Abstract Submitted
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Mechanisms of complete turbulence suppression in turbidity currents[1] MRUGESH SHRINGARPURE, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, Florida, USA, MARIANO CANTERO, Institute Balseiro, (CNEA-UNCu), Bariloche Atomic Center, San Carlos de Bariloche, Rio Negro, Argentina, S. BALACHANDAR, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, Florida, USA — The sustained propagation of turbidity current depends on a tight interplay between suspended sediments and turbulence. This work explores the phenomenon of complete turbulence suppression in a dilute turbidity current due to stratification of suspended sediments. Direct numerical simulations of turbidity currents are carried out to understand the dynamics of complete turbulence suppression. We observe that stratification of sediments leads to damping and spatial redistribution of hairpin and quasi-streamwise turbulent structures in the flow. These turbulent structures are known to be responsible for sustaining turbulence in the flow. We propose that beyond a critical stratification limit, the existing vortical structures in the flow are damped to an extent where they loose their ability to auto-generate subsequent turbulent structures, which ultimately leads to complete loss of turbulence. We also identify three parameters: Reynolds number (Re_τ), Richardson number (Ri_τ) and sediment settling velocity (V_z) to control the flow dynamics. Therefore a criteria for complete turbulence suppression can be defined as a critical value for $Ri_\tau V_z$. Based on simulations, experiments and field data, the critical value appears to have logarithmic dependence on Re_τ.

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