6.028 Comparison of VOCs and their roles in ozone formation at a polluted site and a clean site in southern China.

Early Career Scientist

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Abstract:

Volatile organic compounds (VOCs) are important constituents in the lower troposphere, playing key roles in the formation of ozone (O_3) and secondary organic aerosols (SOA). Although high ground-level O_3 concentration has become a severe problem in both urban and rural areas in southern China, partly due to its hot weather, very limited information is known about the spacial difference of O_3 formation mechanisms in this region. More than fifteen kinds ambient VOCs were measured by a proton transfer reaction-mass spectrometer (PTR-MS) both at an urban site in Shenzhen (SZ) and a regional background site on Mount Wuzhi (WZ) in spring, in order to compare VOCs composition and contribution to the formation of O_3 at these two very different sites. The average measured total VOCs mixing ratio was 26.2 ppbv in SZ, which was far higher than that in WZ (8.2 ppbv). Oxygenated VOCs (OVOCs, 67%) and aromatics (30%) contributed the mostly in SZ, while OVOCs (75%) and biogenic VOCs (BVOC, 15%) were the most abundant species in WZ, where aromatics only contributed 8%. The emission ratios of toluene and C8 aromatics to carbon monoxide (CO) in SZ were about ten times larger than those in WZ, indicating very strong anthropogenic emissions of VOCs, especially aromatics in SZ. The photochemical reactivity analysis showed that aromatics and OVOCs

together consisted of around 90% of the ozone formation potential (OFP) among the measured VOCs in SZ, while BVOCs and OVOCs ranked the two largest species for the OFP in WZ. We also found the formation of O_3 was limited by VOCs in SZ, while it was more sensitive to nitrogen oxides (NOx) in WZ. These comparisons indicated that the O_3 formation mechanisms could be quite different in urban and rural areas in southern China, importantly due to the different VOCs sources and reactivity.