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Internal conductance of Scots pine varies with vapour pressure deficit

Lenka Foltýnová (1,2), Yann Salmon (2,3), Linda Kooijmans (4,5), Ivan Mammarella (2), Kukka-Maaria Erkkilä (2), Huilin Chen (4), Kadmiel Maseyk (6), Wu Sun (7), Timo Vesala (2,3,8), and Teemu Hölttä (3)

(1) Global Change Research Institute Czech Academy of Sciences, Brno, Czech Republic, (2) Institute for Atmospheric and Earth System Research/Physics, Faculty of Science, University of Helsinki, Finland, (3) Institute for Atmospheric and Earth System Research/Forest Sciences, Faculty of Agriculture and Forestry, University of Helsinki, Finland, (4) Centre for Isotope Research, University of Groningen, Groningen, The Netherlands, (5) Meteorology and Air Quality, Wageningen University and Research Center, Wageningen, The Netherlands, (6) School of Environmental, Earth and Ecosystem Sciences, Open University, Milton Keynes, UK, (7) Department of Atmospheric and Oceanic Sciences, University of California Los Angeles, Los Angeles, CA, USA, (8) Viikki Plant Science Centre, University of Helsinki, Helsinki, Finland

Leaf internal conductance is the most limiting step in the transport pathway of CO_2 uptake during photosynthesis when stomata are open. This limitation is especially important in coniferous trees, which, as the major species of boreal forests, play a crucial role in the terrestrial carbon cycle. However, the environmental controls on internal conductance are poorly understood.
Carbonyl sulfide (COS) is an important tracer of stomatal conductance of plants due to its shared metabolic path with carbon dioxide (CO_2). Unlike CO_2, COS is fully hydrated in plant's leaves by carbonic anhydrase, so there are no respiration-like emissions from the plant. Plant leaf conductance could be separated into stomatal conductance (controlling plant's uptake of CO_2 and losses of water), internal conductance (reflecting a conductance to CO_2 diffusion in mesophyll). All processes are important to study to understand a plant's limitations under various conditions in terms of changing climate leading to still more frequent extreme weather situations. However, unlike stomatal conductance, internal one is still understudied.
We measured COS emissions from a Scots pine at Hyytiälä ecosystem research station, Finland, during a spring and summer in 2017 with branch transparent chambers, together with ancillary CO_2 fluxes and meteorological measurements. Based on the CO_2 daytime fluxes, we obtained overall leaf conductance, which could be separated into stomatal (from COS) and internal conductance. Continuous flux measurements enabled us to further study the environmental drivers of internal conductance, providing unique insight into the control of internal conductance under field conditions.