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The Mechanism of Heat Transfer Augmentation in Stagnation Flow Subject to Freestream Turbulence DAVID HUBBLE, Virginia Tech, TOM DILLER, PAVLOS VLACHOS — A physical model is presented which predicts the time-resolved heat transfer coefficient based on the properties of the coherent structures present. Water tunnel experiments have been performed to investigate the mechanism of heat transfer augmentation in stagnation flow subject to freestream turbulence. The experiment combined Time-Resolved Digital Particle Image Velocimetry with an array of simultaneous time-resolved heat transfer measurements. Passive grids produced freestream turbulence with an intensity of 5% at length scales of 1cm, 2cm, and 3cm. The measurements reveal flow fields dominated by coherent structures whose number and strength strongly correlate with the length scale of the freestream turbulence. By examining the transient circulation and location of the identified structures, we observe that stretching and vorticity amplification significantly affects the near-wall flow. The transient heat transfer correlates well with the flow field induced by these structures. The time-resolved model developed represents a great advance over previous time-average predictors.

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