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Impact of vegetation structure and elevation on carbon dioxide fluxes detected by overlaying footprints onto LIDAR data

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Carbon dioxide, water, and energy fluxes vary spatially and temporally within forested environments. In this contribution, a new methodology is presented for extracting structural vegetation characteristics and topography within high-resolution footprints, for direct comparison with carbon dioxide flux observations.

As a first step, a footprint climatology for a flux station in the southern boreal forest in Saskatchewan, Canada (Old Jack Pine, Canadian Carbon Program) is derived using a footprint parameterisation. Tree height, canopy depth, and foliage density obtained from three-dimensional scanning LIDAR data are then extracted within the 30-minute flux footprints. Finally, these components are related to net ecosystem productivity and gross primary productivity measured with eddy covariance methods.

Results illustrate that both structural heterogeneity and local elevation have a significant influence on carbon dioxide fluxes even though the site is rather homogeneous compared to many other sites. Structure and elevation are almost as significant as meteorological driving mechanisms.