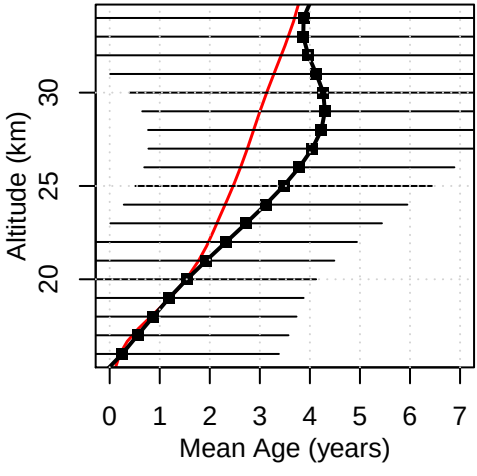
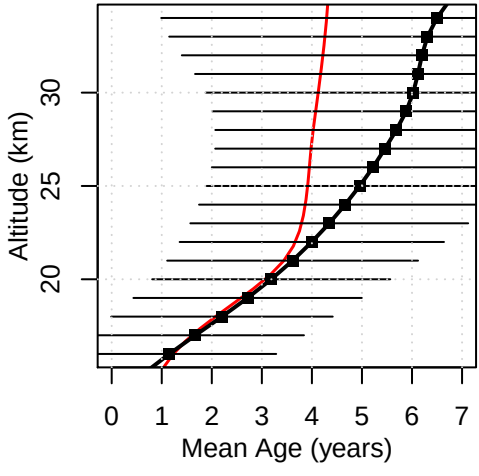
UKCA xkjgj Mean Age of Air

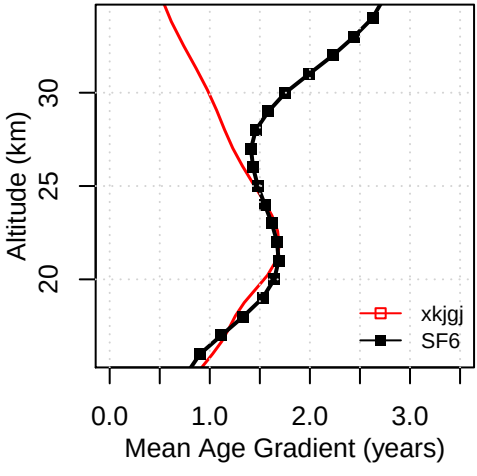
Tropical Mean Age Profile



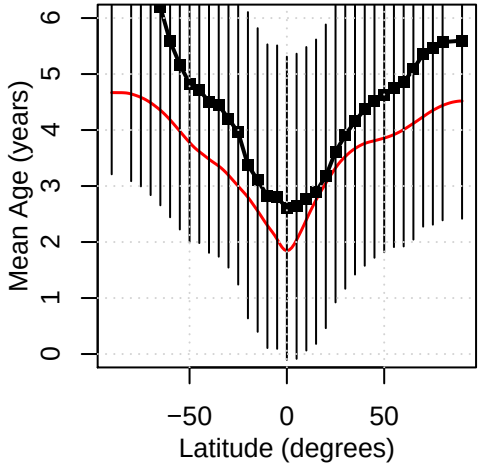
Midlatitude Mean Age Profile

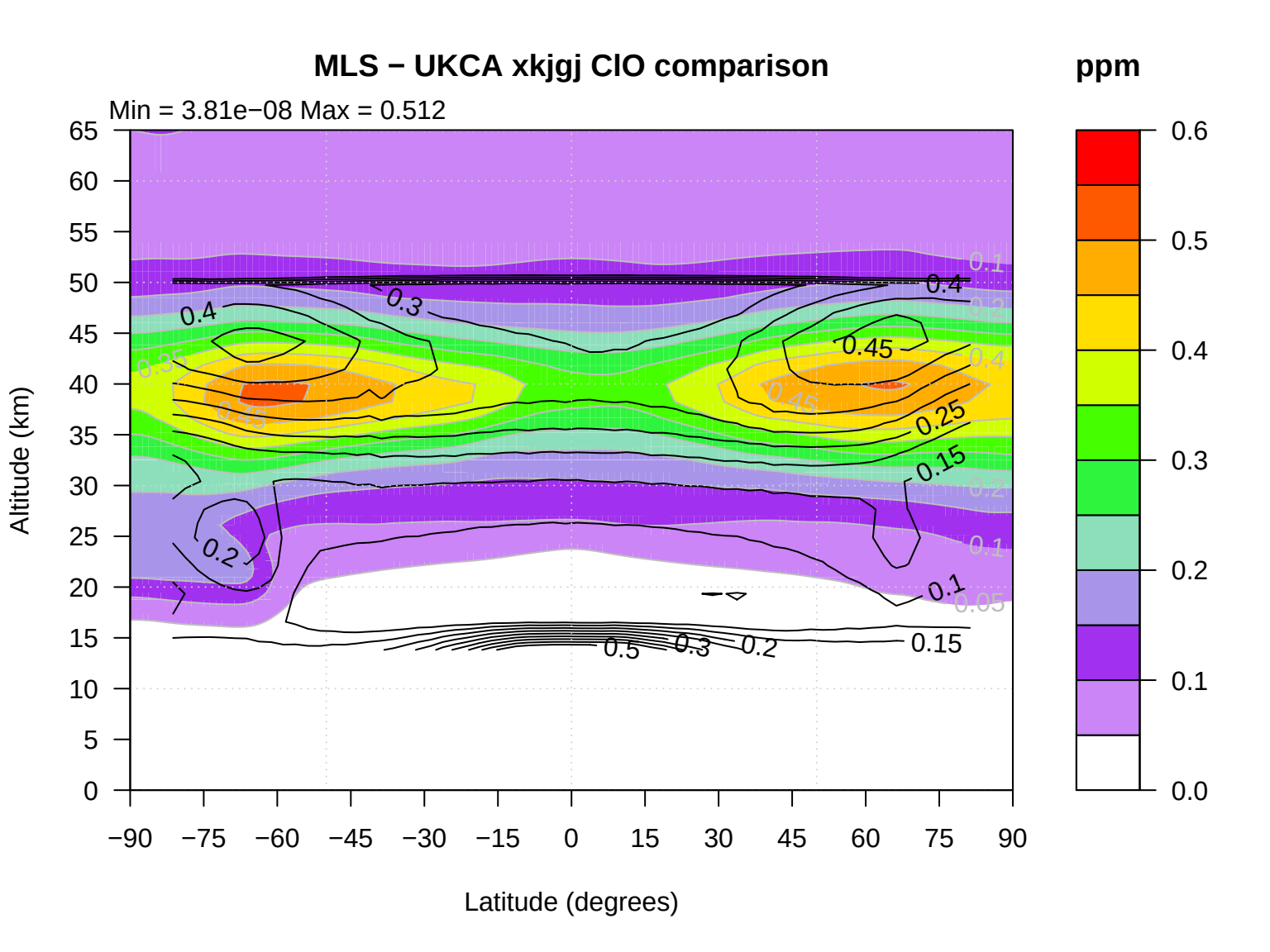


Trop−Midlat Mean Age Gradient Prof

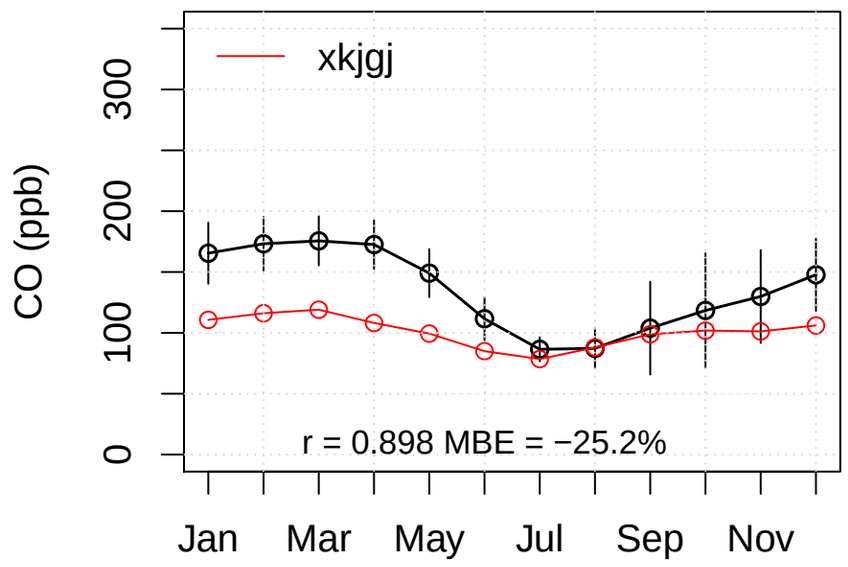


Mean Age, 23km (~50hPa)

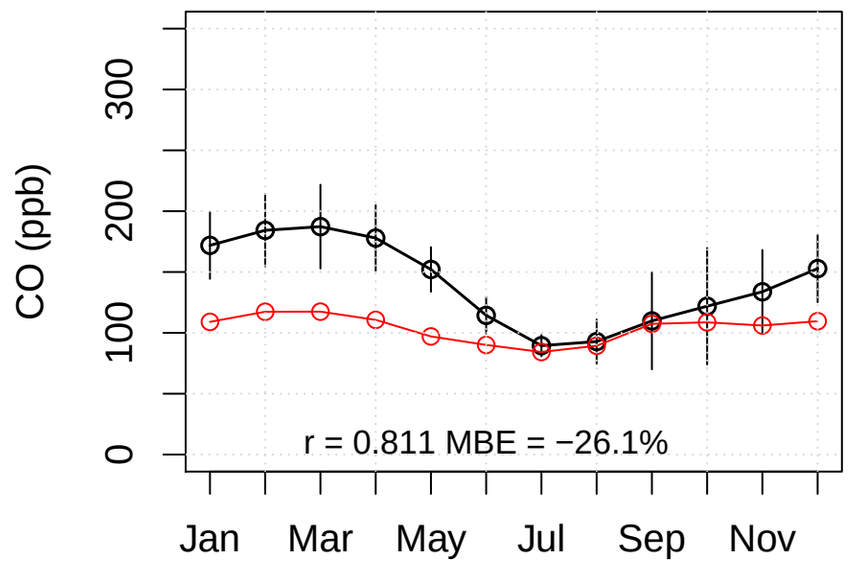



MLS − UKCA xkjgj ClO comparison
ppm
Min = 3.81e−08 Max = 0.512
Altitude (km)
Latitude (degrees)
65
60
55
50
45
40
35
30
25
20
15
10
5
0
−90
−75
−60
−45
−30
−15
0
15
30
45
60
75
90
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.4
0.3
0.4
0.45
0.45
0.25
0.15
0.2
0.1
0.5
0.3
0.2
0.15

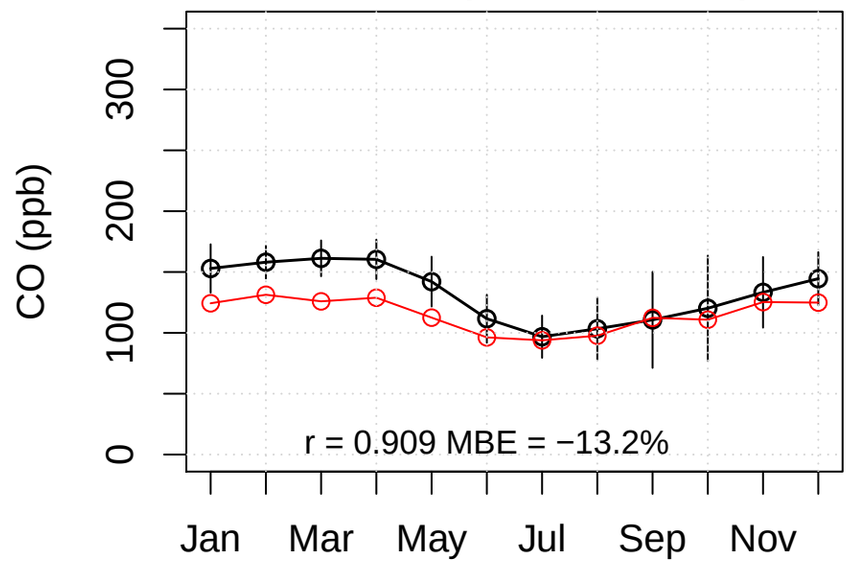
Alert (82.4N, 62.5W, 210m)



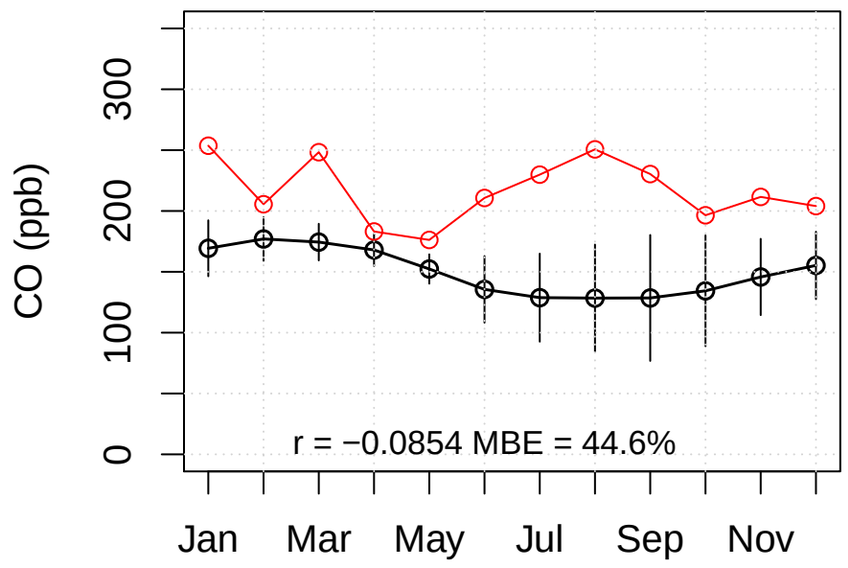
Barrow (71.3N, 156.6W, 11m)



