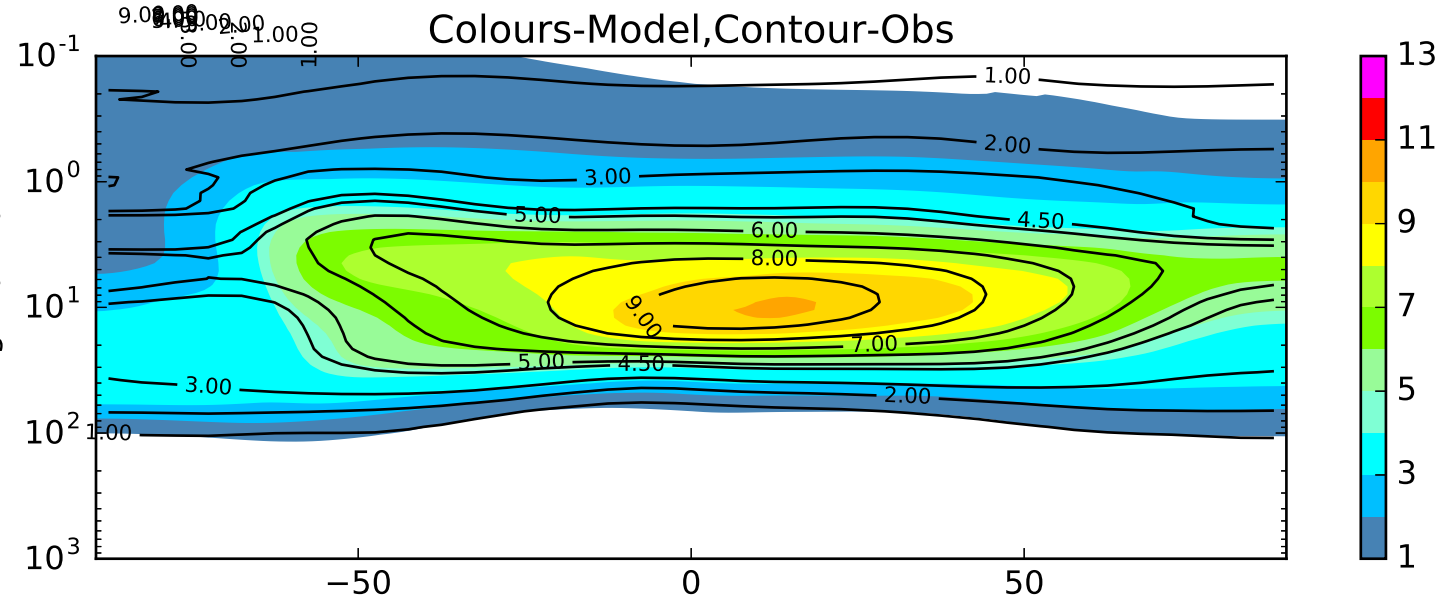
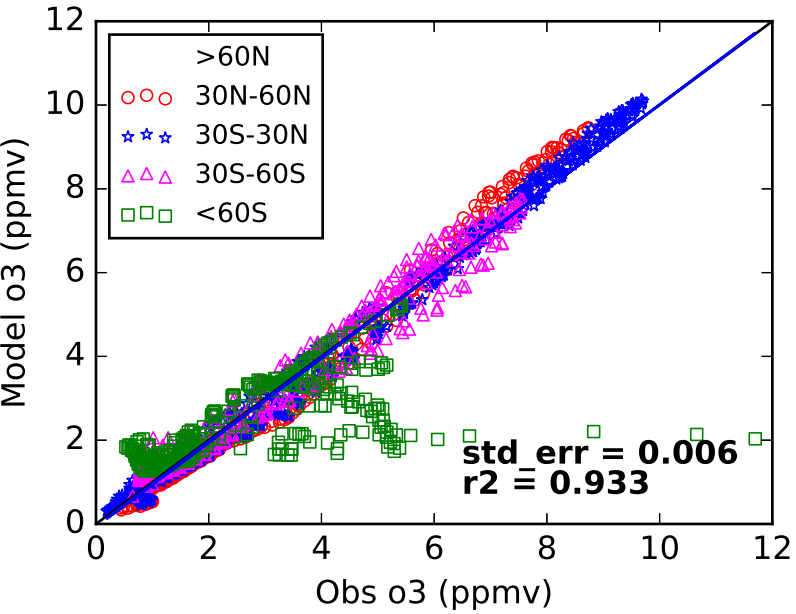
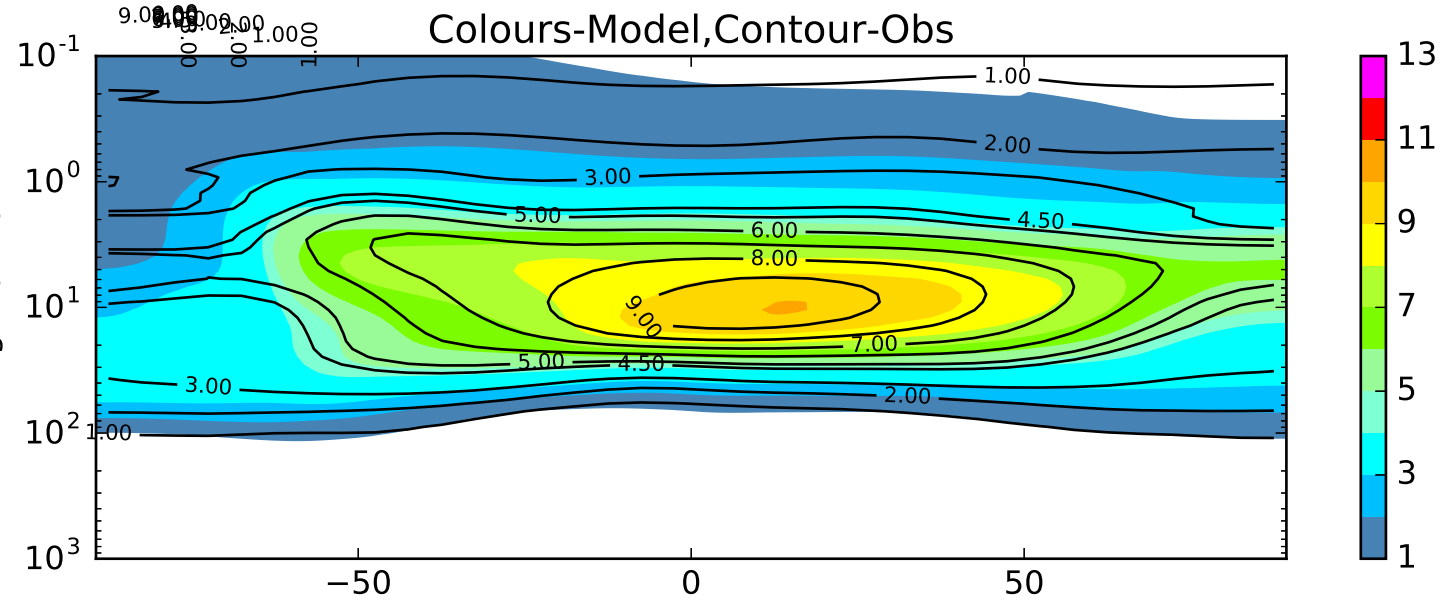
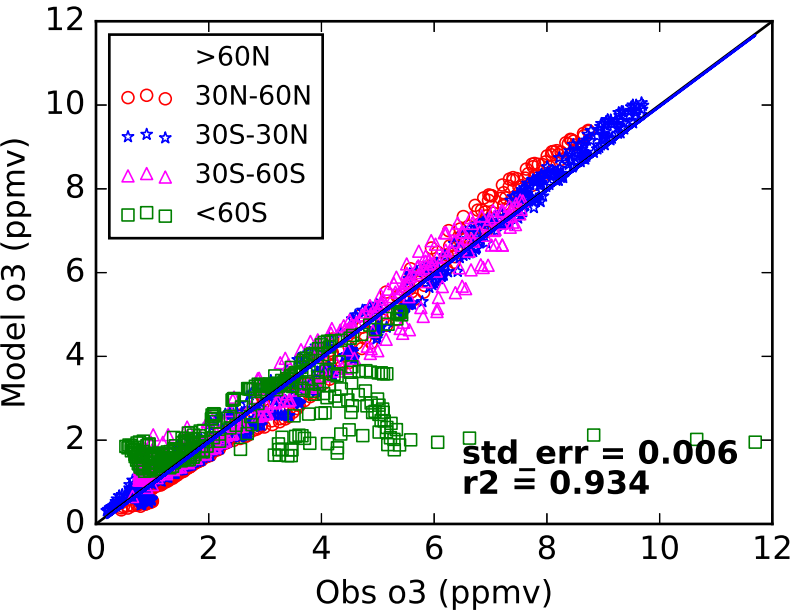


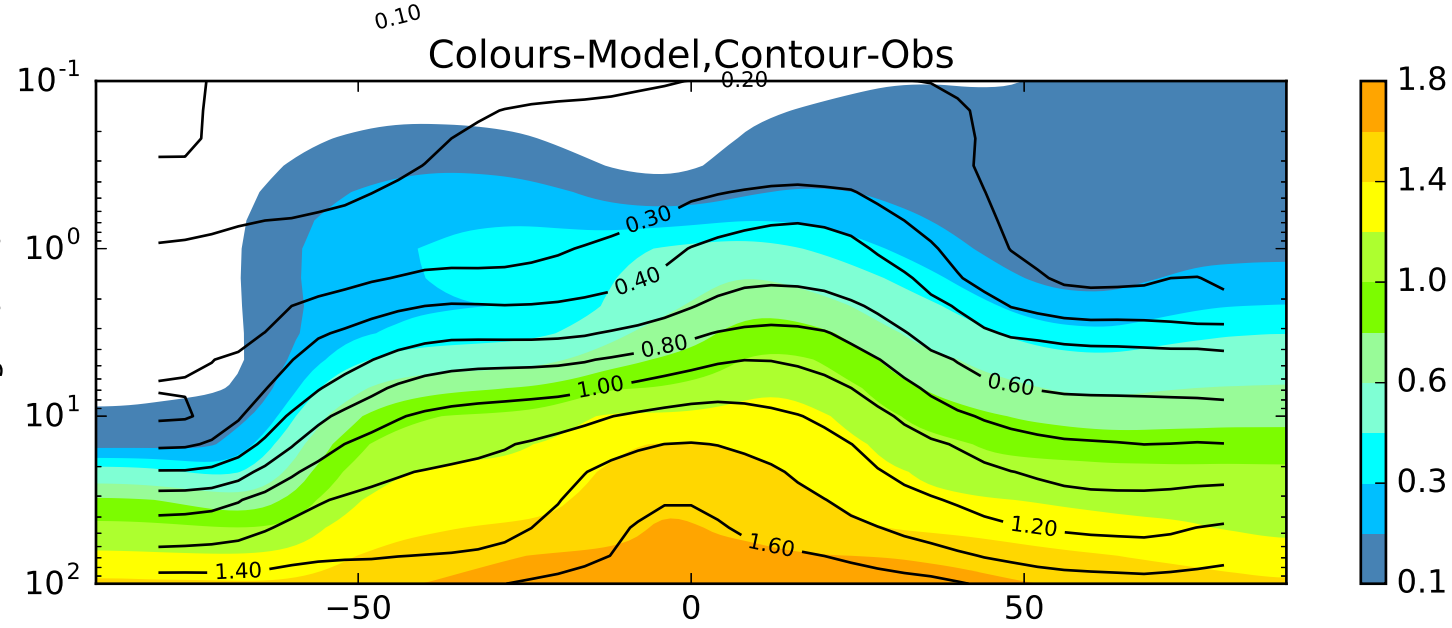


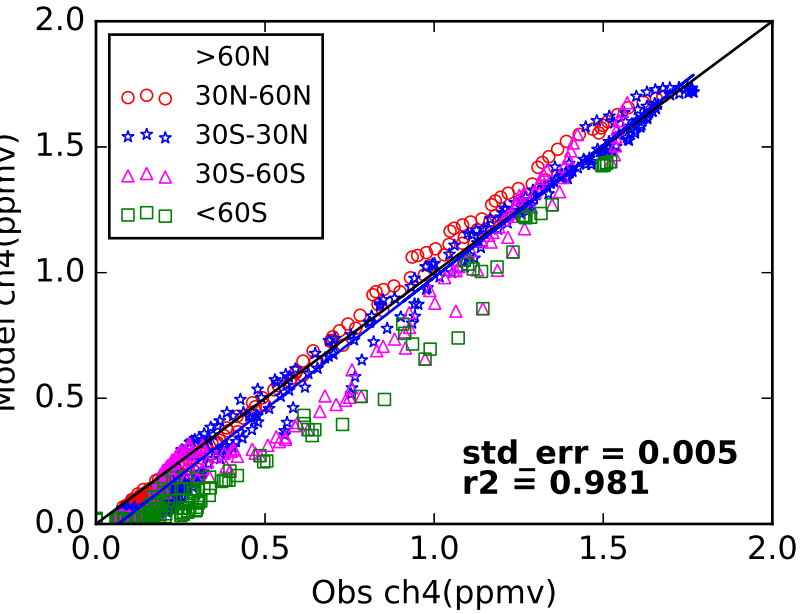
UKCA bg745 vs NIWA-CCMVal:
O3 (ppmv) Jul



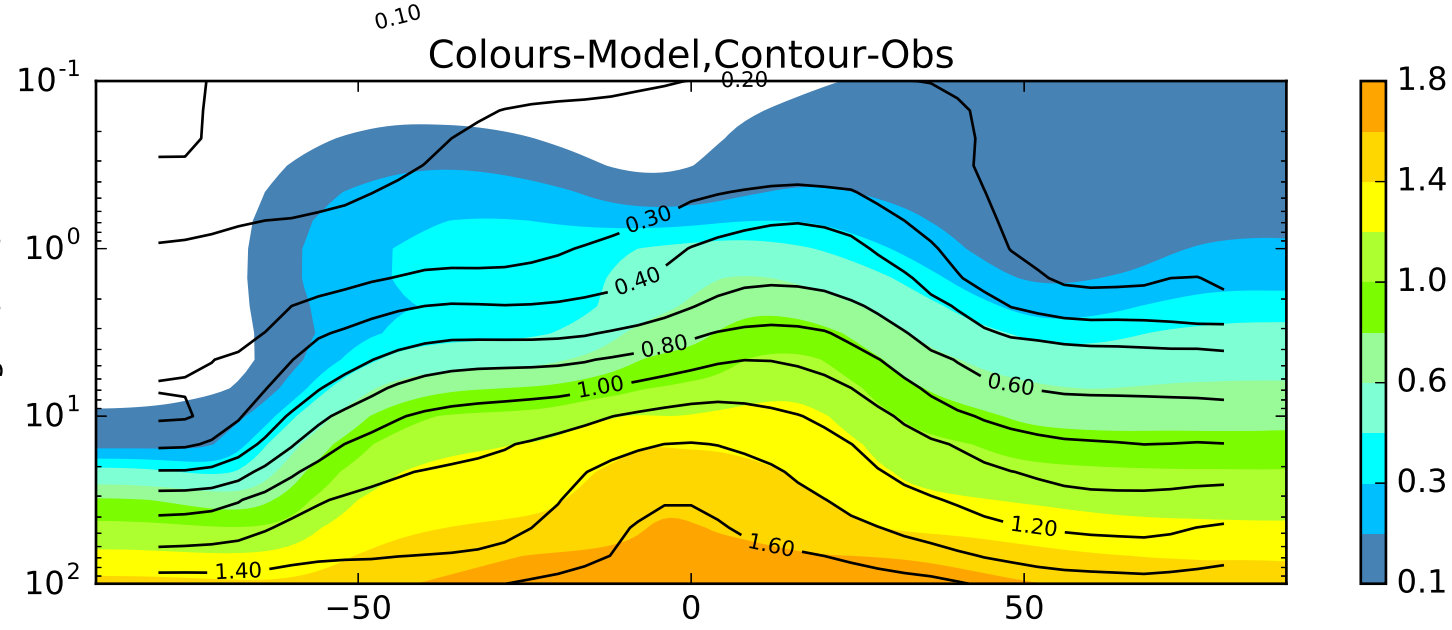


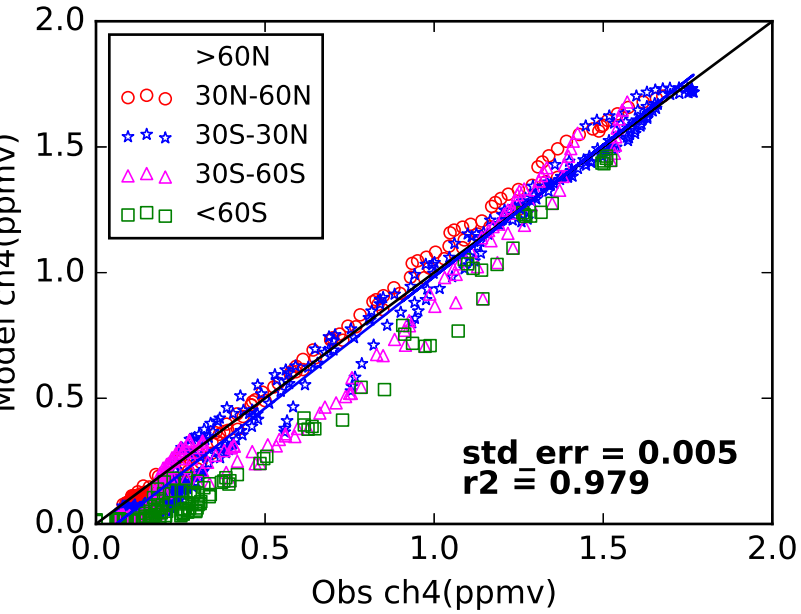
UKCA bk249 vs NIWA-CCMVal:
O3 (ppmv) Jul



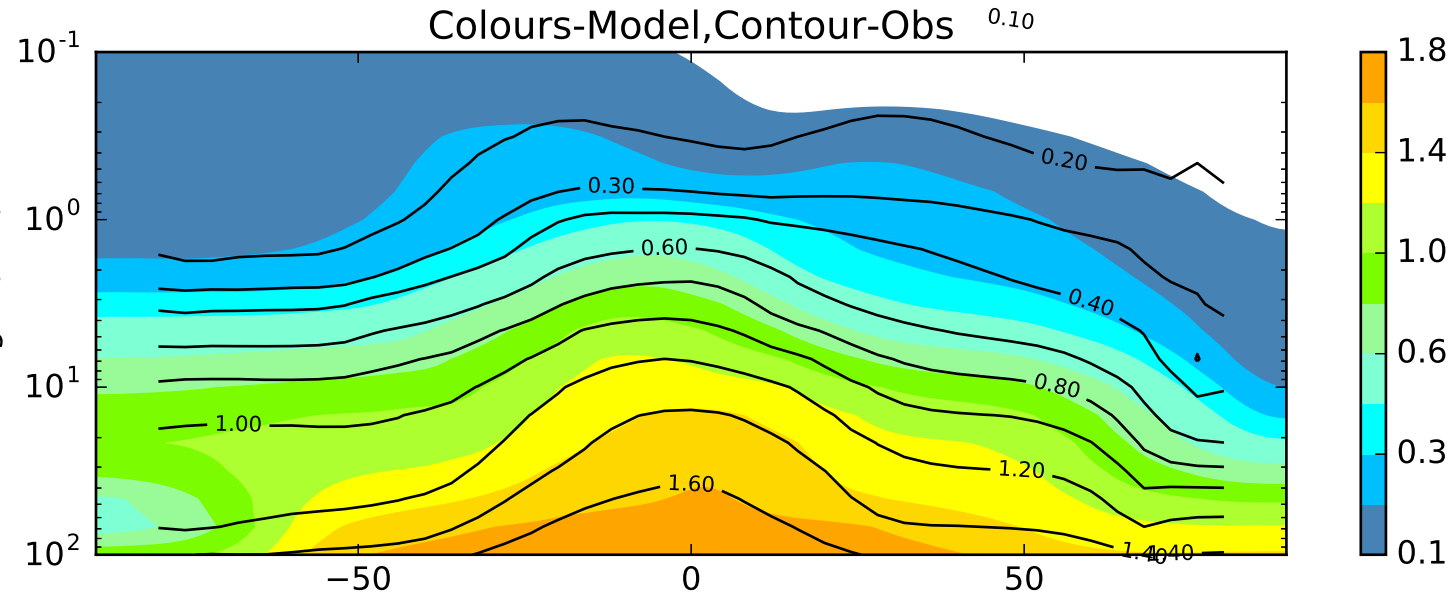


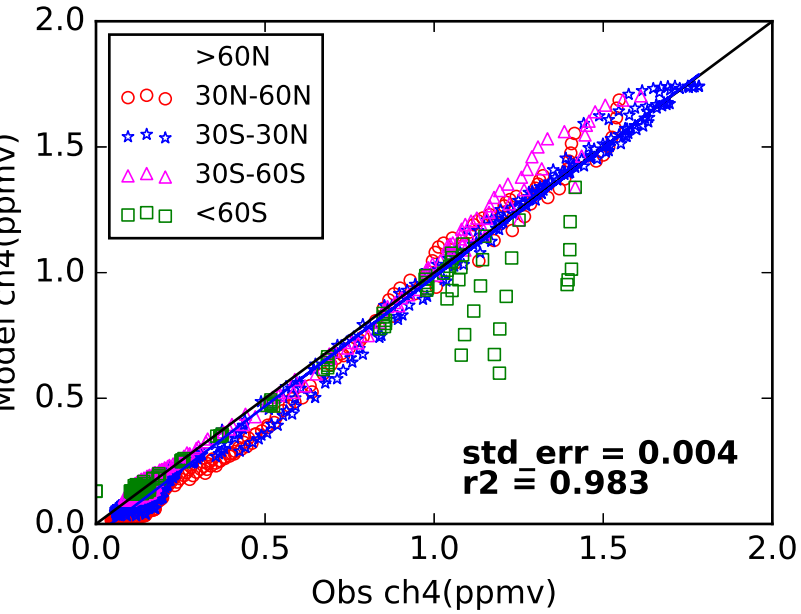
UKCA bg745 vs HALOE:
CH4 (ppmv) Jul



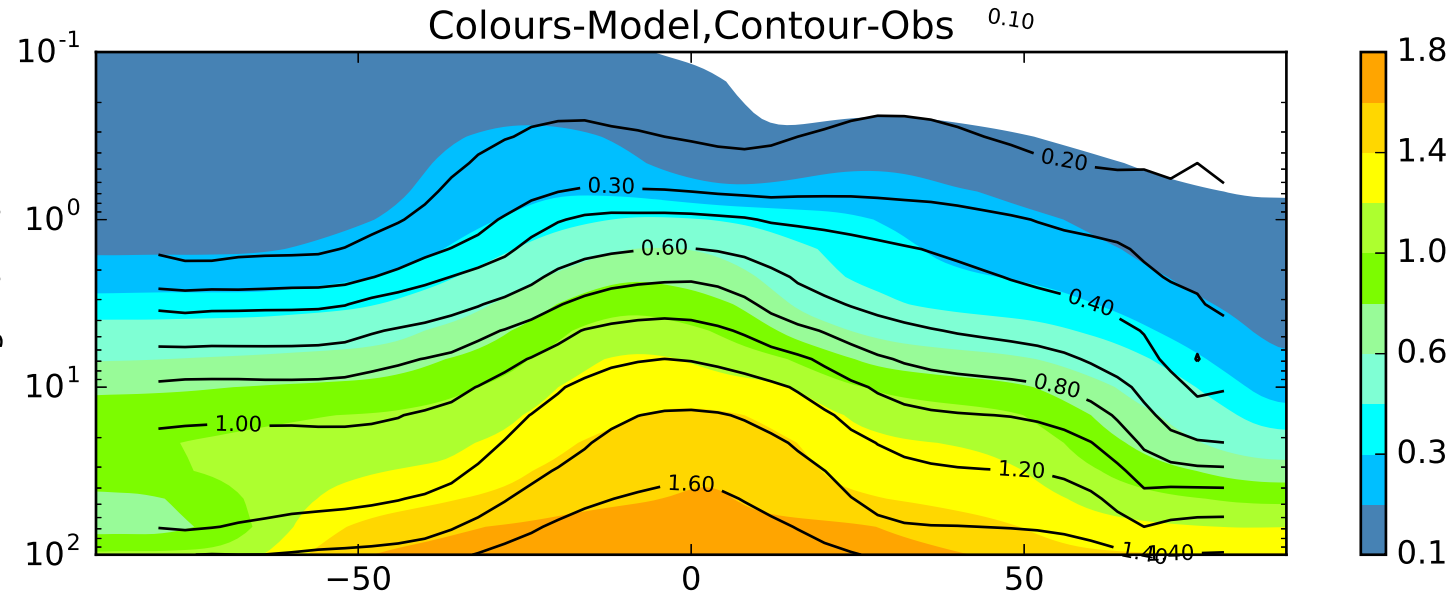


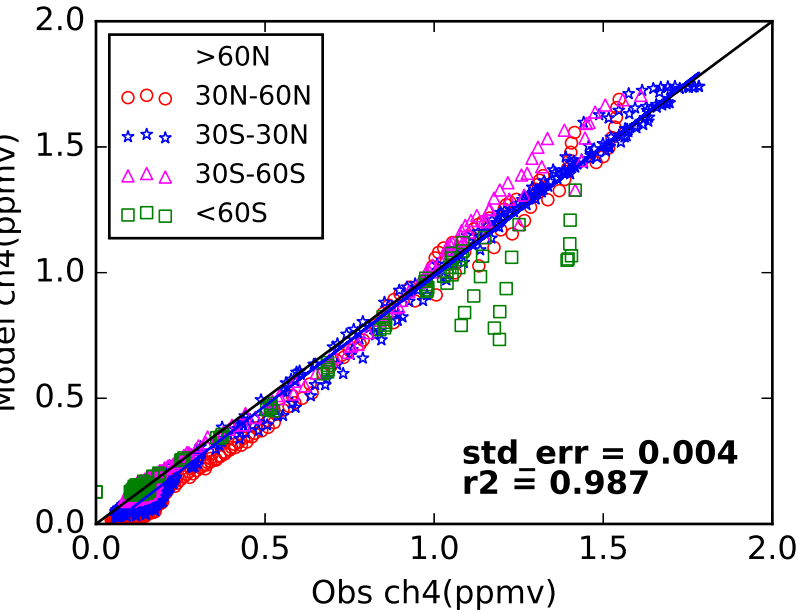
UKCA bk249 vs HALOE:
CH4 (ppmv) Jul



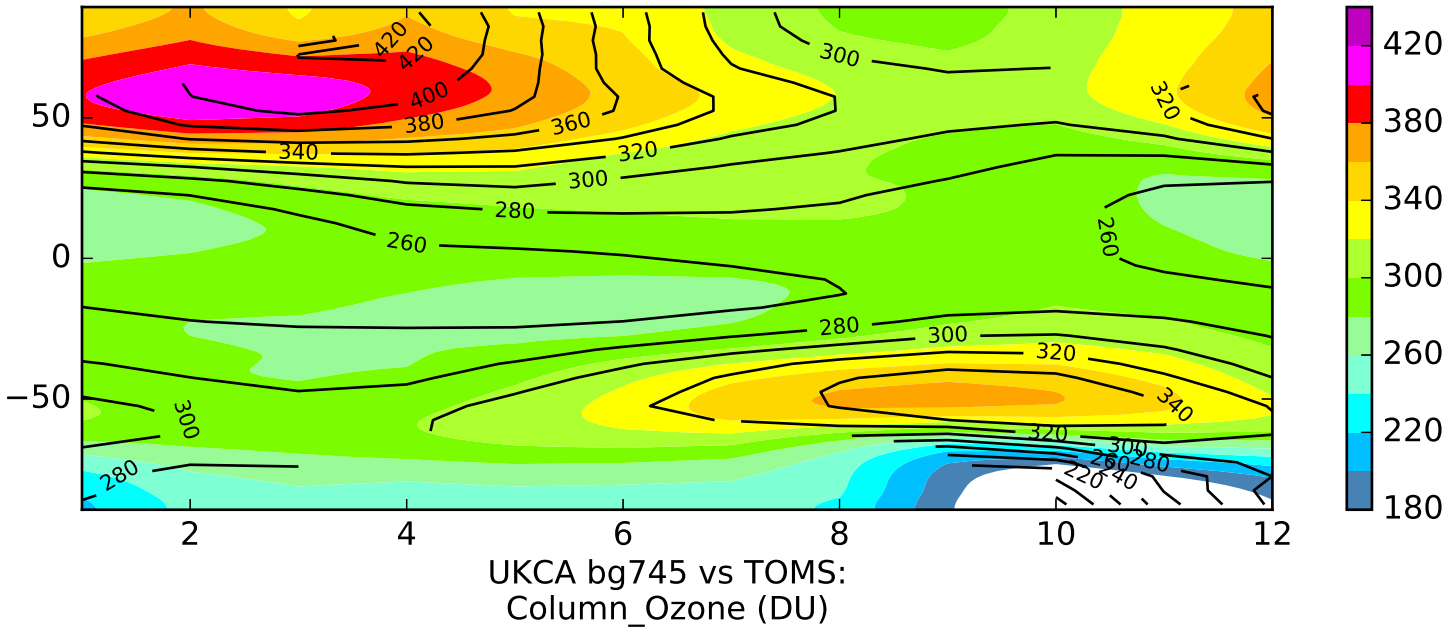


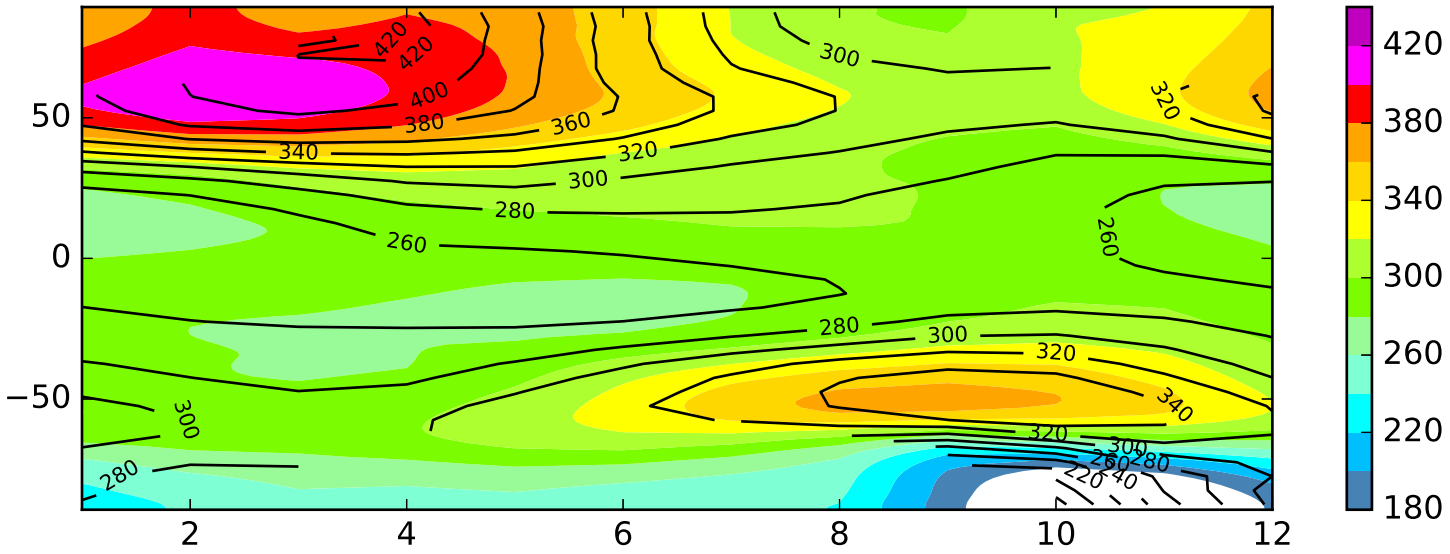
UKCA bg745 vs HALOE:
CH4 (ppmv) Jan

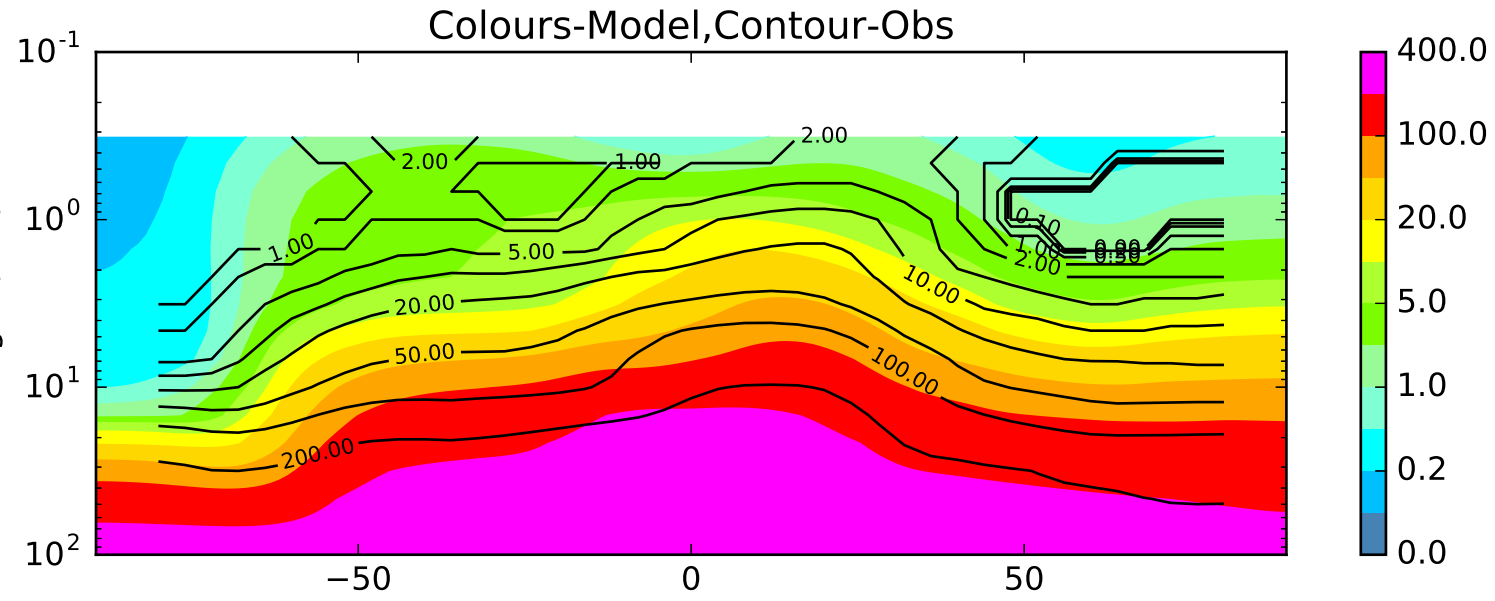


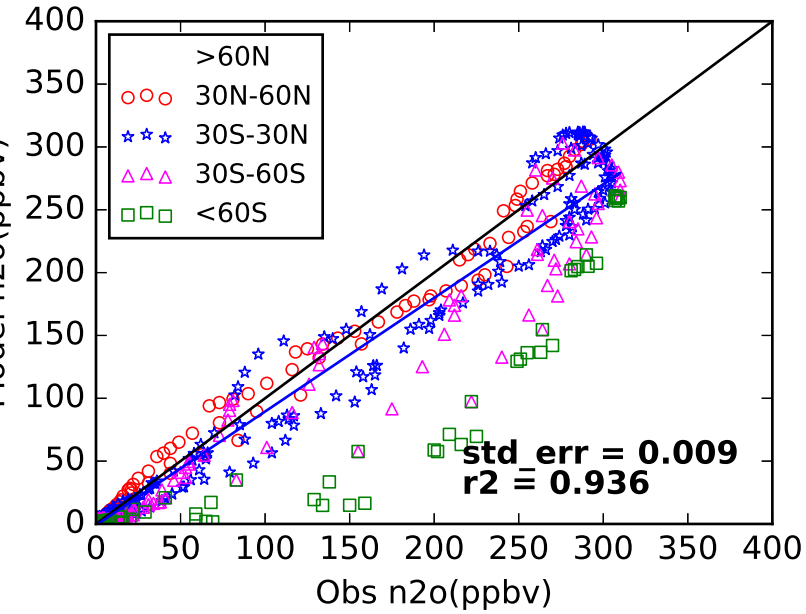


UKCA bk249 vs HALOE:
CH4 (ppmv) Jan

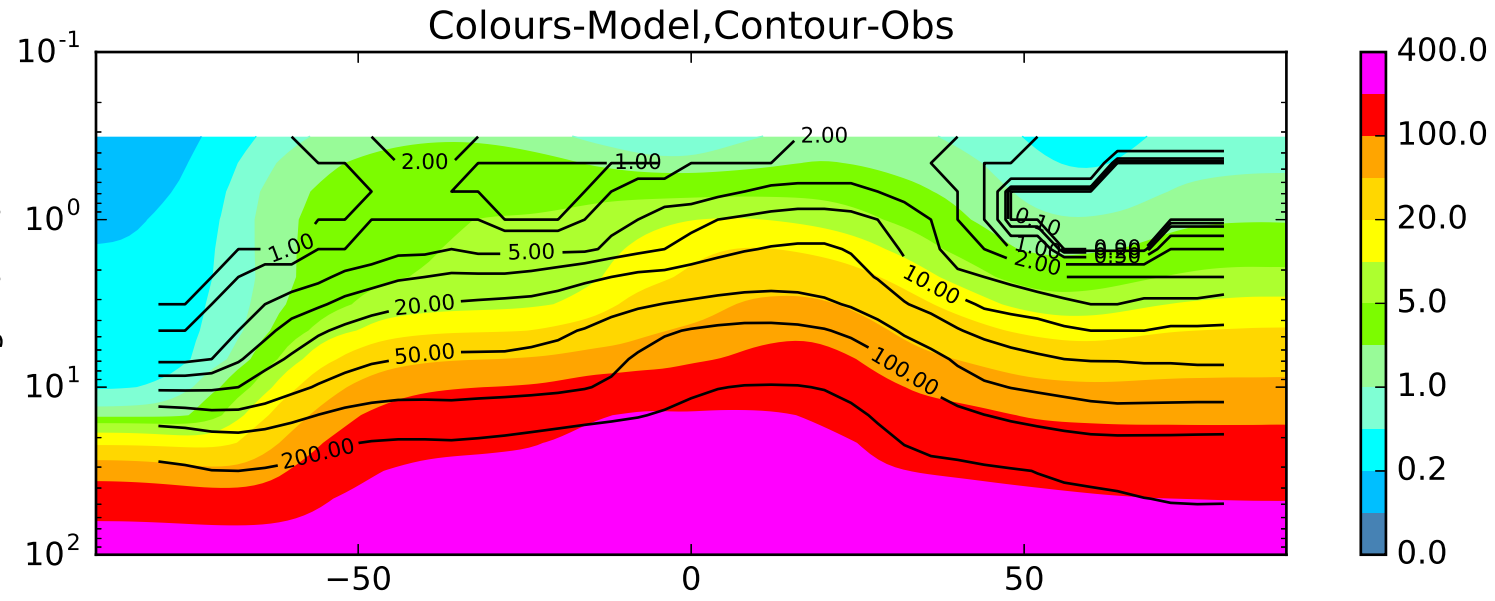

50
0
−50
2
4
6
8
10
12
420
380
340
300
260
220
180
UKCA bg745 vs TOMS:
Column_Ozone (DU)

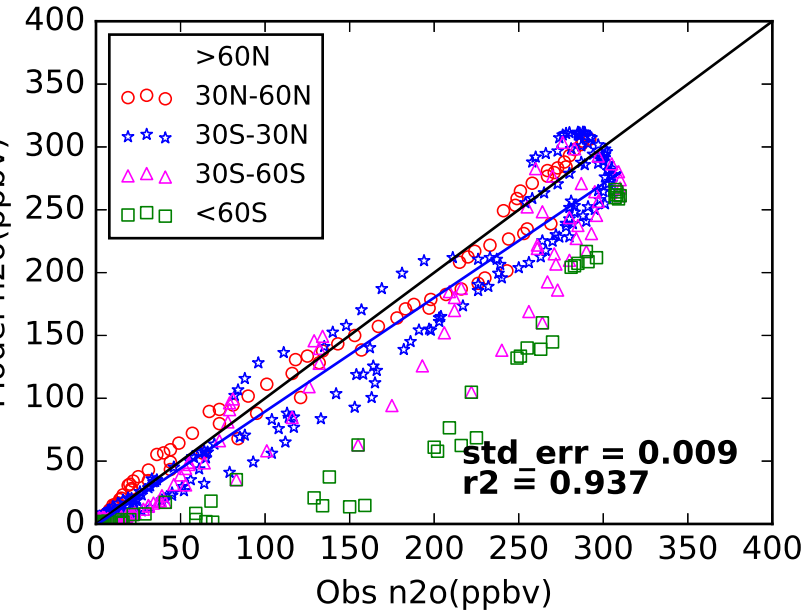

50
0
−50
2
4
6
8
10
12
420
380
340
300
260
220
180
UKCA bk249 vs TOMS:
Column_Ozone (DU)



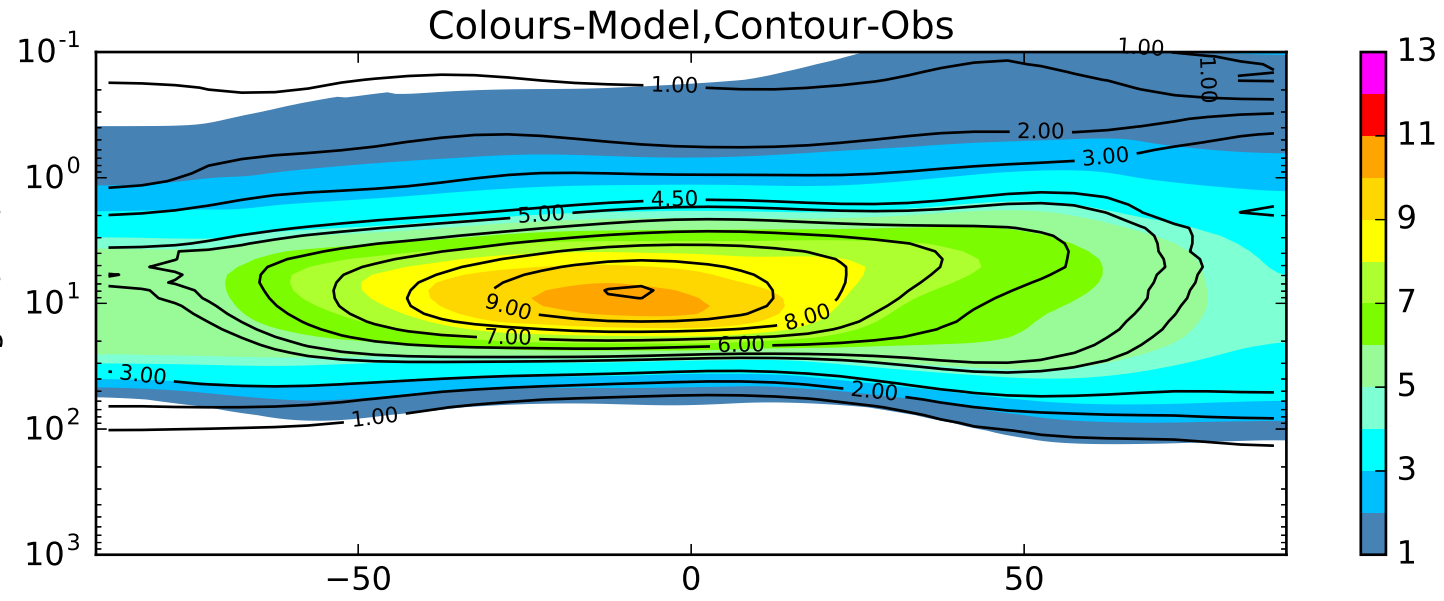


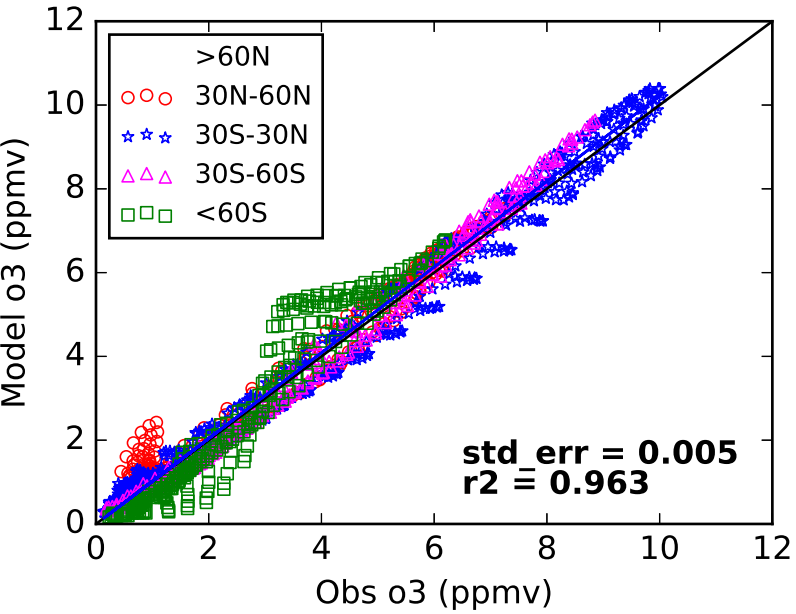
UKCA bg745 vs HALOE:
N2O (ppmv) Jul



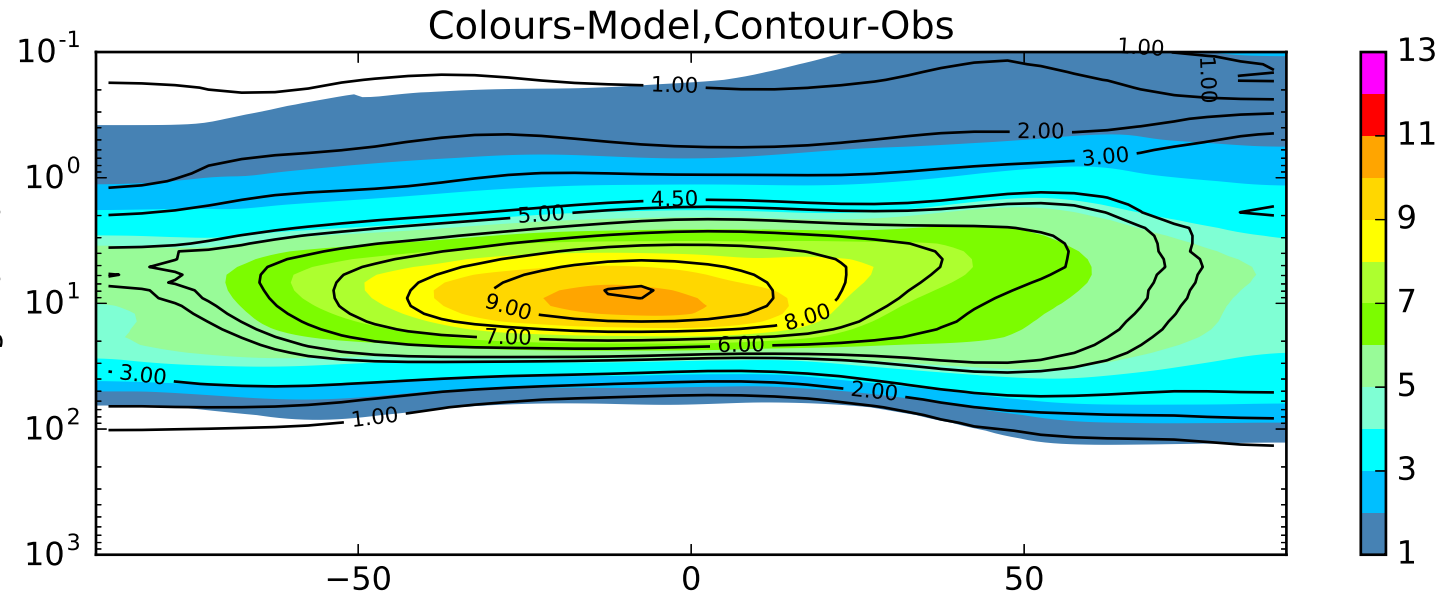


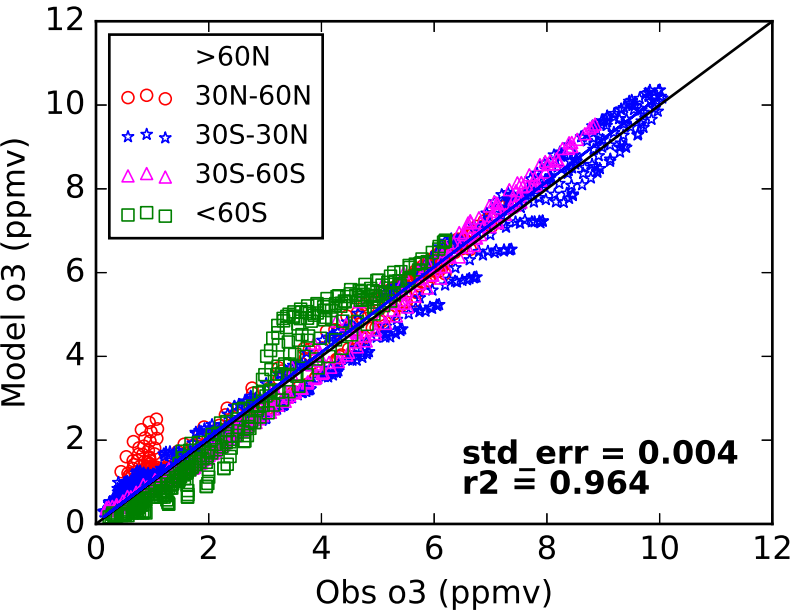
UKCA bk249 vs HALOE:
N2O (ppmv) Jul



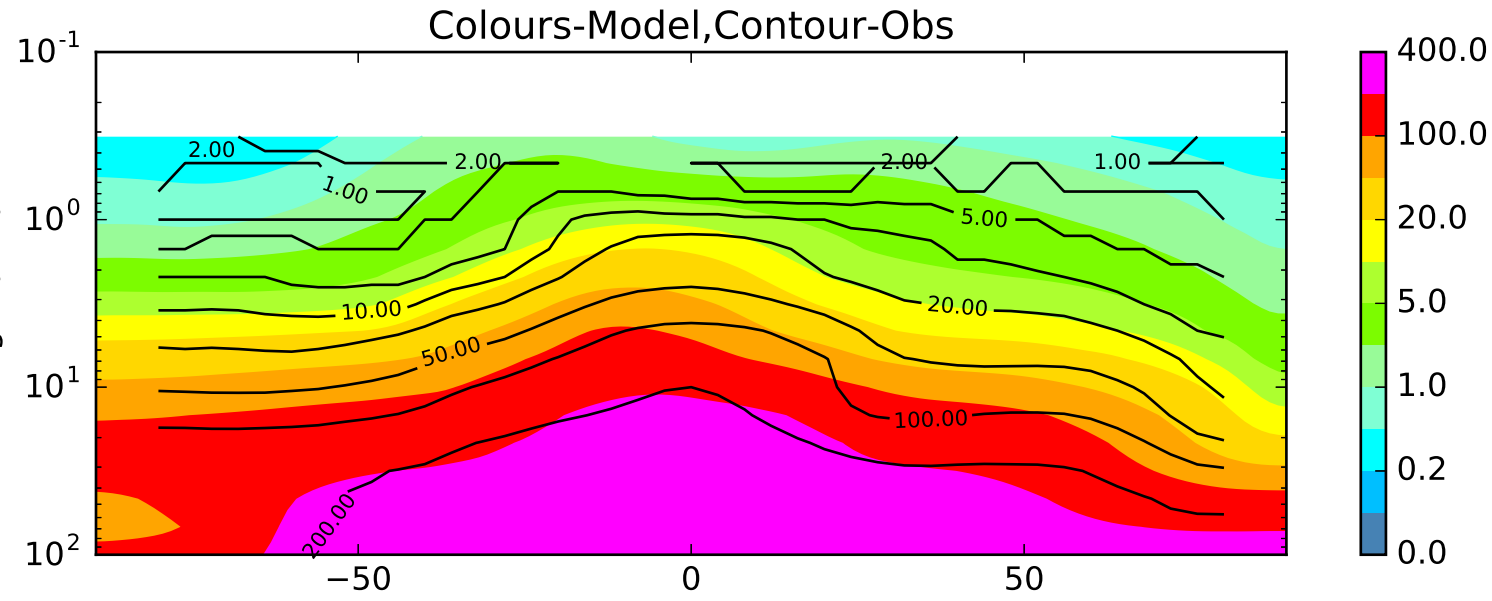


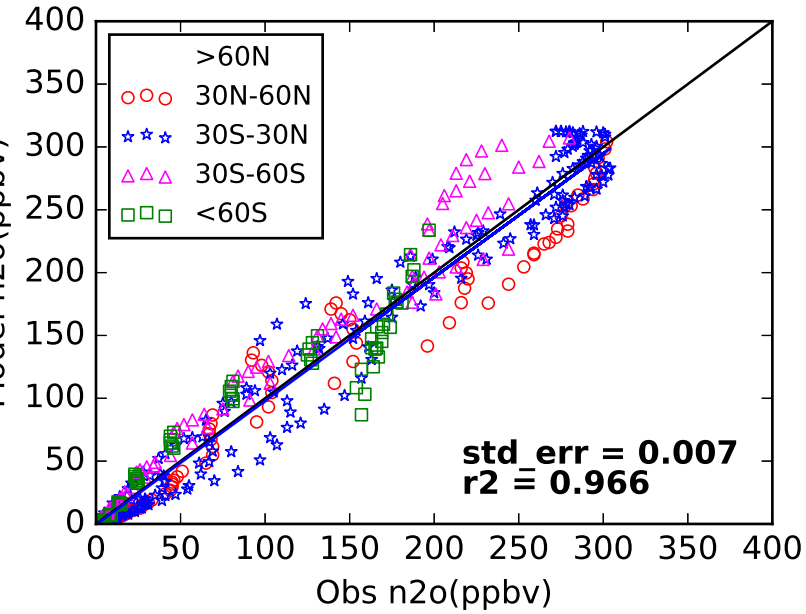
UKCA bg745 vs NIWA-CCMVal:
O3 (ppmv) Jan



