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Entrainment at a sediment concentration interface in turbulent channel flow[1] JORGE SALINAS, MRUGESH SHRINGARPURE, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL, MARIANO CANTERO, Department of computational mechanics, CNEA, Bariloche, Argentina., S. BALACHANDAR, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL — In this work we address the role of turbulence on entrainment at a sediment concentration interface. This process can be conceived as the entrainment of sediment-free fluid into the bottom sediment-laden flow, or alternatively, as the entrainment of sediment into the top sediment-free flow. We have performed direct numerical simulations for fixed Reynolds and Schmidt numbers while varying the values of Richardson number and particle settling velocity. The analysis performed shows that the ability of the flow to pick up a given sediment size decreases with the distance from the bottom, and thus only fine enough sediment particles are entrained across the sediment concentration interface. For these cases, the concentration profiles evolve to a final steady state in good agreement with the well-known Rouse profile. The approach towards the Rouse profile happens through a transient self-similar state. Detailed analysis of the three dimensional structure of the sediment concentration interface shows the mechanisms by which sediment particles are lifted up by tongues of sediment-laden fluid with positive correlation between vertical velocity and sediment concentration. Finally, the mixing ability of the flow is addressed by monitoring the center of mass of the sediment-laden layer.

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