Major comments:

1) *Insufficient description and discussion of a crucial aspect: the deterministic simulations.*

- *While the mathematical framework that forms the Landslide-Tsurrogate v1.0 framework is carefully presented, the description and discussion of the deterministic simulations are inadequately addressed, while these are crucial for building and applying the probabilistic framework. Reading the manuscript, it appears that the choice of the numerical model to be used for the deterministic simulations is largely inconsequential, as is the distinction between 2D and 3D simulations, regardless of the specific characteristics of the site at hand. In my view, this represents a severe oversimplification. Depending on the considered site, 3D (or 2D multi-layer) simulations or may represent the only option to have reliable results, while in other cases also very simple models can be safely used. The choice of the model and its accuracy in reproducing the complex physics of landslide-tsunami generation, propagation and interaction with coast play a crucial role. These aspects should be better discussed as in the current version of the manuscript are not properly addressed.*

Answer: We thank the reviewer for this important comment. We agree that the choice of the deterministic numerical model used to generate the training dataset is a critical component of the overall framework. The intention of the Landslide-Tsurrogate v1.0 framework is not to suggest that the selection of the deterministic model is inconsequential, but rather to provide a flexible probabilistic framework that can be coupled with different numerical models depending on the complexity of the site and the physical processes that must be represented.

The deterministic simulations used to construct the surrogate model must adequately reproduce the relevant physics of landslide-generated tsunami generation, propagation, and coastal interaction. The level of model complexity required depends strongly on the characteristics of the system considered. In relatively simple geometries or for first-order hazard assessments, hydrostatic depth-averaged hydrodynamic models may provide sufficiently accurate results. However, in environments where the generation process involves strong three-dimensional effects, non-hydrostatic models and multilayer description of the water column or even 3D models may be required to obtain reliable results.

The surrogate framework proposed in this study does not impose any restriction on the underlying deterministic model. Instead, it assumes that the deterministic simulations used for training are generated with a model whose physical fidelity is appropriate for the considered application. The surrogate model then serves to efficiently emulate the outputs of that chosen deterministic model within a probabilistic hazard assessment framework.

To clarify this point, we will expand section 3.1 3) Deterministic Simulations*, in the manuscript as follows:

“This step primarily involves selecting and running a numerical model to simulate the landslide-generated tsunamis based on the input parameters generated in the previous step. The surrogate models developed in Landslide-Tsurrogate v1.0 are trained on deterministic tsunami simulations, which therefore constitute a fundamental component of the overall framework. The choice of the numerical model used to generate these simulations should be guided by the physical complexity of the system considered. Depending on the characteristics of the landslide source, the bathymetry, and the relevant hydrodynamic processes, different levels of model complexity may be required. In some cases, depth-averaged shallow-water models may provide adequate accuracy for hazard assessment, while in other settings more sophisticated approaches, such as dispersive or fully three-dimensional models, may be necessary to properly represent the generation mechanism and the resulting wave field. The surrogate model does not impose constraints on the deterministic solver and can in principle emulate the outputs of any numerical model, provided that the training dataset sufficiently samples the parameter space and that the underlying simulations capture the relevant physical processes. Consequently, the reliability of the probabilistic hazard estimates ultimately depends on the adequacy of the deterministic model used to generate the training simulations. [the rest of the section (describing different models available) remains unchanged]”

We will also justify the use of Multilayer HySEA in the Mayotte configuration in subsection 4.2.1 Deterministic Model Setup by modifying the second paragraph as follows:

“All the simulations are performed with the layer-averaged version of the HySEA model family (i.e., Multilayer HySEA; Macias et al., 2021a,b) described in Appendix A. This model couples the landslide dynamics and the generated water waves through a friction term between landslide and water layers. Multilayer HySEA has been shown to be well suited to simulate landslide generated tsunamis in Mayotte. Indeed, a multilayer configuration is required to properly describe the effect of the strong topography variations related to the presence of a coral reef while keeping a reasonable computational cost compared to full 3D models. This enables

performing the numerous simulations required for the surrogate model (Marboeuf et al., 2025). Parameters are set according to Marboeuf et al. (2025). [the rest of the section remains unchanged]"