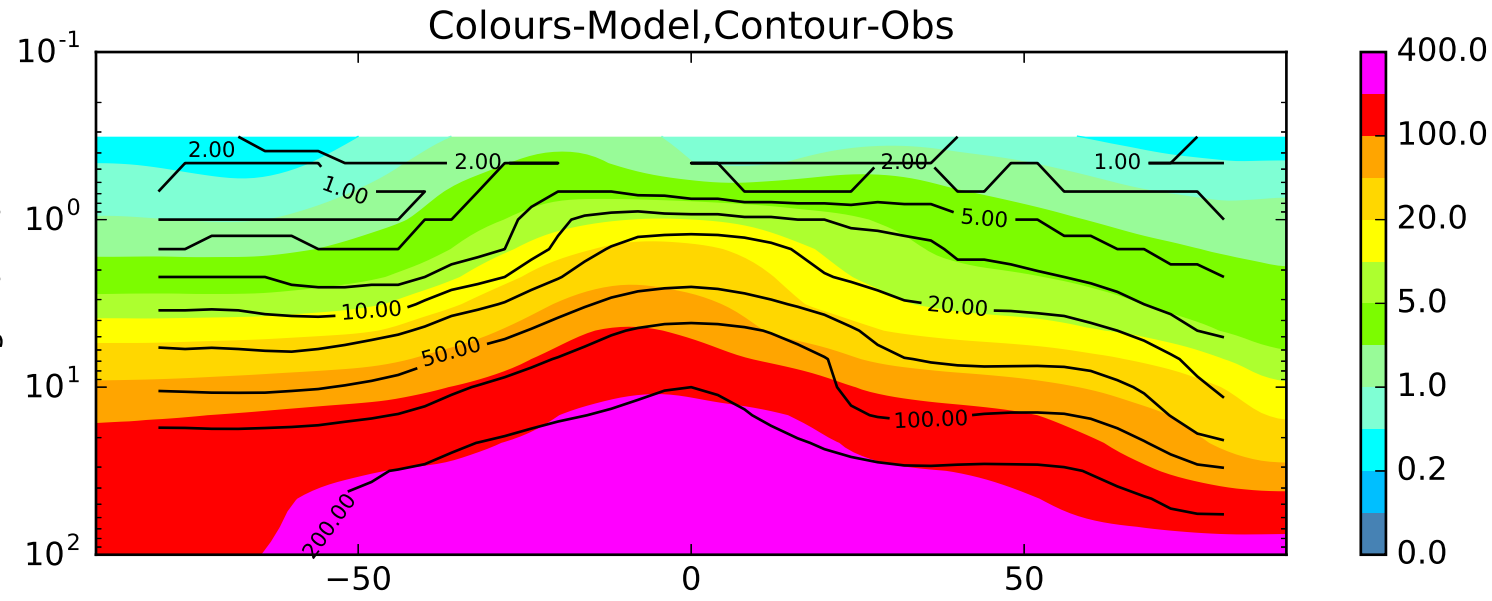


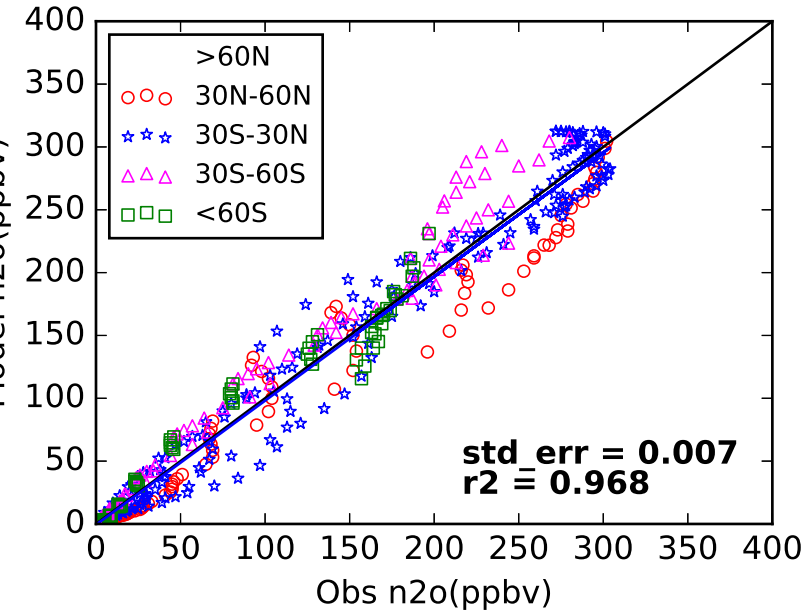
UKCA bk249 vs NIWA-CCMVal:
O3 (ppmv) Jan



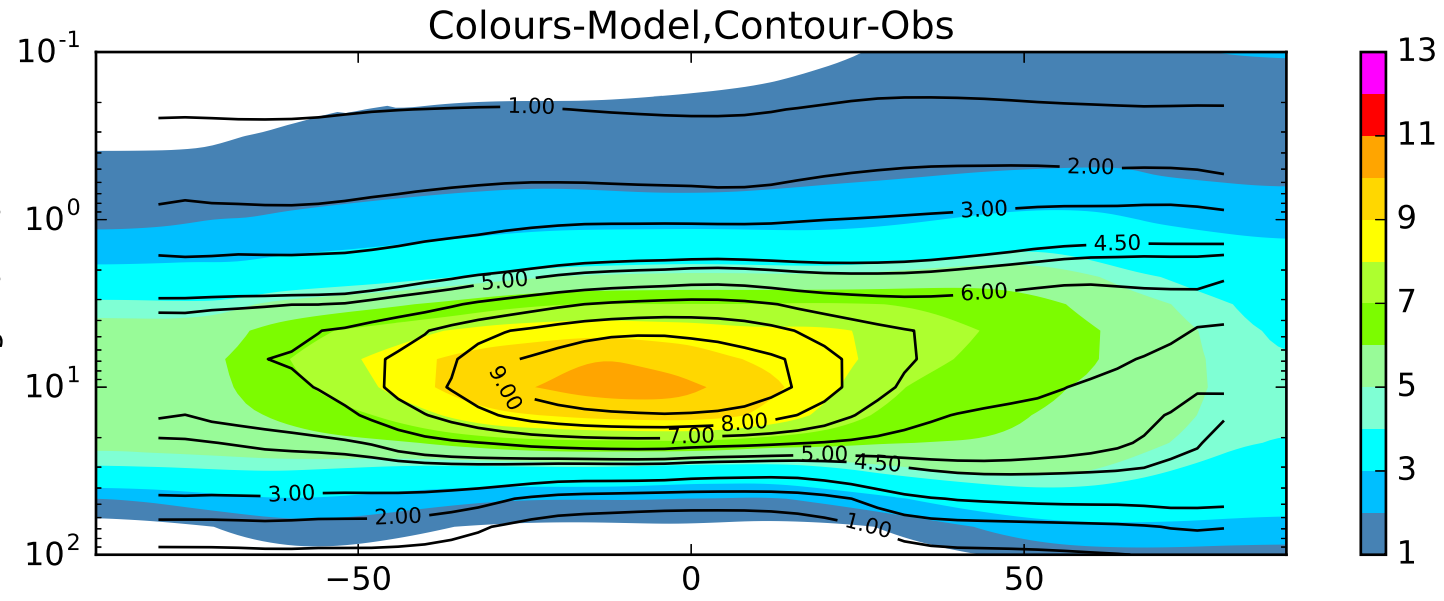


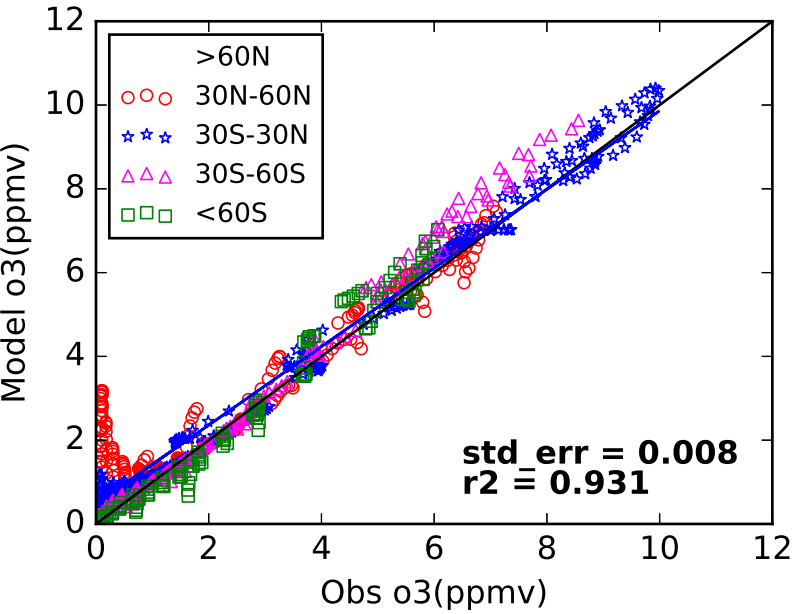
UKCA bg745 vs HALOE:
N2O (ppmv) Jan



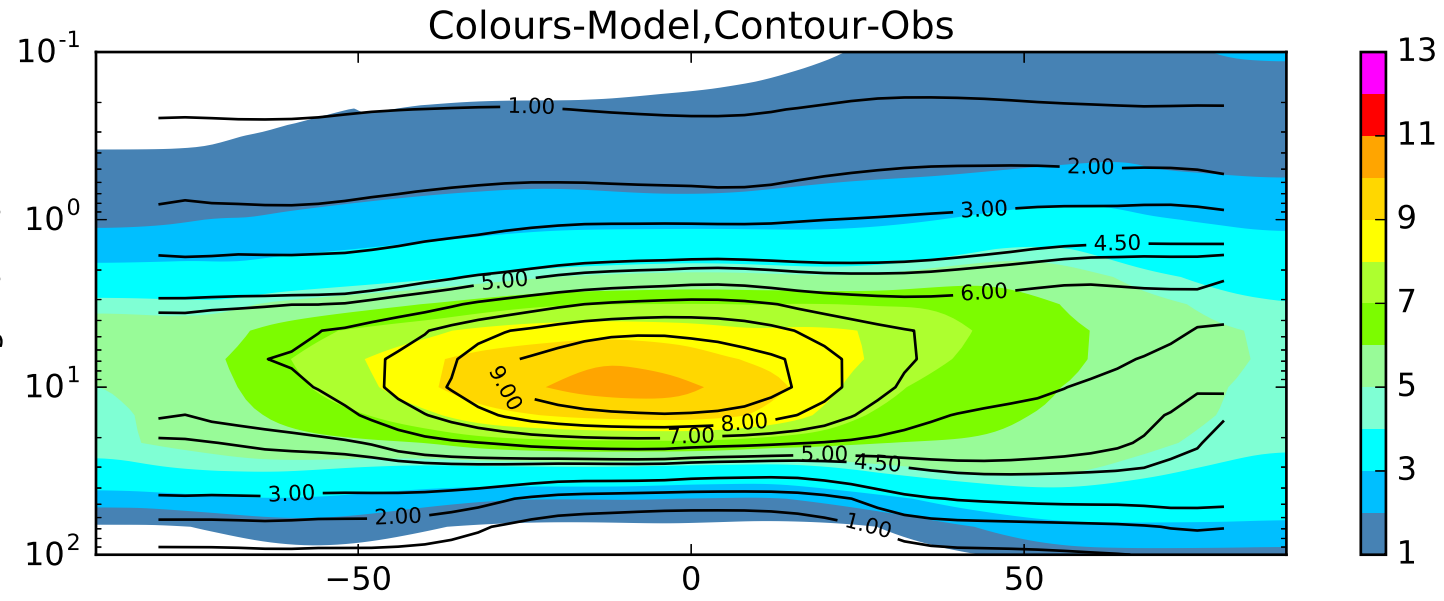


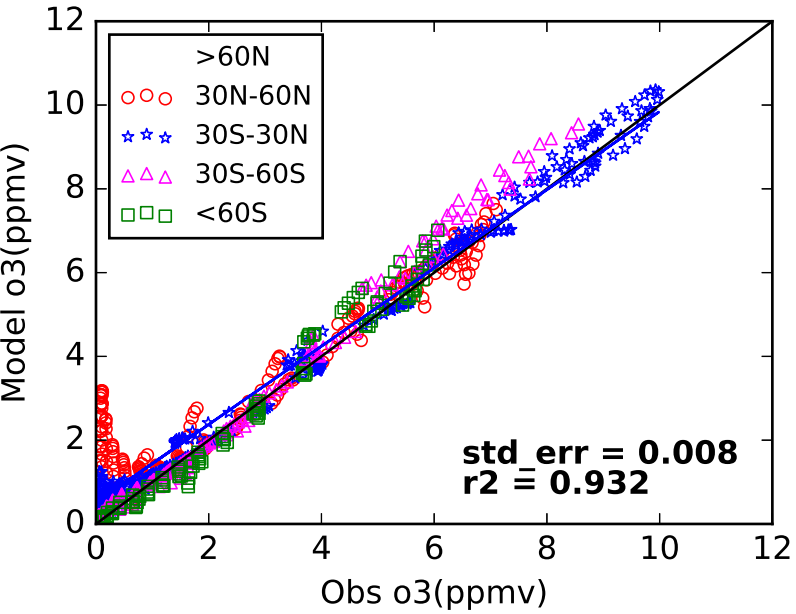
UKCA bk249 vs HALOE:
N2O (ppmv) Jan



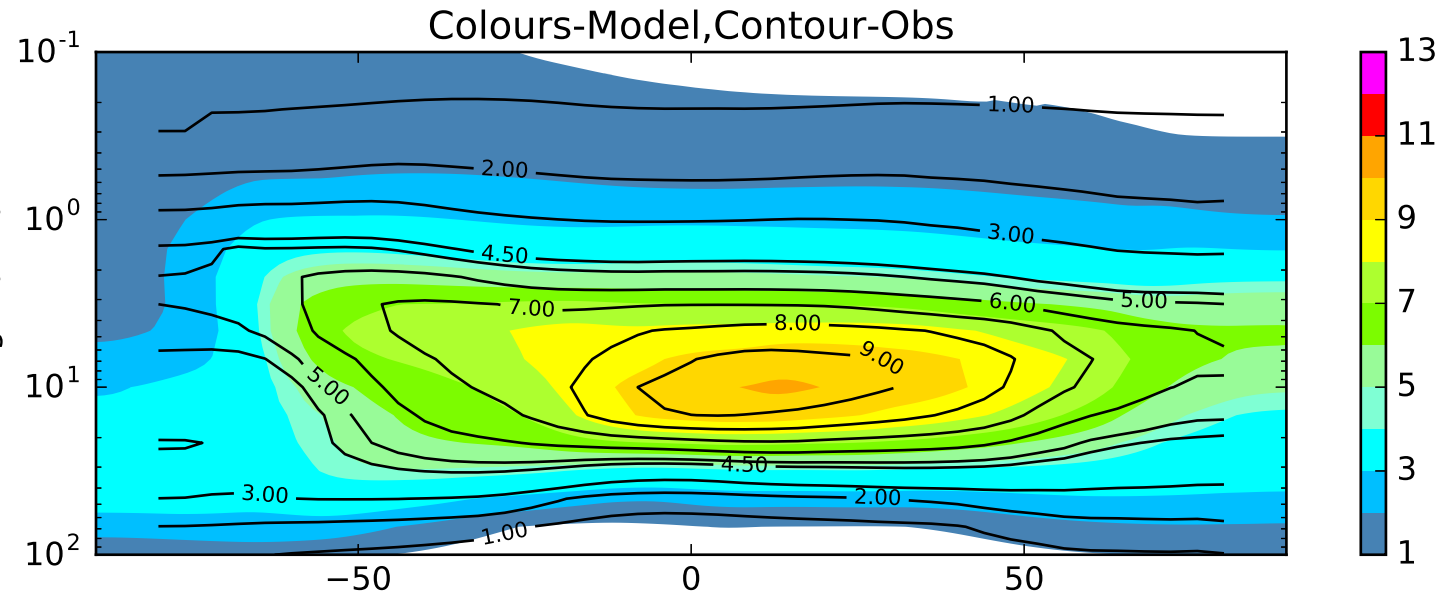


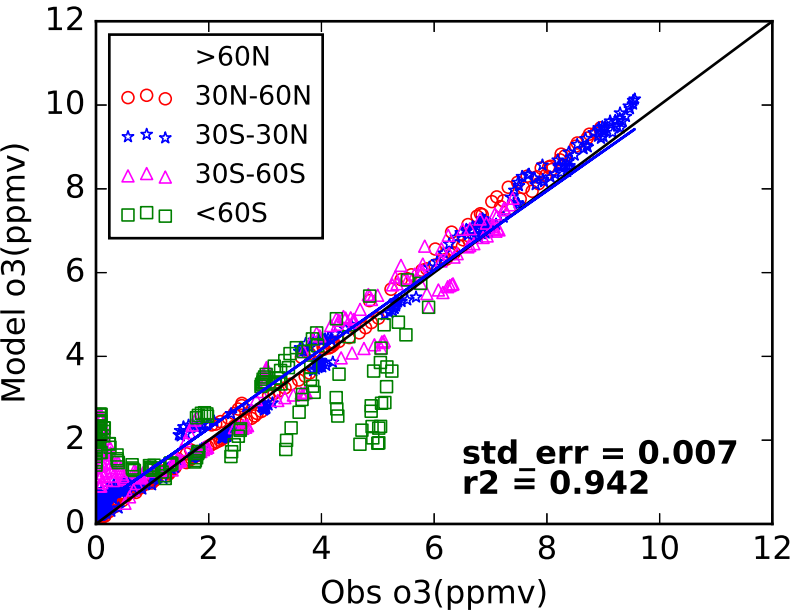
UKCA bg745 vs HALOE:
O3 (ppmv) Jan



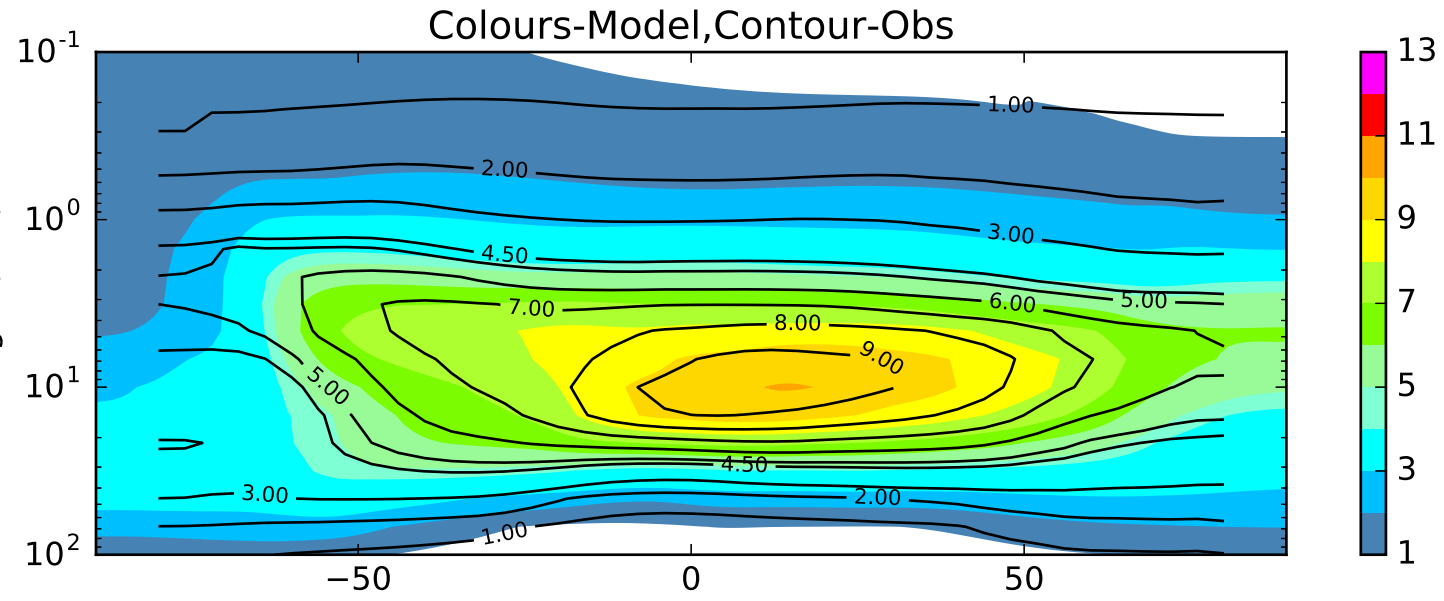


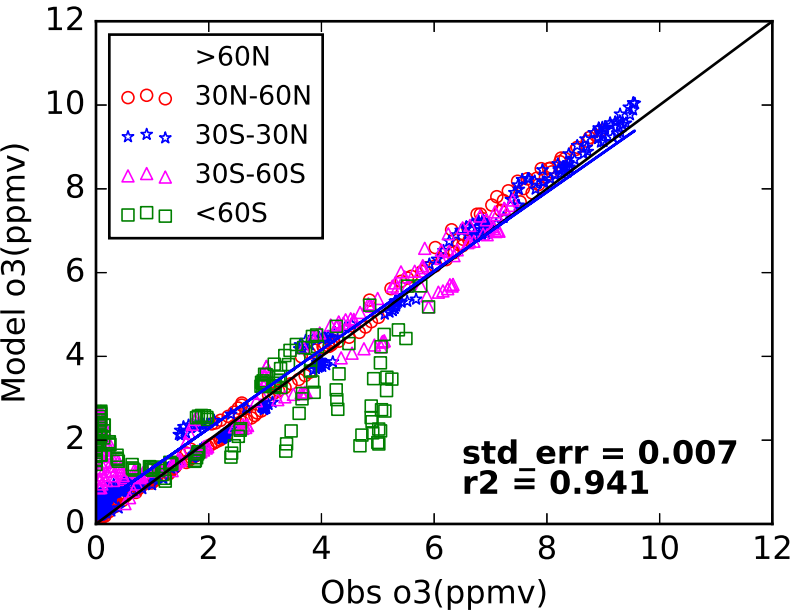
UKCA bk249 vs HALOE:
O3 (ppmv) Jan



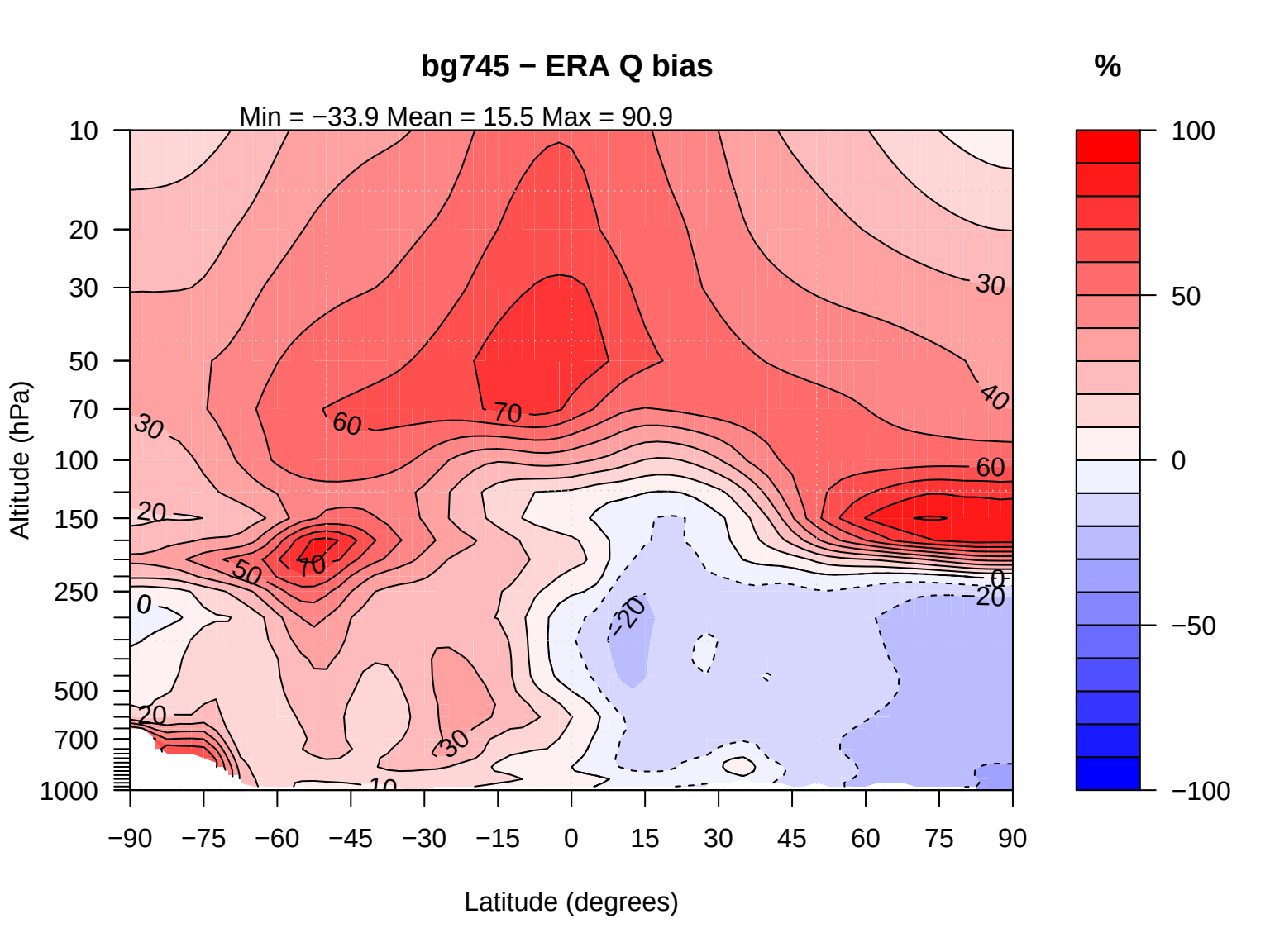


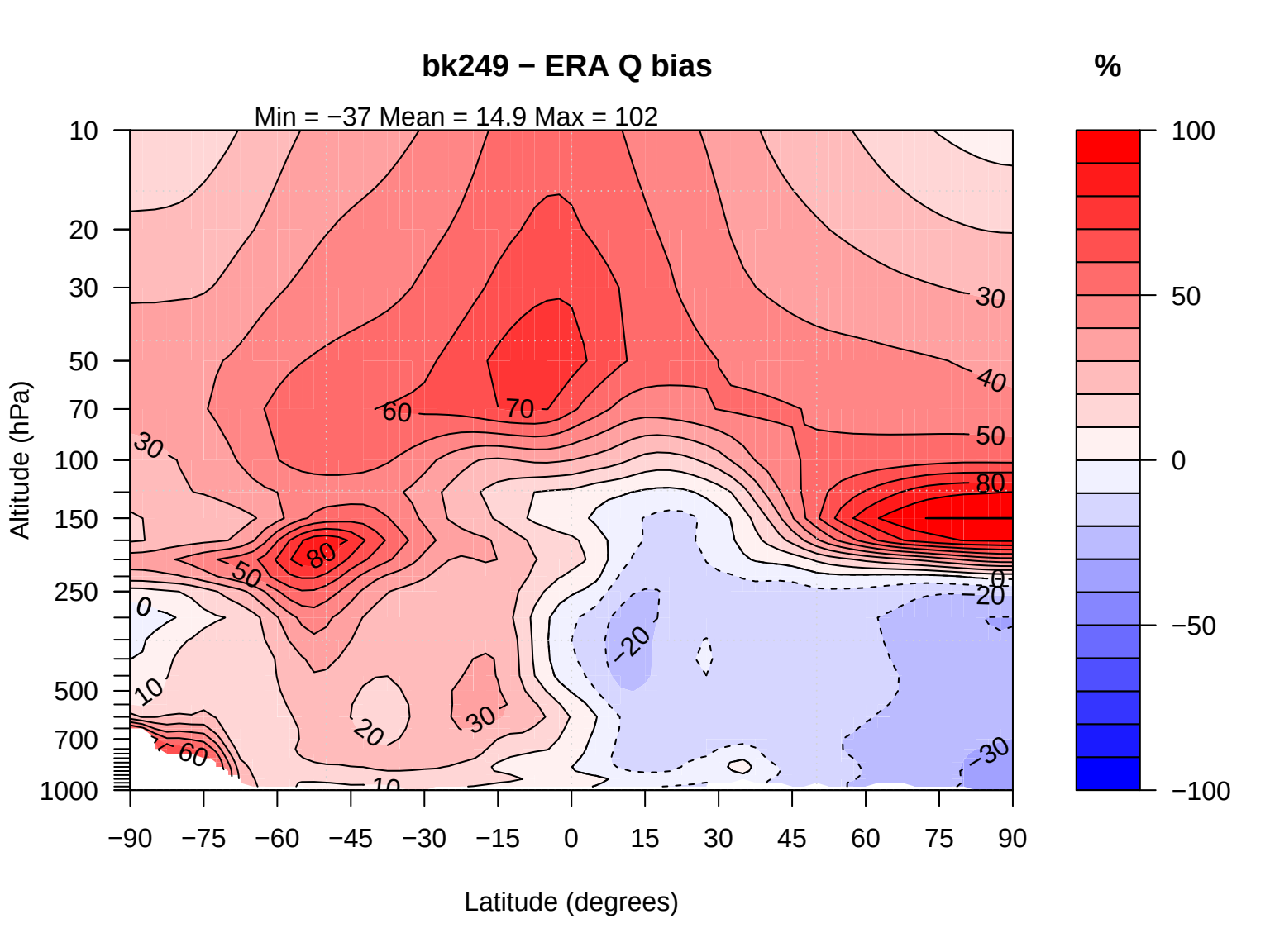
UKCA bg745 vs HALOE:
O3 (ppmv) Jul

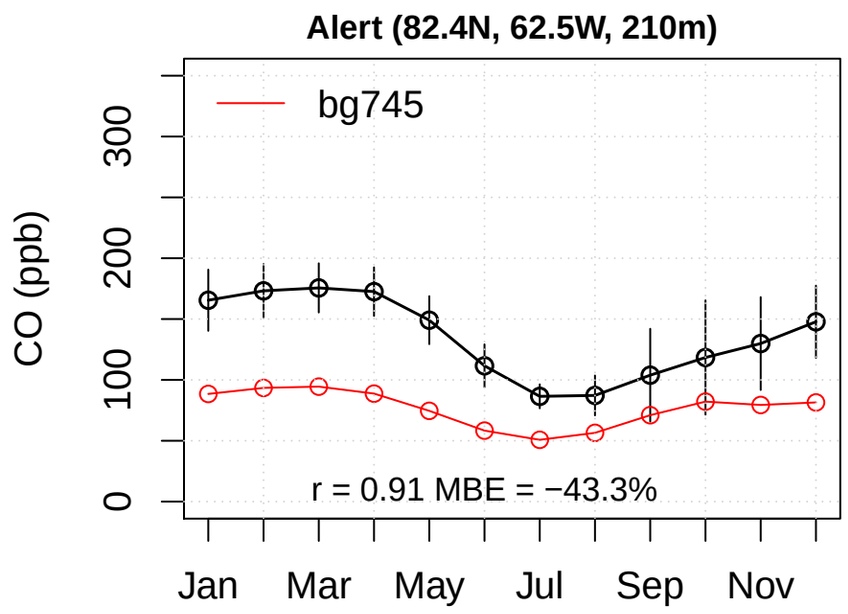


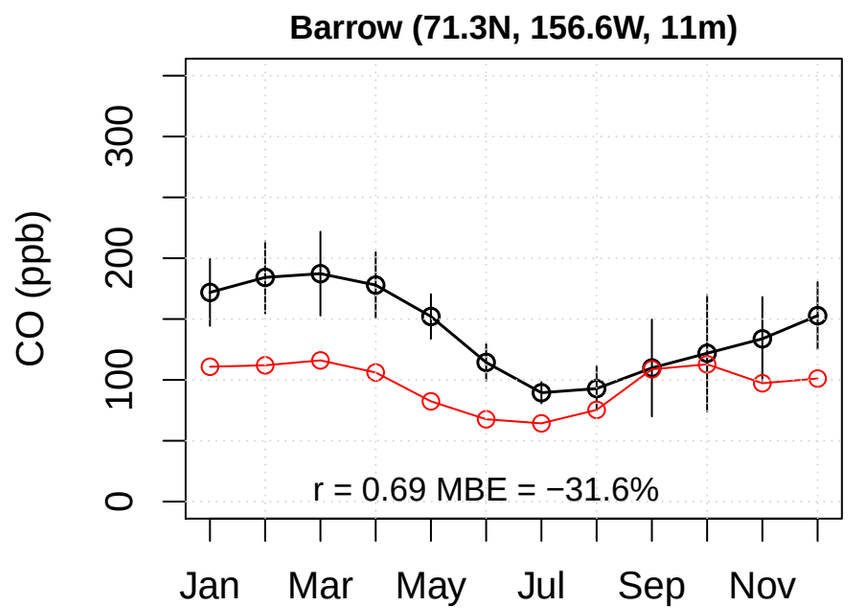


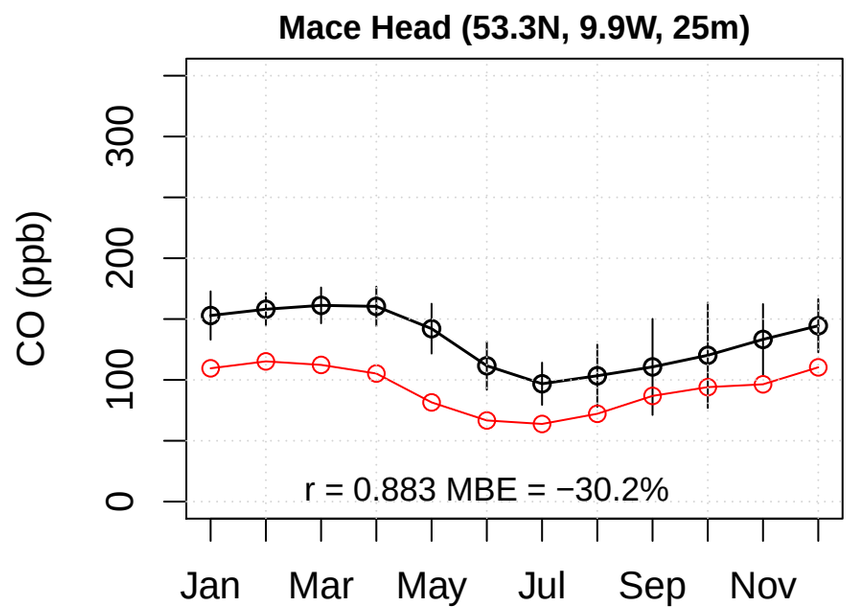
UKCA bk249 vs HALOE:
O3 (ppmv) Jul

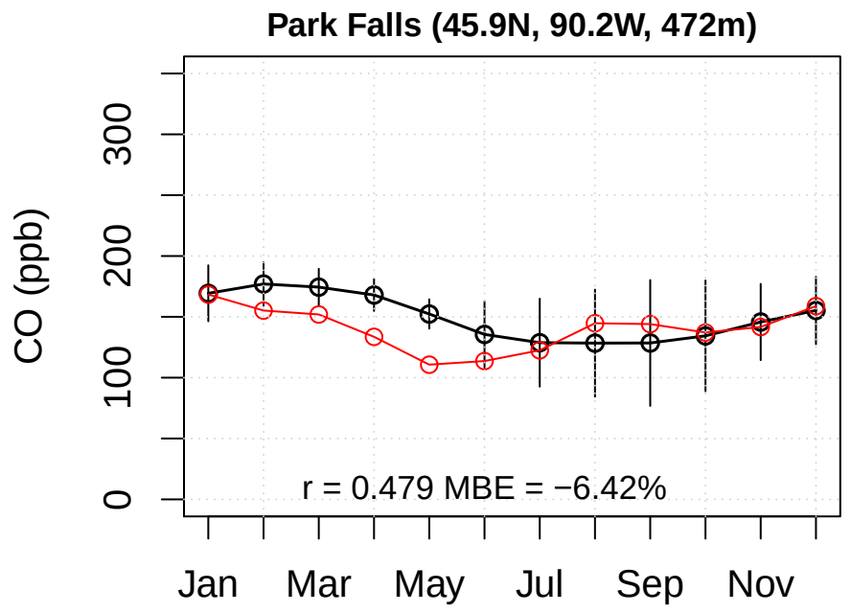

bg745 − ERA Q bias
%
Min = −33.9 Mean = 15.5 Max = 90.9
Altitude (hPa)
Latitude (degrees)
10
20
30
50
70
100
150
250
500
700
1000
−90
−75
−60
−45
−30
−15
0
15
30
45
60
75
90
100
50
0
−50
−100
30
60
70
40
20
50
−20
10

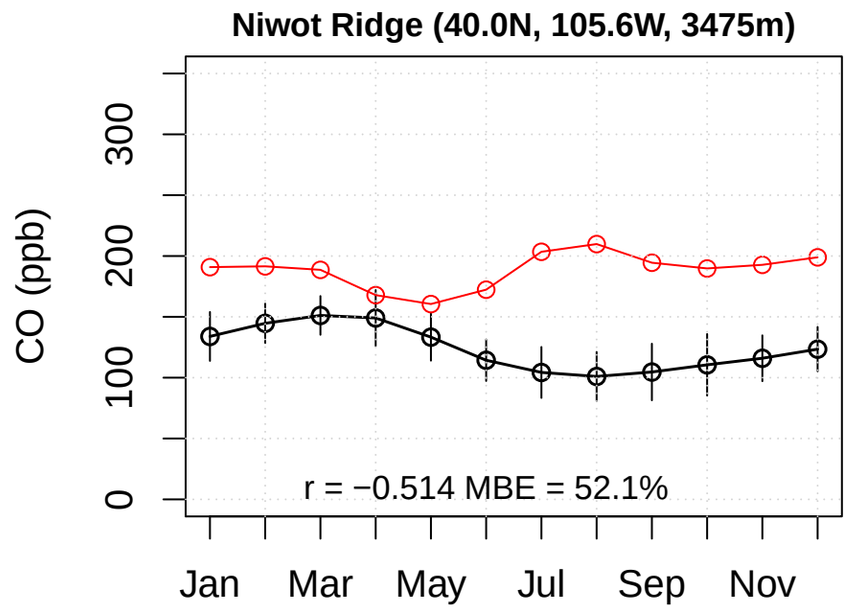

bk249 − ERA Q bias
%
Min = −37 Mean = 14.9 Max = 102
Altitude (hPa)
10
20
30
50
70
100
150
250
500
700
1000
−90
−75
−60
−45
−30
−15
0
15
30
45
60
75
90
Latitude (degrees)
100
50
0
−50
−100

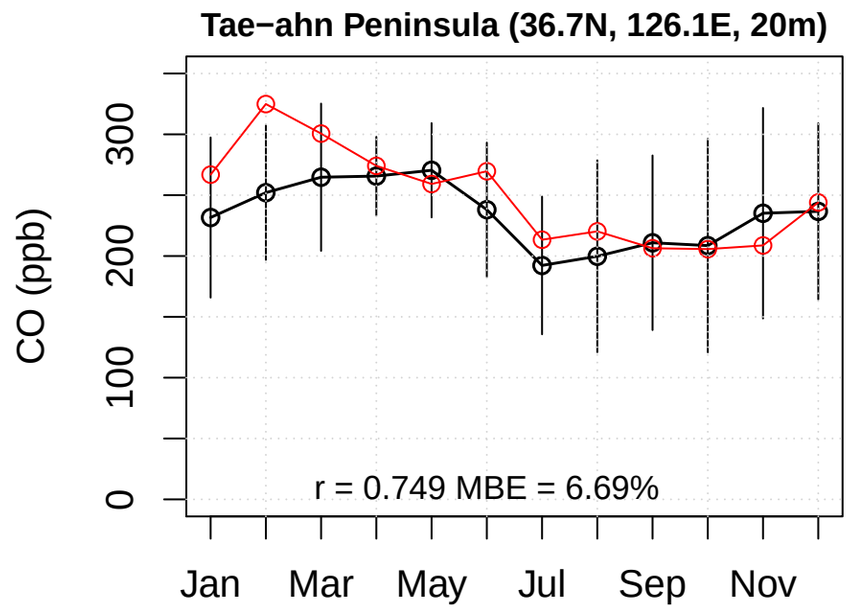

Alert (82.4N, 62.5W, 210m)
bg745
CO (ppb)
0
100
200
300
r = 0.91 MBE = −43.3%
Jan
Mar
May
Jul
Sep
Nov

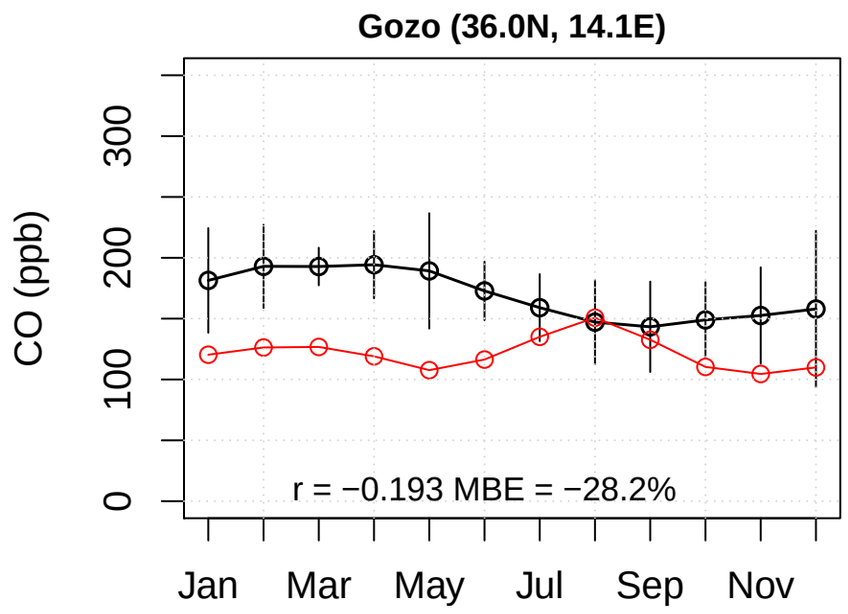

Barrow (71.3N, 156.6W, 11m)
CO (ppb)
0
100
200
300
r = 0.69 MBE = −31.6%
Jan
Mar
May
Jul
Sep
Nov

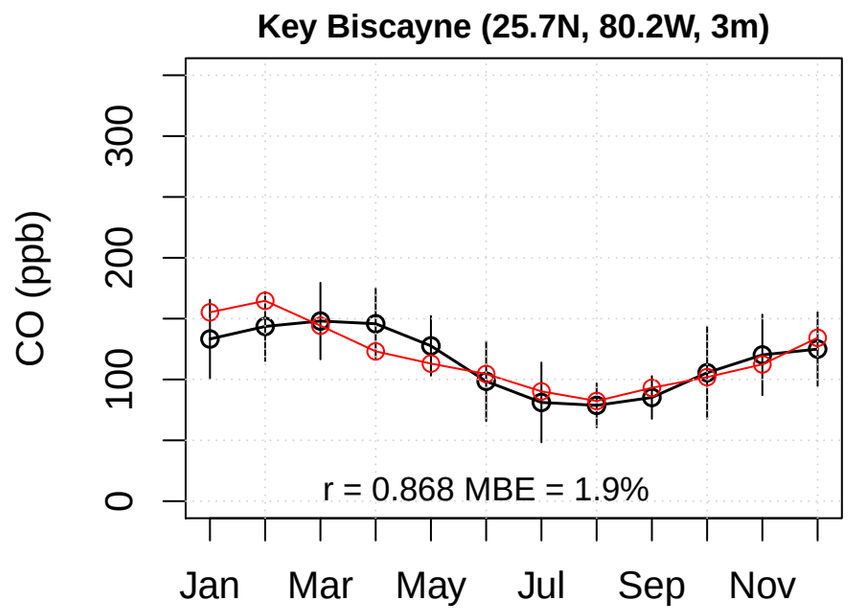

Mace Head (53.3N, 9.9W, 25m)
CO (ppb)
0
100
200
300
r = 0.883 MBE = −30.2%
Jan
Mar
May
Jul
Sep
Nov

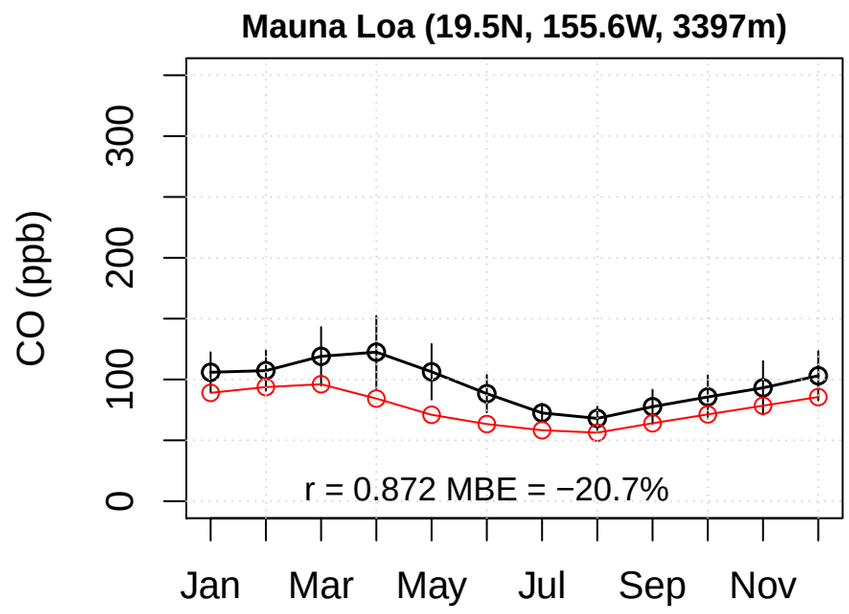

Park Falls (45.9N, 90.2W, 472m)
CO (ppb)
0
100
200
300
r = 0.479 MBE = −6.42%
Jan
Mar
May
Jul
Sep
Nov

