Nighttime chemistry: Field measurements N2O5 uptake and ClNO2 production

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Nighttime chemistry accounts for up to half of the NOx removal from the atmosphere and produces atomic chlorine in the early morning through photolysis of ClNO2. NOx is removed through the production and heterogeneous loss of N2O5. The heterogeneous loss of N2O5 typically produces nitric acid which is removed through deposition. However, it has recently been discovered that in the presence of aerosol chloride, the N2O5 uptake produces ClNO2. The rate N2O5 heterogeneous loss been the subject of several laboratory studies; however, it has rarely been studied using ambient measurements. In this work, N2O5 uptake coefficients are determined from ambient wintertime measurements at the BAO tower in Erie, CO. The uptake coefficients are determined using an iterative box model. These uptake coefficients were found to be anti-correlated with the nitrate fraction of aerosol confirming suppression of uptake by aerosol nitrate. Additionally, a plume of chloride was observed in measurements of aerosol chloride, HCl and ClNO2. The N2O5 uptake coefficient was enhanced in this plume due to the competition between aerosol chloride and nitrate to react with N2O5.