Methane flux estimation of a large seep area offshore Svalbard based on visual observations and inverse hydroacoustic modeling

Mario Veloso (1), Jurgen Mienert (4), Marc De Batist (1), Jens Greinert (2,3,4)

(1) Ghent University, Vakgroep Geologie en Bodemkunde, Renard Centre of Marine Geology, Ghent, Belgium (MarioEnrique.VelosoAlarcon@UGent.be), (4) CAGE - Centre for Arctic Gas Hydrate, Environment and Climate, Department of Geology at UiT -Norways Arctic University, Dramsveien 201, N-9037 Tromsø, Norway, (2) GEOMAR Helmholtz Centre For Ocean Research Kiel, Wischhofstrasse 1-3, 24148 Kiel, Germany, (3) Royal Netherlands Institute for Sea Research (NIOZ), 1790 AB Den Burg (Texel), Netherlands

A seep site area at west of Prins Karl Forland (Svalbard) has been monitored since 2009 in order to evaluate its changes in space and time. Hydroacoustic data captured over four years have been used to understand the dynamic of the gas release and quantify the flow rate of gas coming from the seabed. Echograms indicate that gas release occurs between 200 and 400 mbsl and show that some of the acoustic flares reach the surface. Hydroacoustic data was captured with the EK60 echosounder system which uses a split-beam technique to determine the backscattering position inside the beam. The data obtained gives accurate information of the spatial distribution of the backscattering produced by bubble release. Gas release spot positions have been obtained using a geometrical average of spatial distribution of the backscattering, produced by the bubble cloud above the seafloor.

An inverse hydroacoustic method developed by Muyakshin et al (Muyakshin et al. 2010) has been used to quantify the flow rate of the gas release. The method uses as input the backscattering volume strength (S_V) of the bubble release above the seafloor, bubble size distribution (BSD) obtained from underwater video footage and bubble rising speed (BRS) values determined by models developed by different researchers (e.g., Leifer and Patro, 2002, Woolf 1993, Mendelson 1967). Gridding and interpolation of the acoustic information obtained from Sv values has been carried out, adapting the method in order to be used over a large area.

Flow rate calculations of a selected area (∼220 mbsl) have been carried out (using different BRS models and merged data from different years) giving values between 220 and 347 T/yr of methane assuming continuous discharge and a bubble containing 100% of CH_4. Temporal variability of methane fluxes was evaluated using the 'common' insonified areas with acoustic information of gas release over the seafloor.

Comparison of calculated fluxes from common areas have shown that methane release in 2009 was bigger than the rest of the years (2010, 2012 and 2013) but also has indicated big differences of fluxes during the same year, making clear big differences in a short period of time.

Because our study area represents the reality of methane release in the Arctic, the comprehension of this phenomenon seems to be one of the keys to predict possible implications of the methane release over the climate change.