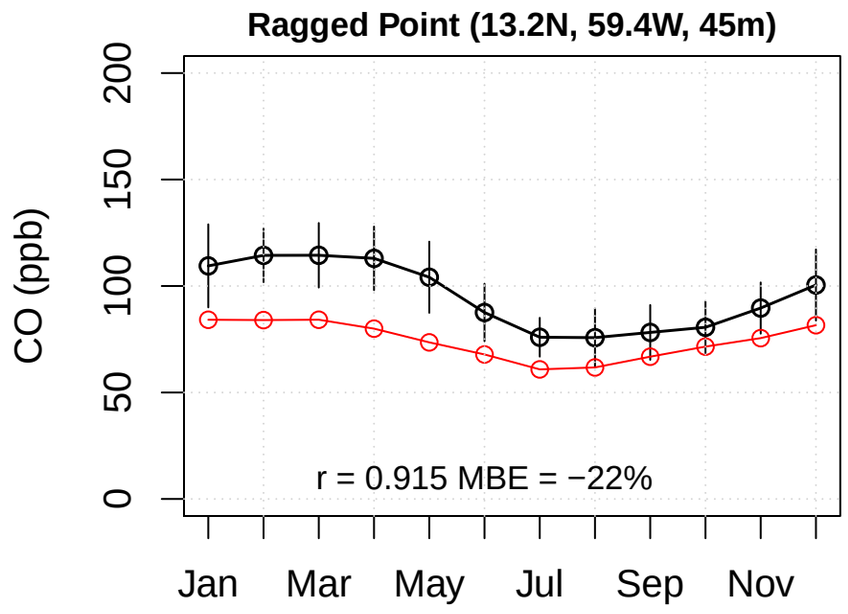

Niwot Ridge (40.0N, 105.6W, 3475m)
CO (ppb)
0
100
200
300
r = −0.514 MBE = 52.1%
Jan
Mar
May
Jul
Sep
Nov

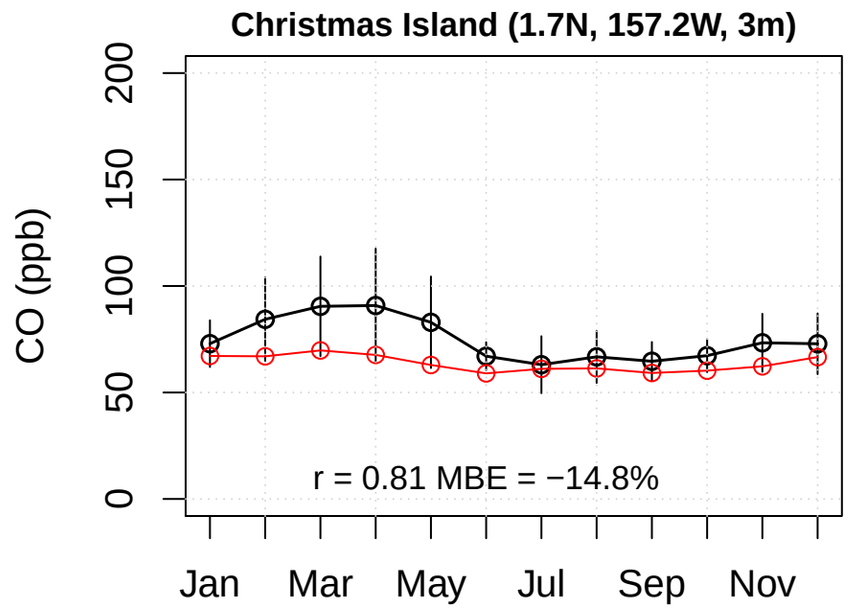

Tae−ahn Peninsula (36.7N, 126.1E, 20m)
CO (ppb)
0
100
200
300
r = 0.749 MBE = 6.69%
Jan
Mar
May
Jul
Sep
Nov

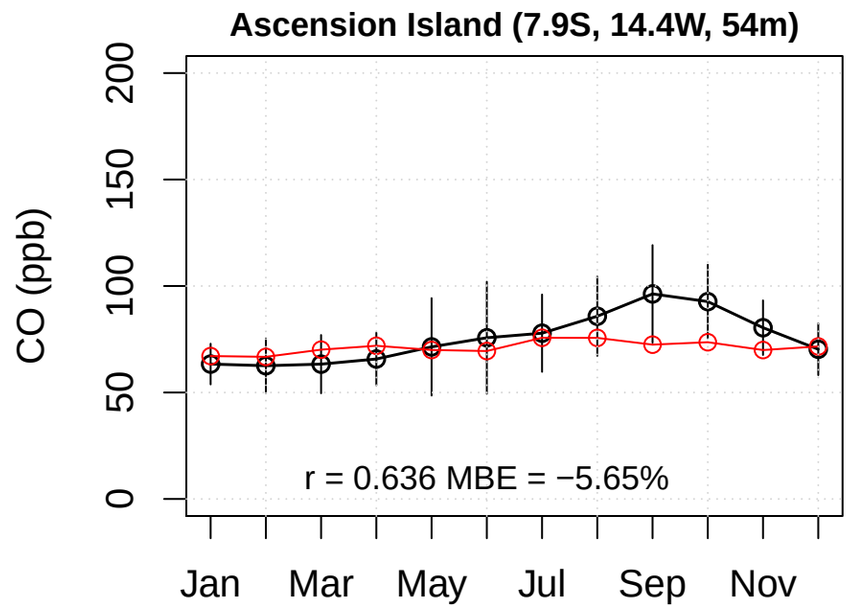

Gozo (36.0N, 14.1E)
CO (ppb)
0
100
200
300
r = −0.193 MBE = −28.2%
Jan
Mar
May
Jul
Sep
Nov

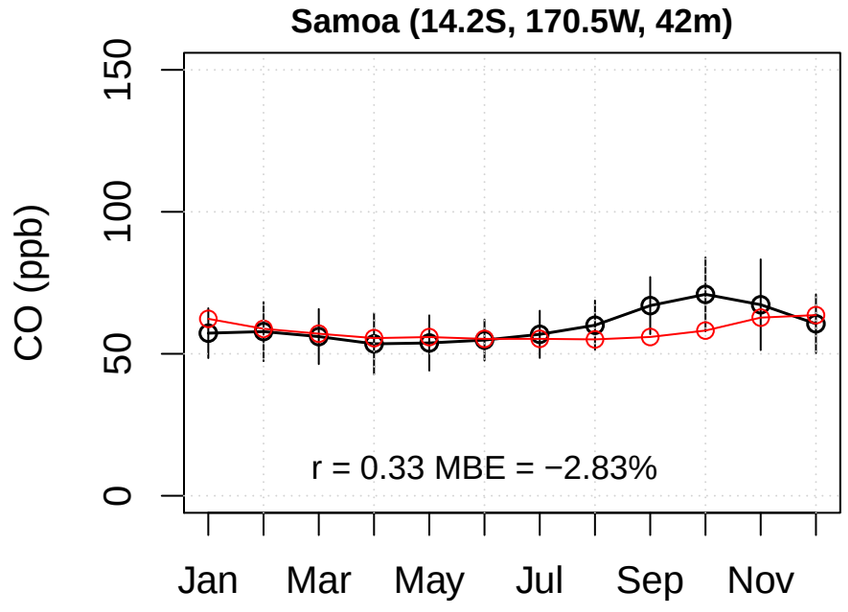

Key Biscayne (25.7N, 80.2W, 3m)
CO (ppb)
0
100
200
300
r = 0.868 MBE = 1.9%
Jan
Mar
May
Jul
Sep
Nov

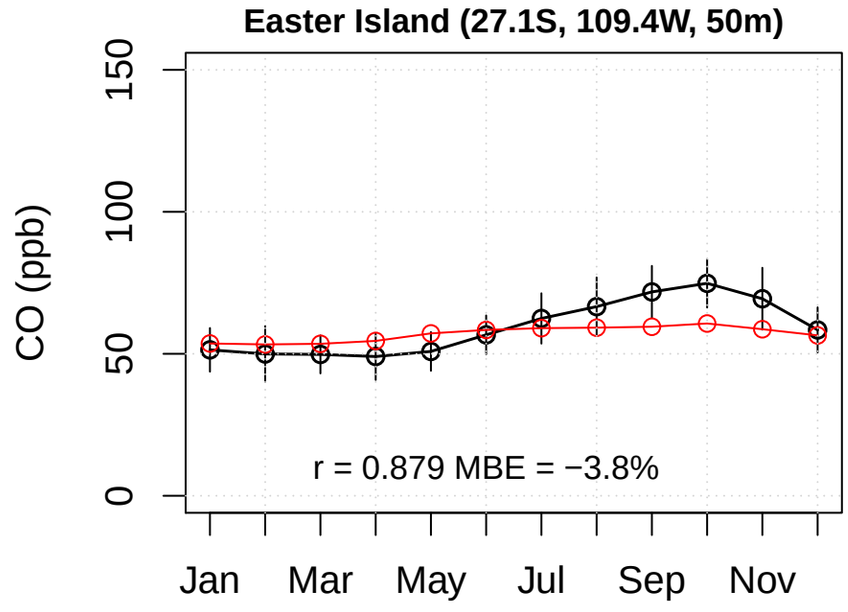

Mauna Loa (19.5N, 155.6W, 3397m)
CO (ppb)
0
100
200
300
r = 0.872 MBE = −20.7%
Jan
Mar
May
Jul
Sep
Nov

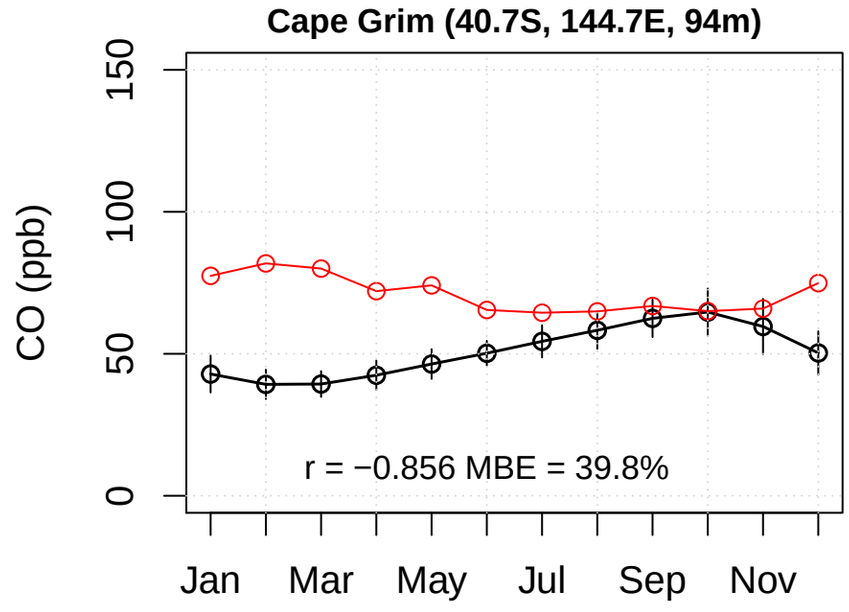

Ragged Point (13.2N, 59.4W, 45m)
CO (ppb)
0
50
100
150
200
r = 0.915 MBE = −22%
Jan
Mar
May
Jul
Sep
Nov

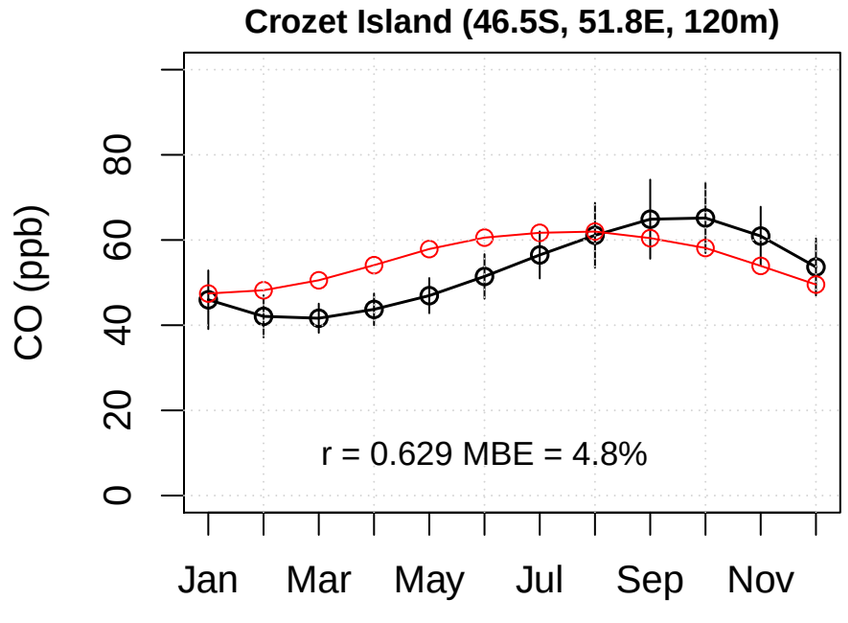

Christmas Island (1.7N, 157.2W, 3m)
CO (ppb)
0
50
100
150
200
r = 0.81 MBE = −14.8%
Jan
Mar
May
Jul
Sep
Nov

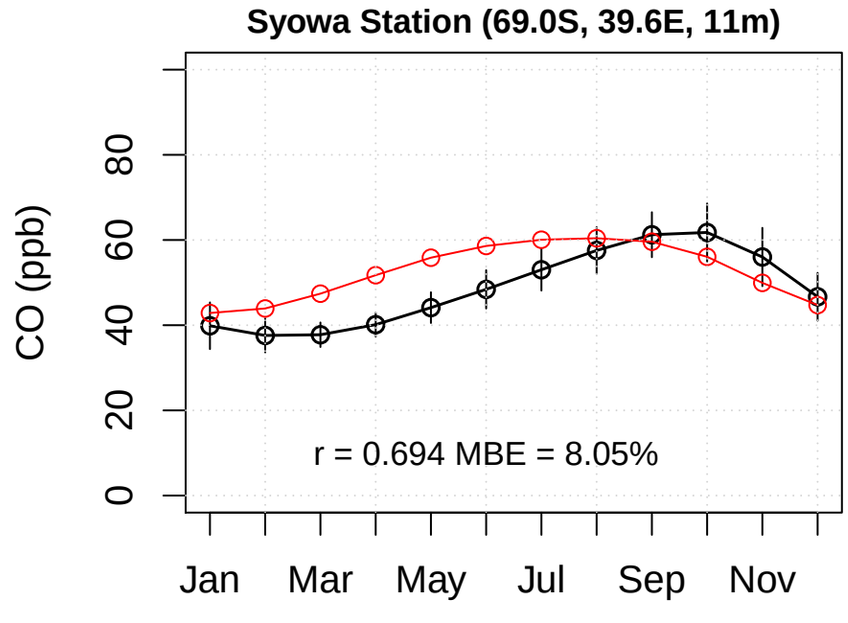

Ascension Island (7.9S, 14.4W, 54m)
CO (ppb)
0
50
100
150
200
r = 0.636 MBE = −5.65%
Jan
Mar
May
Jul
Sep
Nov

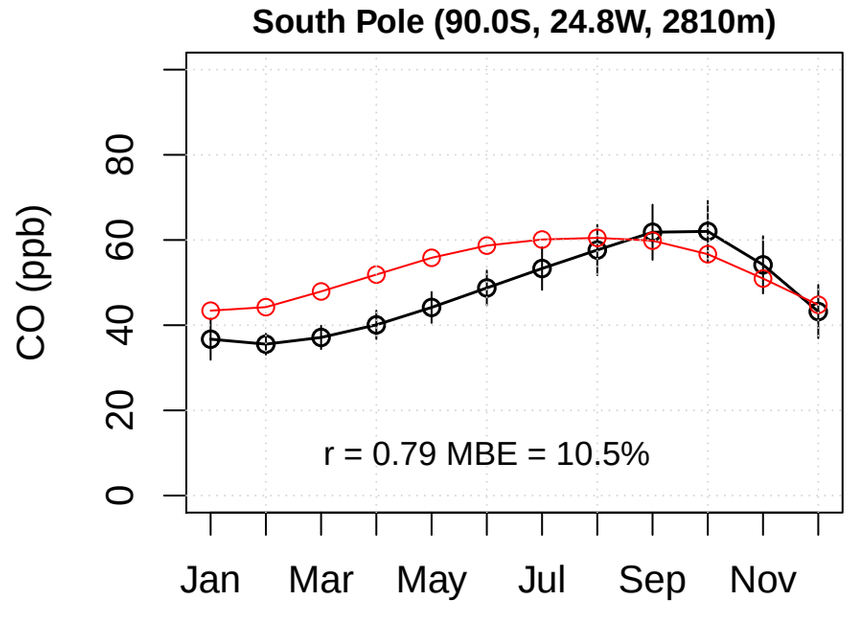

Samoa (14.2S, 170.5W, 42m)
CO (ppb)
0
50
100
150
r = 0.33 MBE = −2.83%
Jan
Mar
May
Jul
Sep
Nov

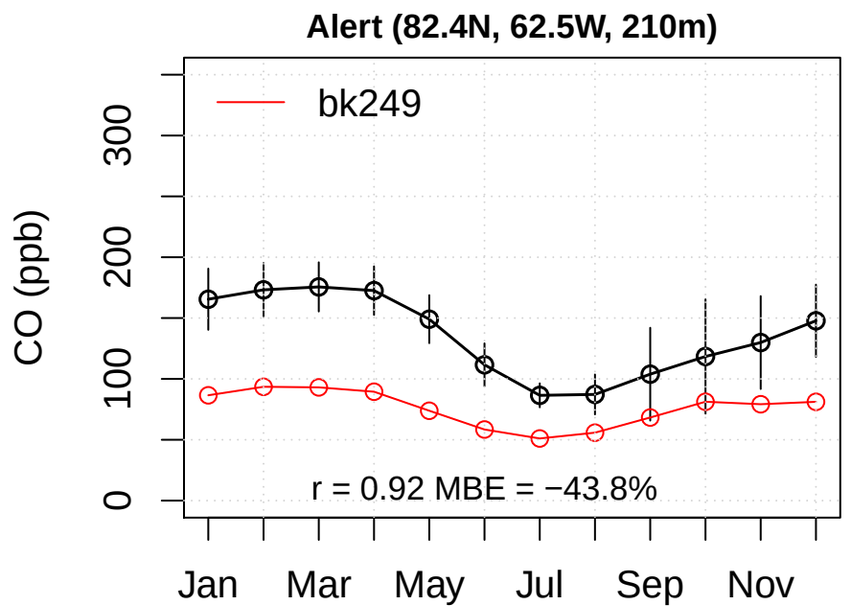

Easter Island (27.1S, 109.4W, 50m)
CO (ppb)
0
50
100
150
r = 0.879 MBE = −3.8%
Jan
Mar
May
Jul
Sep
Nov

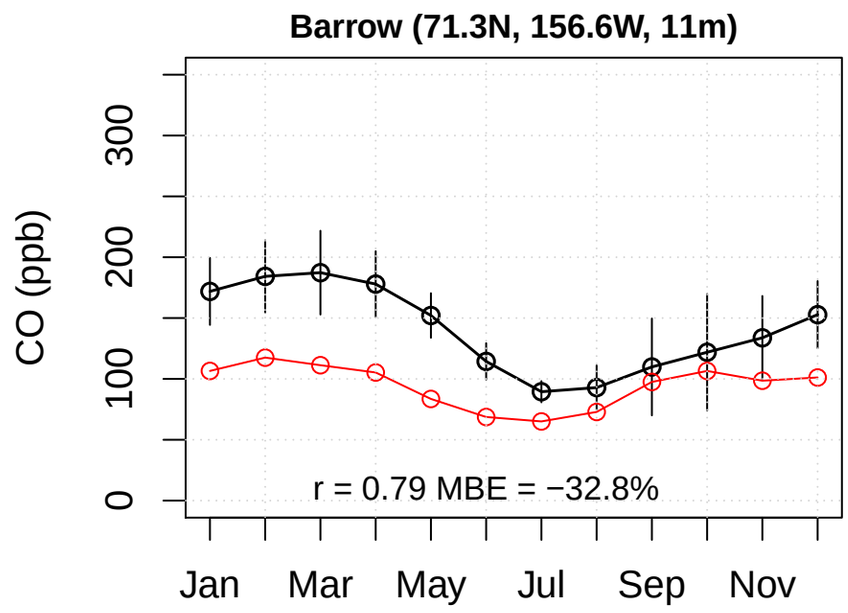

Cape Grim (40.7S, 144.7E, 94m)
CO (ppb)
0
50
100
150
r = −0.856 MBE = 39.8%
Jan
Mar
May
Jul
Sep
Nov

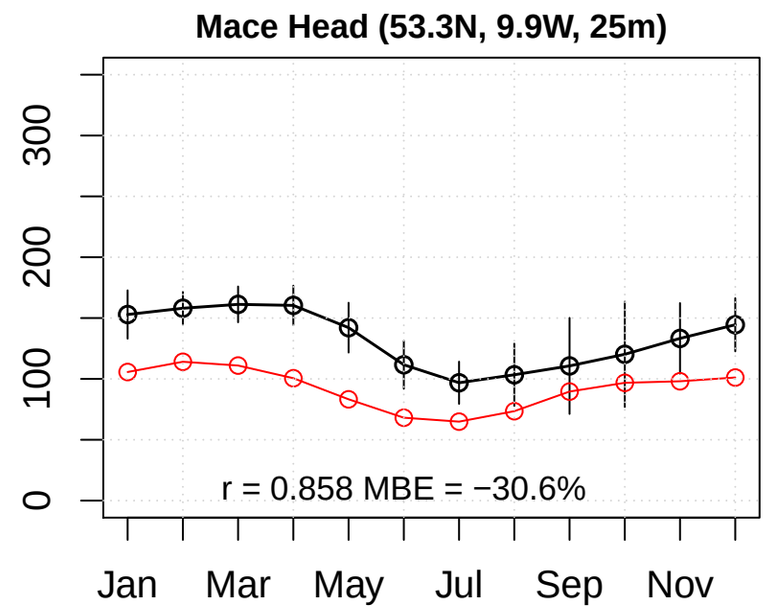

Crozet Island (46.5S, 51.8E, 120m)
CO (ppb)
0
20
40
60
80
r = 0.629 MBE = 4.8%
Jan
Mar
May
Jul
Sep
Nov

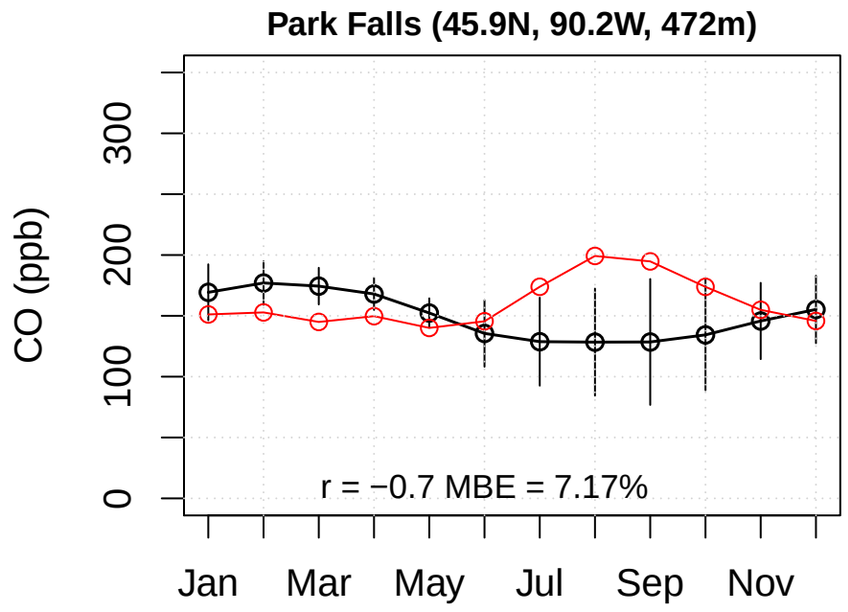

Syowa Station (69.0S, 39.6E, 11m)
CO (ppb)
0
20
40
60
80
r = 0.694 MBE = 8.05%
Jan
Mar
May
Jul
Sep
Nov

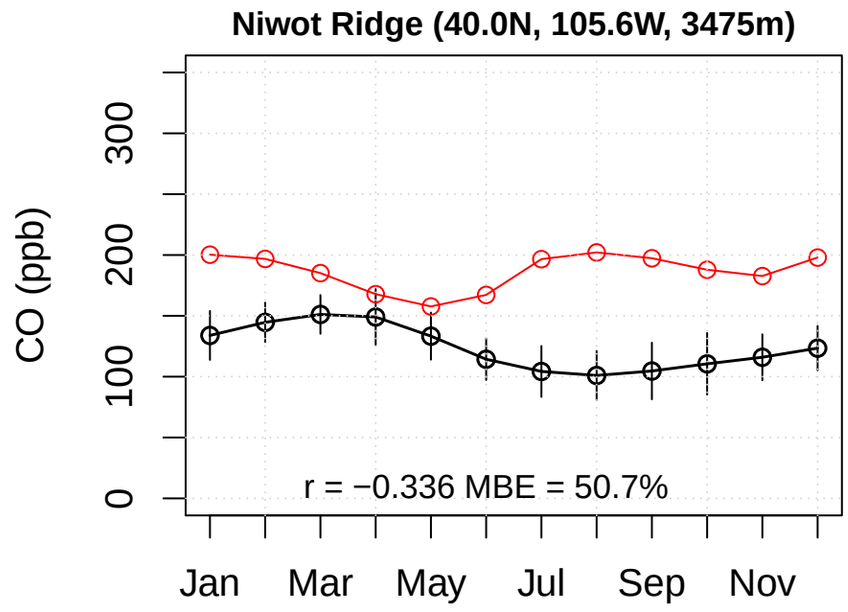

South Pole (90.0S, 24.8W, 2810m)
CO (ppb)
0
20
40
60
80
r = 0.79 MBE = 10.5%
Jan
Mar
May
Jul
Sep
Nov

