

A transferable multicriteria flood risk assessment methodology at high spatial resolution: two case studies in Greece and Cyprus

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Abstract—Floods are the most frequent disasters and affect the largest number of people at a global level. In the framework of a Programming Agreement between the Prefecture of Attica and the National Observatory of Athens, a state-of-the-art methodology was developed and implemented in Greece for multicriteria-based flood risk assessment and management planning at high spatial resolution (building block level). The proposed methodology was then transferred, slightly adapted and applied in Cyprus within the framework of the EXCELSIOR project. This work integrates different data sources and modeling tools, including remote sensing, in situ measurements, field visits, decision tools and physical simulations. It is characterized by considerable added value, as it supports the relevant authorities in improving disaster resilience in many aspects, particularly on raising awareness, designing civil protection exercises, implementing flood risk mitigation measures, prioritizing short-term and long-term flood protection interventions, and making rapid responses more effective during flood events.

Keywords—Flood, hazard, vulnerability, exposure, flood risk assessment, mitigation, disaster resilience, civil protection

I. INTRODUCTION

Floods have affected more than 1.8 billion people since 2000 (data from the Emergency Events Database). In 2023,

164 floods were recorded worldwide, being responsible for the death of 7763 people, affecting the lives of 32.4 million people, and resulting in economic losses of 20.4 billion USD, according to the report “2023 Disasters in Number” (Centre for Research on the Epidemiology of Disasters, 2024) [1]. To mitigate flood risk, decision-makers and civil protection authorities need reliable information on flood risk assessment, covering all disaster management stages, particularly prevention, preparedness, response, and recovery. This need is even more crucial in highly dense urban river basins that are prone to flash floods. Advanced 3D visualization methods, guided by disaster information improve situational awareness in complex urban areas [2].

To prevent new risks and reduce existing ones from natural hazards, the Sendai Framework for Disaster Risk Reduction 2015–2030 was adopted in March 2015 and was coordinated by the United Nations Office for Disaster Risk Reduction (UNDRR) [3]. The Framework’s basic priority for action is the understanding of disaster risk, from pre-disaster, prevention and mitigation to preparedness and effective response to disasters [4].

Thus, to increase disaster resilience, which is a core aim of sustainable development according to the Global Assessment Special Report 2023 on Disaster Risk Reduction [5], special

attention should be given to assessing risks in a reliable way. Risk assessment is derived as a combination of the following factors: hazard, vulnerability, and exposure [6]. Recent studies have demonstrated that ML models with feature selection can enhance the accuracy of flood hazard assessments [7].

Efficient disaster risk management includes mitigation measures such as the design of civil protection measures and the implementation of studies with proper interventions (both structural and non-structural). This is even more crucial in highly dense urban areas, with large populations, critical infrastructure, and important socioeconomic activities.

II. RESEARCH STUDIES

In the framework of a Programming Agreement between the Prefecture of Attica (Greece) and the National Observatory of Athens (NOA), a research study entitled “Earthquake, fire and flood risk assessment in the Region of Attica” was conducted in selected and most vulnerable areas and was delivered in 2024. Within this project, a holistic multicriteria risk assessment methodology has been developed and implemented at high spatial resolution. The research study on flood risk assessment was implemented in five flood-stricken river basins at high spatial resolution by the National Observatory of Athens (NOA), Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS), Operational Unit “BEYOND Center of Earth Observation Research and Satellite Remote Sensing” in cooperation with the National Technical University of Athens (NTUA), School of Civil Engineering, Department of Water Resources and Environmental Engineering, Research Group ITIA.

Next, the proposed flood risk assessment methodology was applied, following adaptation, in the Garryllis river basin, located in Cyprus, within the framework of the EXCELSIOR project, as part of the collaborative activities between the ERATOSTHENES Centre of Excellence (ECoE) and NOA/IAASARS/BEYOND.

