**Partitioning of ecosystem respiration in a beech forest - DTU Orbit (10/12/2018)**

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Terrestrial ecosystem respiration (Reco) represents a major component of the global carbon cycle. It consists of many sub-components, such as aboveground plant respiration and belowground root and microbial respiration, each of which may respond differently to abiotic factors, and thus to global climate change. To correctly predict future carbon cycles in forest ecosystems, Reco must therefore be partitioned and understood for each of its various components. In this study we used the eddy covariance technique together with manual and automated closed-chambers to quantify the individual components of Reco in a temperate beech forest at diel, seasonal and annual time scales. Reco was measured by eddy covariance while respiration rates from soil, tree stems and isolated coarse tree roots were measured bi-hourly by an automated closed-chamber system. Soil respiration (Rsoil) was measured in intact plots, and heterotrophic Rsoil was measured in trenched plots. Tree stem (Rstem) and coarse root (Rroot) respiration were measured by custom made closed-chambers. We found that the contribution of Rstem to total Reco varied across the year, by only accounting for 6% of Reco during winter and 16% during the summer growing season. In contrast Rsoil was approximately half of Reco during winter (52%), spring (45%) and summer (49%), while the contribution increased to 79% during autumn. Based on observed fluxes in the trenched and intact soil plots, we found that autotrophic Rsoil accounted for 34% of Rsoil during summer, i.e. a relatively low fractional estimate compared to findings from other studies. It is likely that dead roots were still decomposing in the trenched soil plots thus causing overestimation of heterotrophic Rsoil. Diel Rstem and Rroot measurements showed a distinct pattern during summer with the highest respiration rates around 13:00-15:00 CET for Rstem, and the highest respiration seen from 9:00–15:00 for Rroot. In contrast, Rsoil showed the lowest respiration during daytime with no clear difference in the diel pattern between the intact and trenched soil plots. Finally, we calculated annual Rsoil for different transects, and found that annual Rsoil estimated from the previously used transect at the site was underestimated due to Rsoil of the transect not being representative for the spatial heterogeneity of Rsoil at the site. This highlights the importance of performing a sufficient number of chamber measurements at a site to adequately capture the spatial variation and estimate Rsoil correctly.

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