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Development of a turbulent boundary layer subjected to free-stream turbulence YANNICK JOOSS, LEON LI, TANIA BRACCHI, R. JASON HEARST, Norwegian University of Science and Technology — Turbulent boundary layers are a fundamental flow that exists in a wide range of natural processes and technical applications. Over the past three decades the effect of free-stream turbulence on the features of a canonical zero-pressure-gradient turbulent boundary layer has been studied extensively, with particular focus on single downstream positions. Nonetheless, there has been little attention given to the influence of varying free-stream turbulence intensity u'_∞/U_∞ on the actual streamwise development of a boundary layer. This study addresses this gap with hot-film measurements in a water channel. Free-stream turbulence is created and varied with an active grid. Wall-normal boundary layer scans are performed along the centerline of the channel at multiple streamwise positions. The resulting mean velocity profiles and turbulent fluctuations in the boundary layer for four different free-stream turbulence conditions are analyzed. Further insight is gained by looking at the spectral distribution of energy at selected streamwise positions.

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