III. DESCRIPTION OF THE STUDY AREAS

The first study area is the Mandra river basin (Fig. 1), which is located in the southwest part of the Attica Region in central Greece. The second study area is the Garryllis river basin (Fig. 2), which is located in the southern part of Cyprus. Both basins include artificial hydrographic network in the urban areas, and are divided in subbasins for higher accuracy.

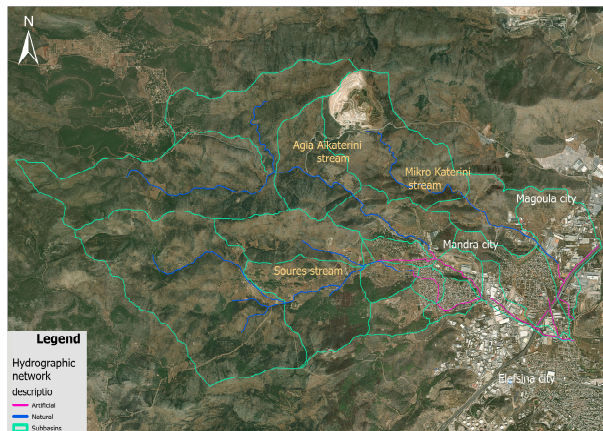


Fig. 1. Subbasin and hydrographic network layers for the catchment of the Agia-Ekaterini, Sours and Mikro-Katerini streams in Mandra area, Greece.

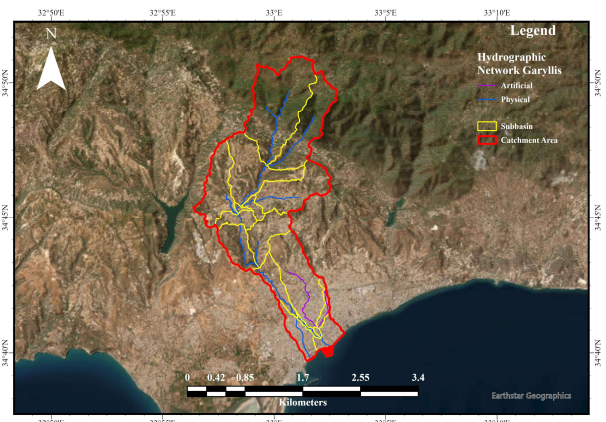


Fig. 2. The Garryllis river basin, subbasins and hydrographic network in Cyprus.

IV. METHODOLOGY

Flood risk was assessed via an integrated methodology that includes geospatial data, remote sensing, in situ observations, hydrologic and hydraulic simulations. This holistic multicriteria methodology, presented in a schematic way in Fig. 3, was developed by the FloodHub research group of the NOA/IAASARS/BEYOND in cooperation with the ITIA research group of the NTUA and was adapted accordingly by the corresponding group of ERATOSTHENES CoE. The flood risk assessment was validated using all available information on historical flood events, high-risk locations indicated by the local population and the competent authorities, as well as the recorded citizens’ calls for aid to the Fire Service in flooded areas.

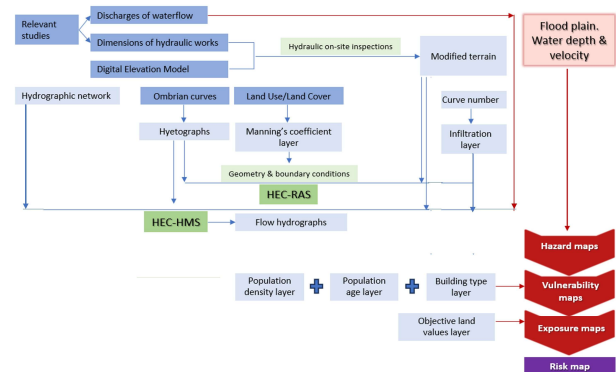


Fig. 3. Schematic overview of the flood risk assessment methodological framework.

A. Data collection

All available data, including geospatial data and earth observation data at the highest available resolution (e.g., digital elevation model (DEM) and land use land cover data) supplemented by relevant technical studies, were collected from competent services, quality checked, and enriched by photointerpretation.

