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Structure and Mixing in Jets and Plumes

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Velocity point measurements (ADV) and PIV and particle tracking are used to compare velocity and scalar (density, volume fraction or temperature) spectra and structure functions in the evolution of jets and plumes in non-homogeneous environments. The Jet-Plume length scales separate the region influenced by buoyancy in the plumes, constrains on the 3D development of the flow produce changes in the spectra and a reduction in the structure function scaling exponents. Entrainment and mixing efficiency vary strongly with the topology of the initial forcing. Considering interactions between unstable plumes, as in a RT front [1] as the turbulent plumes develop, the denser fluid comes into contact with the lighter fluid producing molecular mixing depending on the buoyancy as the Atwood number A, the direct geometrical effect that the initial conditions have over the volume where mixing can take place, and the local intermittency that affects the spectral energy transfer from the large to the mixing/ diffusive scales [2-4] The behaviour of the mixing process is analysed from images of the time evolution of several turbulent mixing processes visualized with LIF, pearlescence and shadowgraph technique. Comparing the different situations with internal and external mixing we estimate the mixing efficiency [5] of the turbulent plumes and jets in non-homogeneous environments.

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