Authors' comments - REVIEWER#1

This study investigates the potential tsunami hazard from landslide scenarios in the Gulf of Pozzuoli using a sequence of numerical models. The authors present four scenarios (three submarine and one subaerial) and simulate the associated tsunamis using both shallow water (SW) and non-hydrostatic (NH) models. The study addresses important local hazard concerns in a densely populated coastal area. While the paper is generally well-structured, several critical aspects require clarification and improvement before the manuscript can be considered for publication.

We thank the reviewer for the insightful and constructive remarks, improving consistently the paper clearness and efficacy. In the following, the reviewer's comments are reported in black, and our replies and comments in red.

Major Comments

Landslide Scenario Definition and Assumptions

The tsunami waveforms generated by landslides are sensitive to the initial conditions, including the location, volume, geometry, and material properties of the sliding mass. The authors mention that the four scenarios were constructed based on a "worst-case credible" approach. However, the paper lacks sufficient detail on how the initial conditions, especially volume and geometry, were determined. The cited reference (Zaniboni and Armigliato, 2025) is listed as a work in progress and is not yet available, making it difficult to assess the robustness of the scenarios.

The citation refers to a book chapter that was supposed to be published last year. Unfortunately, it faced many difficulties in the editing process and now it still in progress. Another reference will be provided (Tonini et al., 2011), describing the approach and its application to the specific case of the town of Catania (Sicily, South Italy). However, we believe that the "worst-case credible" approach is not completely suitable for this investigation, due to the lack of detailed surveys mapping the Gulf of Pozzuoli seabed and to the rapidly changing morphology of the area: then it will be adopted and described, with its limitations and cautions properly addressed. As to the strategy of the scenario selection and definition, it has been outlined in the respective subsection in Discussion chapter.

Moreover, the assumption that geotechnical and geomorphic properties are similar across all four scenarios is not justified or even explicitly stated. This assumption should be clarified, as differences in material properties can significantly influence landslide dynamics and tsunami generation. For instance, variations in density, cohesion, yield strength and/or internal friction angle can lead to different failure mechanisms and velocities, thereby affecting the characteristics of the generated tsunami waves.

The authors should provide more detailed explanations for each scenario's setup, including volume estimates, slope angle, and material assumptions. If geotechnical properties are assumed identical across cases, this simplification should be clearly stated and discussed, along with a justification for why this simplification is reasonable in this context.

We agree that the landslide properties can influence deeply the tsunami generation, but the detailed reconstruction of the scenarios requires detailed surveys and characterization of the deposits. Such tasks are far beyond the purposes of this work which, indeed, could stimulate further investigations in the area. However, some of these considerations will be added in the landslide scenario sub-section of the Discussion and in the Conclusions.

Tsunami Generation Mechanism and Modeling Approach

The modeling approach uses a one-way coupling scheme, where landslide motion is simulated independently and used as input for tsunami generation and propagation. This approach, while computationally efficient, may be insufficient to capture certain physical mechanisms, particularly for subaerial landslides like scenario 4, where the interaction with the water column is highly dynamic and nonlinear. In reality, the water displaced by the landslide can, in turn, influence the landslide's motion.

This is true, but for example in Harbitz et al. (2006) it is stated that, based also on previous studies, the velocity of the landslide front could be reduced of up to 20% by the interaction with the wave it generates. Though not irrelevant, this effect does not affect consistently the generated tsunami and its propagation in the Gulf of Pozzuoli, which is the main focus of this work.

The subaerial case involves a mass plunging from above sea level into the water with high velocity, which contrasts with the more gradual submarine slope failures of the other scenarios. Given these differences in physical processes, it is unclear whether the same numerical treatment is equally valid for both types of landslide.

The two landslide motions are quite different, but the mechanism of tsunami generation is the same, i.e. the uplift of the whole water column due to the passage of the sliding mass on the seabed. Other highly non-linear processes occur in the landslide-water interaction for subaerial cases, but they usually generate effects only in the near field, dissipating quickly with distance from the crash area. In this view, we believe that the modelling approach is suitable for both typology of movement. We'll add some references to cases of subaerial landslides producing tsunamis where our approach produced very good results (Scilla 1783 landslide-tsunami, for example).

The authors should justify the use of the same modeling framework across all scenarios and clearly discuss the limitations of their approach, especially regarding the subaerial case. They should acknowledge the potential limitations of the one-way coupling and discuss how this might affect the accuracy of their results.

Some sentences on this regard will be added in the section describing the modelling approach and in the Discussion section.

Role of Froude Number and Energy Transfer Efficiency

A crucial omission in the discussion of tsunami generation is the role of the Froude number Fr=U/gH, which characterizes the relationship between the landslide velocity (U) and the shallow water wave speed (gH). When the Froude number approaches 1, energy transfer from the landslide to the water is most efficient due to resonance-like effects. This can lead to significant amplification of the generated waves.

While the authors analyze landslide velocities and acknowledge the influence of slide speed and dispersion, they do not discuss the possible amplification effects that occur when the slide velocity approaches the wave celerity. This is particularly relevant for Scenario 4.

The authors should discuss whether any of their scenarios reach near-critical Froude conditions and, if so, whether their model can appropriately represent the associated amplification. Even a simplified estimation of the Froude number for each case would enhance the paper. This analysis would provide a more complete understanding of the tsunami generation process and its potential impact.

We totally agree with this view. The Froude number (defined as $U/\sqrt{gh}$) is a precious indicator of the efficiency of the energy transfer from the mass to the water. We will add its estimation in the plots for each scenario and discuss it accordingly.

Minor Comments:

L9 "consisting into" -> “consisting of”

Ok

L38 “In the specific” -> “Specifically”

Ok.

L43 “assessing” -> “by assessing”

Ok.

L128 "with no back-interactions considered" -> "and back-interactions are not considered"

Ok.

L134 “a finite time” ->unclear since an earthquake occurs in a finite time. Consider rephrasing to something like "a non-instantaneous generation process" or "a generation process that evolves over time".

Ok.

Table 2 - I do not think Table 2 is necessary. We may replace it by a paragraph. Also Table 2 was wrongly referred to at L284 and L308. They should be Table 3 instead.

We agree, Table 2 will be removed, and numbering and references adjusted accordingly.

Figure 1&2 - Two figures can be combined.

We prefer to leave them separated: Fig.1 gives a general overview of the area, including the whole Gulf of Naples, while Fig.2 focuses on the area object of the study, with some toponyms that will be cited later and that wouldn’t be discernable in a larger map.

Figure 3 is almost identical to Figure 2&4 of Aiello et al. (2012). I am concerned about the permission to use these figures. The authors should provide confirmation that they have obtained the necessary permissions to reproduce or adapt these figures.

Figure 3 will be designed from scratch, based on the plots in Aiello et al (2012), to avoid copyright issues.