REPLIES TO REVIEWER 1 COMMENTS

Paper: A lesson in preparedness: Assessing the effectiveness of low-cost post wildfire flood protection measures for the catastrophic flood in Kineta, Greece

Authors: George Papaioannou, Angelos Alamanos, Mohammed Basheer, Nikolaos Nagkoulis, Vassiliki Markogianni, George Varlas, Angelos Plataniotis, Anastasios Papadopoulos, Elias Dimitriou and Phoebe Koundouri

Comments from Reviewer 1

Dear Editor

I have finished my review on the proposed paper “A lesson in preparedness: Assessing the effectiveness of low-cost post-wildfire flood protection measures for the catastrophic flood in Kineta, Greece".

In the proposed paper, the authors’ goal is to develop an integrated simulation framework that combines meteorological, hydrological, hydraulic hydrodynamic models and remote sensing techniques to represent post-wildfire flood hazards and support the design of Post wildfire Flood Protection Treatments (PFPTs).

1. Generally, the manuscript presents a very interesting topic, and the specific research seems to include some significant points for the research community of this field.
2. The proposed paper is generally very well written with acceptable use of English language. However, there are some minor grammatical mistakes and word errors. The authors should check again the paper to correct these minor mistakes. Also, the authors should use mainly passive voice and limit the use of words like "We..., our study ect."
3. The proposed paper is very well structured. It begins with the Introduction with some references that help the reader to get into the subject. In Introduction there is an effort to provide previous studies with similar scientific content, which took place in the research area. Authors try to describe and set the scientific problem and how other researchers have approached it. At the end of Introduction, authors clearly state the goals of the research and the novelty of their study.

4. The methodology is generally very interesting. The authors provide details of the methodology, in a way that other researchers could repeat this research in other areas. However, I have some points that may need some clarifications (see below comments).
5. The results are generally ok. However, I have some comments for costs of PFPTs.
6. The Discussion is maily a repetition of the results. Discussion within the context of comparing the results of the paper with other studies, does not exist. You should compare or discuss your results with previously published studies. Please, enhance the quality of this section by adding more literature from the broader area.

Also, I provide a pdf file with more specific comments.

Response to Reviewer 1 general comments

We sincerely thank the reviewer for his positive assessment and constructive suggestions. We appreciate the recognition of the manuscript's structure, clarity, and relevance to the research community.

In response to the reviewer's feedback, we have:

- *Conducted a thorough language revision to correct minor grammatical issues and reduce first-person phrasing;*
- *Clarified key methodological steps as requested (see detailed responses below);*
- *Revised the cost estimates of PFPTs and added further explanation in the Supplement;*
- *Expanded the Discussion section to include comparisons with relevant literature from post-fire flood studies in Mediterranean and similar environments.*

We believe these revisions improve the clarity and robustness of the manuscript. All comments made by the reviewers have been addressed. The reviewers' comments are shown in "plain text" *and the authors' response in the text with italics.*

Concerning the comment 6

Suggested Insert (to be added after Line 393):

"To our knowledge there is no other study exploring all these flood- and PFPTs-related effects with hydraulic modelling based on a real post-fire event. In order to validate or cross-check our findings with the broader literature, we also reviewed field based studies from the Mediterranean area. Indeed, the results are consistent, demonstrating the effectiveness of small-scale interventions in reducing post-fire runoff and sediment yield.

Margiorou et al. (2022) showed that wooden check dams significantly reduced sediment discharge in burned suburban catchments, while Kastridis et al. (2022) emphasized their cost-efficiency when combined with other erosion control measures. Furthermore, Theofanidis et al. (2025) highlighted that the timing of PFPT implementation is crucial, early post-fire construction enhances sediment interception and reduces downstream impacts. The convergence of our model-based findings with field evidence underscores the mitigation role of PFPTs when rapidly deployed and appropriately located within affected catchments."

Added references:

Theofanidis, A., Kastridis, A., & Sapountzis, M. (2025). Effectiveness of Torrential Erosion Control Structures (Check Dams) Under Post-Fire Conditions—The Importance of Immediate Construction. Land, 14(3), 629. https://doi.org/10.3390/land14030629

Margiorou, Stella, Aristeidis Kastridis, and Marios Sapountzis. 2022. "Pre/Post-Fire Soil Erosion and Evaluation of Check-Dams Effectiveness in Mediterranean Suburban Catchments Based on Field Measurements and Modeling" Land 11, no. 10: 1705. https://doi.org/10.3390/land11101705

Kastridis, A., Margiorou, S., & Sapountzis, M. (2022). Check-Dams and Silt Fences: Cost-Effective Methods to Monitor Soil Erosion under Various Disturbances in Forest Ecosystems. Land, 11(12), 2129. https://doi.org/10.3390/land11122129

Specific comments

Line 65. "I think you mean "silt" fences."

