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Understanding of the atmospheric methane evolution and change over the last 30 years with focus on the Arctic region

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The methane (CH4) concentration is increasing in the atmosphere, both globally and in the Arctic region since ∼2005. The explanation to this is currently not well understood. There are huge reservoirs of CH4 in the Arctic; both methane hydrates in seabed sediments, and organic material in land- and marine-based permafrost which can be partly converted to CH4 after permafrost thaw. Both are vulnerable to destabilization in a warming climate. The Arctic Ocean surface waters may also represent a potentially important source of CH4, which may be sensitive to changes in sea-ice cover. Previous studies show strong atmospheric chemistry feedback to climate warming from Arctic methane emissions.

Final results from the GAME project (Causes and effects of Global and Arctic changes in the MEthane budget), and first results from the MOCA project (Methane Emissions from the Arctic OCean to the Atmosphere: Present and Future Climate Effects: http://moca.nilu.no) will be presented. One goal of these studies is to improve the understanding on how emissions in different regions, transport and chemical processes contribute to observed changes in atmospheric methane distribution the last 40 years, with particular focus on the Arctic, including CH4 emissions from the ocean like the East Siberian Arctic Shelf.

The work is an integrated study combining new measurements at Zeppelin Observatory, Svalbard, analysis of existing and ongoing methane observations and other relevant species, and Chemical Transport Modelling (CTM). The Oslo CTM3 model is used to calculate distribution and changes over the last 40 years. The study include evaluation of different methane sources and source regions, and chemical processes affecting OH distribution and changes, including changes in anthropogenic and natural emissions from different sources.

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