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Transient Convection from Forced to Natural with Flow Reversal on a Vertical Flat Plate BLAKE W. LANCE, BARTON L. SMITH, Utah State University — Transient flow through the forced, mixed and natural convection regimes is studied experimentally on a vertical flat plate. Measurements are ensemble-averaged and include velocity from Particle Image Velocimetry and high fidelity thermal measurements in walls for both temperature and heat flux. The flow is a ramp-down flow transient encompassing all three convection regimes. The initial condition is forced convection downward with subsequent transition to mixed convection, ending with natural convection upward after a flow reversal. Velocity measurements provide time-mean and Reynolds stress profiles across the span of the test section. Near-wall data provide shear stress estimates by fitting a line to the data in the inner portion of the viscous sublayer. Wall heat flux is measured in the plate with thin film heat flux sensors. Flow reversal was observed near the heated plate and turbulence kinetic energy was redistributed from the heated boundary layer towards the freestream. Wall heat flux was decreased and shear stress decreased then reversed. These data are part of a CFD validation dataset meant to assess simulation accuracy and are the final case made available for mixed convection.

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