Detailed field visits were conducted according to a standardized methodology and reporting template to estimate the dimensions of the technical works; identify obstacles or hydraulically sensitive points in the riverbed, critical infrastructure, and services in the area; and collect feedback from the residents.

B. Design hydrographs

In Greece, rainfall hydrographs were derived from updated ombrian (also called intensity-duration-frequency (IDF)) curves, which were constructed and adapted to each river basin, following a new advanced methodology [8, 9]. Available data from previous studies were used, information collected from rainfall in-situ stations were updated when possible whereas available data from additional stations were used to improve the accuracy of the IDF curves wherever appropriate. The final rainfall sample consists of 29 stations at 18 sites managed by 4 public institutions, which jointly cover the period from 1860 to 2020. In Cyprus, rainfall hydrographs were derived from the ombrian curve provided by the Meteorological Department of Cyprus [10], located in the uppermost meteorological station within the river basin close to Kalo Horio village.

Next, hyetographs were compiled by applying the ombrian curves in each subbasin for the three standard return periods (50, 100, and 1000 years), as required by the EU flood directive [11].

C. Hydrological analysis and modeling

Subbasins were designed for a more accurate estimation of runoff on the basis of the river network, both natural and artificial, and the spatial variation of topographical properties and land use-land cover.

Subsequently, the watershed schematic was delineated, and used to perform transient simulations for three flood return periods (50, 100, and 1000 years) via the HEC-HMS 4.10 rainfall-runoff model [12], which was selected because it is a free and open-source software, reliable and user-friendly, which is used worldwide for decades, with an experienced and supportive users' community. HEC-HMS features a completely integrated graphical work environment including a database, data entry utilities, watershed map, computation engine, and results reporting tools.

D. Hydraulic modeling and hazard assessment

The hydraulic model HEC-RAS 6.3 2D was used to assess the spatial patterns of flood hazard [13] by applying the spatially distributed rainfall (rain-on-grid) method. Similarly with HEC-HMS, HEC-RAS was selected because it is a free and open-source software, reliable and user-friendly, which is used worldwide for decades, with an experienced and supportive users community. HEC-RAS interface provides for file management, data entry and editing, hydraulic analyses, tabulation and graphical displays of input and output data, inundation mapping and animations of water propagation, reporting facilities, and context sensitive help. The total hyetograph for each return period was entered without subtracting losses, which were estimated internally following the Soil Conservation Service (SCS) method of Curve Number (CN) III [14]. The land use and cover data were obtained from the European Urban Atlas of the Copernicus Land Monitoring Service for the period 2012-2018 [15], and they were updated through photo interpretation. Additionally, burnt areas were incorporated into the land use and land cover data, derived from the FireHub service of NOAA/IAASARS/BEYOND for the period 1985-2021 for Greece and from the European Forest Fire Information System for the period 2022-2023 for Cyprus. Subsequently, the updated land cover layer polygons were imported into the hydraulic model, and for each land cover class, a value of the Manning roughness coefficient was

assigned to the floodplain and riverbed based on the land-use maps, the sensitivity analysis, and the field measurements. The transient hydraulic simulations were performed using a variable computational time step, and it was carried out at high spatial resolution, ranging from 10 to 25 m depending on the area of the catchment, which was further refined (1-10) in areas of high interest, such as near the stream and road network, and intense topographic relief variations.

The outcomes of the hydraulic model were used to produce the water depth and velocity maps, which are chosen to quantify the flood hazard levels under different flood scenarios.

E. Vulnerability, exposure, and flood risk assessment

For the Greek case site, total flood vulnerability was represented as a weighted estimation of population density and population age (accounting for the socioeconomic factors), as well as building type (disaster resilience parameters), on the basis of the Population and Housing Census 2011 by the Hellenic Statistical Authority at building block level [16]. Higher weights are corresponded to higher population density, to very high and very low population ages (given that children and elderly people need assistance during evacuation), and to the buildings based on the construction materials and the existence of pilotis. For the Cypriot case study, there was no information on building type, hence the vulnerability levels were estimated as a weighted average of population density and population age on the basis of the Population Census 2011 by the Statistical Service [17]. Moreover, the census data were available at street level, so they were corresponded at building block level accordingly.

