Continuous measurement of atmospheric methane concentration using 9-tower network over Siberia

Motoki Sasakawa[1]; Kou Shimoyama[2]; Toshinobu Machida[3]

[1] CGER, NIES; [2] ILTS; [3] NIES

Noritsugu Tsuda[4]; Hiroshi Suto[5]; Mikhael Arshinov[6]; Denis Davidov[6]; Alexandrov Fofonov[6]; Oleg Krasnov[6]

[4] GEF; [5] JAXA; [6] IAO, RAS

We are conducting continuous atmospheric CH_4 measurement (as well as CO_2) with tower network in Siberia in order to investigate CH_4 behavior in the forest, steppe, and wetland region and estimate the distribution of CH_4 flux over this huge area where only few atmospheric researches were made [e.g. *Kozlova et al.,* 2008] due to the severe nature. The tower network consists of 9 towers located at Berezorechka (BRZ; 56.09'N, 84.20'E), Karasevoe (KRS; 58.15'N, 82.24'E), Igrim (IGR; 63.12'N, 64.24'E), Demyanskoe (DEM; 59.47'N, 70.52'E), Noyabrsk (NOY; 63.26'N, 76.46'E), Savvushka (SVV; 51.20'N, 82.08'E), Yakutsuk (YAK; 62.50'N, 129.21'E), Azovo (AZV; 54.43'N, 73.02'E), and Vaganovo (VGN; 53.58'N, 58.24'E). We developed a new portable CH_4 sensor based on a tin-dioxide natural gas leak detector, which enables us to measure CH_4 concentration continuously without high power, large space nor hydrogen gas.

Rigby et al. [2008] reported that global CH_4 growth near the beginning of 2007 followed a period of little change since 1999 [*Dlugokencky et al.,* 2003]. Our first CH_4 system started to work from the second half of 2004, and now 9 systems are operating well. Thus CH_4 growth since 2007 might be observed over Siberia as well. The northwestern Siberia is regarded as one of the most important CH_4 source region in the world because there are huge area of wetland, thus the data from the northern towers can tell us valuable CH_4 source information.

We extracted the representative CH_4 data over Siberia without local source influence using the ratio of $[CH_4]/[CO_2]$. Daytime (13:00-17:00) average of this representative CH_4 data often showed high concentration (over 2000ppb) particularly over the northern sites (IGR and NOY), which suggests that wetlands influence CH_4 over the wide region of northern Siberia. We estimated the annual trends at KRS, IGR, and DEM which have enough data (over 1 year). Trend line at IGR indicates CH_4 concentration is increasing from 2005 to 2008. And the growth rate at IGR has been positive for this period. Averaged seasonal cycles at these three sites show similar shape with two peaks at winter (January and February) and summer (July and August) in a year. Synoptic CH_4 feature over Siberia will be elucidated more using this 9-tower network and CH_4 budget calculation in continental scale will be done with the coming data in the near future.

References

Kozlova, E. A., A. C. Manning, Y. Kisilyakhov, T. Seifert, and M. Heimann (2008), Seasonal, synoptic, and diurnal-scale variability of biogeochemical trace gases and O*2* from a 300-m tall tower in central Siberia, *Global Biogeochem. Cycles, 22,* GB4020, doi:10.1029/2008GB003209.

Rigby, M., et al. (2008), Renewed growth of atmospheric methane, *Geophys. Res. Lett., 35,* L22805, doi:10.1029/2008GL036037.

Dlugokencky, E. J., S. Houweling, L. Bruhwiler, K. A. Masarie, P. M. Lang, J. B. Miller, and P. P. Tans (2003), Atmospheric methane levels off: Temporary pause or a new steady-state?, *Geophys. Res. Lett., 30*(19), 1992, doi:10.1029/2003GL018126.