PreSens
PRECISION SENSING

Scientific Paper:

New Phytologist (2018)

Dynamics of oxygen and carbon dioxide in rhizospheres of *Lobelia dortmanna* – a planar optode study of belowground gas exchange between plants and sediment

Nikola Lenzewski[1], Peter Mueller[1], Robert Johannes Meier[2], Gregor Liebsch[2], Kai Jensen[1] and Ketil Koop-Jakobsen[3]
[1]Applied Plant Ecology, Biocenter Klein Flottbek, Universität Hamburg, Hamburg, Germany
[2]PreSens Precision Sensing GmbH, Regensburg, Germany
[3]MARUM – Center for Marine Environmental Sciences, University of Bremen, Bremen Germany

Summary:

- Root-mediated CO_2 uptake, O_2 release and their effects on O_2 and CO_2 dynamics in the rhizosphere of *Lobelia dortmanna* were investigated.
- Novel planar optode technology, imaging CO_2 and O_2 distribution around single roots, provided insights into the spatiotemporal patterns of gas exchange between roots, sediment and microbial community.
- In light, O_2 release and CO_2 uptake were pronounced, resulting in a distinct oxygenated zone (radius: c. 3 mm) and a CO_2-depleted zone (radius: c. 2 mm) around roots. Simultaneously, however, microbial CO_2 production was stimulated within a larger zone around the roots (radius: c. 10 mm). This gave rise to a distinct pattern with a CO_2 minimum at the root surface and a CO_2 maximum c. 2 mm away from the root. In darkness, CO_2 uptake ceased, and the CO_2-depleted zone disappeared within 2 h. By contrast, the oxygenated root zone remained even after 8 h, but diminished markedly over time.
- A tight coupling between photosynthetic processes and the spatiotemporal dynamics of O_2 and CO_2 in the rhizosphere of *Lobelia* was demonstrated, and we suggest that O_2-induced stimulation of the microbial community in the sediment increases the supply of inorganic carbon for photosynthesis by building up a CO_2 reservoir in the rhizosphere.

Keywords: freshwater lakes, isoetids, plant-soil interaction, radial oxygen loss, rhizobox, rhizosphere imaging, soil biogeochemistry