Seminar “Ocean, Ice and Atmosphere”,
Institute of Environmental Physics (IUP), Univ. Bremen
Date: 20-Jan-2026, 12:15
Place: Building NW1, Room S1360

Ground-based Imaging of Shipping NO_2-Emissions at a Major Shipping Lane

Helge Haveresch[1], Anja Schönhardt[1], Andreas Richter[1], Folkard Wittrock[1], Mihalis Vrekoussis[1,2,3], Hartmut Bösch[1]

(1) Institute of Environmental Physics (IUP), University of Bremen, Bremen, Germany
(2) Center for Marine Environmental Sciences (MARUM), University of Bremen, Bremen, Germany
(3) Climate and Atmosphere Research Center (CARE-C), The Cyprus Institute, Nicosia, Cyprus

Ships contribute significantly to NO_x emissions which affect air quality and human health. Established approaches of monitoring ship emissions rely on in-situ or LP-DOAS measurements and are subject to different limitations like spatial coverage. Therefore, emission estimates of such measurements are typically based on simplified transport models and do not fully account for the actual shape and movement of exhaust plumes.
Remote sensing techniques, such as imaging DOAS (iDOAS) measurements, can help to overcome these limitations. In this study, we present several months of iDOAS measurements of NO_2 (nitrogen dioxide) plumes from individual ships at a major shipping lane near the harbor of Hamburg, using the instrument IMPACT (Peters et al., 2019).
Supplemented by AIS (Automatic Identification System) data, which contains information about the passing ships, the NO_2-column enhancements within the emission plume can be detected and calculated from the measured dSCDs in several hundred cases. The high spatial and temporal resolution of the measurements enhances our understanding of the internal structure, as well as the movement and dispersion of the exhaust plumes. Finally, we demonstrate the quantification of NO_x emissions for selected plumes using the mass balance approach.

References
Peters, E., Ostendorf, M., Bösch, T., Seyler, A., Schönhardt, A., Schreier, S. F., Henzing, J. S., Wittrock, F., Richter, A., Vrekoussis, M., Burrows, J. P. (2019), Full-azimuthal imaging-DOAS observations of NO2 and O4 during CINDI-2, Atmospheric Measurement Techniques, 12(8), doi: https://doi.org/10.5194/amt-12-4171-2019.