



**Enhancing the efficiency of alerting systems through personalized,
culturally sensitive multi-channel communication**

Project No. 261699

Deliverable D6.1

**“Report on the effectiveness of different communication
channels”**

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Introduction

Public alerting systems warns people through several different complementary media channels, as they are in example both fixed and mobile voice networks, Short Message Systems, TV/Radio, newspapers, e-mail, Fax, sirens, bells and flashing lights. Alerting systems use different channels because during the emergency some of them could be out of order, because segments of the population will be easier to reach using one channel rather than another and because some of them might be more effective for a certain time of the day. Furthermore, some of them are more suitable for carrying more “verbose” messages than other media; on the other hand, some of the less rich media facilitate more reactive people behaviours (e.g.: sirens, bells).

Another question arises when considering the kind of alerting targets. Warning messages have to be delivered to both emergency professional and common people. Who is in charge of alerting population about a specific hazard, has also to keep informed as well the other public authorities, but in this second case, the channel should be compliant with communication systems having legal force.

Emergency communications among public authorities

In general, an emergency warning is not ever triggered by the same authority. In Italy, the emergency system is based on a network of public authorities, which cooperate each another on subsidiarity basis. This means that the more a public authority is close to a just recognized hazard the more it should be the first entity in charge for the emergency management, but it has the responsibility of keeping informed the other authorities on the evolving situation.

In Italy, until the 2013 communications among public authorities were mainly based on facsimile transmission (Fax). A recent law (L. 98 09/08/2013) forbids explicitly the use of Fax for official communications between public institutions, and it gives legal force only to communications based on certified electronic mail (PEC), attachments digitally signed, and secure services of inter-application cooperation.

Wireless based Emergency communication

While communications among different public authorities is even more based on internet the internal communication within the same authority, among its professionals and its field crews, is mainly based on wireless GSM network and in particular on SMS exchange.

The main reason is the lack wireless service coverage in particular in the less urbanized area and in the countryside where the only wireless service widely available is GSM.

This is the why in the area of interest for the field test (Messina, Giampileri, Itala and Scaletta Zanclea) smartphones and tablets are not widely utilized by the residential population. In that area only the 46% of the volunteers, which has been selected for the field test, have got a smartphone while the others have got a more simpler GSM mobile device.

The following picture shows wireless service coverage in the area of interest for the field test:

