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Local flow topology dynamics in a turbulent boundary layer GERRIT ELSINGA, IVAN MARUSIC, The University of Melbourne — Experimental data from time-resolved 3D Tomographic Particle Image Velocimetry is used to study the dynamics of the local flow topology in the logarithmic region of a turbulent boundary layer. Specifically, we determine the invariants of the velocity gradient tensor defining the local topology and compute their mean material derivatives as a function of the invariants themselves. Subsequent time integration yields trajectories, which reveal spiralling, periodic orbits representative of the flow evolution in the mean sense. The period is nearly constant and can be thought of as a characteristic life-time for the eddies. It has an associated wavelength of approximately 10 boundary layer thicknesses (using the local average velocity as the convective velocity). This corresponds well with the location where a peak appears in the premultiplied power spectra of the streamwise component of velocity in wall-bounded turbulence. Previous studies have linked that peak to the very large-scale motions or superstructures observed in wall turbulence. Hence, these results may provide a link between the local topology dynamics and the coherent structures commonly observed in boundary layers.

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