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# Ship-based Formaldehyde Measurements in the Marine Boundary Layer during the AQABA Campaign around the Arabian Peninsula

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The AQABA (Air Quality and Climate Change in the Arabian Basin) campaign characterized trace gas concentrations, particulate matter and the impact of anthropogenic emissions on atmospheric processes in the marine boundary layer (MBL). It took place on a research vessel from Malta through Suez Canal to Kuwait and back, thus the full data set contains sampling of rather clean air in the Indian Ocean, dust events in the Red Sea as well as anthropogenic contribution through gas processing or fuel combustion in the Suez Canal and the Arabian Basin.

Formaldehyde (HCHO) is a reactive intermediate during the oxidation process of methane and other volatile organic compounds (VOCs) in the atmosphere, which is converted due to further oxidation into carbon dioxide ($CO_2$), one of the main greenhouse gases in the atmosphere causing climate change. Additionally HCHO can act as a precursor for hydroperoxyl radicals ($HO_2$) through photolysis and the sink reaction with hydroxyl radicals (OH) also produces $HO_2$ and carbon monoxide (CO) thus HCHO is directly influencing the $HO_x$ – budget and the oxidation capacity of the atmosphere.

Gas phase HCHO measurements were performed with a modified Aero-Laser© instrument, using the Hantzsch reaction of HCHO with acetylacetone in ammoniac solution with detection of the fluorescent product 3,5-diacetyl-1,4-dihydrolutidine (DDL) at 510 nm. The used setup has a time resolution of 3 seconds and is sensitive to very low gas phase concentrations with a detection limit $\leq$ 50 pptv.

The data set shown is filtered with nitric oxide (NO) data, which was used to separate contaminated data (due to sampling of ship exhaust plumes) since HCHO and NO are directly emitted through fuel combustion. First studies of the final data set show as expected high HCHO mixing ratios (2 – 12 ppbv) in the Arabian Basin and the Suez Canal caused by gas processing and ship traffic. The rather clean air sampled in the Indian Ocean had more consistent mixing ratios ranging from 0.2 – 1.1 ppbv.