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Modeling of swirling axisymmetric heated jets ALINE COTEL, CHINAR APHALE, WILLIAM SCHULTZ, University of Michigan — The competing effects of buoyancy and swirl are investigated numerically in an axisymmetric jet. One question of interest is the amount of swirl necessary to keep a heated jet cohesive in large-scale environments. An integral model is used to predict axial dependence using similarity in r for velocity and temperature profiles. Hence, this model is also applicable to large-scale atmospheric flows such as tornadoes. The effect of swirl on the jet width and entrainment is studied closely. The inclusion of swirl and temperature of the jet fluid with integral matching over r results in a governing system consisting of three ODEs for momentum, continuity and energy. Density variations due to the heated jet are considered in only two terms, the body force (buoyancy) term in the axial momentum equation and the body force (centrifugal) term in the radial momentum equation. The effect of swirl on entrainment is enhanced only if the jet is heated, then the density gradients constrict the core. The assumed pressure decay with height (z) is justified on the basis of error introduced by the integral matching. The model can predict cases of high swirl that Fluent is unable to compute satisfactorily.

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