Response letter to Reviewer 1.

Dear Reviewer,
Thank you for your time and effort in reviewing the manuscript. We appreciate your positive evaluation of our paper and the comments and suggestions that will help to improve our manuscript further. We would like to address the comments below (in italics) and explain in our detailed point-by-point response how we will incorporate these changes into the revised version of our manuscript.

Kind regards on behalf of all authors,
Thi Dieu My Pham

Thank you for offering an opportunity to review a manuscript that investigated the compound impact of COVID-19 and flood on the mental health of a flood-prone area in Vietnam. The manuscript is well-written and structured, with methodological integrity. However, there are some queries the authors need to address.

Thank you for the overall very positive feedback.

1. In page 2, line 55, the statement 'while the flood …… and under-evaluated' and the following references are misleading, as the authors cited a paper prior to the COVID-19. It would be a good choice if the authors cite Ogunbode et al. (2019) after 'While the flood impacts on mental health are considerable and long-lasting.' Otherwise, the Introduction section is well-written, documenting relevant articles in both global and regional contexts.

We thank the reviewer for this recommendation. We changed this citation for clarification. In the revised manuscript, it will read as: "The co-occurrence of floods and COVID-19 is a typical multi-hazard event (Gill et al., 2022; Simonovic et al., 2021). While the flood impacts on mental health are considerable and long-lasting (Ogunbode et al., 2019), a systematic review of health sector responses to the coincidence of disasters and COVID-19 is underreported and under-evaluated (Sedighi et al., 2021)."

Gill, J.C., Duncan, M., Ciurean, R., Smale, L., Stuparu, D., Schlumberger, J, de Ruiter M. (2022). *P. 2022. MYRIAD-EU D1.2 Handbook of Multi hazard, Multi-Risk Definitions and Concepts.: H2020 MYRIAD-EU Project, grant agreement number 101003276.*

Ogunbode, C. A., Böhm, G., Capstick, S. B., Demski, C., Spence, A., & Tausch, N. (2019). The resilience paradox: flooding experience, coping and climate change mitigation intentions. *Climate Policy, 19*(6), 703–715.

Sedighi, T., Varga, L., Hosseinian-Far, A., & Daneshkhah, A. (2021). Economic Evaluation of Mental Health Effects of Flooding Using Bayesian Networks. *International journal of environmental research and public health, 18*(14).

Simonovic, S. P., Kundzewicz, Z. W., & Wright, N. (2021). Floods and the COVID-19 pandemic-A new double hazard problem. *WIREs. Water, 8*(2), e1509.

Methodology

1. The authors clearly documented the simultaneous occurrence of floods and COVID-19 in the selected study areas. They specifically mentioned using the K6 scale to measure distress among the residents of Hue City.

Importantly, the K6 scale is designed to assess an individual's mental health, specifically measuring distress experienced over the past 30 days (see Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Gfroerer, J. C., Hiripi, E., . . . Zaslavsky, A. M. (2003). Screening for serious mental illness in the general population. *Archives of General Psychiatry*, *60*(2), 184–189. doi: 10.1001/archpsyc.60.2.184). The authors examined the mental health of residents in Hue City concerning incidents that occurred over two years ago. This raises a question about how they addressed the potential recall bias among participants and whether they considered individuals who may have relocated to study areas after 2022 from other parts of the country. Additionally, the authors did not specify any inclusion or exclusion criteria for the population studied.

Thank you for raising this point, which allows us to explain the method, the study site, and the sample in more detail.
Firstly, as the reviewer mentioned, the K6 scale indeed captures the last 30 days, and it is well known that both flooding and COVID-19 can have a long-lasting effect on mental health. The K6 is not significantly affected by the recall period and can help identify the significance of changes in psychological distress over time and evaluate the effectiveness of interventions for psychological distress (Chilver et tal., 2023; Unchiba et al., 2023). Regarding stressors potentially affected by recall bias, we argue that COVID-19 and the flood event were highly impactful for respondents, and, based on our experience, we did not observe problems with respondents' recall.
Secondly, in the first part of the questionnaire, we asked about the 2020 flood experience in the two selected communes. The results show that only 2.9% (4 people) of the respondents in Hai Duong commune and 1.1% (2 people) in Quang Loi commune were not affected by the flood event in that year. This means the situation raised by the reviewer (moving in of respondents) may potentially be the case for these 6 out of 400 respondents, and is therefore, neglectable.