- *Moreover, the deterministic simulations rely on several crucial (sometimes arbitrary) assumptions: i.e., landslide locations, volumes and composition, rheological parameters, shape, extension and geometry of the failure surfaces, etc. These are characterized by huge uncertainty. Since the surrogate models builds upon the deterministic simulations results, these assumptions, or, more importantly, the criteria used to select the input parameters, are crucial. These aspects should be better discussed in the manuscript as in the current version of the manuscript are not properly addressed.*

Answer: Thank you for raising this important point. We agree that deterministic landslide-tsunami simulations rely on several assumptions regarding landslide characteristics, including location, volume, geometry, rheological parameters, and initial conditions. These parameters are often poorly constrained in real-world settings and therefore represent a major source of uncertainty in landslide tsunami hazard assessments.

The objective of the Landslide-Tsurrogate v1.0 framework is precisely to account for this uncertainty by explicitly representing these quantities as stochastic variables. Rather than relying on a single deterministic scenario, the framework allows the user to define probability distributions or plausible ranges for key landslide parameters such as location, volume, friction angle, and geometric characteristics. The surrogate model is then trained on deterministic simulations performed at collocation points in this stochastic parameter space, enabling efficient propagation of parameter uncertainties to the tsunami hazard metrics.

The sparse Gauss–Patterson quadrature used in the framework does not determine the parameter ranges themselves but provides an efficient strategy for sampling the stochastic parameter space once the variables and their distributions have been defined. This approach significantly reduces the number of deterministic simulations required to construct the surrogate model while maintaining accuracy.

We acknowledge that the selection of the stochastic variables and their probability distributions is a critical step that depends on the available geological, geotechnical, and geomorphological information at the site of interest. In practice, these parameters may be informed by slope stability analyses, sediment properties inferred from direct measurements or seismic surveys for example, geomorphological mapping, historical landslide inventories, or expert judgment. In situations where limited information is available, broader parameter ranges may be adopted to reflect epistemic uncertainty.

To clarify these aspects, we have expanded the discussion in the manuscript to better emphasize that the definition of the stochastic variables and their probability distributions is a user-driven step that should be guided by site-specific geological and geotechnical knowledge.

To clarify this point, we will rewrite section 3.1 1) User Specifications*, in the manuscript as follows:

"This step involves defining the stochastic variables used to represent the uncertain characteristics of potential submarine landslides. These variables describe the physical and geometric properties of the landslide source and can be grouped into three main categories: (1) soil parameters, such as cohesion, friction angle, and density; (2) landslide geometry, including the thickness, length, width, and orientation of the shapes used to represent the landslide volume initially released; and (3) initial conditions, such as the mean sea level, which may vary due to tidal fluctuations and long-term sea-level rise.

In principle, the initial released mass and failure characteristics of a submarine landslide could be determined using mechanical slope stability models that incorporate measured soil properties (e.g., density, cohesion, internal friction angle), as well as hydrogeological conditions, structural discontinuities, and fault networks. However, such detailed information is rarely available for offshore environments. Consequently, many landslide properties remain poorly constrained and represent a major source of epistemic uncertainty in landslide-tsunami hazard assessment.

Within the Landslide-Tsurrogate v1.0 framework, these uncertainties are explicitly represented through stochastic variables. Potential landslide locations, for example, may be identified using geomorphological indicators such as steep seabed slopes, sediment accumulations, previously mapped instability features or areas experiencing high seismicity. Landslide volumes, geometric parameters, and rheological properties can then be sampled within plausible ranges derived from regional geological knowledge, previous studies, or expert judgment. Similarly, mean sea level can be treated as an additional stochastic variable to capture the nonlinear interactions between tsunami propagation, tidal variability, and long-term sea-level rise.