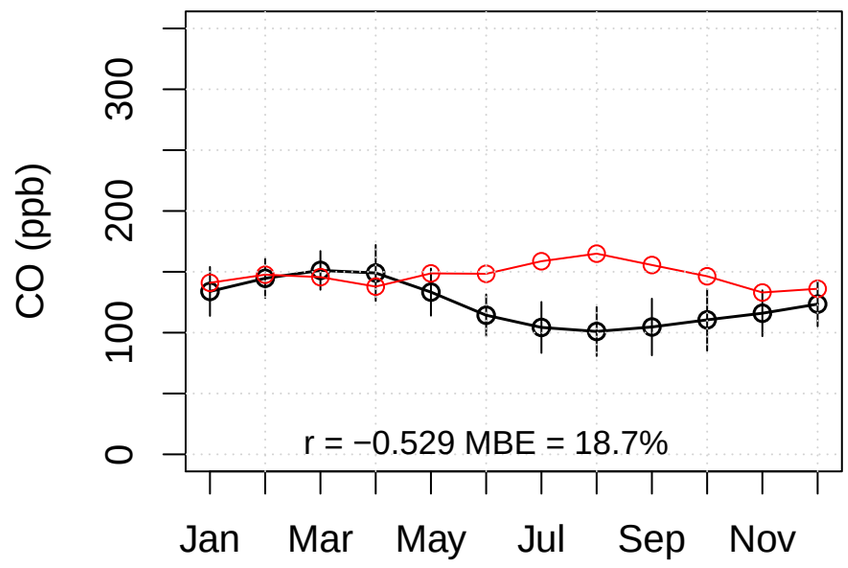
Mace Head (53.3N, 9.9W, 25m)



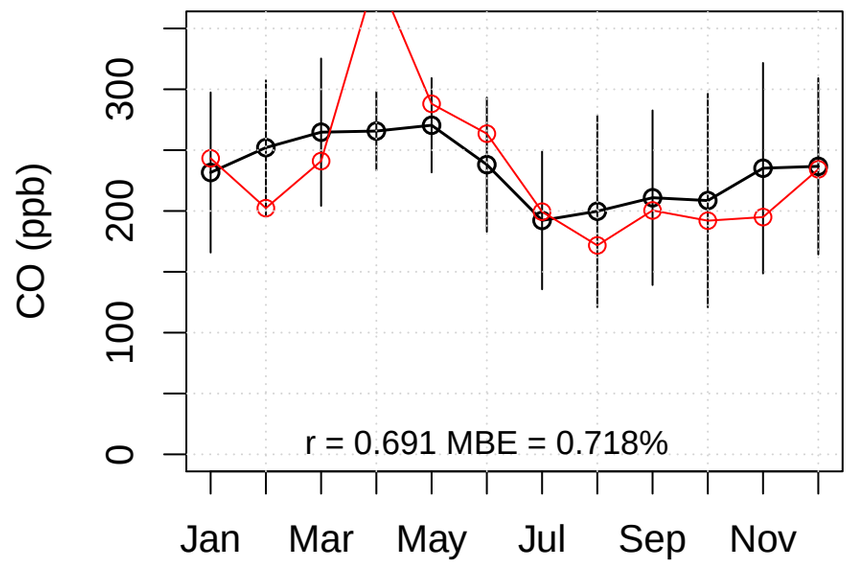
Park Falls (45.9N, 90.2W, 472m)



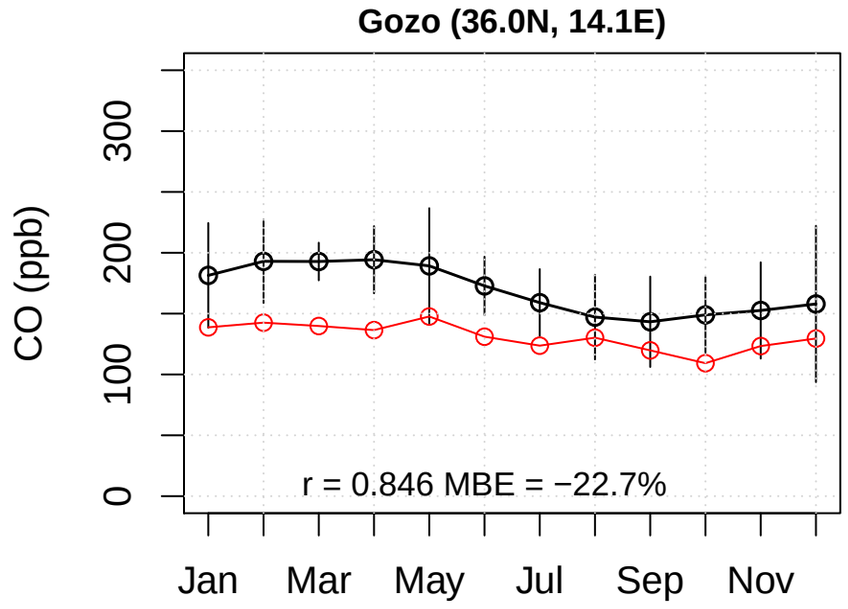
Niwot Ridge (40.0N, 105.6W, 3475m)



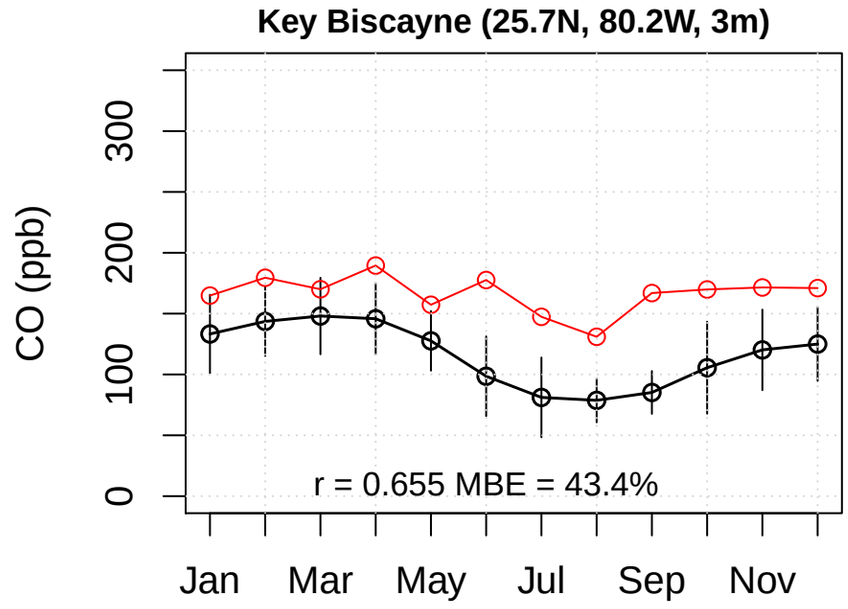
Tae−ahn Peninsula (36.7N, 126.1E, 20m)



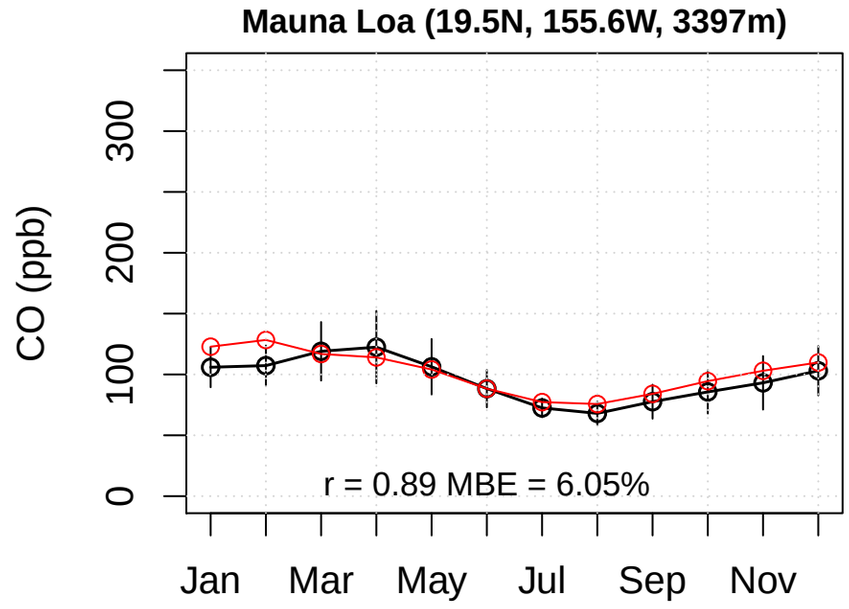
Gozo (36.0N, 14.1E)



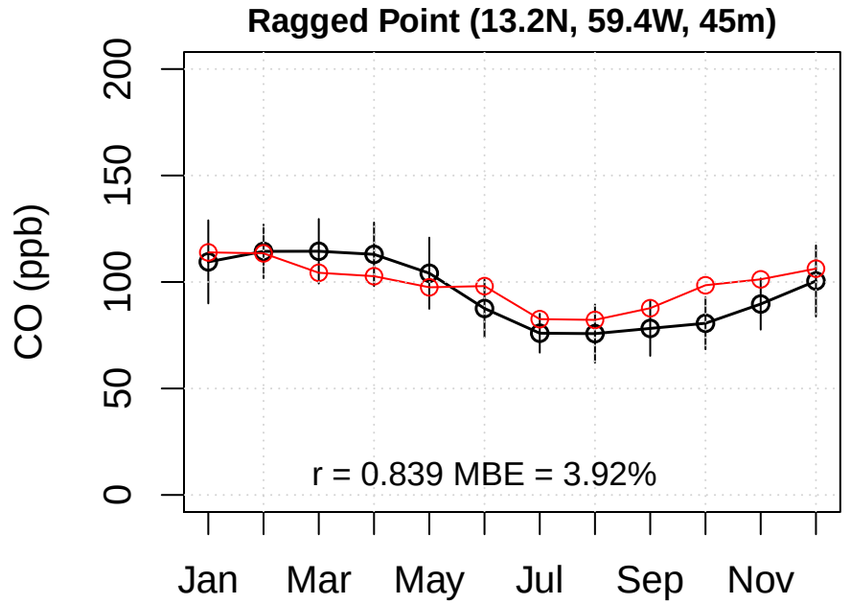
Key Biscayne (25.7N, 80.2W, 3m)



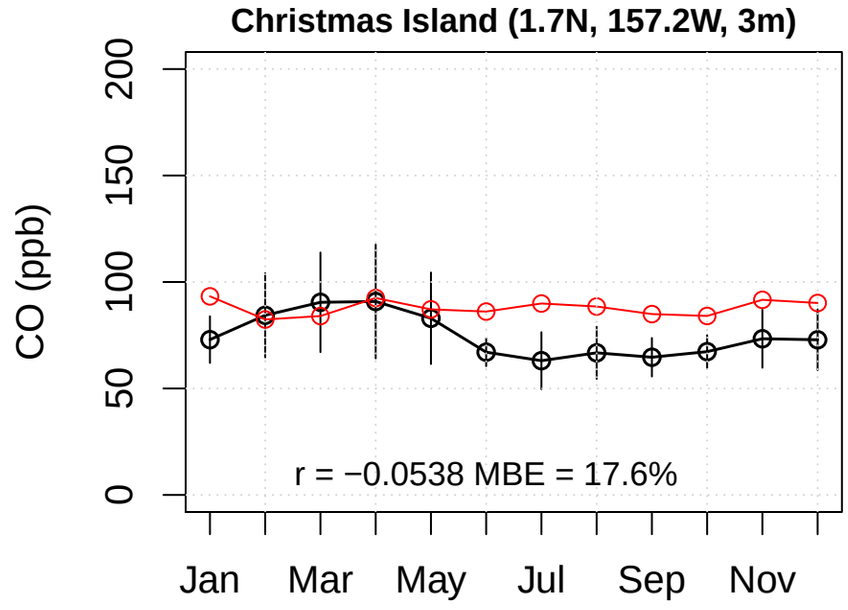
Mauna Loa (19.5N, 155.6W, 3397m)



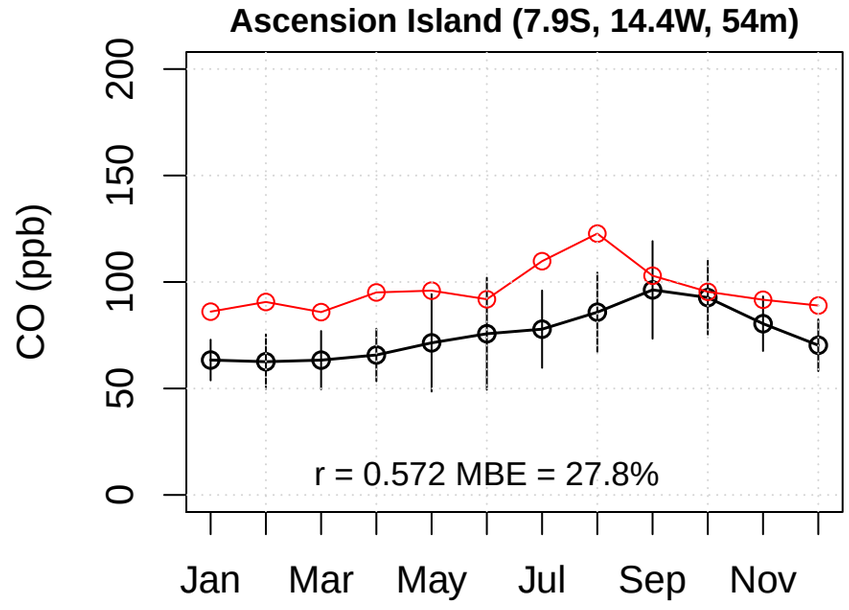
Ragged Point (13.2N, 59.4W, 45m)



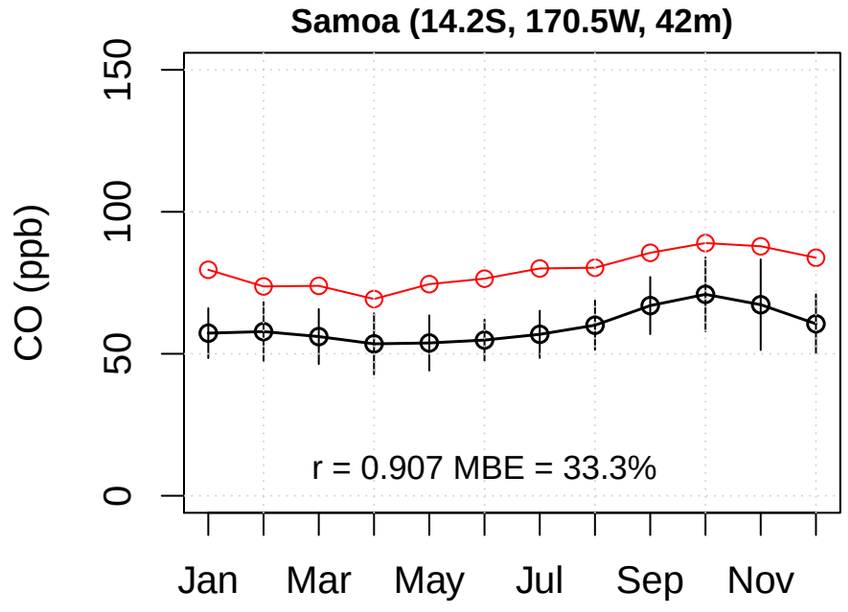
Christmas Island (1.7N, 157.2W, 3m)



