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Do the measurements of branch scale VOC emissions, ecosystem scale fluxes, and surface layer concentrations tell the same story?

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VOC emissions from vegetation can be measured using various methods which typically give emission values in different spatial scales. For example, the commonly used enclosure technique is used to measure emissions in leaf to plant scale, while the micrometeorological flux measurement yield emissions in the ecosystem scale. On the other hand the VOC concentration measurements are affected by emissions from area larger than flux measurements, labeled here as the landscape scale. Furthermore, the concentrations are also affected by atmospheric chemistry and turbulent mixing.

VOC emission inventories have traditionally been based on emission measurements conducted using enclosure techniques. Sometimes also ecosystem scale flux measurements are used as a source of input parameters. These models are often used to provide input data for regional air quality models and they generally operate in the landscape scale. Thus the up-scaling from smaller scales to model scale introduces a source of uncertainty in their results.

We explore the validity of the up-scaling of the emission of various VOCs from branch via ecosystem scale to landscape scale. We utilize emission measurements using both automated enclosure and disjunct eddy covariance techniques conducted at a managed boreal Scots pine forest in Southern Finland. Measurements of atmospheric concentrations of VOC are used together with models that describe turbulent transport and atmospheric chemistry of the VOCs.