



Total Reactive Nitrogen (NO_y) during the AQABA Ship Campaign to the Arabian Basin: Analysis of Ozone Production and Air Mass Age.

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The AQABA (Air Quality and climate change in the Arabian BASin) ship campaign in summer 2017 followed a route from the Mediterranean through the Indian Ocean to the Arabian Gulf. We present a chemical analysis of NO_x and NO_y obtained using Thermal Dissociation Cavity Ringdown Spectroscopy (TD-CRDS).

From the difference between NO_x and NO_y we derive NO_z , which can be considered to sequester NO_x . This value is not directly influenced by local NO_x emissions and thus allows the identification of longer term trends. The observed NO_z mixing ratios (5 minute averages) ranged from 0.3 ppbv in the Indian Ocean to 7.0 ppbv in the Arabian Gulf. As expected, NO_x shows a higher variability from below 0.1 ppbv in the Indian Ocean to 49.3 ppbv on the approach to the Djibouti harbour area.

The partitioning of NO_y between NO_x , organic nitrates, nitric acid and particulate nitrate showed great variability due to the regional influence of megacities, international shipping, petrochemical activity, desert dust and maritime background air. We use the NO_z/NO_y ratio to explore the chemical aging of NO_x emissions during transport and support this analysis with formaldehyde and $\text{SO}_4^{2-}/\text{SO}_2$ measurements. From the correlation between odd oxygen ($\text{O}_x = \text{O}_3 + \text{NO}_2$) and NO_z we calculate the ozone production efficiency of NO_x for different parts of the cruise and identify the underlying chemical processes that control O_3 formation.