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Storytelling Technologies for Dissemination of Scientific Information of Natural Disasters: The June 12, 2017, Mw 6.3 Lesvos (Northeastern Aegean, Greece) earthquake story map

Antoniou, Varvara (1), Mavroulis, Spyridon (2), Spyrou, Nafsika-Ioanna (2), Bardouli, Pavlina (2), Andreadakis, Emmanouil (2), Skourtsos, Emmanuel (2), Kaviris, George (3), Sakkas, Vasilios (3), Carydis, Panayotis (4), Lekkas, Efthymios (2)

(1) National and Kapodistrian University of Athens, School of Sciences, Faculty of Geology and Geoenvironment, Department of Geography-Climatology, Panepistimiopolis, 15784, Athens, Greece, vantoniou@geol.uoa.gr
(2) National and Kapodistrian University of Athens, School of Sciences, Faculty of Geology and Geoenvironment, Department of Dynamic Tectonic Applied Geology, Panepistimiopolis, 15784, Athens, Greece, smavroulis@geol.uoa.gr
(3) National and Kapodistrian University of Athens, School of Sciences, Faculty of Geology and Geoenvironment, Department of Geophysics-Geothermy, Panepistimiopolis, 15784, Athens, Greece
(4) National Technical University of Athens, Greece

Abstract: *On June 12, 2017, a shallow crustal strong earthquake with magnitude 6.3 occurred offshore, south of Lesvos (12:28 GMT), 35.8 km SSW of the capital of Lesvos Island, Mytilene, causing one fatality, extensive earthquake environmental effects and severe structural damage in the SE part of the island. A set of the scientific data acquired in the field and the preliminary scientific results obtained by the aforementioned research has been presented not only to the scientific community but also to the general public and to much broader audiences by using a recently developed and introduced tool: the story telling through story maps. The 2017 Lesvos earthquake story map is presented and emphasis has been given to the used scientific data, its structure as well as the accessibility and sharing.*

Keywords*: story maps, storytelling, dissemination, presentation, natural disasters, earthquakes*

INTRODUCTION

The effective communication of scientific research to different audiences and the accurate dissemination of scientific information shared with both the public and the scientific community is one of the most crucial points of the effective management of the destructive impact of a natural disaster on human, nature, buildings and infrastructure.

As regards the dissemination of information within the scientific community, the majority of scientists present their materials and methods, their results and conclusions in papers presented in various meetings including conferences, workshops and congresses and published in scientific journals. This way of dissemination enable scientists to inform the community about their research, to expose their ideas to criticism by other scientists, and, of course, to stay abreast of scientific developments around the world.

As regards the dissemination of scientific information to the public and especially to non-technical audiences, various tools of representation and dissemination have been developed. Maps have been used to tell stories for thousands of years due to the fact that they can contain and convey a large amount of information in a small amount of space. One of the recently developed and introduced tools in this direction is the story telling through story maps.

Story maps are simple web applications that allow to tell a story about the world. They combine interactive maps, multi-media content such as photos and videos, simple interactive elements that control or enhance aspects of the map, descriptive text providing context, summarizing the aim of the map, and explaining its components as well as credit and source information [Environmental Systems Research Institute (ESRI), 2012]. Story maps are hosted by ESRI in the cloud and may be suitable for presenting and describing various stories and subjects about the world (https://storymaps.arcgis.com/en/gallery/#s=0) including natural disasters among others.

Some components commonly found in story maps are authoritative and well-organized data, clear and useful pop-ups, simple cartography, time-enabled data and dynamic legends. They can be built not only by highly-trained specialists, graphic designers and journalists but also by anyone with a basic familiarity with web and mobile platforms. They can serve not only the general public, but also communities and organizations.

The process of the development and publication of a story map including the following steps (ESRI, 2012): (a) development of a storyboard, (b) collection of information, (c) creation of a web map or maps, (d) selection of a basemap, (e) assembling the map, (f) adjustment and refinement of the map, (g) configuration of pop-ups, (h) adjustment of symbols, (i) saving the map, (j) sharing the map, (k) publication of the map as an app, using a story map template or other means.

As regards natural disasters, story maps represent a new capability of GIS, expanding its typical use for planning, analysis, and decision support and making its products accessible to much broader audiences which will be educated, informed and inspired (ESRI, 2012).
The aim of this paper is the presentation of the story map created for the dissemination of scientific information related to the June 12, 2017, Mw 6.3 Lesvos (Northeastern Aegean, Greece) earthquake.

