The Authors thank the anonymous reviewers for their time. We respond to the each review in order (RC1, RC2) below, where the original text from each reviewer comment is shown in quotation marks with italicised text and our response is shown directly below it.

Reviewer #1:

"The manuscript is intended to be an illustration of the value of kymography to analyse Taylor bubbles flows, which are extensively studied in volcanology, in transparent pipes. As such, this work is clearly in the scope of Geoscientific Instrumentation, Methods and Data Systems. Although the first section of the text (1.1) discusses mainly the importance of characterising the dynamics of bubbles ascending volcanic conduits for understanding the transition from effusive to effusive volcanic activity, the dimensionless parameters of the flows studied in the article are not all comparable with volcanic conditions ; the paragraph 2.1 addresses this issue, explaining that water was included in the study because of its prevalence in the literature, which seems relevant. The methodology used to generate the kymographs is thoroughly detailed, as well as the computations done to extract the key flow parameters from the kymographs. The errors caused by the manual pixel selection and by the distortion induced by the camera lens are quantified, and the correction of the refraction at the tube boundaries is well-explained in Appendix 5. It should be stressed that the raw kymographs as well as the scripts mentionned in the Appendix 4 and 6 are provided by the authors, which constitutes good research practice. As a conclusion, i find the study interesting and serious enough to be accepted, even though i have a few remarks and suggestions."

We thank Reviewer 1 for their careful reading of the manuscript and for their positive and constructive assessment of the study. We are grateful for their recognition of the relevance of the work in contribution to the overall scope of the journal, the detailed methodological description, and the provision of data and scripts as part of good research practice. The comments and suggestions left by the reviewer have been taken into account to improve the clarity and presentation of the manuscript. Specific feedback is addressed below, point by point, for clarity.

"- On figure 4 : the differences between manual evaluation and kymograph measurements are more important with water than with glycerol-water, which is not really mentioned in the paragraph 2.4. The same remarks applies to figures 5 and 6."

This difference occurs as a result of the differing resolutions in kymographs generated from turbulent vs laminar flows; turbulent flows are unstable and exhibit oscillating and unpredictable behaviours, thus there is naturally more variation in the data than when conditions are stable, and there is little variation in the data within the same experimental condition. This behaviour is outlined in section 2.3 (lines 270 – 277), where some additional text has been added to indicate examples of this in the trends observable in later sections for clarification and in line with the reviewer feedback.

"- In 2.4 (l 291), it would be better to express the margin as a relative error rather than an absolute one."

The relative error margin has been added alongside the absolute error in line 322.

"- Appendix 4 : Should the angle on the left-hand member of equation 4 not be theta_PVC rather than theta_air ?"

The authors are in agreement and the equation was adjusted according to the reviewer feedback.

"- Figure 3 : The kymographs in (A) are a bit overloaded with captions, which hinders readibility. For instance, it may not be necessary to draw all the dashed lines in the first kymograph."

Figure 4 (previously Figure 3) has been edited to improve the readability of the labels and uncover the underlying kymographs in alignment with reviewer suggestions.

"- Appendix figure 2 Different names should be given to figures B (theorical) and B (experimental) for the sake of clarity."

The two B plots both show the same data variables (experimental with theoretical), which were split into two separate plots to be more easily viewable as many of the datapoints overlap. The reviewer has highlighted a lack of clarity in this Figure; thus the caption of Appendix Figure 2 has been adjusted to better describe what is shown.

Reviewer #2:

"The manuscript entitled "Experimental analysis of Taylor bubble regimes using kymography: a tool for understanding bubble ascent dynamics in open-vent volcanic conduits" is well written and fits the Geoscientific Instrumentation, Methods and Data Systems scope. This paper presents no new concept but rather a proof of applicability of an existing tool, the kymography, to the given problem of Taylor bubbles in volcanic regimes. The paper is well structured and results are relatively clear. The experimental conditions are well described, and the data obtained are provided, which gives a good reproducibility. However, some points (listed below) could improve the overall quality of the present manuscript."

We thank Reviewer 2 for their careful evaluation of the manuscript, and appreciate their recognition of the relevance of the work in contribution to the overall scope of the journal, the clarity of the presented data, the overall paper structure, and the reproducibility of the data. We acknowledge the reviewer comments and suggestions for improving the manuscript; these have been taken into account during revisions to strengthen the quality and clarity of the manuscript. We address each specific point raised below in detail.

"- More discussions about the correlation and relationship between variables should be added."

