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New insight on flow development and two-dimensionality of turbulent channel flows H. NAGIB, R. VINUESA, E. BARTRONS, M. MUÑOZ, G. SUBASHKI, IIT, Chicago, Y. SUZUKI, Nihon University, Japan — The experimental conditions required for a turbulent channel flow to be considered fully-developed and nominally two-dimensional remain a challenging objective. Oil film interferometry (OFI) and static pressure measurements were carried out over the range $200 < Re_\tau < 800$ in an adjustable-geometry channel flow facility. Three-dimensional effects were studied by considering different aspect ratio (AR) configurations, and also by fixing the AR and modifying the hydraulic diameter D_H of the section. The conditions at the centerplane of the channel were characterized through the local skin friction from the OFI and the centerline velocity at three different streamwise locations, as well as the wall shear based on the streamwise global pressure gradient. The skin friction obtained from the pressure gradient overestimated the local shear measurements obtained from the OFI, and did not reproduce the same AR-dependence observed with OFI. Differences between the local and global techniques were also reflected in the flow development. Development length of high-aspect-ratio channels scales with the hydraulic diameter of the section, and is around 200 channel full-heights H, much larger than the values of around $100 - 150$ H previously reported in the literature.

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