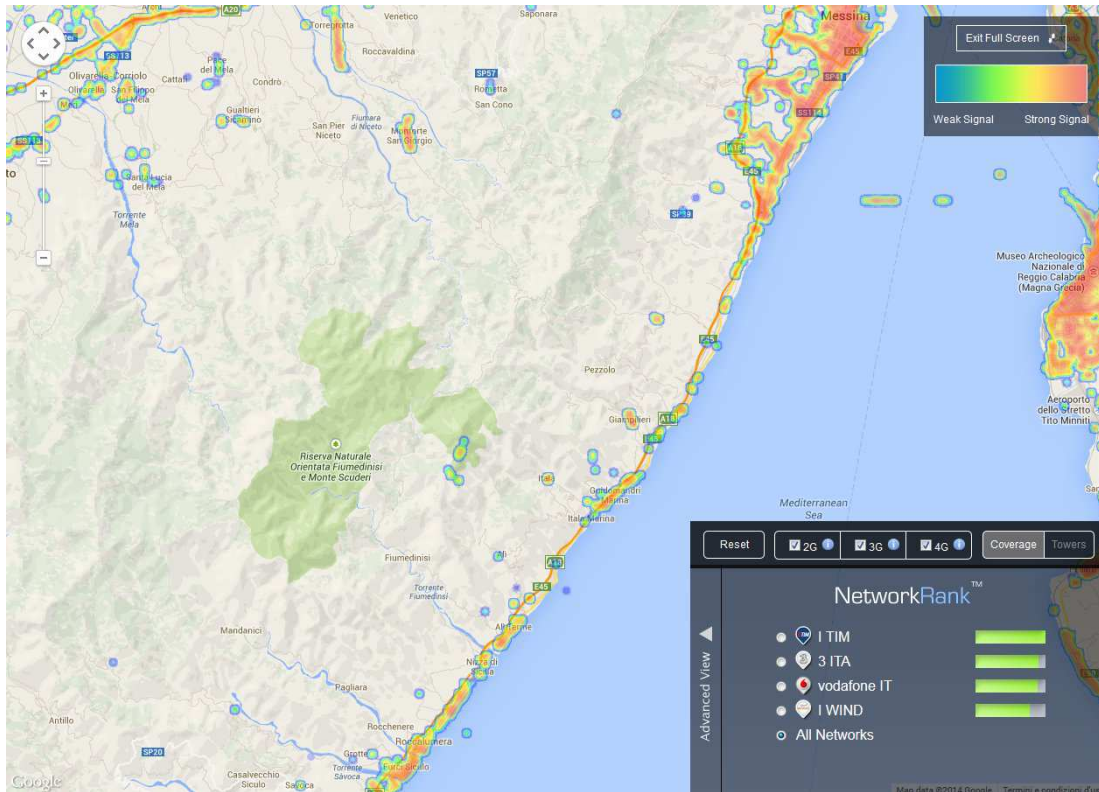


Fig. 1 – 2G, 3G, 4G service coverage in the nord-east side of Sicily

Communication systems for alerting population

Traditionally the communication systems used for alerting population are based on a network of sirens. This traditional systems have good short-term performance with respect to other, even multichannel, systems¹. They are able to be switched on/off via a wireless signal. Just after the flash flood that hit the village of Giampileri in 2009, The regional civil protection authority installed 9 sirens in the town of Messina and close to the villages of the province for alerting population in case of hazard. One of those sirens was installed in the village of Giampileri.

In 2010 the siren system has been tested during an emergency training day, where both regional and local authorities, together with crews of volunteers were involved.

During that training day the local and regional civil protection authorities tested the effectiveness of the emergency warning plan, while simulating a landslide in some suburban areas of the town of Messina (Giampileri, Molino, Altolia, Briga Superiore, Pezzolo, Ponte Schiavo) and in the small towns of Scaletta Zanclea and Itala. During the field test, each local authority switched on its own sirens testing its effect on population.

¹ M. Klafft - Diffusion of Emergency Warnings via Multi-Channel Communication Systems - 2013 IEEE Eleventh International Symposium on Autonomous Decentralized Systems - ISBN: 978-1-4673-5069-3

Sirens have a heavy psychological impact on population because the sound of sirens induce on people a reacting intuitive behaviour (wake-up and run away). This is the why, when the field test was planned, local authorities disagree firmly in taking into consideration the possibility to perform the test even during the night time.

The main side effect of sirens is that they are able to deliver only a few and simple messages, in our case the following acoustic signals are used:

- Intermittent sound, that means Pre-alarm state
- Bitonal sound, that means Alarm state
- Steady state sound that means warning cleared and silenced

However, even if it is well recognized that trained people are usually able to recognize up to 5-7 different siren sounds, people are frequently unaware of the meaning of sirens and they do not know how to respond to them. This is particularly true where the population size is seasonal sensitive as they are the seaside touristic villages of Sicily, because people, in order to retain and recognize several different siren sounds and its associated meaning, should be regularly trained.

During the training day, it has been also recognized that the sound of sirens was barely audible in some areas of interest, and it has been decided to install some additional sirens. In the village of Giampileri it has been installed two more sirens. The following figure shows the siren locations in the province of Messina:

