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Pressure measurements in a rapidly sheared turbulent wall layer[1]

SOURABH DIWAN, JONATHAN MORRISON, Imperial College London — The aim of the present work is to improve understanding of the role of pressure fluctuations in the generation of coherent structures in wall-bounded turbulent flows, with particular regard to the rapid and slow source terms. The work is in part motivated by the recent numerical simulations of Sharma et al. (Phy. Fluids, 23, 2011), which showed the importance of pressure fluctuations (and their spatial gradients) in the dynamics of large-scale turbulent motions. Our experimental design consists of first generating a shearless boundary layer in a wind tunnel by passing a grid-generated turbulent flow over a moving floor whose speed is matched to the freestream velocity, and then shearing it rapidly by passing it over a stationary floor further downstream. Close to the leading edge of the stationary floor, the resulting flow is expected to satisfy the approximations of the Rapid Distortion Theory and therefore would be an ideal candidate for studying linear processes in wall turbulence. We carry out pressure measurements on the wall as well as within the flow – the former using surface mounted pressure transducers and the latter using a static pressure probe similar in design to that used by Tsuji et al. (J. Fluid. Mech. 585, 2007). We also present a comparison between the rapidly sheared flow and a more conventional boundary layer subjected to a turbulent free stream.

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