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On the angular dependence of sound scattering from natural sand in turbulent suspensions

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We report on measurements of the variation with scattering angle of the differential scattering cross section of particles embedded in turbulence. The experimental apparatus consists of a turbulent round water jet carrying the particles, and a pair of broadband MHz-frequency transducers operating as transmitter and receiver and arranged in a bistatic geometry centred on the jet axis. The purpose of the jet is to confine the scatterers within a restricted range interval and thereby eliminate the need to correct the signal for attenuation due to scattering along the transmit and receive paths. Measurements were made at scattering angles between 90 and 170 degrees, for both natural sand grains and spherical glass beads in narrow size distributions with median diameters ranging from 200 to 500 microns. Particle size distributions were determined using different methodologies to obtain both volumetric and projected area estimates of equivalent spherical size. The results are compared to the theory for scattering by a solid sphere. Implications regarding the choice of equivalent sphere size for sound scattering by natural sand grains in suspension are discussed.