O-08

Session 4) Isotopologues in Atmosphere: Ozone, MIF and $\Delta^{17}O$

Ozone isotope variability at the Tibetan Plateau and implication for stratospheric ozone intrusion

Lei Geng[1] & Yichao Wu[1]

[1] University of Science and Technology of China
*Presenting Author Email: genglei@ustc.edu.cn

Stratospheric ozone (O_3) intrusion or the so-called stratosphere-to-troposphere transport (STT) of O_3 plays a critical role in atmospheric oxidation capacity especially during climate transitions. Constraining STT of O_3 has been heavily relying on models due to the lack of robust proxies. Atmospheric O_3 possesses a rare isotopic signal, i.e., the oxygen mass-independent isotope fractionation (expressed as $\Delta^{17}O$), which was predicted to vary with pressure, making the potential to explore STT of O_3 given the expected higher O-MIF in stratospheric than tropospheric O_3. Here we made ozone isotope observations in the Tibetan Plateau, and a notable pattern of increasing $\Delta^{17}O$ with decreasing pressure was observed. However, model calculation based on laboratory-determined and observation-constrained pressure and temperature dependence of $\Delta^{17}O$ indicated the observed increasing $\Delta^{17}O$ with decreasing pressure can't be explained by pressure and/or temperature changes. Aided by the high-resolution data, we concluded the increasing $\Delta^{17}O$ with decreasing pressure pattern in the plateau is more likely caused by stratospheric ozone intrusion. This is supported by the observed diurnal variation of $\Delta^{17}O$ with high night values at Mt. Everest, which is caused by the downslope wind along the glacier at night which brings airmass from higher altitudes. We hypothesize that the abnormally high $\Delta^{17}O$ at Mt. Everest may be further transferred to and preserved in atmospheric nitrate, making the potential to probe past STT of O_3 using nearby ice core records. The latter, combined with polar ice core records, would improve our understanding of the responses and feedbacks of STT O_3 and the associated global Brewer-Dobson Circulation (BDC) to climate changes.