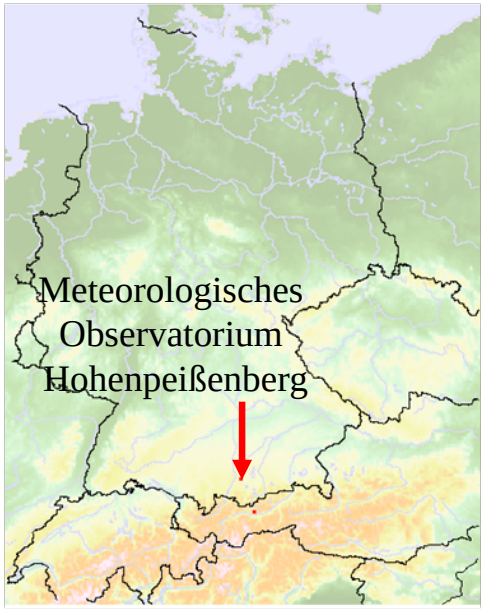
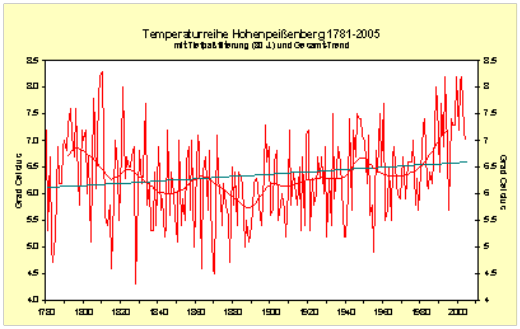
Deutscher Wetterdienst

Long-term measurements of anthropogenic trace gases at the German GAW site Hohenpeissenberg

Christian Plass-Dülmer and Stefan Gilge,
Hohenpeißenberg Meteorological Observatory, DWD