By representing the uncertain landslide characteristics using a limited set of stochastic variables (e.g., location, volume, friction angle, and sea level), the dimensionality of the problem can be kept manageable while still capturing the dominant sources of uncertainty affecting landslide-generated tsunamis. These variables define the stochastic parameter space used to generate the deterministic landslide-tsunami simulations required to construct the surrogate models. The stochastic space is subsequently sampled using sparse quadrature rules, allowing the surrogate models to efficiently approximate the response of the deterministic simulations across the range of possible landslide scenarios.

Finally, it is important to note that the definition of stochastic variables and their ranges is inherently site dependent. Some uncertainties reflect natural variability in environmental conditions (aleatory uncertainty), while others arise from limited knowledge of subsurface properties and landslide triggering mechanisms (epistemic uncertainty). The proposed framework does not prescribe a unique parameterization but instead provides a flexible structure for propagating these uncertainties through the deterministic simulations.”

We will explicitly justify the choice of the three stochastic variables for the Mayotte application by modifying the paragraph at line 485 in subsection 4.1 Steps 1 and 2: User Specifications and Input Parameters:

“Lemoine et al. (2020), Poulain et al. (2022) and Marboeuf et al. (2025) provided numerical simulation of potential submarine landslides and associated tsunamis in Mayotte, related to the on-going seismo-volcanic activity. They showed that the most impacting submarine landslide scenarios were located on a large portion of the transition between the lagoon and offshore zones, presenting the steepest slopes. The volume of these landslide scenarios varies greatly. Consequently, both the location and volume have been chosen as stochastic variables. In this first attempt to apply the Landslide-Tsurrogate v1.0 framework, we limit the number of stochastic variables to three. Given the uncertainties around friction angles in the landslide rheology and their high impact on the granular flow and deposit, friction angles are selected as the last stochastic variable.Furthermore, of all the free parameters involved in the model, it has been shown that these friction angles have the strongest impact on the wave field, compared to the Manning coefficient and the interlayer friction coefficient.

In this study, submarine landslide locations are pragmatically located along the isolines of steepest slope close to the seismic swarm related to the seismo-volcanic activity. [the rest of paragraph line 489 remains unchanged.] ”

- *Finally, it is clear that the surrogate model is highly computationally efficient. Nevertheless, a very important information to be provided is the exact number, or a detailed discussion on the criteria to select the exact number, of the deterministic simulations to be carried out (in general and for the considered study case) and their computational costs.*

Answer: To clarify this point, we will rewrite section 3.1 2) Input parameters, in the manuscript as follows:

“This step is critical in constructing the surrogate models within the Landslide-Tsurrogate v1.0 framework. It involves generating the input parameter sets for the deterministic simulations.

The input parameters correspond to the stochastic variables used to describe the physical and geometric properties of the landslides. Once these stochastic variables and their probability distributions have been defined in the previous step, a sparse Gauss–Patterson quadrature is constructed up to a user-defined total order P. The quadrature nodes—representing collocation points in the stochastic parameter space—are mapped from the canonical space to the physical space. Each combination of parameters defines a deterministic landslide scenario that is then simulated using a numerical landslide-tsunami model.

The total number of deterministic simulations N is determined by three main factors: (i) the number of stochastic variables d, (ii) the total polynomial order P used to construct the surrogate model, and (iii) the quadrature strategy adopted (Gauss–Patterson or dependent Gauss–Patterson). In practice, increasing either the number of stochastic variables or the total order increases the number of collocation points required to accurately represent the stochastic space. The quadrature rule determines how efficiently this space is sampled.

For example, using six stochastic variables and a total order of $P = 5$, the number of required simulations is $N = 10{,}625$ with the Gauss–Patterson sparse grid and $N = 1{,}889$ using the dependent Gauss–Patterson (DGP) approach. The DGP method therefore provides a substantial reduction in the number of deterministic simulations while maintaining comparable surrogate accuracy.

