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Assessment of CH₄ sources in the Arctic using regional atmospheric measurements and their link to surface emissions

Sophie Wittig¹, Antoine Berchet¹, Jean-Daniel Paris¹, Mikhail Arshinov², Toshinobu Machida³, Motoki Sasakawa³, Doug Worthy⁴, and Isabelle Pison¹

¹Laboratoire des Sciences du Climat et de l'Environnement (LSCE), CEA-CNRS-UVSQ, IPSL, Gif-sur-Yvette, France

²V.E. Zuev Institute of Atmospheric Optics, Russian Academy of Sciences, Tomsk, Russia

³Center for Global Environmental Research, National Institute for Environmental Studies (NIES), Tsukuba, Japan

⁴EC, Environment Canada, Canada

The Arctic is a critical area in terms of global warming. Not only are the rising temperatures already causing changes in the natural conditions of this region, but the high potential of increased methane (CH₄) regional emissions are also likely to intensify global warming even stronger in the near term.

This future effect consists in the thawing and destabilization of inland and sub-sea permafrost that enhance the release of methane into the atmosphere from extensive CH₄ and organic carbon pools which have so far been shielded by ice and frozen soil. Moreover, the high latitude regions are already playing a key role in the global CH₄-budget because of such large sources as wetlands and freshwater lakes in addition to human activities, predominantly the fossil fuel industry of the Arctic nations.

However, the level of scientific understanding of the actual contribution of Arctic methane emissions to the global CH₄-budget is still relatively immature. Besides the difficulties in carrying out measurements in such remote areas, this is due to a high inhomogeneity in the spatial distribution of methane sources and sinks as well as to ongoing changes in hydrology, vegetation and carbon decomposition.

Therefore, the aim of this work is to reduce the uncertainties about methane sources and sinks in the Arctic region during the most recent years by using an atmospheric approach, in order to improve the quality of the assessment of the local and global impacts.

To do so, the data of atmospheric CH₄ concentrations measured at about 30 stations located in different Arctic nations have been analysed in regard to the trends, seasonal fluctuations and spatial patterns that they demonstrate as well as their link to regional emissions.