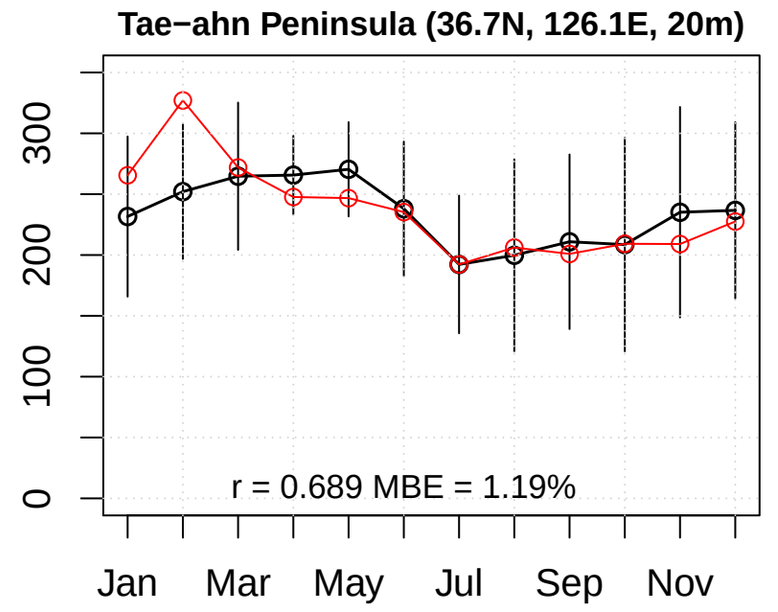

Alert (82.4N, 62.5W, 210m)
bk249
r = 0.92 MBE = −43.8%

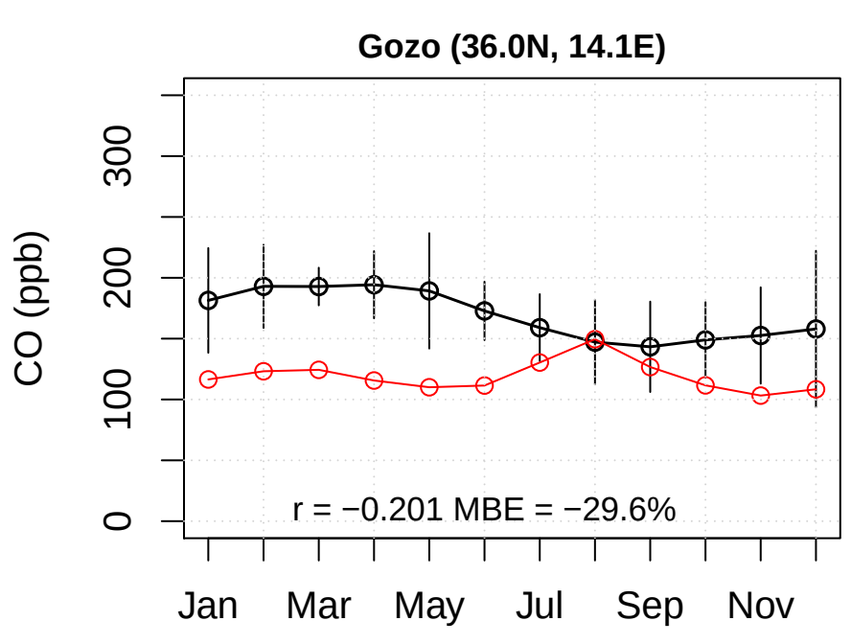

Barrow (71.3N, 156.6W, 11m)
r = 0.79 MBE = −32.8%

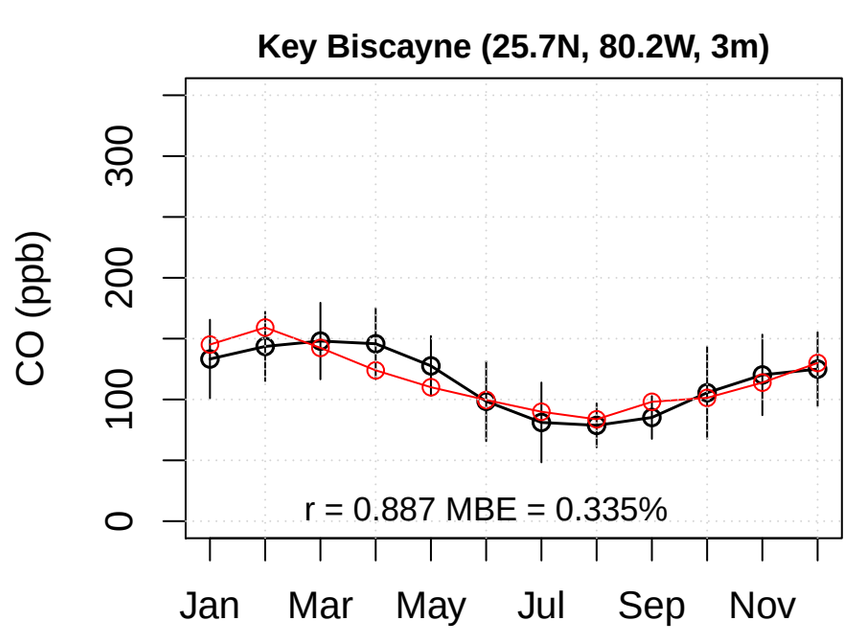

Mace Head (53.3N, 9.9W, 25m)
r = 0.858 MBE = −30.6%

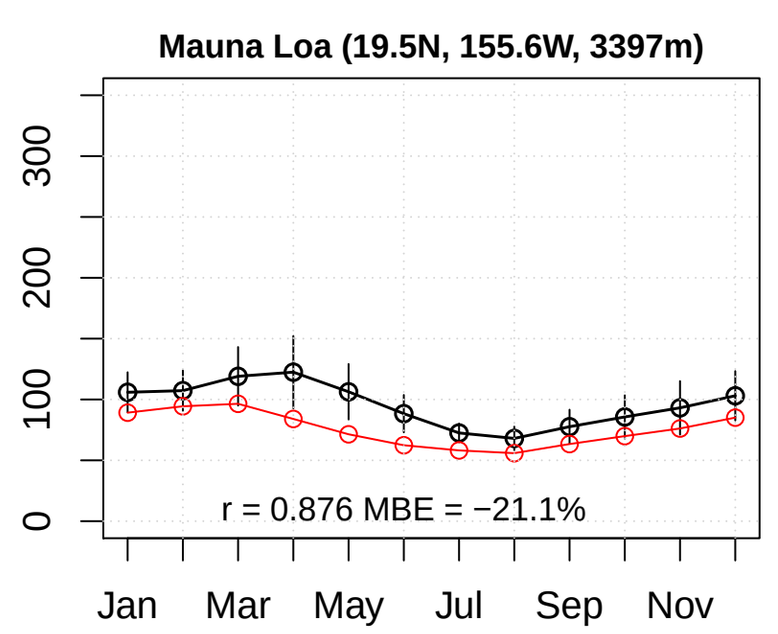

Park Falls (45.9N, 90.2W, 472m)
r = −0.7 MBE = 7.17%

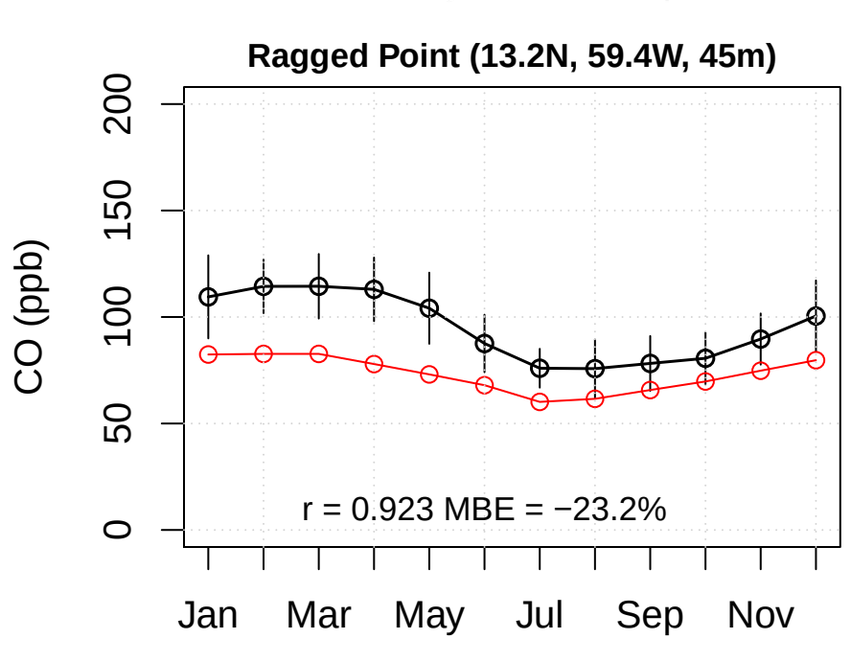

Niwot Ridge (40.0N, 105.6W, 3475m)
r = −0.336 MBE = 50.7%

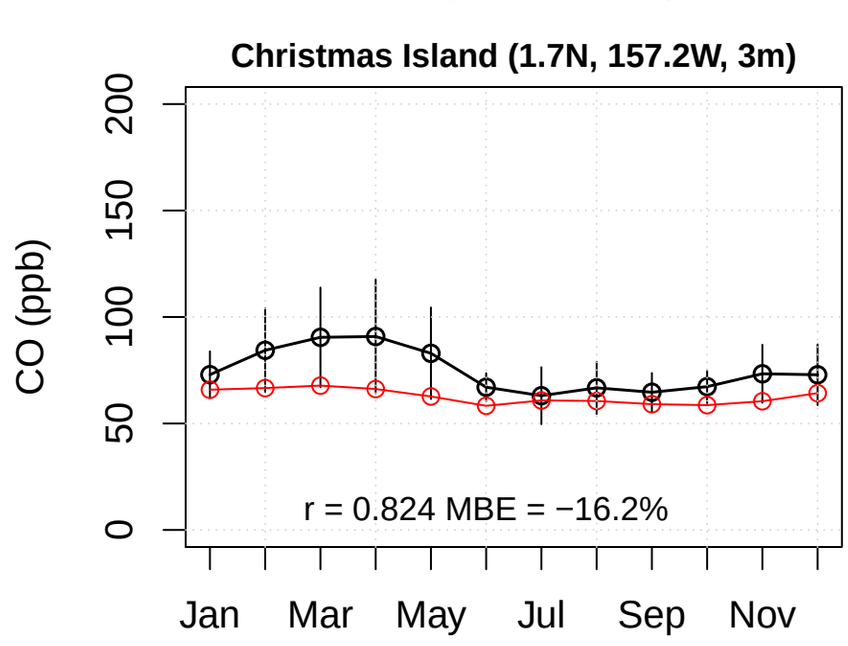

Tae−ahn Peninsula (36.7N, 126.1E, 20m)
r = 0.689 MBE = 1.19%

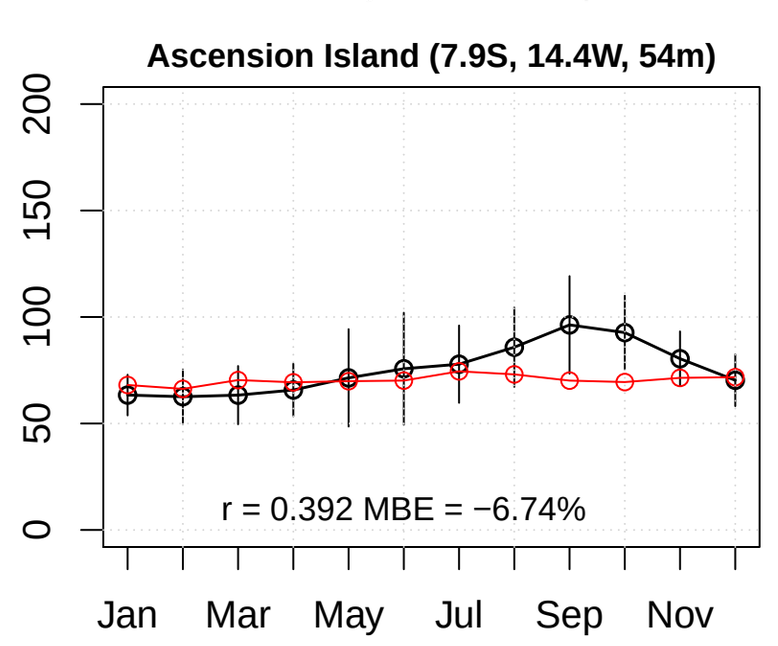

Gozo (36.0N, 14.1E)
r = −0.201 MBE = −29.6%

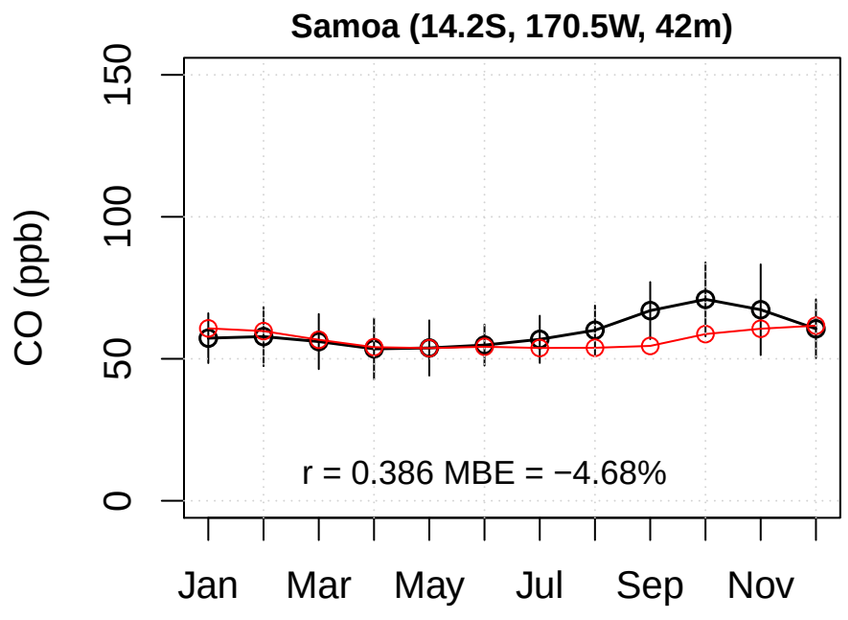

Key Biscayne (25.7N, 80.2W, 3m)
r = 0.887 MBE = 0.335%

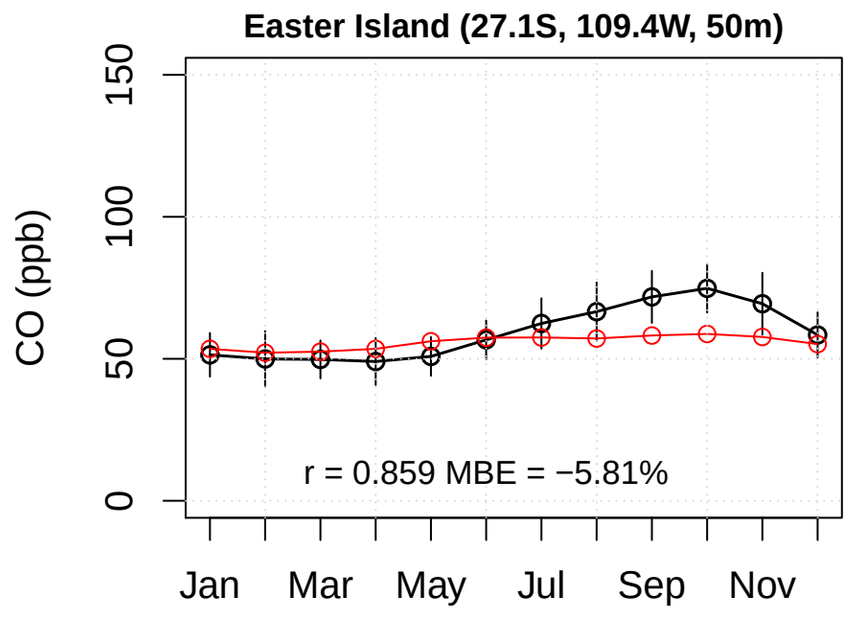

Mauna Loa (19.5N, 155.6W, 3397m)
r = 0.876 MBE = −21.1%

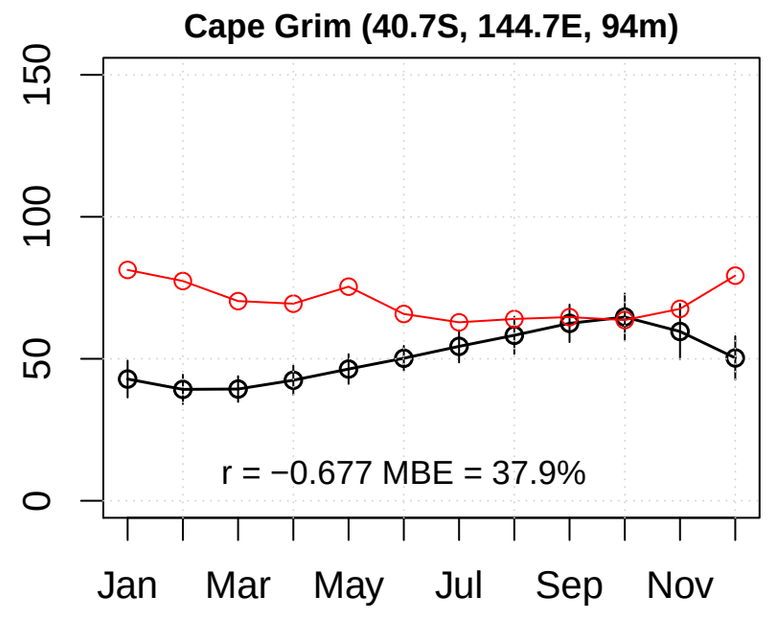

Ragged Point (13.2N, 59.4W, 45m)
r = 0.923 MBE = −23.2%

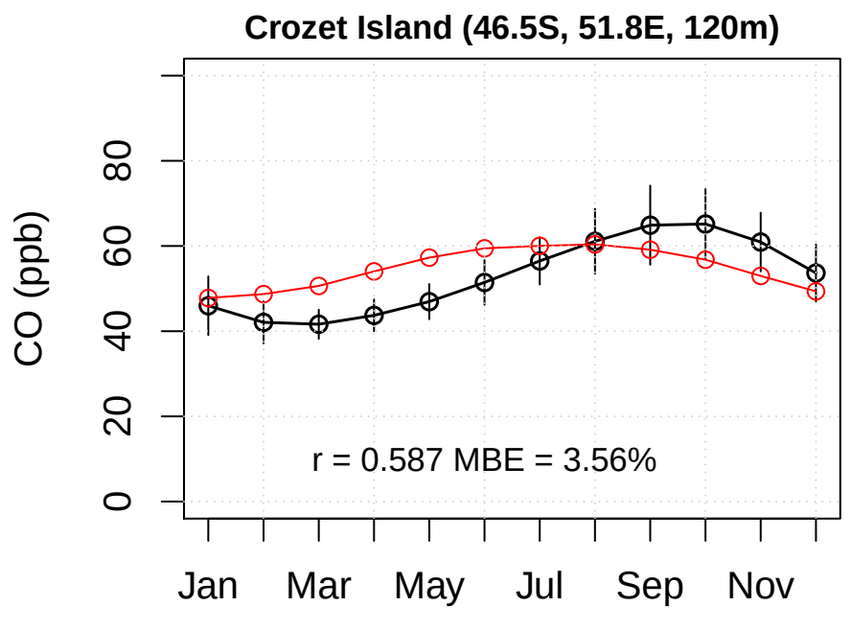

Christmas Island (1.7N, 157.2W, 3m)
r = 0.824 MBE = −16.2%

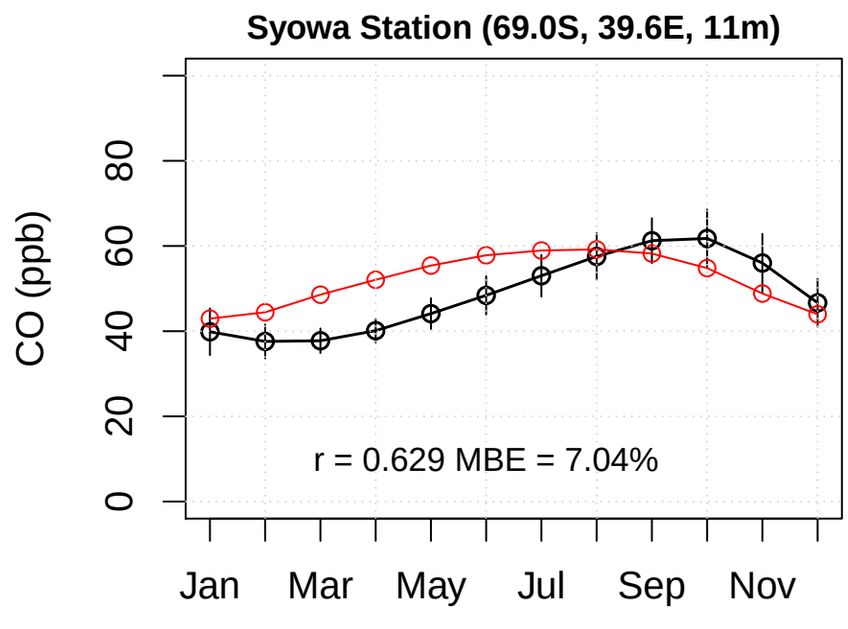

Ascension Island (7.9S, 14.4W, 54m)
r = 0.392 MBE = −6.74%

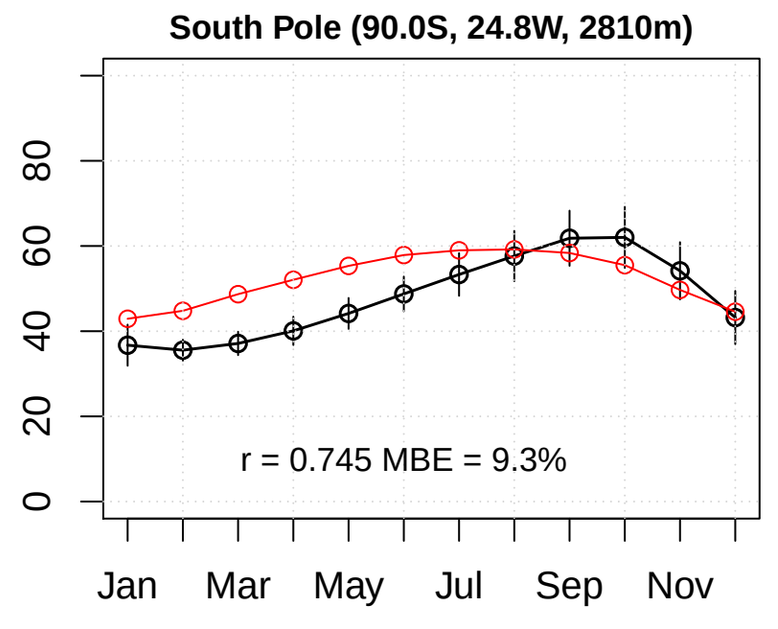

Samoa (14.2S, 170.5W, 42m)
r = 0.386 MBE = −4.68%

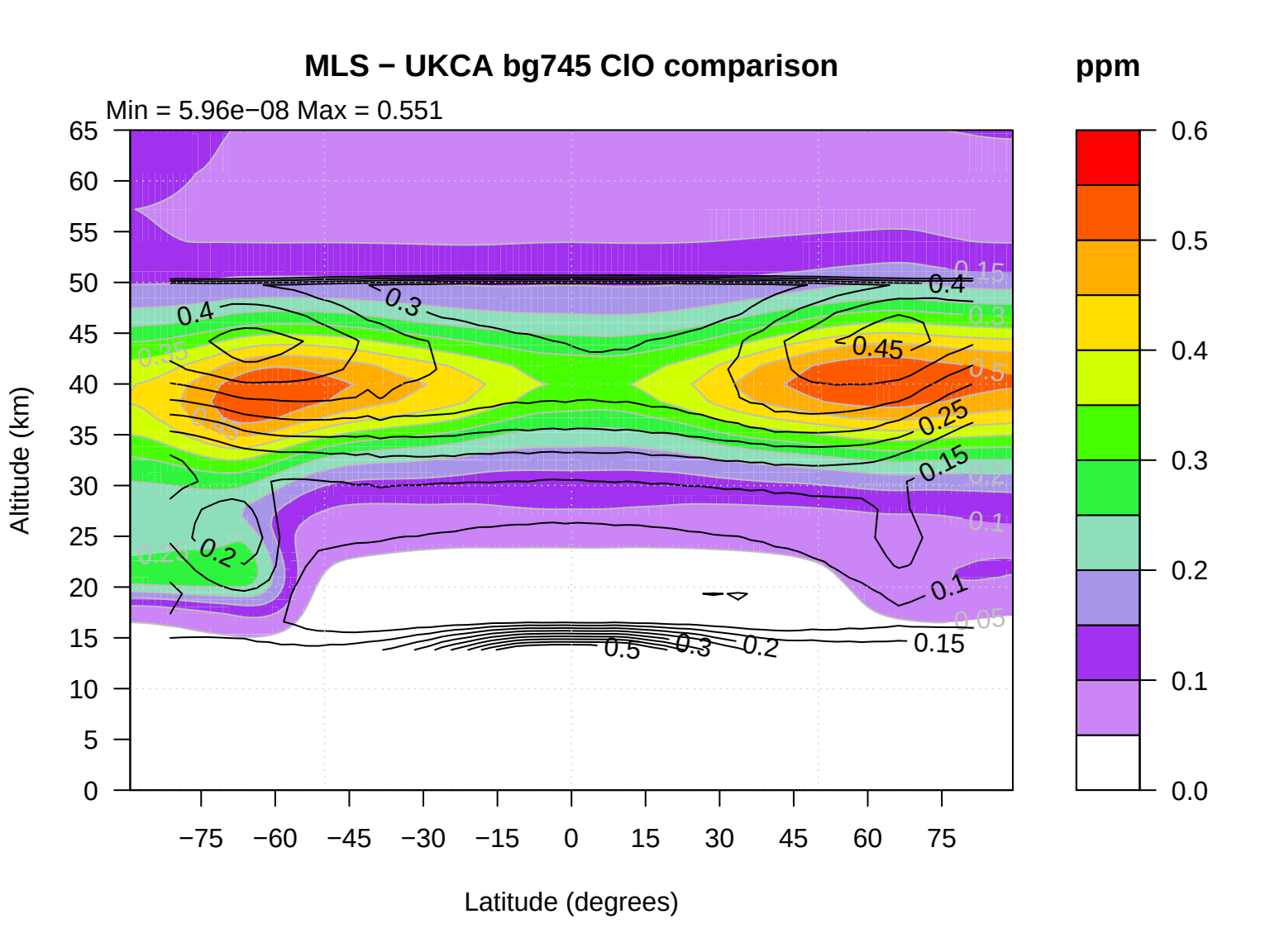

Easter Island (27.1S, 109.4W, 50m)
r = 0.859 MBE = −5.81%

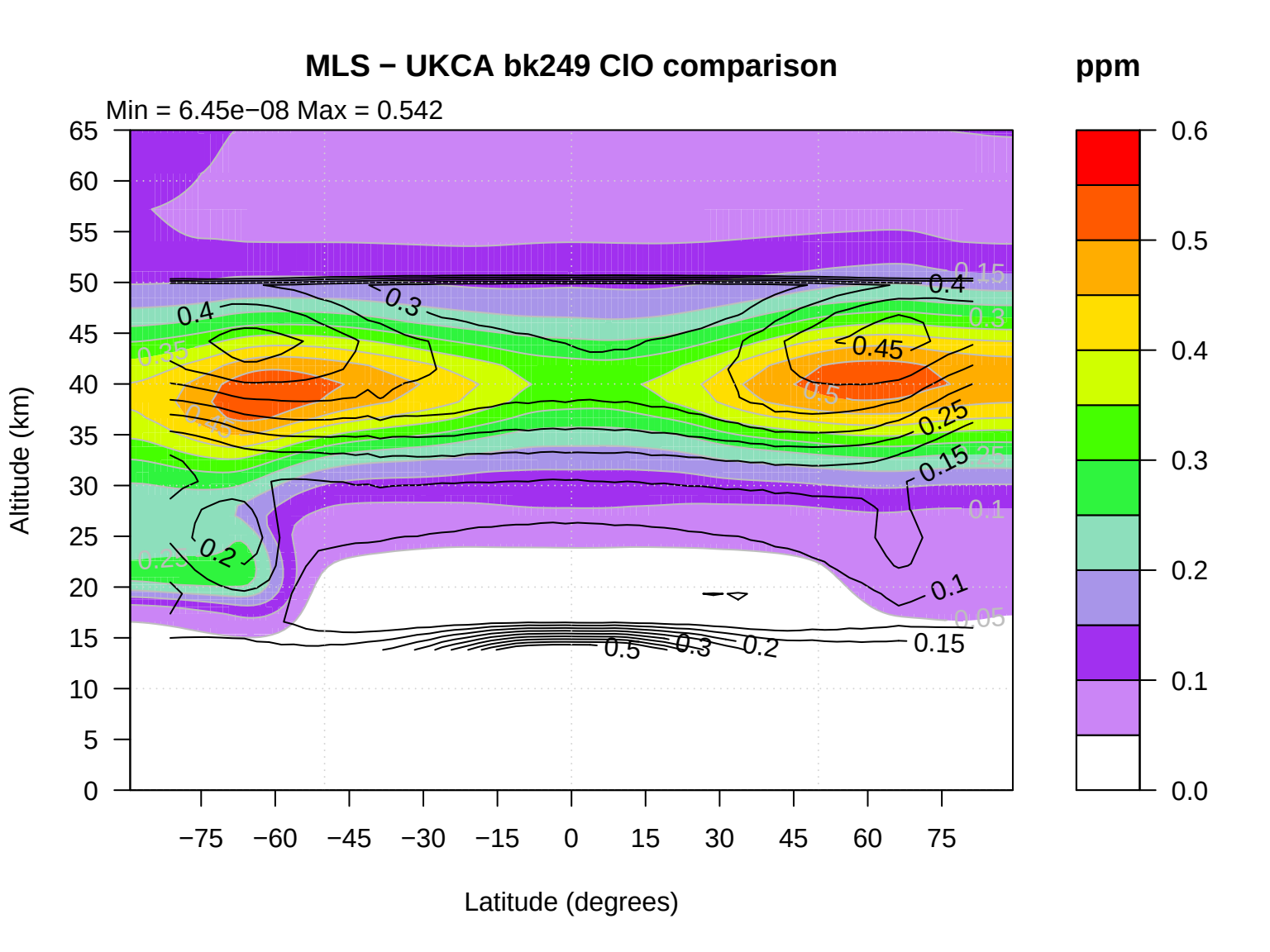

Cape Grim (40.7S, 144.7E, 94m)
r = −0.677 MBE = 37.9%


Crozet Island (46.5S, 51.8E, 120m)
r = 0.587 MBE = 3.56%

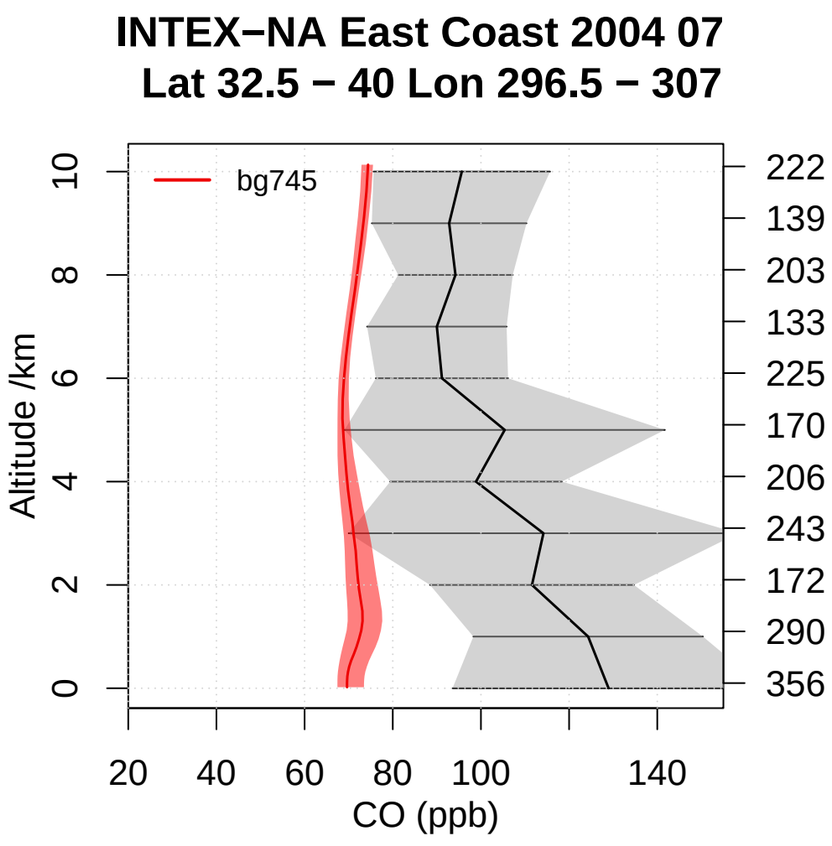

Syowa Station (69.0S, 39.6E, 11m)
r = 0.629 MBE = 7.04%

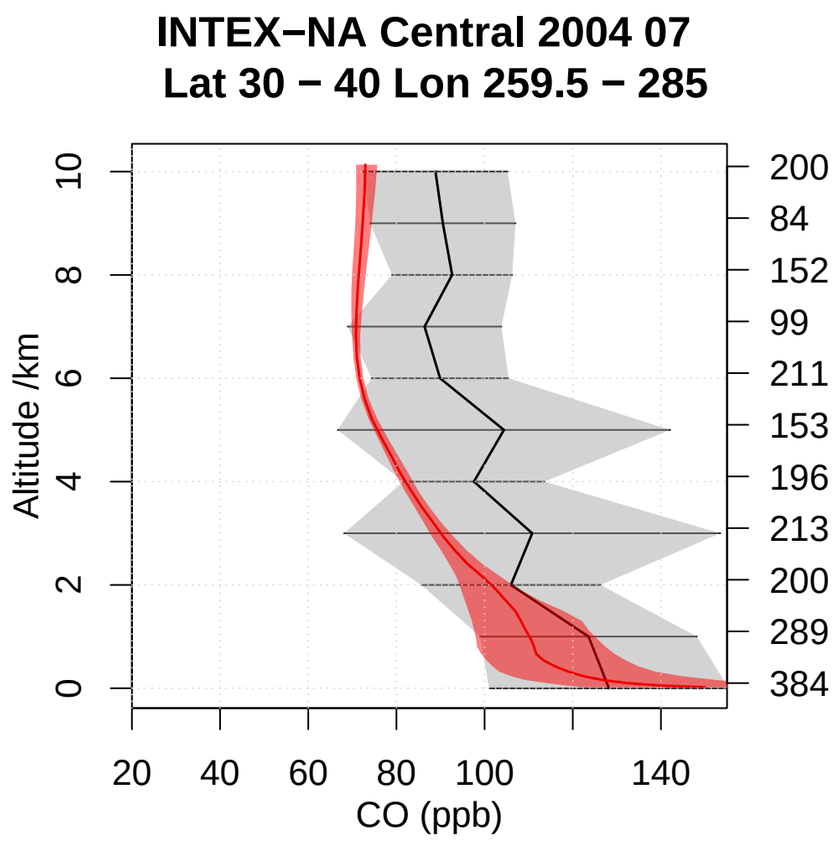

South Pole (90.0S, 24.8W, 2810m)
r = 0.745 MBE = 9.3%

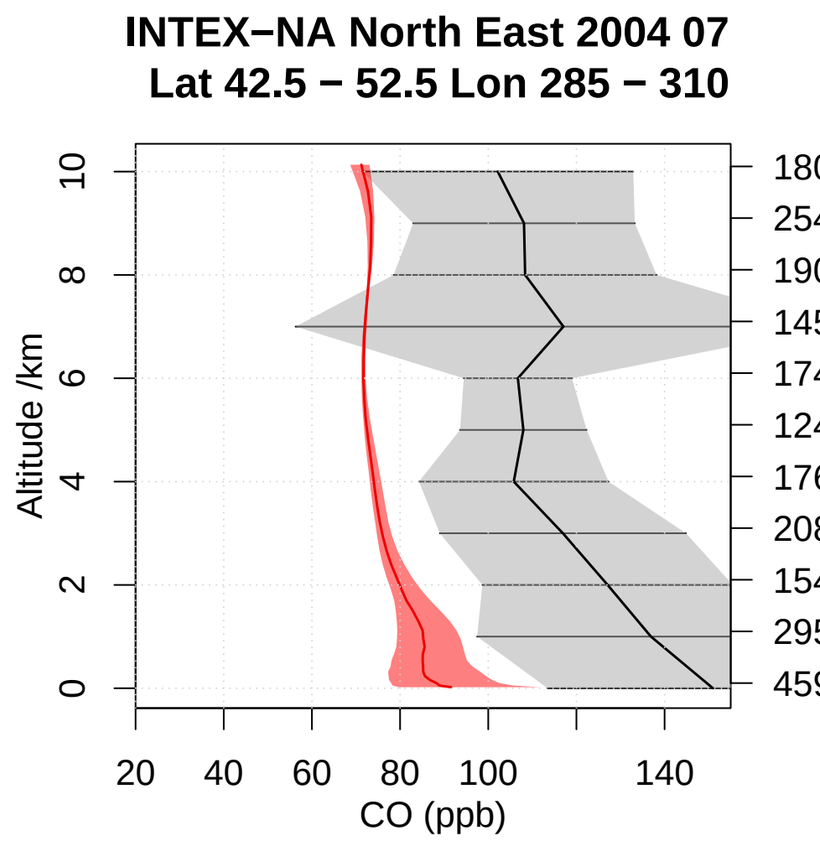

MLS − UKCA bg745 ClO comparison
ppm
Min = 5.96e−08 Max = 0.551
Altitude (km)
Latitude (degrees)
65
60
55
50
45
40
35
30
25
20
15
10
5
0
−75
−60
−45
−30
−15
0
15
30
45
60
75
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.4
0.3
0.45
0.25
0.15
0.2
0.1
0.5
0.3
0.2
0.15

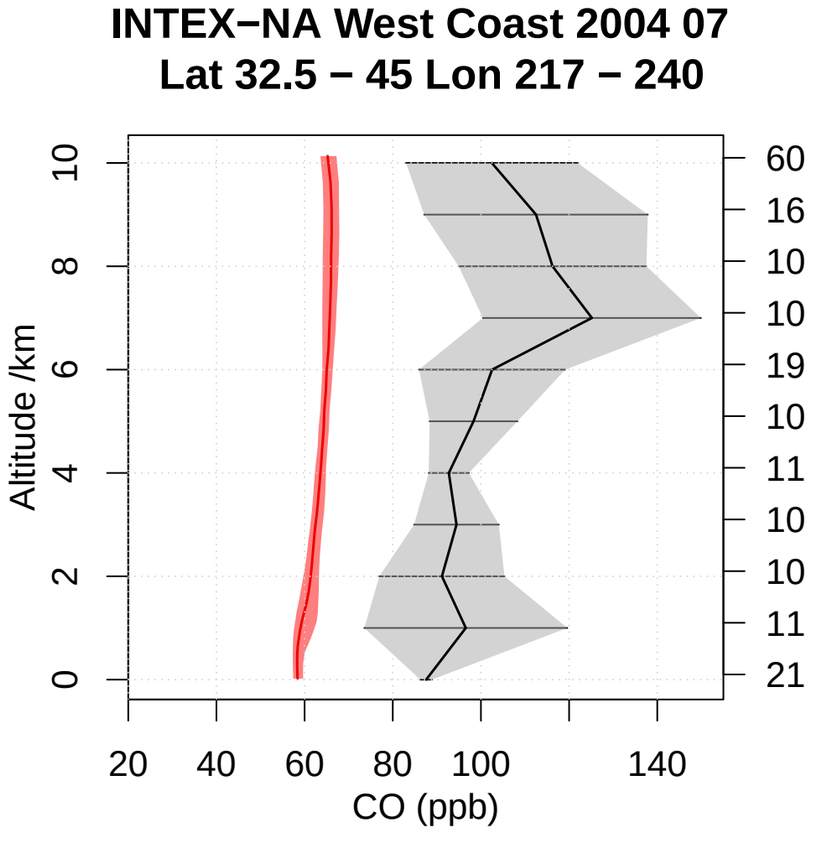

MLS − UKCA bk249 ClO comparison
ppm
Min = 6.45e−08 Max = 0.542
Altitude (km)
Latitude (degrees)
65
60
55
50
45
40
35
30
25
20
15
10
5
0
−75
−60
−45
−30
−15
0
15
30
45
60
75
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.4
0.3
0.45
0.5
0.25
0.15
0.2
0.1
0.05

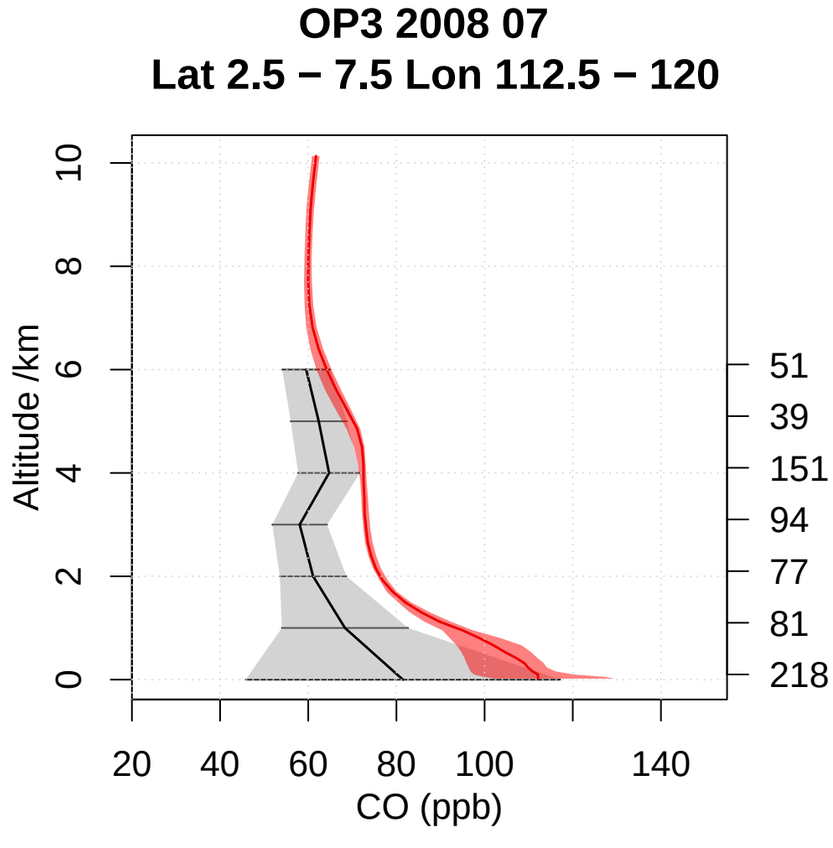
Emmons CO comparison

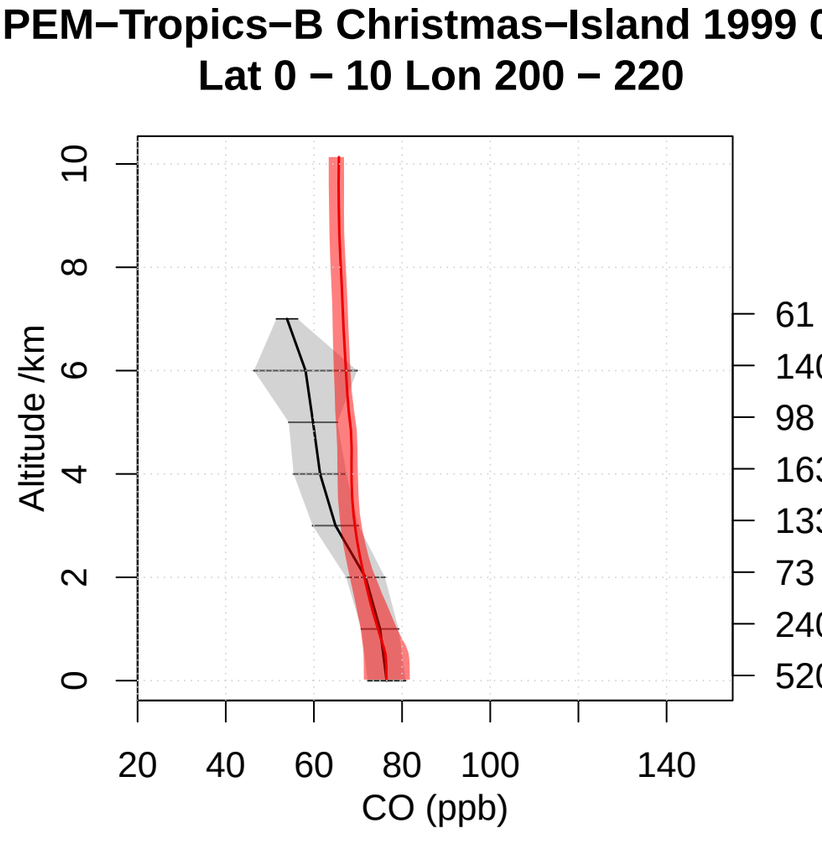


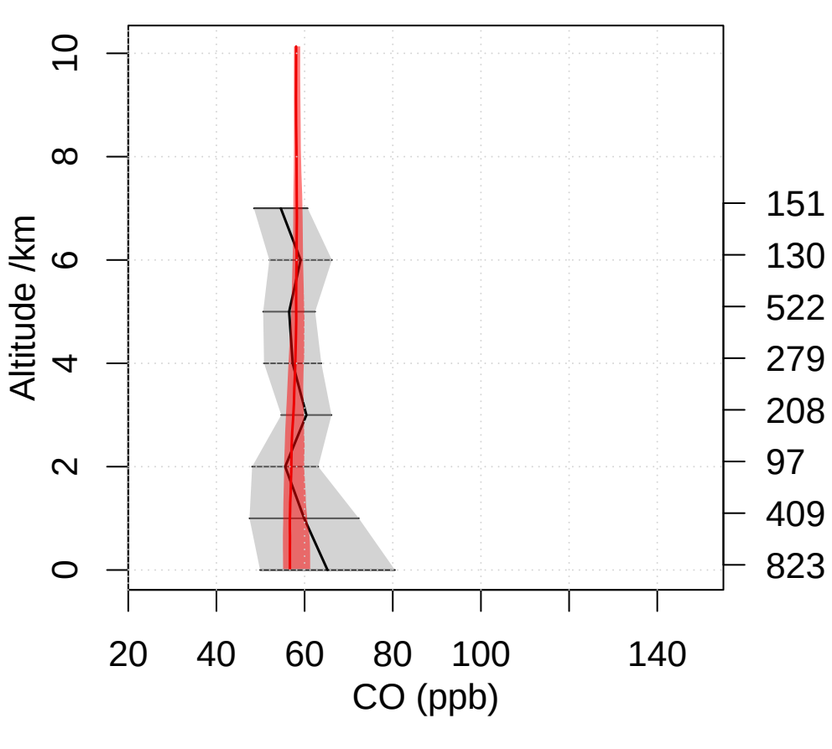


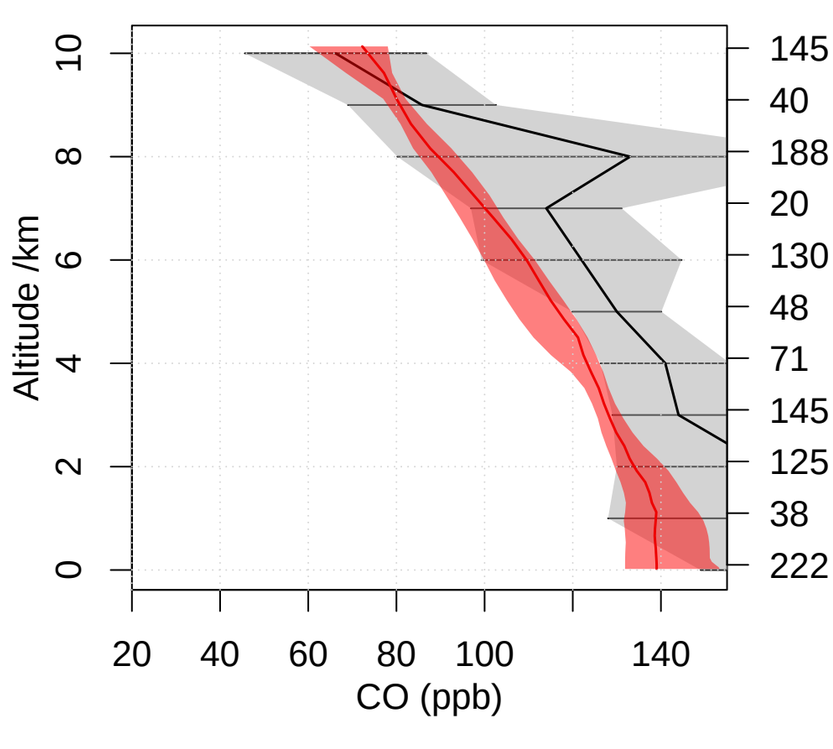


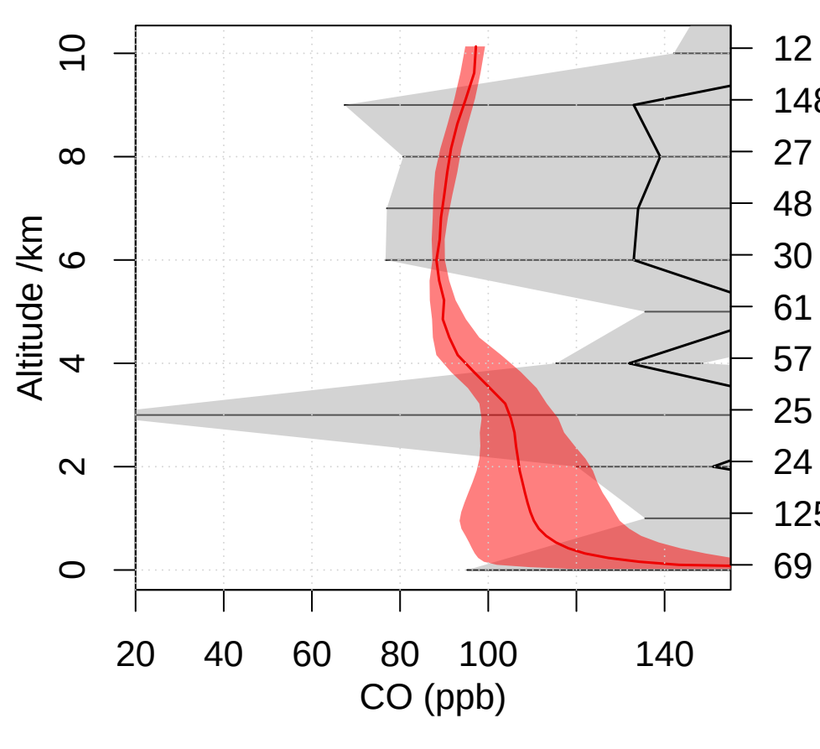


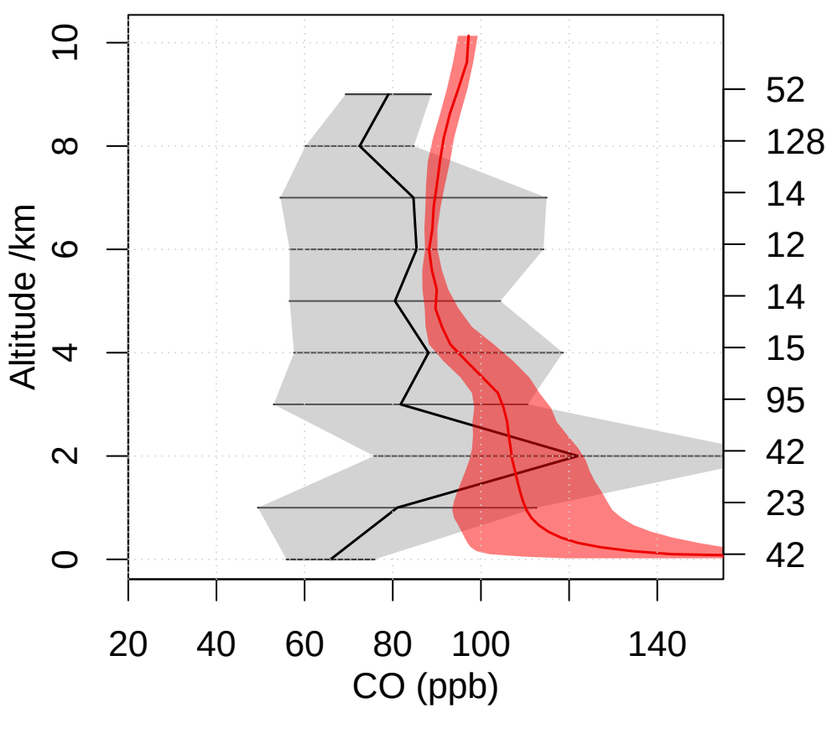


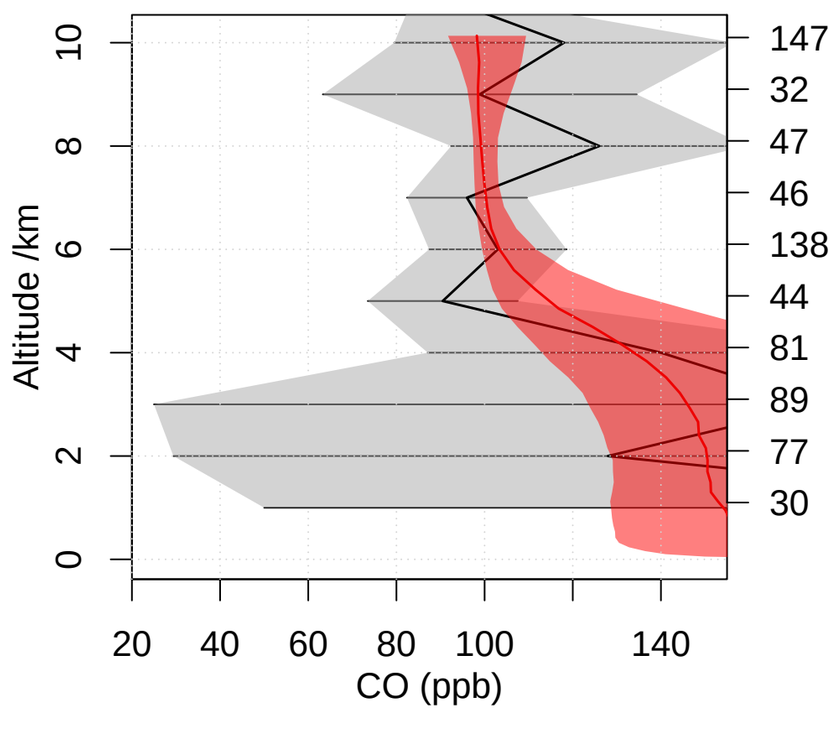


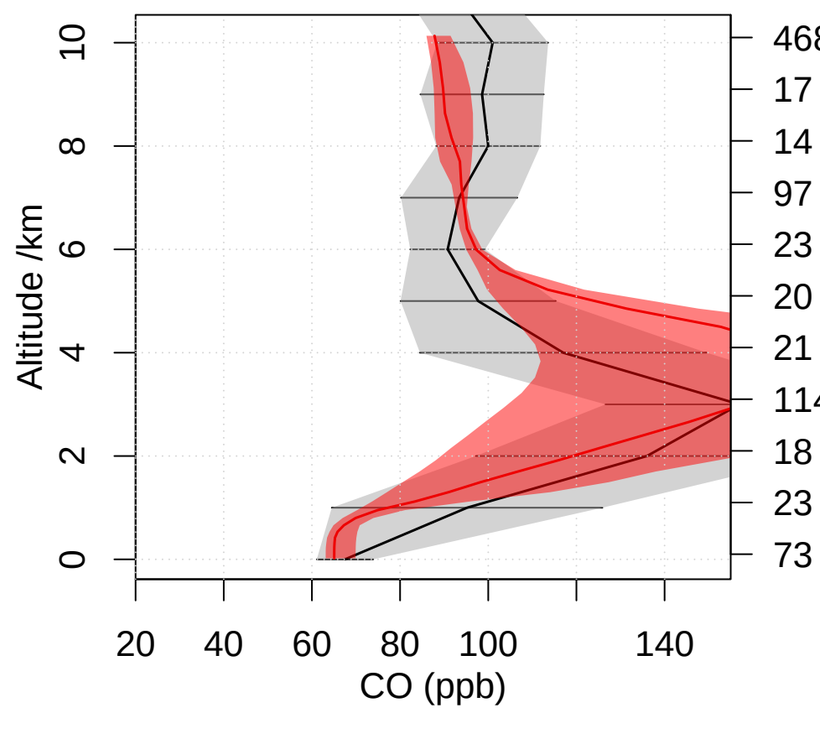






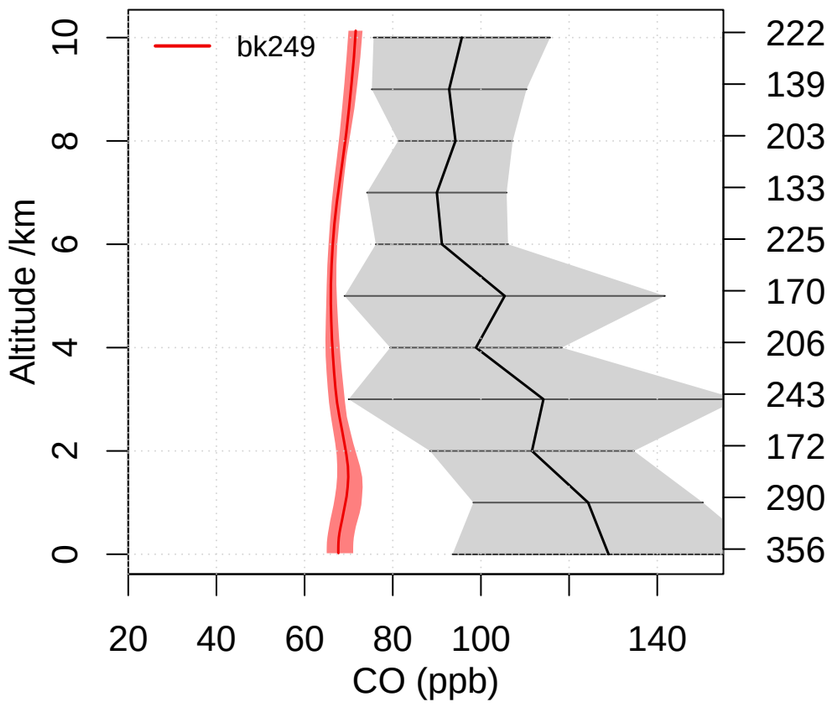




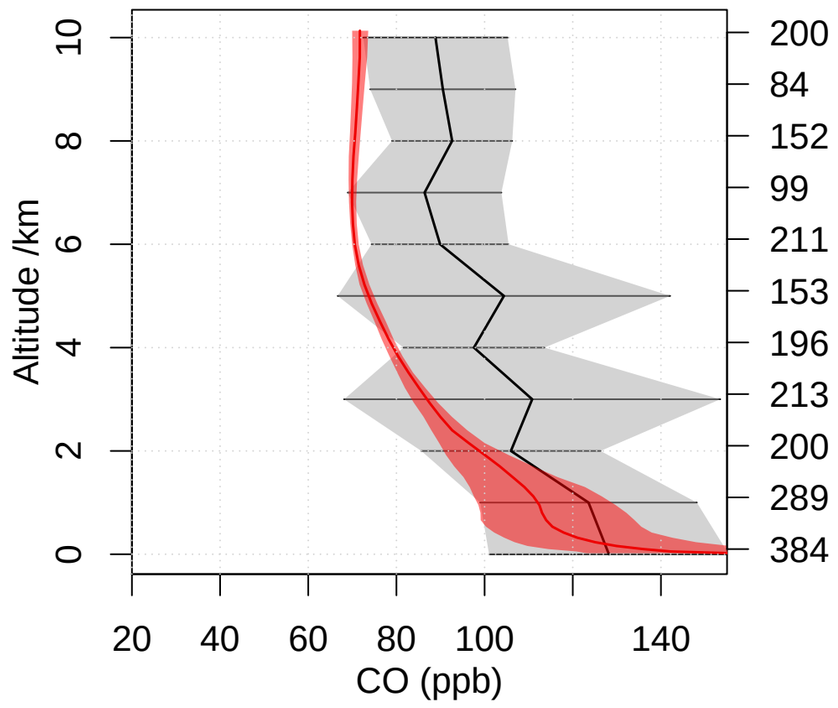


Emmons CO comparison

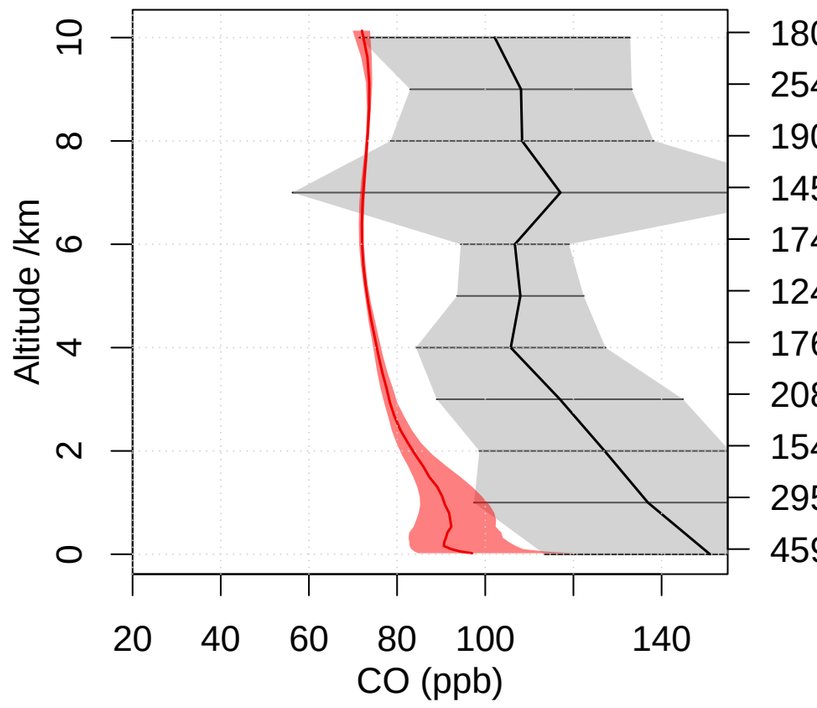
INTEX−NA East Coast 2004 07
Lat 32.5 − 40 Lon 296.5 − 307



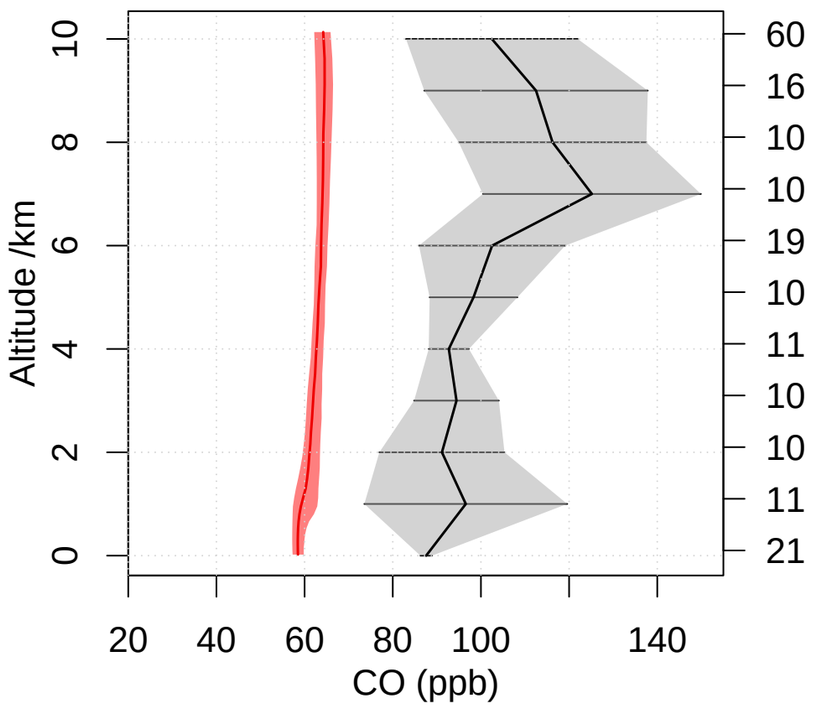
INTEX−NA Central 2004 07
Lat 30 − 40 Lon 259.5 − 285



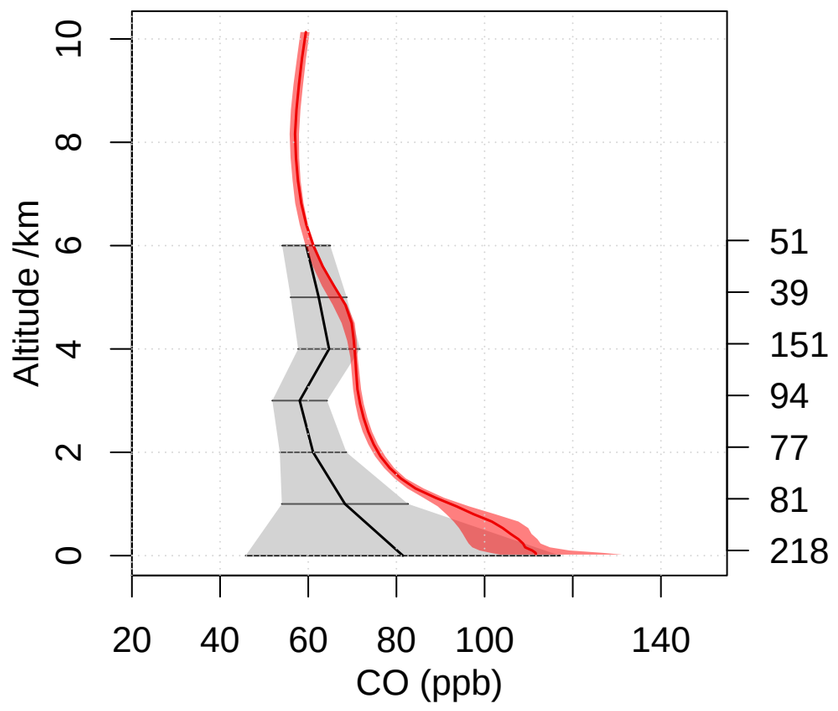
INTEX−NA North East 2004 07
Lat 42.5 − 52.5 Lon 285 − 310



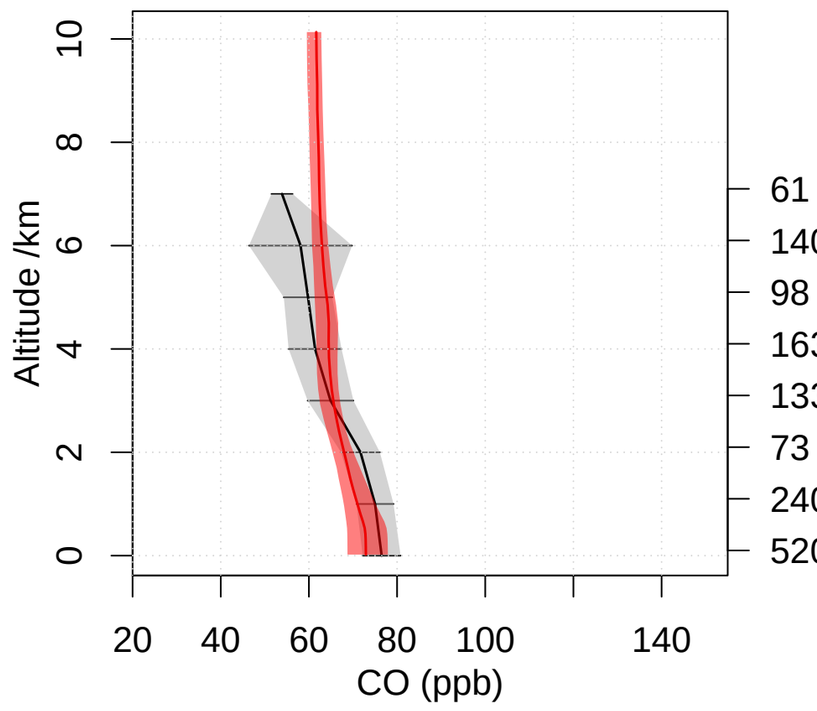
INTEX−NA West Coast 2004 07
Lat 32.5 − 45 Lon 217 − 240



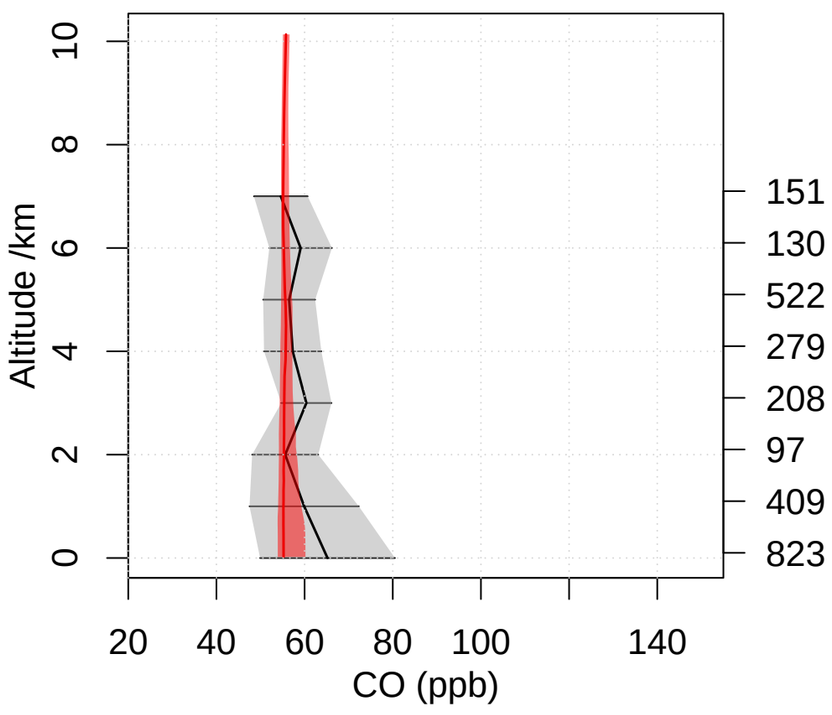
OP3 2008 07
Lat 2.5 − 7.5 Lon 112.5 − 120



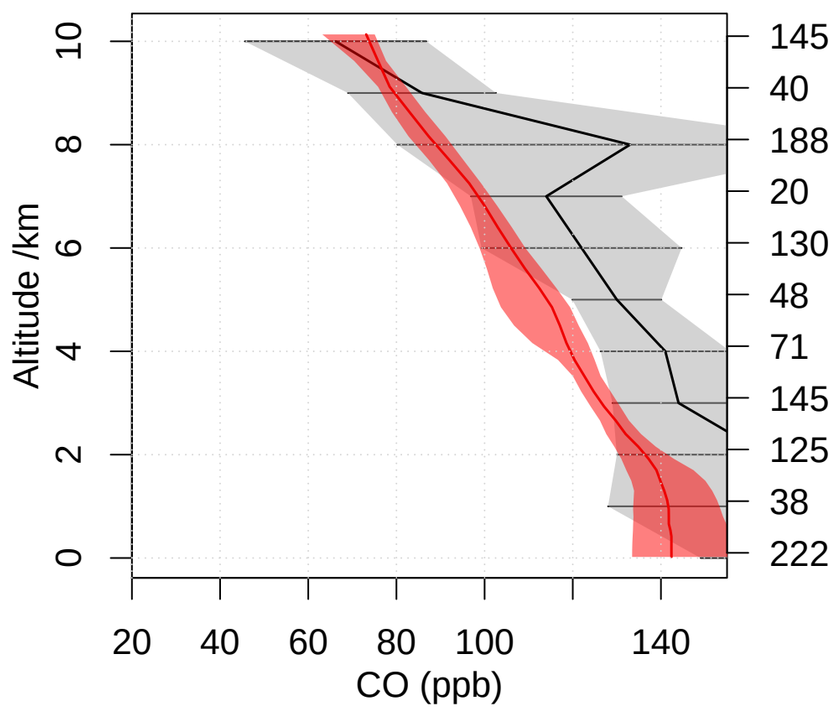
PEM−Tropics−B Christmas−Island 1999 0
Lat 0 − 10 Lon 200 − 220



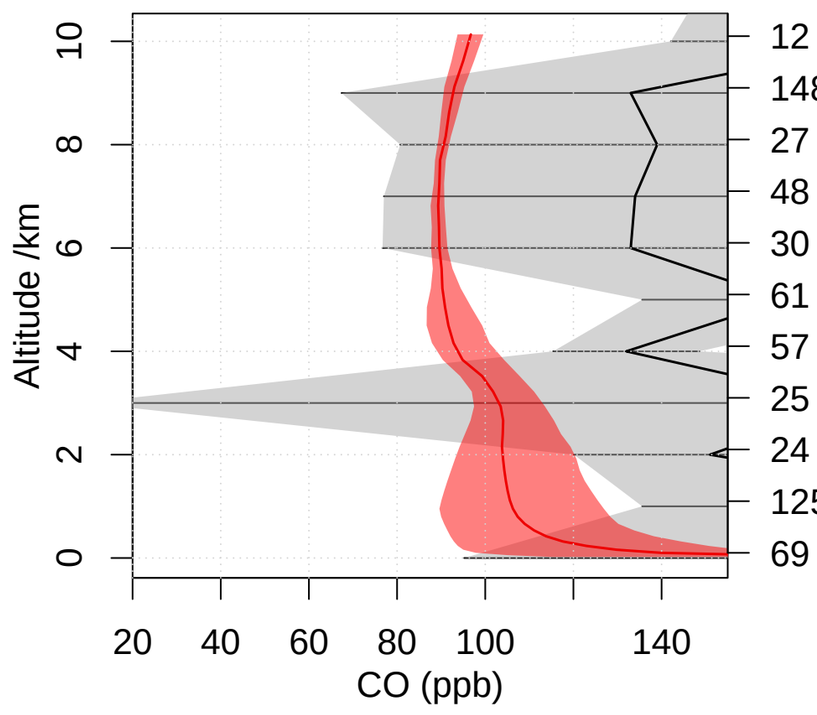
PEM−Tropics−B Tahiti 1999 03
Lat −20 − 0 Lon 200 − 230



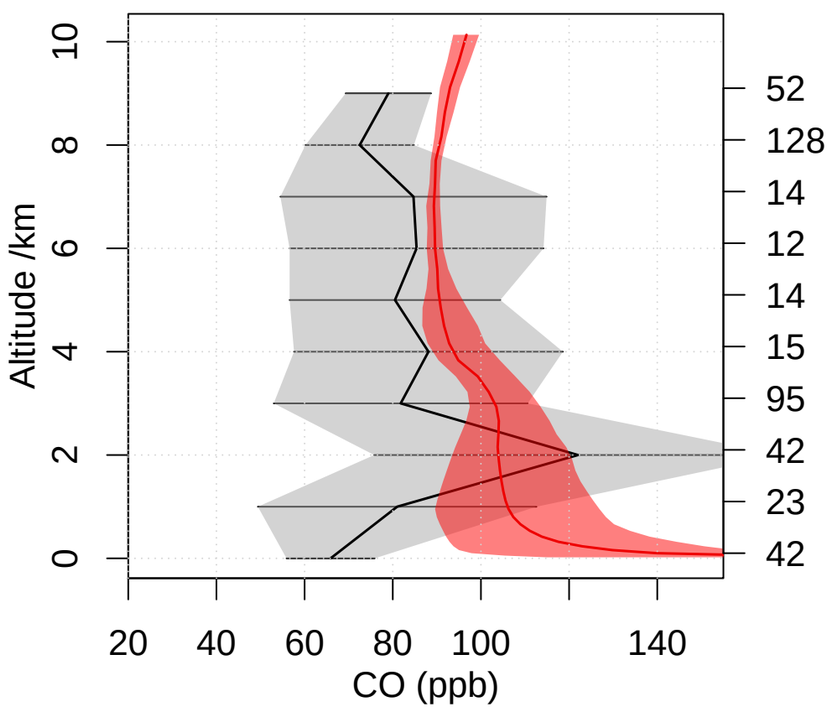
PEM−West−B Japan 1994 02
Lat 25 − 40 Lon 135 − 150