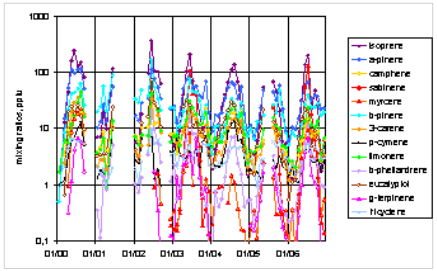
Deutscher Wetterdienst

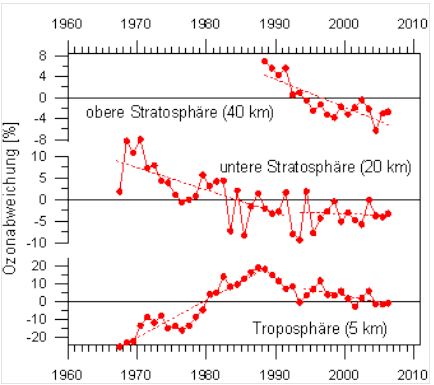


Meteorology
1781

Hohenpeissenberg Observatory

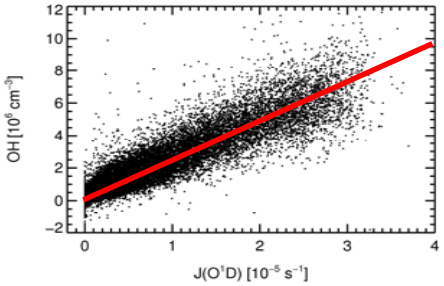
Bio-VOC
2000

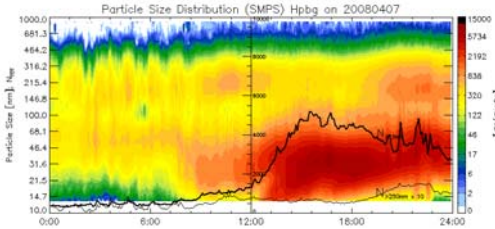




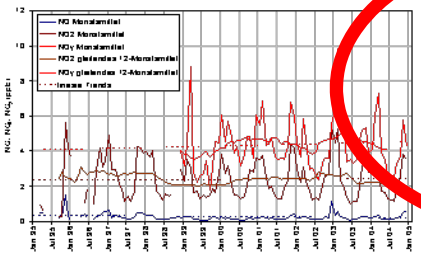
Strat / Trop
Ozone
1967

OH radicals
1998





Aerosol
1995

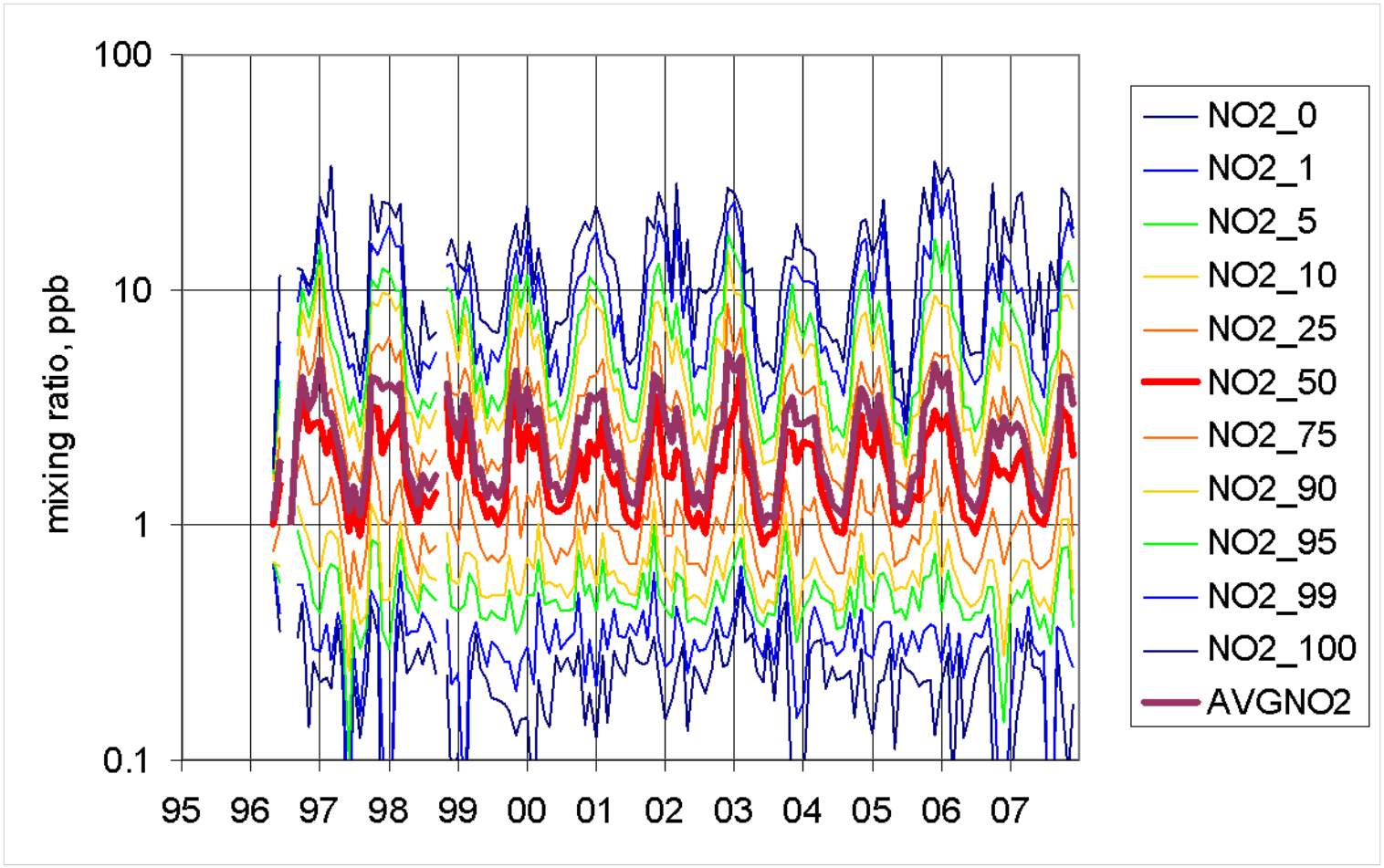


(anthropogenic)
reactive
tracegases
1995

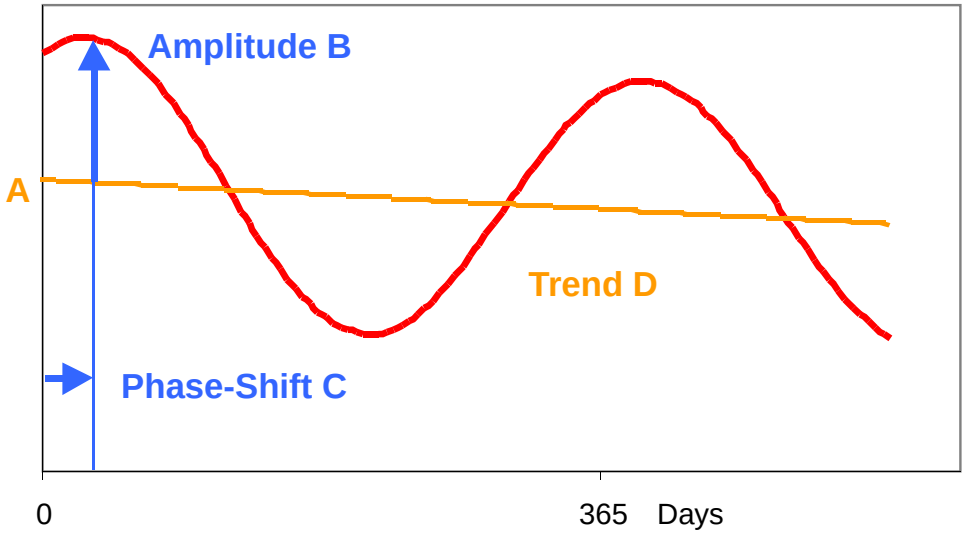
Cooperative Global
Air Sampling Network
2006

