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Published in:
Geophysical Research Abstracts

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Mikkelsen, T. N., Bruhn, D., & Ambus, P. (2017). N2O emission from plant surfaces – light stimulated and a global phenomenon. Geophysical Research Abstracts, y, [EGU2017-6538].

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N₂O emission from plant surfaces – light stimulated and a global phenomenon.

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Nitrous oxide (N₂O) is an important long-lived greenhouse gas and precursor of stratospheric ozone depleting mono-nitrogen oxides. The atmospheric concentration of N₂O is persistently increasing; however, large uncertainties are associated with the distinct source strengths. Here we investigate for the first time N₂O emission from terrestrial vegetation in response to natural solar ultra violet radiation. We conducted field site measurements to investigate N₂O atmosphere exchange from grass vegetation exposed to solar irradiance with and without UV-screening. Further laboratory tests were conducted with a range of species to study the controls and possible loci of UV-induced N₂O emission from plants. Plants released N₂O in response to natural sunlight at rates of c. 20-50 nmol m⁻² h⁻¹, mostly due to the UV component. The emission rate is temperature dependent with a rather high activation energy indicative for an abiotic process. The prevailing zone for the N₂O formation appears to be at the very surface of leaves. However, only c. 26% of the UV-induced N₂O appears to originate from plant-N. Further, the process is dependent on atmospheric oxygen concentration. Our work demonstrates that ecosystem emission of the important greenhouse gas, N₂O, may be up to c. 30% higher than hitherto assumed.

Literature:

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