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A Case Study of Horseshoe Vortex Dynamics at Laminar and Turbulent Juncture Flows TAYFUN AYDIN, ADAM BLACKMORE, ALIS EKMEKCI, University of Toronto — To better understand the impacts of oncoming boundary-layer characteristics on the horseshoe vortex dynamics forming at a cylinder-wall junction, a case study is conducted in a free-surface water channel involving cylinder-channel floor and cylinder-end plate junctions. Endplates had two different leading-edge geometries, namely a sharp and a super-elliptical shape. The Reynolds number was kept at 10,000, based on the cylinder diameter. Laminar boundary layer forms along the channel floor and on the endplate with the super-elliptical leading edge. The plate with a sharp leading edge, however, involves flow separation at the leading edge, followed by a reattachment then an early transition to turbulence. On this plate, turbulent boundary layer is achieved. Flow visualization was performed on the plane of symmetry via PIV. Vortex trajectories and the velocity spectra depict periodic nature of the laminar horseshoe vortices and a variation of the spatial and temporal characteristics of horseshoe systems with the boundary layer thickness. Turbulent approach boundary layer led to disorganized and complex horseshoe vortex formation.

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