EGU2020-15864, updated on 30 Sep 2020
https://doi.org/10.5194/egusphere-egu2020-15864
EGU General Assembly 2020

A novel approach to quantifying resuspension resistance of sediment organic matter against coastal flow

Naiyu Zhang[1], Charlotte Thompson[2], and Ian Townend[3]
[1]University of Southampton, National Oceanography Center, Ocean and Earth Science, Southampton, SO14 3ZH, U.K.(nz2g16@soton.ac.uk)
[2]Channel Coastal Observatory, National Oceanography Centre, Southampton, SO14 3ZH, U.K.
[3]University of Southampton, National Oceanography Center, Ocean and Earth Science, Southampton, SO14 3ZH, U.K.

In order to estimate sediment organic carbon budget in coastal oceans and continental shelves, a first step is to estimate how much of the deposited organic matter is retained within a sediment matrix, for further remineralization and preservation on a geological timescale, rather being physically flushed away by benthic flow[1]. This question becomes more challenging for the regions where 'mobile' layers (e.g. fluff layer, fluid mud and nepheloid layer) are formed due to the massive organic matter inputs, and often frequent resuspension and deposition[2]. Organic matter remineralization and preservation in sediments has been mostly investigated but often overlooks the role of flow-induced shear stresses on suspending the organic matter. While such flow influences in sediment organic matter budget may have little influence on sediment organic matter budget in deep oceans, it cannot be neglected in shallow-water coastal seas and continental shelves where cyclic resuspension, deposition and frequent storm events occur[3,4]. To our knowledge, the resistance strengths of organic matter in sediments against flow resuspension has received little attention.

To investigate this knowledge gap, various organo-clay aggregates and organo-clay-sand aggregates formed under different flow conditions were investigated by a series of laboratory flume[5] and high resolution X-ray Microcomputed Tomography (micro-CT) experiments[6]. Herein, a novel methodology is proposed, which successfully establishes quantitative relationships between the resuspension resistance strengths of these organic aggregates and a wide range of flow intensities, from moderate to storm conditions. The results provide a basis for computing resuspension under a range of flow conditions and, hence improving estimates of the organic matter budget in the coastal zone.

References

- Burdige, D. J. Preservation of organic matter in marine sediments: Controls, mechanisms, and an imbalance in sediment organic carbon budgets? Chem. Rev. **107**, 467–485 (2007).
- McKee, B. A., Aller, R. C., Allison, M. A., Bianchi, T. S. & Kineke, G. C. Transport and

transformation of dissolved and particulate materials on continental margins influenced by major rivers: Benthic boundary layer and seabed processes. Cont. Shelf Res. (2004). doi:10.1016/j.csr.2004.02.009
- Burdige, D. J. Burial of terrestrial organic matter in marine sediments: A re-assessment. Global Biogeochem. Cycles **19**, 1–7 (2005).
- Nicholls, R. J. & Cazenave, A. Sea-level rise and its impact on coastal zones. Science (2010). doi:10.1126/science.1185782
- Thompson, C. E. L., Couceiro, F., Fones, G. R. & Amos, C. L. Shipboard measurements of sediment stability using a small annular flume-core mini flume (cmf). Limnol. Oceanogr. Methods (2013). doi:10.4319/lom.2013.11.604
- Zhang, N. et al. Nondestructive 3D Imaging and Quantification of Hydrated Biofilm-Sediment Aggregates Using X-ray Microcomputed Tomography. Environ. Sci. Technol. **52**, 13306–13313 (2018).

How to cite: Zhang, N., Thompson, C., and Townend, I.: A novel approach to quantifying resuspension resistance of sediment organic matter against coastal flow, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-15864, https://doi.org/10.5194/egusphere-egu2020-15864, 2020