Uchida H, Kuroiwa C, Ohki S, Takahashi K, Tsuchiya K, Kikuchi S, Hirao K (2023). Assessing the Smallest Detectable Change of the Kessler Psychological Distress Scale Score in an Adult Population in Japan. Psychol Res Behav Manag. DOI: 10.2147/PRBM.S417446. PMID: 37465046; PMCID: PMC10351679.

Chilver MR, Burns RA, Botha F, Butterworth P (2023) Comparing estimates of psychological distress using 7-day and 30-day recall periods: Does it make a difference? PLoS ONE 18(12): e0295535. https://doi.org/10.1371/journal.pone.0295535

2. The authors stated they interviewed 400 household heads using systematic random sampling from two communes; however, it is unclear if this sample size adequately represents the study areas.

We would like to clarify that the survey sites and the number of respondents were defined within the project scope, targeting coastal and lagoon communities that are affected by floods each year. Regarding the sampling size, we think that 400 people is a reasonable number to represent the population, in accordance with the formula by Taro Yamane (1967), which applies to both infinite and finite populations. Since there is only an estimate of about 500,000 people in the lagoon area (hue.gov.vn), we used both formulas.
First, the formula for an infinite population (either uncountable or too large to ever count or measure):

$$n = Z^2 \times \frac{p \times (1-p)}{e^2}$$

In which:

***n**: the sample size to be determined.*
***Z**: the Z-value obtained from the standard normal distribution table based on the selected confidence level. Commonly, a 95% confidence level is used, corresponding to **Z = 1.96**.*
***p**: the estimated proportion of success in the population. Typically, **p = 0.5** is chosen because it maximizes the product **p(1 - p), ensuring** a conservative (i.e., safe) sample size estimate.*
***e**: the allowable margin of error. Three commonly used error levels are: ±0.01 (1%), ±0.05 (5%), and ±0.1 (10%), with **±0.05** being the most widely used.*
The result is:

$$n = 1.96^2 \times \frac{0.5 \times (1 - 0.5)}{0.05^2} = 384.16$$

This means we need at least 384 participants for our study.

For the finite population (that is, countable and has a known or measurable number of members), we used this formula:

$$n = \frac{N}{1 + N \times e^2}$$

In which:

- ***n**: the sample size to be determined.*
- ***N**: the population size (total number of units in the population).*
- ***e**: the allowable margin of error. Commonly used error rates are: ±0.01 (1%), ±0.05 (5%), and ±0.1 (10%), with ±0.05 being the most used.*

It is estimated that 500,000 people live in the surrounding lagoon area of Hue city (hue.gov.vn), we have:

$$n = {}^{500{,}000}/_{1 + 500{,}000 \times 0.05^2} = 400$$

Based on the results of both formulas, our sample size adequately represents the targeted population.

Also, the sample characteristics match the city's descriptive statistics reasonably. Except for income, which is sometimes sensitive to ask, gender, age, and education are relatively homogeneous with the city's descriptive statistics and reflect the local context of the lagoon area (TTH Statistic Office, 2022). Because of random sampling, we have tried to eliminate any systematic connection between sampling bias and our dataset.

TTH Statistic Office (2022). *Thua Thien Hue Statistical Yearbook,* from Thua Thien Hue Statistic Office: https://drive.google.com/file/d/1YA7gIxKr4TjMcQWDphL9UpKpFrWGmrXd/view.