The authors acknowledge the need for additional discussion of the trends within the data and have addressed this in lines 326-330, 358-362, 391-396, and 425-426.

"- From the title, abstract and conclusion, it is claimed that these experiments help to understand dynamics in volcanoes. But it is not so clear how. What does these experiments bring to the actual understanding ? This should be clarified."

The authors thank the reviewer for this suggestion and acknowledge the need for further clarification on the volcanic applications/implications of the experimental methods; commentary to address this has been added to lines 70-79 and 108-114.

"- Since the tube is cylindrical, there can be optic effects, in the measurement. These effects are taken into account, but only explained in the appendix 4, which is regrettable, since the reader needs this information to fully understand. Appendix 4 could benefit from an optical sketch."

We thank the reviewer for this insightful comment. The effects of optical distortion associated with the cylindrical tube are addressed in the main text (lines 284-289 and 374–383), where we describe how distortion can be effectively corrected for during the measurement process without the need for additional post-processing calculations. We consider this to be the most effective and efficient workflow for kymograph measurements. Appendix 4 presents an alternative method for correcting for distortion which may be of interest to some readers. This was intentionally placed in the appendix alongside a detailed descriptions of the methods used to quantify distortion to maintain the flow of the main text.

"- Table 1 should include dimensionless numbers studied, plus advantage and drawbacks of the techniques used. This could help to emphasize the contribution here. It could also include an optical flow input."

We thank the reviewer for this suggestion. The primary purpose of Table 1 is to summarise the experimental techniques used in the literature to measure Taylor bubble dynamics, rather than to provide a direct quantitative comparison between studies. As such, dimensionless parameters are not included, as they are often not the focus of the cited works and are not used for direct comparison with the data presented in this paper. The relevant dimensionless parameters are introduced and discussed in the subsequent section where their role in demonstrating the scalability of the experiments to volcano-scale processes is made explicit. We thus feel that their inclusion in Table 1 would be premature and potentially detract from the table's intended focus, and would like to exclude this information from the table. Similarly, the advantages and drawbacks of the different measurement techniques are discussed in the main text (lines 132–153) and excluded from Table 1 as to not overcrowd it. An additional row has been added to the digital image processing category to include an example paper wherein optical flow is used to track Taylor bubble motion.

"- Dimensionless numbers definitions used should be explicit because their definitions are not always unique. For example, the Reynolds number, Re, is taken around a characteristic bubble or in the Poiseuille flow ? And explain why they are not fitting with the volcano numbers ? (from Table 2)"

Clarification of the dimensionless parameters as quantities of tube/conduit, liquid/magma, and characteristic bubble properties has been added (lines 189-191) as per the reviewer suggestion. Additional detail surrounding the application and importance of dimensionless analysis in the context of this paper, and an explanation detailing the discrepancy between the lab-scale and volcano-scale Eotvos and Morton numbers have been added (lines 184-196) as well.

"- In mathematical variables, the subscript index should be in Roman style when they are not referring to another variable (but to a word or abbreviation, etc.). "

We are uncertain of the exact changes required here; the equation and naming conventions used throughout the paper follow those used in the source papers.

"- The bibliographic citation (author name + year) should be homogenized (using italic style everywhere for example)."

The in-text references have been adjusted such that their formatting is now homogenous as per the reviewer feedback. The references in the reference list at the end of the paper are formatted in line with the submission guidelines as available on the EGU GIMDS webpage: https://www.geoscientific-instrumentation-methods-and-data-systems.net/submission.html#references

"- In Figure 2, the variable Lb is not consistent in the way it is measured between the top and the bottom of the figure."

This is because on the raw footage the L_b ROI is simply the absolute distance between the nose and tail of the bubble in the image converted from pixels. On a kymograph, L_b is determined using the time coordinates as detailed in section 2.5, thus the measurement ROI is drawn in the y-direction. Figure 3 (previously Figure 2) simply expresses the required line ROIs for measuring the same parameters in the raw footage vs the kymograph. Clarifying text has been added to the caption of Figure 3 to indicate this more clearly.

"- In Figure 3, caption and image not on the same page, which does not help the reading."

Figure 4 (previously Figure 3) has been adjusted so that the whole figure caption is on the same page.

"- Adding a figure about the Taylor bubbles in the volcano plumbering could help the pedagogy of the introduction."

An additional figure (now Figure 1) has been added to demonstrate the association of specific subsurface two-phase flow regimes with certain surface volcanic activity to better align with the introductory text as per the reviewer feedback.