Geophysical Research Abstracts
Vol. 17, EGU2015-7036, 2015
EGU General Assembly 2015

Using stable isotopes to unravel the role of sea-ice in the methane cycle

Célia Julia Sapart (1,2), Jiayun Zhou (1), Gauthier Carnat (1), Bruno Delille (3), Helge Niemann (4), Thomas Röckmann (2), Carina van der Veen (2), and Jean-Louis Tison (1)

(1) Laboratoire de Glaciologie, Université Libre de Bruxelles, BELGIUM (csapart@ulb.ac.be), (2) Institute for Marine and Atmospheric Research, Utrecht University, Atmospheric physic and chemistry, UTRECHT, Netherlands (c.j.sapart@uu.nl)nstitute for Marine and Atmospheric Research, Utrecht University, Atmospheric physic and chemistry, UTRECHT, Netherlands, (3) Astrophysics, Geophysics and Oceanography department, Université de Liège, BELGIUM, (4) Department of Environmental Sciences, University of Basel, SWITZERLAND

Methane plays an important role in the Earth's climate system. The atmospheric methane concentration has increased in concert with the industrialization, but since the mid 80's the methane growth rate decreased to reach a near-zero level in 2000 and started to increase again from 2007 on. However, the underlying variations in sources and/or sinks that cause these variations are to date not well understood. To predict future climate, it is essential to unravel the processes controlling the methane cycle, especially in the Arctic regions, which are highly vulnerable to climate change and contain large methane reservoirs. Recently, an unexpected methane excess has been reported above Arctic sea-ice showing that sea-ice might play a significant role in the methane cycle. Nonetheless, the nature of the process leading to methane production in or nearby sea-ice has not yet been identified.
We applied a new multi-proxy approach merging atmospheric chemistry, glaciology and biogeochemistry to understand and quantify the processes responsible for the methane excess above sea-ice. We performed methane isotope (δ13C and δD) analyses on sea-ice samples, as well as geochemical measurements, to determine the possible pathways involved in methane production and removal in or nearby sea-ice.
We will present results from sea-ice samples drilled above the shallow-shelf in Barrow (Alaska) from January to June 2009 as well as above deep Southern Ocean locations in 2013. It has long been thought that methane present in sea-water would oxidize in or under the sea ice, but our first stable isotope sea ice profiles show no significant oxidation pattern. On the other hand, we show that landfast sea ice from both the shallow-shelf of Barrow and our deeper Southern Ocean site is supersaturated in methane and that under specific conditions methane is likely formed in the ice.