Precipitation
chemistry
1995

NO_2 distribution – time series



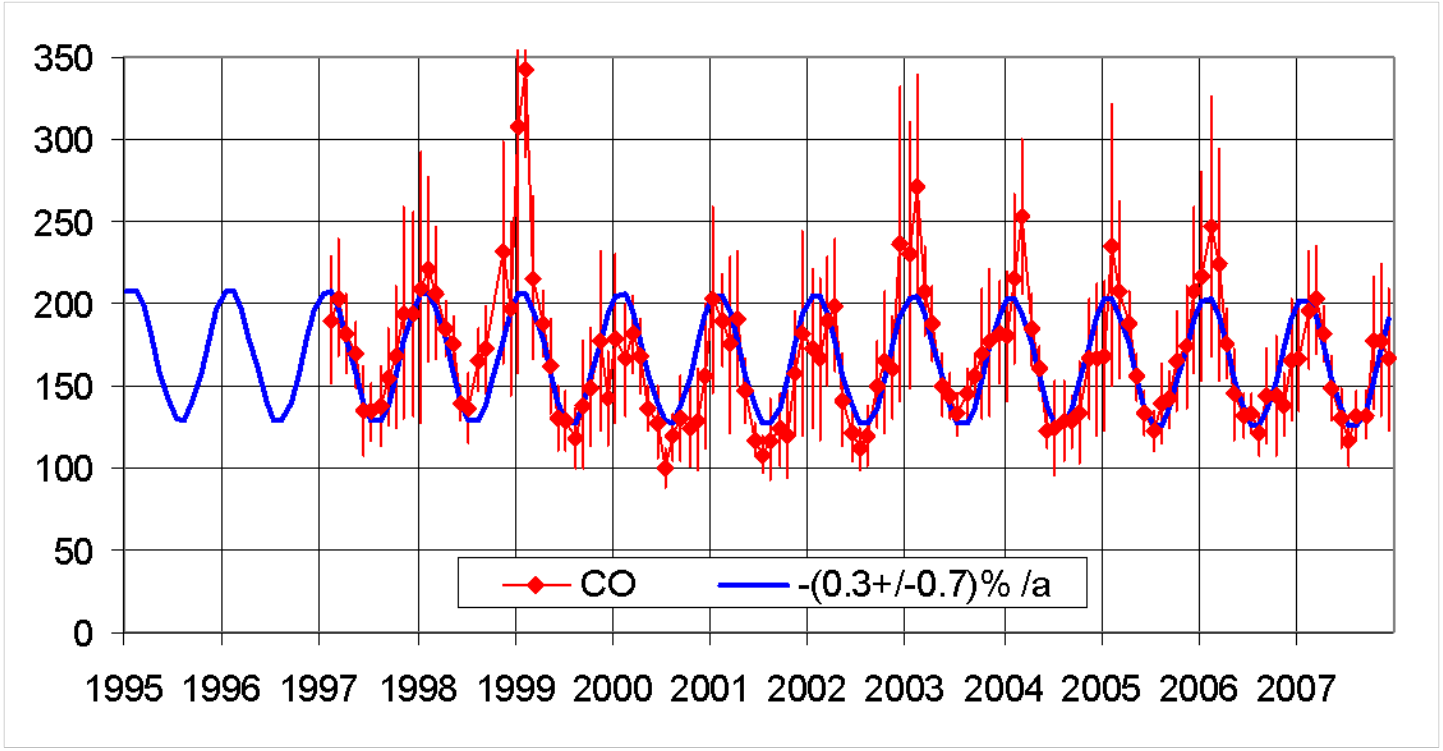
4 Parameter Fit for Trend-Analysis of Trace Gases



$$FIT\ (t) = \{A + B \cos [(t_{JD} - C)\ 2\pi / 365]\}\ \exp [\ D\ (t - t_0) / 365]$$

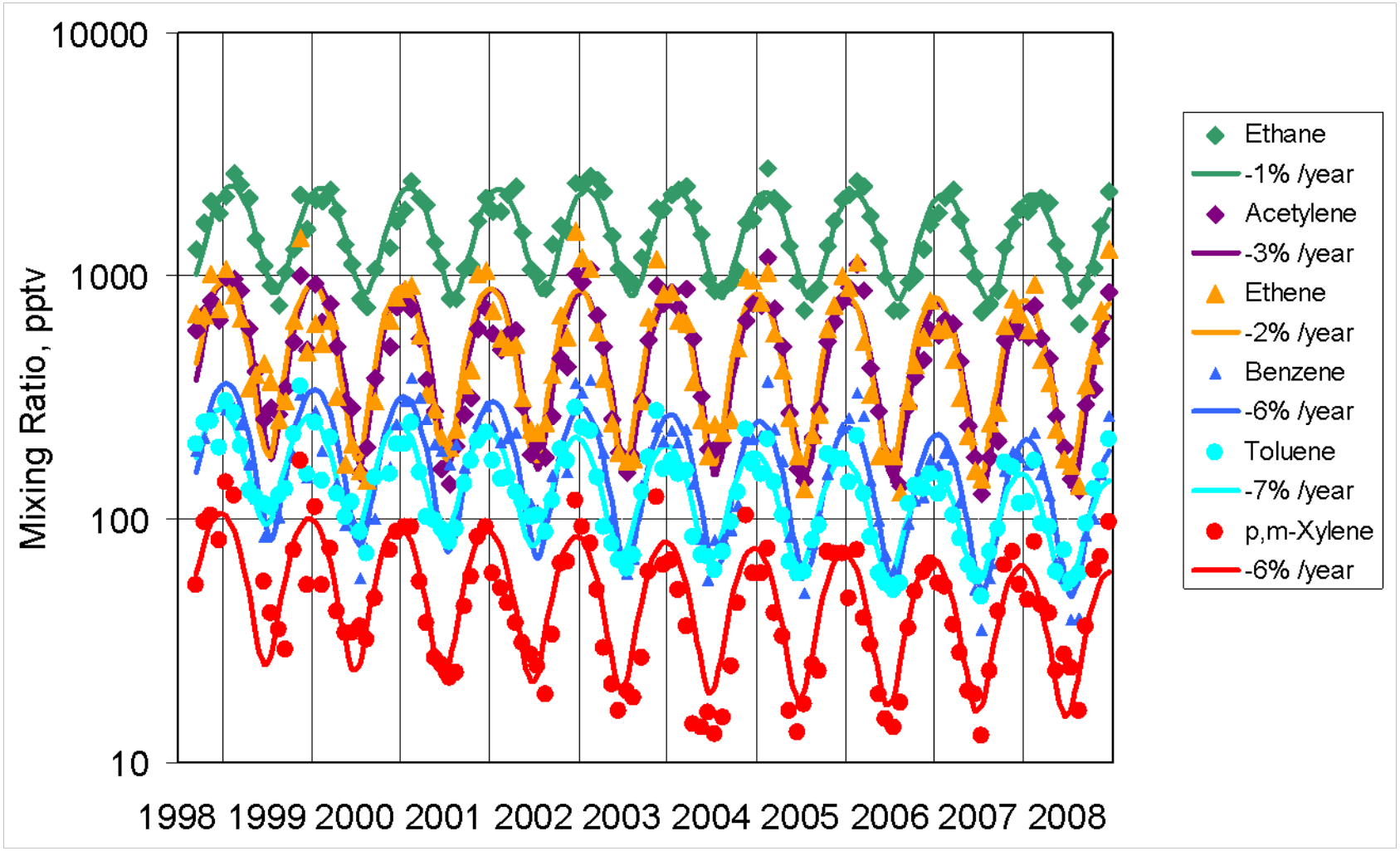
Least Square Fit after rejecting 10% outlying values
Based on monthly means of (noon-time) data

