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Fast-Track Modeling of the Landscape for Hydraulic Studies, Using Drones and Photogrammetry in Field Research

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Introduction

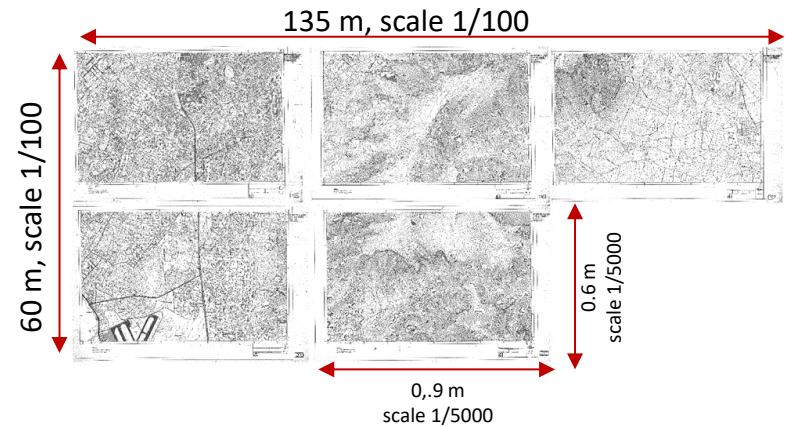
- Hydraulic studies involve numerous assumptions and uncertainties.
- To minimize these uncertainties, various methods are employed [1], typically including terrain modeling through the creation of digital models, as well as the incorporation of water flow parameters like channel roughness [2, 3, 4].
- Field research is a critical step of the methodology which is necessary to describe the condition of flow and channel roughness giving necessary inputs to hydraulic modeling creation [5].
- As field research has a limited view, an advantage method gives the creation of the anaglyph by drones [6].
 - Successive images taken by a drone are uploaded in an application of photogrammetry and allowed us to quickly create a three-dimensional model of the terrain.
 - These models offer a more precise and comprehensive understanding of the area compared to traditional field research.
 - By incorporating critical parameters, like channel roughness, engineers can have more accurate inputs to calibrate the simulation of the water movement in the terrain.
 - Consequently, combining digital terrain models, water flow parameters, and advanced simulation techniques may strongly enhance the accuracy of hydraulic studies.

Field research

- Guidelines with Google maps or Google Earth in the location
- Locating and photographing
- Record observation comments of the position with video on the smartphone



Amenities

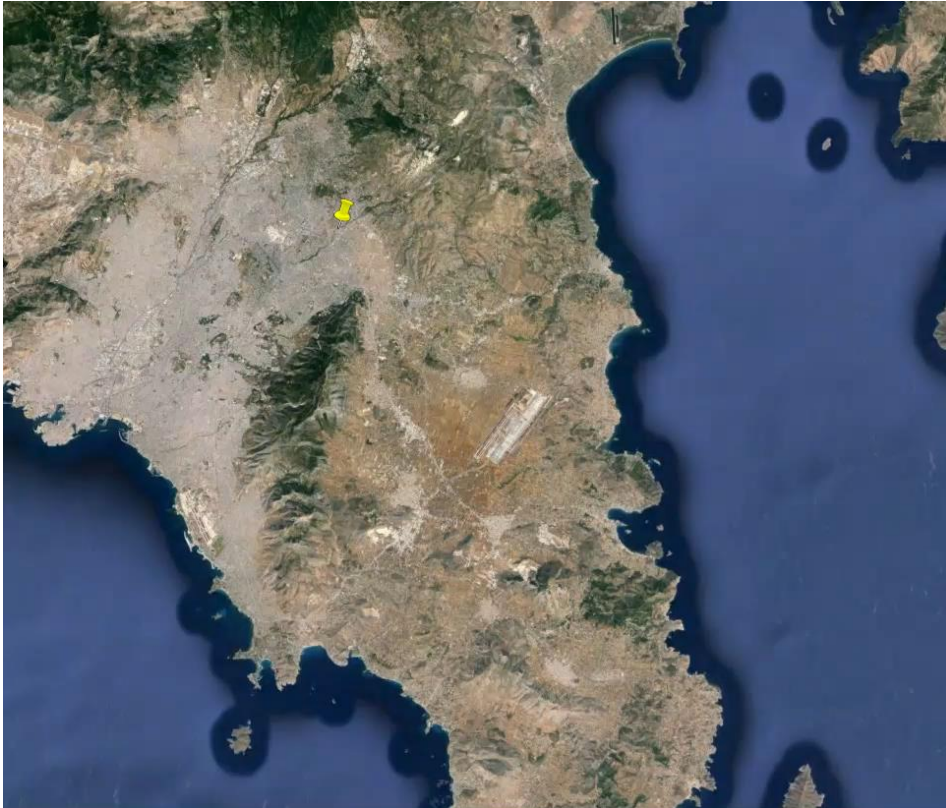


Adversities

There are various dangers inherent in field research, and although we had pointed out some of them, various contingencies arose.

