Geophysical Research Abstracts
Vol. 21, EGU2019-5836, 2019
EGU General Assembly 2019
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Total OH reactivity around the Arabian Peninsula from ship-based measurements

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The Arabian Peninsula is a global change hotspot where an increase in heat extremes and photochemical pollution is expected in the future. The region is a worldwide hub of oil and gas production, accommodates densely populated urban (350 million people) and industrialized areas, and its surrounding waters include key trading routes and bottlenecks for marine traffic. Due to the high solar irradiation, ambient humidity and intense pollution sources in the region, photochemical processes in the atmosphere are expected to be highly active. However, very few observational atmospheric data exist for this region. Therefore a first comprehensive measurement campaign, termed the AQABA (Air Quality and Climate Change in the Arabian Basin) Campaign, was conducted in summer 2017. Measurements were made from on-board the vessel Kommandor Iona, which sailed around the Arabian Peninsula via the Mediterranean, the Suez Canal, the Red Sea, the Indian Ocean, the Arabian Gulf and back along the same route. The vessel hosted a broad range of instrumentation for observation of gas and particle species, amongst which there was a CRM-PTRMS to make the first ship-borne direct measurements of total OH reactivity. Total OH reactivity is the combined loss rate of all compounds that can react with the OH radical, the most important oxidant in the troposphere. The reaction of primary pollutants (e.g. CO), greenhouse gases (e.g. CH4) and VOCs with OH affects both ambient ozone and particle concentrations. Here we show the combined influence of photochemically aged air and fresh emissions, e.g. from petrochemical industry or marine traffic, in the Suez Canal and Arabian Gulf. These two areas display contrasting relationships between OH reactivity and ozone. Taking into account the OH reactivity contributed by 100 species measured individually by PTR-ToF-MS and other instruments, the measured total OH reactivity can be accounted for within its measurement uncertainty both in the Arabian Gulf and the Suez region.