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Integral and Laboratory Modelling of Sedimentation from Turbulent Buoyant Jets

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An integral model is developed to describe sedimentation from a turbulent, particle-carrying, buoyant jet injected at an angle to the vertical into stationary fluid. Sediment is assumed to fall from the jet where the outward component of the fall velocity normal to the jet boundary exceeds the inward entrainment velocity. The sedimentation can be characterized in terms of a non-dimensional fall-speed: the ratio of the particle fall-speed to a typical entrainment velocity. An important result is that this ratio is independent of the source flow rate (above a minimum value). Particles remaining in the jet beyond the near-source region are deposited when the jet spreads horizontally as a radial gravity current once it reaches the free surface, and this deposition is also modelled. The model results are compared to laboratory experiments and show good agreement.

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