Solar UV irradiation-induced production of N2O from plant surfaces - low emissions rates but all over the world

Mikkelsen, Teis Nørgaard; Bruhn, Dan; Ambus, Per

Publication date:
2016

Document Version
Peer reviewed version

Citation (APA):
Solar UV irradiation-induced production of N₂O from plant surfaces - low emissions rates but all over the world.

Teis Nørgaard Mikkelsen¹, Dan Bruhn² and Per Ambus³

¹Department of Environmental Engineering, Technical University of Denmark, Building 115, DK - 2800 Kgs. Lyngby, Denmark. e-mail: temi@env.dtu.dk

²Department of Chemistry and Bioscience, Aalborg University, Fredrik Bajers Vej 7H, DK- 9220 Aalborg East, Denmark. e-mail: db@bio.aau.dk

³Department of Geosciences and Natural Resource Management, University of Copenhagen, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark. e-mail: peam@ign.ku.dk

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:
