Report

Crest position analysis:

In our simulation, the expected water speed is:

$$\sqrt{g * h0} = 4.9 \text{ m/s}$$

Expected sloshing interval is:

$$\frac{L}{\sqrt{g * h0}} = 4.01\text{s}$$

As shown in Figure 1, the result shows an average sloshing interval of 3.966 seconds for dx = 0.2 m, which is lower than the expected sloshing interval. The discrepancy is caused by the particle size we set, which is shown in the following analysis.

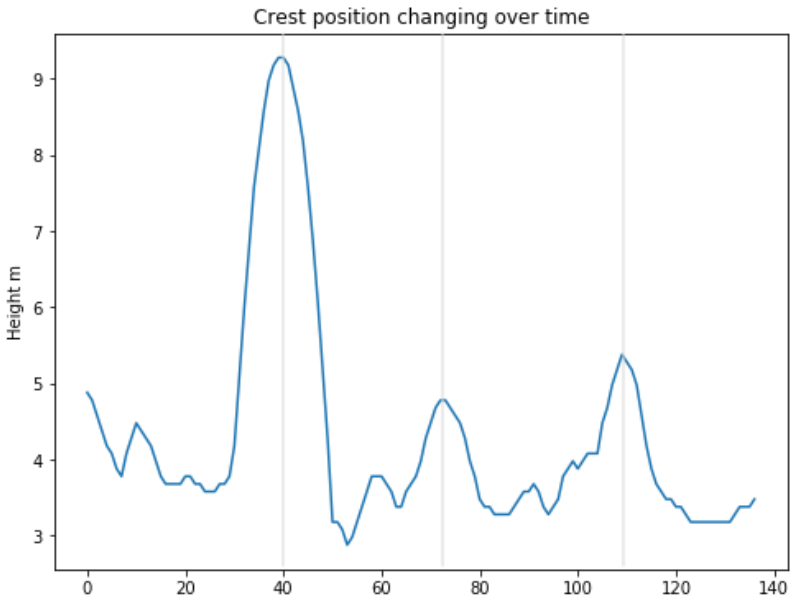

Figure 1: Crest positon changing over time (python Post-processing result)

Sloshing Interval analysis:

Combining Python post-processing process and Paraview, we produced several plots that shows the crest height changing with time for multiple dx values, as shown in figure 2.

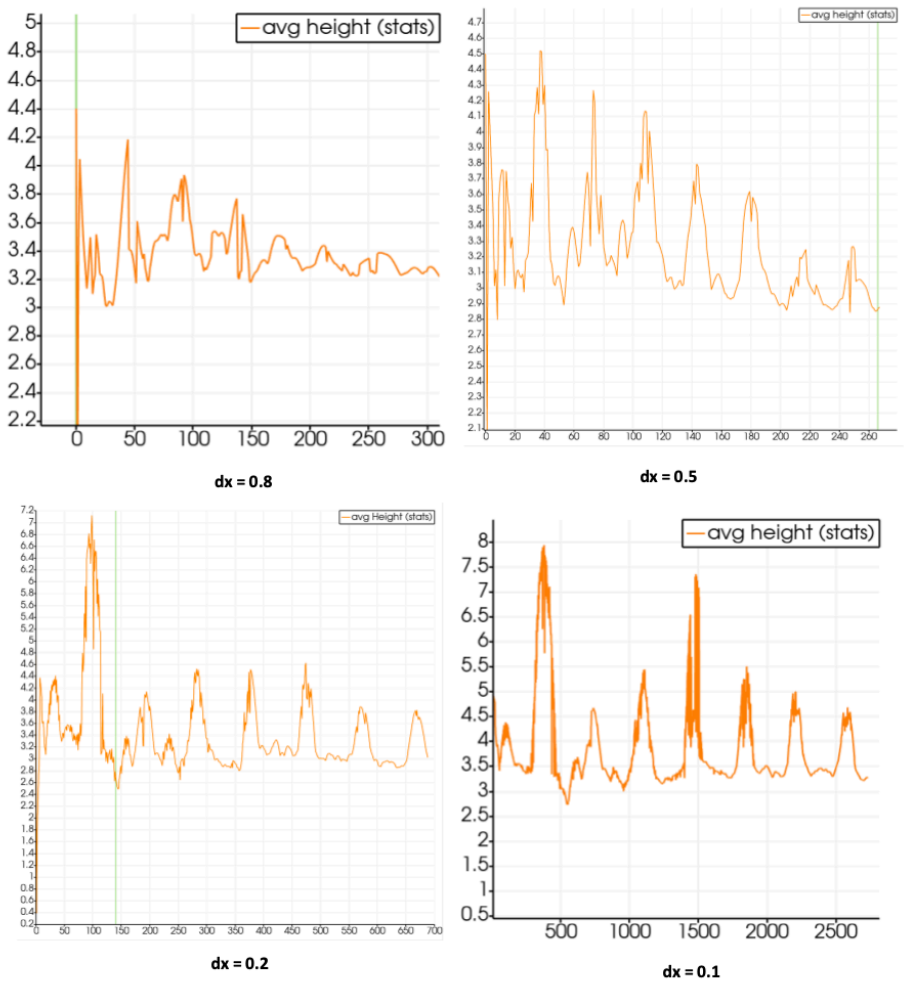

Figure 2: Crest positon changing over time (with various dx)

The trend, number of peaks and occurring time are similar for these simulations. Figure 3 shows a comparison between these simulations.