Sine + trend – fit of CO (ppb)

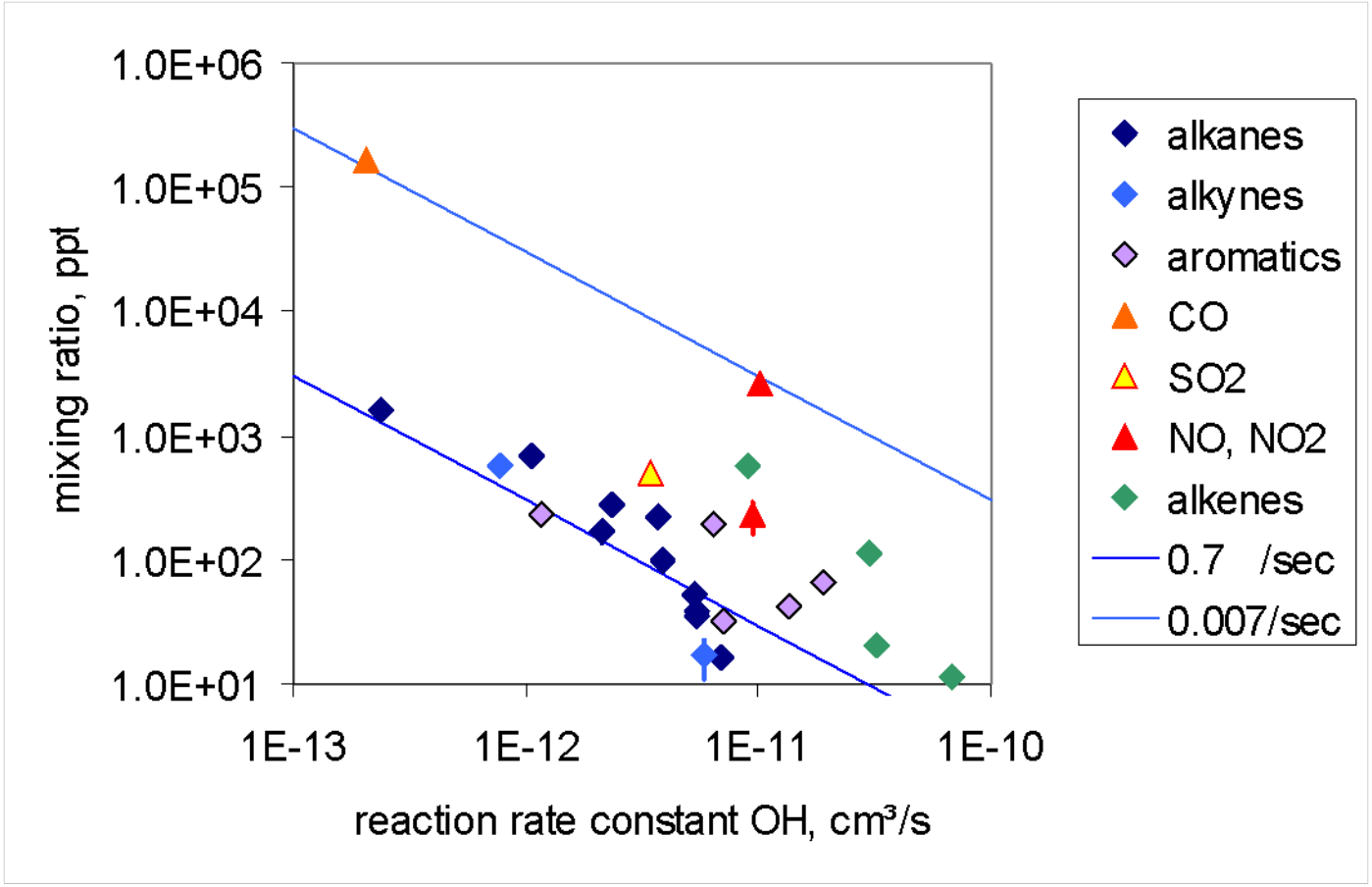


Uncertainties: 2-σ of multiple fits after arbitrarily rejecting 2 years

