Response to Reviewer 1 Comments

First of all the authors need to rewrite this paper, or give it to translate to a native speaker. Now the paper is hard to understand. The introduction needs to be extended and the aim of the work better formulated. The stages of proposed research design need to be clearly explained. Similarly, authors need to explain better the methods they used and clearly present their results. My detailed comments are:

Response: We would like to thank the reviewer for the thoughtful review of the manuscript. The inputs have been very helpful for improving the manuscript. We agree with almost all comments and we revised our manuscript accordingly. We provide a point-by-point response to the reviewer’s comments. All the changes are highlighted in the track changes file attached to this submission. We used the language polishing service of MDPI.

1) Line 14-19: This sentence is so long that it is hard to read and understand it. Please do not use such complicated sentences in this work.

Response: Thank you for your suggestions. Correction has been done.

2) line 39-42: The same as in Abstract this sentence is to long You are using twice and - it's hard to read

Response: Thank you for your suggestions. Correction has been done. The text is as follows:

Stagnant air pockets not only reduce the effective water cross-section, but also reduce the system's water transfer capacity, while at the end of the pipeline, if a valve closed quickly when stagnant gas is present, the pipe may burst, leading to water supply in-terruption and other serious accidents [4].

3) line 172 - what means FS?

Response: FS is the abbreviation of Full-Scale, and we have added comments to the manuscript. The text is as follows:

The pressure sensor was a model HR3202, with a sensing range of -0.1 ~ 1.0MPa, ac-curacy of 0.5% FS (Full-Scale),

4) line 151: Its not a drawing its a picture

Response: Correction has been done.

5) line 156: exhoust pressure is 8kg? kg are the units of mass?

Response: Correction has been done.

6) line 163: its not a diagram its a picture!

Response: Correction has been done.

7) line 172 - what means FS?

Response: FS is the abbreviation of Full-Scale, Correction has been done.

8) line 177 - once again diagram - correct to picture

Response: Correction has been done.

9) line 190: "belive" - such a word should be unuse in technical science. You need to prove someting, we can not belive. Give a reference that someone before You wrote that Engineers belive.

Response: We totally agree with you. Correction has been done. The text is as follows:

Response: In engineering application, the water filling rate is generally between 0.6 and 3.0 m/s, while the pressurized aqueduct system air content should be 5-10%, and undulating sections of pipes usually have a higher air content [2, 29].

10) line 196: What means Outlet pressure in table 2 that value is 0 (is it perfect vacuum?). Pressure should be displayed as absolute pressure value.

Response: Thank you for your suggestions. We have modified the pressure outlet to absolute pressure, and the corresponding value is 101325 Pa.

11) line 202: "Finally" - You just started it a long road to a final?

Response: It's really ridiculous. Thank you for your suggestions. Correction has been done. The text is as follows:

It was concluded that the bubble size follows a lognormal distribution law,

12) line 211: what means mi and sigma square on this figure explain in the manuscript

Response: The relationship between bubble size and number is lognormal distribution, μ and σ^2 are the average value and variance in this lognormal distribution function respectively.

13) line 224: its not a 3-D domain model - You need to rewrite this Figure description

Response: Thank you for your suggestions. This is a three-dimensional geometric model after post-processing, and the subsequent mesh generation is also carried out on this basis.

14) line 258: eq. 5 what sum is it? on which section is calculated, is q a changable number of elements - its totally unclear

Response: Thank you for your suggestions. I am very sorry for our negligence. We refer to authoritative references and restate the mathematical formula of VOF model. The revised text is as follows:

The continuity equation:

$$\frac{\partial(\alpha_q \rho_q)}{\partial t} + \nabla \cdot (\alpha_q \rho_q \vec{v}_q) = 0 \tag{1}$$

Where: α_q *-the* q *fluid volume fraction of the phase;* ρ_q *-fluid volume fraction of the first phase* q *fluid density of the phase;* t *-time;* $\vec{v}_q$ *- velocity of the* q *phase.*

The volume fraction of each phase satisfies in VOF:

$$\sum_{q=1}^{n} \alpha_q = 1 \tag{2}$$

Momentum equation:

$$\frac{\partial(\rho\vec{v})}{\partial t} + \nabla \cdot (\rho\vec{v}) = -\nabla p + \nabla \cdot [\mu(\nabla\vec{v} + \nabla\vec{v}^T)] + \rho\vec{g} + \vec{F} \tag{3}$$

Where: ρ *-volume weighted average density;* $\vec{v}$ *-mixing velocity ;* p *-pressure;* μ *-volume weighted average viscosity;* $\vec{g}$ *-gravity acceleration;* $\vec{F}$ *-surface tension.*