The choice of P represents a trade-off between surrogate model accuracy and computational cost. Higher orders improve the ability of the surrogate model to represent nonlinear interactions between parameters but require more deterministic simulations. Because each deterministic simulation involves

running a full numerical tsunami model, this stage represents the dominant computational cost of the framework.

For this reason, surrogate models can be constructed incrementally by truncating the polynomial expansion to lower orders (e.g., $P = 4$) and only generating additional deterministic simulations to reach the polynomial order needed for the convergence of the surrogate models (e.g., $P_t = 5$).”

- *These aspects should be specifically quantified and discussed for the considered case study. In any case, it would be important to provide guidelines for the application of the framework.*

Answer: To clarify this point, we will rewrite the section 4.1 from line 506 in the manuscript as follows:

“Practically, for each of the five selected zones, the Landslide-Tsurrogate v1.0 framework is implemented with three stochastic variables: the along-isoline distance from the northernmost point (D), the volume of the submarine landslide (V), and the friction angle (δ). These variables are defined using uniform probability distributions based on the range of physically plausible values derived from geological and geomorphological constraints, and expert knowledge:

[equations remain unchanged]

For the maximum total order corresponding to $P_t + 1 = 6$ selected for the Mayotte test case, the number of combinations of the three stochastic variables [Eq. (14)–(18)] that define the input parameters of the deterministic simulations is $N = 207$ per zone. This number results directly from the Gauss–Patterson sparse quadrature construction for three stochastic variables and a polynomial expansion of total order $P_t = 5$.

In practice, the surrogate model is constructed using a training dataset consisting of $N = 135$ deterministic simulations per zone corresponding to $P_t = 5$, while the remaining 72 simulations are used as an independent testing dataset to assess the predictive performance and robustness of the surrogate model. Consequently, a total of 1035 deterministic simulations are required to construct and validate the surrogate models across the five defined zones.

The choice of $P_t = 5$ represents a compromise between surrogate accuracy and computational cost and depends on the convergence of the surrogate models that will be further discussed in section 4.3.2. Lower orders may not adequately capture nonlinear interactions between landslide parameters, while higher orders

would significantly increase the number of required deterministic simulations. For tsunami applications with a limited number of stochastic variables (typically $d \leq 4$), polynomial orders in the range $P_t = 4 - 6$ provide a suitable balance between accuracy and computational efficiency (e.g., Denamiel et al., 2019).

More generally, the number of deterministic simulations required by the Landslide-Tsurrogate framework depends primarily on the number of stochastic variables and the selected polynomial order. In practical applications, it is recommended to (i) limit the number of stochastic variables to the most influential physical parameters and (ii) select a polynomial order that captures the dominant nonlinear behavior without excessively increasing the number of deterministic simulations. The computational cost associated with these deterministic simulations and the parallelization strategy adopted for the Mayotte test case are discussed in Section 4.2.1."

Answer: We will also add the following paragraph at the end of section 4.2.1 in the manuscript:

"To quantify the computational performance of the Landslide-Tsurrogate v1.0 framework for the Mayotte test case, the cost of the deterministic simulations required to construct the surrogate models using Multilayer HySEA is addressed. Each deterministic simulation required approximately 50 minutes of runtime when executed on 1 NVIDIA GPU A100 card (40GB) of the S-CAPAD/DANTE platform at IPGP, France. Because the simulations associated with the quadrature nodes are independent, the training dataset was generated using a parallel workflow in which multiple deterministic simulations were executed simultaneously. A total of 1035 simulations were required to construct and validate the surrogate models across the five landslide zones considered in this study. When distributed across 6 GPU cards, the total wall-clock time required to generate the full dataset was approximately 5.6 days, whereas the equivalent sequential runtime would be approximately 36 days. This parallelization strategy substantially reduces the computational burden associated with constructing the surrogate models and makes the framework tractable for large parameter studies or probabilistic hazard analyses involving multiple potential landslide sources."

