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Measurement-based modeling of bromine chemistry in the Dead Sea boundary layer – Part 2: The influence of NO_2 on bromine chemistry at mid-latitude areas

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Abstract. Understanding the interaction between anthropogenic air pollution and Reactive Halogen Species (RHS) activity has had only limited support from direct field measurements, due to the fact that past field measurements of RHS have been mainly performed in Polar Regions. The present paper investigates the interaction between NO_2 and Reactive Bromine Species (RBS) activity by model simulations based on extensive field measurements performed in the Dead Sea area, as described in a companion paper (Tas et al., 2006). The Dead Sea is an excellent natural laboratory for this investigation since elevated mixing ratios of BrO (up to more than 150 pptv) are frequently observed, while the average levels of NO_2 are around several ppb. The results of the present study show that under the chemical mechanisms that occur at the Dead Sea, higher levels of NO_2 lead to higher daily average mixing ratios of BrO_x. This is the result of an increase in the rate of the heterogeneous decomposition of $BrONO_2$, which in turn causes an increase in the rate of the "Bromine Explosion" mechanism. However, above a certain threshold level of NO_2 (daily average mixing ratios of 0.2 ppbv during RBS activity), the daily average mixing ratios of BrO_x decrease for a further increase in the NO_2 mixing ratios. This investigation shows that the influence of NO_2 on BrO_x production clearly reflects an enhancement of RBS activity caused by anthropogenic activity.

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