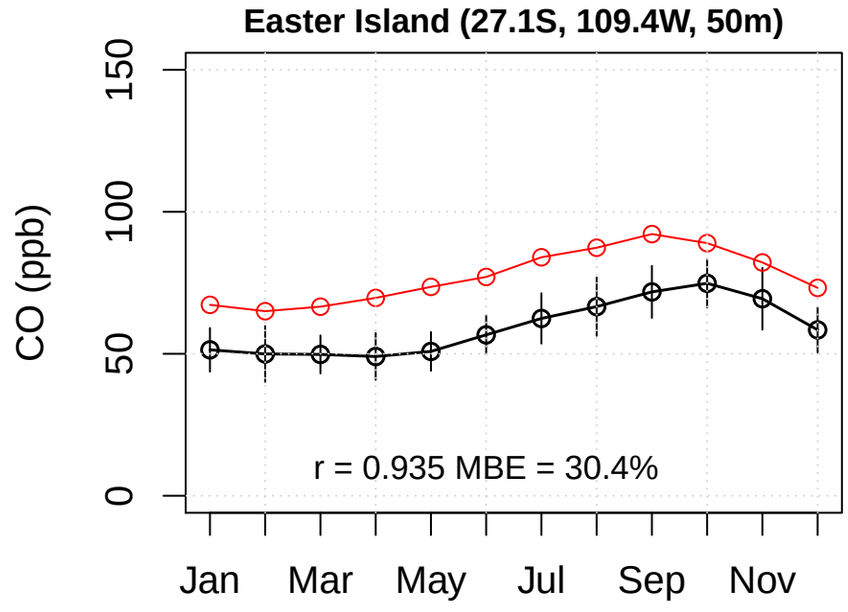
Ascension Island (7.9S, 14.4W, 54m)



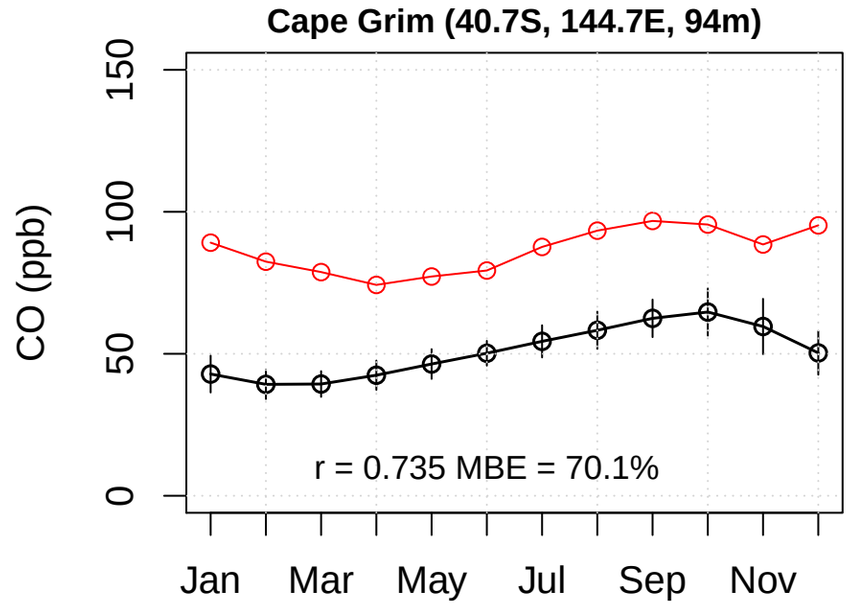
Samoa (14.2S, 170.5W, 42m)



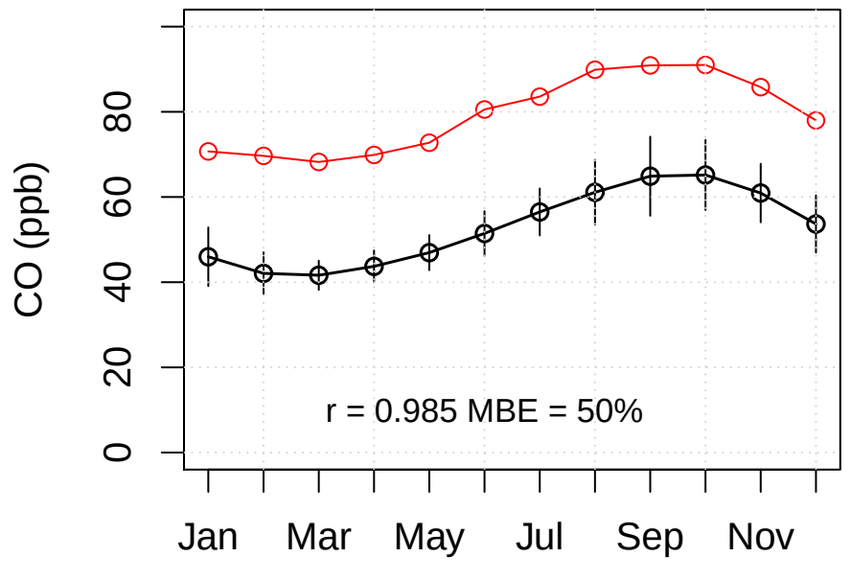
Easter Island (27.1S, 109.4W, 50m)



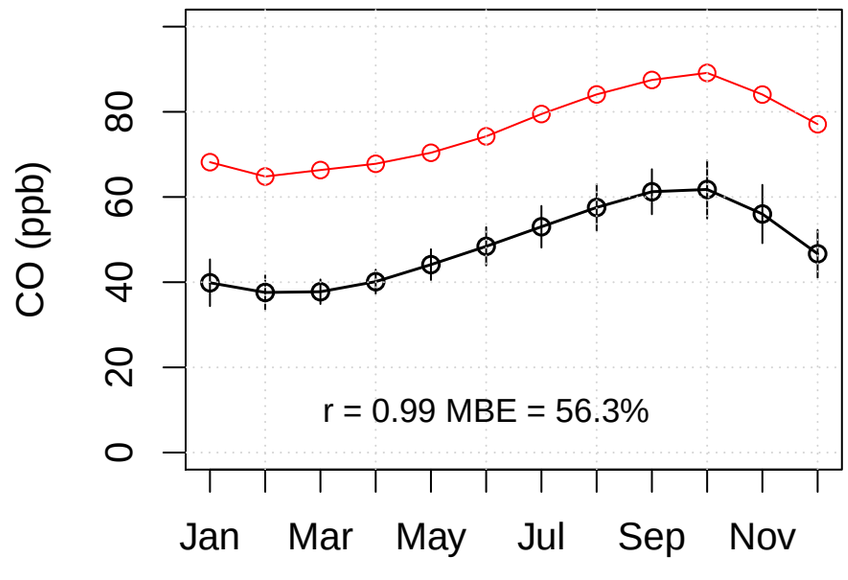
Cape Grim (40.7S, 144.7E, 94m)



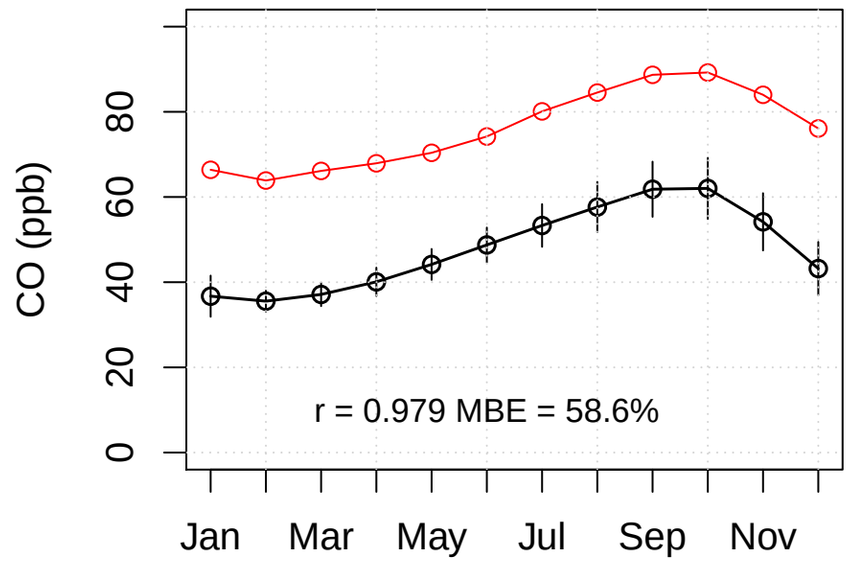
Crozet Island (46.5S, 51.8E, 120m)



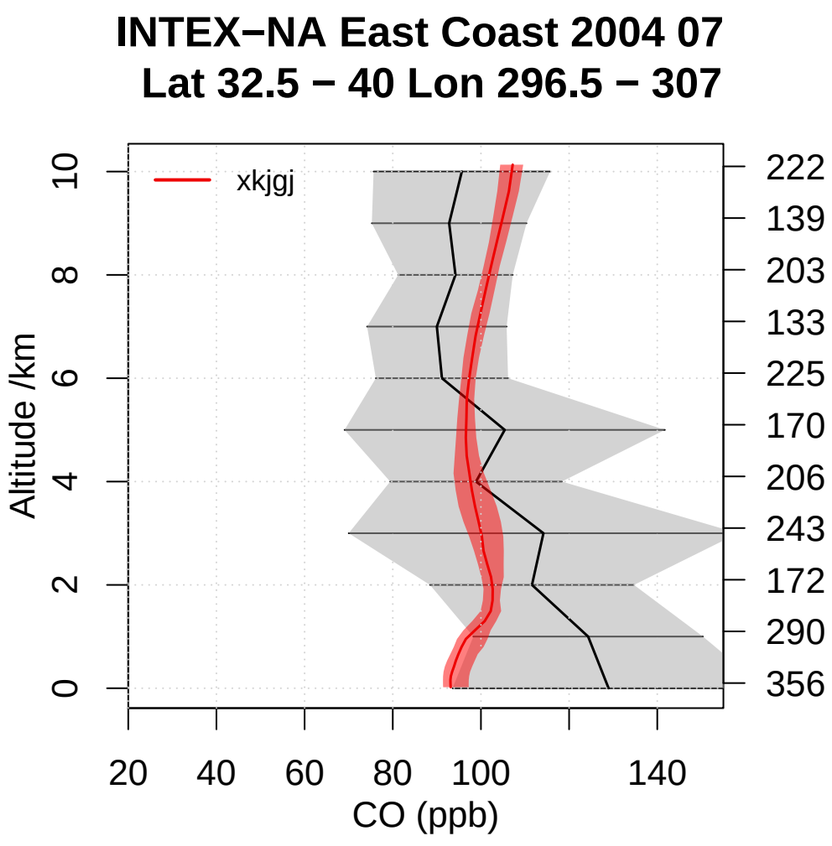
Syowa Station (69.0S, 39.6E, 11m)

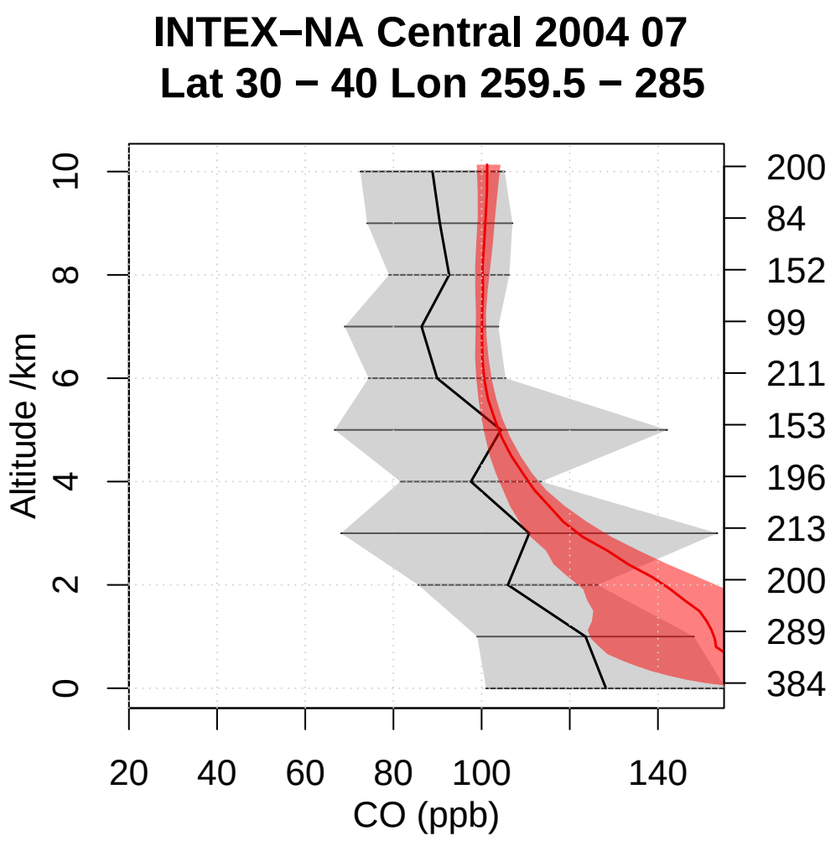


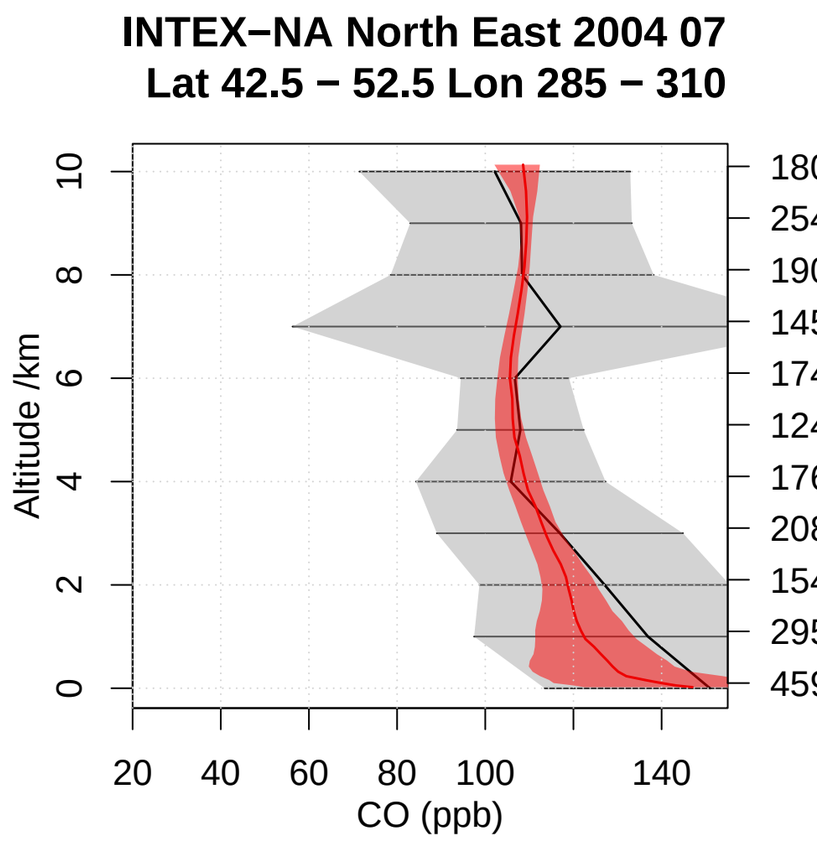
South Pole (90.0S, 24.8W, 2810m)

