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Microbial decomposition of terrigenic organic matter discharged into the Baltic Sea

M. Manecki (1), D. Herlemann (1), F. Pollehne (1), M. Labrenz (1), R. Zimmermann (3), T. Dittmar (2), D. Schulz-Bull (1), and K. Jürgens (1)

(1) Leibniz Institute for Baltic Sea Research Warnemünde, Seestrasse 15, D-18119 Rostock, Germany, (2) Institute for Chemistry and Biology of the Marine Environment, Carl-von-Ossietzky-Str. 9-11, D-26111 Oldenburg, Germany and Max Planck Institute for Marine Microbiology, Celsiusstrasse 1, D-28359 Bremen, Germany, (3) Joint mass spectrometry center of the University of Rostock, Department of Chemistry, Albert-Einstein-Str. 3a, 18059 Rostock, Germany and Helmholtz Zentrum München, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany

The permafrost soils in arctic regions contain a large amount of the worldwide organic carbon and global warming is expected to increase drainage of dissolved organic matter (DOM) into the adjacent oceans. It is yet unclear how this terrigenic organic matter will influence the global carbon cycle and the feedback effects to the climate. We used the Baltic Sea as a model system to investigate the role of abiotic factors on the degradation of terrigenic dissolved organic matter (tDOM) upon discharge into a brackish system as well as the response of the microbial community. Water from the Kalix River in Northern Sweden, which drains also permafrost soils, was used as the tDOM source in incubation experiments with Baltic Sea water. Different qualities of tDOM were compared by applying concentration procedures: tDOM was added to fresh Baltic Sea water as untreated Kalix River water or concentrated by commonly use DOC concentration procedures (lyophilization, ultrafiltration, solid phase extraction). We investigated the TDOC degradation by parallel measurements of dissolved organic carbon (DOC) consumption, DOM composition (using a 15 Tesla Fourier Transformation Ion Cyclotron Resonance Mass Spectrometer (FT-ICR-MS)), microbial activities and microbial community structure. FT-ICR-MS measurements showed qualitative differences in the DOM compositions for the different treatments and a drastic change in DOM composition between the third and fourth week of the incubation experiment. Despite the qualitative differences in DOM composition, the results obtained so far revealed that the added tDOC had, independent of the previous enrichment procedure, only little influence on bacterial activities, bacterial community structure and DOC decomposition dynamics. This indicates that the major portion of the added tDOC is of refractory nature. Instead, bacterial predation by heterotrophic protists had a strong impact on both bacterial community structure and DOC decomposition dynamics. This implies that for future decomposition studies both abiotic and biotic factors have to be considered for a better understanding of the underlying mechanisms in tDOC decomposition.