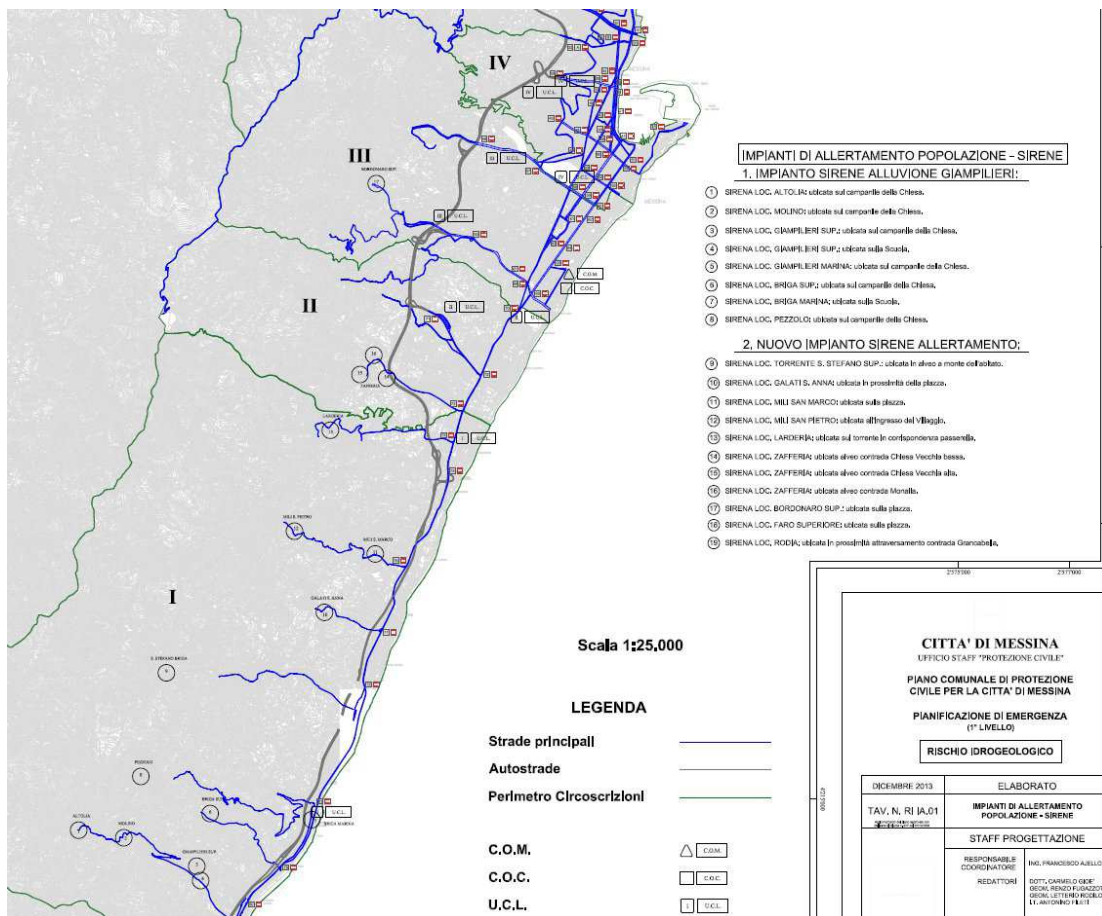


Fig. 1 – siren locations in the area of Messina

Emerging technologies for alerting population

Social media can play an important role in communicating with people before, during and after an emergency. The use of social media during an emergency has already been experienced in Italy during several events (earthquake of Aquila 2009 and Ferrara 2012), and in particular it has been experienced during local events, even of high intensity, as they are hydrogeological or industrial hazards. The main reason is the reliability and availability of mobile internet (3G, 4G) networks during a local event, while during a large-scale event almost all kind of communication systems collapse, mobile internet included.

The main advantages in using social media are the following:

- It is able to broadcast information to the public straight away
- It is a rich media, which is able to inform the public about the hazard and on how to react
- It is also able to rapidly balance false information, mitigating the impact of rumours
- It is a widely used and available technology
- It a two way media, it allows to find out a lot of information from the public

The first time the Civil Protection of Sicilian Region (SIC) experienced the usefulness of social media was just after the flood of the town of Trapani in the west cost of Sicily in 2009 ².

The following picture is the image captured by EumeSAT at 3:00 AM the 16th September of 2009, which shows the intensity of a storm insisting over the west side of Sicily.

