Review of: **Long-term hazard of pyroclastic density currents at Vesuvius (Southern Italy) with maps of impact parameter**

This work considers four impact parameters (dynamic pressure, particle volumetric concentration, temperature, and flow duration) of PDCs at Vesuvius using the deposits of six prior (well-preserved) events. Overall, the manuscript is structured well, with sufficient mathematical detail in the appendix for a reader to follow the process.

My main concern is that the probabilistic components are not being handled correctly – specific examples include Figure 3b and c (where percentile lines are either in the wrong order or cross each other), and the final hazard maps (Figure 7) that appear to be a mishmash of some probabilities, some summation, and no consideration of conditional probabilities (e.g., the probability of a PDC given an eruption), or the potential for future events exceeding the parameters of the six PDCs used. However, I think these issues can be resolved without substantial effort.

**Main comments:**

**1 – The limitations of only 6 PDC deposits:** This may be a necessary limitation of the study, but its limits are not discussed, the deposits used were selected due to their preservation state and continuity. Presumably larger deposits are more likely to be preserved – is deposit preservation effected by location? Whether the PDC occurred before heavy rainfall? Lahars? Ash deposits occurring simultaneously? Does current topography reflect that of the region during each PDC deposition event? Etc. etc.

**2 – Claim that "there is not any correlation between eruption size and PDC intensity"** (Line 298): This is a bold statement provided without any corroborating references. Additionally, do the authors also think that there is no correlation between eruption size and PDC occurrence?

**3 – "Hazard maps**": Not convinced these are hazard maps under any of the current definitions, Figure 7 is useful, but is not a hazard map (see figure comments below).

**4 – Text:** There are quite a few places where the English/grammar needs to be corrected. I have tried to identify most of these, but I cannot guarantee I got all of these.

**Line-by-line:**

Line 9: basing → based

Line 21: in the impending of an eruption → in the likely event of an eruption? Under conditions of an impending eruption?

Line 35: affects → affect

Line 38: unvaluable → invaluable (??)

Line 40: not sure if it's "the hazard of a volcano", it's the PDC hazard during an eruption from a volcano

Lines 43-44: Sentence needs rewriting, and 700,000 not 700.000

Line 51: Suggest removing "This is the way the paper is organized"

Line 56: Pompei → Pompei's

Line 62: "outcropping continuity" probably needs a bit more explanation – how much continuity does a PDC require for its inclusion in your database?

Lines 69-71: I disagree with this statement, using only the PDCs with well preserved deposits almost definitely biases you towards the larger events and in no way are "all the suitable PDC-forming eruptions…considered"

Figure 1: A map of the locations of these deposits would be greatly beneficial, and maybe put the letters on Fig 1c in white? Hard to see in black.

Line 98: extra space between to and a

Lines 108-110: Sentence needs rewriting, and through not trough, and maybe by not from?

Line 130: help constraining → helped constrain

Line 147: ref needs fixing

Line 150 and Line 158: statistic → statistical

Figure 3: Apart from the issues with the percentile lines, I found this figure relatively hard to follow in the text – these are for a single point along the flow? Where the flow depth is 50 m? Maybe a bonus figure before this showing where the cross section is taken might help?

Table 1: Most of these are actually mainly referred to in the Appendix, I wonder if a subsection would be more beneficial here? Or move the whole table to the appendix where the bulk of the maths is anyhow?

Line 175: Is A13 the correct equation for flow temperature??

Line 183: by integration here – is this integrating over the 0 to 100%iles at 10m? Even then, 0.001 might be hard to get to?

Line 184: extra space between of and the

Line 193: remove "value of"

Line 194: What is section 14 of figure 2??

Line 201: flows occurred → flows that occurred

Line 222: DH → delta H

Lines 257 and 260: There has already been and equation (1) and (2)

Figure 5: This is quite hard to read, maybe remove the infrastructure data here or something?

Table 2: Suggest this goes to Appendix

Lines 298: As before – needs references / extra support for this statement

Line 300: "not weaker" is a bit vague – what parameters are you talking about here?

Lines 309-310: Does this addition of zeros force the contours to not enter these areas? Where were the zeros added? Is this saying that future PDCs can never reach locations they have not been to before?

Figure 7: This is a great way of showing the difference in impact parameters across a map but I cannot make the leap to "hazard map". What is the statement you would make associated with a point, e.g., at Afragola airport – what is the hazard there? Is it not "Given an eruption in the next 50 years the exceedance probability….", it is not "In the next eruption we would expect…..", what is the hazard-based statement you can get from these?

Line 322: differentiating → differentiate.

Line 380: "consider the PDCs of all eruptions" → nope, you've considered (and summed essentially) the 6 largest (assumed due to best-preserved) PDCs from previous eruptions.

Line 379: exceeds → exceed

Lines 391-392: Highly speculative here, suggest removal.

Lines 394-397: I don't think you did a "probabilistic approach that accounts for the variability of the intensity…"

Lines 408-410: Same big claim again – requires references.

Line 434: "also the higher end of epistemic uncertainty." → no idea what this means here

Line 478: extra ")" needs removing