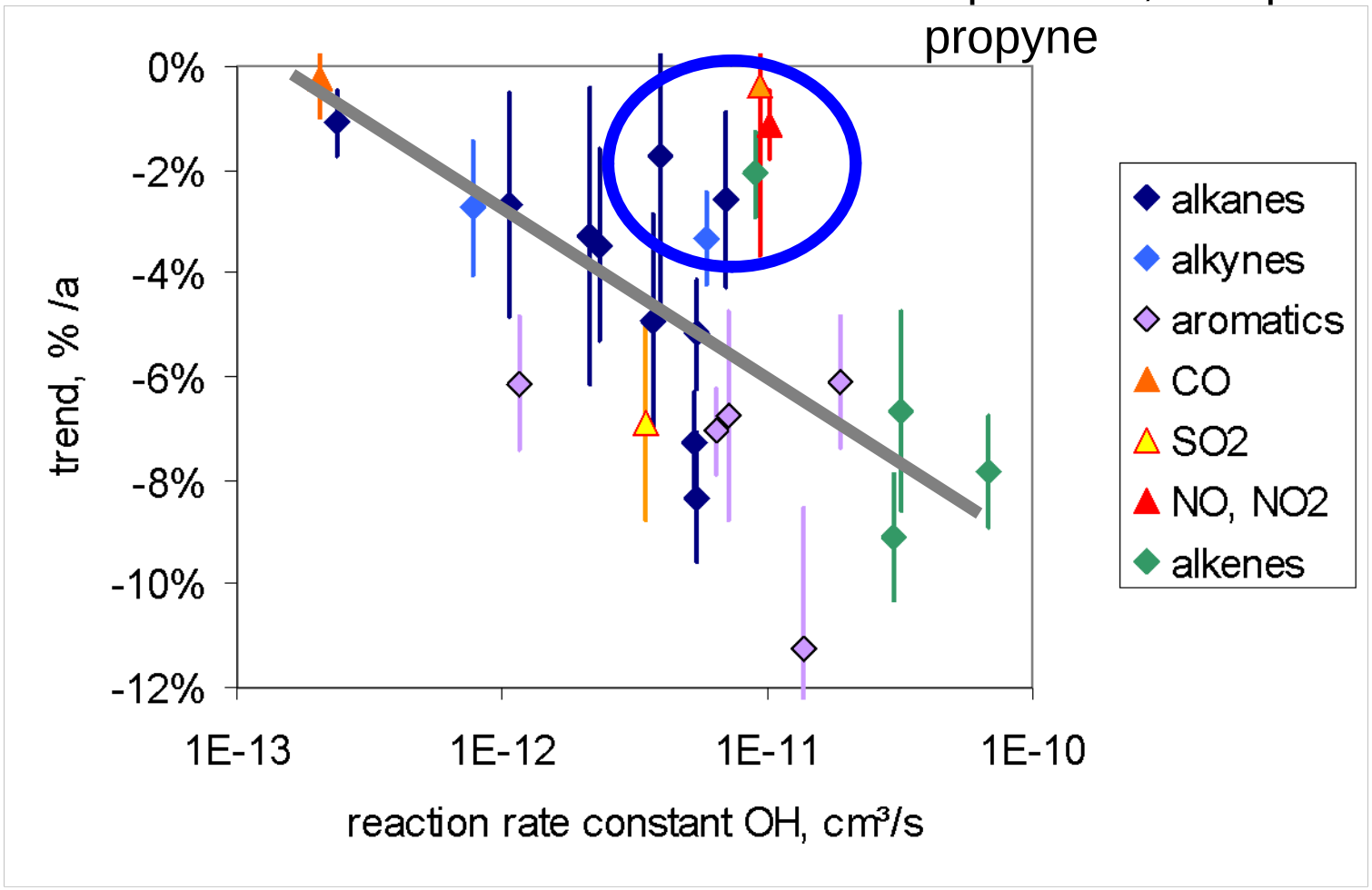
Selected anthropogenic hydrocarbons



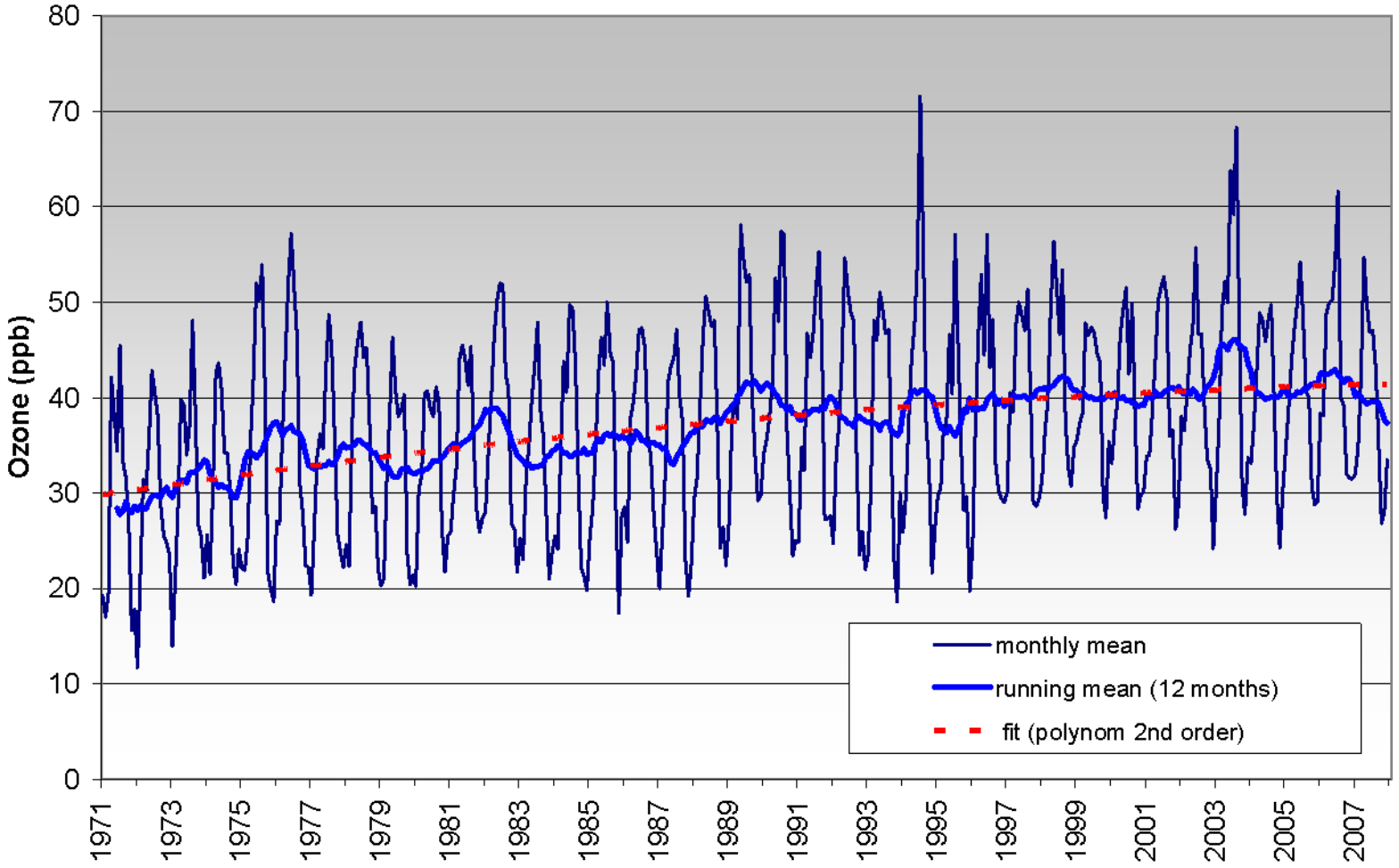
Mean mixing ratios (1998)



