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Storage flux uncertainty impact on eddy covariance net ecosystem exchange measurements

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Complying with several assumption and simplifications, most of the carbon budget studies based on eddy covariance (EC) measurements, quantify the net ecosystem exchange (NEE) by summing the flux obtained by EC (Fc) and the storage flux (Sc). Sc is the rate of change of CO_2, within the so called control volume below the EC measurement level, given by the difference in the instantaneous profiles of concentration at the beginning and end of the EC averaging period, divided by the averaging period. While cumulating over time led to a nullification of Sc, it can be significant at short time periods. The approaches used to estimate Sc fluxes largely vary, from measurements based only on a single sampling point (usually located at the EC measurement height) to measurements based on several sampling profiles distributed within the control volume. Furthermore, the number of sampling points within each profile vary, according to their height and the ecosystem typology. It follows that measurement accuracy increases with the sampling intensity within the control volume. In this work we use the experimental dataset collected during the ADVEX campaign in which Sc flux has been measured in three similar forest sites by the use of 5 sampling profiles (towers). Our main objective is to quantify the impact of Sc measurement uncertainty on NEE estimates. Results show that different methods may produce substantially different Sc flux estimates, with problematic consequences in case high frequency (half-hourly) data are needed for the analysis. However, the uncertainty on long-term estimates may be tolerate.