

1.146 Surface ozone variability in continental South Africa.

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Abstract:

Although elevated surface ozone (O_3) concentrations are observed in many areas within southern Africa, few studies have investigated the regional atmospheric chemistry and dominant atmospheric processes driving surface O_3 formation in this region. Therefore an assessment of comprehensive continuous surface O_3 measurements performed at four sites in continental South Africa was conducted. The regional O_3 problem was evident with O_3 concentrations regularly being higher than 40 ppb, while O_3 levels were higher compared to other background sites in the Southern Hemisphere. The temporal O_3 patterns observed at the four sites resembled typical trends for O_3 in continental South Africa with O_3 concentration peaking in late winter and early spring. Increased O_3 concentrations in winter were indicative of increased emissions of O_3 precursors from household combustion and other low-level sources, while a spring maximum observed at all the sites was attributed to increased regional biomass burning. Source area maps of O_3 and CO indicated significantly higher O_3 and CO concentrations associated with air masses passing over a region with increased seasonal open biomass burning, which indicated CO associated with open biomass burning as a major source of O_3 in continental South Africa. The relationship between O_3 , NO_x and CO indicated a strong dependence of O_3 on CO, while O_3 levels remained relatively constant or decreased with increasing NO_x . The instantaneous production rate of O_3 calculated at Welgegend indicated that ~40% of O_3 production occurred in the VOC-limited regime. These relationships between O_3 and precursor species indicated that continental South Africa can be considered VOC-limited, which can be attributed to high anthropogenic emissions

of NO_x in the interior of South Africa. The study indicated that the most effective emission control strategy to reduce O_3 levels in continental South Africa should be CO reduction associated with household combustion and regional open biomass burning.