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On using sound to study suspensions of flocculating sediments

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The use of megahertz multi-frequency acoustic backscatter systems, ABS, has become an accepted methodology for measuring inorganic non-cohesive suspended sediments in boundary layer studies. This application of acoustics has gained broad utility owing to the development of a comprehensive theoretical description of the interaction of sound with suspended sands. However, the measurement of muddy/silty sediment dynamics has hardly been impacted by ABS, despite such sediments being ubiquitous. This is because in suspension these fine sediments often undergo flocculation and this makes the use of sound problematical due to our lack of understanding of the acoustic scattering properties of flocs. Until recently there were no quantitative measurements on the interaction of sound with flocculating sediments and no theoretical description of how sound is scattered by flocs. To address this lack of a theoretical framework a model has been developed which provides a description of the scattering properties of the primary particles, through the transitional region as the particles begin to bind together, to the case where the dominant scatterers are flocs. To assess the model comparisons are made with recently published data and the results indicate that at least to first order the modelling captures the acoustical scattering characteristics of flocculating sediments. Hopefully this will be the beginning of the quantitative use of acoustics in the muddy/silty sedimentary regime.