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A Combined Modelling and Experimental Approach into Understanding the Oxidative Capacity of Past Atmospheres

Content

The abundance of oxidants, such as ozone (O3) and the hydroxyl radical (OH), within the troposphere is termed; the oxidative capacity. Through control of the atmospheric lifetime of trace gases, the oxidative capacity of our atmosphere is partially responsible for global climate drive. An understanding of how the oxidative capacity of past atmospheres changed with differing climate conditions will allow predictions to be drawn as to how future atmospheres will react to changing climates. The aim of this project is to construct a combined modelling-experimental approach to study the oxidative capacity of past atmospheres. Though the oxidants themselves are not preserved within ice cores, this project proposes that the interpretation of ratios between different terrestrially sourced secondary organic aerosol markers (SOA-markers), found in ice cores, will allow an understanding of the oxidative capacity of past atmospheres. The physical ratios of SOA-markers found in ice cores will be compared to the ratios of the same SOA-markers, studied through atmospheric box modelling. The modelling study will involve observing the change in the SOA-marker ratio with varying oxidant (O3 and OH) exposure. As this is a novel method and the concentrations of SOA-markers are likely to be greatest in northern ice cores, this project will focus on the northern hemisphere. The modelling data will be compared to the physical ratios found from northern ice cores (Mt. Elbrus and Svalbard) to establish the concentration of O3 and OH present in past atmospheres. The likely major emission source in this area is from the Boreal Forest. The biogenically emitted volatile organic compounds (BVOCs) of interest within this project are isoprene, α-pinene, and β-pinene. It is the oxidised products of these BVOCs that make up the SOA-markers of interest.

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Track Classification: Progress in proxy development and interpretation