Constraints on sea to air emissions from methane clathrates in the vicinity of Svalbard

Ignacio Pisso (1), Sunil Vadakkepuliyambatta (2), Stephen Matthew Platt (1), Sabine Eckhardt (1), Grant Allen (3), Joseph Pitt (3), Anna Silyakova (2), Ove Hermansen (1), Norbert Schmidbauer (1), Jurgen Mienert (2), Cathrine Lund Myhre (1), and Andreas Stohl (1)

(1) NILU, ATMOS, Kjeller, Norway, (2) CAGE – Centre for Arctic Gas Hydrate, Environment and Climate, Department of Geology, UiT the Arctic University of Norway, Tromsø, Norway., (3) School of Earth, Atmospheric and Environmental Sciences, University of Manchester, UK

Methane stored in the seabed in the form of clathrates has the potential to be released into the atmosphere due to ongoing ocean warming. The Methane Emissions from Arctic Ocean to Atmosphere (MOCA, http://moca.nilu.no/) proje sct conducted measurement campaigns in the vicinity of Svalbard during the summers of 2014 and 2015 in collaboration with the Centre for Arctic Gas Hydrate, Environment and Climate (CAGE, https://cage.uit.no/) and the MAMM (https://arcticmethane.wordpress.com) project . The extensive set of measurements includes air (BAe 146) and ship (RV Helmer Hansen) borne methane concentrations, complemented with the nearby monitoring site at Zeppelin mountain. In order to assess the atmospheric impact of emissions from seabed methane hydrates, we characterised the local and long range atmospheric transport during the aircraft campaign and different scenarios for the emission sources. We present a range of upper bounds for the CH4 emissions during the campaign period as well as the methodologies used to obtain them. The methodologies include a box model, Lagrangian transport and elementary inverse modelling. We emphasise the analysis of the aircraft data. We discuss in detail the different methodologies used for determining the upper flux bounds as well as its uncertainties and limitations. The additional information provided by the ship and station observations will be briefly mentioned.