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What do we know of canopy exchange of methane in forest ecosystems?

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Forest soils are generally considered as a sink of atmospheric methane (CH_4), while trees and vegetation are not accounted in the CH_4 balance of forests. Recent studies show that trees may both emit and consume CH_4 from the stem and from the canopy, and by doing so, significantly influence the CH_4 balance of forest ecosystems. While tree-stem fluxes are more commonly studied, much less is known of the canopy CH_4 exchange especially in the field. This has partly been due to challenges in accessing forest canopies, but also due to challenges in measuring undisturbed CH_4 exchange by tree shoots. Our aim is to review current understanding of canopy CH_4 exchange and connected processes in forest ecosystems, and to discuss challenges that need to be overcome for reliable canopy flux measurements in the field.

We will present example canopy CH_4 flux data from boreal trees and we will compare in situ enclosure measurements of leaf/shoot exchange to CH_4fluxes measured above the forest canopy using flux gradient and eddy covariance methods. We will also introduce advanced and automated enclosure measurement system developed for continuous CH_4 exchange measurements from tree shoots at Hyytiälä SMEAR II station, Finland. Based on our measurements during the last year, the leaf-level canopy CH_4 exchange of boreal trees involves both emission and consumption processes, while the drivers of the CH_4 exchange are still poorly understood. We also recognize that our understanding of the exchange processes is still incomplete, and to solve that we need more process studies combined with the planned state-of-the-art field measurements.