> *2) In its current form, some parts of the manuscript read more like a user manual than a scientific paper. This is not merely a stylistic issue; rather, the presentation does not adequately convey the points of novelty, nor does it sufficiently emphasize the limitations and/or the assumptions of the proposed framework. Some sections (e.g., Section 3.2, Technical description) are not particularly relevant from a scientific perspective. Similar*

> *considerations apply to Figures 4, 5, and 13. In my view, both Section 3.2 and Figures 4, 5, and 13, should not be included in the main manuscript but rather provided as supplementary material. Therefore, I strongly recommend a reorganization of the manuscript aimed, on the one hand, at avoiding the "user manual" effect and, on the other hand, at emphasizing the novel aspects of the present work.*

Answer: We thank the reviewer for this constructive suggestion regarding the structure of the manuscript. We agree that some parts of the technical description may resemble a user-oriented documentation of the model. However, as this manuscript is submitted to Geoscientific Model Development, providing a clear and transparent description of the model implementation is an important requirement of the journal to ensure reproducibility and usability by the community.

Following the reviewer's recommendation and to improve the readability of the manuscript, we will reorganize the paper accordingly. Section 3.2 (Technical description), which details the practical implementation of the Landslide-Tsurrogate framework, will be moved to the Appendix. This restructuring will allow the main manuscript to focus more strongly on the scientific aspects of the framework, including the methodological development, the probabilistic modelling strategy, and the application to the Mayotte case study, while still making the full technical description available for users interested in implementing the model.

Regarding Figures 4, 5 and 13 these figures will also be transferred to the Appendix together with the technical description they illustrate.

Overall, this reorganization aims to maintain the level of transparency expected for model description papers while improving the focus and readability of the main manuscript.

> *3) The limitations of the present framework are not adequately presented or discussed. This aspect also relates to point 1). While the proposed approach appears useful and promising, like any model it is affected by limitations and shortcomings. These should be more thoroughly discussed and clearly emphasized, particularly in view of applying the framework to generic sites rather than only the considered case study. I therefore recommend explicitly describing and discussing the limitations of the approach, possibly in a dedicated section or subsection.*

Answer: We thank the reviewer for this important comment. We agree that a dedicated section describing the limitations of the model is needed and will be added as follows:

"5. Limitations

While the Landslide-Tsurrogate v1.0 framework provides an efficient approach for propagating uncertainties in landslide-generated tsunami hazard assessments,

several limitations should be acknowledged. These limitations arise from the assumptions made in the representation of landslide sources, the deterministic numerical simulations used to construct the surrogate models, and the surrogate modelling approach itself.

5.1 Surrogate modelling approach

The Landslide-Tsurrogate v1.0 framework relies on gPCE to approximate the response of the deterministic landslide–tsunami simulations across the stochastic parameter space. While gPCE provides an efficient and mathematically rigorous surrogate modelling approach, it also introduces specific limitations that must be considered.

First, the construction of a polynomial chaos surrogate requires that the quantity of interest be defined for all deterministic simulations corresponding to the quadrature nodes. In practice, this means that all model evaluations must return finite values. However, in tsunami simulations certain output variables—particularly those related to coastal inundation—may exhibit undefined or discontinuous behavior. For example, at locations where the tsunami does not reach the coastline for some parameter combinations, quantities such as maximum elevation, time of arrival or maximum speed extent may be zero or undefined, while they become positive for other combinations. These wet–dry transitions introduce discontinuities in the response surface that are difficult to represent accurately with polynomial expansions.

Second, polynomial surrogate models generally perform best when the system response varies smoothly with respect to the stochastic parameters. In the context of landslide-generated tsunamis, strongly nonlinear processes such as shoreline interaction, or abrupt changes in landslide mobility can introduce localized nonlinearities or threshold effects. These behaviors may reduce the convergence rate of the polynomial expansion and lead to reduced surrogate accuracy unless sufficiently high polynomial orders are used.

