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Spatio-temporal variability in benthic microbial activity and particle flux in the Laurentian Trough

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Spatial variability within a single oceanographic station (10-1000m radius) is poorly understood, potentially limiting detection of short-lived moderate fluctuations in organic matter input and the benthic response. Between-station and inter-annual comparisons are also confounded by unknown local spatial variations. The primary objective of this study was to document spatial variability in benthic microbial activity at a single station in the Laurentian Trough (350 m depth) during the early summer phytoplankton bloom period. We also evaluated the influence of local spatial variability on the detection of a benthic response to bloom-related increases in organic matter sedimentation. Box coring and deployment of multicylinder drifting sediment traps were carried out daily over a 20-day period. Two spatial scales were sampled within one boxcore, and a second boxcore provided data on between-core variability. Microbial processes (bacterial abundance, extracellular enzyme activity and ^{3}H-thymidine incorporation into DNA) showed significant spatial variability at the 10-100 m and dm scales, and were correlated with the distribution of photosynthetic pigments and polychaete abundance in the sediments. Polychaetes also influenced microbial activity at finer spatial scales, in relation to tube location. Bacterial extracellular enzyme activity and thymidine incorporation into DNA behaved independently at all spatial scales studied, arguing for a decoupling of these two microbial processes. Significant variation in organic matter sedimentation between cylinders on drifting arrays is attributed to particle aggregation. This may contribute to spatial irregularity in organic matter supply to the seafloor. Spatial variability at the 10-100 m scale for all measures of microbial activity was of magnitude comparable to temporal signals over the course of the phytoplankton bloom. We suggest that local spatial variability and microbial responses to bloom events may be site specific, controlled by factors such as long term sedimentation regimes. These observations point out a need to develop new tools to better resolve the distribution of microbial activity on the seafloor.

Palabras clave: Phytoplankton, Bloom, Bacteria, Bacterioplankton, Microbial activity, Population density, Benthic zone, Spatial variation, Time variation, Summer, Organic matter, Environmental factor, Saint Lawrence Estuary, Brackish water environment, North Atlantic