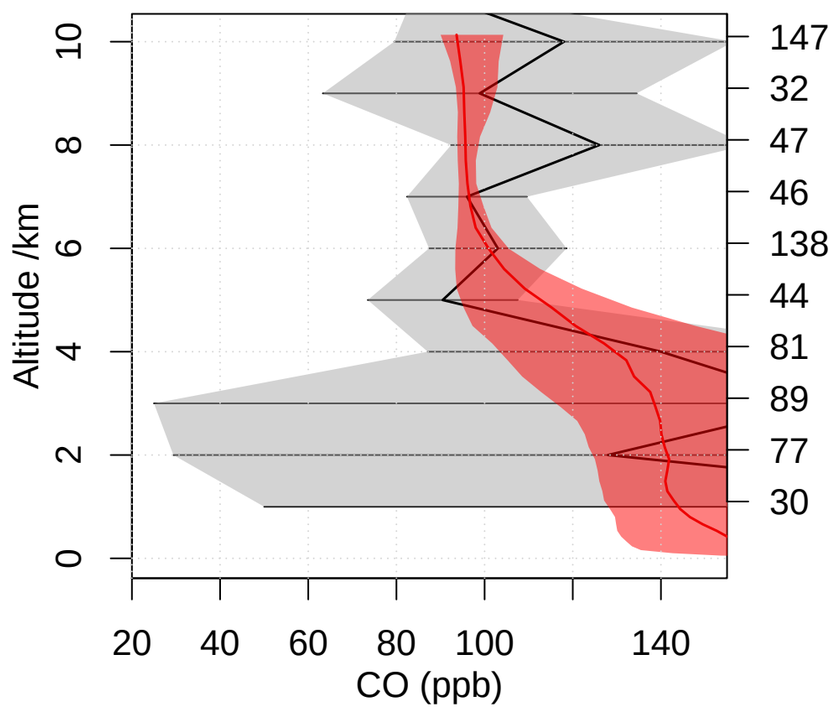
TRACE−A E−Brazil 1992 09
Lat −15 − −5 Lon 310 − 320



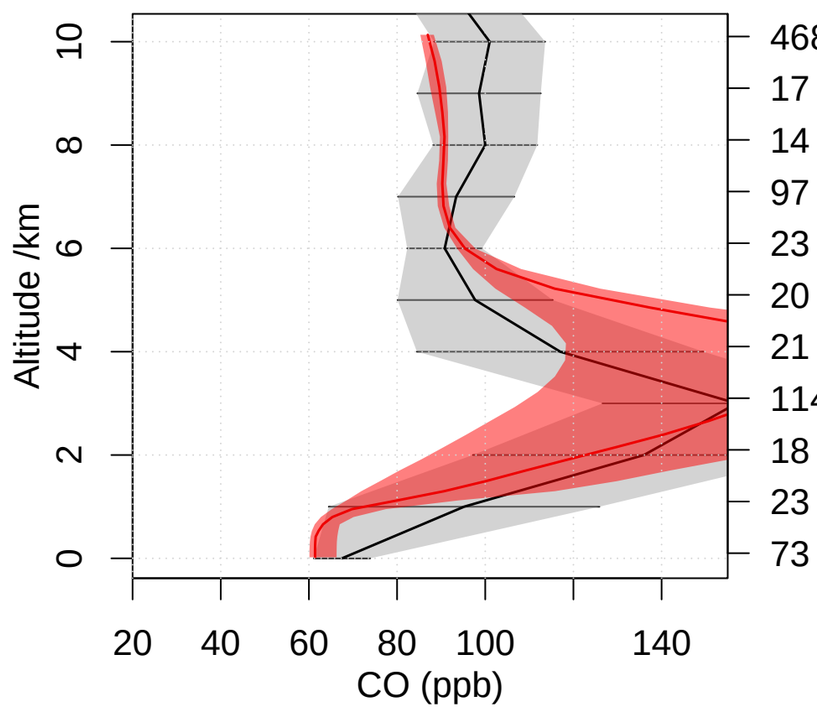
TRACE−A E−Brazil Coast 1992 09
Lat −35 − −25 Lon 310 − 320



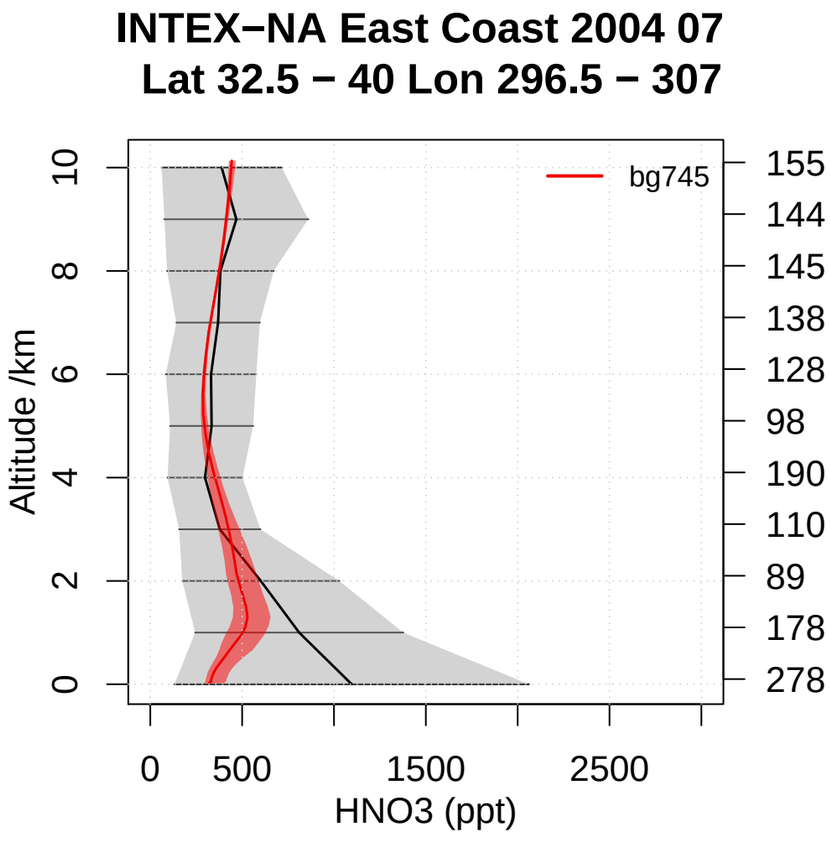
TRACE−A S−Africa 1992 09
Lat −25 − −5 Lon 15 − 35

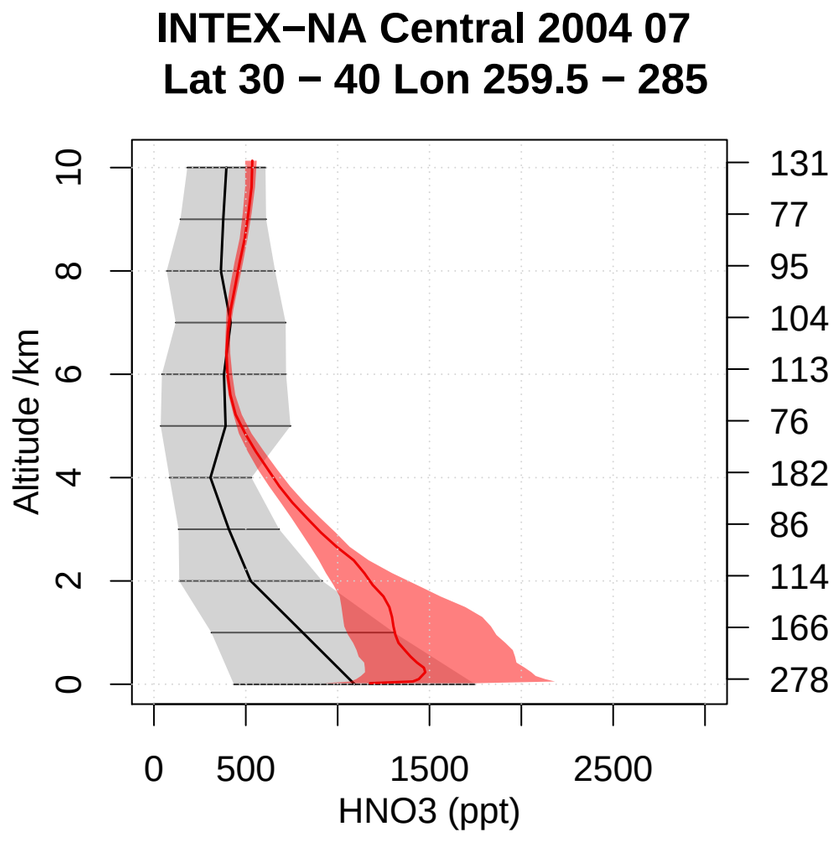


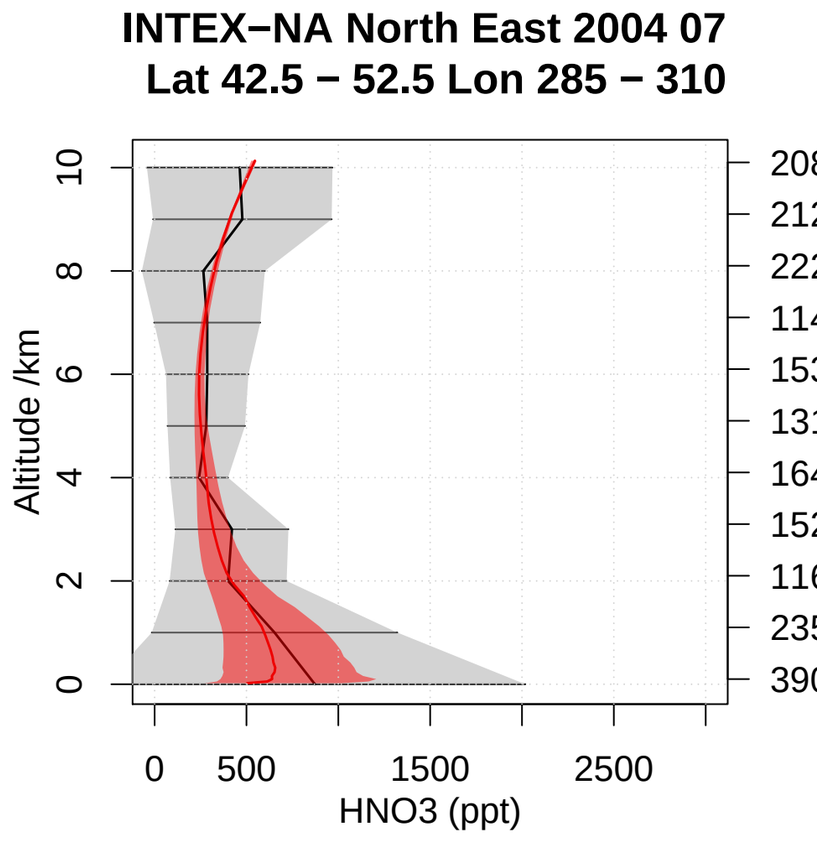
TRACE−A W−Africa Coast 1992 09
Lat −25 − −5 Lon 0 − 10

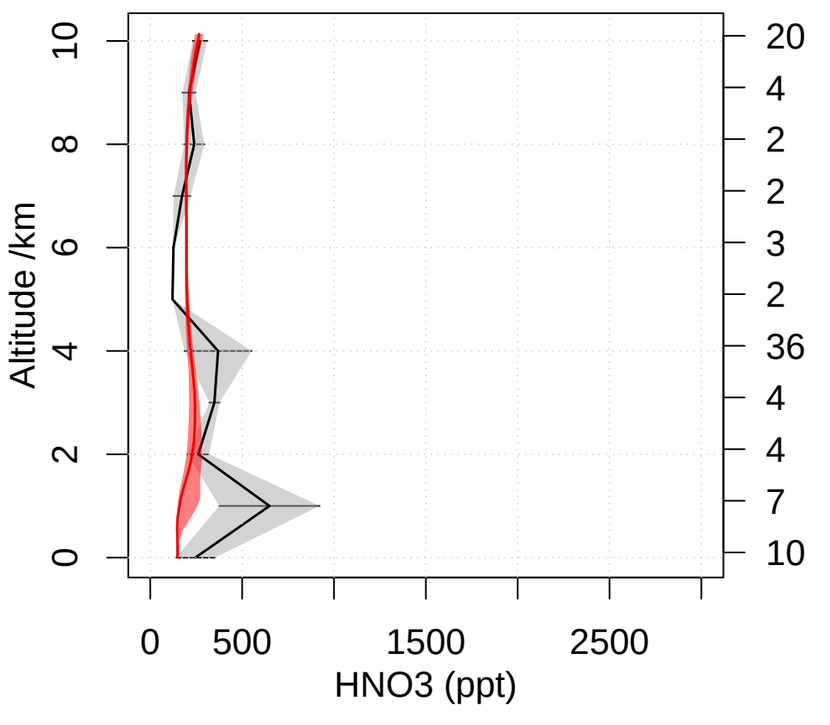


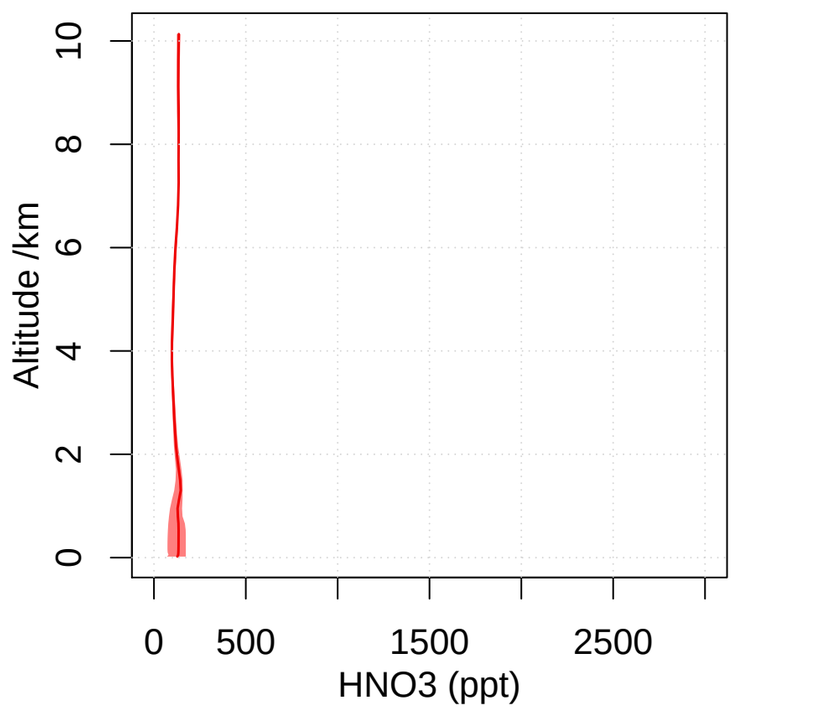
Emmons HNO3 comparison

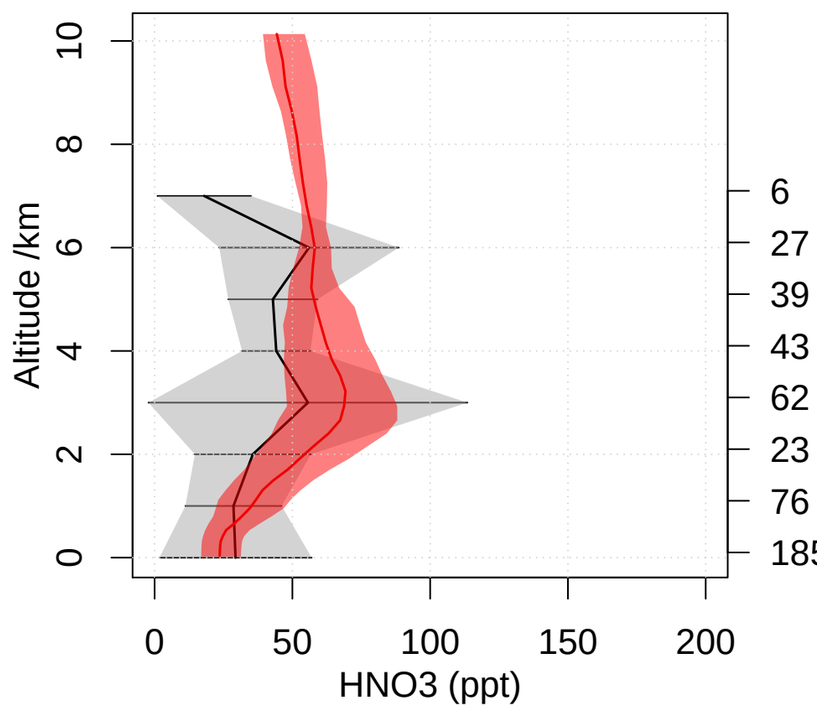


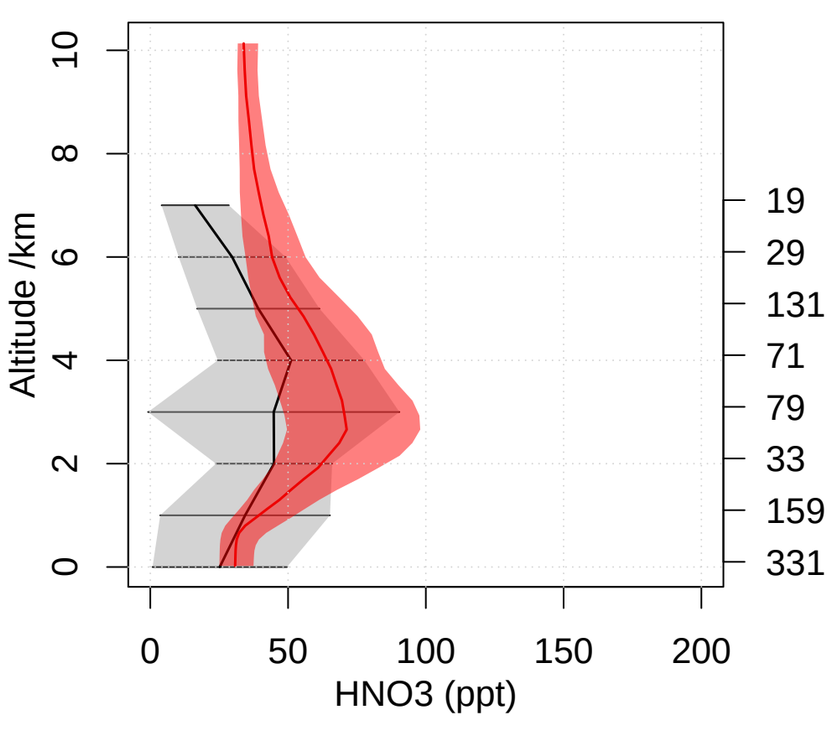


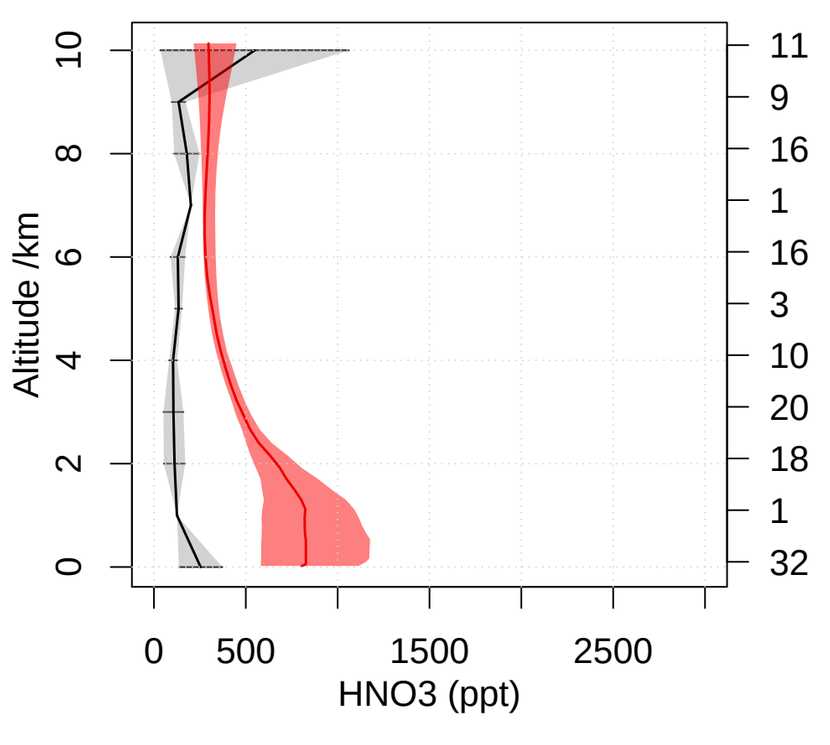


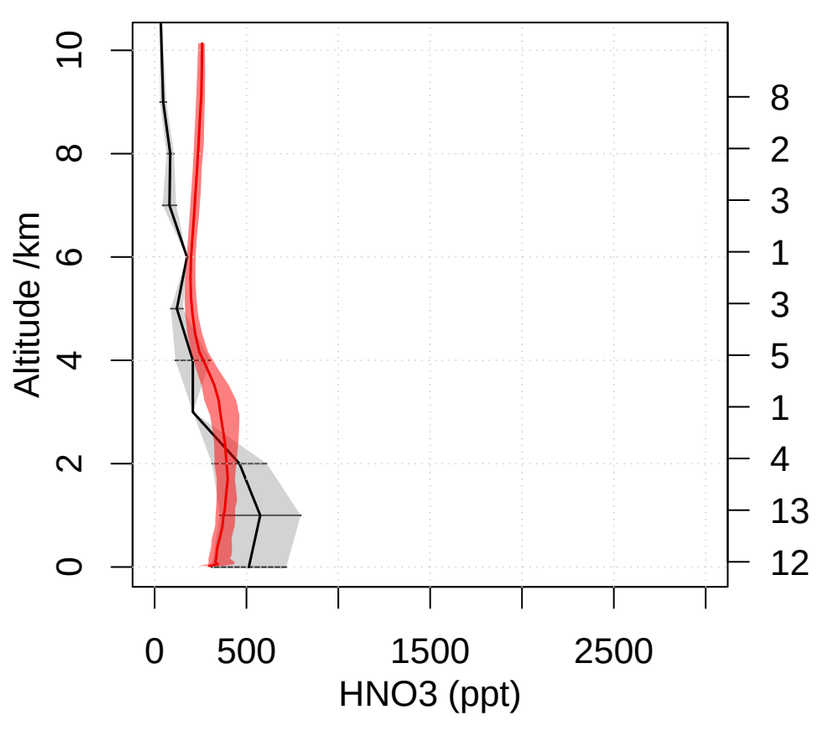


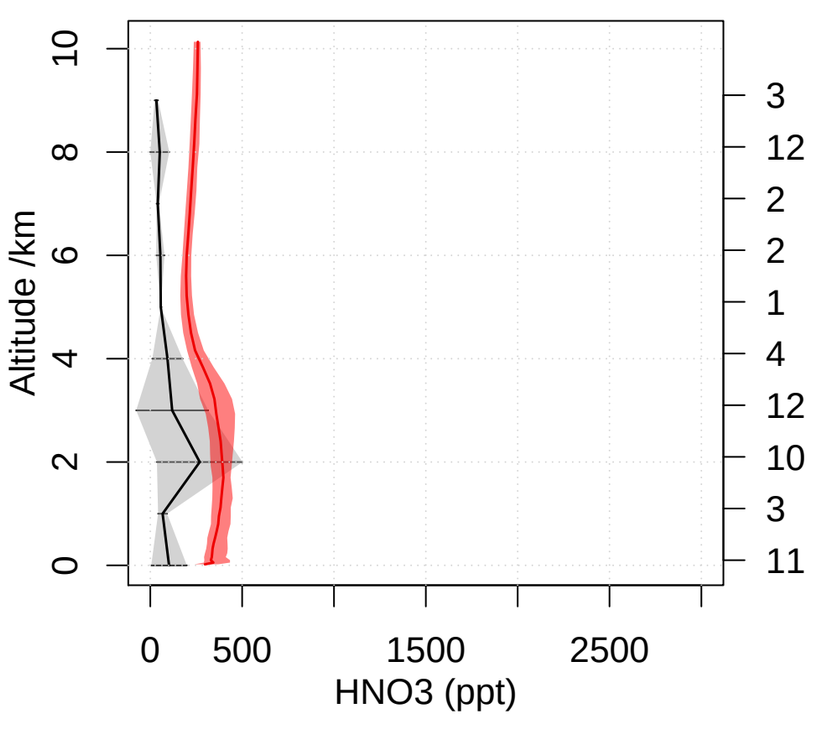


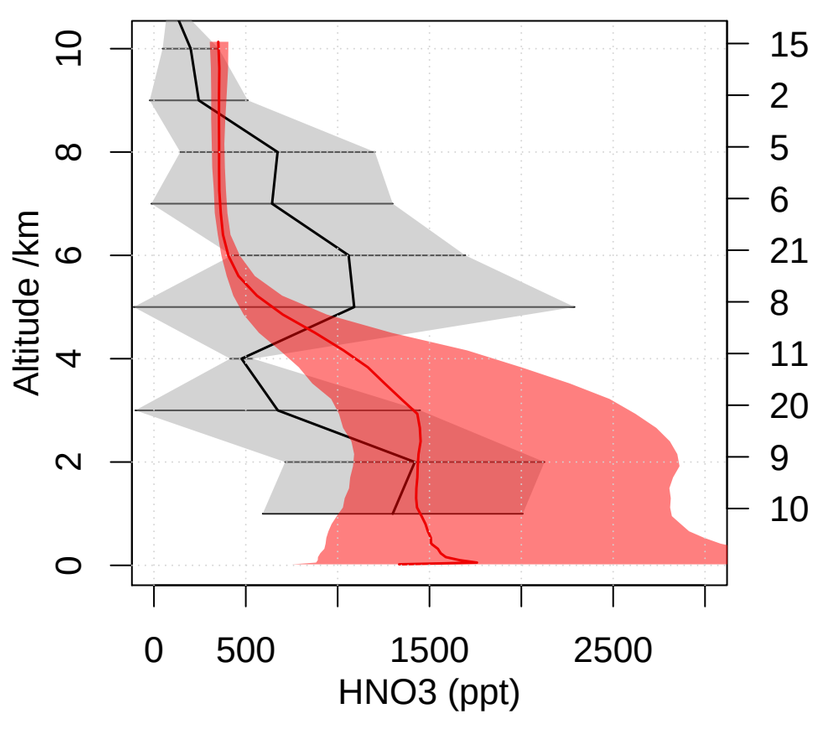


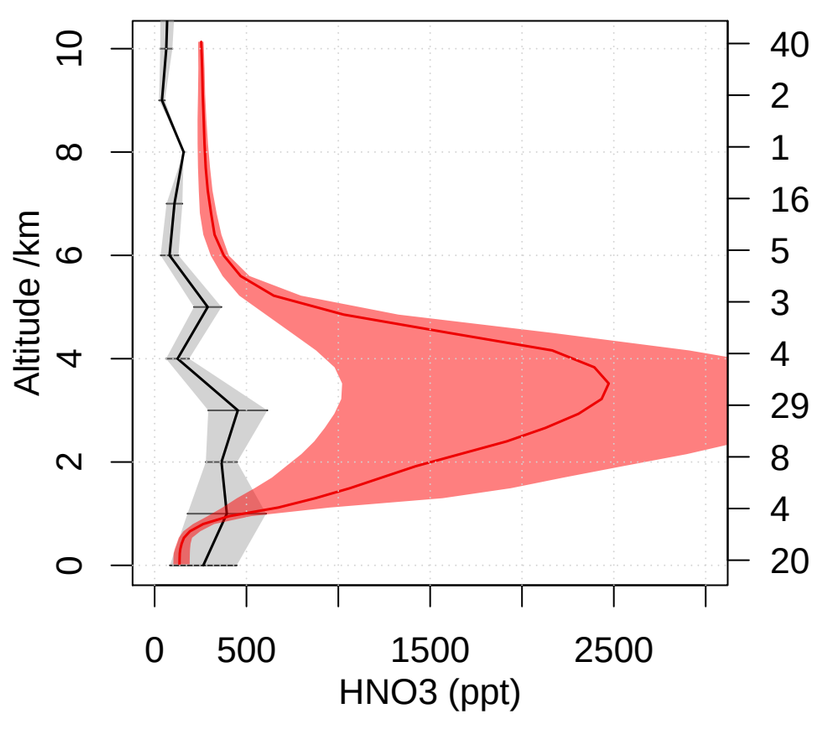




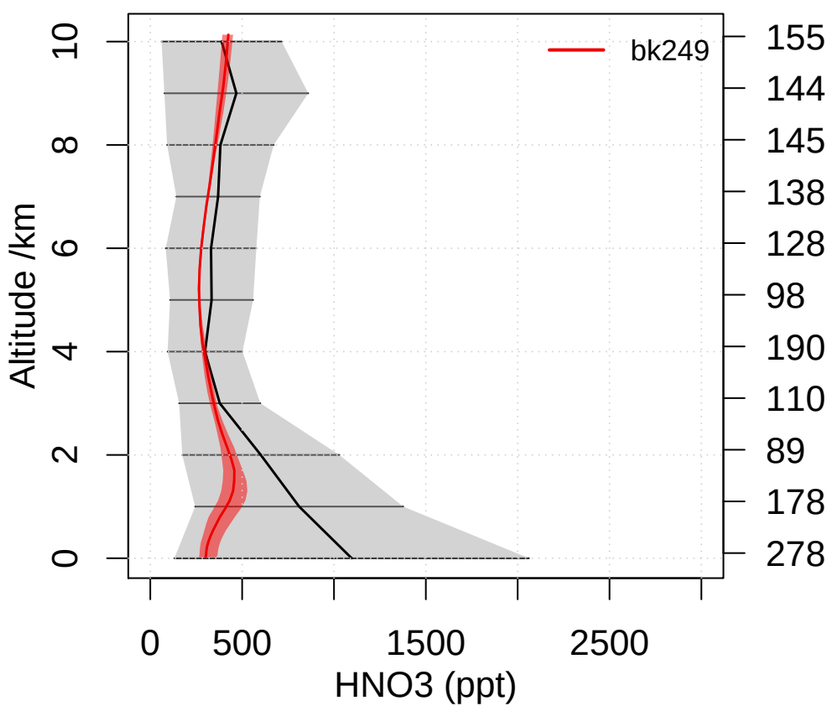


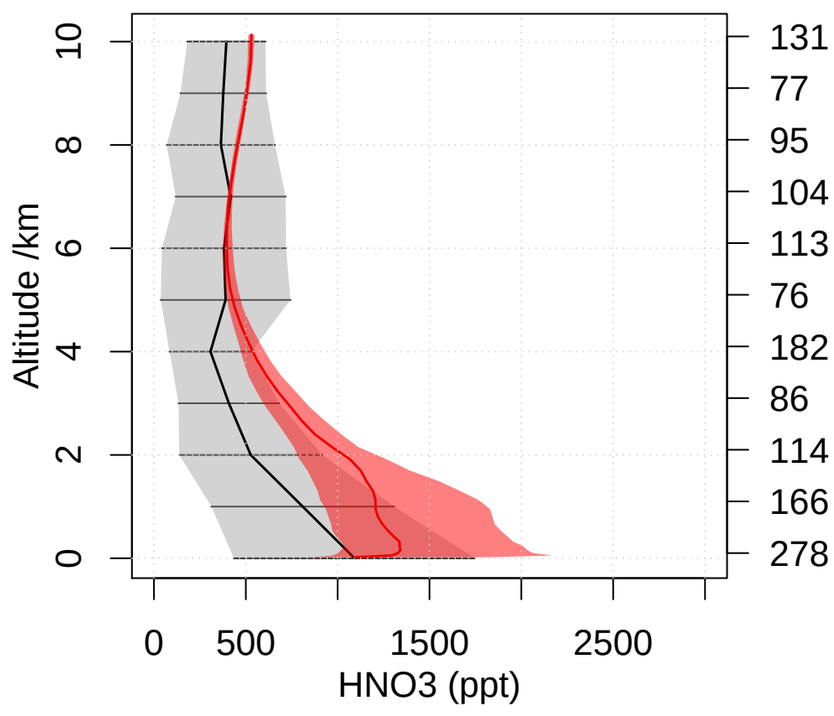


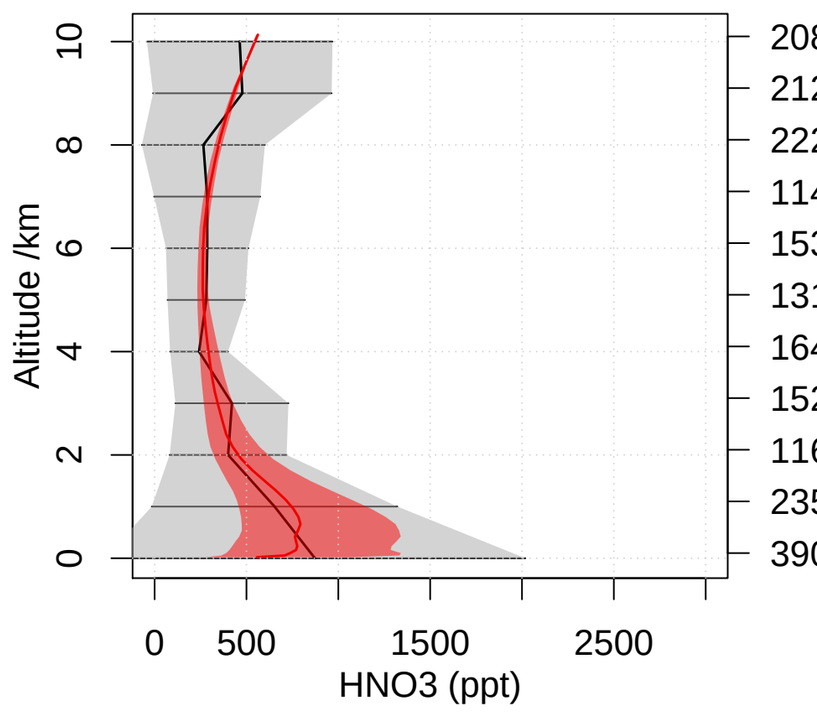


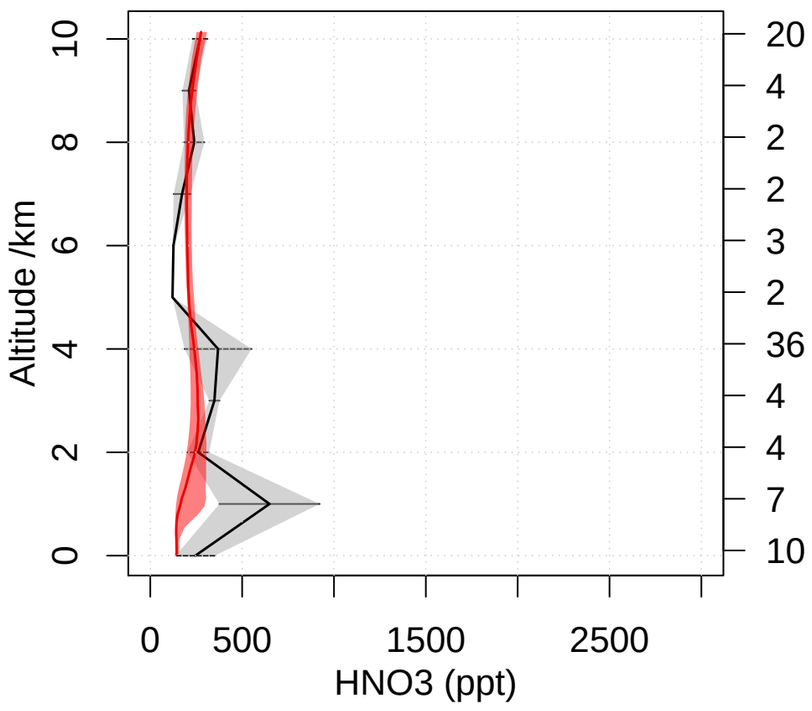


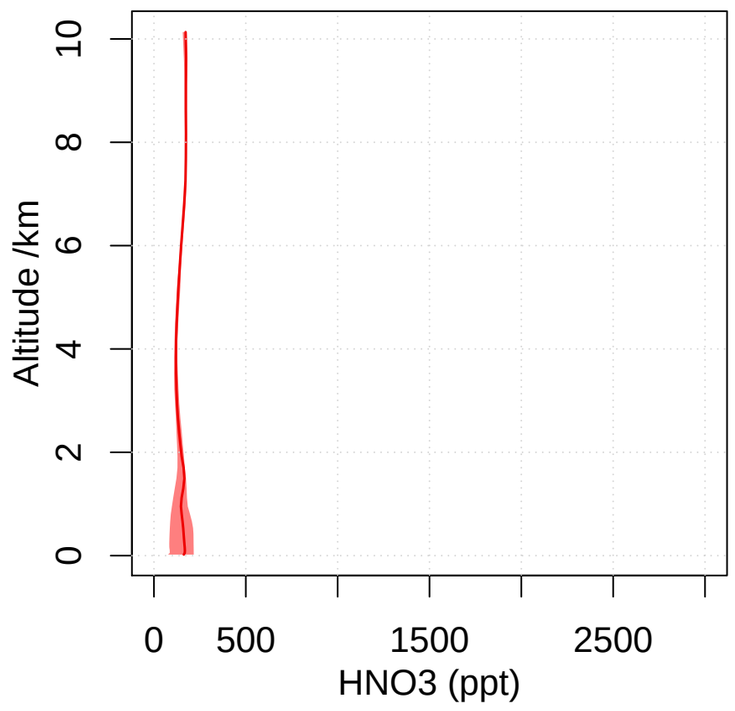
Emmons HNO3 comparison

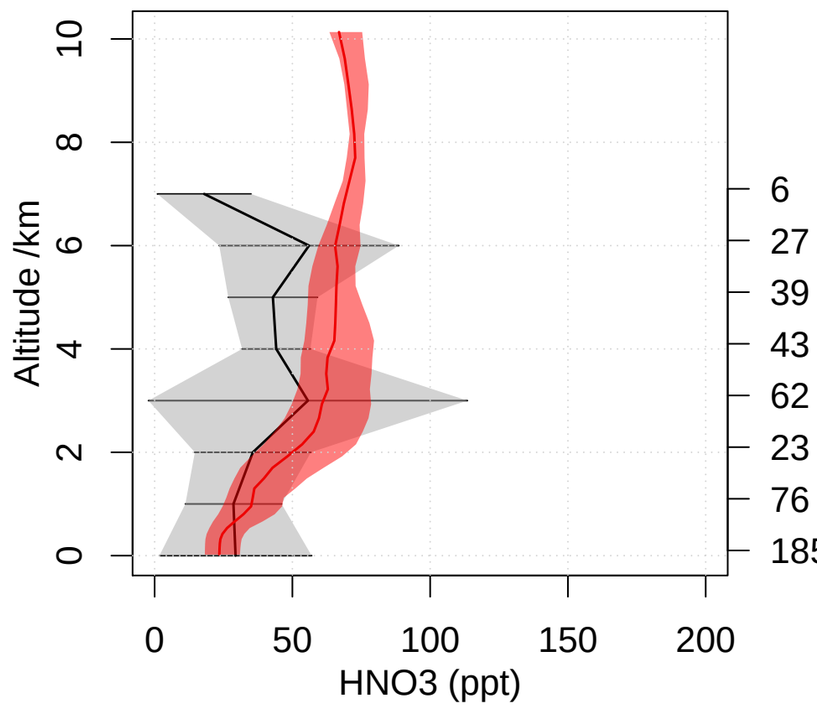


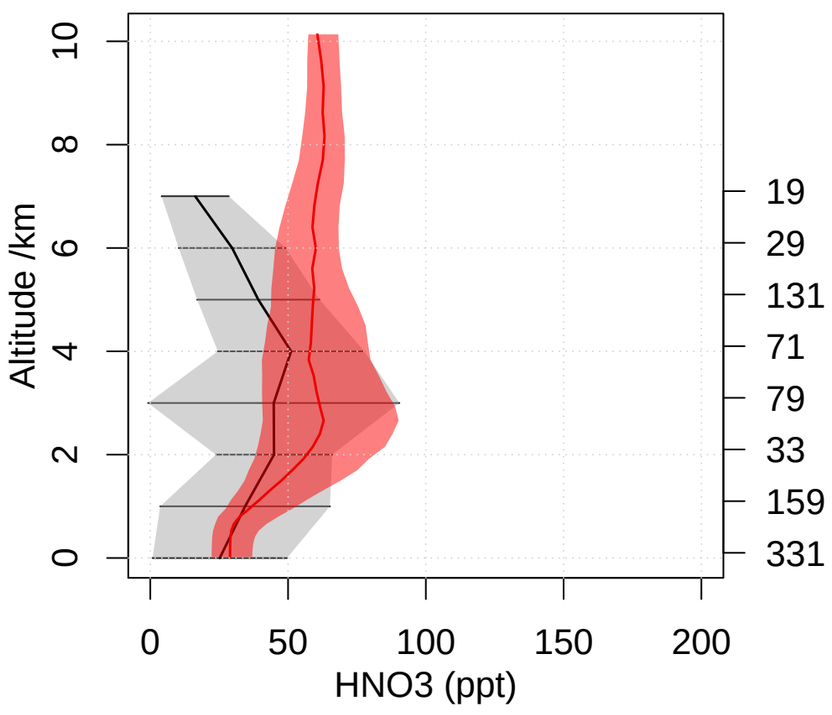


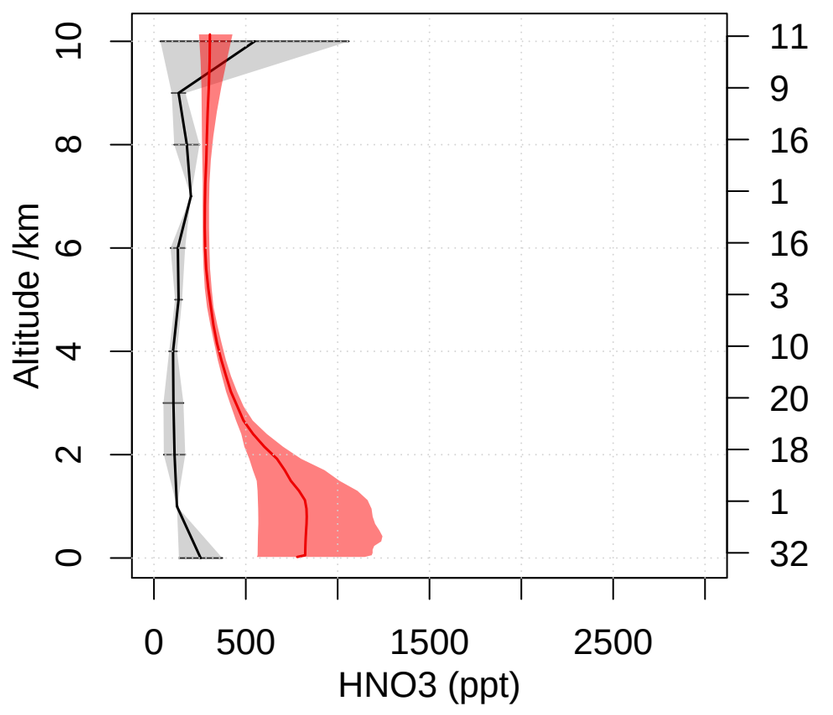


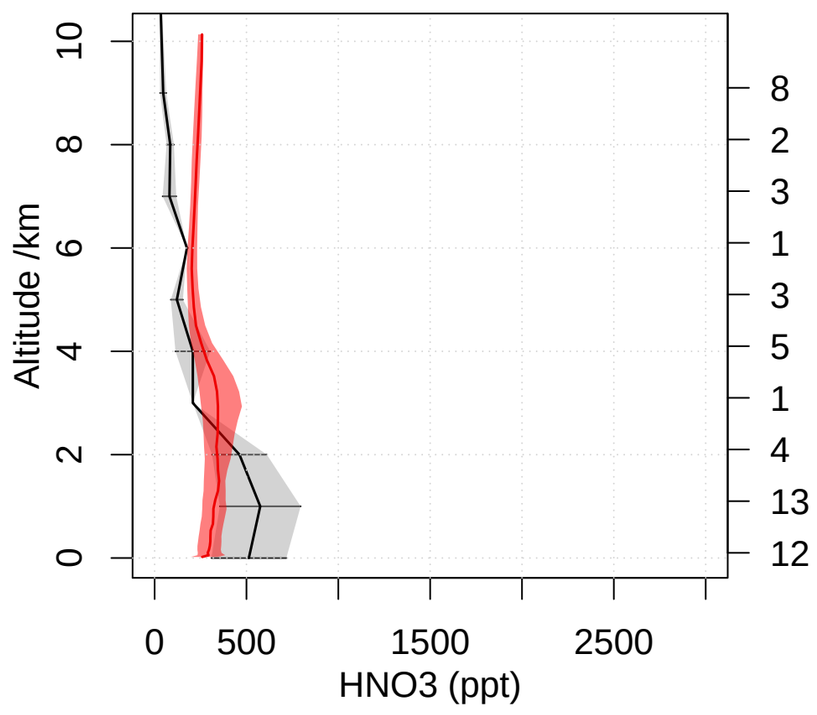


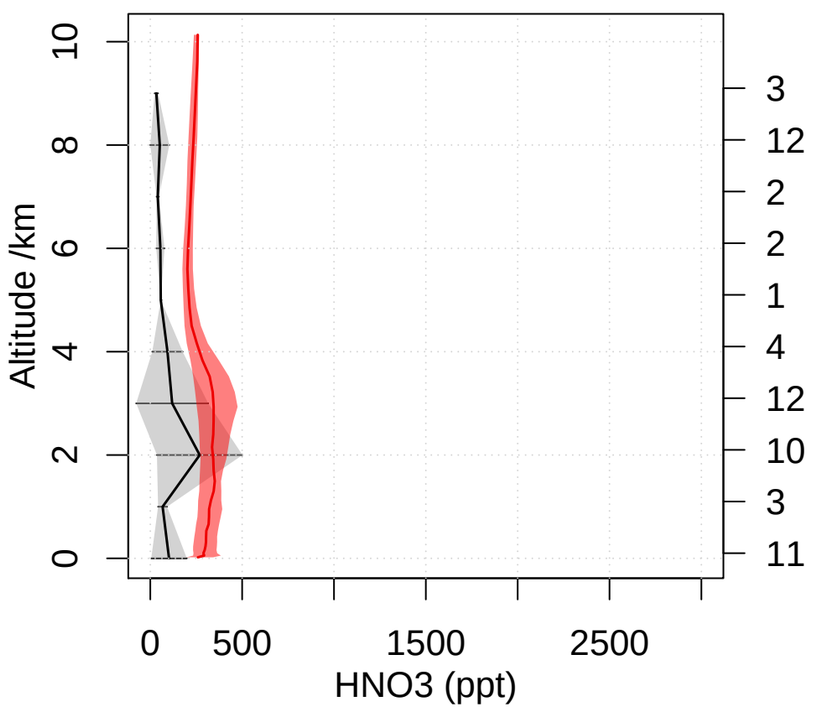


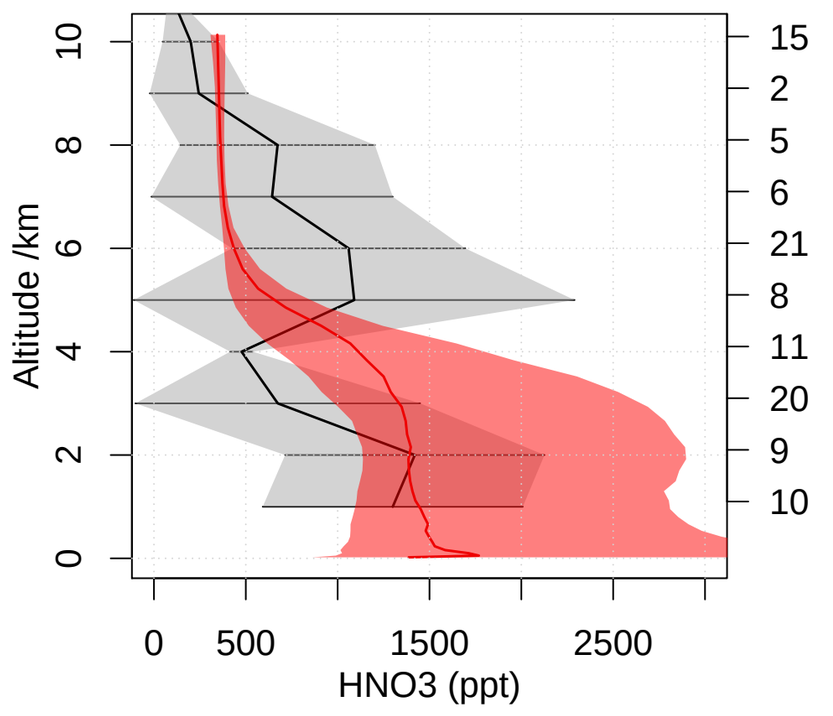


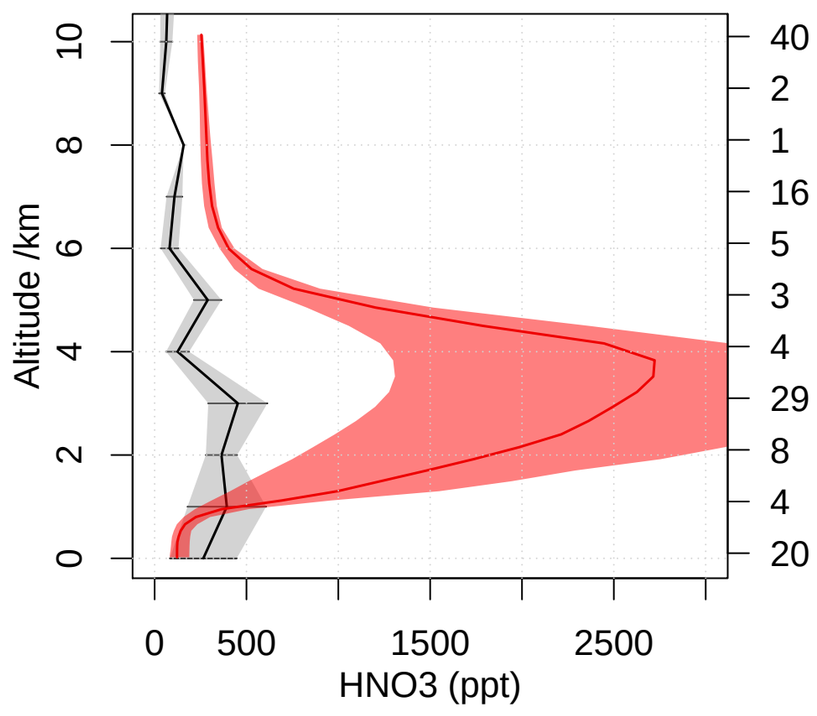






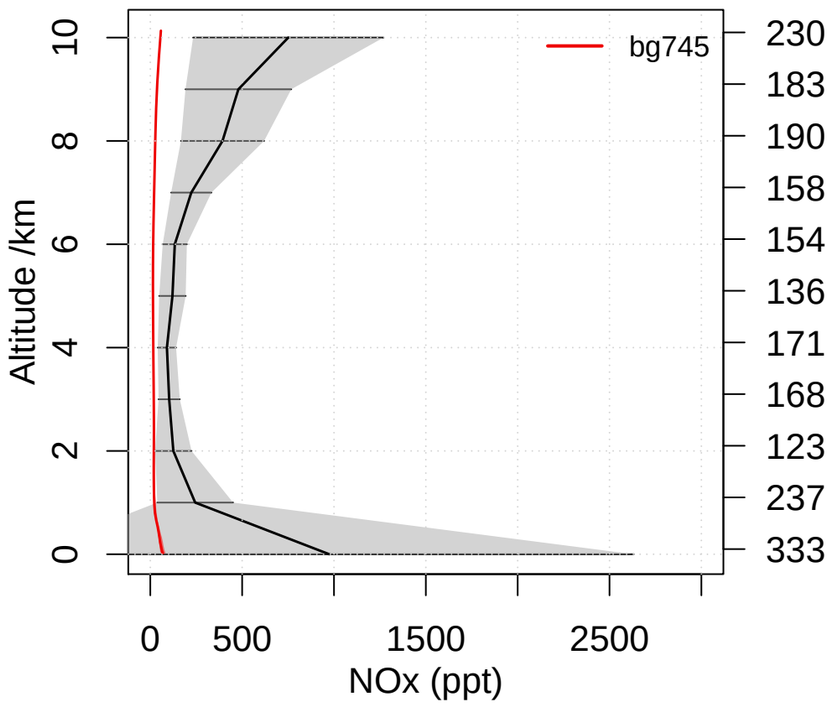




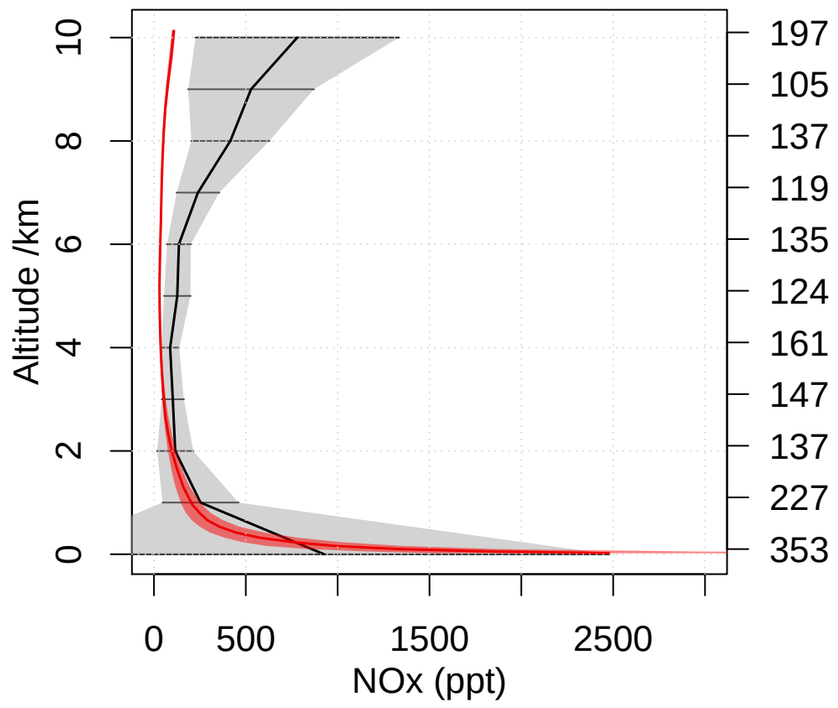


Emmons NOx comparison

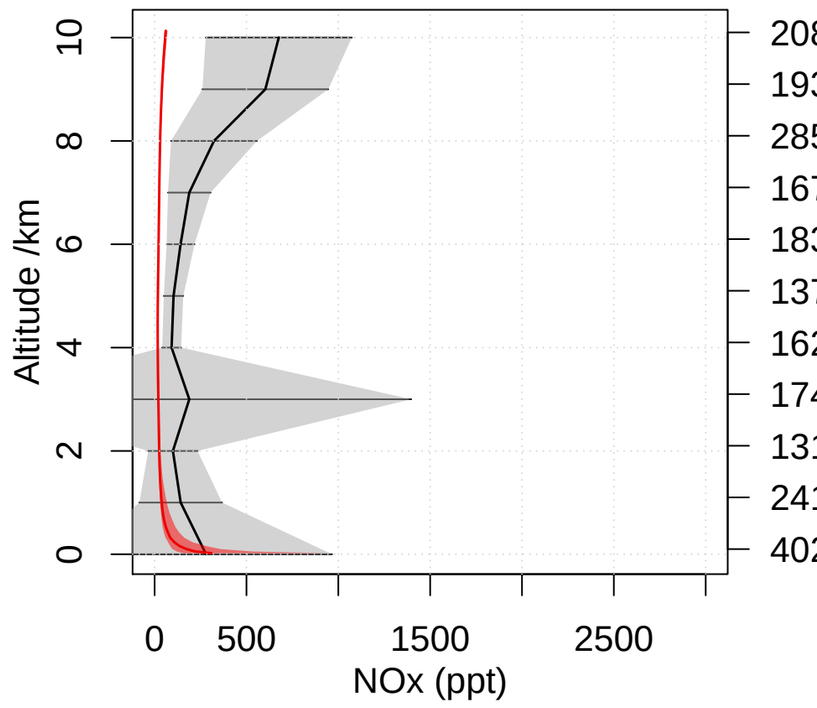
INTEX−NA East Coast 2004 07
Lat 32.5 − 40 Lon 296.5 − 307