Yes, the reviewer is correct. Proper amendments will be implemented in the revised manuscript

Lines 70-71. "This statement is not totally correct. For example, log check-dams (channel treatment) are mainly constructed in secondary streams with intense slope, in order to reduce water velocity and catch as many as possible sediments is the production areas in higher altitudes. You can find studies from Thessaloniki Seich Sou forest and from ancient Olympia in Peloponnese."

According to our previous review on PFPTs (Papaioannou et al. 2023), we have found that the existing literature (although scarce) leaves a high degree of flexibility in the implementation of the majority of those works, including wooden check dams, based on site characteristics. And this is the main reason preventing/making challenging

more generally applicable with concrete examples. According to these findings, we further deepened our analysis for the specific case study of Kineta, designing the exact combination of PFPTs that was expected to work best, while complying with the available guidelines, cost expectations, practice and expert judgment including our previous real-life applications (Evros case study). These findings have been published in Alamanos et al. (2024), where more details can be found.

Lines 69-71 were modified accordingly:

"Channel treatments, on the other hand, are most suitable in small headwater channels, typically where soil burn severity is moderate to high, altered hydrologic response elevate the risk to downstream values and channel gradients are gentle enough for stable installation, ensuring site accessibility for timely maintenance and inspection."

Papaioannou, G., Alamanos, A., & Maris, F. (2023). Evaluating Post-Fire Erosion and Flood Protection Techniques: A Narrative Review of Applications. GeoHazards, 4(4), 380-405. https://doi.org/10.3390/geohazards4040022

Alamanos, A., Papaioannou, G., Varlas, G., Markogianni, V., Plataniotis, A., Papadopoulos, A., Dimitriou, E., and Koundouri, P. (2024). Designing Post-Fire Flood Protection Techniques for a Real Event in Central Greece. Prevention and Treatment of Natural Disasters, 3(2), 211-228. https://doi.org/10.54963/ptnd.v3i2.303

Lines 78-79. "Also, check here doi.org/10.3390/land14030629 the importance of timely PFPTs construction in Greece."

We thank the reviewer for his suggestion. The study conducted by Theofanidis et al. (2025) emphasizes the importance of immediate implementation of erosion control works under post-fire conditions, while Mitsopoulos et al. (2022) demonstrate that the timely implementation of flood protection infrastructure could have significantly reduced flood impacts in an urban flash flood case in Greece. Both references are now cited in the revised manuscript, and the sentence has been updated accordingly.

"The importance of timely and properly planned installation of PFPTs to enhance their effectiveness in mitigating post-wildfire flood risk is also highlighted by Theofanidis et al. (2025) and Mitsopoulos et al. (2022), studying another Greek burnt site."

Line 97. "Typo error??"

We agree with the reviewer, and in the revised manuscript the typo will be corrected (excluding the from line 97).

Line 114. "Here, you should add a polygon with black outline which will show the burned area. Only the clc 2028 do not reveal something important.."

Burned area and burned severity are presented in Figure 4 later in the manuscript (we hope it is also clear from the caption of Figure 4). Thus, since the largest part of the study area was burned, even with low burn severity, we decided not to include it in Figure 1 to avoid confusing the reader with too much complex polygon information.

Line 178-179. "It is known that during a post-fire flood event there is a lot of transportation of sediments and wood debris (logs), which alters the Manning "n" in stream bed in over bank flow. Did you consider/quantify this during the 2D simulation?"

We thank the reviewer to giving us the opportunity to highlight one more novel element of our work which we couldn't included it in our manuscript due to space limitations. Yes, the effect of sediment and wood debris transport on streambed roughness was incorporated in our model through adjusted Manning's n values. This approach was implemented and validated in our previous study (Alamanos et al., 2024), which is now cited in the revised manuscript for clarity. Moreover, we have been upfront and transparent in terms of the Manning's n values (again as calibrated in Alamanos et al., 2024), by including the detailed Table S1 in the supplementary material which includes the pre and post-fire values per land use/land cover and per burn severity class.

