information. To do this, BCSF has been using an online questionnaire since 2000. With the increasing number of smartphones and the possibility to geolocate them, in 2010 we created SismoCom, the first smartphone application developed to rapidly collect macroseismic information. This application is available in French and English on IOS system (free on Apple store for iPhone, iPodTouch and iPad), and a version on Androïd will be available soon improve smartphone coverage.

SISMOCOM FOR RAPID REPORTING

The online questionnaire on www.franceseisme.fr takes between 1 and 4 minutes to fill out, whereas the SismoCom application, based on much a simpler interface, takes only a few seconds and includes features like adding pictures and comments. They are 7 steps to report on SismoCom: i) Start the report (fig.1); SismoCom automatically acquires the GPS position of the device and the timestamp. ii) The witness validates or corrects this information if necessary. iii) He selects complementary characteristics on his position - "inside, outside, in vehicle," "standing while active, sitting while active, resting, sleeping," and the floor number (fig.2). iv) He then chooses amongst 11 drawings the one that best illustrates his observations (fig.3). The same pictures have been used for 10 years at the end of our online questionnaire to represent a summary of an EMS-98 Intensity using average vulnerability of buildings in Europa. These pictures allow a real-time association between online and SismoCom testimonies to rapidly map Intensities. v) He can add his own picture (not obligatory). vi) He can add a comment (not obligatory). vii) He selects "submit my report" to directly transmit his report to the BCSF database.

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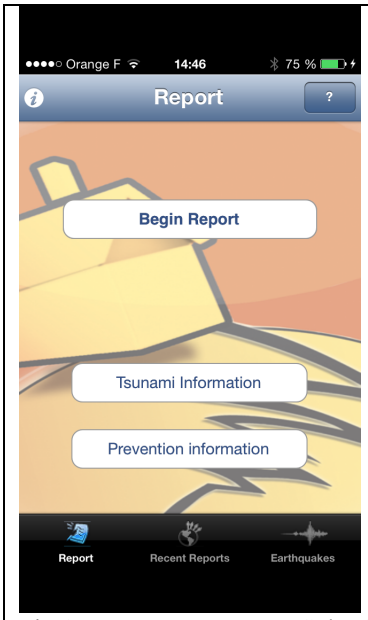

Fig.1. Home page. Selection between report, recent reports and last earthquakes. Links to Tsunami and Prevention informations.

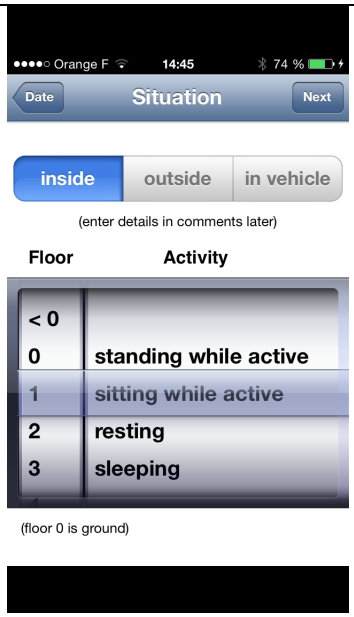

Fig.2. Indication of the situation of the witness.

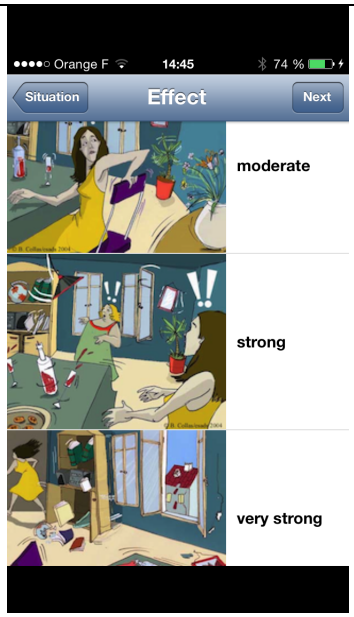

Fig.3. Selection of the drawing corresponding at best to the observations.