Exposure levels were quantified according to the objective land values (€/m²), as obtained by the Greek Ministry of Finance for 2021 [18]. Regarding the Cypriot case, objective land values (€/m²) were collected from the Department of Land and Survey, which served as the basis for exposure values for Cyprus as well [19].

Finally, hazard, total vulnerability, and exposure were combined to estimate flood risk by initially multiplying the levels of hazard and vulnerability together. All three crucial elements were successfully integrated into through risk assessment by multiplying the result of this multiplication by exposure layer to get the overall flood risk. The resulting layer was combined with the exposure layer (objective land values).

Based on the flood risk assessment and the in-situ observations from the field visits, critical points were identified and classified into three risk priority levels according to a series of criteria, such as the flood depth, their proximity to the simulated flood extent and the recorded locations of citizens' calls for aid to the Fire Service, the threat they pose for human lives and critical infrastructures, etc. Regarding the first priority, the critical points were mostly buildings and infrastructure inside the flood extent, posing a severe danger to the local population and the passers-by, both the pedestrians and those in vehicles.

F. Mitigation planning

Mitigation measures were proposed for the worst-case scenario, including the definition of refuge areas and the design of escape routes, taking into account the flood risk and the critical points. For this purpose, a multicriteria analysis was performed considering the following conditions: 1) the

refuge areas should be public buildings in good condition with roofs (not open-air) and be well distributed spatially to cover all the population at risk; 2) the escape routes should respect the traffic directions, avoid intersections with the river network, and 3) follow the optimum route possible (i.e., shortest and safest). Public schools were identified as the most appropriate shelters, especially in the urban areas, and safe escape routes were designed so that all the areas under medium, high and very high flood risk levels were covered.

V. RESULTS

The flood risk assessments for Greece and Cyprus are presented in Fig. 4 and Fig. 5, respectively, along with the shelters and the recommended escape routes. The flood risk assessment methodology was validated with the results of the fatal flash flood that took place in November 2017 in the Mandra River basin [20], which caused 24 recorded fatalities and extensive million-euro damages to properties and infrastructure, rendering it the deadliest flood in Greece in the last 40 years.

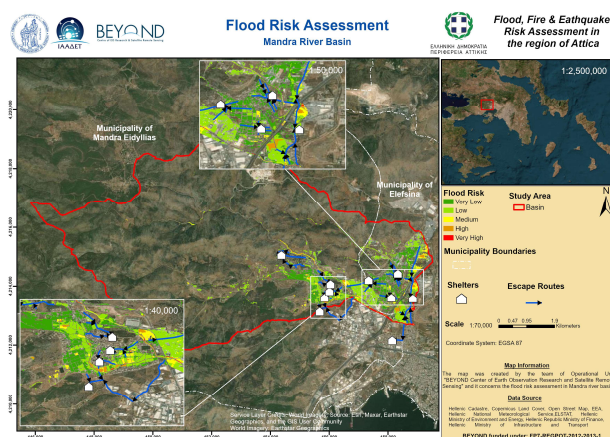


Fig. 4. Map of flood risk assessment, shelters and escape routes in Mandra area, Greece.

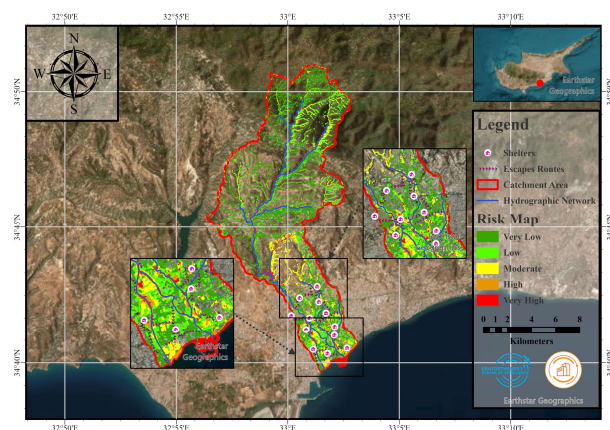


Fig. 5. Map of flood risk assessment, shelters and escape routes in Gyarlis river basin, Cyprus.

