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Contrasts Between Momentum and Scalar Exchanges Over Very Rough Surfaces[1] ELIE BOU-ZEID, QI LI, Princeton Univsersity — Understanding of the physical processes modulating transport of momentum and scalars over very rough walls is essential in a large range of engineering and environmental applications. Since passive scalars are advected with the flow, broad similarity is expected between momentum and scalar transport. However, unlike momentum, which is dominated by form drag over very rough walls, scalar transport must occur through the viscous exchanges at the solid-fluid interface, which might result in transport dissimilarity. To examine these similarities and differences of momentum and passive scalar exchanges over large three-dimensional roughness elements, a suite of large-eddy simulations is conducted. The turbulent components of the transport of momentum and scalars within the canopy and roughness sublayers are found to be similar. However, strong dissimilarity is noted between the dispersive fluxes. The dispersive components are also found to be a significant fraction of the total fluxes within and below the roughness sublayer. Increasing frontal density induces a general transition in the flow from a rough boundary layer type to a mixed-layer-like type, which is found to have contrasting effects on momentum and scalar transport.

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