Geophysical Research Abstracts
Vol. 20, EGU2018-9671, 2018
EGU General Assembly 2018

Earthquake-induced building damage assessment using Unmanned Aircraft Systems (UAS): the case of Vrissa settlement after the 2017 Lesvos earthquake (Northeastern Aegean, Greece)

Varvara Antoniou (1), Emmanouil Andreadakis (2), Spyridon Mavroulis (2), Nafsika-Ioanna Spyrou (2), Emmanuel Skourtsos (2), Panayotis Carydis (3), and Efthymios Lekkas (2)

(1) National and Kapodistrian University of Athens, School of Sciences, Faculty of Geology and Geoenvironment, Department of Geography-Climatology (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, (3) National Technical University of Athens

In recent years, there has been a transition of remote sensing applications for disaster management, from satellite imagery to UAV (UAS) acquired imagery, from monitoring to impact assessment, to search and rescue etc. Tiered reconnaissance has been already successfully implemented in hydrometeorological and geophysical disasters for regional (Tier 1), neighborhood (Tier 2) and per-building (Tier 3) scales. Drones, UAV or UAS can be very useful for Tiers 2 and 3, because they can be rapidly deployed, explicit and fly on demand. Herein, an application of online GIS and UAS deployment was put into action for rapid damage assessment in a traditional settlement of Lesvos Island (Northeastern Aegean, Sea) affected by an earthquake with extreme intensity local characteristics.

The type of Unmanned Aircraft System used was a Phantom 4 Pro tetracopter by DJI. The UAS performed two flights designed for 3D modelling, that is, scanning the area along two sets of paths vertical to each other, at 90m above the ground in the affected area. The flight areas were overlapping so that they would be intercalibrated. 440 images of Vrissa were acquired, and they were input for processing in the Pix4DMapper Pro software. Processing in Pix4D software created a point cloud, a Digital Surface Model, a Digital Terrain Model, a mosaic orthophoto map and a 3D model of the settlement. The difference between the two raster surfaces, DSM and DTM, is the recognized objects: trees, buildings, cars, etc. The settlement is a traditional village over a century old, also declared as preservable settlement by the government. This means that architecture is throughout uniform and buildings have a certain type and form. This uniformity essentially enables the categorization of objects into three groups, the ranges of building heights, and the shorter and taller ones. After subtracting DTM from the DSM, the resulting raster contained only recognizable objects, which were then grouped into the three mentioned groups, and more specifically, building range between 2.5m and 10.7m tall, shorter and taller. In order to refine and reassess damage grades, all objects above ground surface were isolated. Then, adjusting the histogram of the objects raster, large trees, poles, etc. were excluded, resulting in a raster containing all building surfaces and some of the trees, which were then converted to polygons in ArcMap v.10.5 and finally edited manually.

Damage assessment was re-run on final building polygons, applying field observations, but also editing errors of the field work, revisiting the site through 3D model and with use of all footage available for any point on demand. Field observations were then assigned to the new polygons, while a review of damage grade and vulnerability class took place, using all 440 images. Once for every point of the model there is a number of images from different angles, field observations were actually supplemented by aerial observations.

This detail distribution of the assessed damage permits calculations of damage grade percentages and classification of areas with similar statistics of damage grade, and zonal application of the EMS-98 in the area.