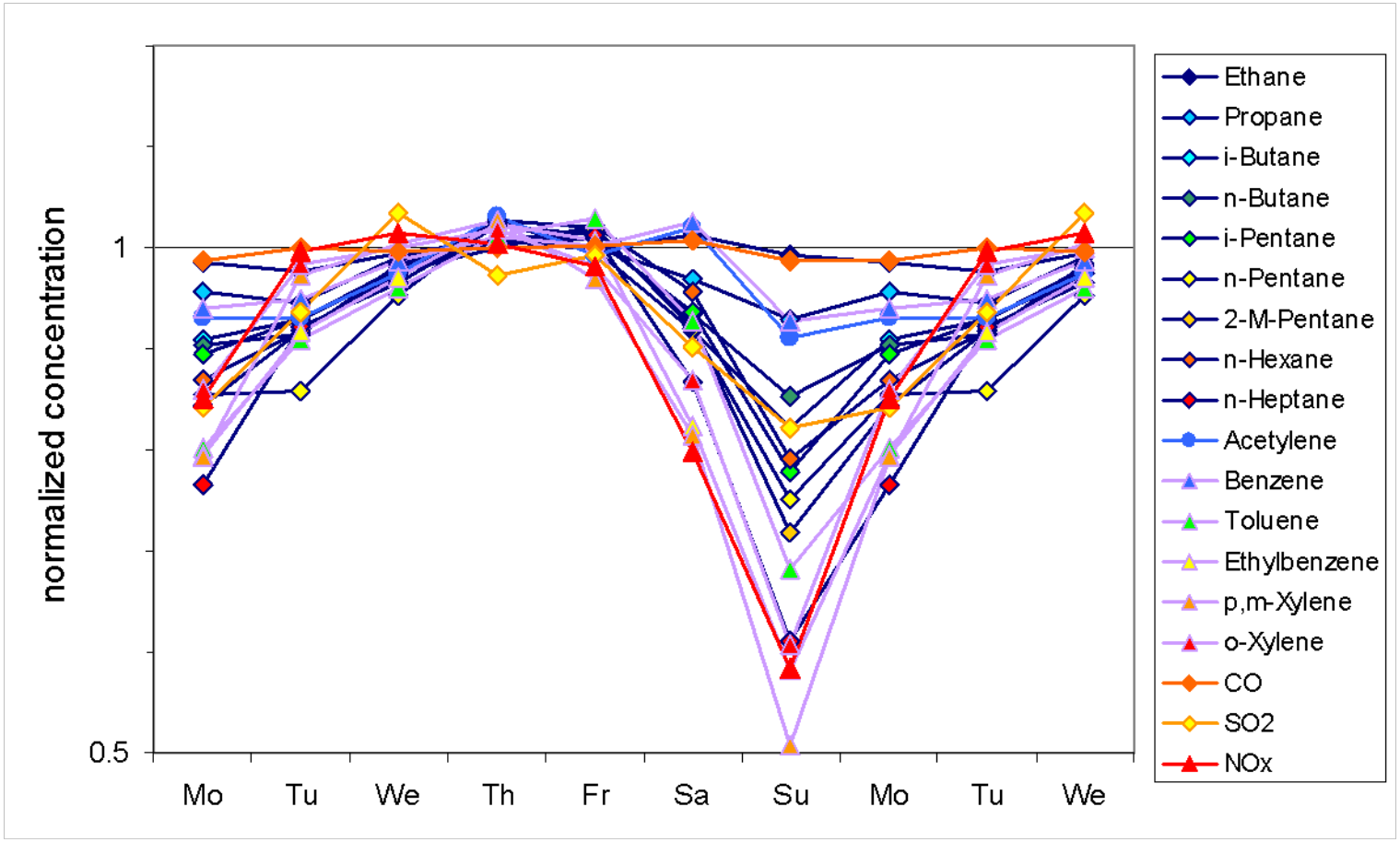
NO, NO_2, ethene, n-pentane, n-heptane, propyne



