1 Results

1.1 Probability Density Functions of the Temporal Evolution of Temperature and Mass

The code is setup so the initial temperature and mass is the same for all the droplets. In the case of no convective heat transfer it would be expected that all droplets evaporate at the same rate and have the same increase in temperature. However, placing the droplets in a Taylor-Green vortex means the droplets will experience a different fluid velocities. Therefore there will be a range of convective heat transfer across the droplets.

This effect can be observed by plotting how the probability density function (PDF) evolves over time. The spread of droplet temperature can be plotted by using the deviation ${T_d}'$:

$$ {T_d}' = T_d - \bar{T_d} \tag{1.1} $$

This process can be used at each timestep to produce a 3D PDF to show how the deviation of droplet temperatures changes.

Table of simulation settings

For the conditions in Table x the corresponding PDF is shown in Figure x.

The initial conditions are not shown in this plot but would be a Dirac function centered around zero on the x-axis. For the next x timesteps the deviation of droplet temperature increases as the droplets spread out into the fluid. The deviation then begins to decrease as the mean droplet temperature reaches the steady state temperature.

1.2 Effect of Stokes Number on Heat and Mass Transfer

The Stokes number will have some bearing on the heat and mass transfer of the droplets. This is because this will change how much the droplets follow the gas flow and therefore how much convective heat transfer there is.