THE STUDIED 2017 LESVOS EARTHQUAKE

On June 12, 2017, a shallow crustal strong earthquake with magnitude 6.3 occurred offshore, south of Lesvos (12:28 GMT), 35.8 km SSW of the capital of Lesvos Island, Mytilene, causing one fatality and severe structural damage in the SE part of the island (Papadimitriou et al., 2017, 2018). The southeastern part of Lesvos Island suffered the most by the earthquake in its natural environment, building stock and infrastructure (Lekkas et al., 2017a, 2017b).

The earthquake environmental effects comprised ground cracks, slope movements and a small-scale tsunami (Lekkas et al., 2017). Building damage was observed in the southeastern part of Lesvos. Very heavy structural damage was limited in the traditional village of Vrissa (Lekkas et al., 2017a, 2017b; Papadimitriou et al., 2018). Taking into account that Vrissa is located inland, further from the epicenter than other settlements with less damage, this village looks like an earthquake impact paradox. For interpreting this paradox, a rapid field macroseismic reconnaissance was conducted performing not only classical methods of earthquake damage assessment (e.g. building-by-building inspection), but also modern and innovative techniques, which comprise the use of Unmanned Aircraft Systems (UAS) and Geographic Information Systems (GIS) online applications as the basis of a rapid post-earthquake damage assessment before any intervention was made in the settlement (Antoniou et al., 2017; Mavroulis et al., 2017). Thus, all earthquake effects on the natural environment and the building stock of Vrissa were collected and saved with maximum accuracy for further processing and analysis. All data and critical information collected were freely accessible from link (https://goo.gl/v9vaQQ) to all ministries, state authorities, agencies competent in civil protection and disaster management as well as in the direction and coordination of the executive and operational forces at central, regional and local level in order to rapidly and effectively respond to the emergency needs of the affected population raised from the earthquake disaster. Moreover, this data went public through the social networks and media during not only the emergency phase but also during the post-disaster phase. Shortly after the data acquisition and the first analysis and interpretation, preliminary scientific reports were published online in seismological centers and earth science related blogs. The scientific results of this interdisciplinary and multiparametric research conducted by geologists, seismologists, engineers and geographers not only in the field during the emergency phase but also in laboratory during the post-disaster phase were published in scientific journals (Papadimitriou et al., 2018), international workshops (Antoniou et al., 2017; Lekkas et al., 2017a, 2017b) and congresses (Mavroulis et al., 2018a, 2018b, 2018c; Antoniou et al., 2018).

THE 2017 LESVOS EARTHQUAKE STORY MAP

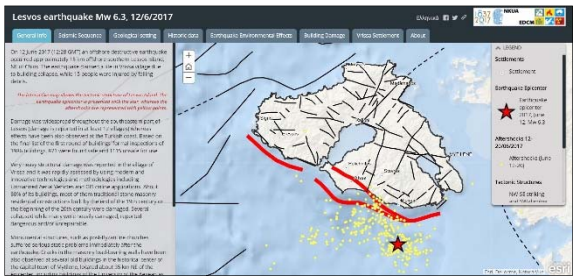
A set of the scientific data acquired in the field and the preliminary scientific results obtained by the aforementioned research has been further presented by using the ESRI Story Map web templates (https://storymaps.arcgis.com/en/). The use of ESRI Story Maps has grown tremendously since being introduced about two years ago, with over 1000 Story Maps now being created each day. Story Maps give the researchers the possibility to authoritative maps with narrative text, images, and multimedia content to help visualize information, and new functionality is being added and improved regularly.

In the case of the 2017 Lesvos earthquake, a story map has been created in order to present this seismic disaster. The story map is accessible at the following link: https://goo.gl/i237Um and is available in both Greek and English language. Various scientific data, maps and videos were combined: (a) the parameters of the earthquake comprising magnitude, focal depth, epicenter location, focal mechanism, aftershocks, number of affected people (fatalities and injured) and damage on buildings and infrastructures, (b) the results of the source parameter determination, the coulomb stress analysis and the application of differential interferometry techniques, (c) the geological setting of Lesvos Island in general and of the earthquake-affected area in particular, (d) data on historical and instrumentally recorded seismicity of Lesvos Island, (e) the earthquake environmental effects induced by the 2017 Lesvos earthquake including ground cracks, slope failures and tsunamis, (f) the non-structural and structural damage induced by the 2017 Lesvos earthquake on residential buildings, monumental structures and industrial facilities of Vrissa, (g) information about the National and Kapodistrian University of Athens, the Environmental Disaster Crisis Management Strategies (EDCM) post-graduate studies program supporting the scientific research on the 2017 Lesvos earthquake and (h) the scientific team comprising members of National and Kapodistrian University of Athens, the National Technical University of Athens and the National Observatory of Athens.

