ANALYSIS OF OZONE FROM THREE AIR INTAKE HEIGHTS AT CAPE POINT

Ernst-Günther Brunke, Thumeka Mkololo and Casper Labuschagne
South African Weather Service, PO Box 320, Stellenbosch, 7599, South Africa
and
Hans-Eckhart Scheel
Forschungszentrum Karlsruhe, IMK-IFU, 82467 Garmisch-Partenkirchen, Germany

1. INTRODUCTION

Surface ozone measurements have been made at Cape Point since 1982 from the top of a 30-m air intake mast. The O_3 long-term trend has been previously evaluated and presented (e.g. Oltmans et al., 2006). In 1996 measurements were started from a 4 m high air intake (glass tube) with high volume air flow. In September 2008 O_3 measurements were extended to also cover the 14-m elevation (half the mast height). For the first time now, comparisons can be made from three air intake levels (4 m, 14 m and 30 m). The data have been analysed for background conditions as well as for air sampled during urban pollution episodes and biomass burning events.

2. METHOD AND DATA

The instruments in use at Cape Point comprise Thermo Electron TE49 analysers differing only in year of manufacture. An O_3 TE calibrator (49i-PS), which has been referenced to the GAW WCC-Empa calibrator in 2007, is being used to calibrate the three instruments every four months. Daily zero and sensitivity checks are conducted automatically. The monthly zero levels are included in the data processing routine, which yields 30-min. averages, while the sensitivity values provide information on long-term instrument stability. The 30-min. averages are filtered via a statistical filter to provide: "all" and "background" data (pollution episodes removed).

3. RESULTS

The seven months of comparative ozone data show on average good agreement (within 0.5 ppb) for the three intake levels under most conditions. Significant deviations occur during pollution episodes, which are particularly pronounced when biomass burning events (Brunke et al., 2001) are observed. A few case histories of such fire events, which took place in the SW Cape at the beginning of 2009, are presented (Fig. 1).

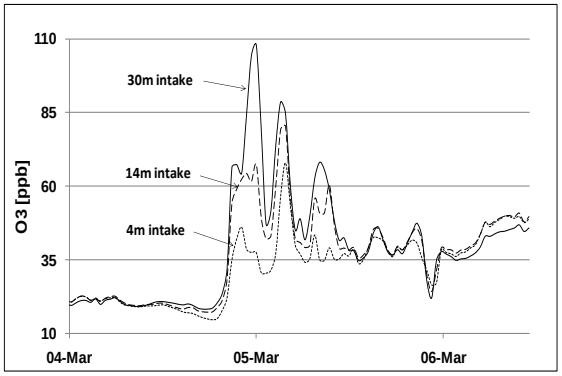

Fig. 1: O_3 levels observed at three air intakes on 5 March 2009 during a fire plume.

In order to better understand these events, as for earlier studies (Brunke and Scheel, 1998) O_3/CO relationships have been determined (Fig. 2). These reveal instances of ozone production (positive slope) as well as destruction (negative slope) depending on the composition and age of the pollution plume.

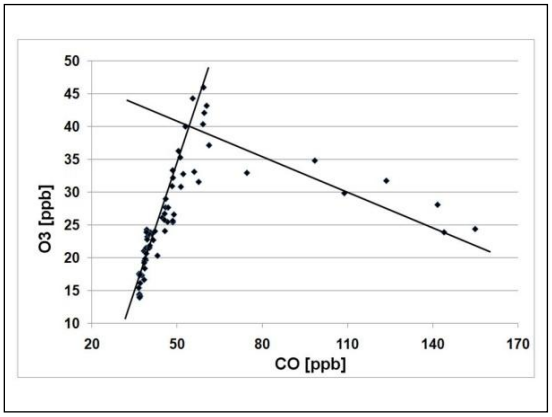

Fig. 2: O_3/CO plot for fire episode observed on 17 February 2009.

Average diurnal cycles show minima in the morning at about 08:00 and maxima at 12:00 till 13:00 with peak-to-peak values of 2.5 ppb. These are similar for all three intakes. Furthermore, the cycles do not differ much whether “all data” or clean maritime air episodes are selected.

4. REFERENCES

Brunke, E-G., Labuschagne, C. and Scheel, H.E. (2001). Trace gas variations at Cape Point, South Africa, during May 1997 following a regional biomass burning episode. Atmos. Environ. 35, 777-786.

Brunke, E-G. and Scheel, H.E. (1998). Surface ozone measurements at Cape Point (34 °S, 18 °E): 'Atmospheric Ozone, Proceedings of the XVIII Quadrennial Ozone Symposium, L'Aquila, Italy, 12-21 September 1996', R.D. Bojkov, G. Visconti (eds.), 331-334.

Oltmans, S.J. et al. (2006). Long-term changes in tropospheric ozone. Atmos. Environ. 40, 3156-3173.