THE CAPE POINT TIME SERIES OF CO_2, CH_4, CO AND O_3

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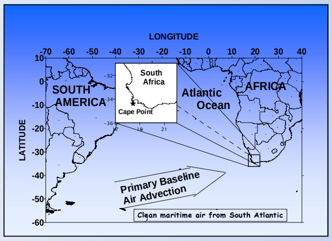


Site Characteristics

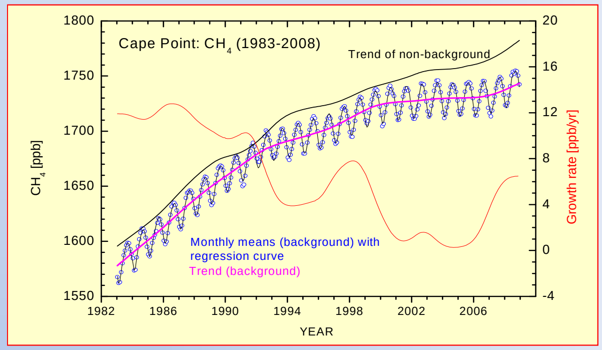
Cape Point (CPT): 34° S, 18° E; 230 m asl. Time zone UT+2. Global station within the WMO/Global Atmosphere Watch (GAW) network.

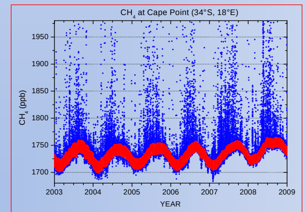
Trajectories indicate a major contribution from subsiding air masses. Background levels of the major greenhouse gases are usually prevailing for more than 60 % of the time. Statistical data filters are applied for respective data selection.

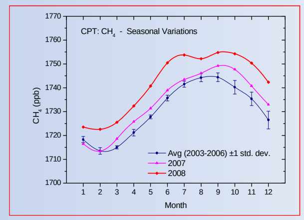
Goals of the Measurements

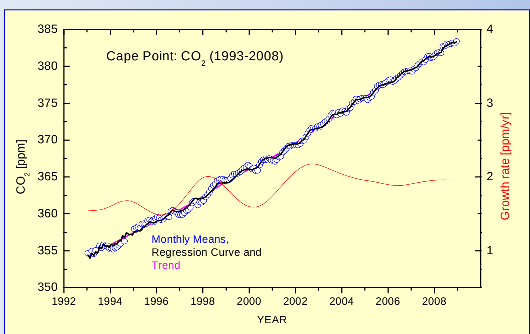
Long-term trends and seasonal variations of trace species under conditions representative of southern hemispheric mid-latitudes. *Note that the temporal variability of trend curves and growth rates is dependent on the degree of smoothing chosen for the calcu-lations.*

Trends of regional air pollution. Case studies of pollution episodes, notably biomass burning. Currently efforts for distinguishing between maritime and continental background levels.





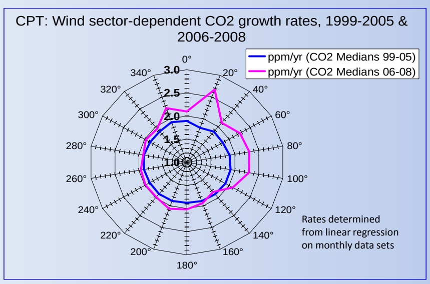




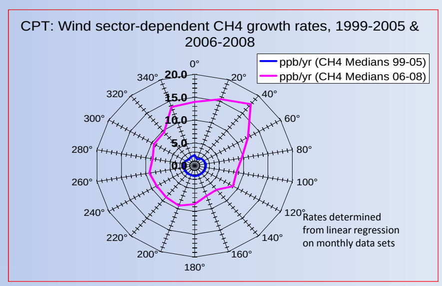
Carbon dioxide (CO_2): Continuous rise of CO_2. Fluctuation of growth rates between 1.5 and 2.2 ppm yr^{-1} (5-year smoothing), however, with an overall increase: Linear fit ranging from 1.6 ppm yr^{-1} in early 1993 to 2.1 ppm yr^{-1} at the end of 2008. Indication of recent stabilization around 2 ppm yr^{-1}. Little seasonal variations (not shown) with an average amplitude of 0.6 ppm between maximum in August and minimum in March.

Methane (CH_4): Long-term increase (trend) with overall decrease in growth-rates between 1983 and 2003.
Stabilization until 2006. Recent increase again. Possible causes (increase in emissions in both hemispheres, drop in hydroxyl radical concentration) still under discussion (e.g., Rigby et al. (2008), Geophys. Res. Lett. 35).
Seasonal variations with maximum around September/-October and minimum in February.

Stronger CH_4 increase measured under non-background conditions since the mid-1990s. Probably related to growing local sources to the north of the station. Refer to plots of wind sector-dependent growth rates.



Growth rates of CO_2 [ppm yr^{-1}] and CH_4 [ppb yr^{-1}] as a function of wind direction for the periods 1999 – 2005 and 2006 – 2008 are maximal for the northerly sector. This reveals increasing anthropogenic sources associated with the recent expansion of the greater Cape Town area.

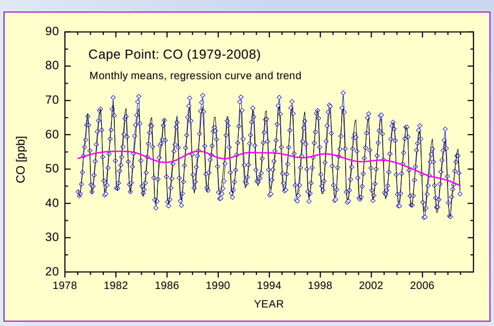


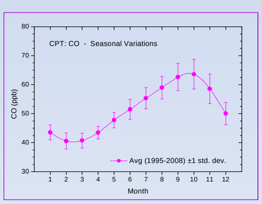
Carbon monoxide (CO): No significant long-term trend. However, pronounced inter-annual variability. Since 2003 a slight overall decline of the CO concentrations with abnormally low annual mean values for 2006 and 2008. Causes still under investigation. Note: In spite of thorough instrumental checks, the possibility of recent analytical artefacts cannot be ruled out. Seasonal variations with maximum in September/October and minimum in February.

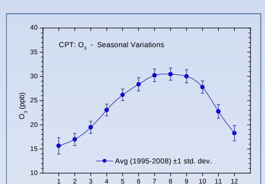
Summary and Conclusions

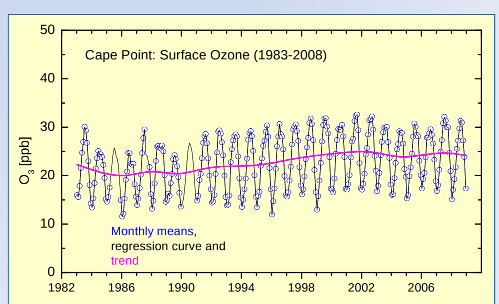
The Cape Point time series of the greenhouse gases CO_2 and CH_4 display features typical of southern hemispheric mid-latitudes. The recent CH_4 increase agrees with the globally observed renewed rise. The trend of surface ozone ranks among the highest of comparable sites. The recently observed decline of CO in the 30-year record is not paralleled elsewhere in the southern hemisphere. Therefore, further investigations of both analytical and atmospheric conditions are foreseen.

Surface ozone (O_3): Positive trend between 1990 and 2002, accompanied by an increase in seasonal peak-to-peak amplitudes. Since 2003 the increase has levelled off. Seasonal variations with flat July-September maximum and minimum in January.









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