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Dynamics and structure of backflow events in turbulent channels[1]
JOSE CARDESA-DUENAS, Univ Politecnica de Madrid, JASON MONTY, University of Melbourne, JULIO SORIA, Monash University, MIN CHONG, University of Melbourne — A statistical description of flow regions with negative streamwise velocity is provided based on simulations of turbulent plane channels in the range $547 \leq Re_\tau \leq 2003$. It is found that regions of backflow are attached and their density per surface area - in wall units - is an increasing function of Re_τ. Their size distribution along the three coordinates reveals that, even though in the mean they appear to be circular in the wall-parallel plane, they tend to become more elongated in the spanwise direction after reaching a certain height. Time-tracking of backflow regions in a $Re_\tau = 934$ simulation showed they convect downstream at the mean velocity corresponding to $y^+ \approx 12$, they seldom interact with other backflow events, their statistical signature extends in the streamwise direction for at least 300 wall units and they result from a complex interaction between high and low spanwise vorticity regions far beyond the viscous sublayer. This could explain why some statistical aspects of these near-wall events do not scale in viscous units; they are dependent on the Re_τ-dependent dynamics further away from the wall.

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