Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Properties of the total kinetic energy balance in wall-bounded turbulent flows ANG ZHOU, University of New Hampshire, JOSEPH KLEWICKI, University of New Hampshire, University of Melbourne — The properties of the total kinetic energy balance in turbulent boundary layer and channel flows are explored empirically. The total kinetic energy transport equation, which is the combination of mean and turbulent kinetic energy transport equations, is appropriately simplified for fully developed turbulent channel flow and the two-dimensional flat plate boundary layer. Different from the turbulence kinetic energy equation, a suitable grouping of terms is found that cleanly segregates the leading balances in the total energy equation. Available high-quality data reveal a four-layer structure for the energetics that is qualitatively different from the four-layer description of the mean dynamics [Wei *et al.* 2005, *J. Fluid Mech.* **522**, 303]. The wall-normal widths of the layers exhibit significant Reynolds number dependencies, and these are empirically quantified. Present findings indicate that each of the four layers is characterized by a predominance of some of the terms in the governing equations. Particular significance is attached to the ratio of the sum of viscous diffusion and dissipation terms to the production/turbulent diffusion term, since these groupings allow the characterization of the layer widths. The third layer exhibits a complex leading order balance exchange that is described in detail.

Ang Zhou
University of New Hampshire

Date submitted: 26 Jul 2015 Electronic form version 1.4