The NEE-PAR relationship for a young spruce plantation

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In a young Norway spruce stand (planted in 2012) at Hoxmark, Southeast Norway, Net Ecosystem Exchange (NEE) was measured using Eddy Covariance. The data were carefully processed with time-dependent stand parameters (i.e. canopy height), a detailed footprint analysis and calculated at 30 min temporal resolution. Photosynthetic Active Radiation (PAR) as the primary driver for carbon uptake was also available at the site.

Despite its young age, the plantation already acted as a net carbon sink according to the annual NEE budget, e.g. by ca. 300 g C m\textsuperscript{-2} in 2019. However, the response of the system depended strongly on hydrometeorological conditions. We demonstrate this by investigating the relationship between NEE and PAR for this system in a temporally local fashion (30 days moving windows), using a Michaelis-Menten approach involving three parameters. Although the regression captured up to ca. 80% of the variance, the parameter estimates differed substantially throughout the season, and were contrasting between the very dry year 2018 and the close to normal year 2019.

Comparison with other EC-equipped sites in a future study will clarify whether this variable sensitivity is due to the young age or is a pattern pertaining also to mature spruce stands.