MSc Internship Vacancy

Modelling of microbially-driven removal of methane and ammonium in coastal waters

Name of Supervisors:

Lina Piso MSc (PhD candidate, daily supervisor)

Prof. Dr. Caroline Slomp (principal investigator)

Desired starting date internship:

January or February 2024

Short project description:

Over the past century, anthropogenic activities have led to climatic warming, eutrophication and deoxygenation of coastal marine ecosystems. All these processes stimulate the anaerobic degradation of organic matter by a complex network of microorganisms, which increases the production of methane (CH_4) and ammonium (NH_4^+). Release of CH_4 and NH_4^+ from the sediment to the overlying water is modulated by microorganisms that drive a range of redox reactions, which transform CH_4 and NH_4^+ to less harmful compounds (i.e. CO_2 and N_2). At present, we still incompletely understand the transformation pathways of CH_4 and NH_4^+ in eutrophic coastal waters. As a consequence, we cannot accurately project CH_4 emissions to the atmosphere and rates of N recycling. Recently, various gene-based models have been developed to describe the microbial pathways that remove CH_4 and/or NH_4^+ in coastal ecosystems (Reed et al., 2014; Lenstra et al., 2023). In this internship such a gene-centric reactive transport model will be applied to obtain a better understanding of the microbial pathways that remove CH_4 and NH_4^+ in a Swedish coastal ecosystem.

Relevant literature:

- Reed, D.C., Algar, C.K., Huber, J.A., and Dick, G.J. (2014). Gene-centric approach to integrating environmental genomics and biogeochemical models. *Proceedings of the National Academy of Sciences, 111*(5), 1879-1884.
- Lenstra, W.K., van Helmond, N.A.G.M., Dalcin Martins, P., Wallenius, A.J., Jetten, M.S.M., and Slomp, C.P. (2023). Gene-based modeling of methane oxidation in coastal sediments: constraints on the efficiency of the microbial methane filter. *Environmental Science & Technology, 57*(34), 12722-12731.

Methods covered during the internship:

- Analysis and interpretation of microbial and (geo)chemical data for the water column of the Stockholm Archipelago.
- Application of a gene-centric biogeochemical model i.e. a reactive transport model (RTM) (using R and R studio).