VI. DISCUSSION

This research study analyses the flood hazard, total vulnerability and exposure of the study areas in conjunction with the actual physical and socioeconomic parameters of each study area. Taking all this into consideration, this study estimates the flood risk in the most objective and reliable

way, secured by science and technology –and proposes appropriate mitigation measures. This is the first time that such a holistic approach for risk assessment has been implemented on building block level in Greece and Cyprus.

Various challenges were encountered during the hydraulic simulation (flood hazard assessment) due to model instability, which are caused mainly by the complexity of the topography of the study area. For this reason, and owing to the inherent uncertainty of the models [21], various tests were performed by varying the resolution of the computational mesh, the solution scheme and the required values of the adjusted variable time step on the basis of Courant conditions until the converged solutions were free of instabilities/numerical errors, achieved acceptable computational loads, and were hydraulically reasonable.

Moreover, in the process of total vulnerability and exposure estimation, additional challenges were faced due to data gaps. A multicriteria technique was developed and applied to fill the data gaps, using both photo interpretation and logical assumptions. Further challenges need to be addressed in the proposal of mitigation measures for the worst-case scenario, including the definition of refuge areas and the design of escape routes, because not all requirements are always covered for a specific area. In such cases, safety was prioritized to distance.

VII. CONCLUSIONS

In conclusion, this state-of-the-art multicriteria methodology is reliable, validated, and transferable. It uses a variety of data sources and provides results at a high analysis level (building block level). This work is characterized by considerable added value, as it supports public actors and stakeholders in strategic decision-making towards disaster resilience and the management of disastrous events. Additionally, the contributions of this work are twofold: both the prevention phase and the operational phase during a crisis; the prevention phase prioritizes and implements the necessary interventions according to the risk level; and the operational phase addresses how to successfully evacuate the affected areas safely and order.

Indeed, the prototype knowledge created through this work supports the relevant authorities in adopting effective policies and practices for disaster risk management and is used for risk assessment both for prevention and mitigation. In Greece, it currently supports the Prefecture of Attica in the optimum implementation of the National Civil Protection Plan and the work of Civil Protection Coordination Bodies (e.g. co-designing and implementing civil protection exercises, both map exercises and field exercises, at local and regional level) [22] [23] [24] [25]. In Cyprus, the outcomes from this methodology have been shared with the Department of Civil Defense, and the Water Development Department. These organizations have devoted considerable efforts to optimize evacuation plans and compile emergency response procedures. The proposed approach aims at strengthening the risk management strategies concerning floods. All the above-mentioned factors were repeatedly confirmed and evaluated positively according to the stakeholders' feedback.

This approach is in line with the requirements for the implementation of the EU Floods Directive 2007/60/EC, the Sendai Framework for Disaster Risk Reduction, the UN SDGs, and the UN Early Warnings for All initiative.

