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The structure of turbulent wall jets and plumes

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Work is based principally on experiments but we present also some comparisons between experimental and numerical results. A series of experiments have been performed consisting on detailed turbulent measurements of the 3 components of velocity to obtain a basic understanding on the processes of interaction that lead to mixing and mass transport between boundaries and free shear layers. The turbulent wall jet configuration occurs often in environmental and industrial processes such as river plume/coastal interaction or deep convection. Three types of experiments with different jet configurations. The first experiment was made at small Reynolds number and the second and third ones at higher velocities (water and two phase "bubbly jet/plume"). The configurations are explained providing information about the characteristics of the turbulent free jet, the axel-symmetric circular jet and turbulent wall jet and plumes. Comparisons between different experiments with the above configurations provide information on the entrainment and mixing properties of each. The experimental measurements of turbulent velocity comprise Acoustic Doppler Velocimeter measurements of the jet centreline and at off centred radial positions in the experimental water flume at several distances from the wall. Results of experiments include: velocity distribution, entrainment angle of the jet, jet average and fluctuating velocity, Reynolds number, standard deviation, boundary layers function, correlations and turbulence intensity. Conclusions about the different range of the jet flows include the justification of the maximum of turbulent intensity at a certain distance from the wall for the different experiments and the applications to environmental jets and plumes.