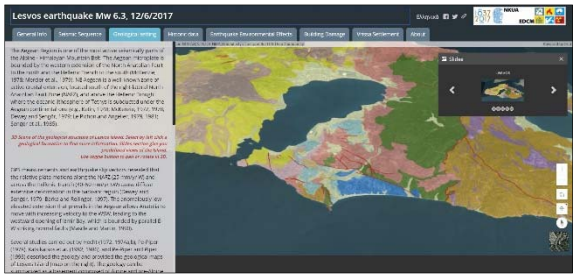
The 2017 Lesvos earthquake story map comprises the following tabs entitled (a) general info, (b) seismic sequence, (c) geological setting, (d) historic data, (e) earthquake environmental effects, (f) building damage, (g) Vrissa settlement and (h) about (https://goo.gl/gKQHoY). All users interested not only in the characteristics and the impact of the 2017 Lesvos earthquake, but also in various aspects of earth sciences, civil and earthquake engineering and natural disasters have the opportunity to remain on any given tab for as long as required and navigate freely between them at their pace. Moreover, they have the possibility to expand or hide explanatory legends, quickly switch between slides, open or close pop-up photos and maps, view properties and attributes of selected geometries such as date, latitude, longitude, magnitude and depth of earthquake epicenters presented as point

geometries, view the dominant types of buildings in the affected area and the earthquake-induced damage in the traditional settlement of Vrissa classified into 4 categories (green color: no to slight structural damage, slight to moderate non-structural damage, blue color: moderate structural damage, heavy non-structural damage, purple color: heavy structural damage, very heavy non-structural damage, red color: very heavy structural damage, partial or total collapse).

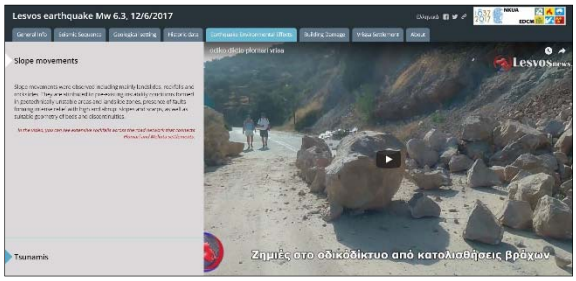
(a)



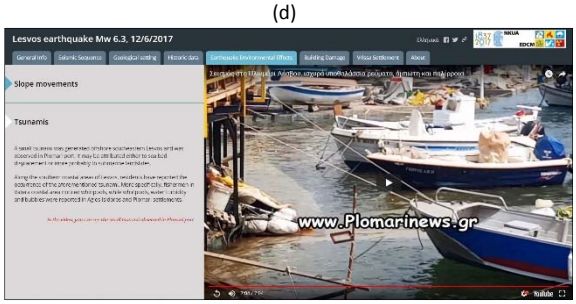
(b)



(c)

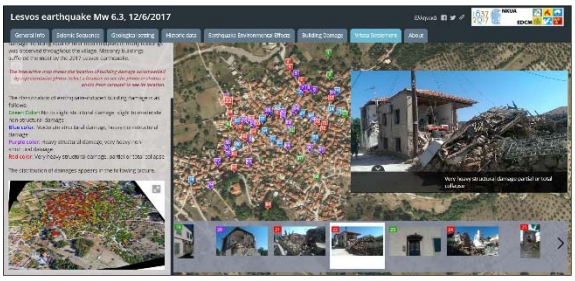


(d)



(e)

(f)



(g)

Figure 3: Screen captures of the (a) Introduction, (b) "General info", (c) "Geological setting", (d, e) "Earthquake Environmental Effects", (f) "Building Damage" and (g) "Vrissa Settlement" tabs of the story map for the 2017 Lesvos earthquake.

As far as the accessibility of this story map is concerned, users of smart phones and devices operating on all systems are now able to open this story map and use all of its features. Moreover, they can share the story map in social media and beyond by easy-to-use share links/buttons.

CONCLUSIONS

The creation of story maps contributes to the exploitation of the scientific knowledge gained by the scientific community and the information of the general public. This aims to the effective communication and cooperation in such an important issue as the generation of a strong earthquake with destructive impact on the local population, the natural and built environment as well as in the effective prevention and management of earthquake disasters in earthquake prone areas.

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