3. The authors are requested to mention the reliability of K6 in their study.

We agree with this suggestion and will add this component to the article in the introduction of the K6 as follows: According to Wojujutari and Idemudia (2024), who worked on 'A Reliability Generalization Meta-Analysis of Kessler Psychological Distress Scale (K-10 and K-6), the scales were adapted into multiple languages, including English, Chinese, Swahili, Farsi, Indonesian, Japanese, Hindi, and Portuguese, reflecting their global applicability and adaptability. For the K-6, their results revealed high internal consistency (mean α = 0.84, 95% CI [0.80, 0.88]). Reliability varied across populations and languages. The K-6 scale showed a high reliability among outpatients (α = 0.89) and the general population (α = 0.87). The authors concluded that the K6 is a reliable tool for measuring psychological distress in both general and clinical groups. Its high reliability and adaptability make it valuable in clinical practice and research. It is recommended to use and adapt global mental health assessments, with attention

to cultural and language considerations. In addition, in the article 'Screening for Serious Mental Illness in the General Population' by Kessler et al. (2003), the authors showed that K6 is robust for screening for Serious Mental Illness and concluded that it is crucial for clinical studies and clinical epidemiology.

Kessler RC, Barker PR, Colpe LJ, et al (2003). Screening for Serious Mental Illness in the General Population. *Arch Gen Psychiatry. 60(2):184–189. DOI:10.1001/archpsyc.60.2.184*

Wojujutari AK, Idemudia ES (2024). Consistency as the Currency in Psychological Measures: A Reliability Generalization Meta-Analysis of Kessler Psychological Distress Scale (K-10 and K-6). *Depress Anxiety. DOI: 10.1155/2024/3801950. PMID: 40226709; PMCID: PMC1191909*.

4. The authors are requested to provide any relevant articles that support merging 'moderate' and 'severe' distress into the 'Yes' category. If they choose not to merge 'no' and 'moderate' distress into the 'no or moderate' distress category, they must explain this decision. The authors are requested to address or clarify the issues mentioned above in the methodology.

We thank the reviewer for this suggestion, and we would like to clarify our decision as follows:

The widely used Kessler K6 non-specific distress scale screens for severe mental illness, defined as a K6 score ≥ 13, estimated to afflict about 6% of US adults. The K6, as currently used, fails to capture individuals struggling with more moderate mental distress that nonetheless warrants mental health intervention." They provide a cut-off for 'moderate' mental distress, which we use and which is appropriate for your research question. Since the severe group is too small, the prevalence shows only 0.8%. It is too small to analyze as a group. Combining this group with the moderate helped refine the analysis by comparing the presence of stress experience with no experience at all, providing a more precise comparison (Perez-Valero et al., 2021). Prochaska et al. (2012) also indicated that it is necessary to use K6 to detect, examine, and quantify the correlates of moderate distress, given its clinical relevance.

Eduardo Perez-Valero, Miguel A. Lopez-Gordo, Miguel A. Vaquero-Blasco (2021). EEG-based multi-level stress classification with and without smoothing filter. *Biomedical Signal Processing and Control. Volume 69, 102881, ISSN 1746-8094, https://doi.org/10.1016/j.bspc.2021.102881*.

US Centers for Disease Control and Prevention *(https://www.cdc.gov/mental-health/about/index.html)*

Prochaska, J. J., Sung, H.-Y., Max, W., Shi, Y., & Ong, M. (2012). Validity study of the K6 scale as a measure of moderate mental distress based on mental health treatment need and utilization. *International Journal of Methods in Psychiatric Research, 21(2), 88–97. https://doi.org/10.1002/mpr.1349*

Response letter to Reviewer 2.

Dear Reviewer,

Thank you for taking the time to review our manuscript. We value your positive feedback and the suggestions provided to enhance our paper. Below, we respond to your comments (in italics) and outline how we will incorporate these revisions into the updated manuscript.

Kind regards on behalf of all authors,

Thi Dieu My Pham

The paper is well-written, presenting a clear and logical structure, which facilitates the reader's understanding.

