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Simulation of plume rise: Study the effect of stably stratified turbulence layer on the rise of a buoyant plume from a continuous source by observing the plume centroid SUDHEER REDDY BHIMIREDDY, Univ of Texas, San Antonio, KIRAN BHAGANAGAR, University of Texas, San Antonio — Buoyant plumes are common in atmosphere when there exists a difference in temperature or density between the source and its ambience. In a stratified environment, plume rise happens until the buoyancy variation exists between the plume and ambience. In a calm no wind ambience, this plume rise is purely vertical and the entrainment happens because of the relative motion of the plume with ambience and also ambient turbulence. In this study, a plume centroid is defined as the plume mass center and is calculated from the kinematic equation which relates the rate of change of centroids position to the plume rise velocity. Parameters needed to describe the plume are considered as the plume radius, plumes vertical velocity and local buoyancy of the plume. The plume rise velocity is calculated by the mass, momentum and heat conservation equations in their differential form. Our study focuses on the entrainment velocity, as it depicts the extent of plume growth. This entrainment velocity is made up as sum of fractions of plume's relative velocity and ambient turbulence. From the results, we studied the effect of turbulence on the plume growth by observing the variation in the plume radius at different heights and the centroid height reached before loosing its buoyancy.

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