Geophysical Research Abstracts
Vol. 16, EGU2014-10123, 2014
EGU General Assembly 2014

Exchange of nitrous oxides and carbon dioxide measured using the eddy covariance technique in a high-latitude city

Leena Järvi (1), Annika Nordbo (1), Üllar Rannik (1), Sami Haapanala (1), Mari Pihlatie (1), Ivan Mammarella (1), Anu Riikonen (2), Eero Nikinmaa (2), and Timo Vesala (1)

(1) University of Helsinki, Department of Physics, Helsinki, Finland (leena.jarvi@helsinki.fi), (2) University of Helsinki, Department of Forest Sciences, Helsinki, Finland

In Helsinki, Finland, carbon dioxide (CO_2) fluxes have been measured continuously using the eddy covariance (EC) technique since 2005. In summer 2012, the measurements were supplemented with the fluxes of nitrous oxide (N_2O) in order to examine how the exchanges of these two important greenhouse gases behave in urban environment.

The EC measurements are made at the semi-urban measurement station SMEAR III Kumpula site located four kilometres north-east from the Helsinki city centre. The measurements are made on the top level of a 31 meters high lattice tower (60°12.17'N, 24°57.67'E) located on a hill, 26 m above sea level. The area around the tower can be divided into three surface cover sectors: built, road and vegetation, each representing the typical surface cover of the area. These areas allow us to examine the effect of different urban surface covers to the exchange of CO_2 and N_2O. The measurement setup includes an ultrasonic anemometer (USA-1, Metek GmbH) and a closed-path infrared gas analyzer (LI-7000, LI-COR) to measure the CO_2 flux. During the summer 2012 measurement campaign lasting from 21 June till 27 November, the N_2O flux was measured using a TDL spectrometer. Commonly accepted procedures were used to post-process the raw 10 Hz data.

Overall, the measurement surroundings act as a source for both CO_2 and N_2O. The long-term measurements of the CO_2 flux show a strong seasonal variation with clear effect from vegetation. In summer in the direction of high fraction of vegetation cover, the CO_2 uptake exceeds its emissions and a downward flux reaching on average 10 μmol m^{-2} s^{-1} is observed. N_2O on the other hand reaches its maxima values (campaign median 2.0 μmol m^{-2} h^{-1}) in the same direction. This indicates that vegetation cannot be neglected in the urban greenhouse exchange studies. Traffic had a clear role emitting both N_2O and CO_2 with higher emissions during the rush hours than at other times. In the direction of the heavily trafficked road, dependence between the two fluxes was observed.

The annual CO_2 emission calculated from five years are on average 1760 g C m^{-2}. Most of the emissions come from the road sector with an annual emission of 3500 g C m^{-2}. Using the measured emission ratio between N_2O and CO_2 as a proxy in this direction yielded an annual N_2O emission of 0.26 g N m^{-2}.