Sedimentary organic matter of a high Arctic fjord as an indicator of climate warming

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The studies were carried out in an Arctic fjord – the Kongsfjord (Spitsbergen). Despite high latitude, the climate of this fjord has a sub-Arctic character due to the pronounced influence of relatively warm Atlantic water. This accelerates climate changes there and thus makes also that region a good monitoring site for studying the climate driven shifts in the marine environment. Productivity of ecosystems, increased glaciers retreat and changes of load of organic matter (OM) deposited to the sediments are obvious manifestations of climate warming. The main aim of this study was to establish if sedimentary OM is affected by recent climate warming. The spatial variability of both organic and inorganic carbon (C_{org}, C_{inorg}) and total nitrogen (N_{tot}) concentrations, the stable isotopes composition of C_{org} and N_{tot} ($\delta^{13}C$, $\delta^{15}N$) and the OM provenance was used to document the influence.

Although there are no significant spatial differences in total carbon concentrations, a very clear patterns are observed for C_{org} and C_{inorg} distributions. The lowest C_{org} concentration (10.5 mg/g) were measured at innermost stations and they increased (18.0 mg/g) along the fjord axis. Additionally, increase of C_{org} concentration was noticed towards the surface of sediment cores, in layers deposited within the last 50 years. A similar trend was observed for other measured parameters. For instance $\delta^{13}C_{org}$ ranged between -24.24 ‰ and -21.18 ‰ and values slightly decreased to the surface of the cores. These can be caused by a variety of processes. The most important are: (i) increased load of OM from melting glaciers, (ii) changes in the ecosystem productivity and/or (iii) gradual mineralization of OM in sediment. Stable isotopes shifts can be due to the recent increase in supply of the terrigenous OM and/or changes of phytoplankton $\delta^{13}C_{org}$ signature caused by the rising penetration of atmospheric CO_2 and/or a decrease of the biomass of ^{13}C-enriched ice algae.

To conclude, the results indicate shifts occurring in the functioning of the investigates ecosystem in the last few decades and suggest that they have been quite likely related to the climate warming. However, it is still unclear what processes are responsible and thus, also, what future directions of changes are to be expected.