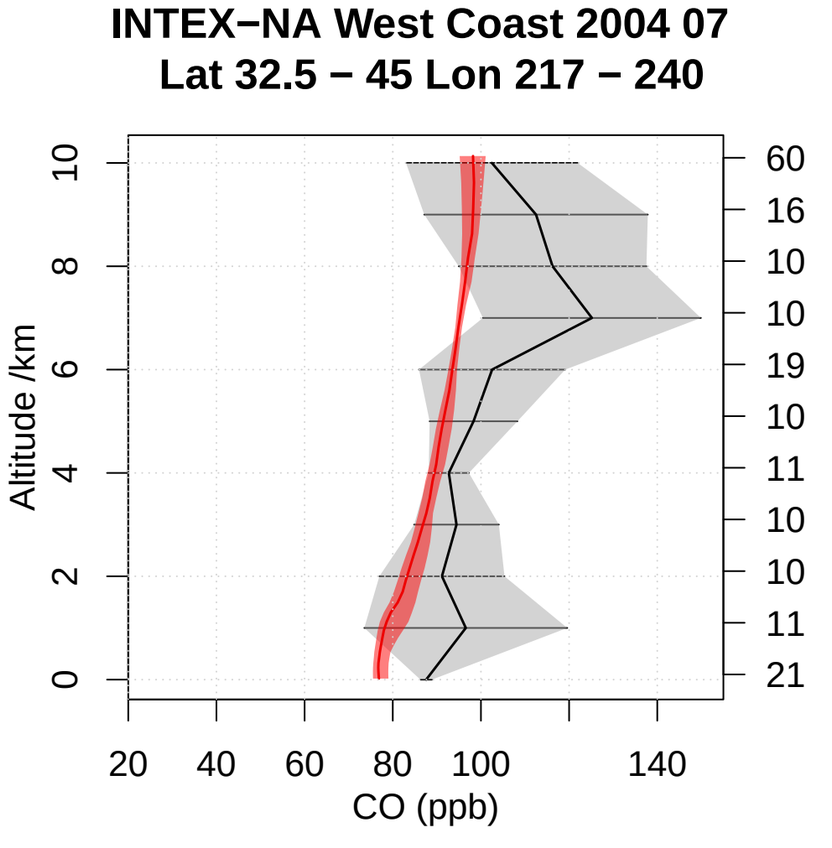


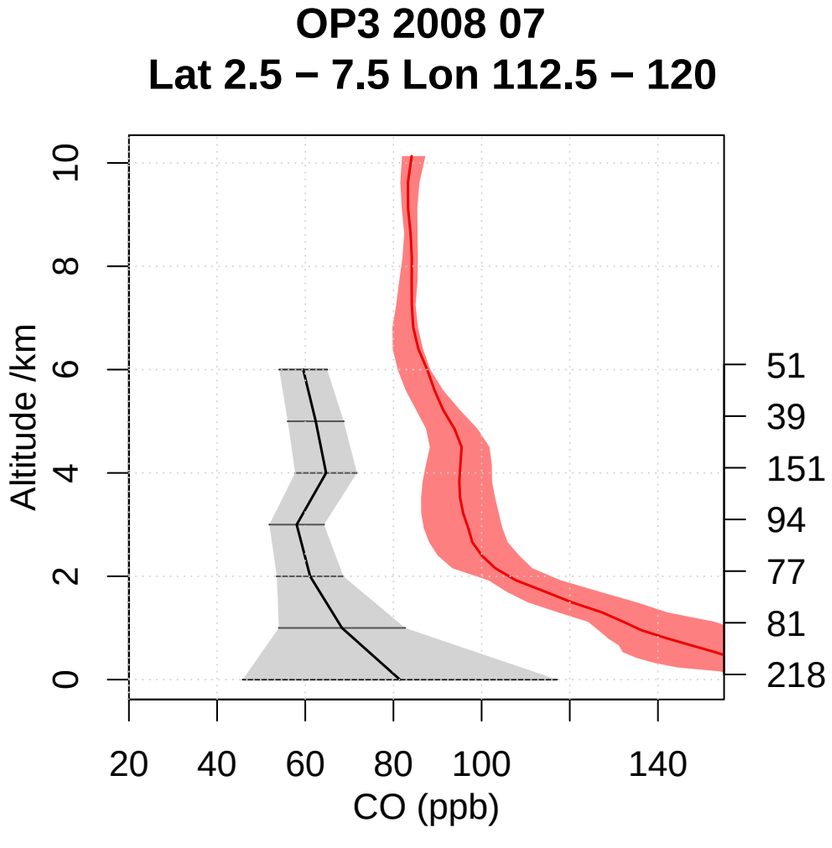
Emmons CO comparison

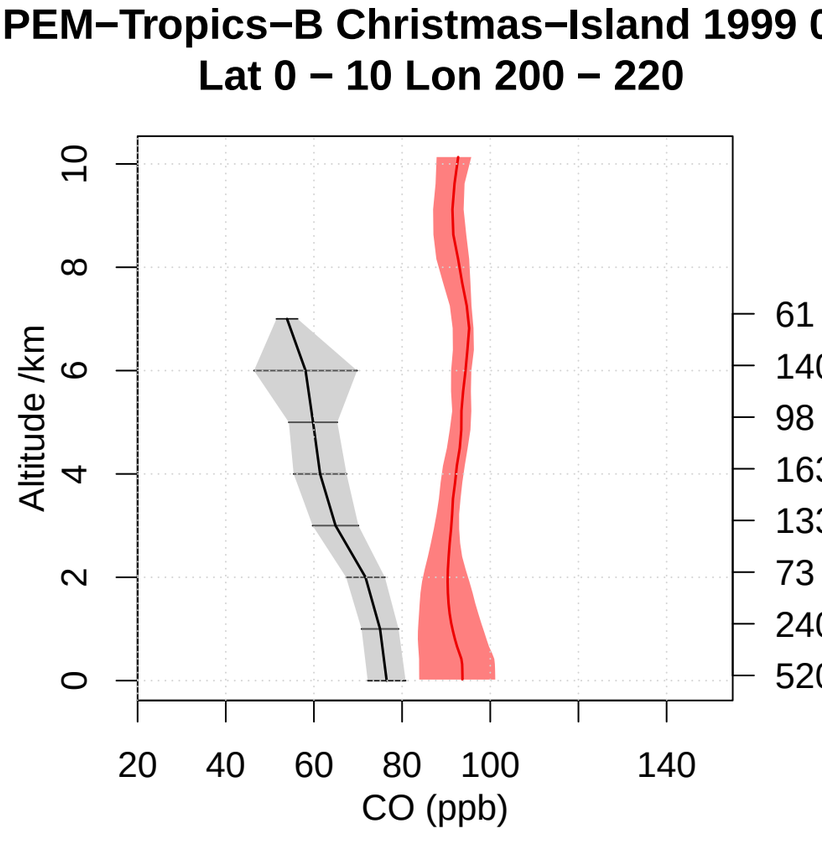


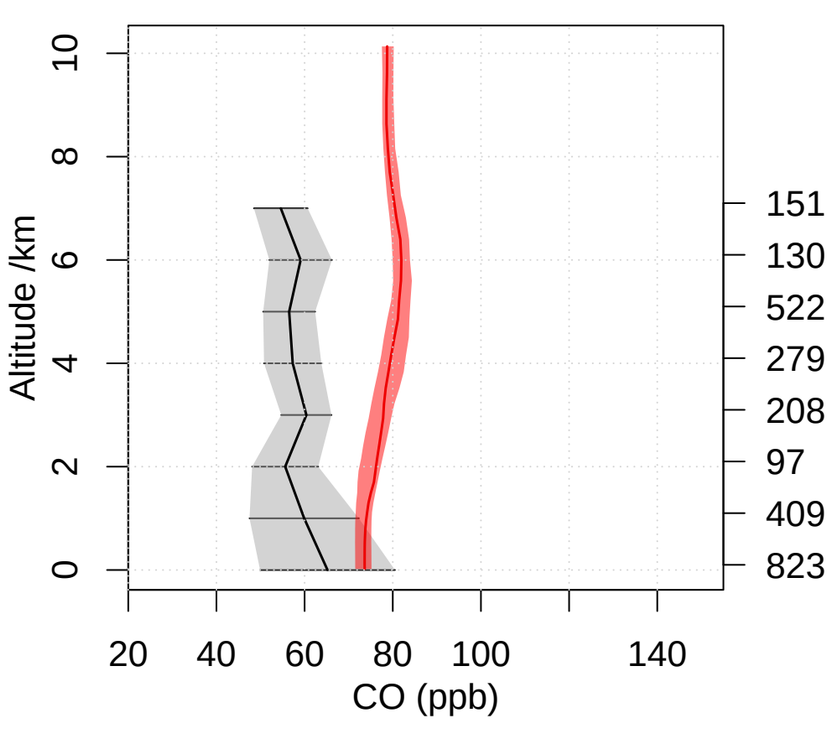


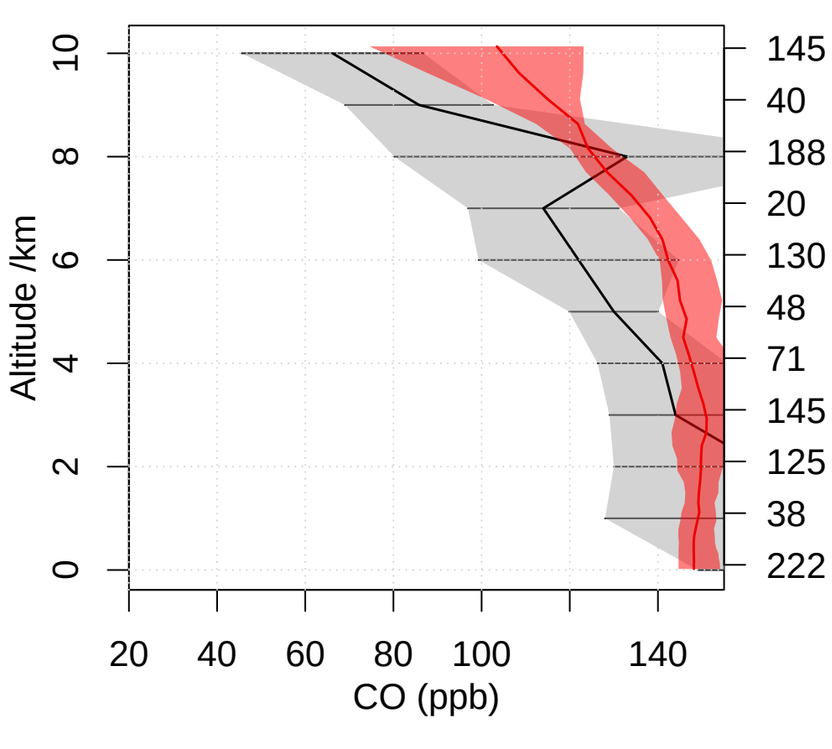


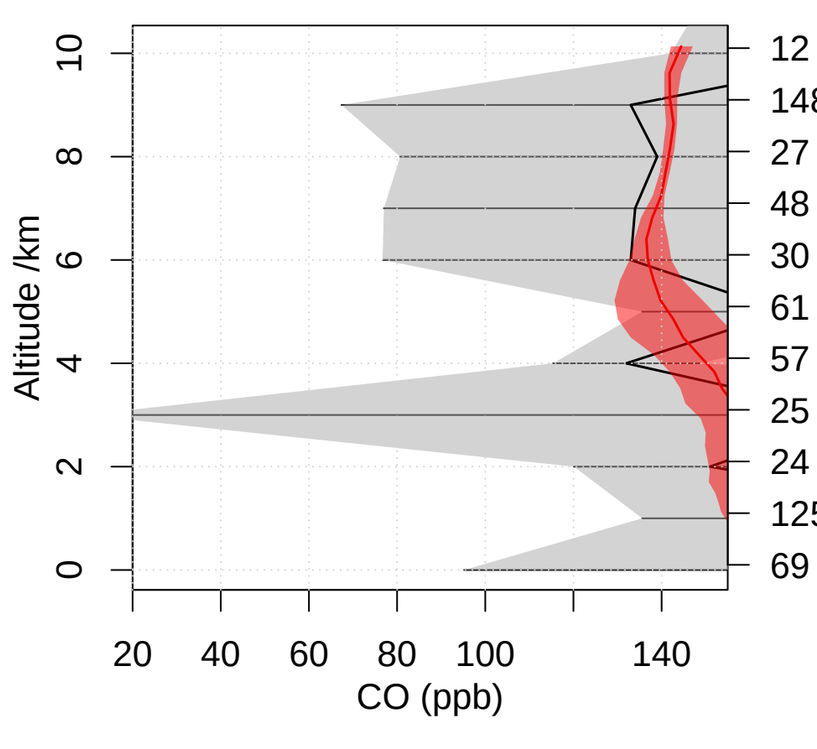


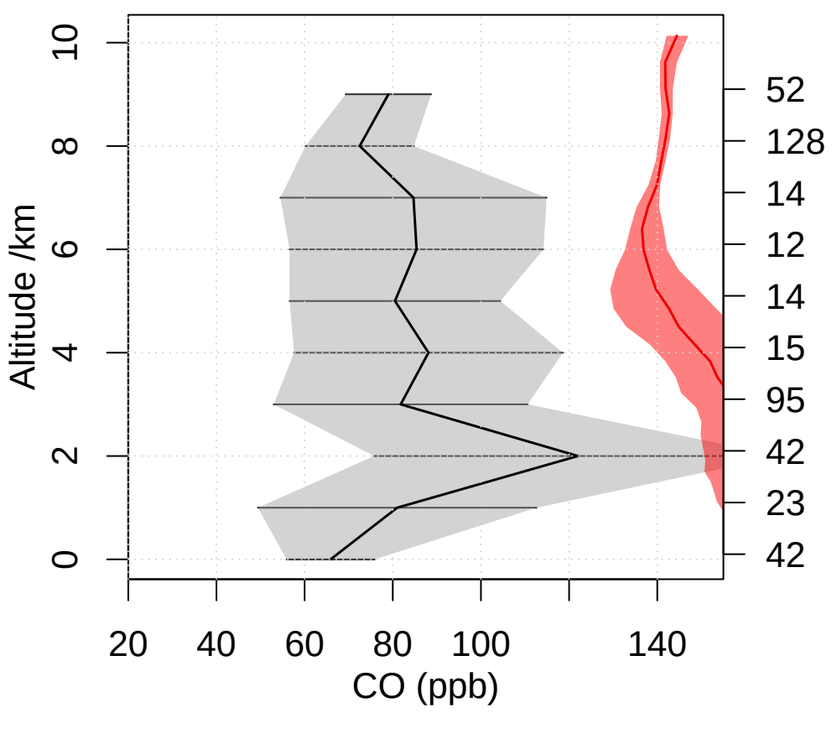


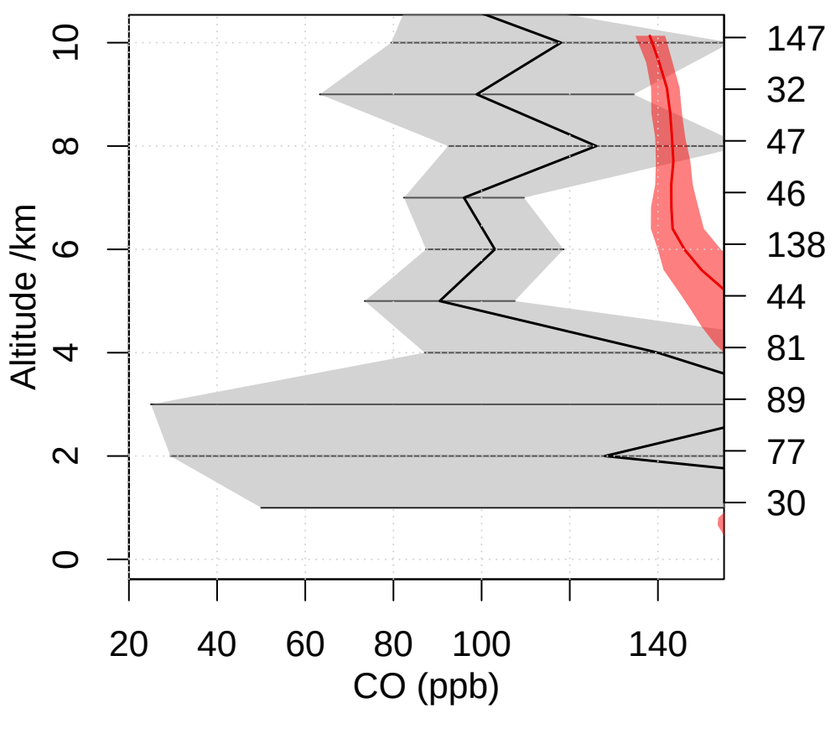


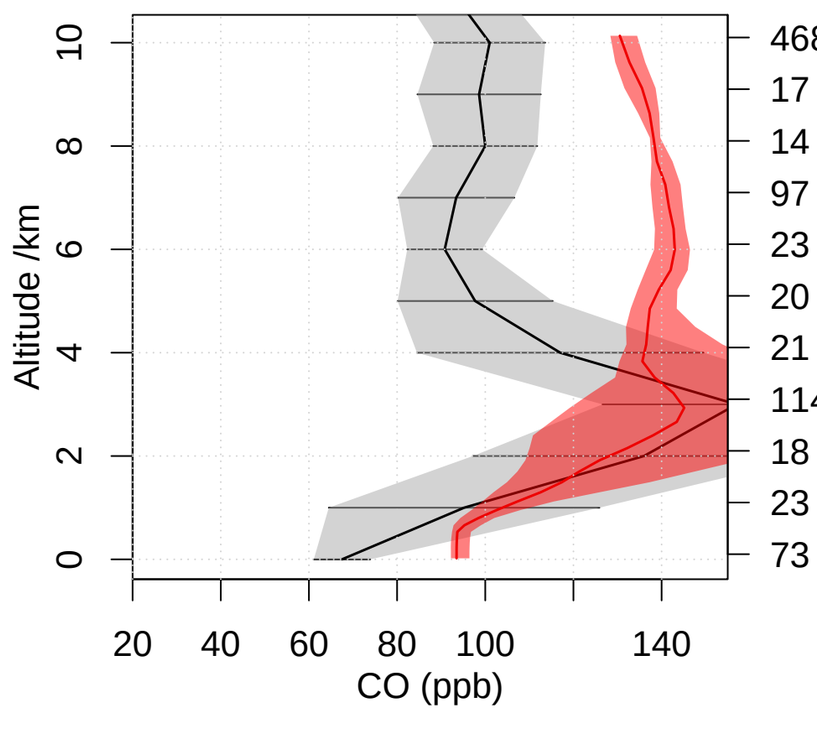




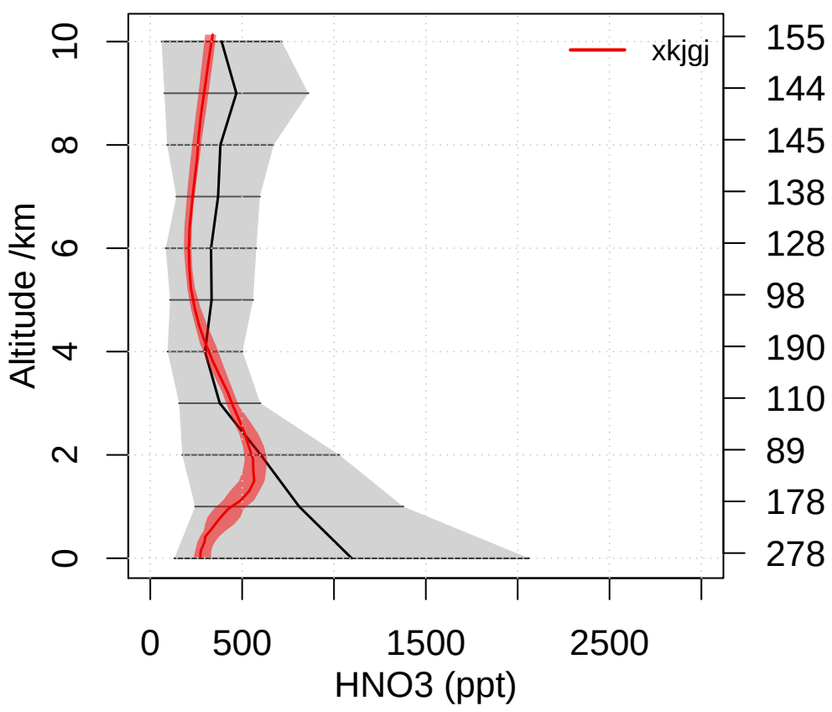