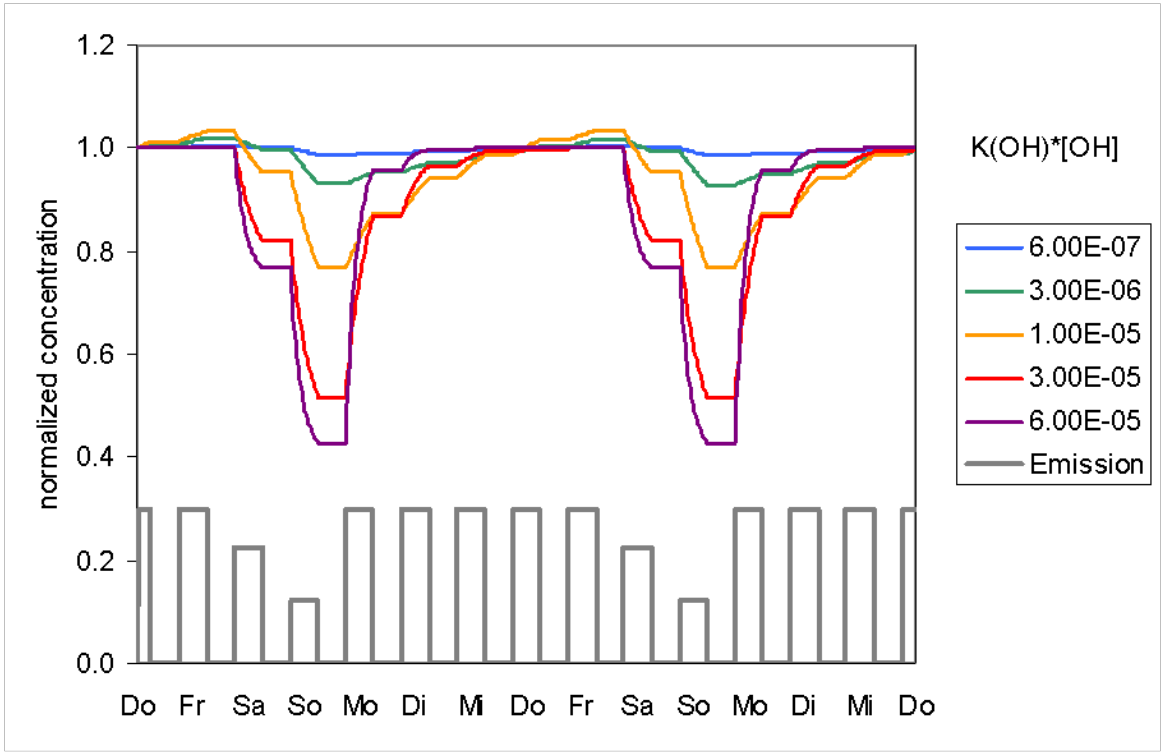
Ozone - Trend


Ozone (ppb)
0
10
20
30
40
50
60
70
80
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
monthly mean
running mean (12 months)
fit (polynom 2nd order)

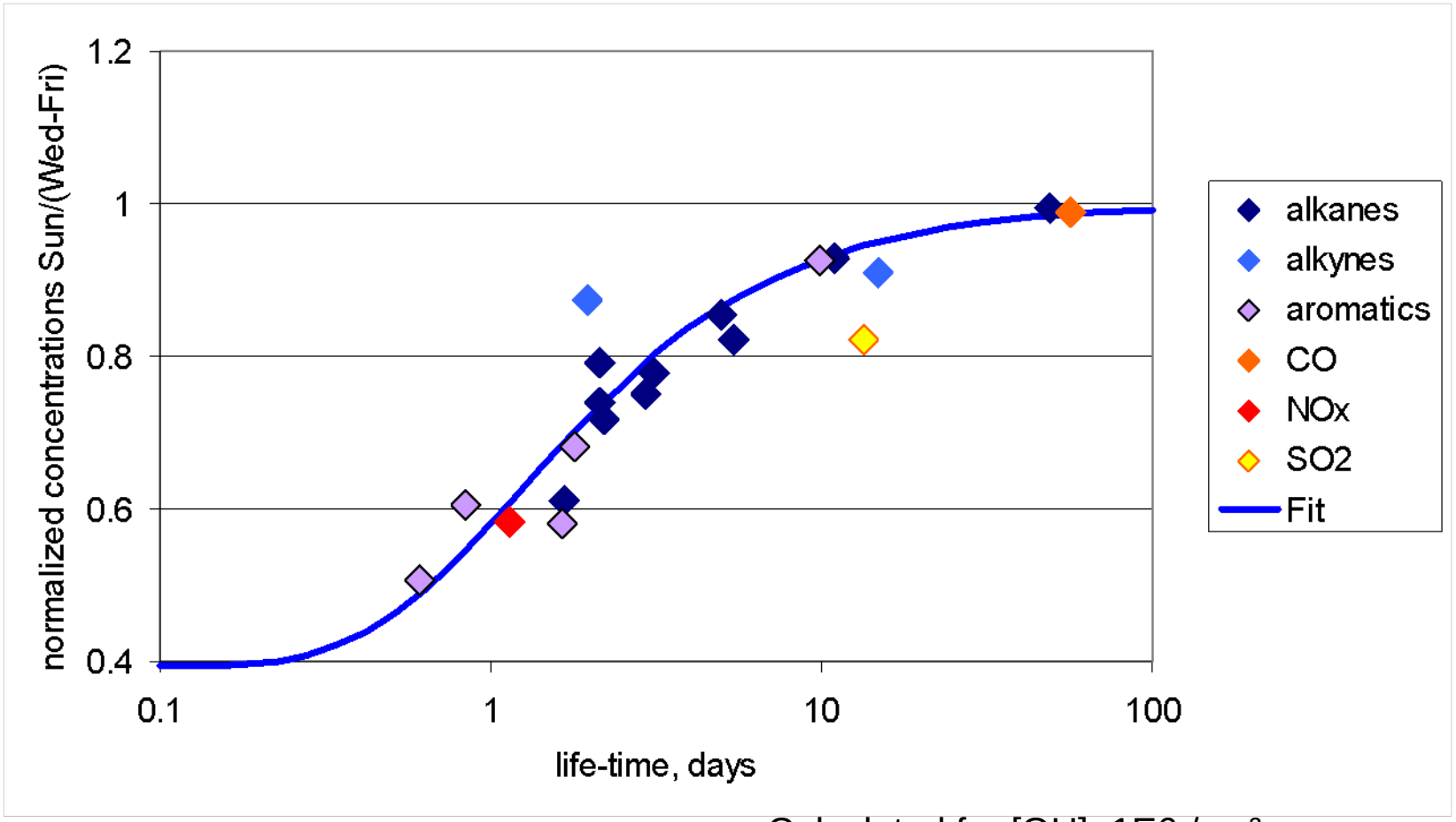
Weekly Cycles derived from all data, all seasons



