Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Coinciding Features in a Turbulent Boundary Layer via Lagrangian Coherent Structures, Dynamic Mode Decomposition and Proper Orthogonal Decomposition NASEEM ALI, Portland State University, MURAT TUTKUN, Institute for Energy Technology, Norway, RAU'L CAL, Portland State University — Low order decompositions and Lagrangian coherent structures are used to identify structures in a high-Reynolds-number turbulent boundary layer flow. Data are collected in Laboratoire de Mécanique de Lille (LML) wind tunnel using time resolved stereo particle image velocimetry. Low-order descriptors are based on proper orthogonal decomposition (POD) and dynamic mode decomposition (DMD) frameworks to obtain energy content and frequency information of the flow, respectively. Repelling and attracting Lagrangian coherent structures (LCS)s reveal complex patterns within the flow field containing a hyperbolic behavior and the shapes of the attracting and repelling vary with advection time as result of the temporal coherence. The attracting and repelling LCSs are matched with POD and DMD modes to understand the relationship between the frameworks and respective representations. The POD is used as a low pass filtering of kinetic energy and then mode-dependent velocity reconstructions provide, firstly, the most coherent features of the flow and second are employed to generate new mode-based LCSs. This representations then provide clarity as to the organization of the LCS based on the energy contained in them and the dynamic coherence.

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Date submitted: 01 Aug 2015 Electronic form version 1.4