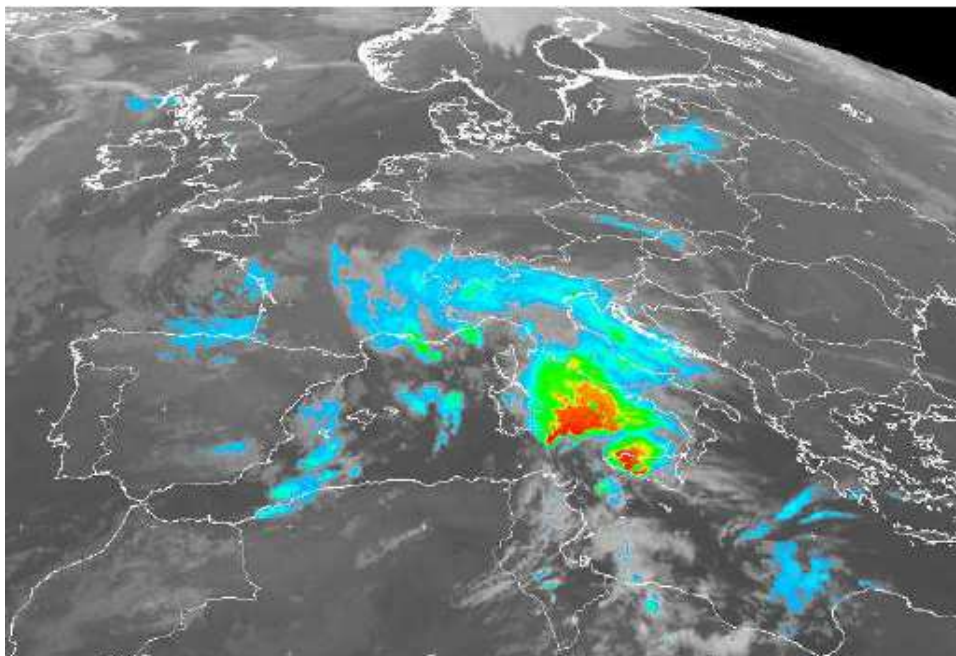


Fig 3 – EumeSAT image captured the 16th September 2009

² G. Basile - Rapporto sugli eventi meteo che hanno colpito la Sicilia il giorno 16 settembre 2009 – Dipartimento di Protezione Civile Regione Sicilia – Allegato alla nota prot. 45013 del 21/09/2009

During this event 150 mm of rain fell down in only 3:20 hours, causing several urban flash flood in the town of Trapani and its countryside.

The post event analysis of flood damages had been performed by using the videos captured by people during and after the storm with their mobile phones and posted to you tube. The following picture shows the location of flooded areas as they are recognized by analysing the videos:

