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Direct numerical simulation on the effect of slip velocity in bubble plumes[1] HYUNDUK SEO, Pusan National University, SIVARAMAKRISHNAN BALACHANDAR, University of Florida, KYUNG CHUN KIM, Pusan National University — Bubbly plume is one of the examples of multi-phase flow which is not confined by the sidewall. The bubbly plume has been applied to enhance the mixing for aeration or reaction between the gas and liquid phases. Air-water plume has higher slip velocity rather than other combinations of fluids. In this study, two-phase fluids governing equations are solved by DNS using the spectral element method code Nek5000 with Eulerian-Eulerian approach. To investigate the role of slip velocity in forming a plume structure, we calculated higher-order statistics such as turbulence kinetic energy budget. Not only higher-order statistics but also plume parameters in the conventional integral framework were calculated to quantify and characterize the plume structure. From the statistics, higher slip velocity results in a sharp interface between the inner core region and the outer annular region of the plume. Plume core region with high slip velocity is confined as a column of gas-phase which cannot be dispersed from the centerline. In higher slip velocity cases, TKE production by the buoyancy perturbation happened in the smaller region rather than smaller slip velocity case, but enhanced mean shear around inner plume core has a dominant contribution on the production of TKE.

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