Among them:

$$\rho = \alpha_l \rho_l + \alpha_g \rho_g \tag{4}$$

$$\mu = \alpha_l \mu_l + \alpha_g \mu_g \tag{5}$$

Where: α_l*,* α_g*, - denotes the liquid phase volume fraction and the gas phase volume fraction, respectively;* ρ_l*,* ρ_g*,- denotes liquid phase volume fraction and gas phase volume fraction, respectively;* μ_l *,* μ_g*, - denotes liquid-phase density and gas-phase viscosity , respectively.*

The continuous surface force model is used to simulate the surface tension of gas-liquid interface, and the surface tension is added to equation (3) as a source term. Including

$$\vec{F} = \sigma \frac{2\rho k_1 (\nabla \vec{s_1})}{\rho_l + \rho_g} \tag{6}$$

$$k_1 = \nabla \cdot \vec{n_1} \tag{7}$$

Where: σ *is the surface tension coefficient;* k_1 *is the surface curvature;* s_1 *is the surface normal vector at the interface;* n_1 *is the unit normal vector.*

15) line 254 and 255 - so there is no difference between alfa and rho as the authors writes that both are the volume fraction; instead where they evidently have liquid and gas phase dynamic viscositoes they mentione abut density.

Response: Correction has been done. Density has been correctly modified to viscosity.

16) line 251: mixing velocity (not speed)

Response: Correction has been done.

17) line 246: rho is rather the fluid density. What thq means

Response: Correction has been done. The text is as follows:

where α_q is the q fluid volume fraction of the phase; ρ_q is the fluid volume fraction of the first phase q fluid density of the phase; t represents time; and $\vec{v}_q$ is the velocity of the q phase.

18)not involve" or should be "does involve"?

Response: This study does not involve the law of conservation of energy.

19) line 292: so You mean Fluent?

Response: Thank you for your suggestions. Correction has been done. The text is as follows:

The numerical simulation was solved by Fluet 2020 R2 software,

20) line 280: Intensity - it should be density.

Response: Thank you for your suggestions. Correction has been done.

21) line 270: what reference helped to select 1.42; 1.68 and 0.09 constats values. What values takes S_k and S_epsilon such to fit simulation results to experimental?

Response: Thank you for your suggestions. The values of these two parameters are derived from empirical formulas, and we have better simulation results by adopting the default values of Fluent software.

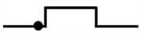
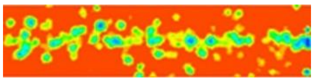
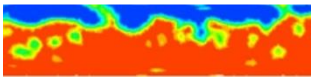
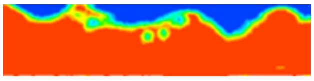
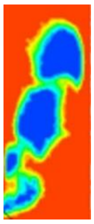
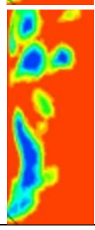
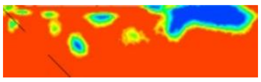
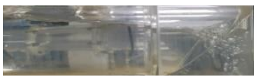
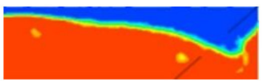
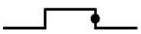
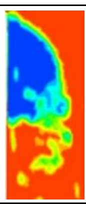
22) line 321: what kind of quantitative model was used. I only read about "results are within the error range" The fit was not great if a properly done qualitative comparison was done it would be shown. Fit between numerial and experimental was in my opinion poor. Of course maybe the mean vales of pressures are on the same level in the selected time range by the authors...

Response: We make qualitative analysis by comparing the pressure signals of P1 monitoring point in the time range when bubbles flow through the point. Because the collection and transmission of pressure signals need an uncontrollable short time in the experiment, there is a slight deviation in time, but the frequency and amplitude of pressure signal fluctuations are relatively consistent.

23) line 311: the length of manuscripts in MDPI journals is not restricted, so You are welcom to compare at least one -two more cases in revised version of this paper.

Response: We totally agree with you. Because it takes a lot of space to list all the working conditions, taking the most typical working condition 12 as an example, the flow velocity and bubble air content are the maximum under this working condition. We have evolved and optimized the qualitative analysis of different flow patterns and quantitatively analyzed the pressures at all monitoring points. The text is as follows：

In order to verify the accuracy of the numerical simulation calculation, it is necessary to compare and analyze the flow pattern changes in the pipe; in order to avoid redundancy in this article, the following is a comparison of the flow pattern changes in Case 12 (2.0 m/s, 0.15 air content), as shown in Figure 12. The flow pattern of the whole flow process changes into bubble flow–wavy flow–slug flow–churning flow–bubble flow–plug flow.

