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Integrated Carbon Flux Analysis in a Mid-Latitude Deciduous Forest: The First 10 Years

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In this study, we compare 10 years (1998-2007) of carbon budget estimates obtained with two independent methods: the micrometeorological approach based on eddy-covariance measurements, and the biometric method based on carbon stock increment measurements in a mixed deciduous forest in the Morgan-Monroe State Forest, Indiana, USA. Even though the cumulative estimates of both methods for the ten-year period are within 1% of each other, differences between biometric estimates of net ecosystem productivity (NEP-BM) and the corresponding eddy covariance based estimates (NEP-EC) were large in some years (up to 100%). We focus our analysis on the inter-annual variability in NEP and on the differences between the two methods and what processes they represent. We interpret our results in terms of ecosystem response to inter-annual and seasonal meteorological variability, extreme weather events (like late-spring or early-fall frost and intense and prolonged droughts), and consequences for allocation to different carbon pools. This work confirms the importance of long-term experiments in which results from both approaches are used to reduce overall uncertainty of NEP estimates, increase the understanding of carbon partitioning among different compartments of the forest ecosystem, and helps to explain observed inter-annual variability.