



## **Quantification of flocculated suspended sediment porosity using micro-CT image data analysis - Implications and applications**

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Flocculated suspended sediments (or populations of flocs) in fluvial and estuarine environments are critical components of the global sediment transport system, these sediments interact with, and transport, contaminants and pollutants such as microplastics and heavy metals, and therefore a full understanding of their settling and transport behaviour is vitally important. Pore spaces within flocs are an important component of the internal structure and have a great effect on settling velocity and behaviour. Porosity can affect specific density, as well as pore network characteristics such as pore throat size and distribution affecting hydrodynamic drag. Currently, sedimentological modelling software uses estimations or proxy measures of pore space within floc structures, such as saturation and drying of the sediment. To measure and understand better the nature of porosity in these flocs, the use of a capture and imaging procedure can be employed using LabSFLOC and micro-CT image data analysis software. LabSFLOC is a system consisting of a settling column combined with a camera and recording software, used to collect sediment settling video data which is processed to produce settling velocity, shape and size of individual flocs. Micro-CT involves scanning the sediment samples using tomography, which can be processed to produce image stacks to be analysed for porosity among other measures. The imaging procedure can produce a highly accurate measure of overall pore space percentage, pore throat size and distribution, pore distribution and pore network characteristics.

The overall research aim is to quantify the dimensions and distribution of pore space in flocculated sediments, then comparing these measurements to settling velocity data gathered from the same sediment population prior to scanning, to determine the extent to which these new 3D porosity data affect settling behaviour. The first stage of this analysis involved the development of a method to extract quantifiable pore networks from the image stack data created by micro-CT scanning. The second stage is to produce datasets that can be used to characterise individual flocs in terms of not only their overall percentage pore space, but also in terms of their pore network characteristics such as throat size, distribution and overall pore space distribution. The third stage will then be to compare these datasets to the settling velocity, overall size and shape characteristics measured using the video data gathered from the LabSFLOC.

Pore space percentage, alongside pore network characteristics data will be presented, with some potential inclusion of preliminary comparable statistical data from the cross-scale analysis with LabSFLOC settling data. This will establish and convey a reliable method for pore space quantitative measurement by means of image data analysis, alongside insight into the statistical importance of these measurements regarding settling characteristics. The implications and applications of this method development, and use within the field of suspended sediment science, will be the focus of this presentation.