REFERENCES

- [1] Centre for Research on the Epidemiology of Disasters, “2023 Disasters in numbers”, CRED, Belgium, 2024. Available: <https://reliefweb.int/report/world/2023-disasters-numbers>
- [2] Luo, L., Zhu, J., Fu, L., Pirasteh, S., Li, W., Han, X., & Guo, Y. (2021). A suitability visualisation method for flood fusion 3D scene guided by disaster information. *International Journal of Image and Data Fusion*, 12(4), 301–318. <https://doi.org/10.1080/19479832.2021.1961315>
- [3] United Nations Office for Disaster Risk Reduction, “Sendai Framework for Disaster Risk Reduction 2015-2030”, UNISDR, Switzerland, 2015. Available: <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>
- [4] C. Wannous, and G. Velasquez, United Nations Office for Disaster Risk Reduction (UNISDR), “UNISDR’s Contribution to Science and Technology for Disaster Risk Reduction and the Role of the International Consortium on Landslides (ICL)”, Cham, Springer, Switzerland, pp. 109-115, 2017, DOI: 10.1007/978-3-319-59469-9_6
- [5] United Nations Office for Disaster Risk Reduction, “GAR Special Report: Measuring Resilience for the Sustainable Development Goals”, UNISDR, Geneva, 2023. Available: <https://www.undrr.org/gar/gar2023-special-report>
- [6] C.J. Van Westen, “Remote Sensing and GIS for Natural Hazards Assessment and Disaster Risk Management, Treatise on Geomorphology”, Academic Press, pp. 259-298, 2013, DOI: 10.1016/B978-0-12-374739-6.00051-8
- [7] A. Habibi, M. R. Delavar, B. Nazari, S. Pirasteh, and M. S. Sadeghian, “A novel approach for flood hazard assessment using hybridized ensemble models and feature selection algorithms,” *Int. J. Appl. Earth Obs. Geoinformation*, vol. 122, p. 103443, Aug. 2023, doi: 10.1016/j.jag.2023.103443
- [8] T. Iliopoulou, N. Malamos, and D. Koutsoyiannis, “Regional ombrian curves: Design rainfall estimation for a spatially diverse rainfall regime”, *Hydrology*, 9 (5), 67, DOI:10.3390/hydrology9050067, 2022
- [9] D. Koutsoyiannis, T. Iliopoulou, A. Koukouvinos, N. Malamos, N. Mamassis, P. Dimitriadis, N. Tepetidis, and D. Markantonis, Technical Report, “Production of maps with updated parameters of the ombrian curves at country level” (implementation of the EU Directive 2007/60/EC in Greece), Department of Water Resources and Environmental Engineering – National Technical University of Athens, 2023.
- [10] Department of Meteorology, Ministry of Agriculture, Rural Development and Environment, Republic of Cyprus. Available: https://www.moa.gov.cy/moa/dm/dm.nsf/home_en/home_en?openform
- [11] European Parliament and Council, “Directive 2007/60/EC on the assessment and management of flood risks”, *Official Journal of the European Union*, Belgium, 2007.
- [12] US Army Corps of Engineers Hydrologic Engineering Center, “HEC-HMS open-source rainfall-runoff model”. Available: <https://www.hec.usace.army.mil/software/hec-hms/>
- [13] US Army Corps of Engineers Hydrologic Engineering Center, “HEC-RAS open-source hydraulic model”. Available: <https://www.hec.usace.army.mil/software/hec-ras/>
- [14] Soil Conservation Service (SCS) (1956, 1964, 1972, 1993) “Hydrology, Section 4”. In: *National engineering handbook*. Washington, DC, USA, USDA.
- [15] Copernicus Programme, Land Monitoring Service, “Urban Atlas 2018”, Available: <https://land.copernicus.eu/local/urban-atlas/urban-atlas-2018>
