



## Quantification of strong emissions of methane in the Arctic using spectral measurements from TANSO-FTS and IASI

Zakia BOURAKKADI, Sébastien PAYAN, and Jérôme BUREAU  
LATMOS, Paris, France (zakia.bourakkadi@latmos.ipsl.fr)

Methane is the second most important greenhouse gas after the carbon dioxide but it is 25 times more effective in contributing to the radiative forcing than the carbon dioxide(1).

Since the pre-industrial times global methane concentration have more than doubled in the atmosphere. This increase is generally caused by anthropogenic activities like the mass use and extraction of fossil fuel, rice paddy agriculture, emissions from landfills...

In recent years, several studies show that climate warming and thawing of permafrost act on the mobilization of old stored carbon in Arctic causing a sustained release of methane to the atmosphere(2),(3),(4).

The methane emissions from thawing permafrost and methane hydrates in the northern circumpolar region will become potentially important in the end of the 21st century because they could increase dramatically due to the rapid climate warming of the Arctic and the large carbon pools stored there.

The objective of this study is to evaluate and quantify methane strong emissions in this region of the globe using spectral measurements from the Thermal And Near Infrared Sensor for carbon Observations-Fourier Transform Spectrometer (TANSO-FTS) and the Infrared Atmospheric Sounding Interferometer (IASI). We use also the LMDZ-PYVAR model to simulate methane fluxes and to estimate how they could be observed by Infrared Sounders from space.

To select spectra with high values of methane we developed a statistical approach based on the singular value decomposition. Using this approach we can identify spectra over the important emission sources of methane and we can by this way reduce the number of spectra to retrieve by an line-by-line radiative transfer model in order to focus on those which contain high amount of methane.

In order to estimate the capacity of TANSO-FTS and IASI to detect peaks of methane emission with short duration at quasi-real time, we used data from MACC (Monitoring Atmospheric Composition and Climate) simulations to compute spectra which we are compared to those from TANSO-FTS and IASI.

### References

- [1] Intergovernmental Panel on Climate Change (2007), *Climate Change 2007: The Physical Science Basis*, edited by S. Solomon et al., Cambridge Univ.Press, Cambridge, U.K.
- [2] N. Shakhova, I. Semiletov, A. Salyuk, V. Yusupov, D. Kosmach, O.Gustafsson.: Extensive Methane venting to the atmosphere from sediments of the East Siberian Arctic shelf, *SCIENCE* 5 March 2010, Vol 327.
- [3] K. Negandhi, I. Laurion, M. J. Whiticar, P. E. Galand, X. X. Connie Lovejoy.: Small thaw ponds: An unaccounted source of methane in the canadian high Arctic, *PLOS ONE* november 2013/ vol 8/issue 11/e78204.
- [4] J. T. Crawford, R. G. Striegl, K. P. Wickland, M. Dornblaser, and E. Stanley.: Emissions of carbon dioxide and methane from a headwater stream network of interior Alaska, *Journal of Geophysical Research : Biogeosciences*, VOL, 118, 482-494, doi:10.1002/jgrg,20034, 2013.