



Basal respiration – a proxy to understand spatial variability of soil CO₂ emissions in urban regions

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Soil respiration (Rs) is an important terrestrial CO₂ efflux and received significant attention at different scale levels. However, the sampling density is limited and global Rs databases are biased towards natural ecosystems and towards north America and Europe. This limits our understanding of the spatial variability of Rs. The methodological constraints of direct Rs measurements in the field limit the number of observations. As an alternative approach to approximate the spatial variability of Rs, we used basal respiration (BR) as an indirect measurement. First, the direct Rs and indirect BR measurements were compared at a 10 km² test area in Moscow city, which included adjacent forests, croplands and urban lawn plots. Rs was monitored by in situ chamber approach with an IR Li-820 gas analyzer at 50 points during the growing season (June-October 2013, 9 time repetitions per point). In the same area, 32 locations were sampled and BR was measured under controlled conditions. Rs was affected by anthropogenic disturbance with the highest values in urban lawns. BR was mainly controlled by soil organic carbon (SOC) with maximum rates in the forested area. Total variability reported by direct observations was 10% higher, than one for BR, although the spatial variability captured by both approaches was similar confirmed by significant correlation between variance coefficients (CV) of the values. This shows that BR is a relevant proxy to analyze the spatial variability of Rs. Subsequently, the sampling area was expanded to the Moscow region for which respiration was mapped using digital soil mapping techniques and BR as a proxy for Rs. Although the absolute levels of respiration remained uncertain, the spatial patterns of BR are likely to correspond well with Rs patterns. Land use largely determined the spatial heterogeneity of soil respiration. Most variation occurred in the urban areas. BR is a relevant and straightforward proxy to understand patterns of Rs especially in regions where direct and high-resolution measurements are currently unavailable