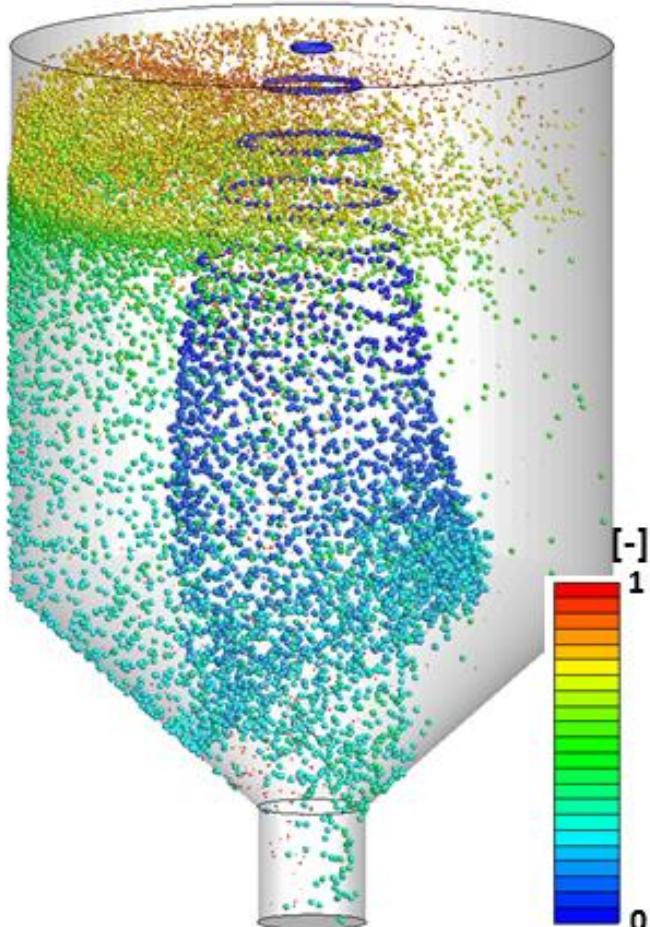


Droplet Evaporation Simulation in Spray Dryer



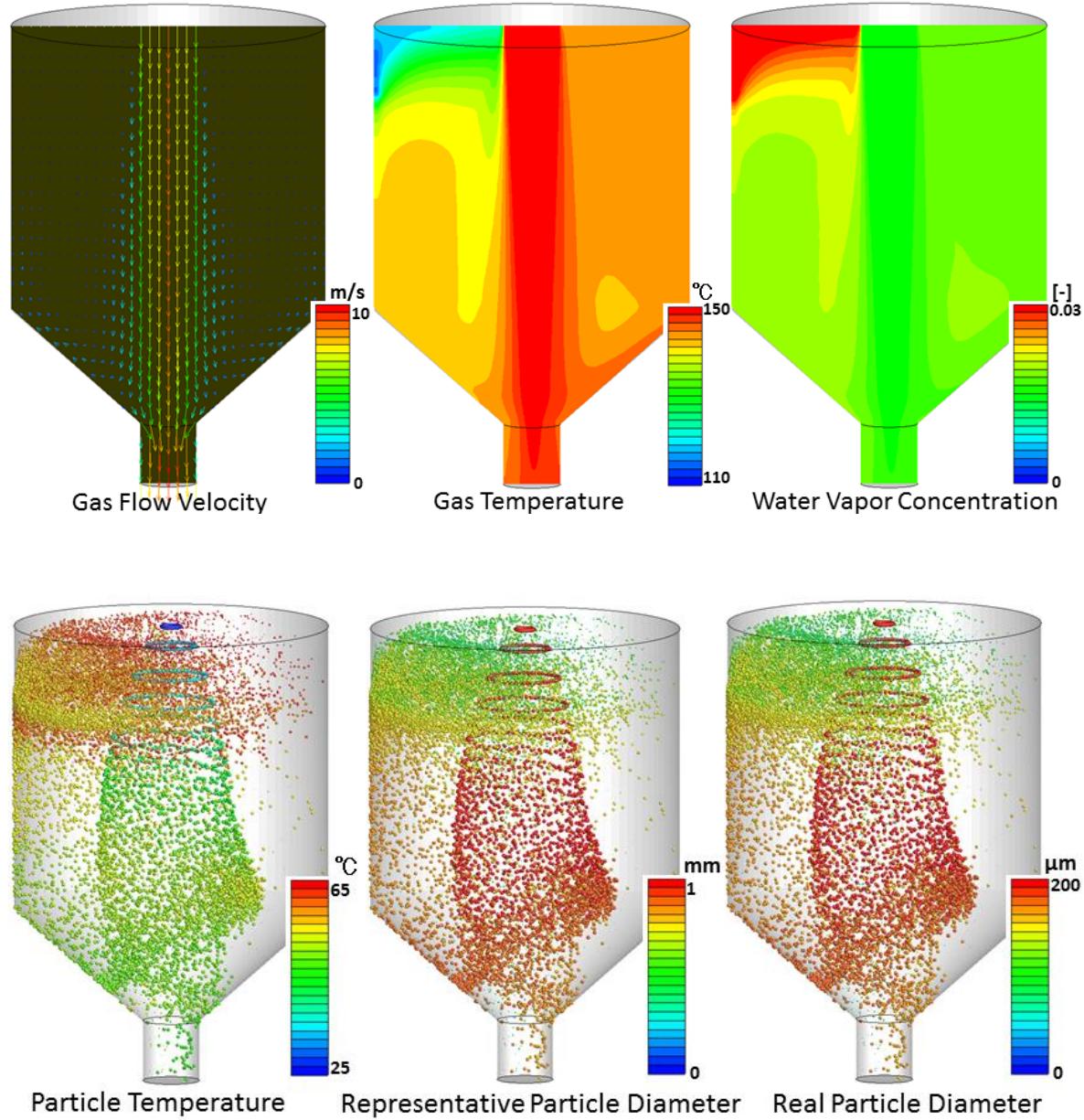
Moisture Evaporation Rate

The process of evaporation of liquid droplets injected with gas from a rotating nozzle located in the center near the ceiling of the spray dryer is simulated numerically.

In addition to evaporation due to boiling after the droplet reaches the boiling point (100 °C), evaporation at room temperature before reaching the boiling point is also considered as a liquid evaporation model. For evaporation at temperature before reaching the boiling point, the evaporation rate is determined using an evaporation model based on the water vapor concentration in the gas and the saturated vapor pressure.

In the simulation, particles are assumed to be droplets without solids, but it is also possible to assume that the liquid adheres to the solid particle surface.

In the figure above, the droplet is 20 times larger than the representative particle diameter (particle diameter used for the calculation of particle contact).



The DEM-based representative particle model is used for the simulation of the droplet particles, giving a diameter distribution for the real droplet particles at the time of generation. Both the representative particle and real particle diameters decrease as the particle mass decreases with evaporation of the liquid. The real particle diameter is used for the calculation of particle-fluid drag force, particle-fluid heat transfer and particle surface area, which are related to droplet behavior, temperature and evaporation rate. In the figure above, the droplet is shown at 20 times larger than the representative particles.