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On the effect of turbulence on bubbles in a horizontal channel flow JERRY WESTERWEEL, MARC HARLEMAN, RENE DELFOS, TOM VAN TERWISGA, Delft University of Technology — We present results on the concentration of small gas bubbles in water in a fully-developed horizontal turbulent channel flow. The bubble concentration reaches an equilibrium distribution that is characterized by the Rouse number. Results are obtained by both numerical simulations (DNS) and experiments (PIV) at comparable Reynolds numbers. The gas bubbles in the experiment have a Stokes number that is much smaller than unity, although they do not follow the fluid motion. The volume fraction is sufficiently low to assume one-way coupling. Dispite the low concentration and Stokes number, the bubbles appear to have a preferential concentration at the edge of a downward fluid motion away from the top channel wall. We present a simple model to explain the preferential concentration. For increasing Stokes numbers the rise velocity of individual bubbles in the turbulent channel flow appears to be only 40-50 per cent of the theoretical rise velocity for solid spheres (or gas bubbles in water containing impurities), while the gas bubble Reynolds number remains sufficiently small to assume only linear effects. This is in agreement with earlier reports on the sedimentation of solid particles in a turbulent flow.

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