EGU23-17507, updated on 16 May 2023
https://doi.org/10.5194/egusphere-egu23-17507
EGU General Assembly 2023


# Monitoring flocculation during a deep-sea mining test in the Clarion-Clipperton Zone, eastern equatorial Pacific Ocean

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Where fine-grained marine sediments are being brought in suspension and become subject to transport by currents, aggregation of cohesive primary particles (flocculation) can occur. By changing the inherent particle properties, flocculation processes play an important role in speeding up settling and redeposition of sediment particles. However, while numerous laboratory experiments have been conducted to understand properties and behavior of flocs, so far, there is not yet an appropriate method to monitor flocculation in-situ. Gaining a better understanding of the flocculation process and how it will affect the dispersion of man-made sediment plumes is important to assess the impact of human activities on the environment, for example in the context of deep-sea mining or offshore dredging.

In this study, the inherent acoustical and optical properties of sediment particles are studied using in-situ plume monitoring data collected by the MiningImpact2 project consortium during the first deep-sea mining trial of a pre-prototype polymetallic nodule collector vehicle. The trial was conducted in April 2021 at 4500 m water depth in the Clarion-Clipperton Zone (eastern equatorial Pacific Ocean) by the Belgian contractor DEME-GSR. During this trial, one of the main goals was to monitor the spatiotemporal evolution of the sediment plume generated by the mining vehicle. For this purpose, numerous sensors were deployed around the test area including ADCPs of different frequencies, OBSs and deep-sea particle camera. In this study, the main interest is to use this dataset to gain knowledge on the variability of particle properties and to monitor flocculation in the generated plume.

The monitoring array of sensors proved successful in measuring the dispersion of the plume around the mining site. In the data recorded in the plume, a gradient in optical and acoustic response was found, suggesting a change in inherent particle properties such as their size and shape induced by flocculation. The evolution of particle size as inferred by the particle camera recordings (PartiCam) corroborated this finding. In combination with currents and environmental measurements, this dataset provided valuable information to better understand the flocculation process.