Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Large eddy simulation study of spanwise spacing effects on secondary flows in turbulent channel flow[1] MOHAMMAD ALIAKBARIMIYANMAHALEH, WILLIAM ANDERSON, UT Dallas — The structure of turbulent flow over a complex topography composed of streamwise-aligned rows of cones with varying spanwise spacing, s is studied with large-eddy simulation (LES). Similar to the experimental study of Vanderwel and Ganapathisubramani, 2015: J. Fluid Mech., we investigate the relationship between secondary flow and s, for $0.25 \leq s/\delta \leq 5$. For cases with $s/\delta > 2$, domain-scale rollers freely exist. These had previously been called "turbulent secondary flows" (Willingham et al., 2014: Phys. Fluids; Barros and Christensen, 2014: J. Fluid Mech.; Anderson et al., 2015: J. Fluid Mech.), but closer inspection of the statistics indicates these are a turbulent tertiary flow: they only remain "anchored" to the conical roughness elements for $s/\delta > 2$. For $s/\delta < 2$, turbulent tertiary flows are prevented from occupying the domain by virtue of proximity to adjacent, counter-rotating tertiary flows. Turbulent secondary flows are associated with the conical roughness elements. These turbulent secondary flows emanate from individual conical topographic elements and set the roughness sublayer depth. The turbulent secondary flows remain intact for large and small spacing. For $s/\delta < 1$, a mean tertiary flow is not present.

[1]This work was supported by the Air Force Office of Sci. Research, Young Inv. Program (PM: Dr. R. Ponnoppan and Ms. E. Montomery) under Grant # FA9550-14-1-0394. Computational resources were provided by the Texas Adv. Comp. Center at the Univ. of Texas

William Anderson
UT Dallas

Date submitted: 28 Jul 2015 Electronic form version 1.4