

Abstract Submitted
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How history effects influence favourable pressure gradient turbulent boundary layers¹ CAGRI METIN, TAYGUN R. GUNGOR, Istanbul Technical University, MARK P. SIMENS, U. Politecnica de Madrid, YVAN MACIEL, Universite Laval, AYSE G. GUNGOR, Istanbul Technical University — A new direct numerical simulation database of a non-equilibrium turbulent boundary layer (TBL) that evolves under an adverse pressure gradient (APG) followed by a favourable pressure gradient (FPG) is presented. The TBL in the FPG region reaches up to $Re_\theta = 12650$, and the shape factor H varies from 2.95 to 1.4. The non-dimensional pressure gradient is maintained constant in both the APG and FPG zones with the same absolute value. The database provides information about how history effects influence TBLs. The mean velocity profile in the inner layer of the FPG TBL, which is exposed to a FPG after having been exposed to an APG, returns to match the law of wall but only in the viscous wall region of TBL up to $y^+ \approx 60$ at $H = 1.6$. On the other hand, the mean velocity profile in the outer layer of the TBL preserves the history effect of the APG and departs from the expected FPG behaviour. The accumulated outer peaks of Reynolds stresses still preserve their strength while inner peaks emerge. The database proves that the inner and outer layers of the boundary layer respond differently to the pressure gradient. Further results on history effects will be presented at the meeting.

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