Week 8 Progress Report

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1 Drift velocity comparisons for various depths

- Created a figure which shows the numerical and analytical solutions for the drift velocity at three depth cases
- *shallow depth*: $h < \lambda$, I used $h = 8$
- *intermediate depth*: $h \approx \lambda$, I used $h = 10.1$
- *deep water*: $h >> \lambda$, I used $h = 100$
- λ is fixed such that $\lambda >> A$, I used $\lambda = 10$ and $A = 0.1$

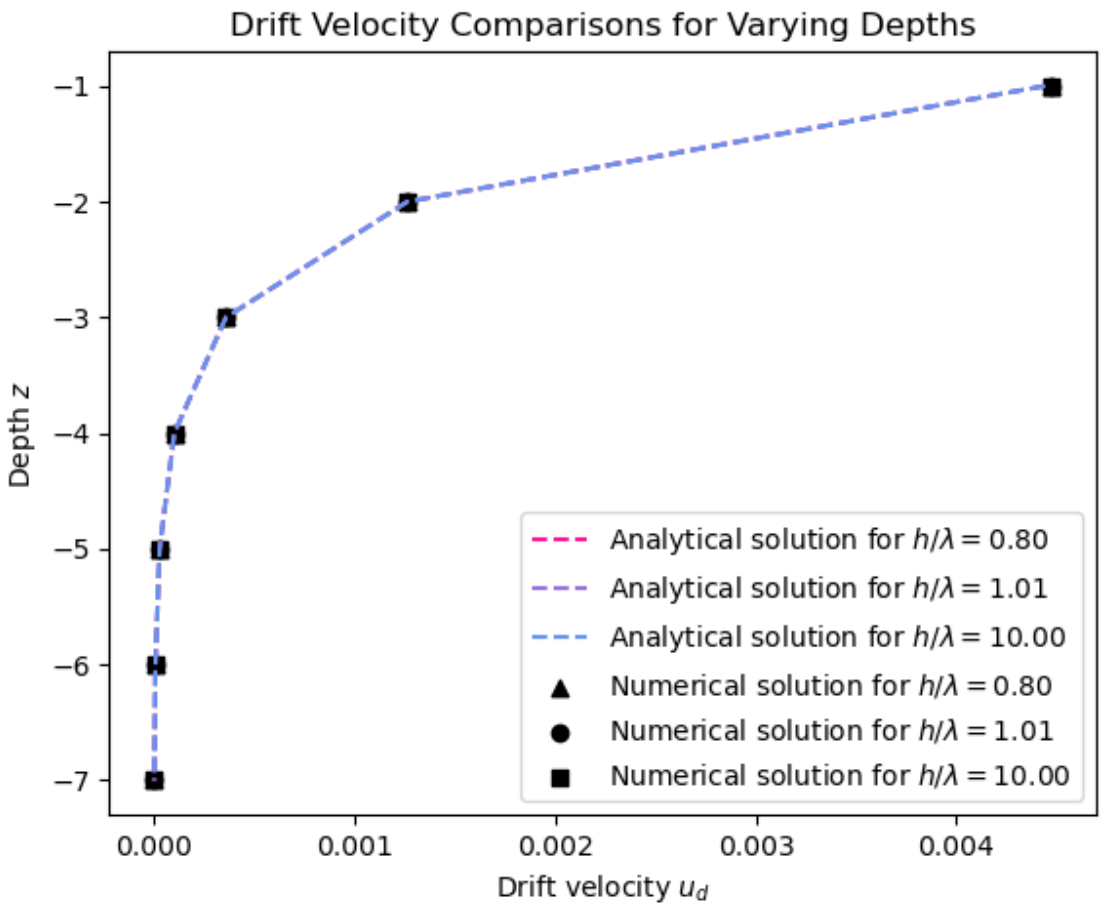

Figure 1: Numerical and analytical solutions for drift velocity for shallow, intermediate, and deep water

