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Fossil fuel CO₂ detection by atmospheric ¹⁴C and CO₂ mixing ratio measurements in the city of Debrecen, Hungary

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Fossil fuel CO2 content in the air of a major Hungarian city (Debrecen) was determined using together measurement of CO2 mixing ratio and radiocarbon (14C) content of air.
In this project we developed a high precision atmospheric CO2 monitoring station in Debrecen. An integrating sampling system (developed by ATOMKI) was applied for radiocarbon measurements. One sampler was installed in Debrecen station and two independent 14CO2 sampling line were installed ~ 300 km far from Debrecen at Hegyhátsál station as independent background references, where high precision atmospheric CO2 mixing ratio measurement is also running since 1997.
During the winter of 2008/09 we measured the mixing ratio and radiocarbon content of atmospheric CO2 at Debrecen and the reference station simultaneously. It was concluded that trends in CO2 mixing ratio variations in time are very similar at the three different sampling points (2 m above ground in Debrecen, 10 m and 115 m above ground in Hegyhátsál). Air quality in Debrecen during September of 2008 seemed to be relatively clear from the point of view of its CO2 content at least. When winter came closer in October, with lover outside temperature and less sunshine hours the CO2 content of air was increased in general at all the three sampling points, but this effect was more intensive closer to the ground level.
According our radiocarbon observations it was clearly indicated that there was not significant amount of fossil fuel CO2 in the air of Debrecen during September in 2008. But during the winter of 2008/09 the Δ14C value of atmospheric CO2 of Debrecen decreased with more than 40 ‰ relative to September's results, and according our calculations it was caused by about 20 ppm fossil fuel CO2 which appeared as a surplus amount in the air above the September level.

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