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DNS of Oscillatory Boundary Layer Over a Closely Packed Layer of Sediment Particles[1] CHAITANYA D. GHODKE, JOSEPH SKITKA, SOURABH V. APTE, Oregon State University — Fully resolved direct numerical simulations are performed using fictitious domain approach (Apte et al., JCP 2009) to investigate oscillatory turbulent flow over a rough wall corresponding to the experimental work of Keiller & Sleath (JFM 1976) and representative of a sediment layer in coastal environments. Four particle Reynolds numbers in the range, $Re = 660 - 2780$ are studied for a fixed sphere size and results are compared against available experimental data. Flow is characterized in terms of coherent vortex structures, Reynolds stress variation, turbulent cross-correlations and PDF distributions. Reynolds stress is negative during the first half of the cycle as ejection and sweep events prevail and is positive during the second half where outward/inward interactions of motion are dominant. The net lift coefficient remains positive over the cycle with a period which is half of that of the forcing function and is well correlated with phase averaged velocity square (U^2). The pressure contribution towards the net lift force is found to be more dominant over the viscous contribution. Also the PDF distributions of velocity fluctuations show non-Gaussian behavior. These detailed findings are useful in improving the criterion for predicting sediment incipient motion.

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