SEISMOLOGICAL INFORMATION AVAILABLE TO THE USER

The witnesses directly benefit from SismoCom by having in one-step access on their smartphone to the intensity map based on all reports (online questionnaire and SismoCom) (fig.4). Another page allows them to get the list of the last events located by EMSC to identify the potential felt event (fig.5). The event list can be sorted, as for example by "distance" to the device or by "felt" level at the device location (fig.6). The citizens have free access to this information; SismoCom being an application that gives continuously updated information.

Fig.4. Intensity map based on testimonies for an earthquake in Pyrénées, France, 2010.

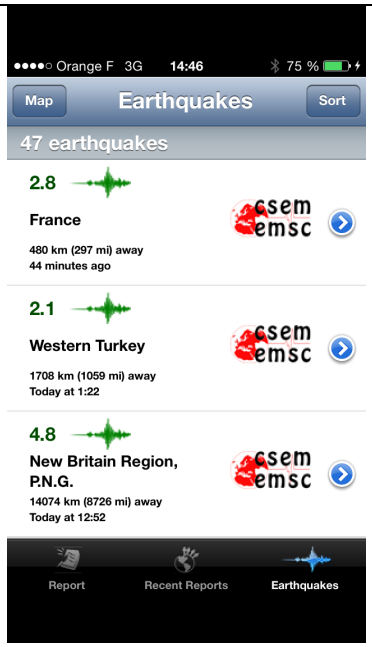

Fig.5. Characteristics of the last 60 earthquakes (EMSC data) sorted by "felt" level.

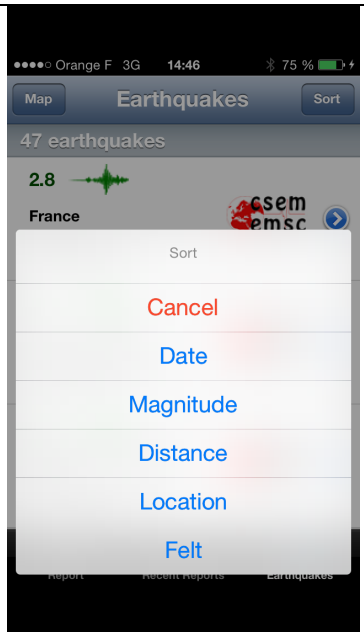

Fig.6. Sorting possibilities of the list of earthquakes

BCSF WITNESSES DATABASE AND SCIENTIFIC INTEREST.

BCSF has collected more than 59 000 testimonies over 14 years, more than 1300 were obtained le last three years with the SismoCom application. SismoCom has been downloaded all over the world and used even outside Europa as testimonies from Japan after the 2011 great Honshu earthquake. Nevertheless, the drawings are based on EMS-98 and common vulnerability in Europa, therefore testimonies from outside Europa indicating intensity of VI and more are questionable. In Europa, most testimonies obtained up to now with SismoCom are from France, Italy and Spain.
We observed, using our database, that 95% of the Intensity deduced from these drawings are similar, ± 1 degree, with expert processing of the answers on individual questionnaire, 60% have equal values. No any other automatic methods tested up to now by BCSF, including USGS DYFI approach, give better results (Schlupp et al. 2013).

Outside contributing to rapid information after an earthquake, these data has a real scientific interest. Contrary to communal enquiry that informs statistically on a citywide basis, individual testimony characterizes local observations that can be compared with instrumental measurements. These individual testimonies also allow seismologists to identify and study the origin of local variations in the strength of the shaking. The finer granularity of individual reports can improve our understanding of seismic hazard and risk.

CONCLUSION

The main characteristics of the application are:
- Rapid exchange of information and collaboration between scientific observatory and citizens, whatever their location, be it inside or outside buildings.
- Display directly on the smartphone the mapping of event impact using in near real-time citizen observations collected by the BCSF from the SismoCom application and the online questionnaire.
- An easy-to-use list of earthquakes that could have been felt by the witness, provided by EMSC who use automatic or manual locations from European seismological observatories.
- Links to additional information, such as a link to tsunami warning center and prevention information.

The application can be used on a European scale, as the drawings are not affected by language. Several European countries have shown their interest in the application and collaboration has started with Belgium. Online and SismoCom near real-time Intensities can be shared with associated countries to rapidly share information, as BCSF already does with Spain (SisPyr.eu)

REFERENCES

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