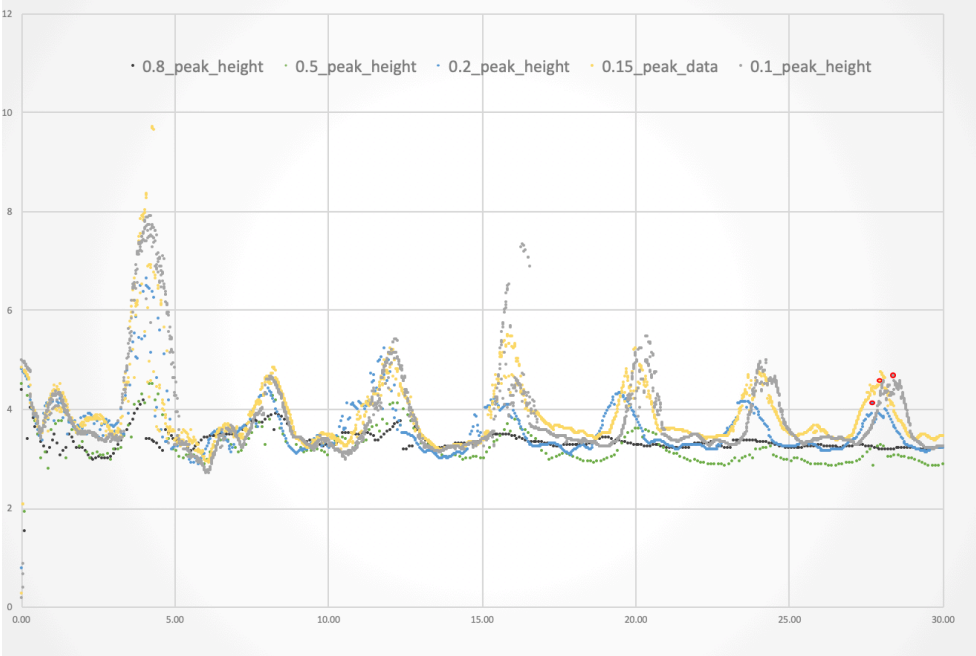

Figure 3: Comparison of Crest positon changing over time (with various dx)

The variation in the height of crest is caused by different particle size. That when the particle size is smaller, particles are easier to splash higher. This can be explained by the effect of dx. When dx is larger, h is larger, and the effect of smoothing kernel is larger, which exerts larger traction onto the particles. So that the particles move less actively.

This can also be explained by the principle of SPH. SPH is representing molecular scale particles with larger particles. The larger particles can be considered as an ensemble of small particles, which moves less active.

The sloshing interval in our simulation is shown in table 1 and figure 4:

Table 1: Particle Interval and Sloshing interval

Particle Interval (dx)	0.8	0.5	0.2	0.15	0.1
Sloshing interval	3.89	3.95	3.97	3.99	4.05
Error toward expected Sloshing interval	0.19	0.13	0.11	0.09	0.03

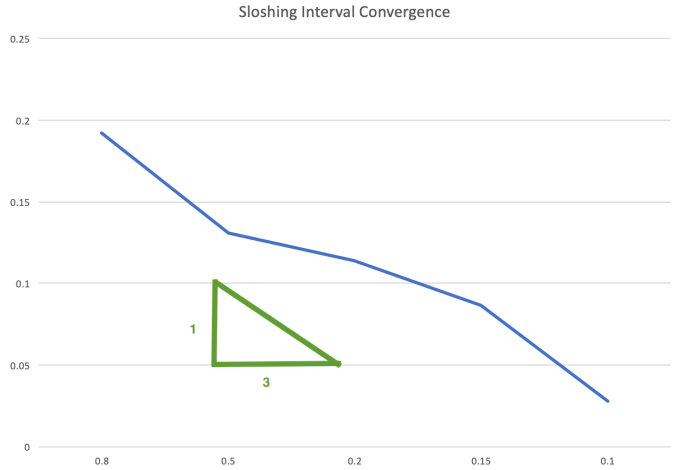

Figure 4: Convergence of Sloshing Interval with dx

The result shows a 3rd order of convergence, which implies that dx does influence the accuracy of the simulation. Smaller the particle, more accurate the result is.