

# RE-SUSPENSION PROCESS IN TURBULENT PARTICLE-FLUID MIXTURE BOUNDARY LAYERS

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Many theoretical applications of geophysical flows, such as sediment transport (e.g. Jenkins & Hanes, 1998) and aeolian transport of particles (e.g. Hopwood et al., 1995) utilize concepts for describing the near wall velocity profiles of particle suspensions originally arising from classical single phase theories. This approach is supported by experiments indicating the existence of a logarithmic fluid velocity profile similar to single phase flows also in case of high Reynolds number wall bounded particle suspension flows with low particle volume fractions (Nishimura & Hunt, 2000). Since the concept of a logarithmic near wall profile follows from classic asymptotic theory of high Reynolds number wall bounded flows the question arises to what extent this theory can be modified to account for particles being suspended in the ambient fluid. To this end, the asymptotic theory developed by Mellor (1972) is applied to the Favré-averaged equations for the carrier fluid as well as the dispersed phase derived on the basis of a volume averaged dispersed two-phase theory (Gray & Lee, 1977). Numerical solutions for profiles of main stream velocities and particle volume fraction in the fully turbulent region of the boundary layer for different turbulent Schmidt numbers are computed applying a Finite Difference box scheme. In particular, attention is focused on the turbulent re-suspension process of particles from dense granular flow adjacent to the bounding surface into the suspension. From these results boundary conditions in form of wall functions for velocities as well as the volume fraction of the particles can be derived and the validity of analogy laws between turbulent mass and momentum transfer at the bounding surface can be proved from an asymptotic point of view. The application of these concepts in the field of snow avalanche simulation (Zwinger, 2000) is discussed.