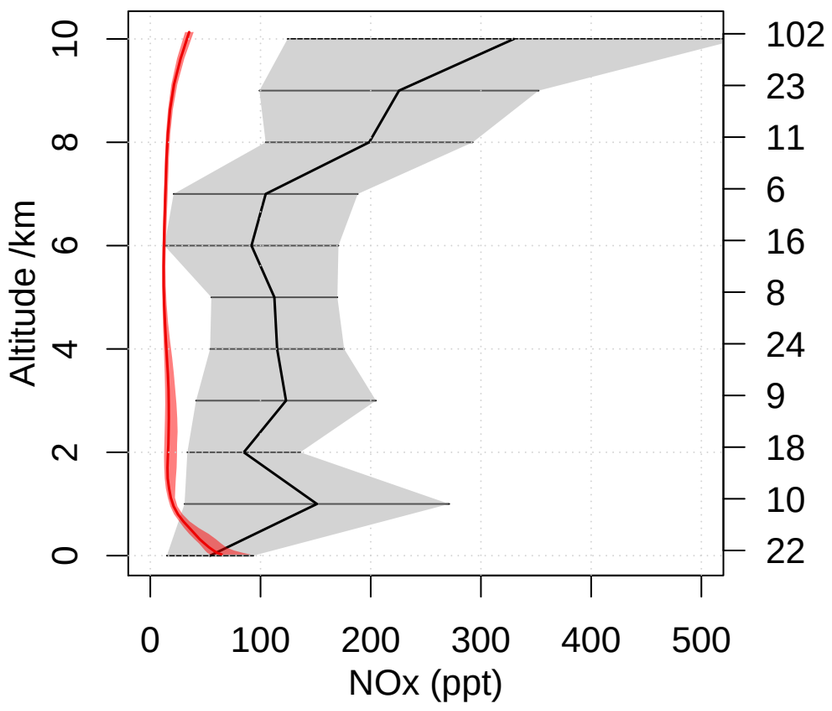
INTEX−NA Central 2004 07
Lat 30 − 40 Lon 259.5 − 285



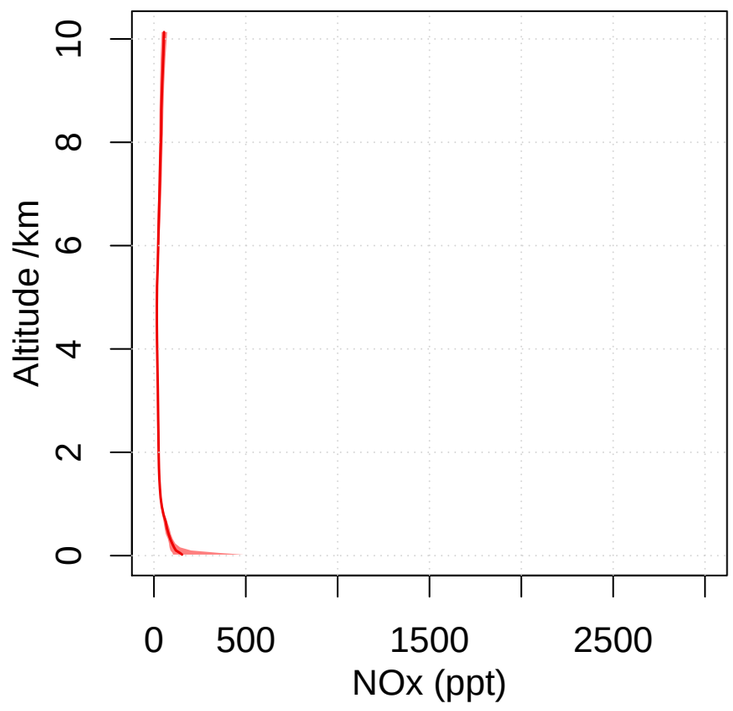
INTEX−NA North East 2004 07
Lat 42.5 − 52.5 Lon 285 − 310



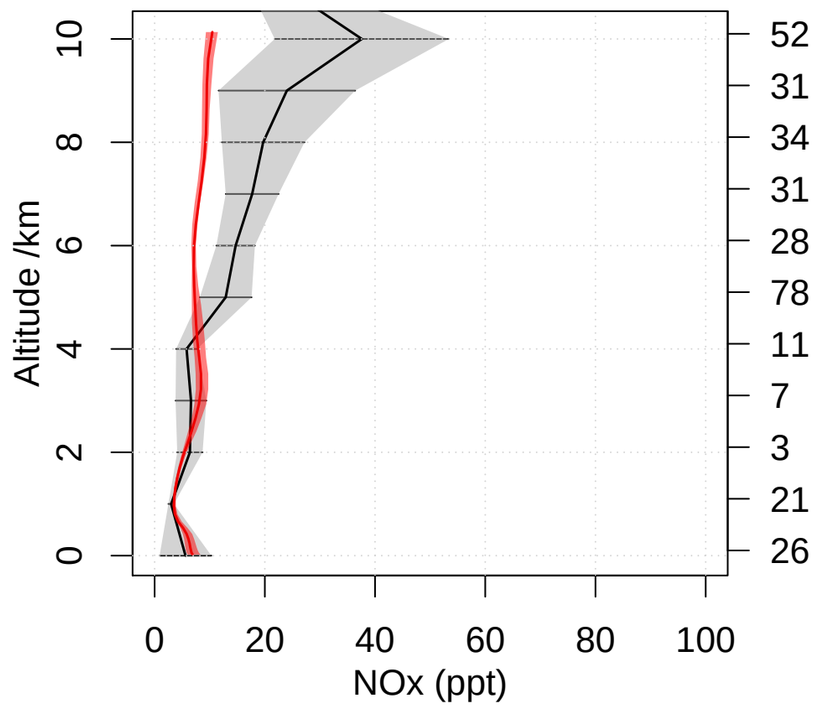
INTEX−NA West Coast 2004 07
Lat 32.5 − 45 Lon 217 − 240



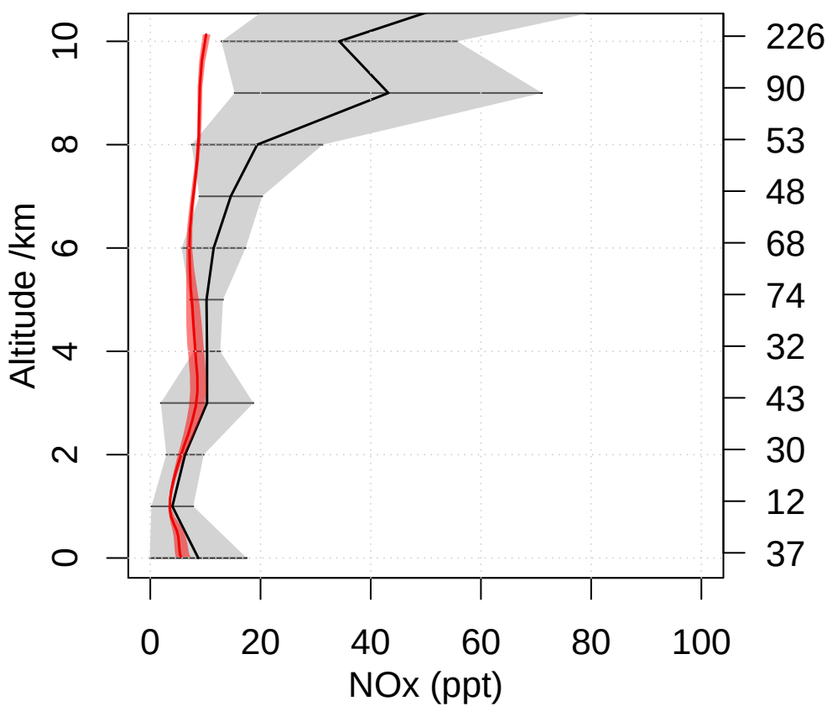
OP3 2008 07
Lat 2.5 − 7.5 Lon 112.5 − 120



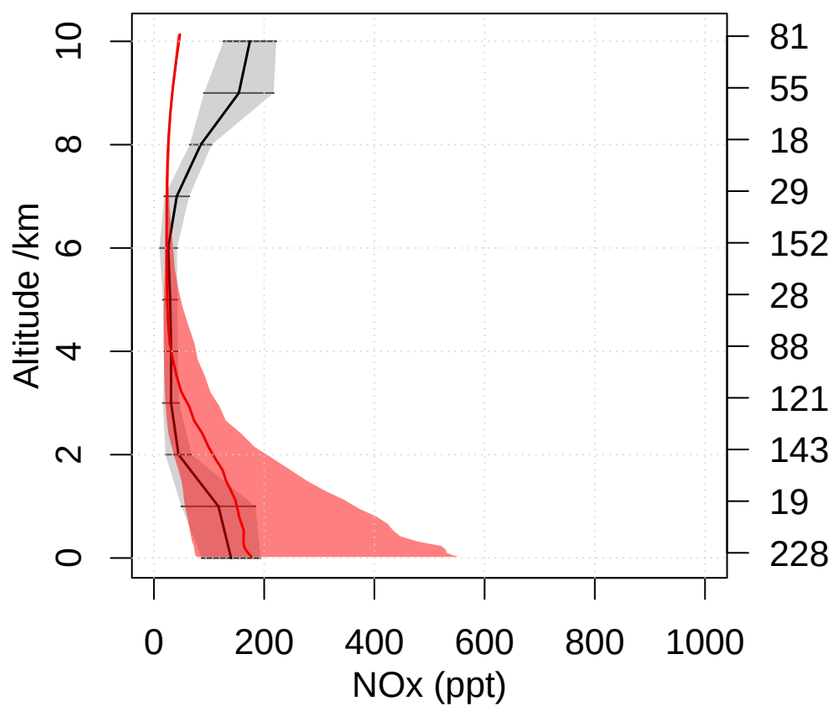
PEM−Tropics−B Christmas−Island 1999 0
Lat 0 − 10 Lon 200 − 220



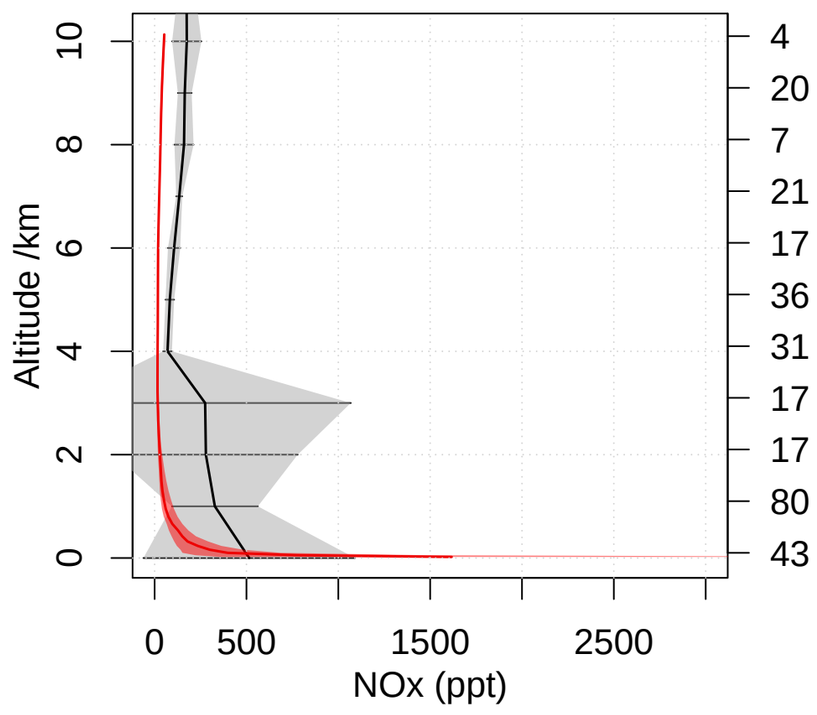
PEM−Tropics−B Tahiti 1999 03
Lat −20 − 0 Lon 200 − 230



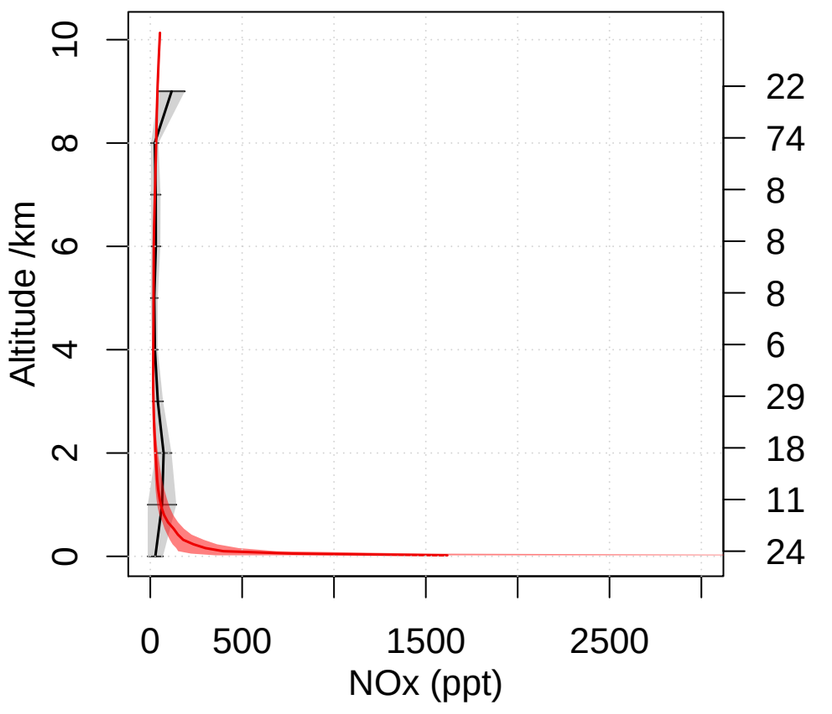
PEM−West−B Japan 1994 02
Lat 25 − 40 Lon 135 − 150



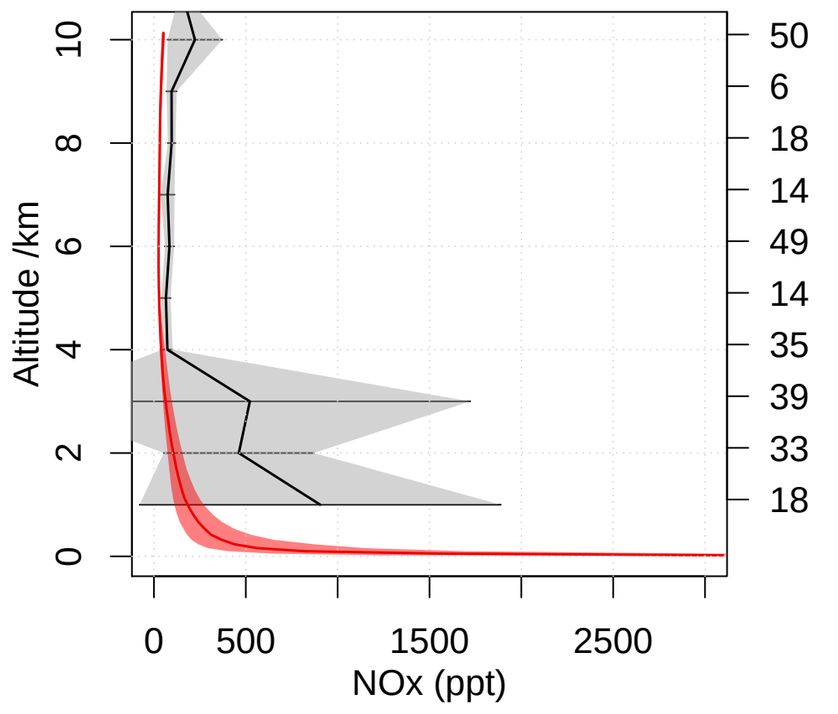
TRACE−A E−Brazil 1992 09
Lat −15 − −5 Lon 310 − 320



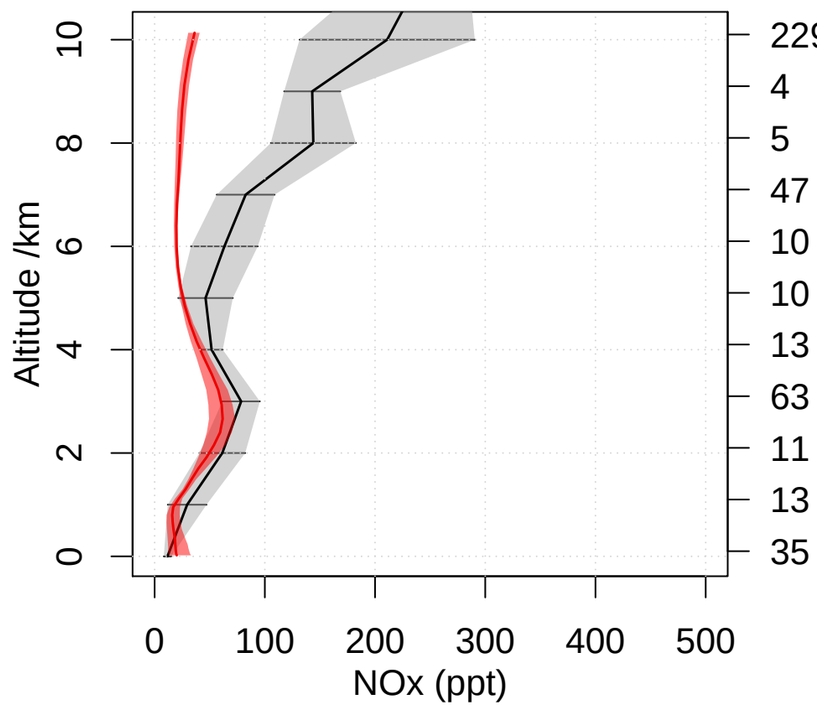
TRACE−A E−Brazil Coast 1992 09
Lat −35 − −25 Lon 310 − 320



TRACE−A S−Africa 1992 09
Lat −25 − −5 Lon 15 − 35

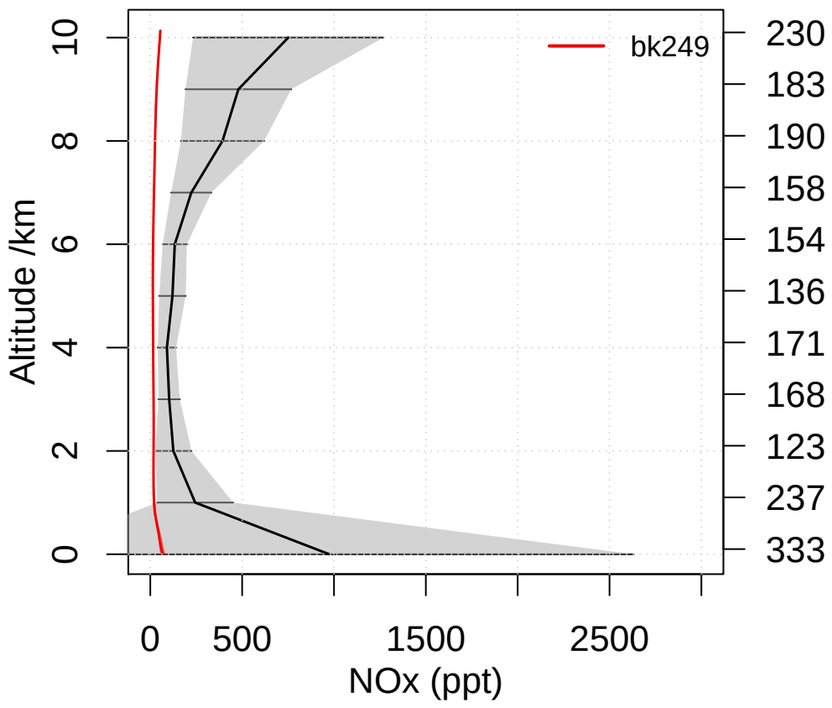


TRACE−A W−Africa Coast 1992 09
Lat −25 − −5 Lon 0 − 10

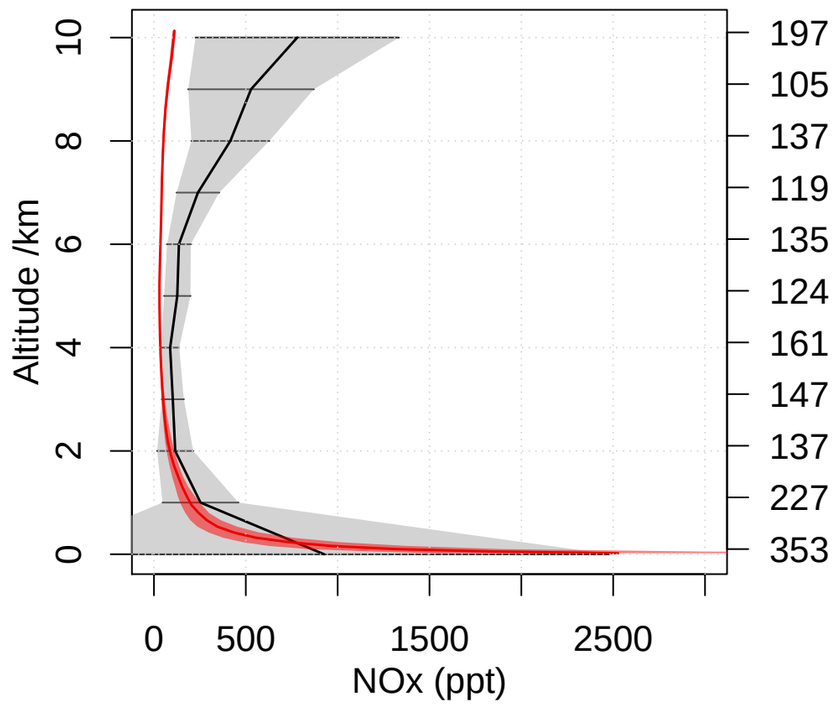


Emmons NOx comparison

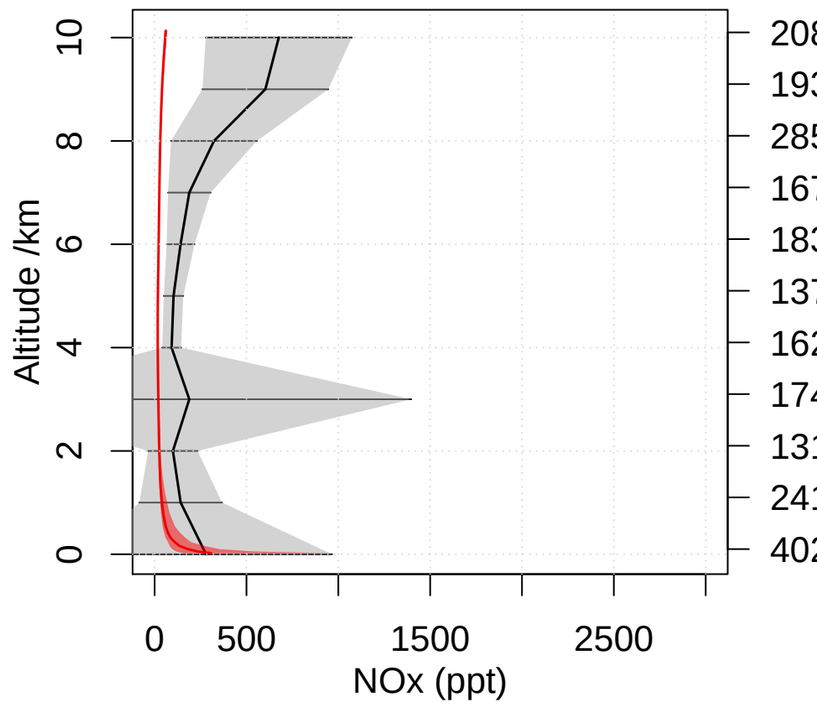
INTEX−NA East Coast 2004 07
Lat 32.5 − 40 Lon 296.5 − 307



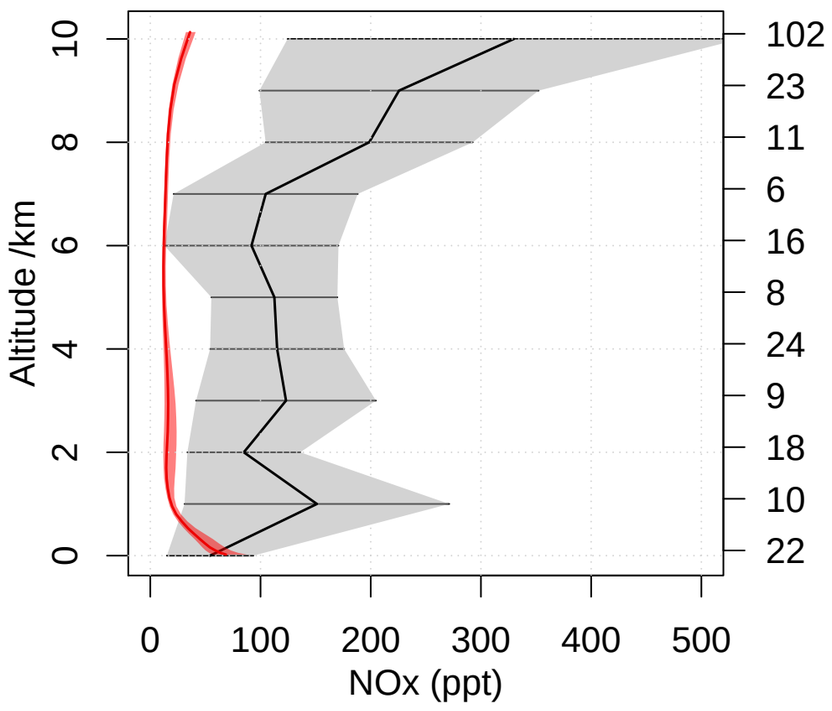
INTEX−NA Central 2004 07
Lat 30 − 40 Lon 259.5 − 285



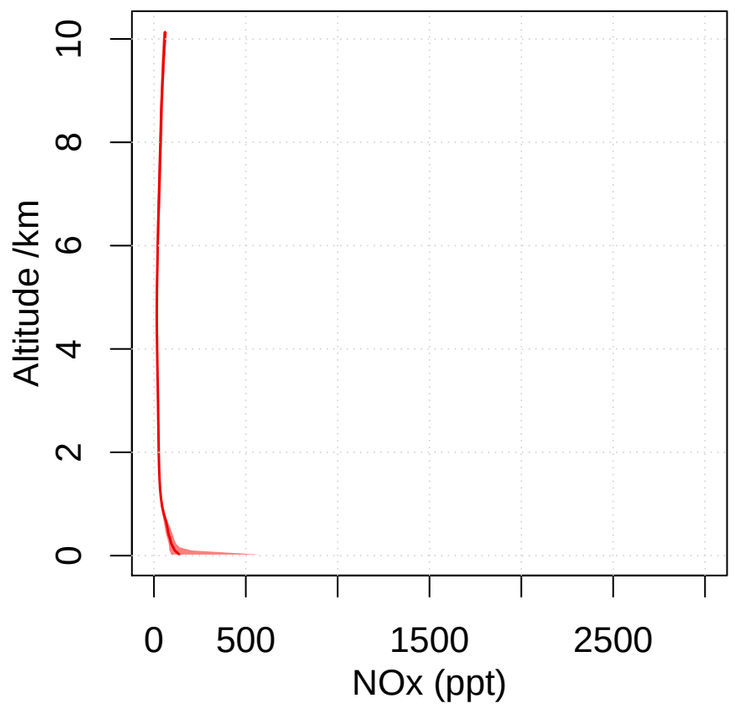
INTEX−NA North East 2004 07
Lat 42.5 − 52.5 Lon 285 − 310



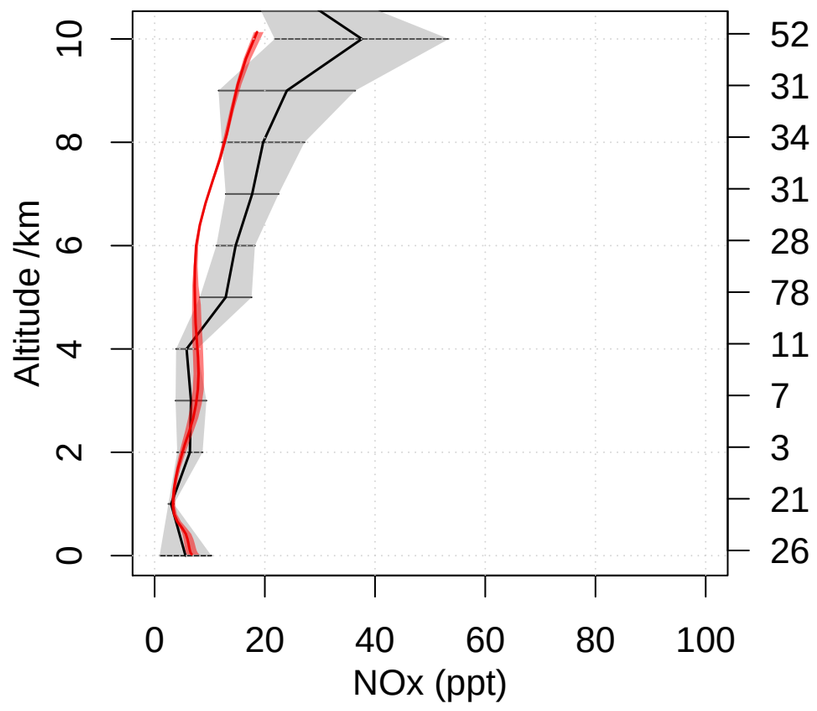
INTEX−NA West Coast 2004 07
Lat 32.5 − 45 Lon 217 − 240



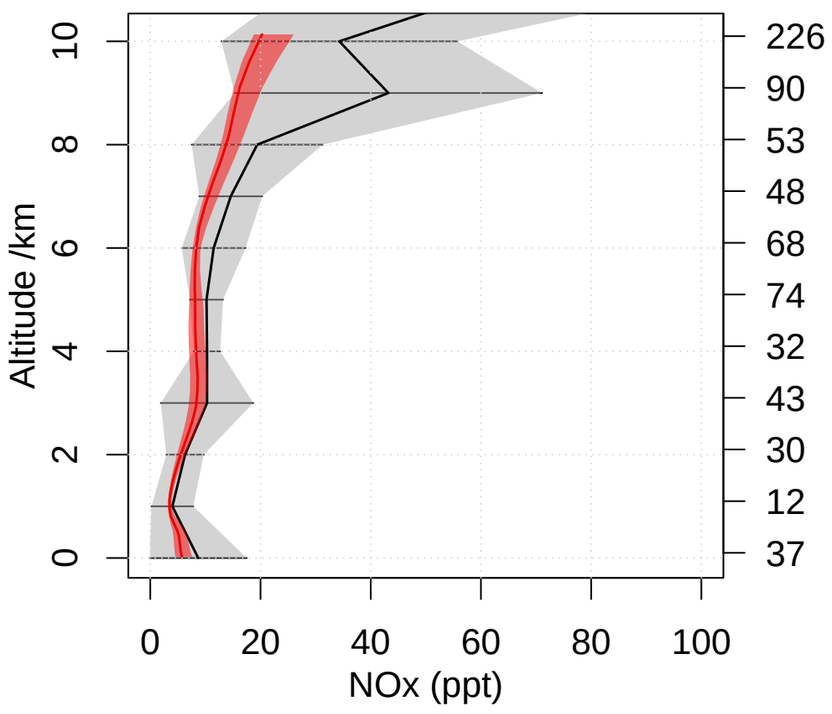
OP3 2008 07
Lat 2.5 − 7.5 Lon 112.5 − 120



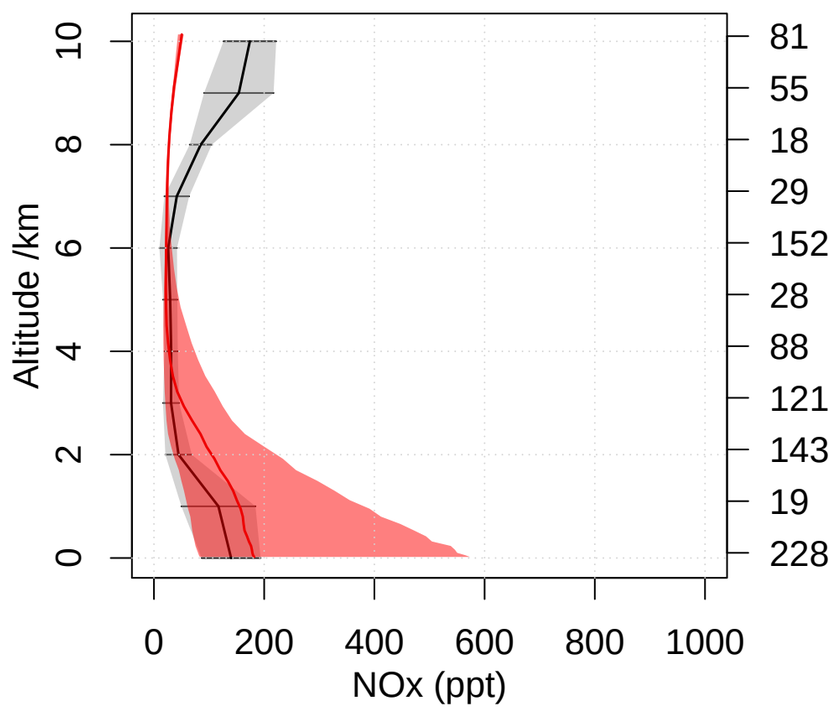
PEM−Tropics−B Christmas−Island 1999 0
Lat 0 − 10 Lon 200 − 220



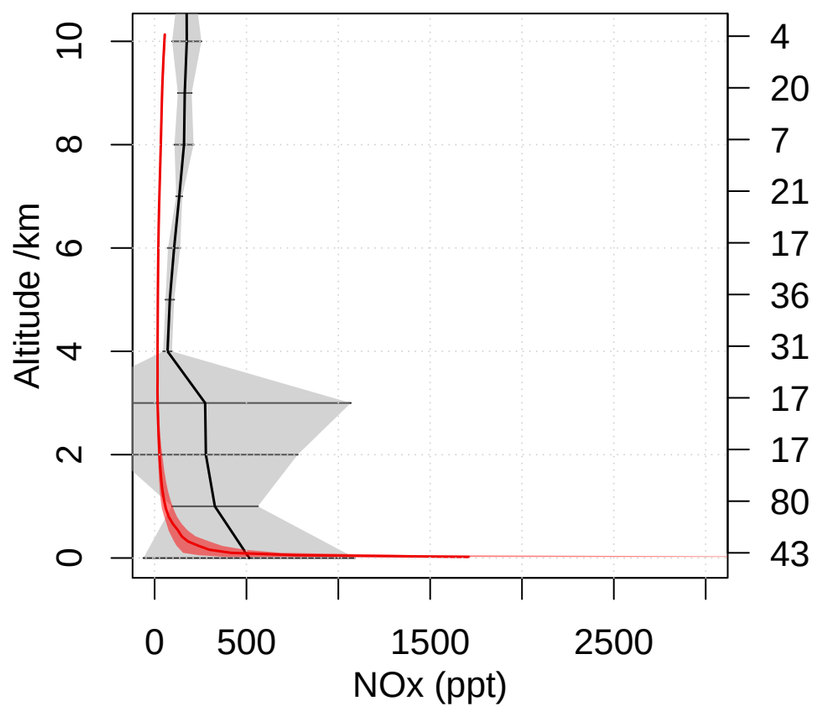
PEM−Tropics−B Tahiti 1999 03
Lat −20 − 0 Lon 200 − 230



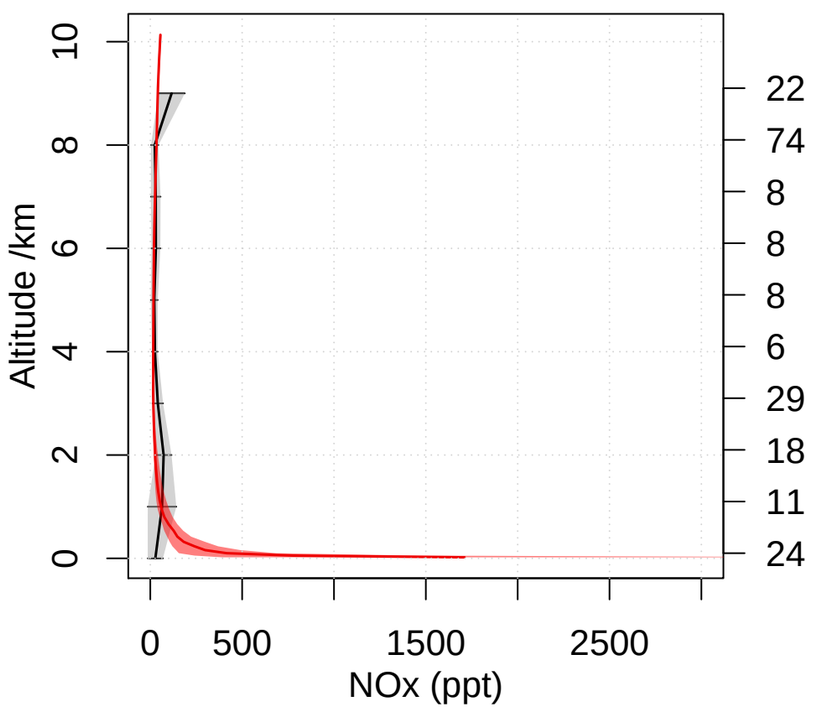
PEM−West−B Japan 1994 02
Lat 25 − 40 Lon 135 − 150



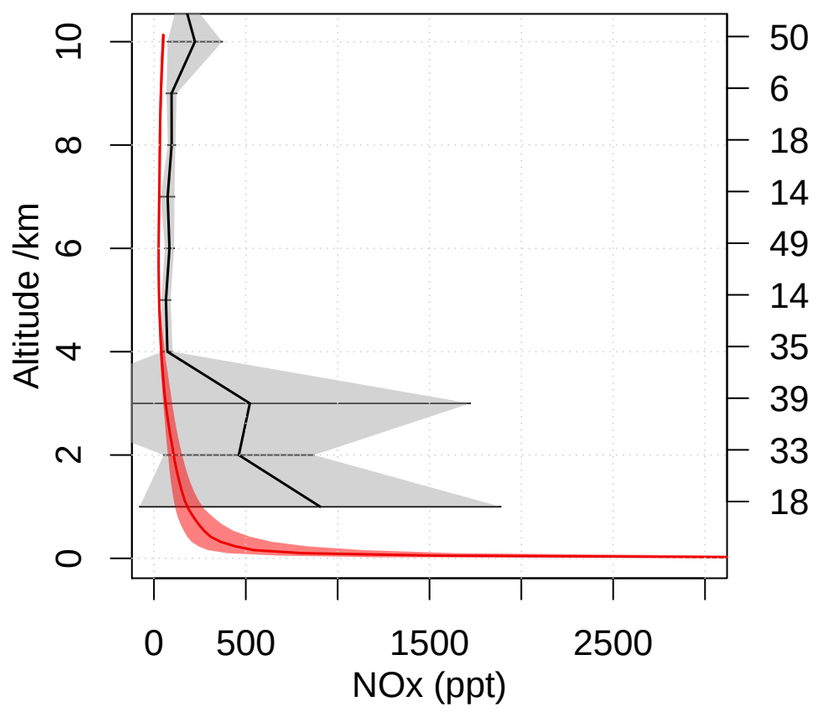
TRACE−A E−Brazil 1992 09
Lat −15 − −5 Lon 310 − 320



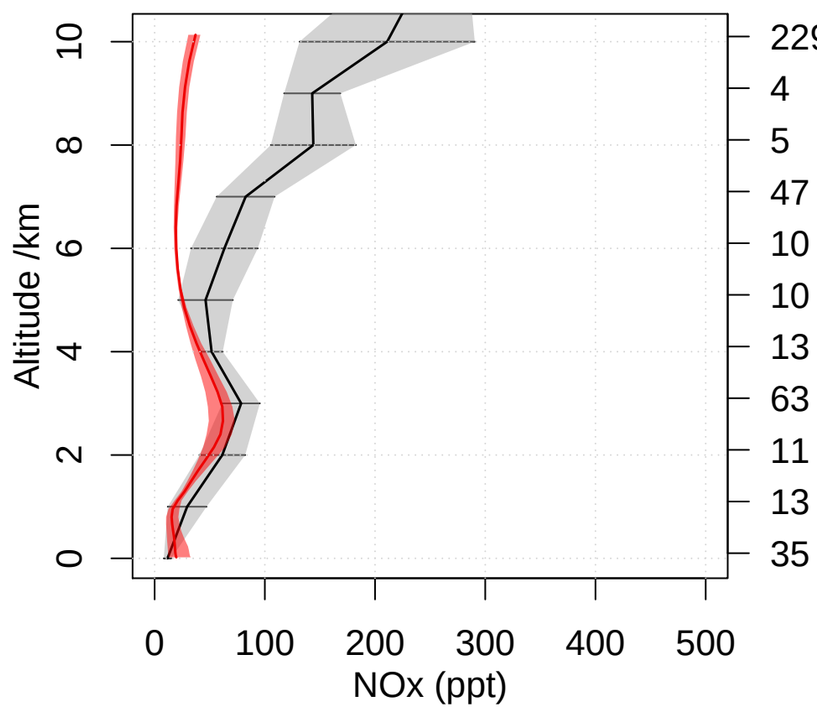
TRACE−A E−Brazil Coast 1992 09
Lat −35 − −25 Lon 310 − 320

