

Abstract Submitted
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Characteristic scales of momentum-carrying eddies in wall turbulence¹ ADRIAN LOZANO-DURAN, Stanford University, H. JANE BAE, California Institute of Technology — In our current understanding of wall turbulence, the logarithmic layer is populated by a collection of multi-scale momentum-carrying eddies attached to the wall (Townsend 1976). In this framework, the classic characteristic velocity and length scales of wall attached eddies are the friction velocity and distance to the wall, respectively. In the present work, we show that these classic scales can be thought of as a particular case, and that the momentum-carrying eddies are more generally controlled by the mean energy production and mean shear with no explicit reference to the wall. Consistent with this argument, we propose new characteristic velocity, length, and time scales for the momentum-carrying eddies. The validity of the new scaling is demonstrated by direct numerical simulations of modified turbulent channel flows in which the friction velocity and distance to the wall remain unaltered, but the mean energy production and mean shear change significantly. The results show that, under those conditions, the flow structures follow the new proposed velocity and length scales rather than the classic scales.

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