

Eutrophication and deoxygenation are key drivers of coastal methane emissions

CAROLINE P. SLOMP

Department of Microbiology, Radboud Institute for Biological and Environmental Sciences, Radboud University

Methane is a potent greenhouse gas. Over the past century, methane concentrations in the atmosphere have risen sharply. Coastal environments account for a major proportion of marine methane emissions and are increasingly affected by eutrophication and deoxygenation. In this presentation, I will present results of recent field and modeling work on methane dynamics and its microbial removal in a range of coastal systems (e.g. Baltic Sea, Dutch coastal zone) that differ in their degree of eutrophication and redox conditions (e.g.[1-5]). In our studies, we combine detailed chemical analyses (including methane isotopes) with microbial community analyses. In my presentation, I will specifically focus on (1) the role of various microbial pathways for removal of methane in the water column and sediment, (2) the role of ebullition in enhancing methane emissions, and (3) the use of reactive transport modeling to elucidate key controls on the microbial methane filter in coastal systems. Overall, our work highlights that, with ongoing eutrophication, deoxygenation and climate change, methane emissions from coastal systems will likely greatly increase in future.

[1] Zygadłowska et al. (2024), *Environ. Sci. Technol.* 58, 10582-1059

[2] Zygadłowska et al. (2024) *Geochim. Cosmochim. Acta* 384, 1-13

[3] Venetz et al. (2024) *FEMS Microbiology Ecology*, 100, fae007

[4] Lenstra et al. (2023) *Environ. Sci. Technol.* 57, 12722-12731

[5] Dalcin Martins et al. (2024). *Environ. Sci. Technol* 58, 11421-11435