



Shoot-level monitoring of O₃ and NO_x fluxes of Scots pine (*Pinus sylvestris* L.)

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O₃ and nitrogen oxides (NO_x=NO+NO₂) are important atmospheric pollutants. Both are involved in atmospheric chemistry in various significant ways. O₃ is a greenhouse gas. Both gases have potentially harmful effects on plants, but NO_x can have nutritional as well as toxic effects. One of the processes underlying the atmospheric balance of O₃ and NO_x is their interaction with vegetation. Both are removed, absorbed, and NO_{rmx} potentially also emitted by the foliage. The mechanisms driving these processes are not known in sufficient detail for accurate modeling of leaf-level O₃ and NO_x fluxes for the needs of i.e. global atmosphere-biosphere models. For example, the role of biogenic volatile compounds (BVOCs) in ozone scavenging and the role of nitrate in the biological and chemical NO_x emissions require further research.

The SMEAR II (Station of Measuring Forest Ecosystem-Atmosphere Relations) station in Hyytiälä, Finland, is well-known for its series of shoot-level O₃ and NO_x fluxes measured on Scots pine (*Pinus sylvestris* L.) in the field. Measurements from shoot-scale gas exchange chambers have provided valuable insights into O₃ and NO_x exchange (i.e. Raivonen & al. 2009, Altimir & al. 2006). The measuring system has since been upgraded with at least two major improvements:

- A new chamber type was designed in order to remove the enclosure effect. The chamber is built as a sliding box that encloses the shoot only for the short time needed to make a measurement and otherwise allows the shoot to experience all occurring ambient conditions, including wind and rain.

-In order to allow targeted flux measurement of NO_x, not NO_y, the molybdenum converter of the NO_x analyser was replaced with a photolytic, NO₂-specific one.

We present preliminary results of O₃ and NO_x shoot-scale flux measurements after these improvements and discuss their value in increasing our understanding of the shoot-scale processes involving O₃ and NO_x.

Altimir N., Kolari P., Tuovinen J.-P., Vesala T., Bäck J., Suni T., Kulmala M. & Hari P. 2006. Foliage surface ozone deposition: a role for surface moisture? *Biogeosciences* 3 : 209-228.

Raivonen M., Vesala T., Pirjola L., Altimir N., Keronen P., Kulmala M. & Hari P. 2009. Compensation point of NO_x exchange: Net result of NO_x consumption and production. *Agric for Meteorol* 149(6-7):1073-81.