- [16] Hellenic Statistical Authority, “Population and Housing Census 2011”, HAS, Greece, 2011. Available: <https://www.statistics.gr/en/statistics/pop>
- [17] Statistical Service, Republic of Cyprus, “Population Census 2011”, Cyprus, 2011. Available: <https://www.cystat.gov.cy/en/default>
- [18] Ministry of Finance Greece, “Objective land value zones”, 2023. Available: <https://maps.gsis.gr/valuemaps/>
- [19] Department of Lands and Surveys, Ministry of Interior, Republic of Cyprus, “DLS Portal”. Available: <https://portal.dls.moi.gov.cy/en/>
- [20] A. Tsouni, S. Antoniadis, E. Ieronimidi, K. Karagiannopoulou, N. Mamassis, D. Koutsoyiannis, C. Kontoes, Chapter 18 - Multiparameter analysis of the flood of November 15, 2017 in west Attica using satellite remote sensing, in *Geoinformatics for Geosciences*, N. Stathopoulos, A. Tsatsaris, and K. Kalogeropoulos, Eds., in *Earth Observation*, Elsevier, 2023, pp. 325–357. doi: <https://doi.org/10.1016/B978-0-323-98983-1.00019-3>
- [21] P. Dimitriadis, A. Tegos, A. Oikonomou, V. Pagana, V. Koukouvinos, N. Mamassis, D. Koutsoyiannis, and A. Efstratiadis, “Comparative evaluation of 1D and quasi2D hydraulic models based on benchmark and real-world applications for uncertainty assessment in flood mapping”, *Journal of Hydrology*, 534, pp. 478-492, 2016.
- [22] Civil Protection Directorate of the Region of Attica with the support of the Operational Unit “BEYOND/IAASARS/NOA”, “Skamandros SD 2022” Map Exercise for the Southern Sector of Athens,” Greece, Oct. 23, 2023. [Online]. Available: <https://www.patt.gov.gr/6-%ce%b5%ce%bd%ce%b7%ce%bc%ce%b5%cf%81%cf%89%cf%83%ce%b7%6-1-%ce%b5%ce%bd%ce%b7%ce%bc%ce%b5%cf%81%cf%89%cf%83%ce%b7-%ce%b3%cf%81%ce%b1%cf%86%ce%b5%ce%af%ce%bf-%cf%84%cf%8d%cf%80%ce%bf%cf%85/dt-perifereiaiw-attikhw/%ce%bc%ce%b5-%ce%b5%cf%80%ce%b9%cf%84%cf%85%cf%87%ce%af%ce%b1-%ce%bf%ce%bb%ce%bf%ce%ba%ce%bb%ce%b7%cf%81%cf%8e%ce%b8%ce%b7%ce%ba%ce%b5-%ce%b7-%ce%ac%cf%83%ce%ba%ce%b7%cf%83%ce%b7-%cf%83%ce%ba/>
- [23] Civil Protection of Megara with the support of the Operational Unit “BEYOND/IAASARS/NOA”, “Dardanos’ Field Exercise for the Megara Municipality,” Greece, Nov. 21, 2022. [Online]. Available: <http://beyond-eocenter.eu/index.php/news-events/563-civil-protection-dardanos>
- [24] Civil Protection Directorate of the Region of Attica with the support of the Operational Unit “BEYOND/IAASARS/NOA”, “Skamandros WA 2022” Map Exercise for the Regional Unit of Western Attica,” Greece, Dec. 05, 2022. [Online]. Available: <https://www.patt.gov.gr/6-%ce%b5%ce%bd%ce%b7%ce%bc%ce%b5%cf%81%cf%89%cf%83%ce%b7%6-1-%ce%b5%ce%bd%ce%b7%ce%bc%ce%b5%cf%81%cf%89%cf%83%ce%b7-%ce%b3%cf%81%ce%b1%cf%86%ce%b5%ce%af%ce%bf-%cf%84%cf%8d%cf%80%ce%bf%cf%85/dt-perifereiaiw-attikhw/%ce%bc%ce%b5-%ce%b5%cf%80%ce%b9%cf%84%cf%85%cf%87%ce%af%ce%b1-%ce%bf%ce%bb%ce%bf%ce%ba%ce%bb%ce%b7%cf%81%cf%8e%ce%b8%ce%b7%ce%ba%ce%b5-%ce%b7-%ce%ac%cf%83%ce%ba%ce%b7%cf%83%ce%b7-%cf%83%ce%ba/>
- [25] Civil Protection Directorate of the Region of Attica with the support of the Operational Unit “BEYOND/IAASARS/NOA”, “Skamandros 2024 - D.T.A.’ Map Exercise for the Western Sector of Athens / Kifissos River,” Greece, Sep. 30, 2024. [Online]. Available: <http://beyond-eocenter.eu/index.php/news-events/696-askisi-perifereia-attikis>