Alamanos, A., Papaioannou, G., Varlas, G., Markogianni, V., Papadopoulos, A., & Dimitriou, E. (2024). Representation of a Post-Fire Flash-Flood Event Combining Meteorological Simulations, Remote Sensing, and Hydraulic Modeling. Land, 13(1), 47. https://doi.org/10.3390/land13010047

Lines 224-225. "How this blockage was quantified during the simulation?"

We thank the reviewer for this question. In the post-fire scenario, field reports, photographs from the site inspection and a drone survey after the event, confirmed that the bridge and culverts were fully blocked by sediments. Therefore, in the simulation (blocked scenario), we excluded the culverts from the model and modified the DEM at the bridge section to represent total blockage. This will be clarified in the revised manuscript.

Suggested modification of the manuscript in lines 224-225:" In this scenario, the major culverts were excluded from the modeling, and the bridge geometry was modified in the DEM to represent full blockage by sediment and debris, consistent with field observations from the actual flood event."

Line 338 "Maybe its better to say "...and 49.25 €/m2 per wooden check dam.""

We thank the reviewer for his proposal. Proper amendments will be implemented in the revised manuscript.

Suggested modification of the manuscript in lines 338: " 49.25 €/m^2 per wooden check dam"

Line 341 "The average cost per check dam is 172€. However, as far as I know this cost is very low for Greek reality. Please, see the following study from Greece. You will see that only the digging cost per check dam is 44.15€ (http://dpe.damt.gov.gr/apps/anartiseis/files/922/ΜΕΛΕΤΗ_ΠΡΙΝΟΣ_ΞΥΛΟΦΡΑΓΜΑΤΑ_Δασάρχη.pdf).

Also, for one worker the minimum net daily salary (8 hours) is 80€ (without security costs), the daily compensation for the use of chainsaw is 30€ and the overnight compensation is 40€. Which means at least 150€ per day for one worker.

So, the daily cost only for salary and digging for one worker is at least 200€. Without taking into account the costs of fuels, other materials, social security, draft animals and personnel transportation costs (https://dasarxeio.com/wp-content/uploads/2024/07/67801_2268_2024.pdf).

How many check dams could be constructed by one worker in 8 hours? Do not forget that the same worker is logging the burned trees.

In supplementary material you did not provide the source of the construction costs. You have to find the official Greek tables of wooden check dams construction costs."

We thank the reviewer for this valuable and well-documented observation. We fully agree that the initially presented figure of 172€ for the wooden check dam construction

was incomplete, as it did not include the overhead and contractor's profit margin and the VAT.

Following the reviewer's suggestion, we have revised our cost estimate to reflect the final cost including all obligatory expenses, which amounts to approximately 252€ per dam. This estimate is based on official costings used by the Forestry Agency of Alexandroupolis, drawn from recent field works conducted after the large wildfire event in the Evros region.

In the revised manuscript we will update the corresponding cost results and the respective table at the supplementary material accordingly.

The values that will practically change, refer to the "protection costs"; instead of €3.45 mil, they will rise to €5,05 mil.

This still, does not change our conceptual contribution, that is in line with rational and proactive disaster management, that is that prevention is better (also in economic terms) than cure.

Suggested modification of the manuscript in line 342:

"Which, in total, sums to €3.45 mill. The final PFPTs cost, including the overhead and contractor's profit margin and the VAT, is €5,05 mil."

Suggested Amendment in Supplementary Material (Section S4):

"The total cost of a wooden check dam was initially estimated at 172€, covering direct labor and material expenses. However, when including the overhead and contractor's profit margin and the VAT, the final cost rises to approximately 252€, in alignment with recent official works conducted by the Forestry Agency of Alexandroupolis following the Evros wildfire."

REPLIES TO REVIEWER 2 COMMENTS

Paper: A lesson in preparedness: Assessing the effectiveness of low-cost post wildfire flood protection measures for the catastrophic flood in Kineta, Greece

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Comments from Reviewer 2

General comments

This preprint addresses a clearly relevant hydrological risk question for HESS: how wildfire-induced landscape change modulates subsequent flood hazard, and how post-wildfire flood protection treatments (PFPTs) might reduce impacts in a real Mediterranean setting. The manuscript is generally well written, easy to follow, and the end-to-end workflow is communicated in a logical sequence (meteorology → RS → hydraulics → PFPT design → economics). The work's main novel contribution is not one single model component, but the integration of: (i) storm reconstruction with WRF-ARW, (ii) Sentinel-2–based burn severity characterization and flood extent mapping for validation, (iii) 2D HEC-RAS rain-on-grid hydrodynamic simulation, (iv) explicit spatial design and terrain-level insertion of PFPTs (LEBs and WCDs) to test counterfactual scenarios, and (v) a cost comparison that contrasts PFPT implementation costs with direct flood-damage costs. I also consider the economic layer to be a strong and relatively uncommon addition in post-fire flood studies. The manuscript quantifies PFPT costs (≈€3.45M) and compares them to direct damages (≈€25.2M), using Greek techno-economic specifications for the PFPT bill of quantities and a semi-automated exposure counting approach (SAM + manual checking) for damage estimation. Overall, I see this as a solid contribution with tangible operational value (scenario-based preparedness planning), provided that several methodological and traceability elements are clarified to strengthen reproducibility and to better constrain uncertainty.