The language is objective and well-founded, and the methodology is well-defined, with appropriate quantitative methods.

Furthermore, this topic is very relevant, especially in the context of research on multiple risks and public health. The work is interesting and useful for NHESS readers.

Thank you for the overall very positive feedback.

1. ABSTRACT

An adequate abstract-please provide a statement explaining the "why" the study was conducted. I believe that explaining the "why" can demonstrate the purpose behind creating conceptual understanding.

Thank you for this suggestion. We will slightly rephrase the lines from 9-12 like this:

Experiencing severe flooding tends to negatively impact mental health, creating a significant public health issue. Moreover, extreme events can co-occur, magnifying potential impacts. Insights into the combined impact of co-occurring disasters on mental health, such as floods and COVID-19, are, however, largely lacking. We addressed this research gap by conducting 400 face-to-face interviews in October 2023 in Hue City, Vietnam, where residents faced simultaneous flooding and COVID-19 in 2020.

2. INTRODUCTION

- Lines 69-98: I suggest moving the initial part of these lines to the methodology section and another part to the results and discussion section.

Thank you for this suggestion. However, from our point of view, this section still explains how we identified the research gap we aim to address. Therefore, we would prefer to keep this paragraph where it is, but we will improve the connection between this part and the identified sections.

We will emphasize this link by revising the first sentence as follows:

From line 69: "Furthermore, to be more certain about this research gap, we conducted a further search on the Web of Science and PubMed databases using the strings: 'flood', 'COVID-19', AND 'mental health' in December 2023 (see Appendix 1); we found 52 articles in the Web of Science and 55 articles in PubMed"….

3. CASE STUDY AREA

- Line 111: Is there any information on the percentage of the country's population that has been or is currently affected by floods?

This information was mentioned on line 153 (generally) stating that: "About 70% of Vietnam residents live in coastal communities and, as such, are highly exposed to intensifying storms and floods (CFE-DM, 2021)."

- Line 122: Is it possible to cite historical extreme events that have occurred in the region over the decades? I believe this information is important for understanding the historical context and frequency of floods in the region.

Thank you for this suggestion. We will add the following information to the part you mentioned:

"In recent decades, Thua Thien Hue province has faced several devastating floods. While the region has annual small to moderate floods with minor impacts, the occasional major to historic floods have severe consequences for people, the economy, infrastructure, and the environment (Sett et al., 2025). Local stakeholders and households identified the floods of 1999, 2020, and 2023 as particularly severe (Vietnam Disaster and Dyke Management Authority, 2019; Man Nhi, 2023; Sett et al., 2025). The most severe recent flood was the historic 1999 event, caused by heavy rainfall in Hue that lasted 10 days and reached 3,063 mm in the city center (Villegas, 2004). The flood resulted in 793 deaths, damaged more than 870,000 houses, and severely affected households in Hue and infrastructure (IFRC, 1999). The exceptional 2020 flood event from early October to mid-November was caused by nine consecutive major storms, with typhoons hitting Central Vietnam (DMPTC, 2021), bringing heavy rainfall—2,747 mm recorded in Hue and up to 5,226 mm in the mountainous upstream areas (VRAIN, 2024)—and leading to riverine and flash floods as well as landslides in some regions (IFRC, 2020). These floods left two people dead, two missing, and one injured in the central city of Hue, according to the city's Civil Defence Steering Committee (Vietnam News, 2025). The 2023 flood was also recognized as the 'worst in a decade' (Thanh, 2023). The city centre recorded up to 2,858 mm of rainfall, and more than 4,135 mm in the mountainous upstream regions (VRAIN, 2024). The flood level nearly reached the historic levels of the 1999 floods (Sett et al, 2025).

References:

DMPTC (2021). Disaster Information Data Base. Available at www.dmc.gov.vn/disaster-infomation-pt32.

