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## Evaluation of low-cost eddy covariance for CO<sub>2</sub> fluxes over agroforestry and grassland

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Agroforestry is an integration of trees in cropland or grassland and is discussed, within Germany and the EU, as a potential “Green Solution” for agriculture. Agroforestry alters the microclimate, productivity, biodiversity, and nutrient and water usage – as compared to standard agricultural practise. A potentially key benefit is the higher carbon sequestration of agroforestry, relative to monoculture systems, which could provide an interesting option for mitigating climate change, while still providing valuable arable land. Net ecosystem exchange studies of CO<sub>2</sub> (NEE) of agroforestry systems are rare, in comparison to the extensive studies of NEE of agricultural systems (croplands and grasslands). Therefore, the current study, as part of the SIGNAL (sustainable intensification of agriculture through agroforestry) project, investigates the NEE of agroforestry compared to that of monoculture agriculture.

At five locations across Germany, paired flux measurements above agroforestry and monoculture agronomy are performed using innovative low-cost CO<sub>2</sub> eddy covariance sensors (slow response Vaisala GMP343 IRGA, with custom made housing). During the summer of 2020 simultaneous measurements of the low-cost setup and a LI-COR 7200 are performed, above grassland at 3.5 m and adjacent agroforestry grassland at 10 m measurements height.

The low-cost eddy covariance system is able to capture the turbulent (diurnal) CO<sub>2</sub> flux dynamics and the response to management activities. After spectral corrections and applying quality control, the low-cost system at the agroforestry site (slope = 0.92, R<sup>2</sup> = 0.88) performs better than the low-cost system at the grassland site (slope = 0.67, R<sup>2</sup> = 0.80), when compared to the LI-COR measurements. This is probably due to the difference in turbulence caused by different surface roughness and measurement height. The preliminary cumulative carbon flux during the four-month measurement campaign shows a significant difference between the grassland (source of (+) 16-38 gC/m<sup>2</sup>) and agroforestry grassland (sink of (-) 148-164 gC/m<sup>2</sup>), in favour of agroforestry. By applying post processing software, we aim to further optimize the frequency corrections for the low-cost system. In the future the obtained post processing scheme will be applied to the other low-cost eddy covariance systems within the project.