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Quantifying Methane Emissions from the Arctic Ocean Seabed to the Atmosphere

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Large quantities of methane are stored under the seafloor in the shallow waters of the Arctic Ocean. Some of this is in the form of hydrates which may be vulnerable to deomposition due to surface warming. The Methane Emissions from Arctic Ocean to Atmosphere MOCA, (http://moca.nilu.no/) project was established in collaboration with the Centre for Arctic Gas Hydrate, Environment and Climate (CAGE, https://cage.uit.no/). In summer 2014, and summer and autumn 2015 we deployed oceanographic CTD (Conductivity, Temperature, Depth) stations and performed state-of-the-art atmospheric measurements of CH4, CO_2, CO, and other meteorological parameters aboard the research vessel Helmer Hanssen west of Prins Karl's Forland, Svalbard. Air samples were collected for isotopic analysis (13C, 2H) and quantification of other hydrocarbons (ethane, propane, etc.). Atmospheric measurements are also available from the nearby Zeppelin Observatory at a mountain close to Ny-Ålesund, Svalbard. We will present data from these measurements that show an upper constraint of the methane flux in measurement area in 2014 too low to influence the annual CH4 budget. This is further supported by top-down constraints (maximum release consistent with observations at the Helmer Hansen and Zeppelin Observatory) determined using FLEXPART foot print sensitivities and the OsloCTM3 model. The low flux estimates despite the presence of active seeps in the area (numerous gas flares were observed using echo sounding) were apparently due to the presence of a stable ocean pycnocline at $\sim$50 m.