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Validation of A One Dimensional Model for Volumetrically Forced Jets Using Large Eddy Simulations AMITABH BHATTACHARYA, CHANDRA SHEKHAR PANT, Indian Institute of Technology, Bombay, Mumbai, India — Volumetrically forced jets are often considered as idealized models for atmospheric clouds. In this work, we use an existing energy-consistent approach for dynamically expressing the entrainment rate constant, α, in terms of radial integrals of the velocity field, Reynolds stress field and bouyancy field. We use a mixing length model to relate the Reynolds stress to the velocity gradient. We then construct a one-dimensional (1-D) model for evolving volumetrically forced jets, in which we assume that the radial variation of the axial velocity has a Gaussian shape. The imposed external forcing, with a Gaussian radial profile, is applied within a certain height range, far from the jet inlet. Large Eddy Simulations of forced jets are conducted to validate this 1-D model. We find that the axial velocity deviates significantly from a Gaussian profile if the forcing is confined to a radius that is much smaller than the jet radius; this in turn can lead to discrepancy between the LES and the 1-D model. On the other hand, if the forcing radius is comparable to the jet radius, then the 1-D model agrees well with the LES, even at high forcing Richardson number. The bouyancy flux within the forcing zone is predicted well by the 1-D model for all the cases.

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