Simulated weekly cycles



K(OH)*[OH]	CO, Ethane K= 2E-13	Benzene K= 1E-12	NO, NO2, Ethene K= 1E-11	Propene, Xylenes K=2E-11
Winter [OH]=5E5	1E-7	5E-7	5E-6	1E-5
Summer [OH]=3E6	6E-7	3E-6	3E-5	6E-5

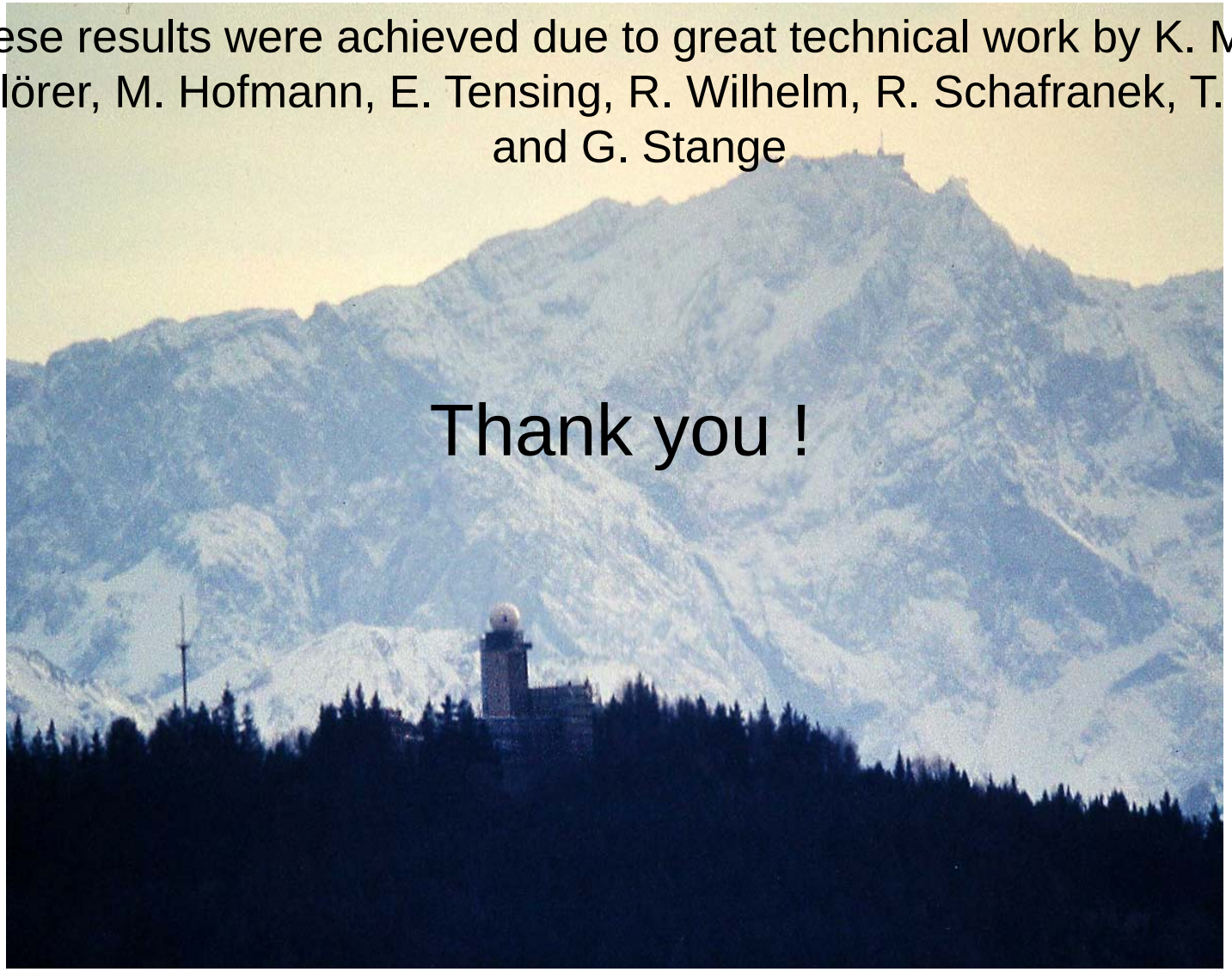


Calculated for [OH]=1E6 /cm³

Conclusion

- Anthropogenic trace gases are declining at MOHp
- Trends are stronger for shorter lived compounds
- NOx decline (-1.0% / y) weaker than expected – emissions?
- Weekly cycles show reduced emissions by about 60% on Sundays
- Weekly and annual cycles provide powerful tools to constrain emission estimates

These results were achieved due to great technical work by K. Michl, E. Plörer, M. Hofmann, E. Tensing, R. Wilhelm, R. Schafranek, T. Elste, and G. Stange



Thank you !