Observation position	Physical test	Numerical simulation	Flow pattern
			Bubble flow
			Plug flow
			Transition flow pattern of slug flow and wavy flow
			Slug flow
			Transition flow pattern of slug flow and churning flow
			Plug flow
			Transition flow pattern of slug flow and wavy flow
			Slug flow

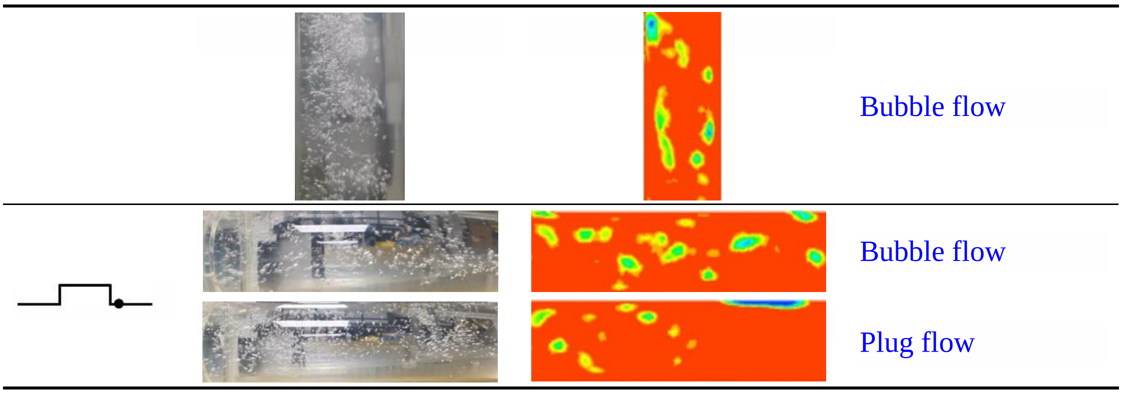


Figure 12. Comparison of experimental and numerical simulation flow patterns.

In order to further ensure the effectiveness of CFD numerical simulation, the pressure of each monitoring point obtained via the numerical simulation of Case 12 is quantitatively compared with the experimental data. As shown in Figure 13, the simulation results are all within the error range, and the accuracy of CFD numerical simulation is further confirmed by combining qualitative analysis with quantitative analysis.

