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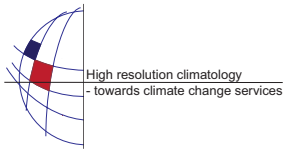

Diurnal and seasonal variability of carbon dioxide net turbulent flux in the center of Łódź, Poland

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Research concerning intensity of carbon dioxide absorption/emission is one of the most important climatologic issues, especially today, when the role of this gas in global warming process is widely discussed. During recent years, number of papers presenting characteristics of CO2 exchange between active surface and troposphere rapidly grew because of wide application of eddy covariance method which enables the accurate measurements of heat and mass exchange within the surface-troposphere system. Measurements of turbulent vertical carbon dioxide net flux above the urban terrain are carried out relatively rare, despite the fact that the cities are meaningful sources of CO2, which is a side effect of public transport, industry, house heating etc. Continuous measurements of carbon dioxide turbulent flux carried out with the eddy covariance method have been made in Łódź since July 2006. The measurement point is located in the west part of the densely built-up city centre, where artificial surfaces clearly prevail over natural terrain. The measurement system includes a Kipp & Zonen's CNR1 net radiometer, RMY 81000 sonic anemometer, and Li-cor 7500 open path H2O/CO2 infra red gas analyser. Sensors are installed on the high tower 20 m above the roof of the building and 37 m above the ground. The diurnal and annual variability of carbon dioxide flux FCO2 for the period July 2006 – March 2010 is analysed in this work. The results show characteristic features in diurnal and annual courses of FCO2. Independently from the season, upward fluxes of the order of 0–15 μmol m–2 s–1 prevail in the data. During the cold season an increase in turbulent CO2 exchange is observed and FCO2 quite often exceeded 30 μmol m–2 s–1. This can be attributed to anthropogenic CO2 emissions, which are particularly strong in winter due to, among other things, mineral fuel combustion during domestic heating. The average monthly fluxes are positive in all seasons, which means that emission of CO2 in the surroundings of the measurement point prevails over absorption. Apart from the season, the maximum of flux occurred during the day and the minimum during the second part of the night. Wintertime monthly averaged fluxes are much higher than summertime ones. The observed increase in CO2 exchange during weekdays in comparison with weekends can be caused by the weekly rhythm of traffic in the surroundings of measurement point. Funding for this research was provided by the Polish Ministry of Science and Higher Education (State Committee for Scientific Research) under grant N N306 519638 for the years 2010–2013.