Response to Reviewer 2 general comments

We thank the reviewer for their constructive and encouraging feedback. We appreciate the recognition of the manuscript's integrative approach and practical relevance.

In response, we have clarified key methodological aspects to strengthen reproducibility, including:

- *Adding a summary table of the Rain-on-Grid setup,*
- *Detailing the implementation of blocked culverts and bridge,*
- *Revising and documenting PFPT cost estimates (to accommodate a comment by Reviewer 1),*
- *Emphasizing depth and velocity changes in the Discussion, and*
- *Ensuring consistent terminology throughout the text.*

We believe these revisions improve the clarity and robustness of the manuscript. All comments made by the reviewers have been addressed. The reviewers' comments are shown in "plain text" *and the authors' response in the text with italics and blue font.*

Specific comments:

While the main elements of the hydraulic setup are described in the text, it would be useful to add a compact table (main text or Supplement) summarising the key HEC-RAS Rain-on-Grid configuration (computational grid/mesh resolution, numerical time step, boundary conditions, rainfall forcing input format, representation of bridges/culverts), including a brief note on how the "blockage" condition is parameterised in the "reality" scenario. This modest addition would materially improve traceability and reproducibility.

We thank the reviewer for this excellent suggestion. A summary table has now been added in the Supplementary Material (Table Sx) detailing the key parameters of the Rain-on-Grid setup, including grid resolution, time step, rainfall input format, representation of hydraulic structures, and the treatment of blockage in the "reality" scenario. We believe this addition improves the reproducibility and transparency of the modeling approach.

Suggested Addition to Supplement (new Table Sx):

Model feature	***Configuration***
General computational mesh resolution	*General resolution = 10 m* *Resolution near log-erosion barriers = 5 m* *Resolution near the wooden check dams = 2 m*
Initial time step	*1 second*
Adaptive time step configuration	*Maximum Courant = 3.5*

	Minimum Courant = 0.5 *Number of time steps before doubling = 4* *Maximum number of doubling base time step = 6* *Maximum number of halving base time step = 7*
Downstream boundary condition	*Normal depth with 0.025 friction slope*
Forcing boundary condition	*Gridded rainfall data derived from the Advanced Weather and Research Forecasting (WRF-ARW) v4.2 model. The data were prepared in GeoTIFF format before being imported into HEC-RAS.*
Culverts	*Implemented as a box culvert with the following key configurations:* *Entrance Loss Coefficient = 0.4* *Exit Loss Coefficient = 1* *Manning's n for Top and Bottom = 0.013*
Bridge	*Bridge blockage was simulated by modifying the terrain to reproduce the flow obstruction observed during the flood event.*

The results indicate not only changes in flooded extent, but also clear differences in flow depth and velocity between scenarios. A slightly stronger emphasis on these aspects in the Discussion could further support the interpretation of the mitigation benefits, given their direct relevance to damage severity and hazard intensity.

We thank the reviewer for this suggestion. The manuscript already reports spatially explicit differences in water depth and flow velocity between the post-wildfire scenarios with and without PFPTs (Section 3.3; Fig. 5A–B). We have strengthened the Discussion to better highlight how the documented reductions in depth and velocity, particularly along the main flow paths and central stream, are directly relevant to flood hazard intensity and potential damage severity.

Short Paragraph to Insert after Line 390:

"In addition to reducing flood extent, the PFPT scenario also resulted in lower flow depths and velocities (Fig. 5A–B), with velocity reductions exceeding 1.0 m/s in parts of the main channel. These reductions are directly linked to flood hazard intensity and damage severity, further supporting the protective value of the proposed measures."

The manuscript uses both **“burnt”** and **“burned”** to describe post-fire conditions. Although both forms are correct in English, it would improve stylistic coherence to choose one and use it consistently throughout the text.

We thank the reviewer for pointing this out. We have revised the manuscript to use the term “burned” consistently throughout.