

# Study of Gas-aerosol Partitioning and Speciation of Organic Nitrate in a Nitrogen-dominated Atmosphere in the Netherlands

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## Abstract

In northern Europe, especially in the Netherlands, the harmful effects of excessive nitrogen deposition on natural areas have led to a political crisis, pitting farmers against industrial growth and housing construction. In the Netherlands, ammonium and nitrate aerosol account for most of the particulate matter mass. Where volatile organic compounds are strongly emitted alongside ammonia (NH<sub>3</sub>) and nitrogen oxides (NO<sub>x</sub>), the formation of organic nitrate may also be important, because it has longer atmospheric lifetime and therefore allows the transport of nitrate further downwind to deposit onto pristine ecosystems. However, the chemical speciation of nitrate is still poorly understood. In this study, we investigate the partitioning and speciation of organic nitrate between gas and aerosol-phase in the Netherlands. We combine the co-located measurements of ambient aerosol-phase composition using aerosol chemical speciation monitoring (ACSM) and total odd nitrogen (NO<sub>y</sub>) using a chemiluminescence analyzer with modified inlet. The observations take place at the Cabauw tower facility, part of the Dutch Ruisdael Observatory atmospheric research infrastructure, in a polluted rural site in central Netherlands. To assess the aerosol phase speciation, we apply the NO<sub>2</sub><sup>+</sup>/NO<sup>+</sup> ratio method to extract the organic nitrate fraction from ACSM observation. For the gas phase, co-located NO<sub>x</sub> measurements are subtracted from the NO<sub>y</sub> measurements to extract the concentration of organic nitrate reservoir species. We determine the vapor pressure of ambient organic nitrate using partitioning coefficients (K<sub>p</sub>) between the gas and aerosol-phase and comparing them with the theoretical value using SIMPOL.1 method. Through these combined gas and aerosol nitrate speciation studies, we examine how the composition shifts with pollution episodes from different source regions and meteorological conditions.

## Early Career Scientist

YES, I am an early career scientist.

## IGAC Activities

MAP-AQ: Monitoring, Analysis and Prediction of Air Quality, BBURNED: Biomass Burning Uncertainty: ReactionNs, Emissions and Dynamics, GEIA: Global Emissions Initiative