Dominic Sett, Florian Waldschmidt, Kerstin Büche, Andrea Ortiz Vargas, Eike Behre, Maxime Souvignet, Bien Thanh Vu, Olabisi S. Obaitor, Ulrike Schinkel, Yvonne Walz, Matthias Garschagen, Nguyen Dang Giang Chau, Nguyen Hoang Khanh Linh, Felix Bachofer, Michael Hagenlocher (2025). Technical Report. *Flood risks in Hue, Central Viet Nam: An assessment of flood hazards, exposures, vulnerabilities, root causes and impacts.* https://floodadapt.eoc.dlr.de/media/pdfs/FAVN_Flood_risks_in_Hue_final.pdf#:~:text=Thua%20Thien%20Hue%20province%20in,which%20cause%20significant%20damage%20to

IFRC (1999). Vietnam: Floods. Appeal no. 32/99, 25 November 1999. International Federation of Red Cross and Red Crescent Societies.
Available at https://www.ifrc.org/docs/appeals/99/3299.pdf.

IFRC (2020). *Operation Update Report. Vietnam: Floods*. International Federation of Red Cross and Red Crescent Societies. Available at https://adore.ifrc.org/ Download.aspx?FileId=380049.
html?lang=en-US. Accessed on 18 June 2024.

JBA Risk Management (2020). Vietnam floods: A tale of six cyclones. *https://www.jbarisk.com/products-services/event-response/vietnam-floods/*

Villegas, Piero (2004). Flood Modelling in Perfume River Basin, Hue Province, Vietnam. Enschede: International Institute for Geo-information Science and Earth Observation. Available at https://docslib.org/doc/12221267/flood-modelling-in-perfum-e-river-basinhue-province-vietnam.

VRAIN (2024). [Specialized Rain Measurement System]. Masters Thesis. Available at https://www.vrain.vn/landing. Accessed on 18 June 2024. Man Nhi (2023). Thừa Thiên Huế hứng đợt lũ lớn chưa từng có trong 10 năm qua (Thua Thien Hue is experiencing the worst floods in the past 10 years). *(https://dantri.com.vn/xa-hoi/thua-thien-hue-hung-dot-lu-lon-chua-tung-co-trong-10-nam-qua-20231116193741441.htm*

Vietnam Disaster and Dyke Management Authority (2019). Flood in 1999, 20 years ago: Unforgettable story, lessons learnt remain forever. *https://phongchongthientai.mard.gov.vn/en/Pages/flood-in-1999-20-year-ago-unforgetable-story-lessons-learnt-left-forever.aspx*

Vietnam News (2020). Four dead or missing after exceptionally heavy flooding in Huế *https://vietnamnews.vn/society/1728495/four-dead-or-missing-after-exceptionally-heavy-flooding-in-hue.html. (October 30, 2020)*

Thanh, Vo (2023). Thua Thien-Hue floods worst in a decade, 17 November. Hanoi: VnExpress International, 17 November 2023. Available at https://e.vnexpress.net/news/news/environment/thua-thien-hue-floods-worstin-a-decade-4678254.html.

TTH (2022). Report on the implementation of response to rain and flooding caused by the circulation of storm No. 5 and storm No. 6 in Thua Thien Hue province dated 20 Oct 2022.

- Lines 144-151: I suggest moving this paragraph closer to Figure 1.

This is indeed a good suggestion. We will do that in the revised version.

- Are the populations of these two communities representative of the population of Hue City?

Thanks for this question. Regarding the sampling method, we explain as follows:

We would like to clarify that the survey sites and the number of respondents were defined within the project scope, targeting coastal and lagoon communities affected by annual flooding. In Part 4.1, we already provided a detailed comparison of our sample with the province's population. W*e indicate that the sample characteristics align reasonably with the city's official census data. Except for income, which is sometimes sensitive to ask, gender, age, and education are relatively homogeneous with the city's census data and reflect the local context of the lagoon area (TTH Statistic Office 2022). Because of random sampling, we have tried to eliminate any systematic connection between sampling bias and our dataset." Regarding the sample size, we consider 400 participants a reasonable number to represent the population, based on the formula by Taro Yamane (1967), given an estimated population of 500,000 in the lagoon area (hue.gov.vn).*

Reference:

TTH Statistic Office (2022). *Thua Thien Hue Statistical Yearbook,* from Thua Thien Hue Statistic Office: https://drive.google.com/file/d/1YA7gIxKr4TjMcQWDphL9UpKpFrWGmrXd/view.