Finally, inundation-related quantities of interest, such as maximum run-up or flooded area, are particularly challenging to represent within the gPCE framework because they depend on complex wetting–drying dynamics and may exhibit non-smooth spatial patterns. For this reason, the present implementation primarily focuses on tsunami wave characteristics at locations outside of the inundation zone, where the response is generally smoother and more amenable to polynomial approximation. Extending the framework to accurately represent inundation processes may require alternative surrogate modelling strategies or hybrid approaches combining gPCE with other statistical or machine learning methods.

5.2 Deterministic modelling strategy

The accuracy of the surrogate models ultimately depends on the ability of the underlying deterministic numerical model to represent the physical processes governing landslide-tsunami generation, propagation, and coastal interaction. The surrogate model does not introduce new physical information but rather approximates the response of the deterministic model across the stochastic parameter space. Consequently, any simplifications or inaccuracies in the deterministic model are directly inherited by the surrogate model.

In particular, the representation of submarine landslide dynamics may vary significantly depending on the assumptions made in the models (e.g., rigid-block motion, depth-averaged granular flow models, or fully coupled hydro-mechanical approaches). The suitability of a given model depends on the characteristics of the considered site, including bathymetric complexity, sediment properties, and the expected failure mechanisms. For some environments, simplified landslide parameterizations may provide reasonable approximations of tsunami generation, whereas other cases may require more advanced three-dimensional or multilayer models to capture complex flow behavior and landslide–water interactions. The present framework is therefore not tied to a specific deterministic model but relies on the user to select an appropriate model for the site under investigation.

Furthermore, in the Mayotte test case, submarine landslides are represented using simplified geometric parameterizations (e.g., paraboloid shapes for the initial mass released) and a limited number of stochastic variables describing their location, volume, and rheological properties. While this representation allows the dimensionality of the stochastic space to remain manageable, it necessarily simplifies the complex geometry and mechanical behavior of real submarine landslides.

Natural submarine slope failures may involve irregular geometries, heterogeneous sediment properties, progressive failure mechanisms, or multi-stage collapses. Such processes may not be fully captured by simplified parametric representations. As a result, the surrogate models should be interpreted as providing probabilistic estimates of tsunami hazard for a range of idealized landslide scenarios rather than precise predictions of specific failure events.

5.3 Dimensionality of the stochastic parameter space

The efficiency of the surrogate modelling approach depends strongly on the number of stochastic variables used to describe the system. As the number of uncertain parameters increases, the number of deterministic simulations required to construct accurate polynomial surrogate models grows rapidly. Although sparse quadrature methods substantially reduce the number of required simulations compared with full tensor grids, the approach may still become computationally demanding when the dimensionality of the stochastic space is large.

For this reason, the framework is best suited to applications where the dominant sources of uncertainty can be represented by a relatively small number of stochastic variables (up to 6). In practice, careful parameter selection and sensitivity analysis may be necessary to identify the most influential parameters and avoid unnecessary expansion of the stochastic space.

5.4 Representation of uncertainty

The Landslide-Tsurrogate framework represents uncertainty through prior probability distributions assigned to the stochastic variables describing landslide characteristics and environmental conditions. The definition of stochastic variables and their probability distributions are inherently site dependent. Bathymetric conditions, sediment characteristics, tectonic setting, and coastal morphology all influence landslide dynamics and tsunami propagation.

However, in many practical applications, the available geological and geotechnical information may be limited, and the choice of probability distributions may rely partly on expert judgment or regional analogues. Due to these limitations, the prior distributions of all stochastic variables are assumed uniform in the current version of the Landslide-Tsurrogate framework. As a result, the probabilistic outputs of the framework reflect both natural variability and epistemic uncertainty associated with limited knowledge of the system.