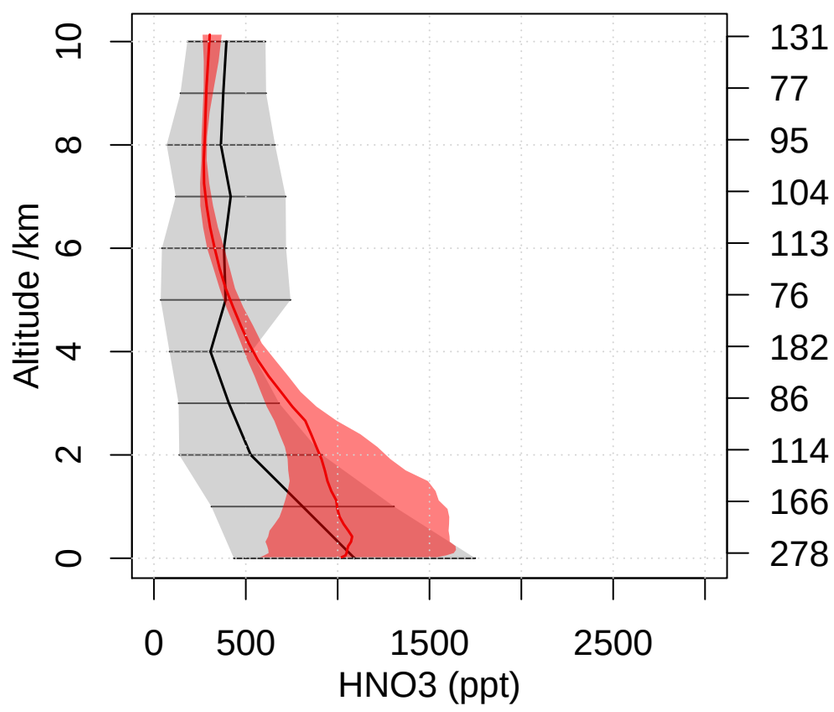


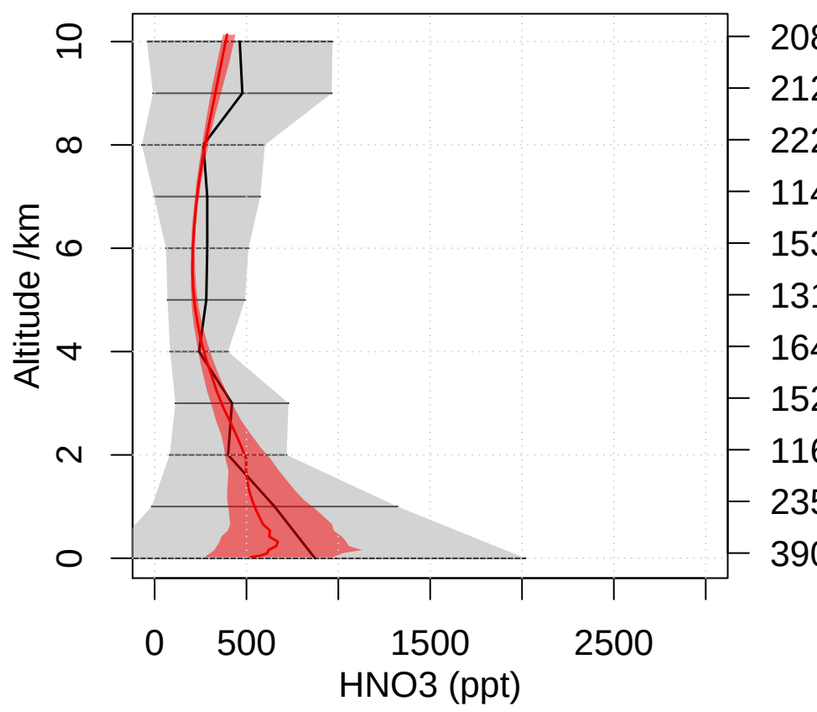


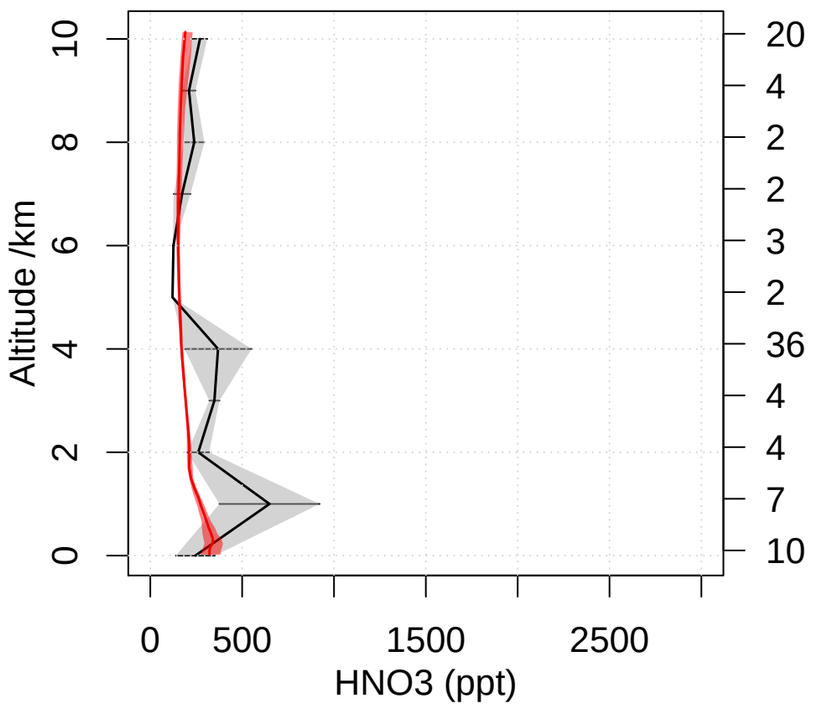


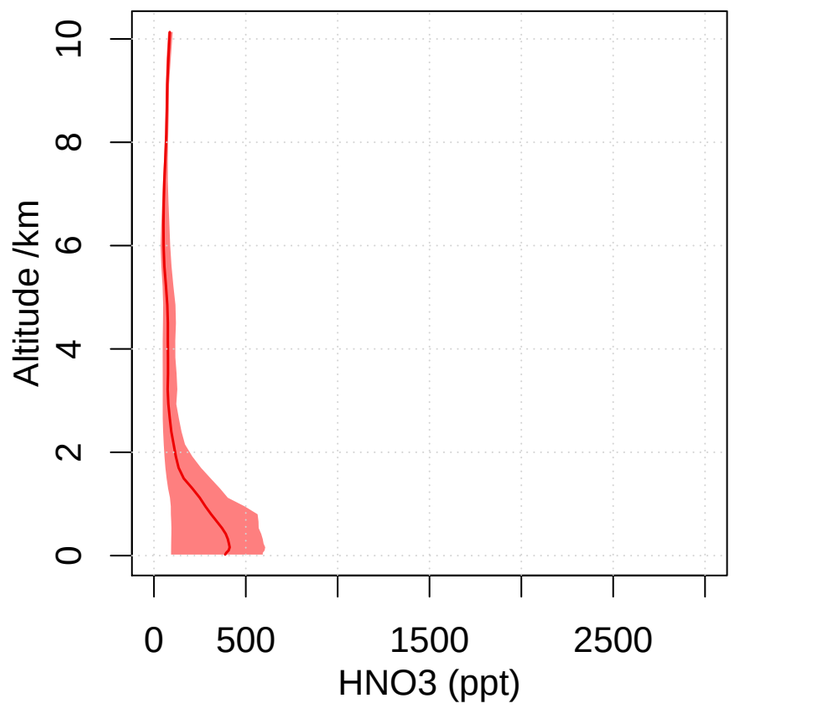
Emmons HNO3 comparison

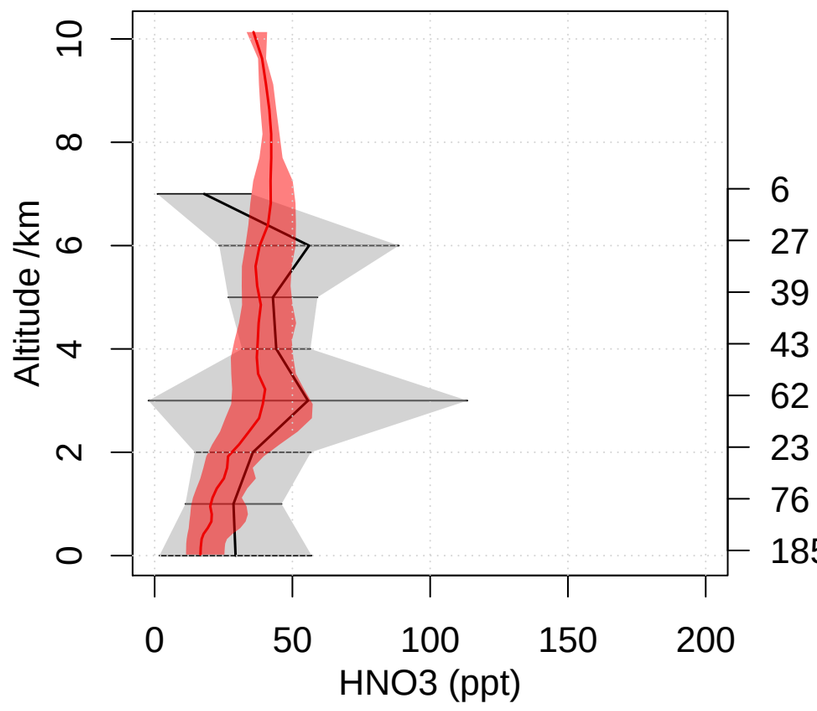


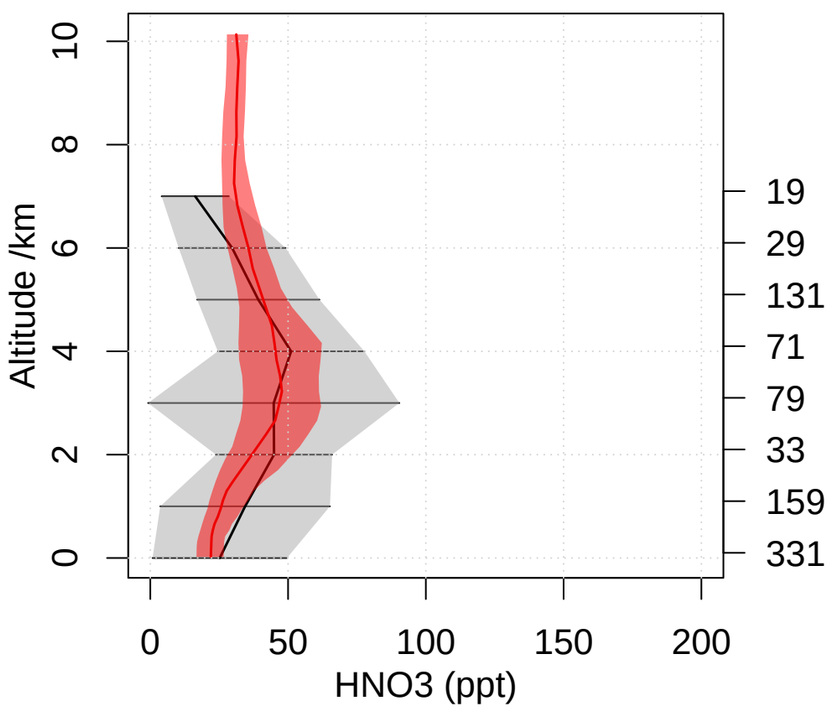


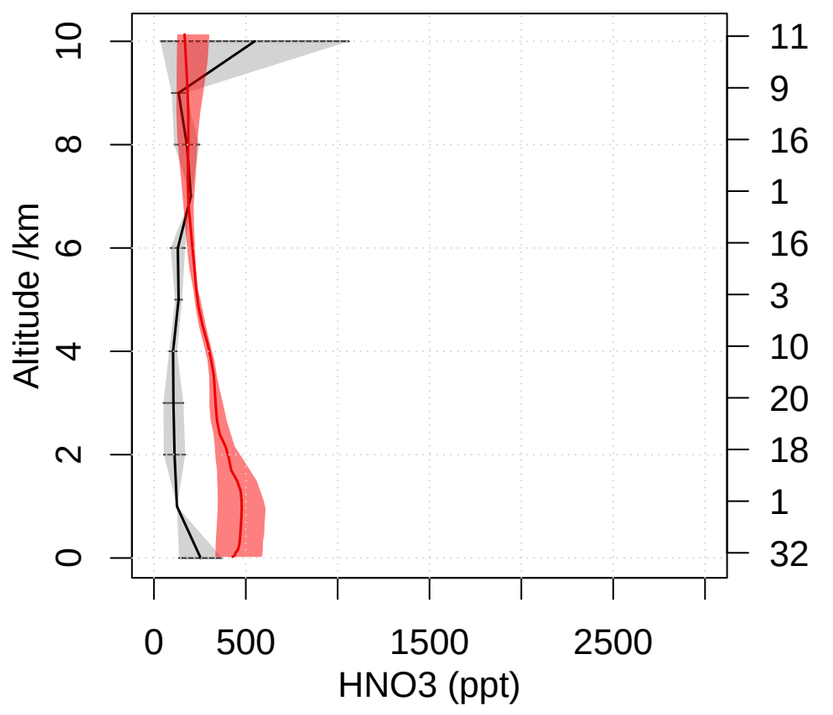


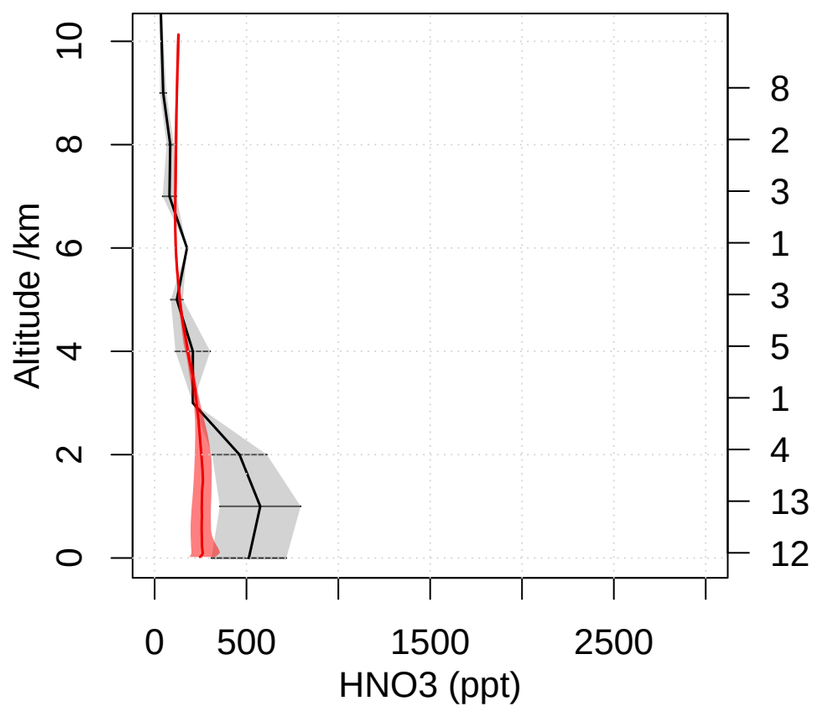


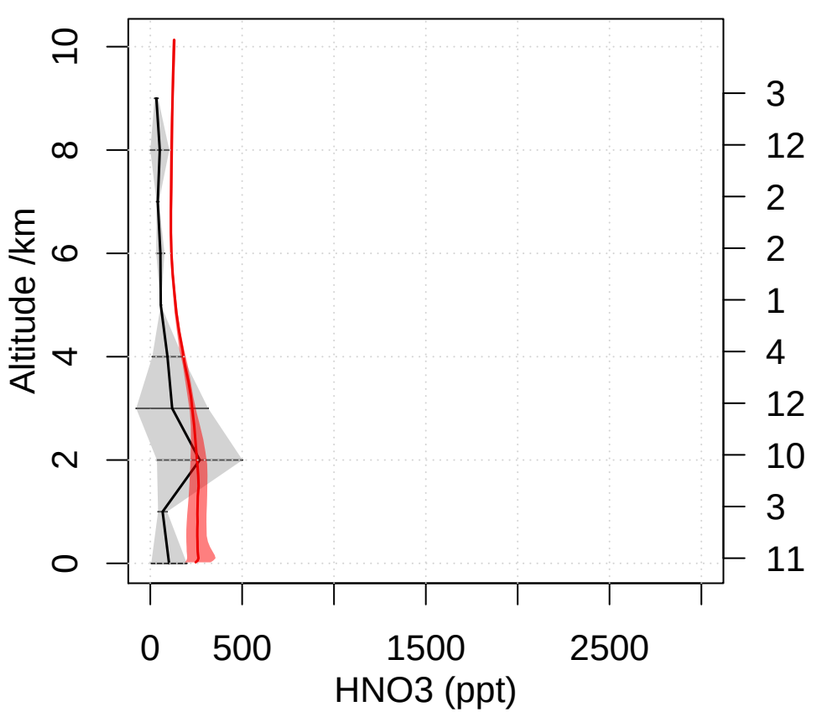