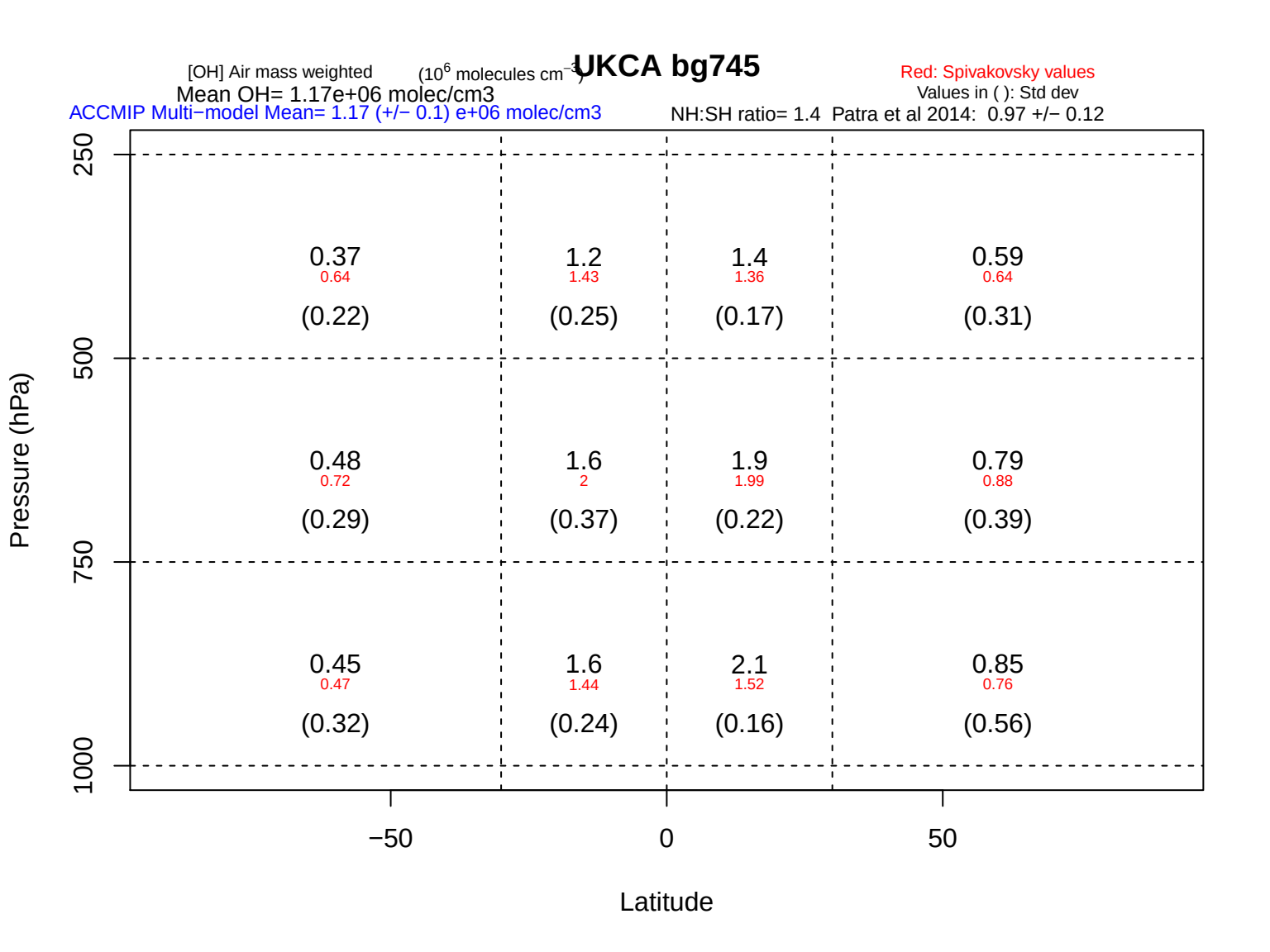


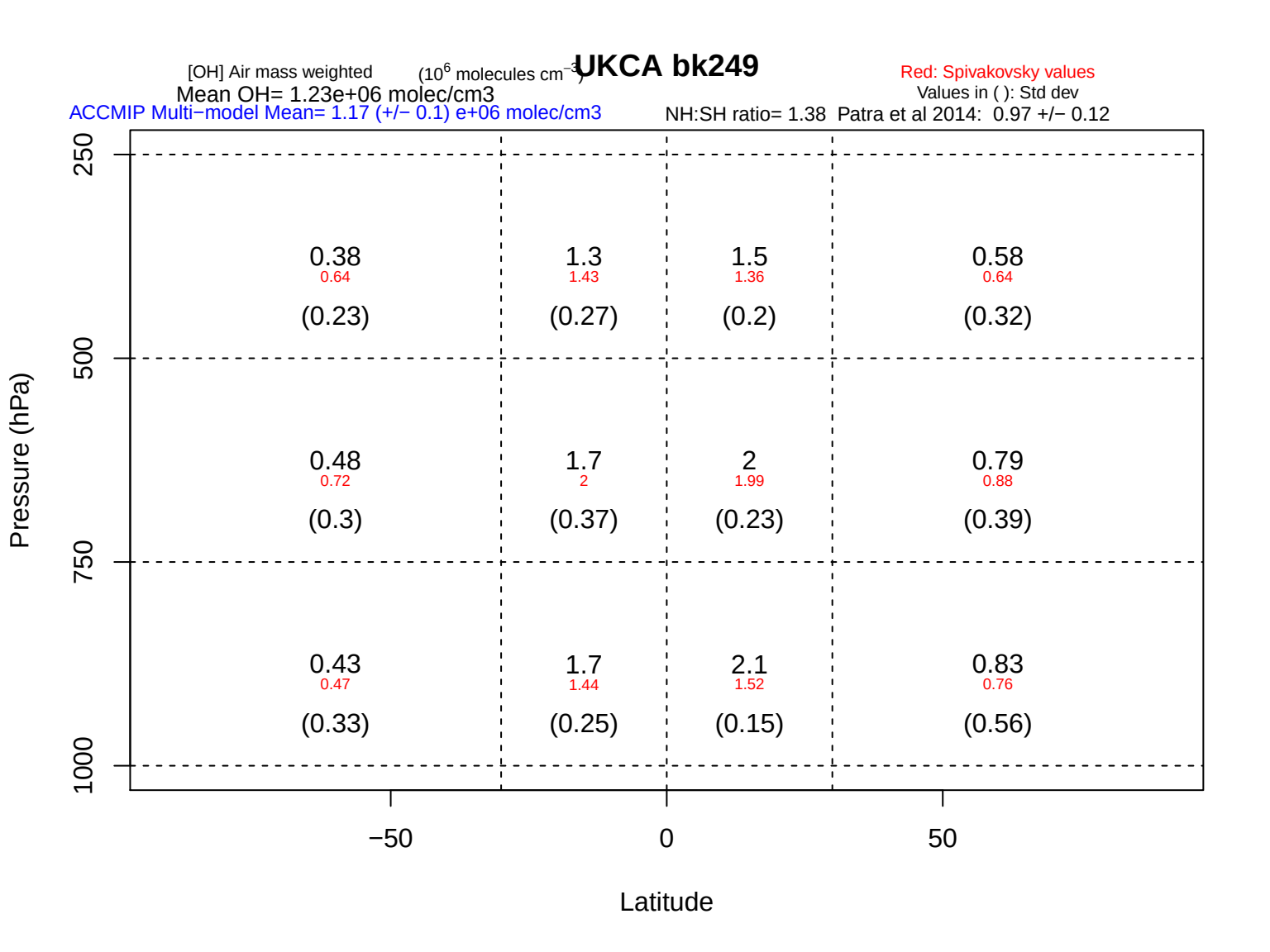
TRACE−A S−Africa 1992 09
Lat −25 − −5 Lon 15 − 35

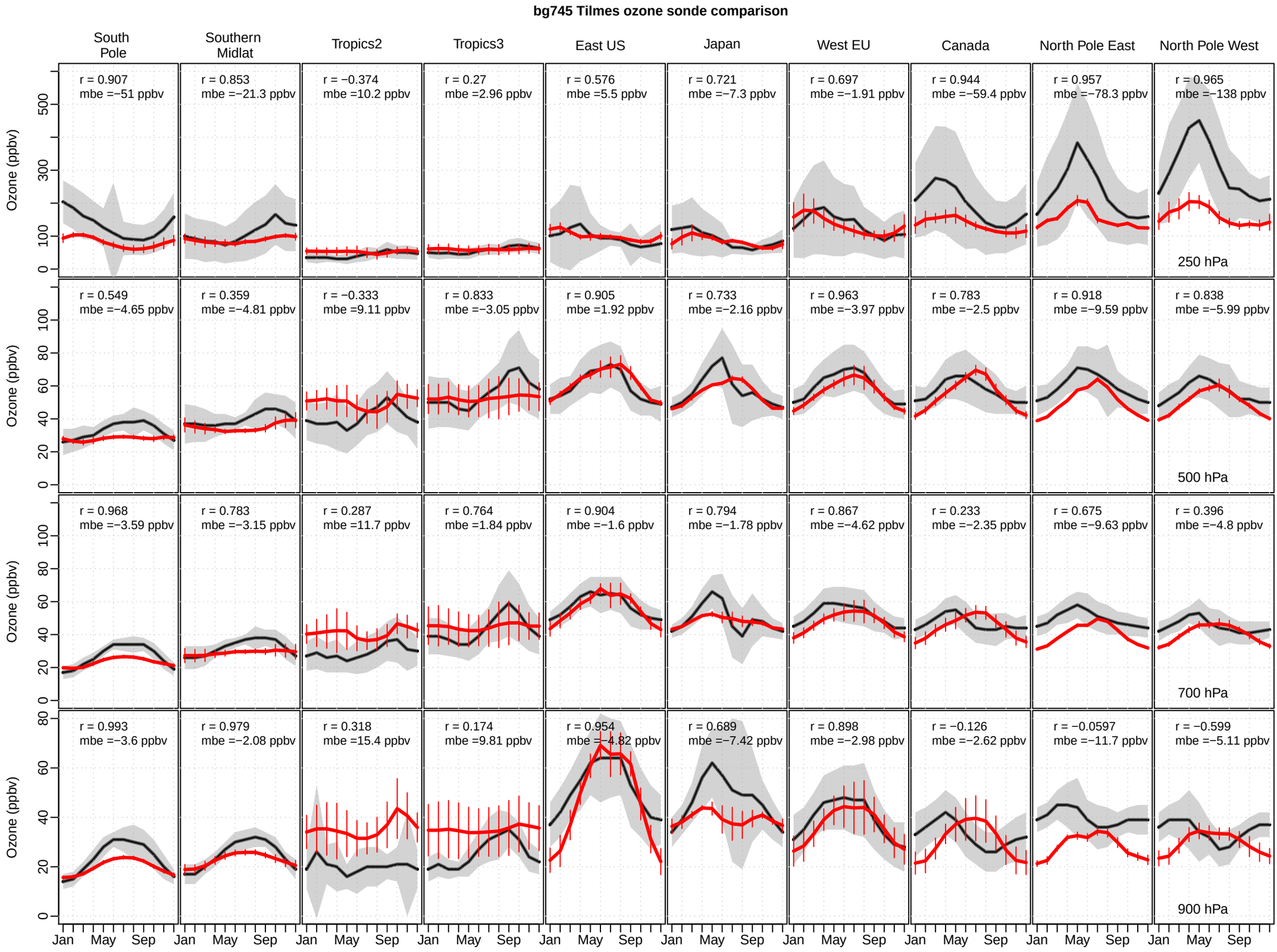


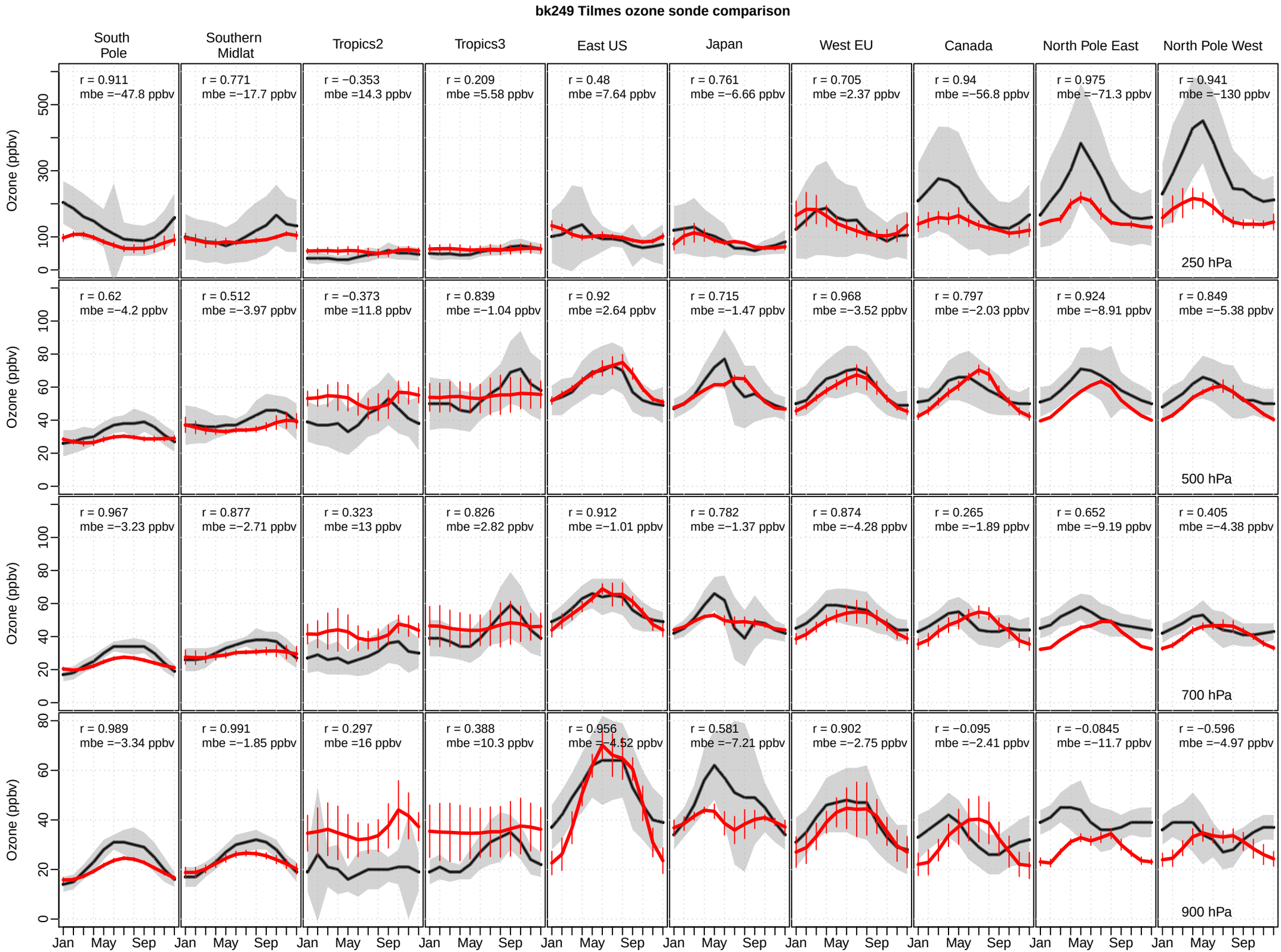
TRACE−A W−Africa Coast 1992 09
Lat −25 − −5 Lon 0 − 10

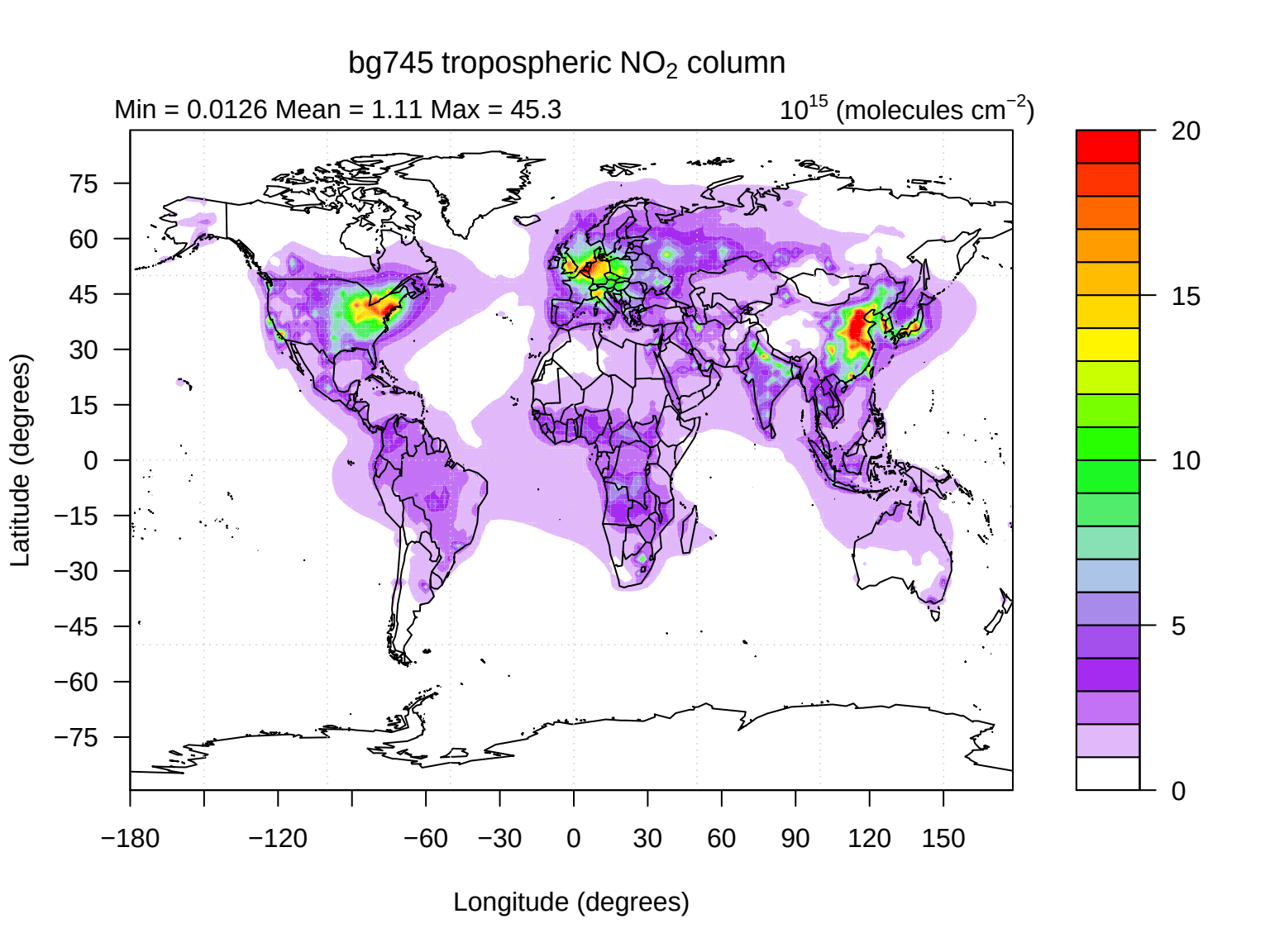


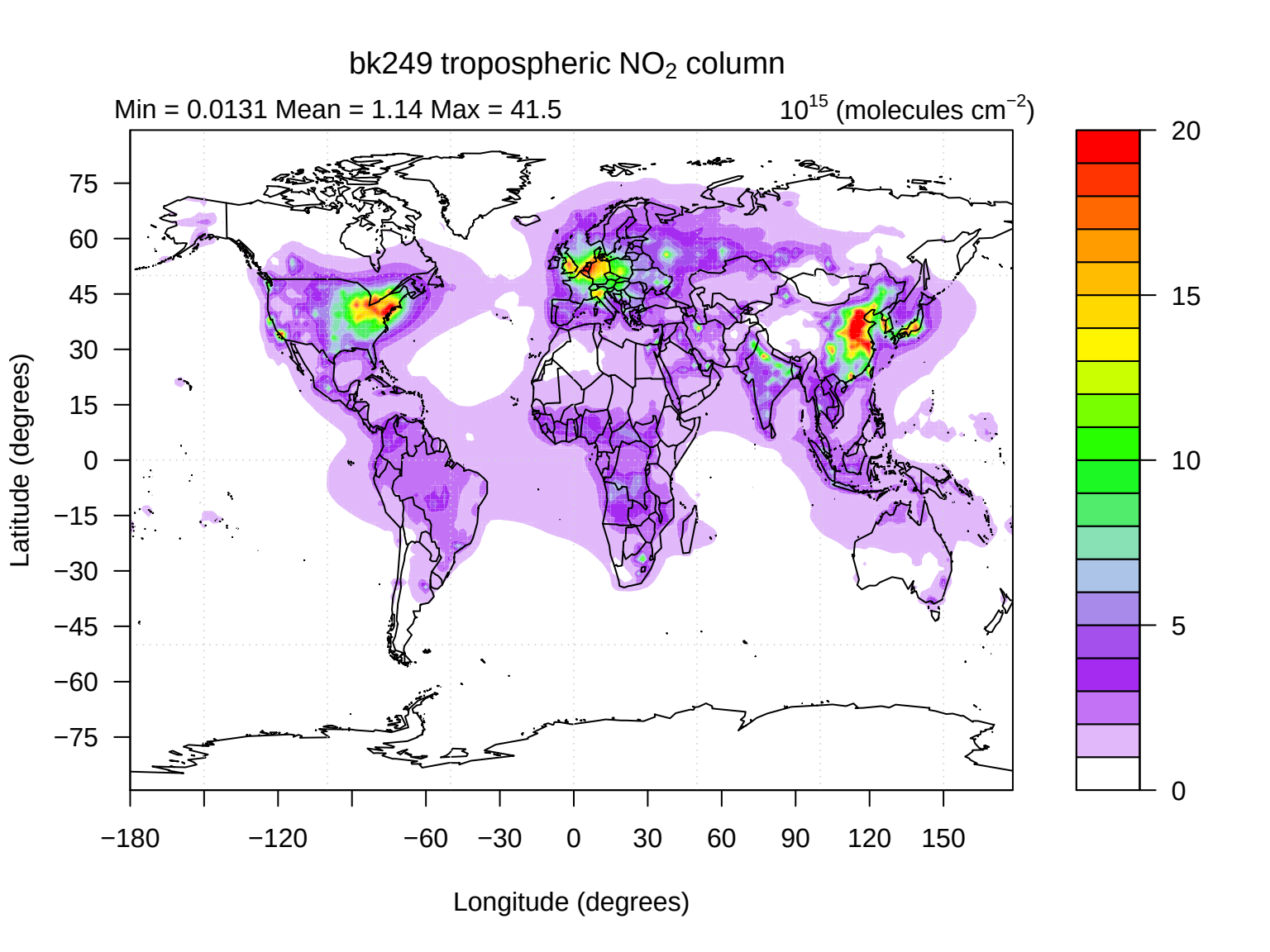

[OH] Air mass weighted (10^6 molecules cm^{-3})
UKCA bg745
Red: Spivakovsky values
Values in ( ): Std dev
Mean OH= 1.17e+06 molec/cm3
ACCMIP Multi−model Mean= 1.17 (+/− 0.1) e+06 molec/cm3
NH:SH ratio= 1.4 Patra et al 2014: 0.97 +/− 0.12
0.37
0.64
(0.22)
1.2
1.43
(0.25)
1.4
1.36
(0.17)
0.59
0.64
(0.31)
0.48
0.72
(0.29)
1.6
2
(0.37)
1.9
1.99
(0.22)
0.79
0.88
(0.39)
0.45
0.47
(0.32)
1.6
1.44
(0.24)
2.1
1.52
(0.16)
0.85
0.76
(0.56)
Pressure (hPa)
250
500
750
1000
−50
0
50
Latitude

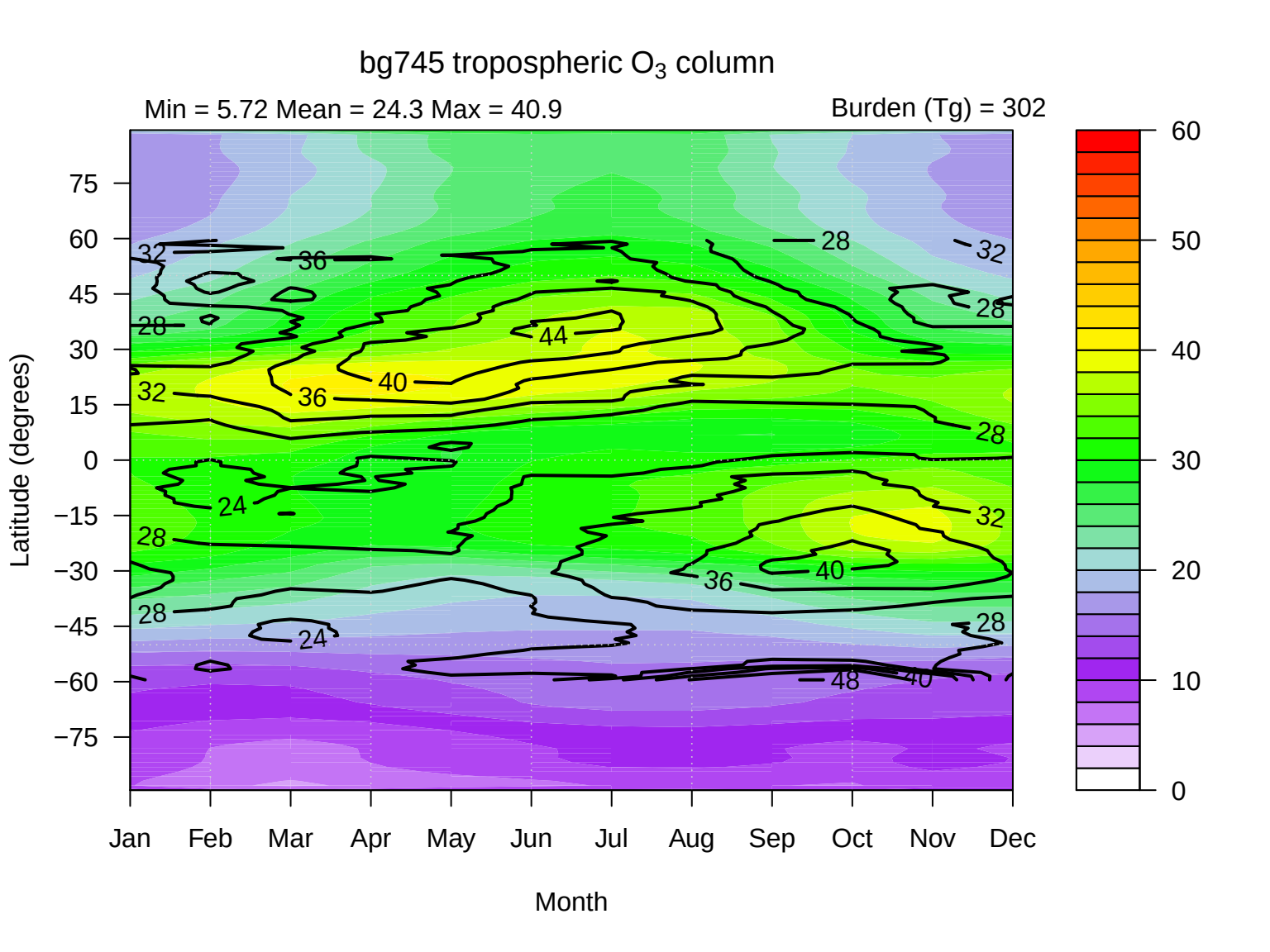

[OH] Air mass weighted (10^6 molecules cm^-3)
UKCA bk249
Red: Spivakovsky values
Values in ( ): Std dev
Mean OH= 1.23e+06 molec/cm3
ACCMIP Multi−model Mean= 1.17 (+/− 0.1) e+06 molec/cm3
NH:SH ratio= 1.38 Patra et al 2014: 0.97 +/− 0.12
0.38
0.64
(0.23)
1.3
1.43
(0.27)
1.5
1.36
(0.2)
0.58
0.64
(0.32)
0.48
0.72
(0.3)
1.7
2
(0.37)
2
1.99
(0.23)
0.79
0.88
(0.39)
0.43
0.47
(0.33)
1.7
1.44
(0.25)
2.1
1.52
(0.15)
0.83
0.76
(0.56)
Pressure (hPa)
250
500
750
1000
−50
0
50
Latitude

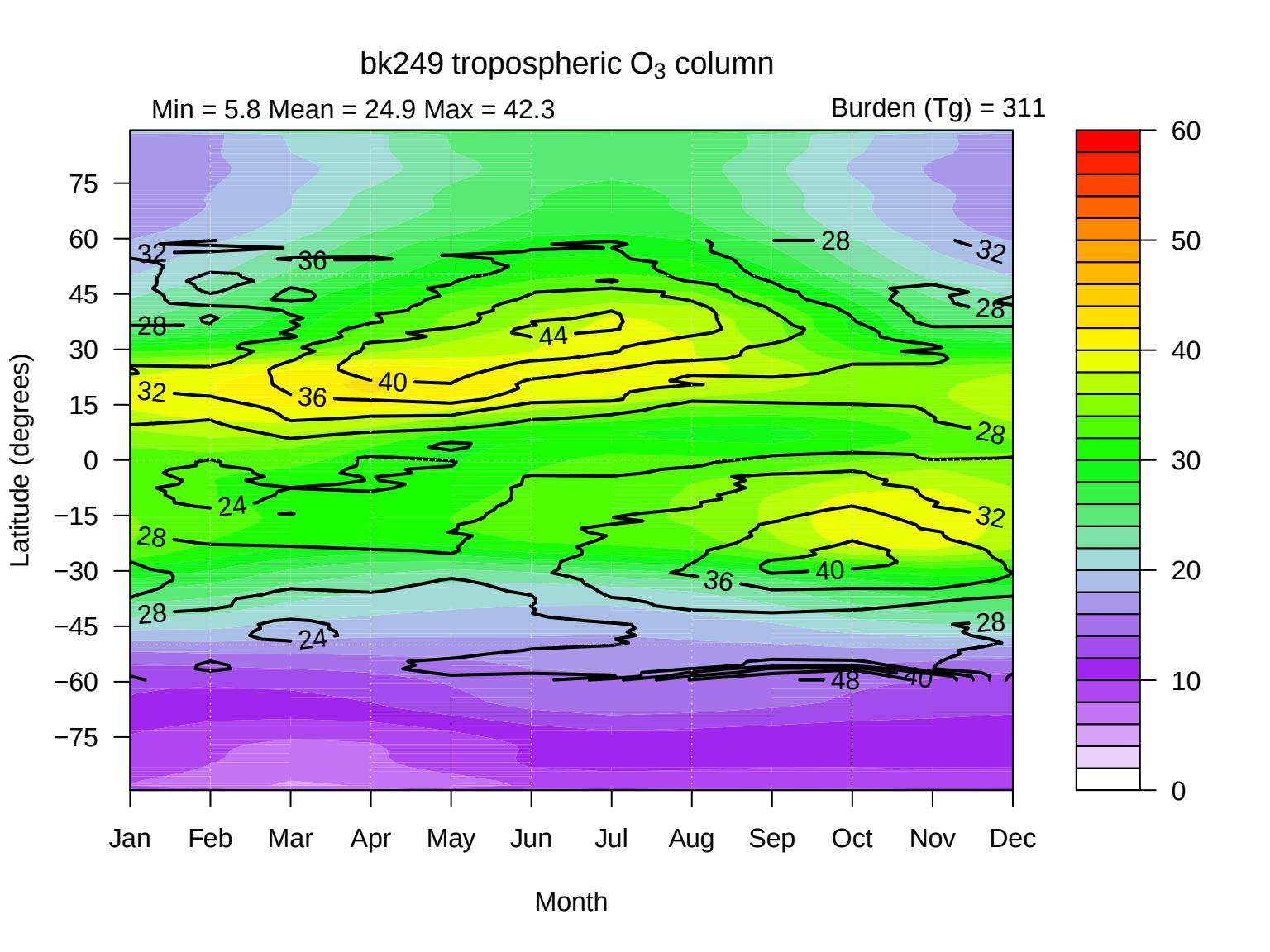

bg745 Tilmes ozone sonde comparison
South Pole
Southern Midlat
Tropics2
Tropics3
East US
Japan
West EU
Canada
North Pole East
North Pole West
Ozone (ppbv)
r = 0.907
mbe =−51 ppbv
r = 0.853
mbe =−21.3 ppbv
r = −0.374
mbe =10.2 ppbv
r = 0.27
mbe =2.96 ppbv
r = 0.576
mbe =5.5 ppbv
r = 0.721
mbe =−7.3 ppbv
r = 0.697
mbe =−1.91 ppbv
r = 0.944
mbe =−59.4 ppbv
r = 0.957
mbe =−78.3 ppbv
r = 0.965
mbe =−138 ppbv
250 hPa
r = 0.549
mbe =−4.65 ppbv
r = 0.359
mbe =−4.81 ppbv
r = −0.333
mbe =9.11 ppbv
r = 0.833
mbe =−3.05 ppbv
r = 0.905
mbe =1.92 ppbv
r = 0.733
mbe =−2.16 ppbv
r = 0.963
mbe =−3.97 ppbv
r = 0.783
mbe =−2.5 ppbv
r = 0.918
mbe =−9.59 ppbv
r = 0.838
mbe =−5.99 ppbv
500 hPa
r = 0.968
mbe =−3.59 ppbv
r = 0.783
mbe =−3.15 ppbv
r = 0.287
mbe =11.7 ppbv
r = 0.764
mbe =1.84 ppbv
r = 0.904
mbe =−1.6 ppbv
r = 0.794
mbe =−1.78 ppbv
r = 0.867
mbe =−4.62 ppbv
r = 0.233
mbe =−2.35 ppbv
r = 0.675
mbe =−9.63 ppbv
r = 0.396
mbe =−4.8 ppbv
700 hPa
r = 0.993
mbe =−3.6 ppbv
r = 0.979
mbe =−2.08 ppbv
r = 0.318
mbe =15.4 ppbv
r = 0.174
mbe =9.81 ppbv
r = 0.954
mbe =−4.82 ppbv
r = 0.689
mbe =−7.42 ppbv
r = 0.898
mbe =−2.98 ppbv
r = −0.126
mbe =−2.62 ppbv
r = −0.0597
mbe =−11.7 ppbv
r = −0.599
mbe =−5.11 ppbv
900 hPa
Jan
May
Sep


bk249 Tilmes ozone sonde comparison
South Pole
Southern Midlat
Tropics2
Tropics3
East US
Japan
West EU
Canada
North Pole East
North Pole West
Ozone (ppbv)
r = 0.911
mbe =−47.8 ppbv
r = 0.771
mbe =−17.7 ppbv
r = −0.353
mbe =14.3 ppbv
r = 0.209
mbe =5.58 ppbv
r = 0.48
mbe =7.64 ppbv
r = 0.761
mbe =−6.66 ppbv
r = 0.705
mbe =2.37 ppbv
r = 0.94
mbe =−56.8 ppbv
r = 0.975
mbe =−71.3 ppbv
r = 0.941
mbe =−130 ppbv
250 hPa
r = 0.62
mbe =−4.2 ppbv
r = 0.512
mbe =−3.97 ppbv
r = −0.373
mbe =11.8 ppbv
r = 0.839
mbe =−1.04 ppbv
r = 0.92
mbe =2.64 ppbv
r = 0.715
mbe =−1.47 ppbv
r = 0.968
mbe =−3.52 ppbv
r = 0.797
mbe =−2.03 ppbv
r = 0.924
mbe =−8.91 ppbv
r = 0.849
mbe =−5.38 ppbv
500 hPa
r = 0.967
mbe =−3.23 ppbv
r = 0.877
mbe =−2.71 ppbv
r = 0.323
mbe =13 ppbv
r = 0.826
mbe =2.82 ppbv
r = 0.912
mbe =−1.01 ppbv
r = 0.782
mbe =−1.37 ppbv
r = 0.874
mbe =−4.28 ppbv
r = 0.265
mbe =−1.89 ppbv
r = 0.652
mbe =−9.19 ppbv
r = 0.405
mbe =−4.38 ppbv
700 hPa
r = 0.989
mbe =−3.34 ppbv
r = 0.991
mbe =−1.85 ppbv
r = 0.297
mbe =16 ppbv
r = 0.388
mbe =10.3 ppbv
r = 0.956
mbe =−4.52 ppbv
r = 0.581
mbe =−7.21 ppbv
r = 0.902
mbe =−2.75 ppbv
r = −0.095
mbe =−2.41 ppbv
r = −0.0845
mbe =−11.7 ppbv
r = −0.596
mbe =−4.97 ppbv
900 hPa
Jan
May
Sep


bg745 tropospheric NO2 column
Min = 0.0126 Mean = 1.11 Max = 45.3
10^15 (molecules cm^-2)
Latitude (degrees)
75
60
45
30
15
0
−15
−30
−45
−60
−75
−180
−120
−60
−30
0
30
60
90
120
150
Longitude (degrees)
20
15
10
5
0

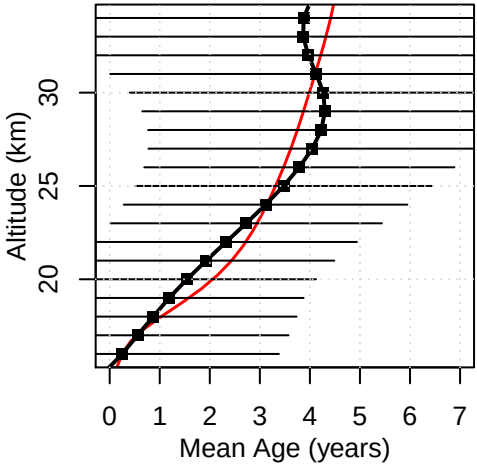

bk249 tropospheric NO2 column
Min = 0.0131 Mean = 1.14 Max = 41.5
10^15 (molecules cm^-2)
Latitude (degrees)
75
60
45
30
15
0
−15
−30
−45
−60
−75
−180
−120
−60
−30
0
30
60
90
120
150
Longitude (degrees)
20
15
10
5
0


bg745 tropospheric O_3 column
Min = 5.72 Mean = 24.3 Max = 40.9
Burden (Tg) = 302
Latitude (degrees)
75
60
45
30
15
0
−15
−30
−45
−60
−75
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
60
50
40
30
20
10
0

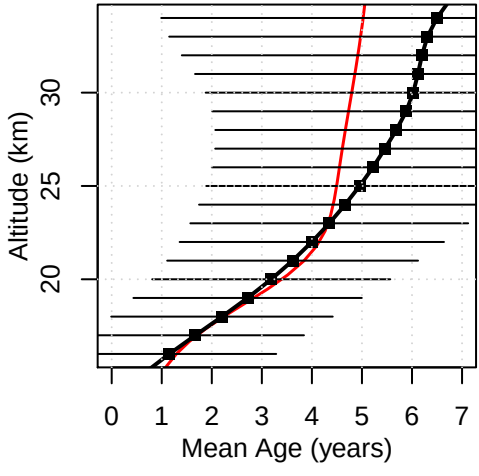

bk249 tropospheric O_3 column
Min = 5.8 Mean = 24.9 Max = 42.3
Burden (Tg) = 311
Latitude (degrees)
75
60
45
30
15
0
−15
−30
−45
−60
−75
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
60
50
40
30
20
10
0

UKCA bg745 Mean Age of Air

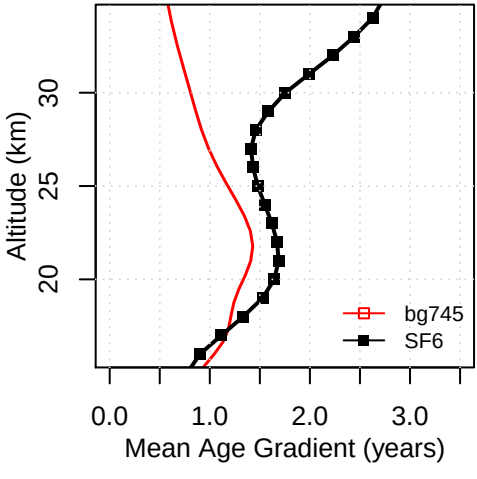
Tropical Mean Age Profile



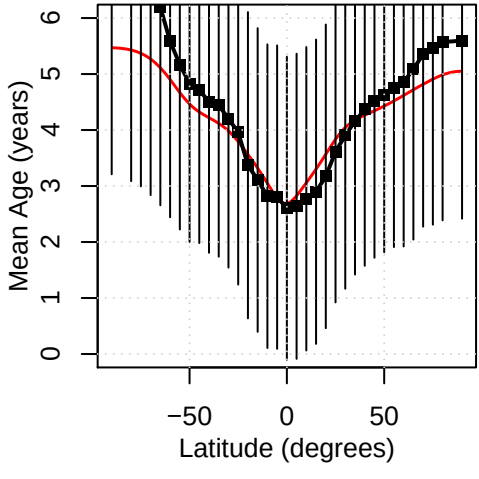
Midlatitude Mean Age Profile



Trop−Midlat Mean Age Gradient Prof

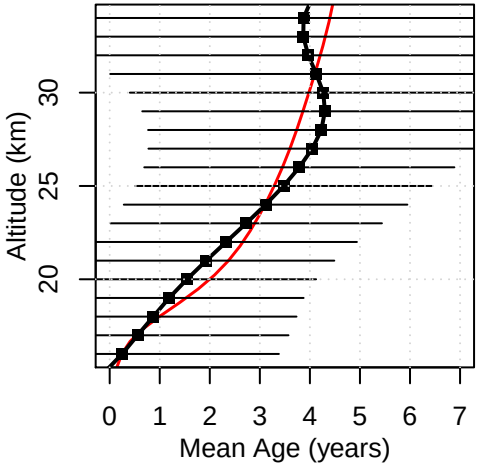


Mean Age, 23km (~50hPa)

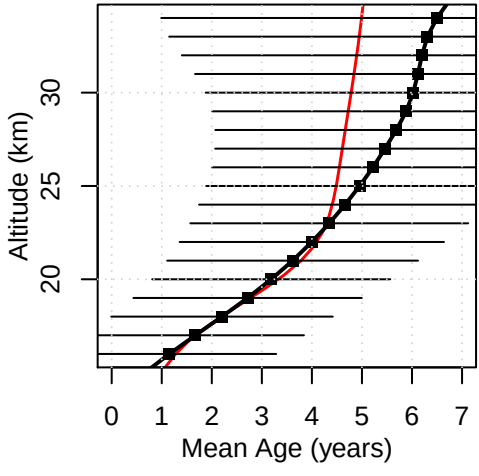


UKCA bk249 Mean Age of Air

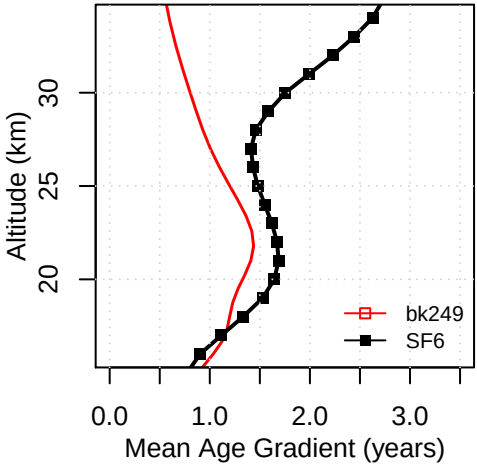
Tropical Mean Age Profile



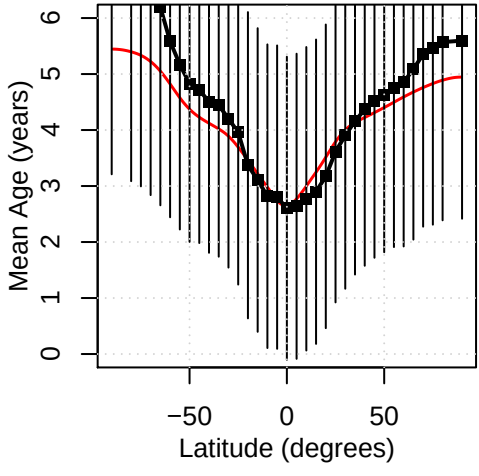
Midlatitude Mean Age Profile

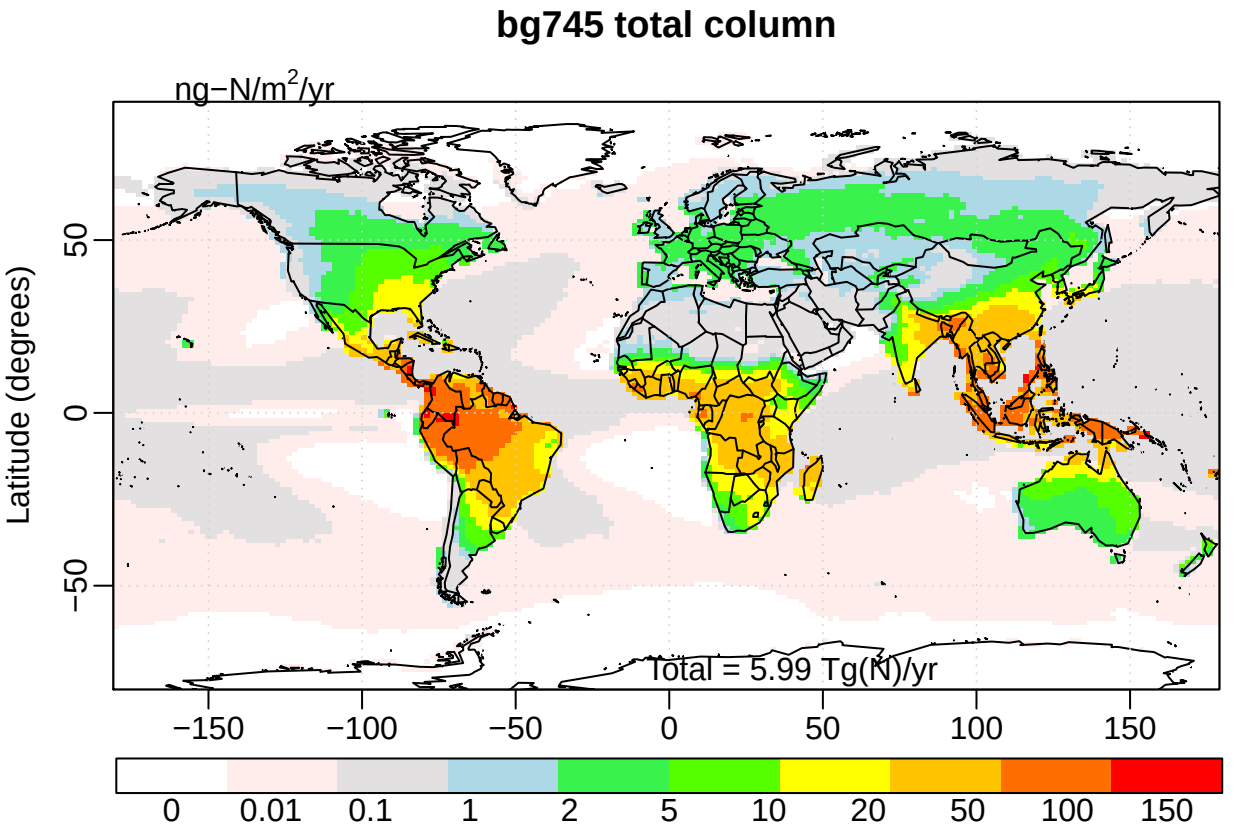


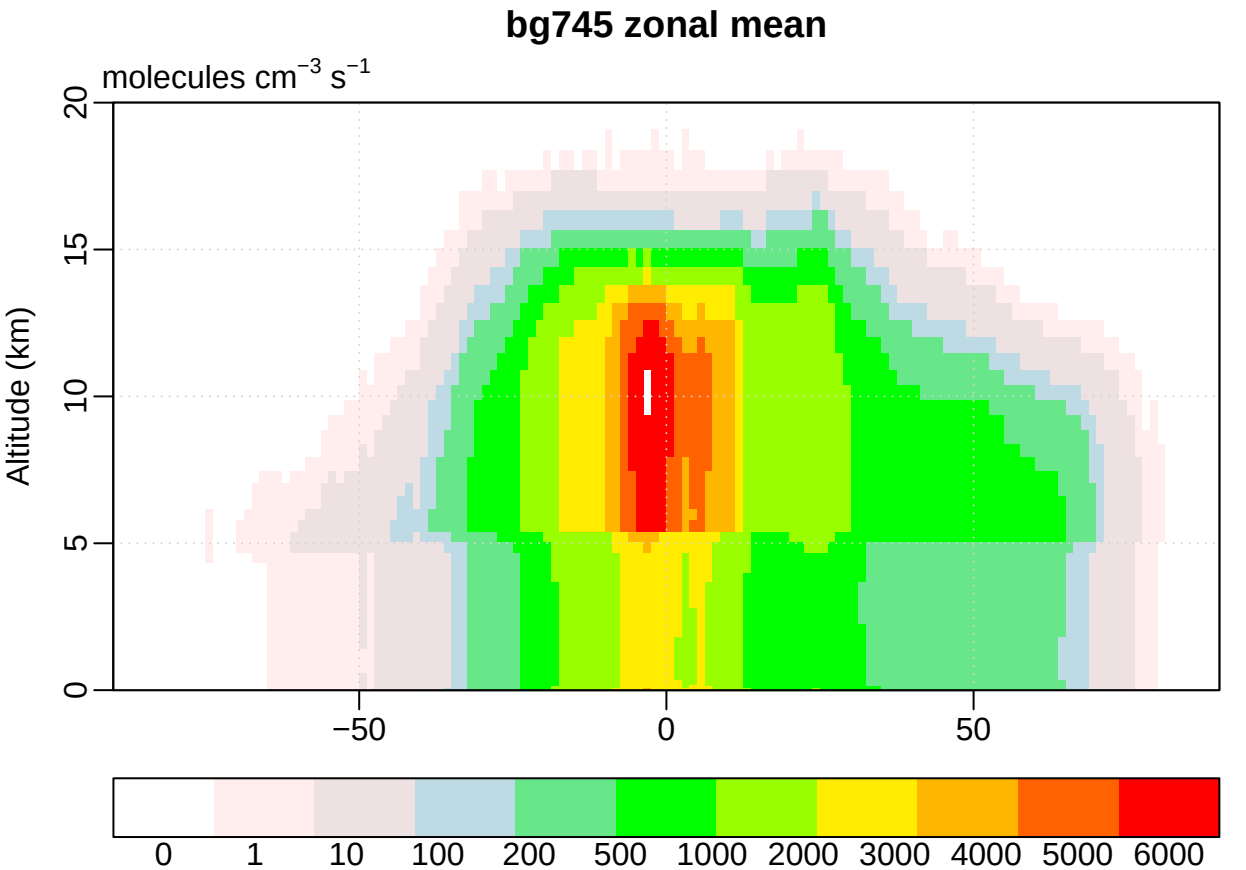
Trop−Midlat Mean Age Gradient Prof

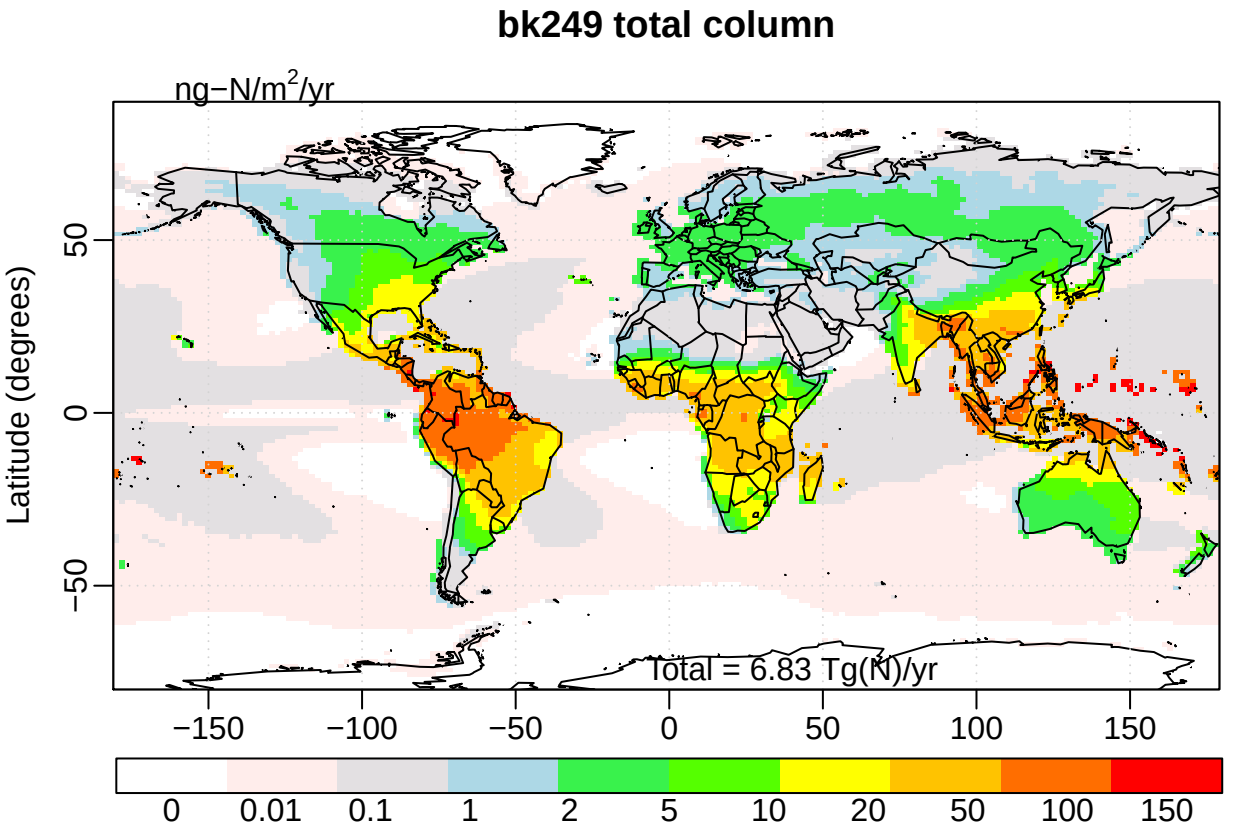


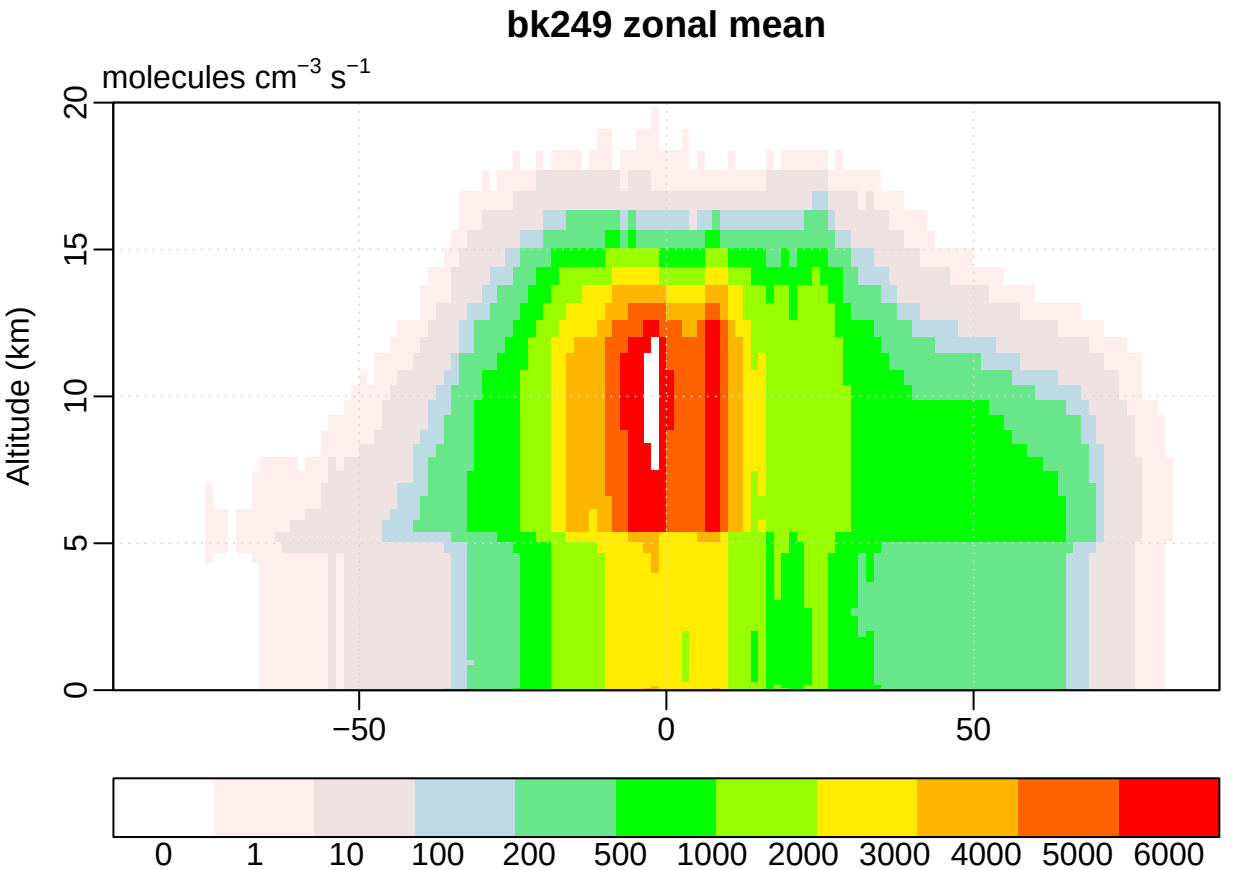
Mean Age, 23km (~50hPa)

