



Methane Emissions from the Arctic Ocean to the Atmosphere

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The release of methane (CH₄) presently stored in vast hydrate deposits under the seafloor is a potential climate tipping point and a major uncertainty in the global methane budget. Significant methane hydrate deposits are located in shallow waters in the Arctic where they may destabilise, releasing methane to the atmosphere due to ocean warming. To address this issue the Methane Emissions from Arctic Ocean to Atmosphere (MOCA, <http://moca.nilu.no/>) project was established in cooperation with the CAGE Centre of Excellence (<http://cage.uit.no/>). State-of-the-art oceanographic and atmospheric measurement techniques were applied over a large area of the Arctic including northern Norway, the Barents Sea, and areas of shallow water around Svalbard during summer 2014. Oceanographic measurements included the deployment of 63 measurement stations (temperature, salinity, density, oxygen, fluorescence, turbidity, etc.), water column sampling (CH₄, nitrate, phosphate, silicates), and echo sounding (revealing locations where streams of gas bubbles are vented). Atmospheric on-line measurements were performed aboard the research vessel Helmer Hanssen (CH₄, CO₂, CO, meteorological parameters) and during a flight campaign (CH₄, etc.). Air samples were collected for isotopic analysis (¹³C, ²H) and quantification of other hydrocarbons (ethane, propane, etc.). Finally, atmospheric measurements are compared with long term data sets from the nearby Zeppelin Mountain monitoring station (Ny Ålesund, Svalbard). Back-trajectory analysis and FLEXPART modelling are used to rule out non-local sources. Here we present an overview of all of these activities and the first results from MOCA in cooperation with CAGE - Centre for Arctic Gas Hydrate, and Climate at UiT, The Arctic University of Norway. We demonstrate that there are hotspots of activity where hydrocarbons are being emitted from the ocean, while in some areas emissions are surprisingly well contained by local biological and hydrological conditions.