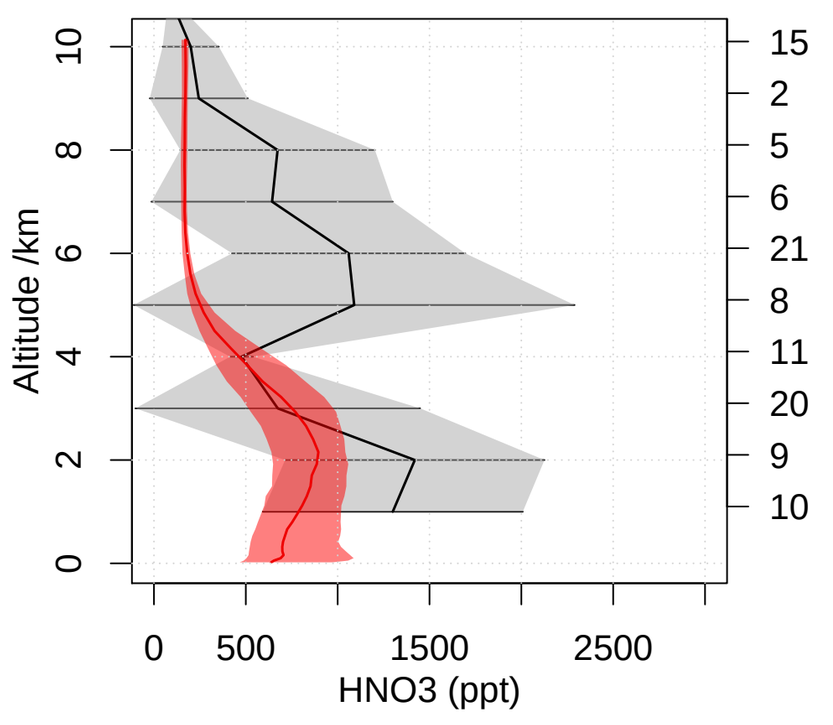


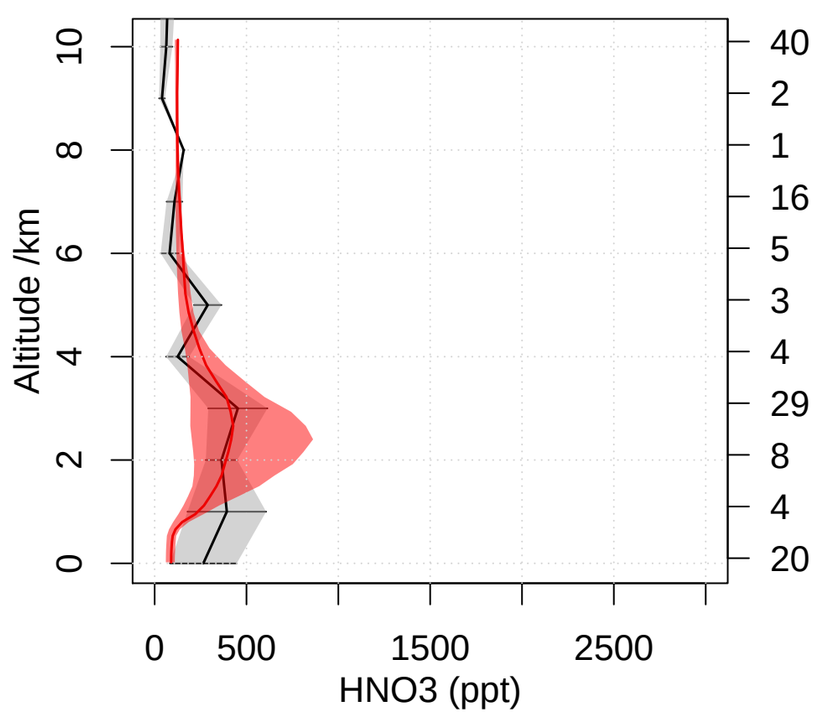






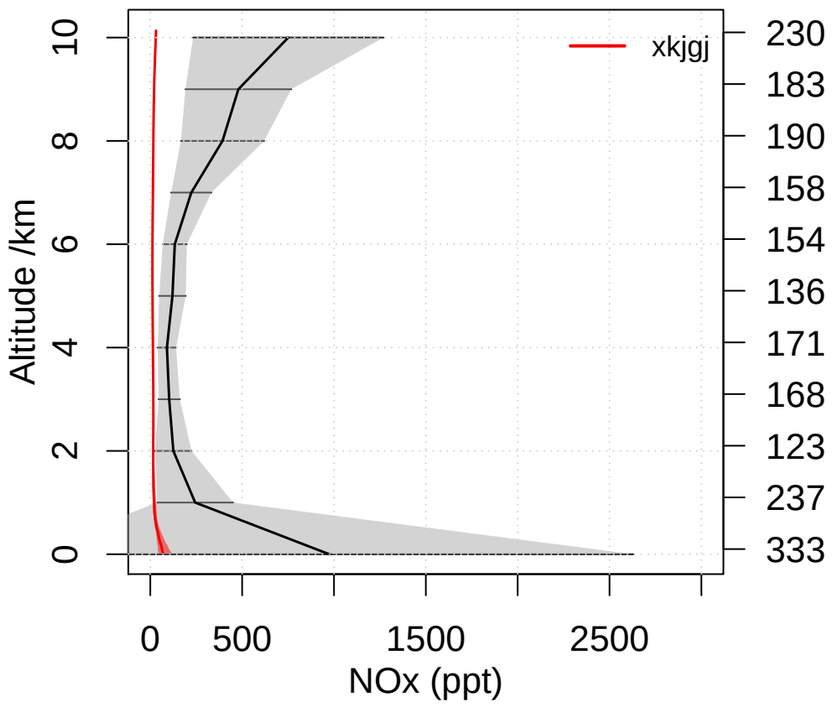




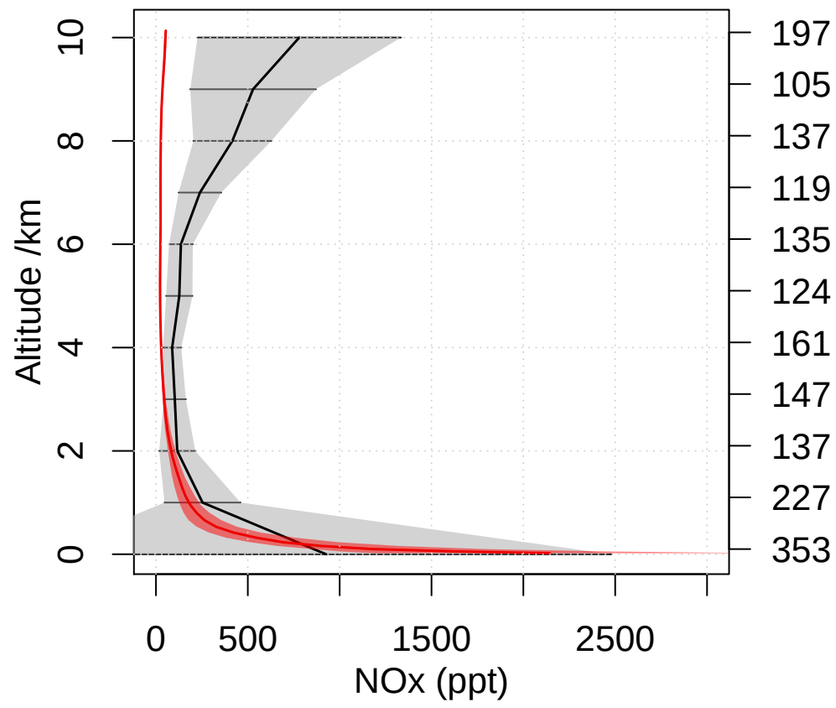


Emmons NOx comparison

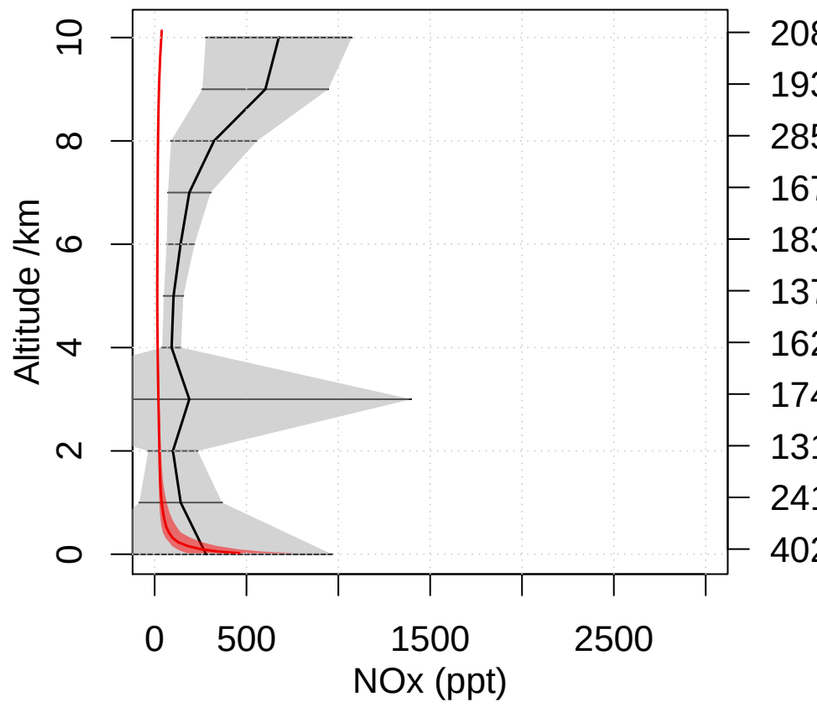
INTEX−NA East Coast 2004 07
Lat 32.5 − 40 Lon 296.5 − 307



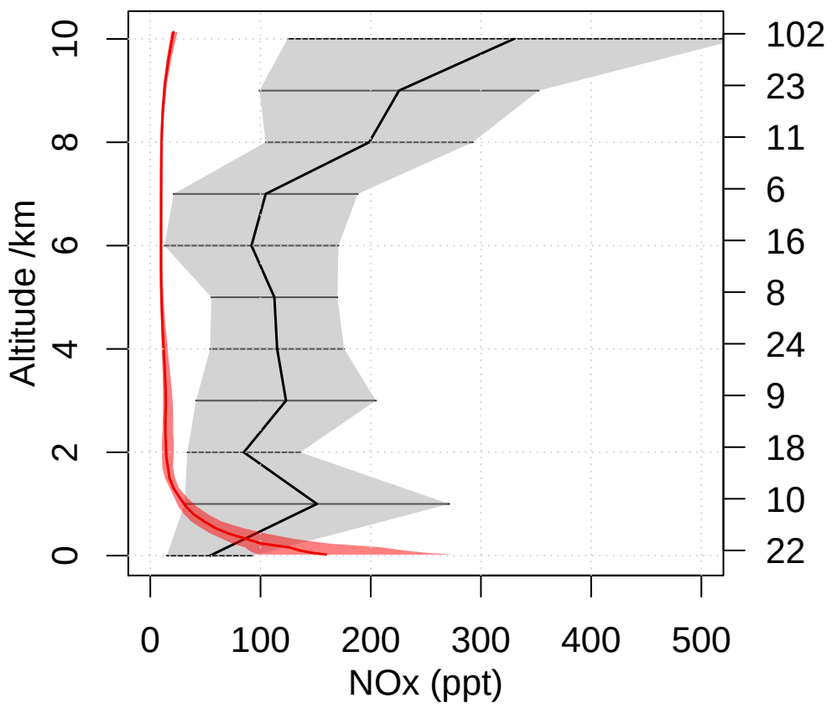
INTEX−NA Central 2004 07
Lat 30 − 40 Lon 259.5 − 285



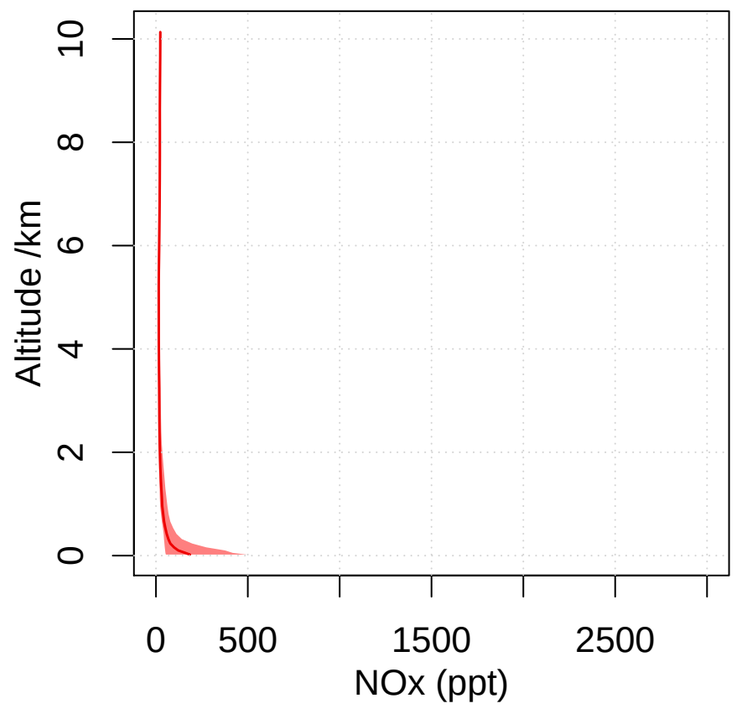
INTEX−NA North East 2004 07