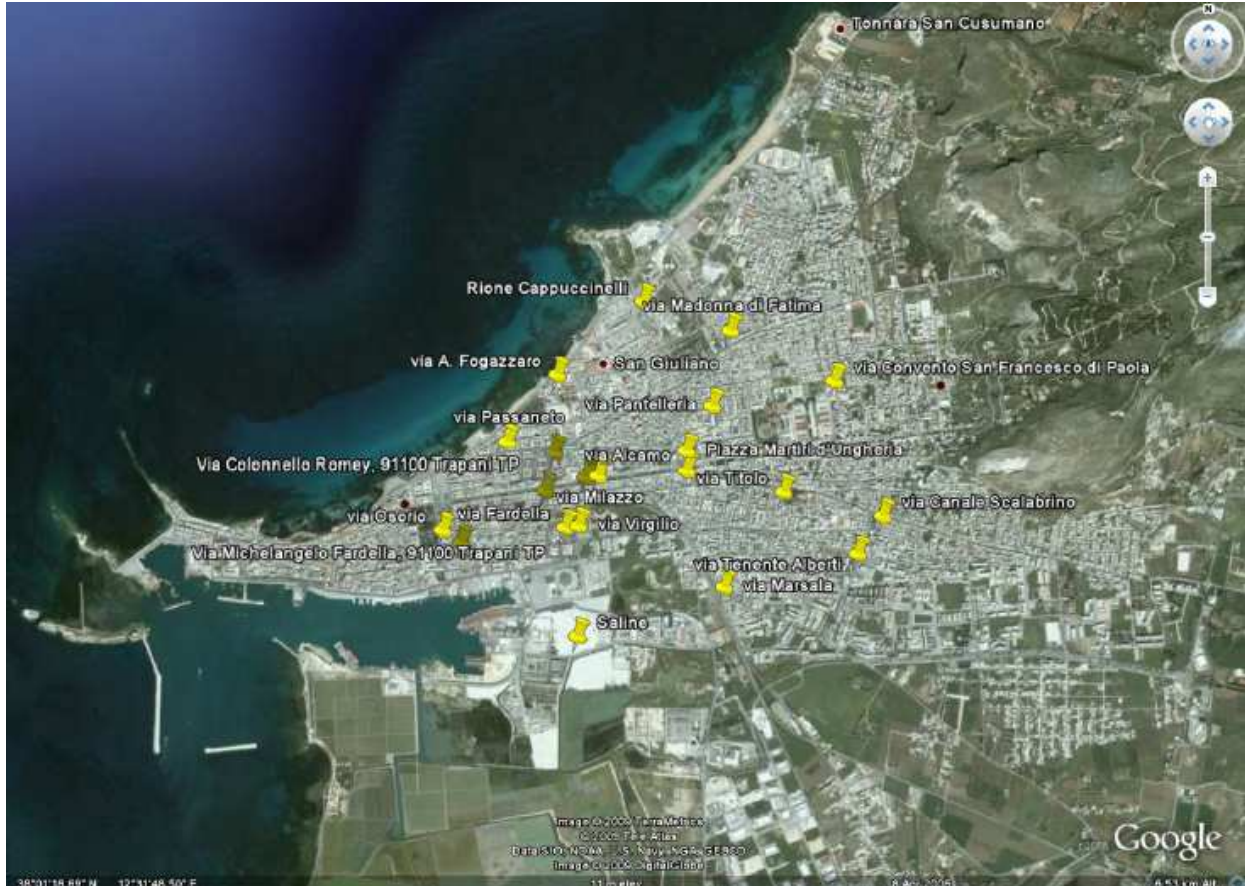


Fig. 4 – Streets flooded by the storm of 16th September 2009

Recently the INGV (National Institute of Geophysics and Volcanology) has deepened the use of Social media for alerting people. INGV in the Italian civil protection framework has the responsibility of alerting people for both seismic and volcanic risks. In the following section has been reported their experience in informing people on earthquakes through social media³

The experience of INGV of managing information through Social media

The 11th of May 2011 INGV has felt for the first time the need of having an institutional social media account. That day a false information about a next terrible earthquake in Rome had been broadcasted through internet, social media, radio and TV, which had panicked many people. In

³ A. Amato – INGV Terremoti: The Communication is a risk, the silence is a fault – Protezione Civile Anno 4 n.14, Gennaio Marzo 2014

that case INGV had to reply to the false rumours by forwarding the voice of the seismic Italian Authority through social media. In particular, INGV posted several information video on you tube, and today those video have been visiting more than 400.000 times.

Today the INGV twitter account has more than 100.000 followers, and this channel is used in both the ways, for keeping people informed and for getting information from people.

Just after an earthquake people uses to tweet something about their traumatic experience, and those tweet are also GeoReferred, and those tweets can be displayed in a map showing the extent to which people sensed the earthquake. In other words, through twitter, people can be used as human sensors. Tweets spread very fast in the first 5 minutes after the earthquake, and unfortunately, INGV is able to release its first official communication about it after 20-30 minutes from the event.

In order to avoid the spreading of false information there is the need of increase the capability of informing correctly people about the seismic event since the first moment after the event. A threshold of 5 minutes after the event has been set. INGV is trying to reach this goal by increasing the effectiveness of automatic analysis of sensed seismic waves.

Conclusions

In conclusion it is valuable the INGV's experience with social media, which must be taken into consideration not only for their effectiveness and their performance for informing people but because they are already widely used by people and that's it.

INGV has experienced the fact that since few minutes after a significant earthquake, rumours and false information spread on twitter, and that information must suddenly contrasted by scientific and distinguish ones, which are made available on the same social platforms.

Furthermore, it is valuable that these participative communication platforms can be used in both directions, for informing people and for keeping informed by people, which can be used as human sensors. What should be deepen in the next future is the real time content analysis of tweets. The sentiment analysis of people, while they are sharing information about a hazard, can be used to estimate, since from the first minutes after the event, the impact of the hazard. The sentiment analysis can be also used to adapt the messages in order to induce correct behaviours in the population during and after an emergency.