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Variation in the Turbulence Structure of Supersonic Boundary Layers with Mach Number using DNS Data[1] MATTHEW RINGUETTE, M. PINO MARTIN, ALEXANDER SMITS, MINWEI WU, Princeton University — We utilize a direct numerical simulation database to characterize the properties of coherent structures in supersonic turbulent boundary layers at Mach numbers from 3 to 5. Tools to calculate the average structure angle, convection velocity, and length scale are developed, and the results show good agreement with the available experimental data. We find that the structure angle and convection velocity increase with higher Mach number, while the streamwise integral length scale decreases. The structures are taller with increasing Mach number, consistent with the trend in structure angle. The spacing of the wall streaks is slightly narrower and more uniform with increasing Mach number. We observe hairpin vortices clustered into streamwise packets at all Mach numbers, and create an algorithm that identifies and characterizes these hairpin packets. The average packet convection velocity, length, and number of hairpins increase with higher Mach number, while the packet height and angle decrease.

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