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Experimental and numerical investigation of low-drag intervals in turbulent boundary layer[1] JAE SUNG PARK, SANGJIN RYU, University of Nebraska-Lincoln, JIN LEE, United Technologies Research Center — It has been widely investigated that there is a substantial intermittency between high and low drag states in wall-bounded shear flows. Recent experimental and computational studies in a turbulent channel flow have identified low-drag time intervals based on wall shear stress measurements. These intervals are a weak turbulence state characterized by low-speed streaks and weak streamwise vortices. In this study, the spatiotemporaldynamics of low-drag intervals in a turbulent boundary layer is investigated using experiments and simulations. The low-drag intervals are monitored based on the wall shear stress measurement. We show that near the wall conditionally-sampled mean velocity profiles during low-drag intervals closely approach that of a low-drag nonlinear traveling wave solution as well as that of the so-called maximum drag reduction asymptote. This observation is consistent with the channel flow studies. Interestingly, the large spatial stretching of the streak is very evident in the wall-normal direction during low-drag intervals. Lastly, a possible connection between the mean velocity profile during the low-drag intervals and the Blasius profile will be discussed.

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