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Ship-based NO_x and O_3 measurements in the marine boundary layer around the Arabian Peninsula

Ivan Tadic, John N. Crowley, Philipp Eger, Hartwig Harder, Uwe Parchatka, Jan Schuladen, Jos Lelieveld, and Horst Fischer

Max Planck Institute for Chemistry, Atmospheric Chemistry, Mainz, Germany (i.tadic@mpic.de)

The Arabian Peninsula is a hot and dry desert region between Africa and Asia that is exposed to intense solar radiation and pollution emissions from a multitude of anthropogenic sources, including on- and off-shore petrochemical industry. Recent studies show that the extreme weather conditions and emissions are intensifying in this unique atmospheric environment. However, in-situ measurements of trace gases on and around the Arabian Peninsula are sparse. We present ship-based NO_x and O_3 measurements obtained during the AQABA campaign (**A**ir **Q**uality and Climate in the **A**rabian **Ba**sin) onboard the 'Kommandor Iona' Research and Survey Vessel that sailed from Toulon to Kuwait and back in summer 2017 in order to investigate chemical processes in the marine boundary layer (MBL) in the region.

We will present NO_x and O_3 measurements and interpret differences observed in the various regions investigated during AQABA. While the lowest NO_x and O_3 mixing ratios of less than 0.1 $ppb_v$and 20 ppb_v, respectively, were observed over the Arabian Sea, a significant northward increase in pollution towards the Gulf of Oman was observed from August 06^{th} to August 08^{th}, with mean mixing ratios of NO_x and O_3 of up to 5 ppb_v and 40 ppb_v respectively. A further increase in O_3 was encountered over the Arabian Gulf. In late summer, strongly elevated O_3 mixing ratios of more than 60 ppb_v were detected over the Mediterranean Sea with mean $NO_x < 0.3$ ppb_v.

Daytime relative NO maximum mixing ratios of $\sim$ 30 ppt_v were observed over the Arabian Sea. Concurrent NO_2, O_3 and $J(NO_2)$ measurements enabled the estimation of RO_2 from the Leighton Ratio indicating daytime maximum RO_2 mixing ratios of 40-70 ppt_v for clean regions. Gross ozone production rates (GOPR) estimates based on the difference between NO_2 photolysis and the oxidation of NO by O_3 generally yield daytime maximum GOPR below 1 ppb_v h^{-1} over the Arabian Sea and the Red Sea. Due to higher NO_2, about three times higher GOPR were observed over the northern part of the Red Sea and the Mediterranean. Final HO_x data will enable the calculation of net ozone production rates.