

Abstract Submitted
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Counter gradient diffusion in a plane wall jet O. RAMESH, Indian Institute of Science, V. DHAMOTHARAN, City University London, U.K — Turbulent wall-jets are important in a variety of applications such as the Coanda effect for boundary layer separation control, film-cooling applications in a jet engine etc., One of the important features of a wall jet is the existence of a region of counter gradient diffusion of momentum. The counter-gradient region is a sort of pathological situation for RANS based turbulence models as they would not be able to predict this region. In this study we show from our experiments in a wall jet the counter-gradient region of diffusion can be understood from simple structural models for a wall jet eddy. Towards this flow visualization and hotwire measurements have been performed. It is seen from the smoke flow visualizations that the outward portion of the flow is backward leaning i.e. in the upstream direction. This is consistent with the orientation of eddy structure obtained from two-point correlation measurements. A building block eddy of a wall jet is proposed that has aspects of a boundary layer eddy in the inner wall region and a jet eddy in the outer region. It is argued by a simple vortex dynamics model that the counter-gradient region occurs due to the influence of the jet eddies in the near-wall region.

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