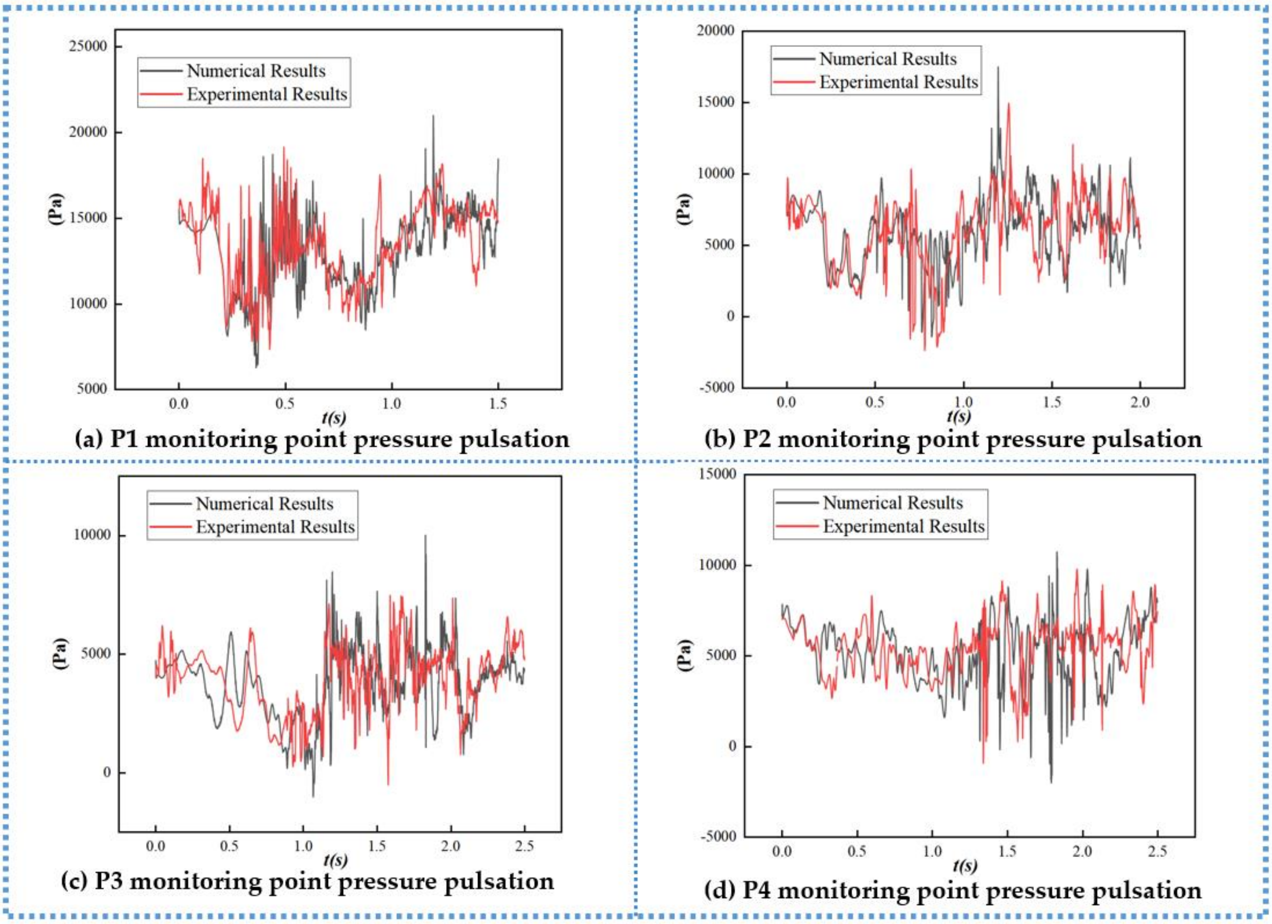


Figure 13. Comparison of experimental and numerical simulation pressure.

24) The figures 14-16 are so small that its hard to see anything, please enlarge them.

Response: Thank you for your suggestions. The figures have been enlarged.

25) line 402: do You compare experimental results or only numerical. You should compae both of them!

Response: Thank you for your suggestions. In this paper, more emphasis is placed on numerical simulation, and physical experiments mainly provide bubble distribution law for numerical simulation and numerical simulation verification. In the next article, we will focus on the processing process and data processing methods of the experiment.

26) line 433: I do not understand the authors selection of cases to comparison. Here we see they analyze pressures for cases 1-4 while earlier they analazed many other cases up to Case 12.

Response: We have divided three flow velocity conditions, and each group of flow velocity conditions has four different air content conditions. We analyzed all the working conditions by grouping.

27) Figures 14 to 16 are so small that I do not see anything. Thats why its hard for me to check the authors description of the phenomenas simulated.

Response: Thank you for your suggestions. The figures have been enlarged.

28) line 509: Try in revised version to cite more recent works. Some papers about cavitation that can enrich the introductions are:

a) High-Speed Imaging of Water Hammer Cavitation in Oil–Hydraulic Pipe Flow. https://doi.org/10.3390/fluids7030102

b) Modeling Transient Pipe Flow in Plastic Pipes with Modified Discrete Bubble Cavitation Model. https://doi.org/10.3390/en14206756

c) CFD Investigations of Transient Cavitation Flows in Pipeline Based on Weakly-Compressible Model. https://doi.org/10.3390/w12020448

d) Concerning Dynamic Effects in Pipe Systems with Two-Phase Flows: Pressure Surges, Cavitation, and Ventilation. https://doi.org/10.3390/w14152376

e) Cavitation Erosion Characteristics for Different Metal Surface and Influencing Factors in Water Flowing System. https://doi.org/10.3390/app12125840 etc.

Response: Thank you for your suggestions. We have carefully read several references recommended by you, which greatly enriched our theoretical knowledge. And choose two references related to our research direction to join the introduction. Add the following text:

Based on the experimental test and numerical analysis, considering the basic dynamics of air–water interaction in unventilated pipes, Ramos, H.M. et al. [21] expounded the correlation between cavitation and valve performance and predicted air exchange through any installed valve, and their roles in changing the system behavior during unsteady flow.

Tang et al. [28] studied the cavitation flow in the pipeline based on the computational fluid dynamics (CFD) method of Fluent software, and successfully captured the formation, development and collapse process of cavitation bubbles, and clearly and intuitively observed the uneven distribution of steam bubbles in the pipe length and diameter direction, as well as the slow movement process of steam bubbles along the top of the pipe wall.

21. Ramos, H.M.; Fuertes-Miquel, V.S.; Tasca, E.; Coronado-Hernández, O.E.; Besharat, M.; Zhou, L.; Karney, B. Concerning Dynamic Effects in Pipe Systems with Two-Phase Flows: Pressure Surges, Cavitation, and Ventilation. Water 2022, 14, 2376. https://doi.org/10.3390/w14152376

28. Tang, X.; Duan, X.; Gao, H.; Li, X.; Shi, X. CFD Investigations of Transient Cavitation Flows in Pipeline Based on Weak-ly-Compressible Model. Water 2020, 12, 448. https://doi.org/10.3390/w12020448

29) line 506: such a acknowledgment can be written after the review process - before it You (authors) do not know if the review process will be constructive or not :)

Response: We totally agree with you. We will pay strict attention to these problems in our future work.

Thank you again for putting forward so many constructive suggestions. Your suggestions have improved our article in essence.