



Long-term multi-variable time series of seep sites offshore West Spitsbergen

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The West Svalbard continental margin is an area of prominent methane seepage where shallow gas accumulation and release of methane gas to the water column have been observed. Methane release has been linked to both gas hydrate dissociation, melting permafrost, and vertical migration from deeper gas reservoirs, and the exact cause of seepage is still not fully understood (e.g. Sahling et al., 2014). Several factors have been suggested to affect the methane release, such as seasonal fluctuations in bottom water temperatures and pressure changes due to ocean tides (Berndt et al., 2014; Römer et al., 2016).

Investigations of methane release in the area are mostly based on point measurements acquired when sea and ice conditions allow for ship access, making both long and short term monitoring challenging. To shed more light on the temporal nature of the seep sites offshore Western Svalbard, two ocean observatories equipped with a wide array of instruments were deployed from June 2015 to May 2016 at ~250 and 90 m depth where thousands of methane seeps have been observed. The time-series highlight rapid and drastic changes in methane concentration up to several hundreds of nmol/kg within a few hours. The main driver for these rapid changes is the ocean currents and observations indicate that seepage persisted throughout the whole annual cycle. High concentrations of methane (up to ~1400 nmol/kg) were observed during periods of calm winds and ocean conditions, suggesting that the available energy for ocean mixing impacted the distribution of the methane. A decreased methane concentration in winter was not correlated with decreasing ocean temperatures and no relationship was found between the methane concentration and changes in hydrostatic pressure.

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