4. METHODS

- Line 154: Please briefly explain the tool and include a link to access it.

Yes, we will add information about the KoboToolbox to line 154. It will read:

Line 154: "KoBoToolbox (https://www.kobotoolbox.org), created by the Harvard Humanitarian Initiative, is an open-source collection of tools designed for data gathering and analysis in humanitarian crises and difficult settings. It was used to conduct 400 face-to-face interviews in the two coastal communes of Hai Duong and Quang Loi from October 6 to 30th 2023.

- Was the collective memory of the community taken into consideration, given that the interviews were conducted years after COVID-19? How might this introduce bias into the respondents' answers? Do the authors consider this factor a limitation of the method?

(Suggested reading for concepts and discussion: https://doi.org/10.1111/jfr3.12679; doi.org/10.1002/2017WR022036; https://doi.org/10.3986/AGS49107).

To us, this is an interesting suggestion, relevant to papers on social/collective memory, and worth considering for inclusion or clarification. We carefully read the recommended articles and found that this aspect is already reflected in our discussion (see lines 402-421). However, we recognize that this aspect requires further analysis, which may involve another survey or a panel study to provide concrete evidence. So, it is quite ambitious to include it in this research at this point in time. Therefore, we have revised the manuscript to state this as a recommendation for future study, such as a longitudinal study, to compare changes in the impact on mental health in accordance with collective memory decay over time.

It will read like this:

(After line 180): In our research context, for the first time, we used K6 to screen the mental health status of affected people three years after the events, to capture the mental health status of respondents. Some people may be concerned that the recall of affected people may change over time as the collective memory decays (Song et al., 2021). We would argue that the K6 scale indeed captures the last 30 days, and it is well known that both flooding and COVID-19 can have a long-lasting effect on mental health (Unchiba et al., 2023). The K6 is not affected by the recall period and can help identify the significance of changes in psychological distress over time and evaluate the effectiveness of interventions for psychological distress (Chilver et al., 2023; Unchiba et al., 2023). Regarding the stressors potentially affected by recall bias, we argue that COVID-19 and the flood event were highly impactful for the respondents, and, based on our experience, we did not observe problems with respondents' recall.

And line 503:

For future research, it is necessary to investigate this topic over time (longitudinal study), across different areas and groups to better understand the variation and cumulative impacts of concurrent disasters on mental health, enabling more effective response and prevention activities. Also, it would be helpful to have more studies on the need for support, solutions, and interventions, such as establishing public health records for social memory and infrastructure after devastating events, to improve psychological assistance as part of multi-risk management.

References:

Song S, Wang S, Fu B, Dong Y, Liu Y, Chen H, Wang Y (2021). Improving representation of collective memory in socio-hydrological models and new insights into flood risk management. In: *J Flood Risk Management* 14 (1), Artikel e12679. DOI: 10.1111/jfr3.12679

Uchida H, Kuroiwa C, Ohki S, Takahashi K, Tsuchiya K, Kikuchi S, Hirao K (2023). Assessing the Smallest Detectable Change of the Kessler Psychological Distress Scale Score in an Adult Population in Japan. *Psychol Res Behav Manag*. DOI: 10.2147/PRBM.S417446. PMID: 37465046; PMCID: PMC10351679.

Chilver MR, Burns RA, Botha F, Butterworth P (2023). Comparing estimates of psychological distress using 7-day and 30-day recall periods: Does it make a difference? *PLoS ONE* 18(12): e0295535. https://doi.org/10.1371/journal.pone.0295535

- I congratulate the authors on their excellent paper.

Thank you very much for your encouragement!