Geophysical Research Abstracts
Vol. 14, EGU2012-4539-1, 2012
EGU General Assembly 2012

Exchange of nitrogen dioxide (NO_2) between plants and the atmosphere under laboratory and field conditions

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Nitric oxide (NO), nitrogen dioxide (NO_2), often denoted as nitrogen oxides (NO_x), and ozone (O_3) are considered as most important compounds in atmospheric chemistry. In remote areas NO_x concentration is related to biological activities of soils and vegetation. The emitted NO_x will not entirely be subject of long range transport through the atmosphere. Aside oxidation of NO_2 by the OH radical (forming HNO_3), a considerable part of it is removed from the atmosphere through the uptake of NO_2 by plants. The exchange depends on stomatal activity and on NO_2 concentrations in ambient air. It is known that NO_2 uptake by plants represents a large NO_2 sink, but the magnitude and the NO_2 compensation point concentration are still under discussion.
Our dynamic chamber system allows exchange measurements of NO_2 under field conditions (uncontrolled) as well as studies under controlled laboratory conditions including fumigation experiments. For NO_2 detection we used a highly NO_2 specific blue light converter (photolytic converter) with subsequent chemiluminescence analysis of the generated NO. Furthermore, as the exchange of NO_2 is a complex interaction of transport, chemistry and plant physiology, in our field experiments we determined fluxes of NO, NO_2, O_3, CO_2 and H_2O. For a better knowledge of compensation point values for the bi-directional NO_2 exchange we investigated a primary representative of conifers, Picea abies, under field and laboratory conditions, and re-analyzed older field data of the deciduous tree Quercus robur.