Our experience has shown that field research should be done by a team and without haste.

Field research, the view from ground



[6, 7]

Field research, the view from drone



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DJI_0300



DJI_0301



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DJI_0321



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Creation of 3D model



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Click to upload or drag files into this area

Photogrammetry for professional 3D model quality,
works for featureful objects or scenes

[8]

Results



Conclusions

- The drone's perspective provides greater clarity regarding the situation in the field.
- However, since this perspective is unusual, it is not necessarily something the engineer in the office who makes the hydraulic model, can easily perceive.
- By creating a digital 3D model of the anaglyph in a user-friendly .obj or .stl file, the researcher who is working in the hydraulic model, can easily open it and see the exact conditions in the field.
- This method optimizes the researcher's performance in the field, providing a clear view of the area using a simple drone, without the need for specialized drones or high-tech equipment.
- As hydraulic studies are extremely important for ensuring the safety and prosperity of societies [4, 9], a swift response with studies and projects ensures their resilience.
- Further research will examine how these 3D models of the anaglyph could be 3D printed and used to simulate the water flow with physical models.

References (1)

1. Wang, N.; Sun, F.; Koutsoyiannis, D.; Iliopoulou, T.; Wang, T.; Wang, H.; Liu, W.; Sargentis, G.-F.; Dimitriadis, P. How can changes in the human-flood distance mitigate flood fatalities and displacements? *Geophysical Research Letters*, 50, 2023. e2023GL105064. <https://doi.org/10.1029/2023GL105064>
2. Sigourou, S., Tsouni, A., Pagana, V., Sargentis, G.-F., Dimitriadis, P., Ioannidis, R., Chardavellas, E., Dimitrakopoulou, D., Mamasis, N., Koutsoyiannis, D., and Kontoes, C. An advanced methodology for field visits towards efficient flood management on building block level, EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-16168, <https://doi.org/10.5194/egusphere-egu23-16168>, 2023.
3. Tsouni, A., Sigourou, S., Dimitriadis, P., Pagana, V., Iliopoulou, T., Sargentis, G.-F., Ioannidis, R., Chardavellas, E., Dimitrakopoulou, D., Mamasis, N., Koutsoyiannis, D., and Kontoes, C. Multi-parameter flood risk assessment towards efficient flood management in highly dense urban river basins in the Region of Attica, Greece, EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-12624, <https://doi.org/10.5194/egusphere-egu23-12624>, 2023
4. Sargentis, G.-F., Sigourou, S., Multiparametric flood risk assessment. Management planning in high spatial resolution in Attica. *KTIRIO* 5/2024, 22-23, 2024.
5. Moraiti K.; Sigourou S.; Dimitriadis P.; Ioannidis R.; Benekos I.; Iliopoulou T.; Kitsou O.; Mamassis N.; Koutsoyiannis D.; Sargentis G.-F. Documenting the Changing Floodplain of Nileas Basin in North Euboea (Greece) before and after Storms Daniel and Elias. *Rural and Regional Development* . 2024; 2(3):10013. <https://doi.org/10.35534/rrd.2024.10013>

References (2)

6. Sargentis G.-F.; Moraiti K.; Benekos I.; Ioannidis R.; Mamassis N. Fast-Track Documentation of the Alterations on the Landscape, before and after a Natural Hazard—Case Study: North Euboea Greece before and after Storms Daniel and Elias. *Rural and Regional Development* 2024, 2, 10016. <https://doi.org/10.70322/rrd.2024.10016>
7. Google. Google Earth Pro, Version 7.3.3.7786; Map Publisher: Washington, DC, USA, 2021.
8. Kiriengine. Available online: <https://www.kiriengine.app/>
9. Sargentis, G.-F. *Issues of Prosperity: Stochastic Evaluation of Data Related to Environment, Infrastructures, Economy and Society*. Ph.D. Thesis, National Technical University of Athens, School of Civil Engineering, Athens, Greece, 2022.

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