Future applications could benefit from improved constraints on landslide occurrence, sediment properties, and triggering mechanisms, which would allow more realistic parameter distributions to be defined. Consequently, future developments of the Landslide-Tsurrogate framework should include the possibility to build surrogate models with non-uniform prior distributions of the stochastic variables.

In summary, the Landslide-Tsurrogate framework should be viewed as a flexible methodological approach that can be adapted to different environments. Applying the framework to other sites requires careful consideration of the local geological setting, the selection of appropriate deterministic models, and the definition of stochastic

variables that adequately represent the dominant uncertainties affecting landslide-generated tsunamis.”

Specific points:

- *L79-80. “Since monitoring such landslide-generated tsunamis is not currently state-of-the-art, achieving this goal necessitates a numerical modeling approach.” It is not clear what the Authors meant with this sentence. Please, explain/reformulate/remove.*

Answer: We thank the reviewer for pointing out that the sentence was unclear. Our intention was to emphasize that submarine landslides themselves are rarely monitored or detected in real time, which makes numerical modelling approaches necessary for hazard assessment. The sentence will be removed.

- *L80-81. “However, executing ensembles of landslide-tsunami simulations in real time is computationally prohibitive.” It is not clear to me why ensembles simulations should be performed in real-time. PTHA is based on carrying out many simulations before the potential event, aiming at exploring the uncertainty in the parameters space. Based on the results of the PTHA real-time simulations might not be computationally expensive. In fact, they are currently used for Tsunami Early Warning Systems (TEWS) purposes.*

Answer: We thank the reviewer for this comment. Our intention was not to suggest that ensembles must necessarily be performed in real time. Rather, we intended to emphasize that exploring the large uncertainty associated with submarine landslide parameters requires evaluating many tsunami simulations, which can be computationally expensive when using full numerical models. We will reformulate the sentence in the revised manuscript to clarify this point and avoid confusion with the scenario databases used in operational Tsunami Early Warning Systems:

“However, exploring the uncertainty associated with submarine landslide parameters would require evaluating large ensembles of landslide–tsunami simulations. Running such ensembles with full numerical models can be computationally prohibitive, which motivates the development of surrogate modelling approaches capable of rapidly approximating the system response across the stochastic parameter space.”

- *L308-310. “The balance between numerical cost and accuracy is thus constraint by the availability of computational resources which, practically, plays a crucial role on the choice of the numerical model and simulation setup.” See comment 1).*

Answer: please see reply in point 1) above.

- *L663-665. “Across all zones and most locations, landslide volume emerges as the dominant contributor to output variance of the maximum elevation and speed, with its* *sensitivity index typically approaching or exceeding 0.75. This finding underscores the central role of landslide magnitude in determining tsunami hazard intensity. The landslide location shows variable importance depending on the region and metric." These are expected and well-known aspects, not new findings of the present work. Please, reformulate/remove.*

Answer:

"Across all zones and most locations, landslide volume emerges as the dominant contributor to the output variance of the maximum elevation and flow speed, with its sensitivity index typically approaching or exceeding 0.75. This result is consistent with the established understanding that the magnitude of the failing mass strongly controls the intensity of landslide-generated tsunamis. Rather than representing a new physical insight, this outcome provides an important consistency check, confirming that the surrogate modelling framework correctly reproduces the expected physical sensitivities of the system. The landslide location shows a more variable influence depending on the region and the considered metric, reflecting the role of local bathymetric conditions and coastal geometry in modulating tsunami propagation and coastal impacts."

- *L692-693. "An important aspect of the Mayotte submarine landslide test case is the emphasis on user-friendly interfaces (Fig. 13) that allow both researchers and decision-makers to interact with probabilistic tsunami hazard data efficiently." I am not sure about the usefulness of Figure 13 as it is not clear the scientific content of the figure itself. See comment 2). I suggest removing this figure and/or providing it as an appendix/supporting information. The same considerations apply to Figures 4, 5, Section 3.2 Technical description.*

Answer: please see reply in point 2) above.