Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Experimental study of turbulence induced wall temperature fluctuations[1] ANIRBAN GARAI, JAN KLEISSL, Dept. of Mechanical and Aerospace Engineering, University of California, San Diego, BOUNDARY LAYER LATE AFTERNOON AND SUNSET TURBULENCE COLLABORATION — Turbulent heat transport is critical in engineering applications and atmospheric flows. The relative strength of background shear and buoyancy near the wall influences coherent structures responsible for much of the heat transport. Previous studies show that shear dominated flow causes streaky-like structures; whereas buoyancy dominated flow causes cell-like structures. In this work, we investigated the influence of flow structures on the wall temperature and heat flux in a convective atmospheric boundary layer. Turbulence data at different heights and high frequency wall temperature were obtained during the Boundary Layer Late Afternoon and Sunset Turbulence field campaign at Lannemezan, France from 7 June – 8 July, 2011. Conditional averaging confirms that the warm wall causes warm ejection events, and cold sweep events cause cooling of the wall. The wall temperature structures move along the wind and their advection speed is close to the wind speed of the upper logarithmic layer and mixed layer, have a size of about 0.2 times the boundary layer depth, become streakier with stability and its standard deviation follows a -1/3 power law with stability parameter, Obukhov length.

[1]We are thankful to all Boundary Layer Late Afternoon and Sunset Turbulence field campaign participants for data sharing and funding from a NASA New Investigator Program award.

Anirban Garai
Dept. of Mechanical and Aerospace Engineering,
University of California, San Diego

Date submitted: 24 Jul 2012 Electronic form version 1.4