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Methane release from seeps offshore W-Svalbard: Considerations to extrapolate fluxes into the water/atmosphere

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Increased (5-100 nM) and sometimes strongly increased (> 100 nM) methane concentrations in the water column, at the sea surface and even in the atmosphere (8 ppm) have been reported from Arctic areas. Some increases are clearly related to localized methane seep sites, others show a strong link to river runoff or to a widely spread (diffuse) methane release from degrading organic matter possibly linked to thawing permafrost. An important question in the marine science community is if the warming of the Arctic is already accelerating methane fluxes from the seabed into the water column and whether we are experiencing a significant flux into the atmosphere.

Marine methane fluxes from localized seep sites have been studied for several decades already and the general biogeochemical processes and transport mechanisms have been identified (e.g. AOM, carbonate precipitation, bubble release, sea-atmosphere fluxes) and are fairly well understood. But we still know very little about the temporal variability of methane release and the link to thawing offshore permafrost is still very un-researched. Two areas, the Eastern Siberian Shelf and W-Spitzbergen have been targeted by repeated research cruises to gain more knowledge about this topic. Here, we present work from W-Spitzbergen carried out from 2009 to 2011.

Since the discovery of methane seepage offshore Svalbard in 2008 (Westbrook et al., 2008), there has been an international effort to study this area by geophysical, oceanographic, visual and geochemical methods. Repeated hydroacoustic surveys with singlebeam and multibeam systems proved that bubble release in seep areas, at the upper gas hydrate boundary and the shelf edge has been continuous over the three years period. However, specific bubble releasing vents do show intermediate activity with episodic or cyclic release. In addition to this inconstant release, changing currents and internal waves physically influence the methane distribution in the water column, in addition biological processes reduce the methane concentration due to aerobic methane oxidation. Data show that tide-related currents and regional currents off W-Spitzbergen influence methane concentrations and distribution patterns more significantly than previously assumed. Further, we think that internal waves complicate the distribution pattern and thus the possible transport of methane into the atmosphere. Microbial activity oxidizing methane has been detected but rates are not very high.