Lat 42.5 − 52.5 Lon 285 − 310



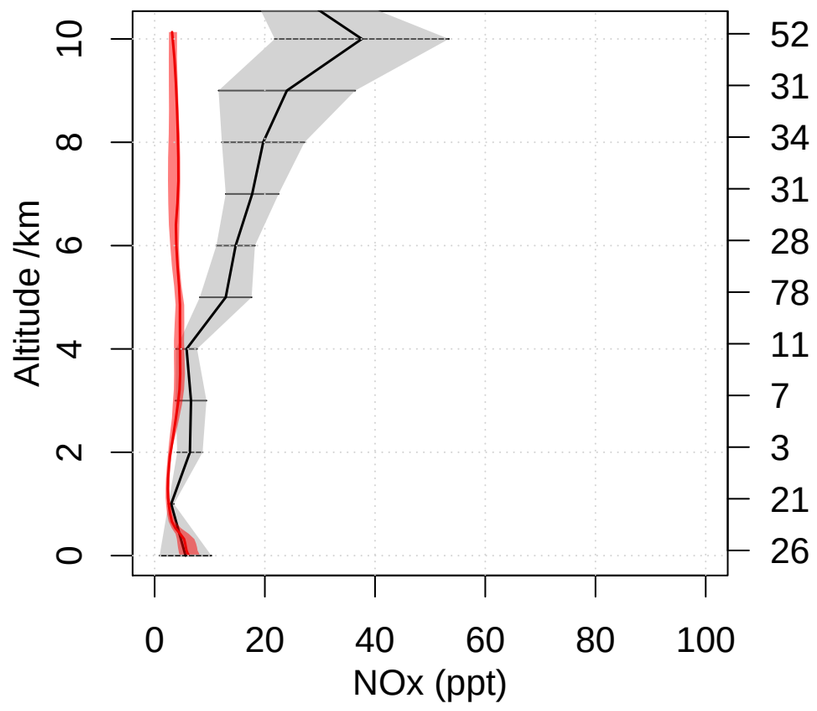
INTEX−NA West Coast 2004 07
Lat 32.5 − 45 Lon 217 − 240



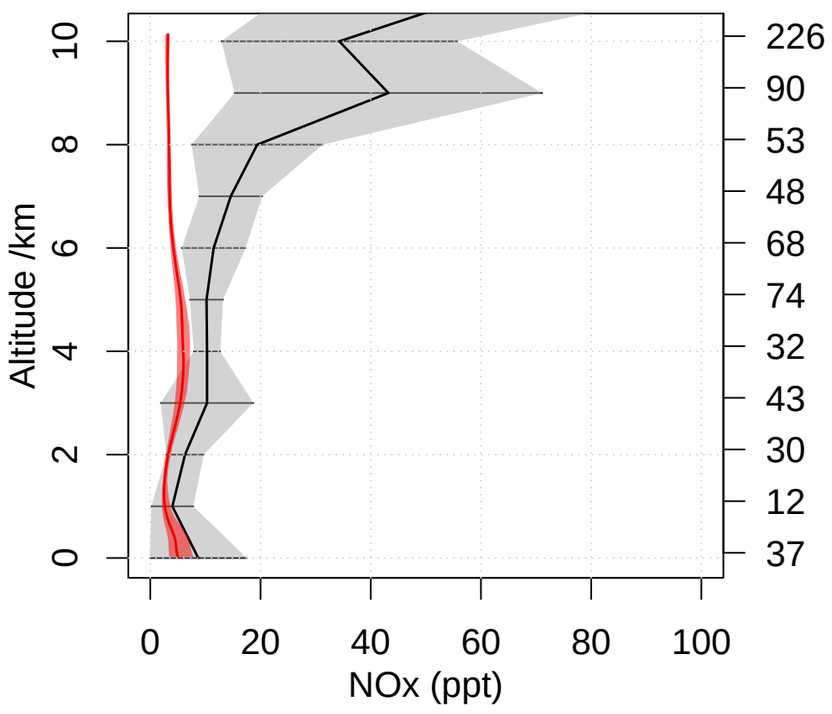
OP3 2008 07
Lat 2.5 − 7.5 Lon 112.5 − 120



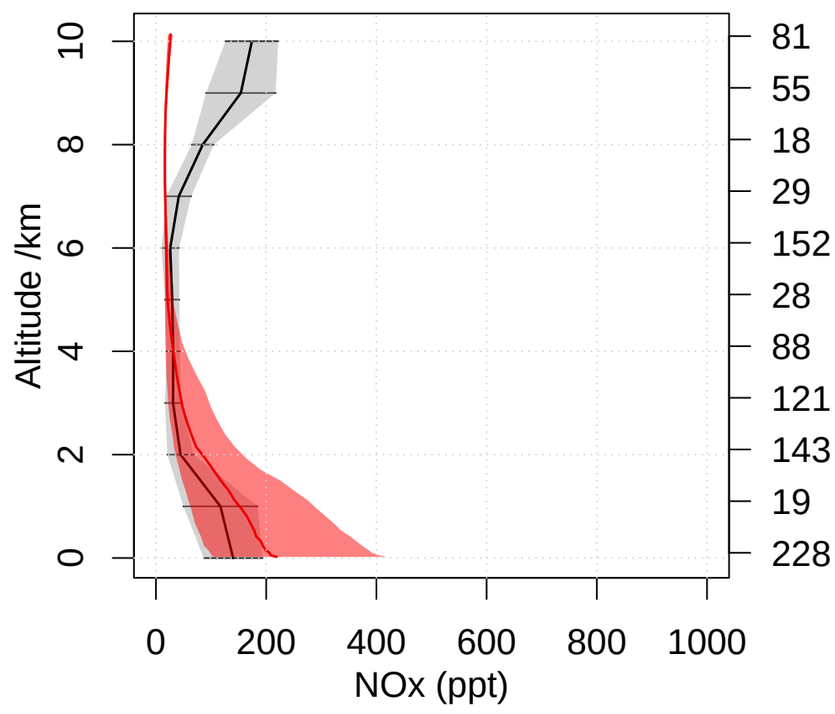
PEM−Tropics−B Christmas−Island 1999 0
Lat 0 − 10 Lon 200 − 220



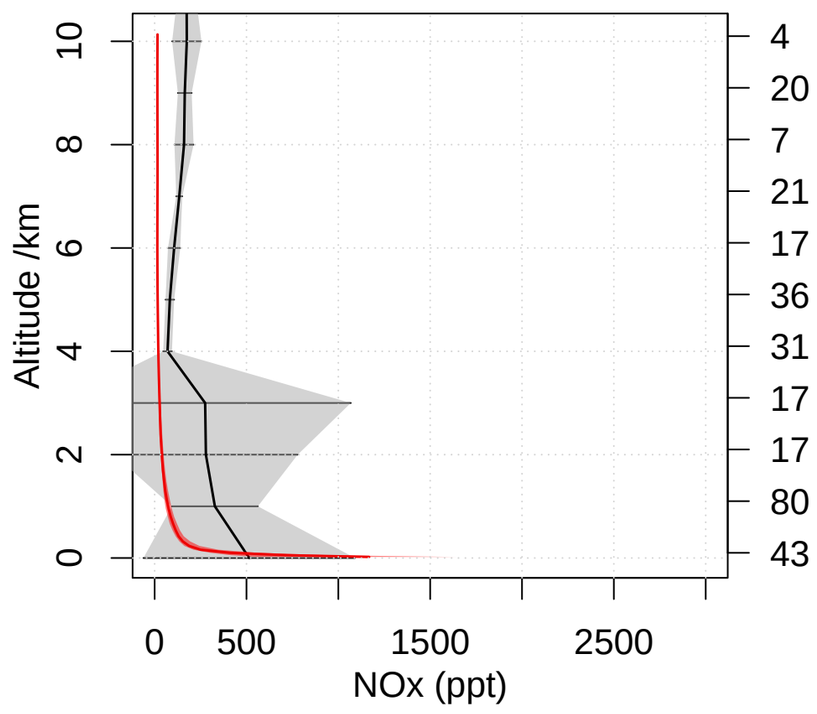
PEM−Tropics−B Tahiti 1999 03
Lat −20 − 0 Lon 200 − 230



