

What can we learn about marine air pollution from MAX-DOAS measurements?

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Abstract

- How do shipping emissions influence the coastal air quality?
- Do regulations really change the emissions?
- What spatial information can we retrieve from MAX-DOAS measurements?
- How does the NO₂ field over a shipping lane look like?
- What about other marine air pollution sources like oil rigs?

To answer these questions we will look into three years of ground-based MAX-DOAS measurements on the island Neuwerk in the German Bight as well as ship-borne MAX-DOAS measurements on multiple ship cruises in the North and Baltic Sea.

The three year time series of measurements of NO₂ and SO₂ on Neuwerk has been analyzed for contributions from shipping emissions. More than 2000 individual ship emission plumes have been identified in the data and analyzed for the emission ratio of SO₂ to NO₂. Contributions of ships and land-based sources to air pollution levels in the German Bight have been estimated. The impact of recent introduction of stricter fuel sulfur content limits on the SO₂ emissions is shown.

The “onion-peeling MAX-DOAS” approach has been applied for the first time to ship emission measurements: Utilizing the fact that the effective light path length in the atmosphere depends systematically on wavelength, simultaneous measurements and DOAS retrievals in UV and visible spectral range make it possible to derive the spatial distribution of ship emissions and to analyse the movement of the exhausted plumes. For the validation of the approach, a comparison to airborne imaging DOAS measurements during the NOSE campaign 2013 is shown.

Ship-borne MAX-DOAS measurements during several BSH annual summer survey cruises in North and Baltic sea have been investigated for emissions of other marine air pollution sources like oil rigs.

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