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Laboratory measurements of the anomalous isotopic composition of ozone

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Ozone is of great importance for the chemistry of the atmosphere and its isotopic signature affects that of many other trace constituents. Due to differences in chemical and physical properties, most of the isotope fractionations are dependent on mass and follow the fractionation (MDF) equation $\Delta^{17}O = \delta^{17}O - 0.52\ \delta^{18}O$. However, many atmospheric components show an oxygen isotope anomaly, defined as the excess ^{17}O over what is expected based on ^{18}O isotopic abundances. The processes that generate such deviations in ^{17}O are termed mass-independent fractionations (MIF). The ozone formation reaction is the most important example for a reaction that leads to the formation of a mass-independent isotope effect. To what degree ozone destruction processes also influence the isotopic composition of O_3 is still a subject of intense debate.

Within the framework of INTRAMIF (Initial Training Network on Mass-Independent Fractionation) we are setting up new experiments to characterize the influence of such O_3 destruction reactions on the anomalous isotopic composition of O_3 and important isotope transfer reactions in the atmosphere and in this presentation we present the experimental setup and first results.

We first examined the reproducibility of our experimental system. Experiments were then carried out under different photochemical conditions, and the first experiments focus on the influence of wavelengths used. To measure the O_3isotopic composition precisely, after the experiment ozone is collected in a cold trap, which allows quantitative collection of O_3 at the triple point temperature of nitrogen (63 K). To measure the oxygen isotopes in $O_3$by isotope ratio mass spectrometry, O_3 is converted to O_2.