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Identification and tracking of hairpin vortex auto-generation in turbulent wall-bounded flow YANGZI HUANG, MELISSA GREEN, Syracuse Univ — Hairpin vortices have been widely accepted as component structures of turbulent boundary layers. Their properties (size, vorticity, energy) and dynamic phenomena (origin, growth, breakdown) have been shown to correlate to the complex, multi-scaled turbulent motions observed in both experiments and simulations. As established in the literature, the passage of a hairpin vortex creates a wall-normal ejection of fluid, which encounters the high-speed freestream resulting in near-wall shear and increased drag. A previously generated simulation of an isolated hairpin vortex is used to study the auto-generation of a secondary vortex structure. Eulerian methods such as the Q criterion and 2 function, as well as Lagrangian methods are used to visualize the three-dimensional hairpin vortices and the auto-generation process. The circulation development and wall-normal location of both primary and secondary hairpin heads are studied to determine if there is a correlation between the strength and height of the primary hairpin vortex with the secondary hairpin vortex auto-generation.

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