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Behavior captured by Lagrangian coherent structures near the wall in a turbulent boundary layer ZACHARY WILSON, Portland State University (PSU), MURAT TUTKUN, Norwegian Defence Research Establishment, RAÚL BAYOÁN CAL, PSU — In this study, Lagrangian coherent structures (LCS) are identified in a plane that is 50 viscous lengths from the wall in a turbulent boundary layer. To locate the LCS, the criteria introduced by Haller (2011)[1], which is based on a variational approach to optimizing normal repulsion (or attraction), is applied. The flow map is constructed by using time resolved velocity fields, obtained from high speed (1.5 kHz) PIV measurements, to compute trajectories (Integration time $\sim y^+\delta_\nu/u_\tau$ and time steps $\sim \delta_\nu/u_\tau$). The various turbulent behaviors captured by the repelling and attracting LCS are examined. In particular, the computed LCS are compared with plots of streamwise momentum, velocity fluctuations, dissipation, and various Eulerian fields that highlight vortical structures. It is found that different LCS depict structures corresponding to different Eulerian criteria. For instance, some LCS are boundaries between high and low momentum regions, while others surround vortical structures and/or exhibit high dissipation.

[1]Haller, G. Physica. D 240 7. (2011)

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