

Abstract Submitted
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Analysis of the contribution of velocity-vorticity correlations to skin friction coefficient in adverse pressure gradient turbulent boundary layers (APG-TBLs)¹ SHEVARJUN SENTHIL, CALLUM ATKINSON, JULIO SORIA, LTRAC, DMAE, Monash University — DNSs are used to analyse the contribution of velocity-vorticity correlations to skin friction in incompressible TBL flows with different pressure gradients, namely a zero pressure gradient (ZPG), a mild APG, and a strong APG. Their contributions are computed based on the decomposition presented by Yoon et. al. (2016). The contribution of the molecular transfer due to the mean vorticity is negligible and does not change with the pressure gradient. For all the pressure gradient cases, the contribution of the advective vorticity transport term is negative, whereas the vortex stretching term provides a positive contribution to the skin friction coefficient. It is shown that the combined contribution of these two terms can be considered as the contribution from the Reynolds shear stress with a constant weight for all the pressure gradient cases. The contributions from the molecular diffusion at the wall and the streamwise inhomogeneity effects resulting from the spatial development of the flow increase with the pressure gradient and become dominant contributors when the flow reaches the verge of separation. An alternate method, based on the identity of Renard and Deck (2016), to compute the contribution of velocity-vorticity correlations is also presented.

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