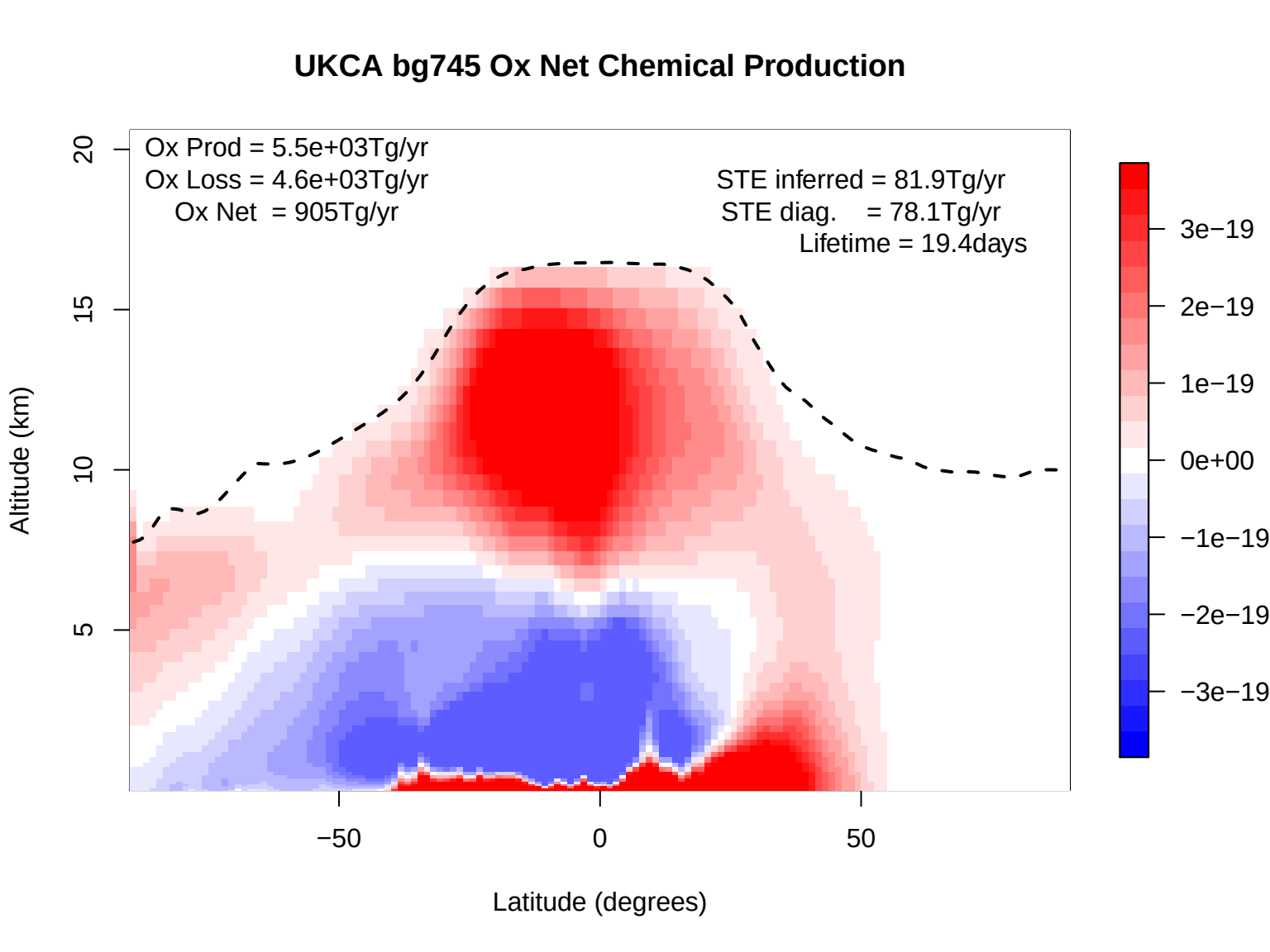


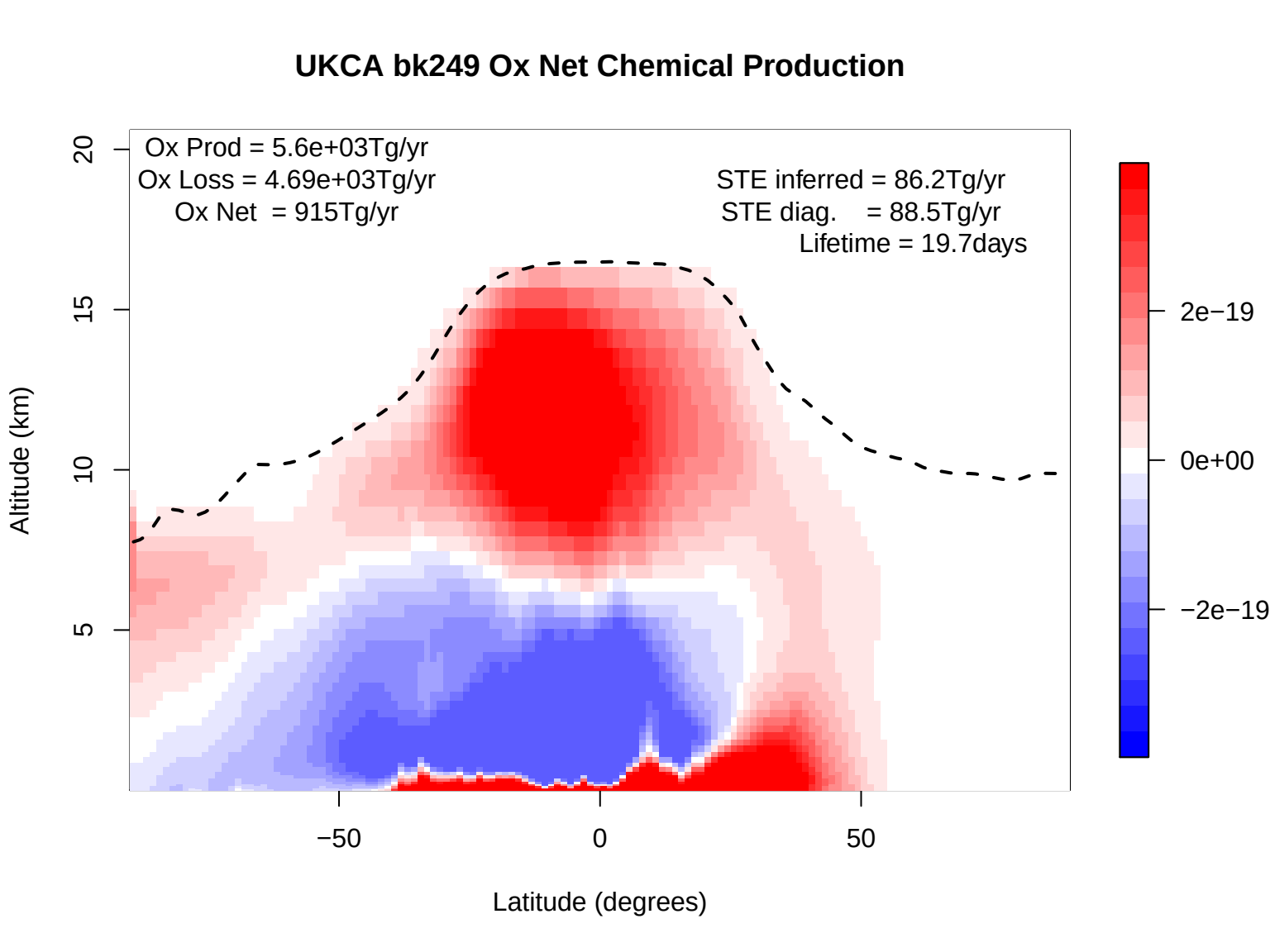

bg745 total column
ng−N/m2/yr
Latitude (degrees)
50
0
−50
Total = 5.99 Tg(N)/yr
−150
−100
−50
0
50
100
150
0
0.01
0.1
1
2
5
10
20
50
100
150

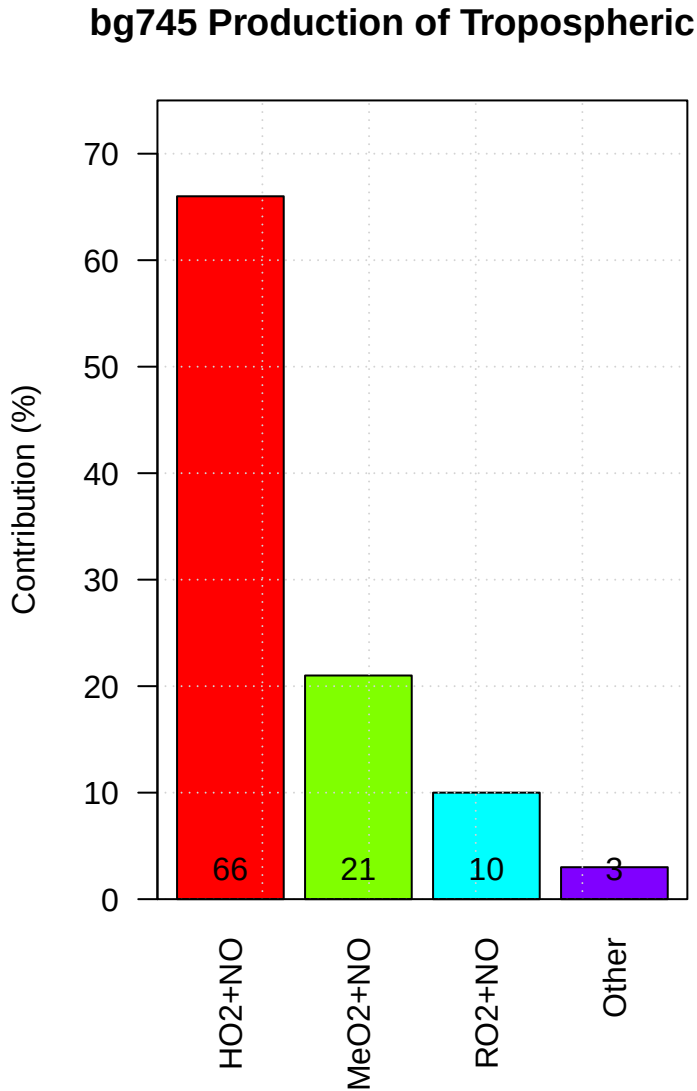

bg745 zonal mean
molecules cm−3 s−1
Altitude (km)
20
15
10
5
0
−50
0
50
0
1
10
100
200
500
1000
2000
3000
4000
5000
6000

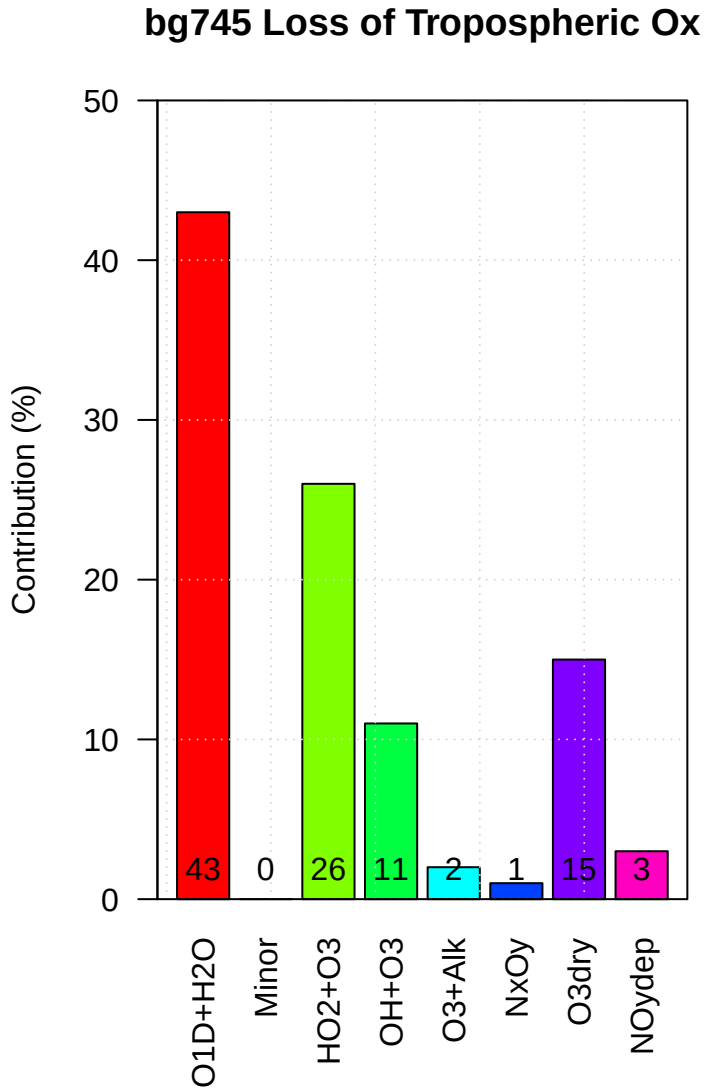

bk249 total column
ng−N/m2/yr
Latitude (degrees)
50
0
−50
Total = 6.83 Tg(N)/yr
−150
−100
−50
0
50
100
150
0
0.01
0.1
1
2
5
10
20
50
100
150

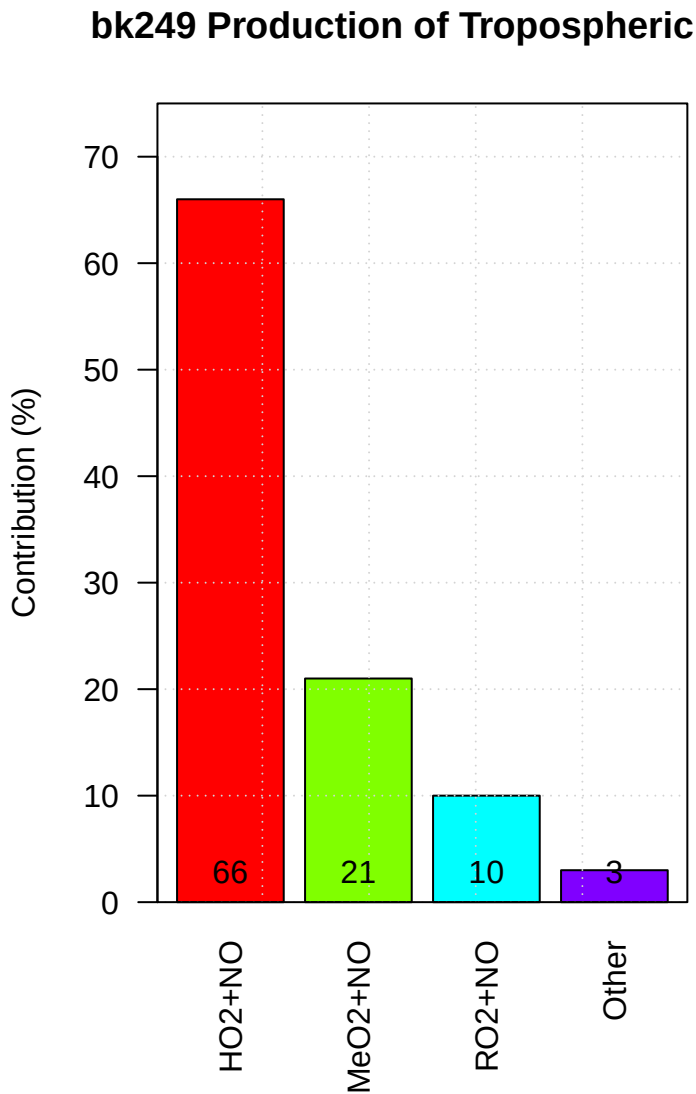

bk249 zonal mean
molecules cm−3 s−1
Altitude (km)
20
15
10
5
0
−50
0
50
0
1
10
100
200
500
1000
2000
3000
4000
5000
6000

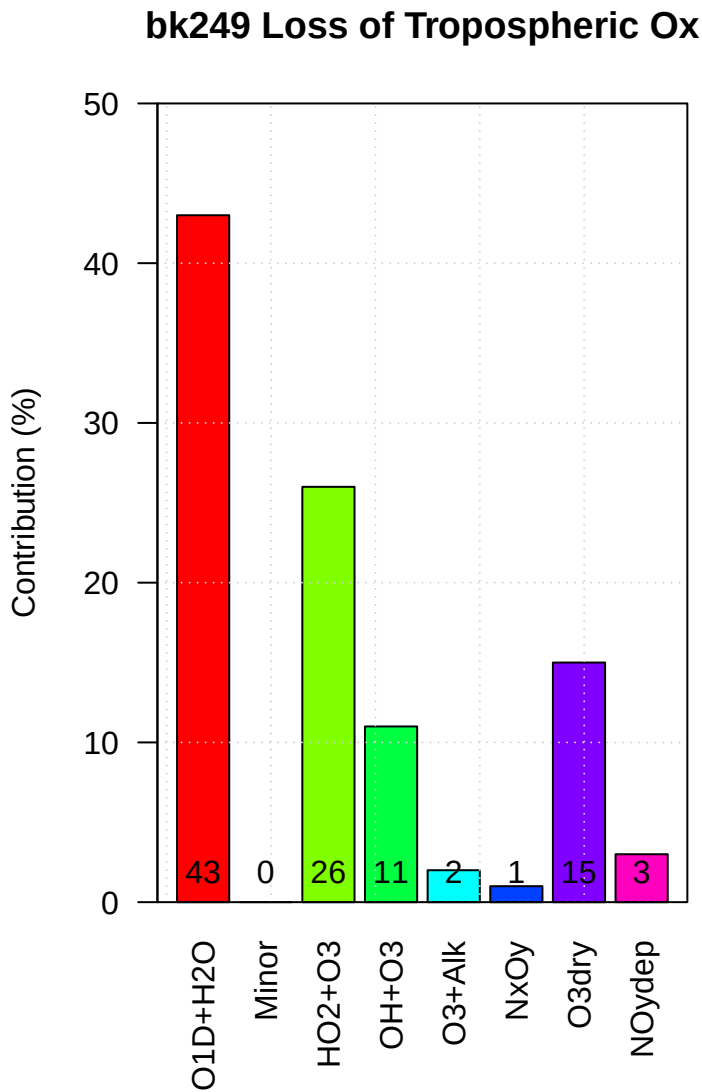

UKCA bg745 Ox Net Chemical Production
Ox Prod = 5.5e+03Tg/yr
Ox Loss = 4.6e+03Tg/yr
Ox Net = 905Tg/yr
STE inferred = 81.9Tg/yr
STE diag. = 78.1Tg/yr
Lifetime = 19.4days
Altitude (km)
20
15
10
5
−50
0
50
Latitude (degrees)
3e−19
2e−19
1e−19
0e+00
−1e−19
−2e−19
−3e−19

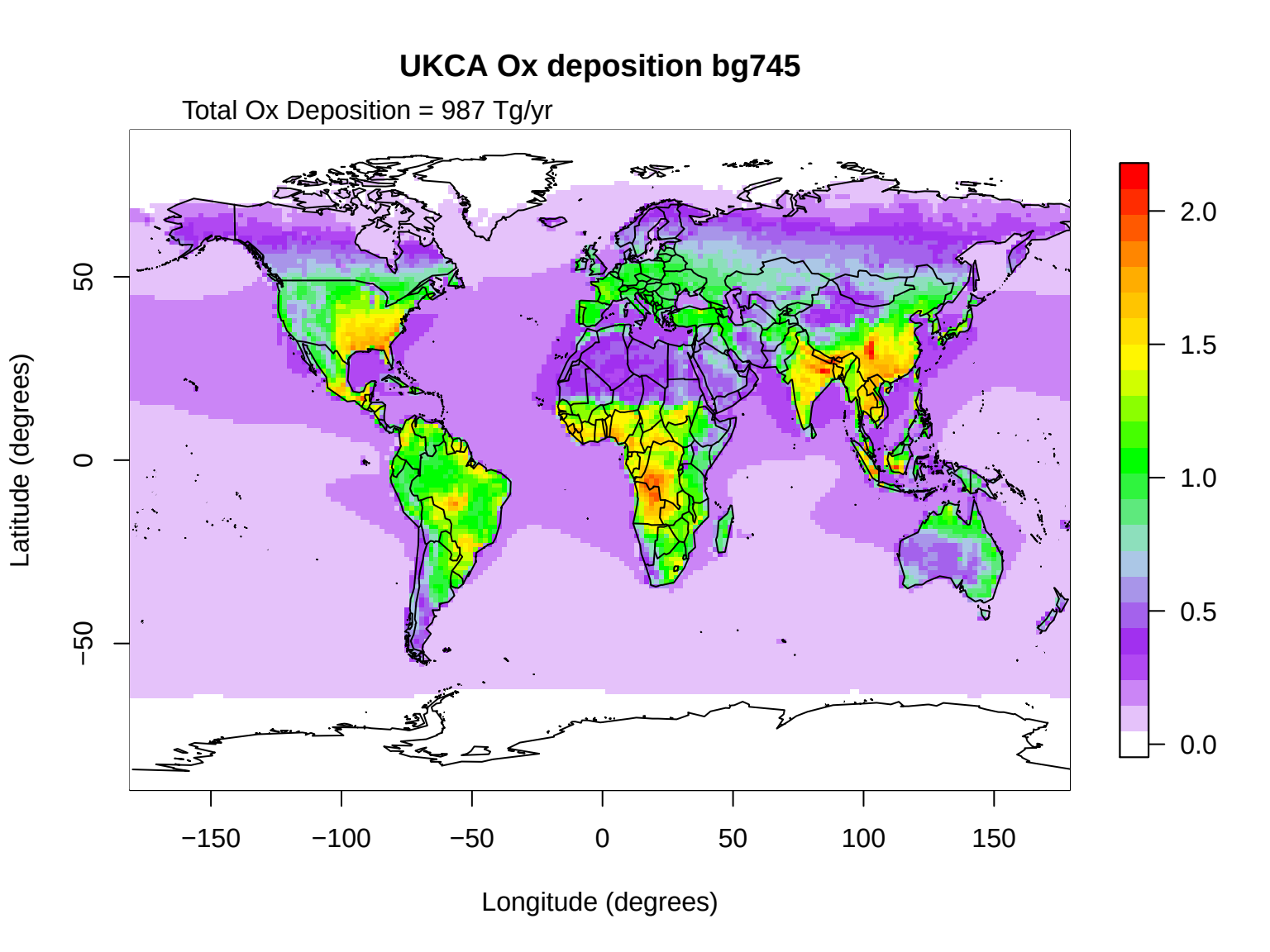

UKCA bk249 Ox Net Chemical Production
Ox Prod = 5.6e+03Tg/yr
Ox Loss = 4.69e+03Tg/yr
Ox Net = 915Tg/yr
STE inferred = 86.2Tg/yr
STE diag. = 88.5Tg/yr
Lifetime = 19.7days
Altitude (km)
20
15
10
5
−50
0
50
Latitude (degrees)
2e−19
0e+00
−2e−19

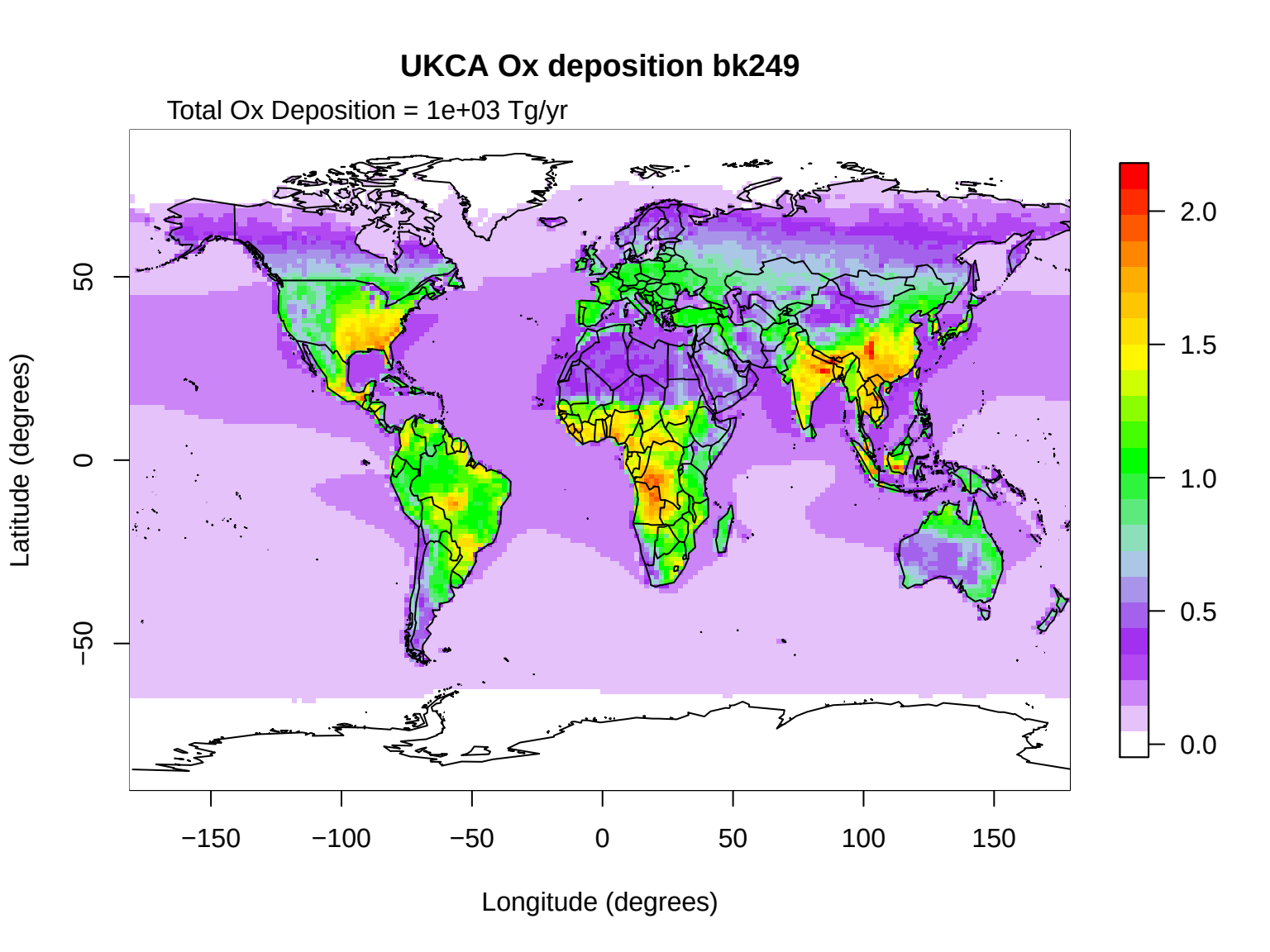

bg745 Production of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
60
70
66
21
10
3
HO2+NO
MeO2+NO
RO2+NO
Other


bg745 Loss of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
43
0
26
11
2
1
15
3
O1D+H2O
Minor
HO2+O3
OH+O3
O3+Alk
NxOy
O3dry
NOydep


bk249 Production of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
60
70
66
21
10
3
HO2+NO
MeO2+NO
RO2+NO
Other


bk249 Loss of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
43
0
26
11
2
1
15
3
O1D+H2O
Minor
HO2+O3
OH+O3
O3+Alk
NxOy
O3dry
NOydep


UKCA Ox deposition bg745
Total Ox Deposition = 987 Tg/yr
Latitude (degrees)
50
0
−50
−150
−100
−50
0
50
100
150
Longitude (degrees)
2.0
1.5
1.0
0.5
0.0


UKCA Ox deposition bk249
Total Ox Deposition = 1e+03 Tg/yr
Latitude (degrees)
50
0
−50
−150
−100
−50
0
50
100
150
Longitude (degrees)
2.0
1.5
1.0
0.5
0.0

90S − 60S

60S − 30S

30S − 30N

30N − 60N

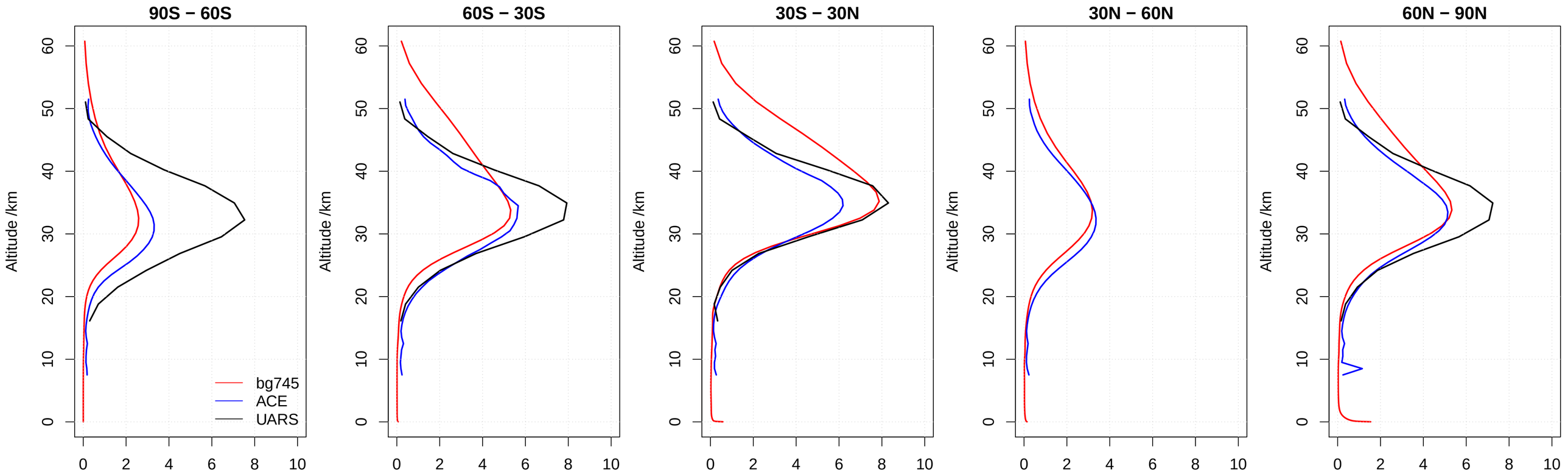
60N − 90N

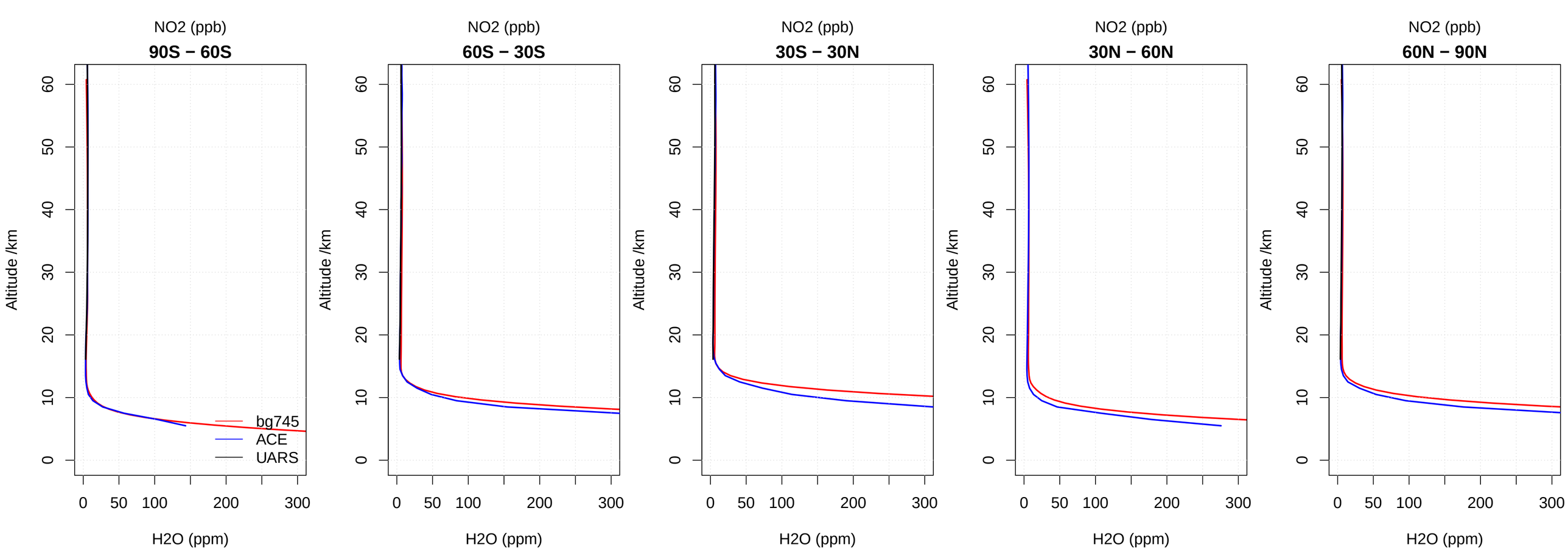
Altitude /km

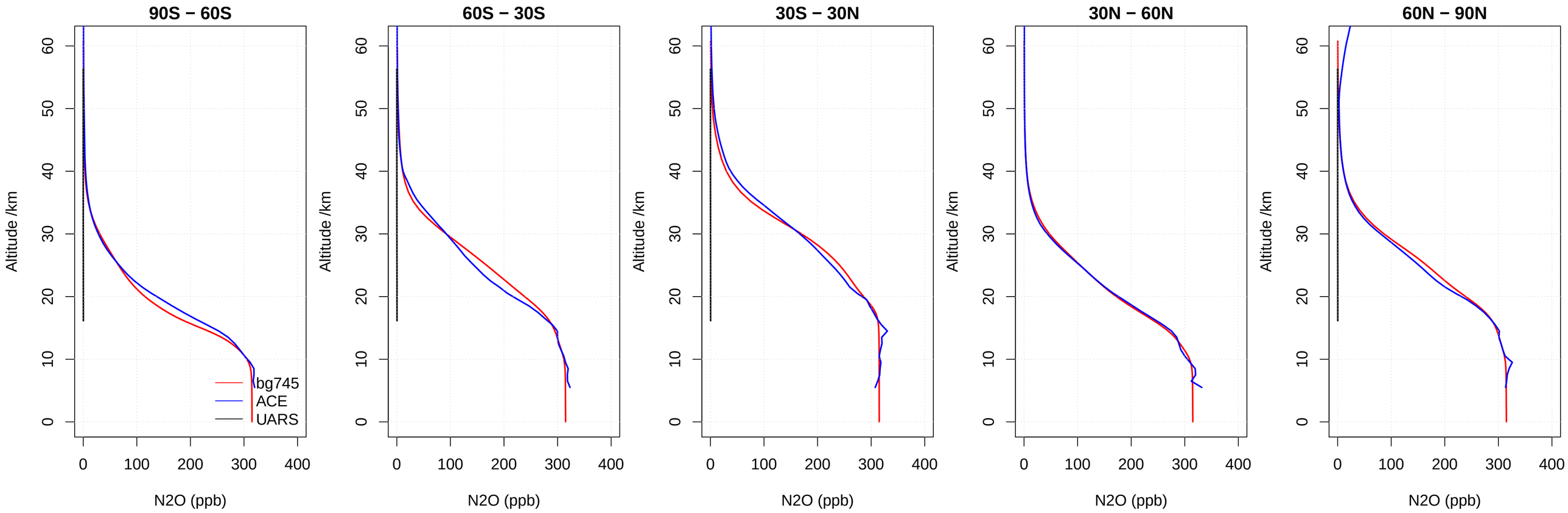
Ozone (ppm)

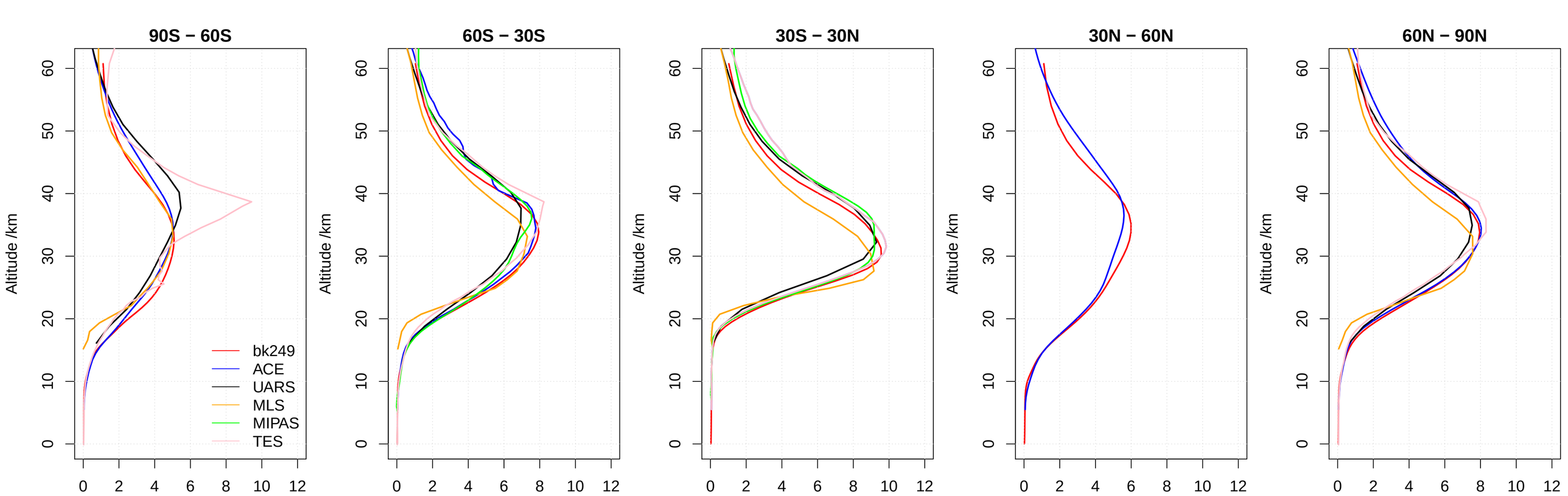
HONO2 (ppb)

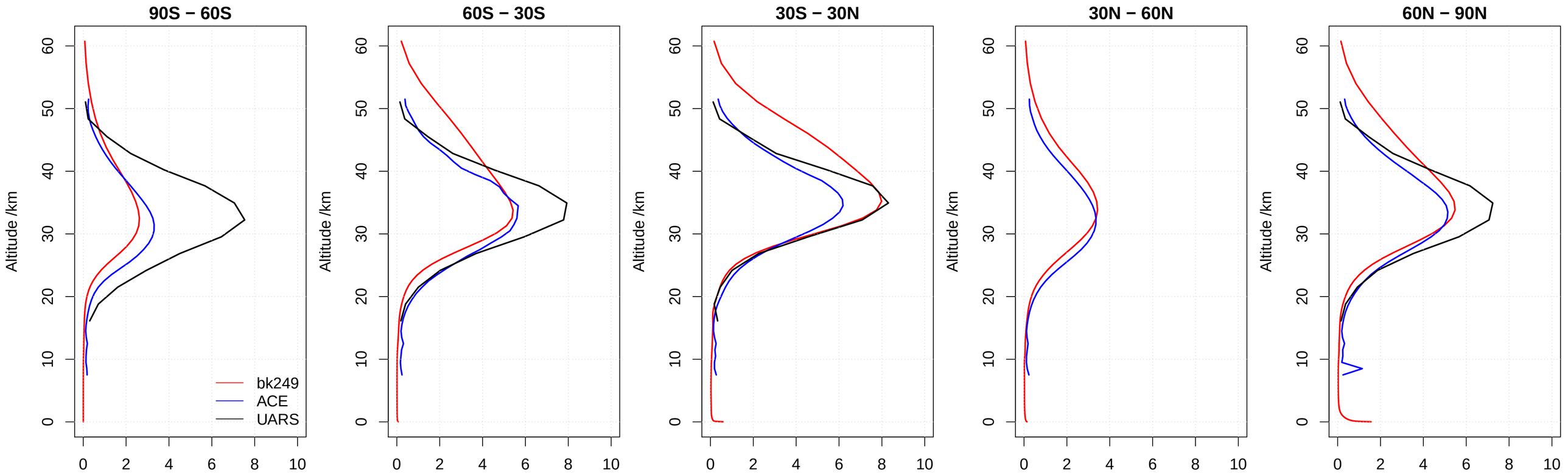
bg745
ACE
UARS
MLS
MIPAS
TES

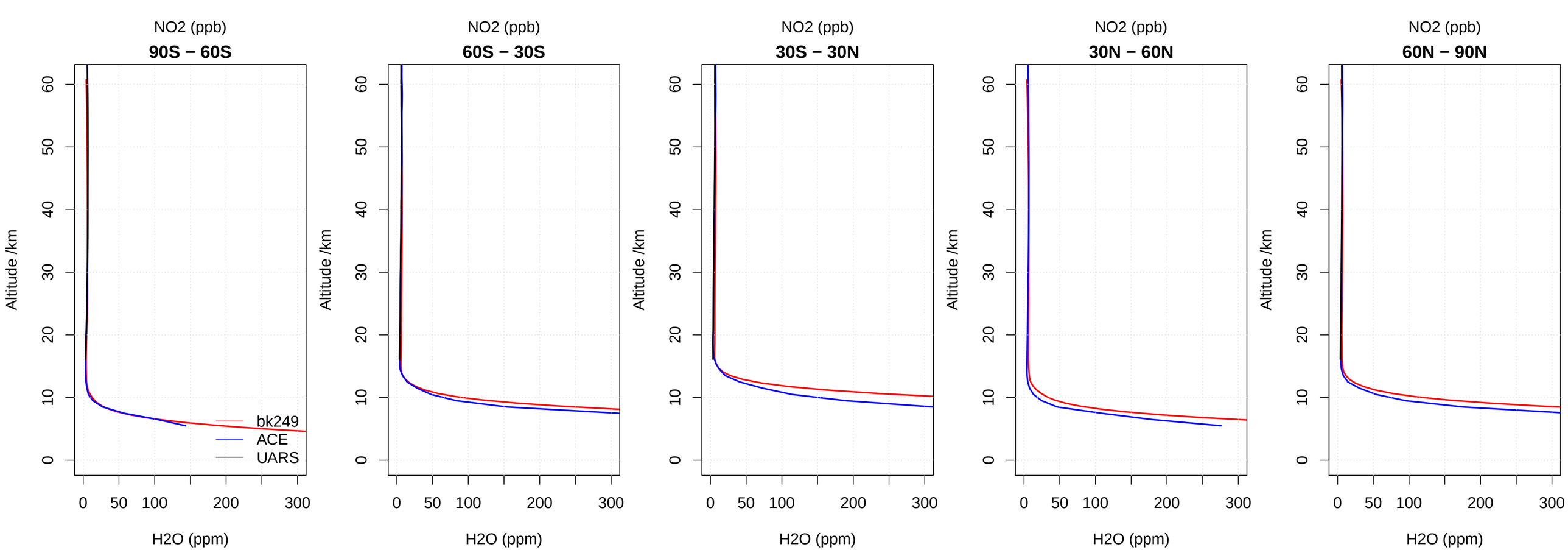

90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
0
10
20
30
40
50
60
0
2
4
6
8
10
bg745
ACE
UARS

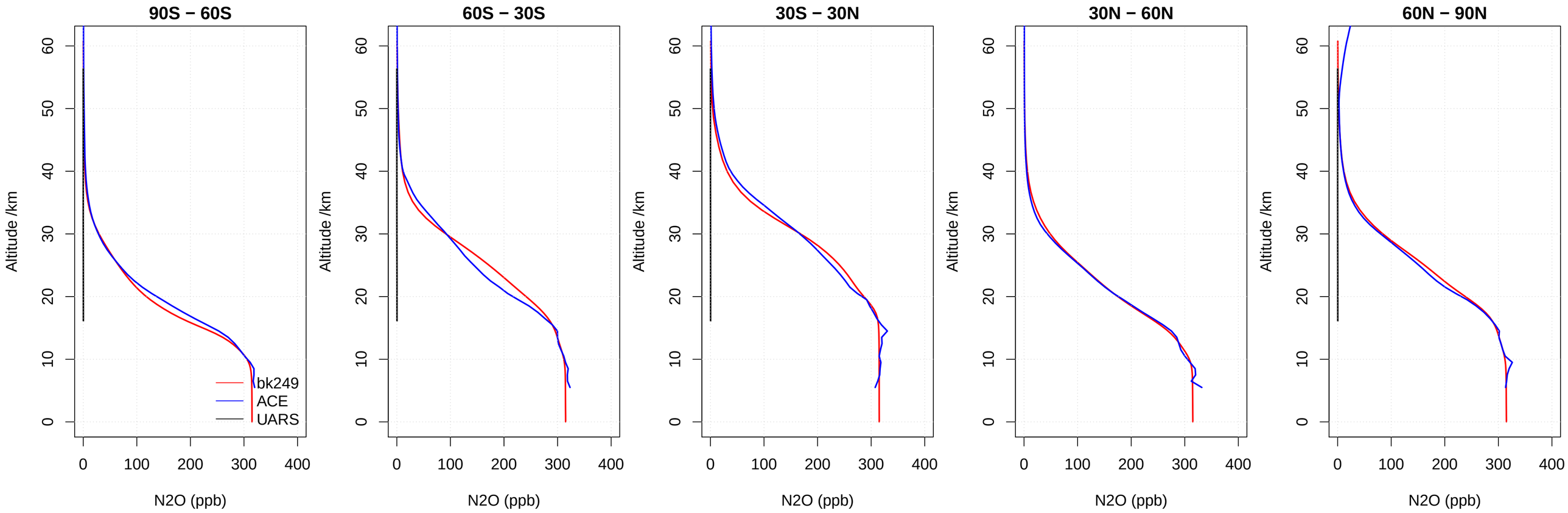

NO2 (ppb)
90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
0
10
20
30
40
50
60
0
50
100
200
300
H2O (ppm)
bg745
ACE
UARS


90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
N2O (ppb)
bg745
ACE
UARS
0
10
20
30
40
50
60
0
100
200
300
400


90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
Ozone (ppm)
HONO2 (ppb)
bk249
ACE
UARS
MLS
MIPAS
TES


90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
0
10
20
30
40
50
60
0
2
4
6
8
10
bk249
ACE
UARS


NO2 (ppb)
90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
0
10
20
30
40
50
60
0
50
100
200
300
H2O (ppm)
bk249
ACE
UARS


90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
N2O (ppb)
bk249
ACE
UARS
0
10
20
30
40
50
60
0
100
200
300
400