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Mean Momentum Balance in Adverse Pressure Gradient Boundary Layers[1] SYLVIA ROMERO, SPENCER ZIMMERMAN, JIMMY PHILLIP, JOSEPH KLEWICKI, University of Melbourne — Utilizing Large Eddy Simulation (LES) data from Bobke et al. (2017) the mean momentum equation for a two-dimensional adverse pressure gradient boundary layer (APG BL) will be analyzed in comparison to the channel flow case. The properties of the mean momentum balance (MMB) for a channel flow are well characterized (e.g. see Wei et al. (2005)). Like the channel flow case, the MMB for the two-dimensional zero pressure gradient boundary layer (ZPG BL) is a balance of three terms. Morrill-Winter et al. (2017) transformed the MMB terms of the ZPG BL into a form like the channel flow case. Using the data of Bobke et al. (2017), the present analysis examines whether a similar transformation is applicable to APG flows. The MMB for APG flows is a balance of four terms, unlike the three for the ZPG BL and channel flow. The fourth term, the pressure gradient term, is a negative constant in APG flows, but is a positive constant in channel flows. The change in dominance of the MMB terms will be discussed, as well as the dependence of the balance on the pressure gradient and distance from the wall. Various aspects such as the history effects of the developing pressure gradient and the location where the viscous force loses dominance will also be discussed.

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