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# Ship-based $NO_x$ measurements in the Marine Boundary Layer of the Arabian Peninsula

Ivan Tadić, Uwe Parchatka, and Horst Fischer
Max Planck Institute for Chemistry, Atmospheric Chemistry Department, Mainz, Germany

The ship-based AQABA (**A**ir **Q**uality and Climate in the **A**rabian **Ba**sin) campaign deployed on the 'Kommandor Iona' Research and Survey Vessel provided for the first time more than 60 days of continuous trace gas observations in a broad spectrum of meteorological and climatic influences in the Marine Boundary Layer (MBL) of the Arabian Peninsula. Here a two-channel chemiluminescence instrument for the detection of $NO_x$ (= NO + $NO_2$) was deployed, with the $NO_2$-channel equipped with a photolysis chamber to selectively convert $NO_2$ to NO.

In the recent past there have been studies indicating that ongoing (photo-)chemistry in remote regions with low $NO_x$ is poorly understood [1][2]. $NO_x$ acting as an $O_3$ precursor and as an indicator for fossil and biomass burning also influences the abundances of trace gases such as CO, $CH_4$ and $HO_x$ (= OH + $HO_2$). It can vary from several hundreds of $ppb_v$ close to frequented traffic roads down to several $ppt_v$ in the MBL, at higher altitudes and in Antarctica [2]. Low $NO_x$-regions are generally accepted to be called those regions possessing $NO_x$ mixing ratios below 1 $ppb_v$. It is the MBL that covers the predominant part of the earth's surface and exhibits ideal conditions to study baseline (photo-)chemical processes [1]. It is considered an important region in terms of chemical $O_3$ loss [1] whereas the Arabian Peninsula is a dry and warm region influenced by Saharan dust and suffering from the petro-chemistry of the Arabian Gulf and incident solar radiation.

We will present $NO_x$ data with exemplified timelines of the unique regions of the cruise, in particular of the second part of the campaign whose measurements were less affected by contamination of the ship exhaust itself. To study the influence of petrochemical industry on the trace gas composition of the MBL, $NO_x$ in the Arabian Gulf can be investigated with detected mixing ratios often exceeding the 1 $ppb_v$-level during daytime. The Indian Ocean was predestinated to study the photochemical production of NO through photolysis of $NO_2$ during daytime. Here multiple, diurnal NO profiles could be measured with NO peak mixing ratios below 50 $ppt_v$ during midday and the most stable baseline NO mixing ratios during nighttime with NO practically not being present. Due to higher ship traffic, the entrance into the Red Sea and the Suez Canal are suitable to gain an assessment on the chemical composition of ship plumes.

**References:**

[1] Z. Hosaynali Beygi et al., *Oxidation photochemistry in the Southern Atlantic boundary layer: unexpected deviatons of photochemical steady state,* Atmos. Chem. Phys., 11, 8497-8513 (2011)

[2] C. Reed et al., *Interferences in photolytic $NO_2$measurements: explanation for an apparent missing oxidant?,* Atmos. Chem. Phys., 16, 4707-4724 (2016)