2 Stokes number convergence test

- Plotted various values of the Stokes number vs the relative error for each depth case (shallow, intermediate, deep)
- Attempted to plot the critical Stokes number at various depths (various values of h)
- Used a tolerance of $0.1\% = 1\text{e}{-3}$
- Used the initial depth z_0 with the biggest discrepancy between the numerical and analytical solutions
- Couldn't find a Stokes number close enough to zero to produce a critical Stokes number (took too long to run)
- Code needs to be refactored to improve efficiency

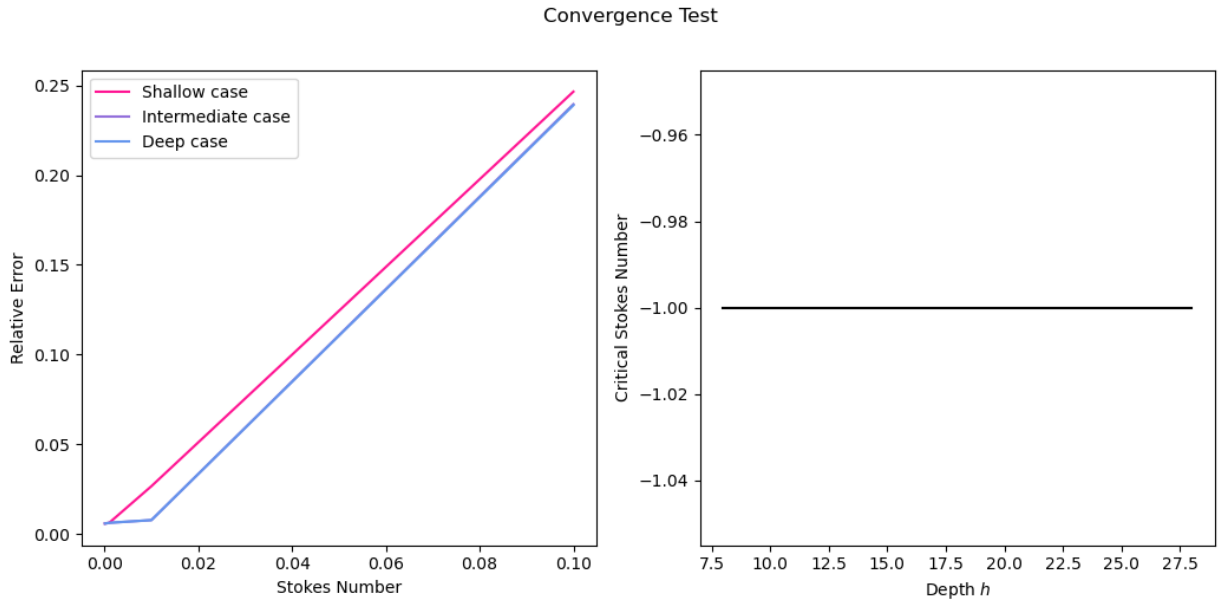

Figure 2: A convergence test for the Stokes number for shallow, intermediate, and deep water, where no critical values were found (code returns -1 for the critical Stokes number if a critical Stokes number was not found)

3 Literature search & miscellaneous tasks

- Compared the analytical solution from Jacque's paper to the one I am currently using (from the Bremer and Breivik paper), I think they're the same
- Quick search for drift velocity asymptotic expansion
  - Stochastic Stokes' Drift, Homogenized Functional Inequalities, and Large Time Behaviour of Brownian Ratchets gives an asymptotic expansion of the traveling diffusion front corresponding to the stochastic Stokes' drift with given potential flow
  - Travelling fronts in stochastic Stokes' drifts has an asymptotic expansion of a diffusive travelling front
  - Stochastic Stokes' drift with inertia Expands the stochastic Stokes drift velocity
- Corrected terminology when referring to terms in the RHS of the Maxey-Riley equation

- reorganized code so that I can easily import frequently reused code
  - Maxey-Riley equation implementation
  - velocity field implementation
  - particle trajectories
  - drift velocity comparisons between numerical and analytical solutions

4 Next steps

- Going through Rory's code for history term implementation and attempting to implement the history term using that and Carlos' thesis as a guide
- Performing another convergence test after including history
- Comparing the trajectory of a negatively buoyant particle produced by my code to the figures shown in the literature