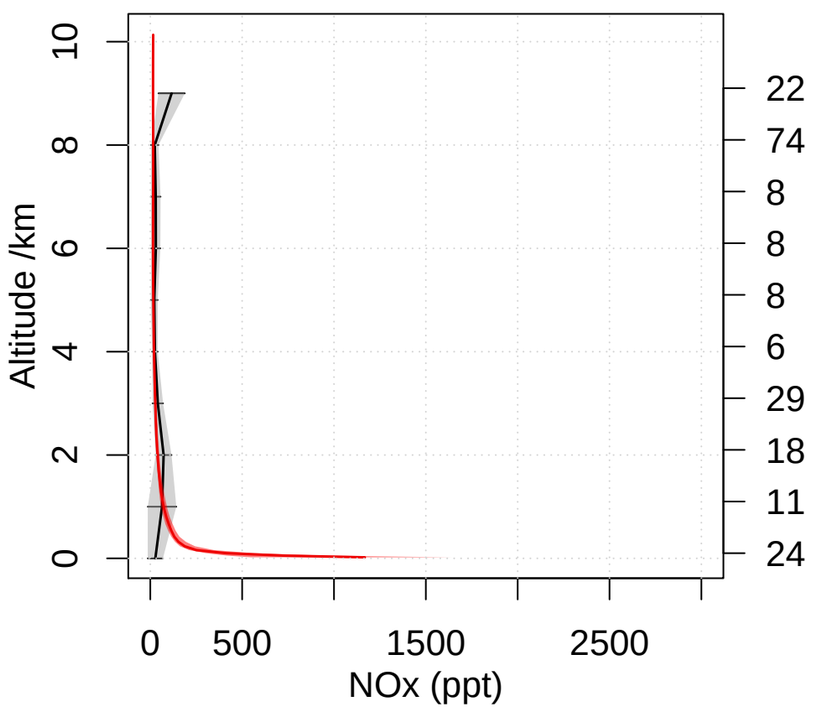
PEM−West−B Japan 1994 02
Lat 25 − 40 Lon 135 − 150



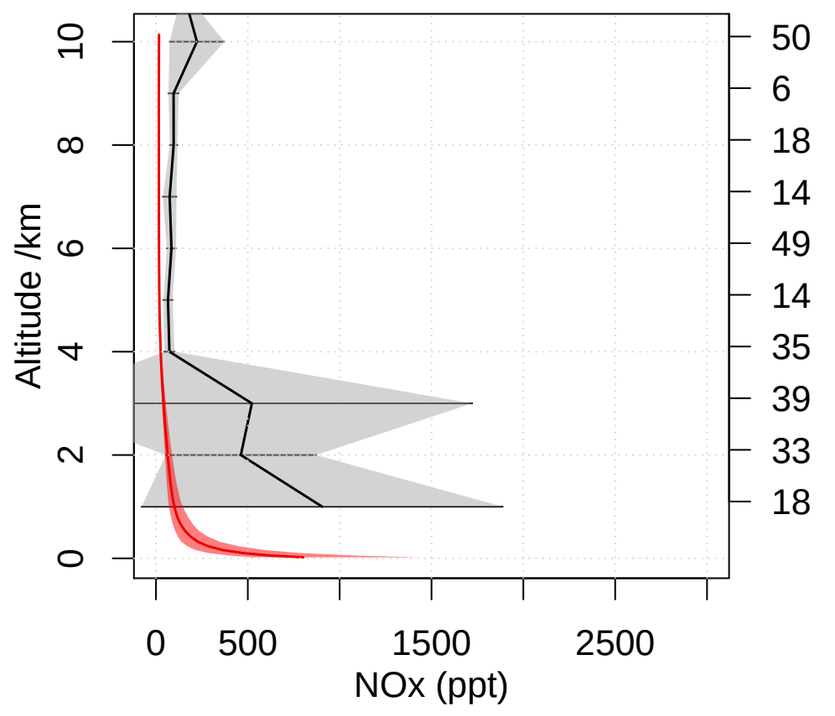
TRACE−A E−Brazil 1992 09
Lat −15 − −5 Lon 310 − 320



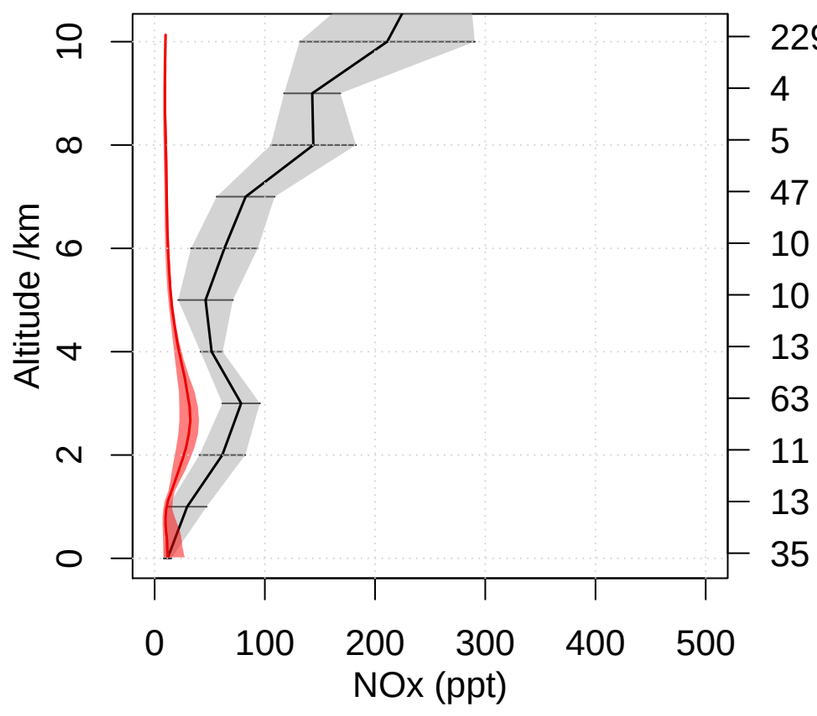
TRACE−A E−Brazil Coast 1992 09
Lat −35 − −25 Lon 310 − 320

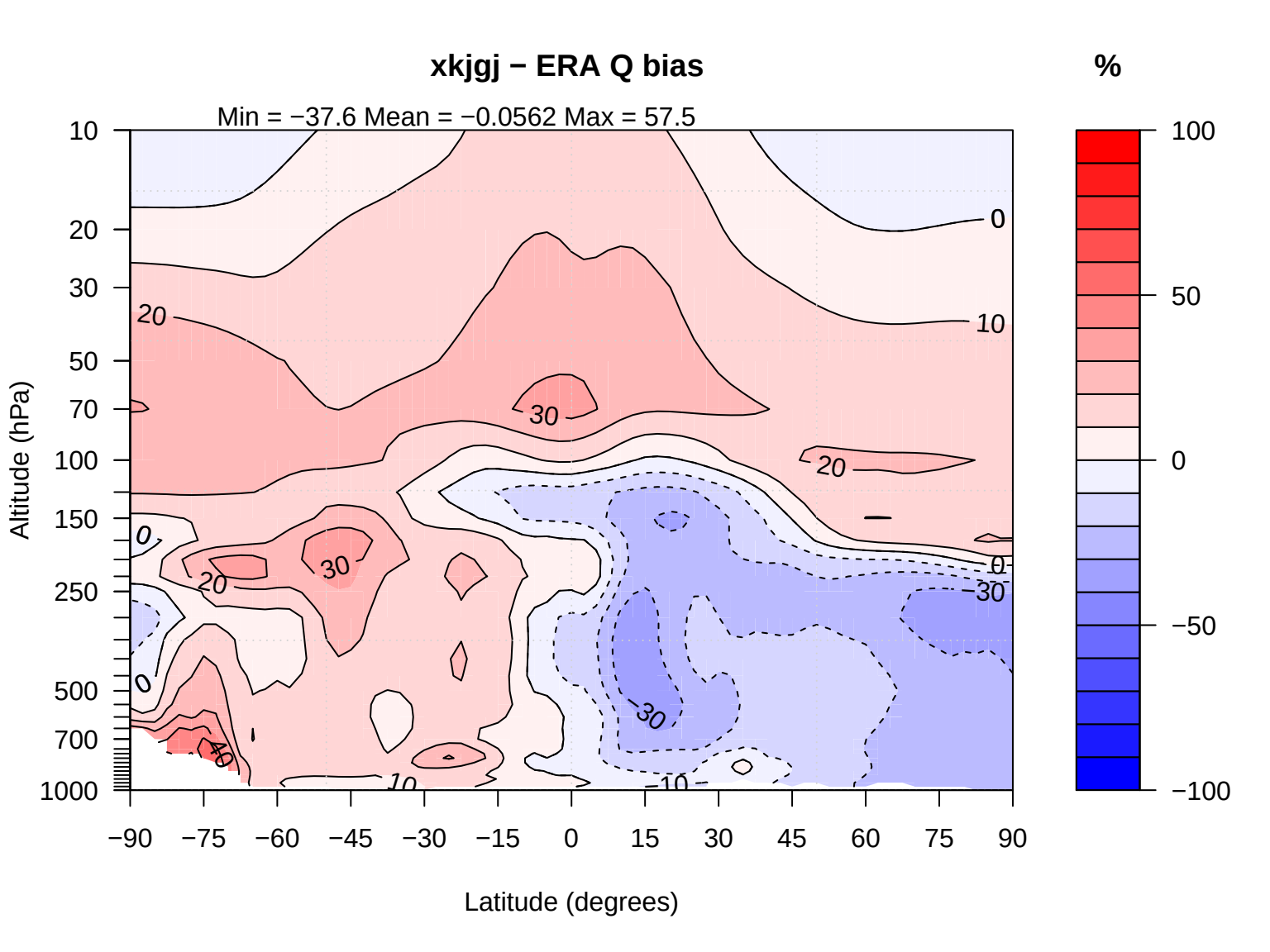


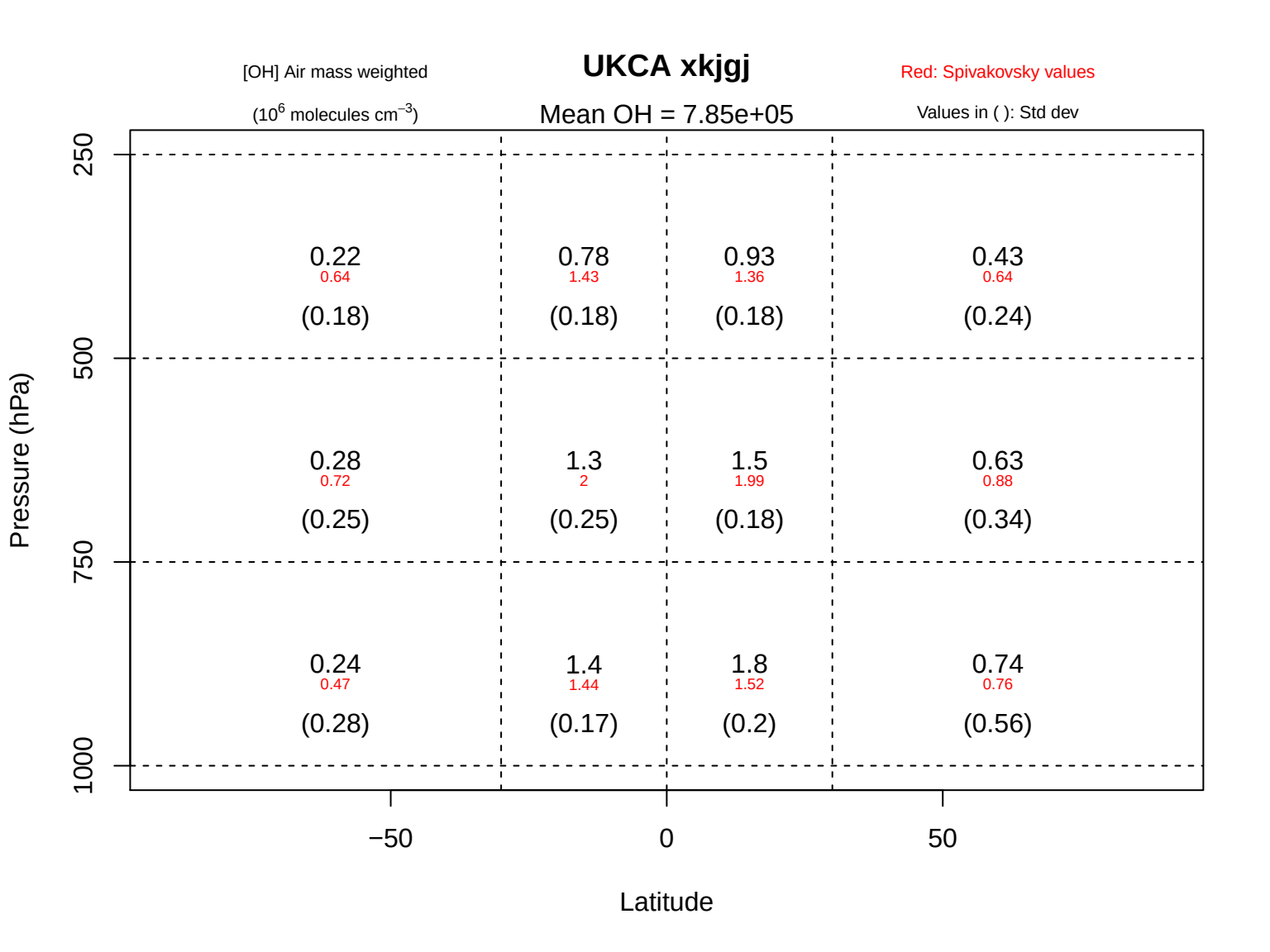
TRACE−A S−Africa 1992 09
Lat −25 − −5 Lon 15 − 35

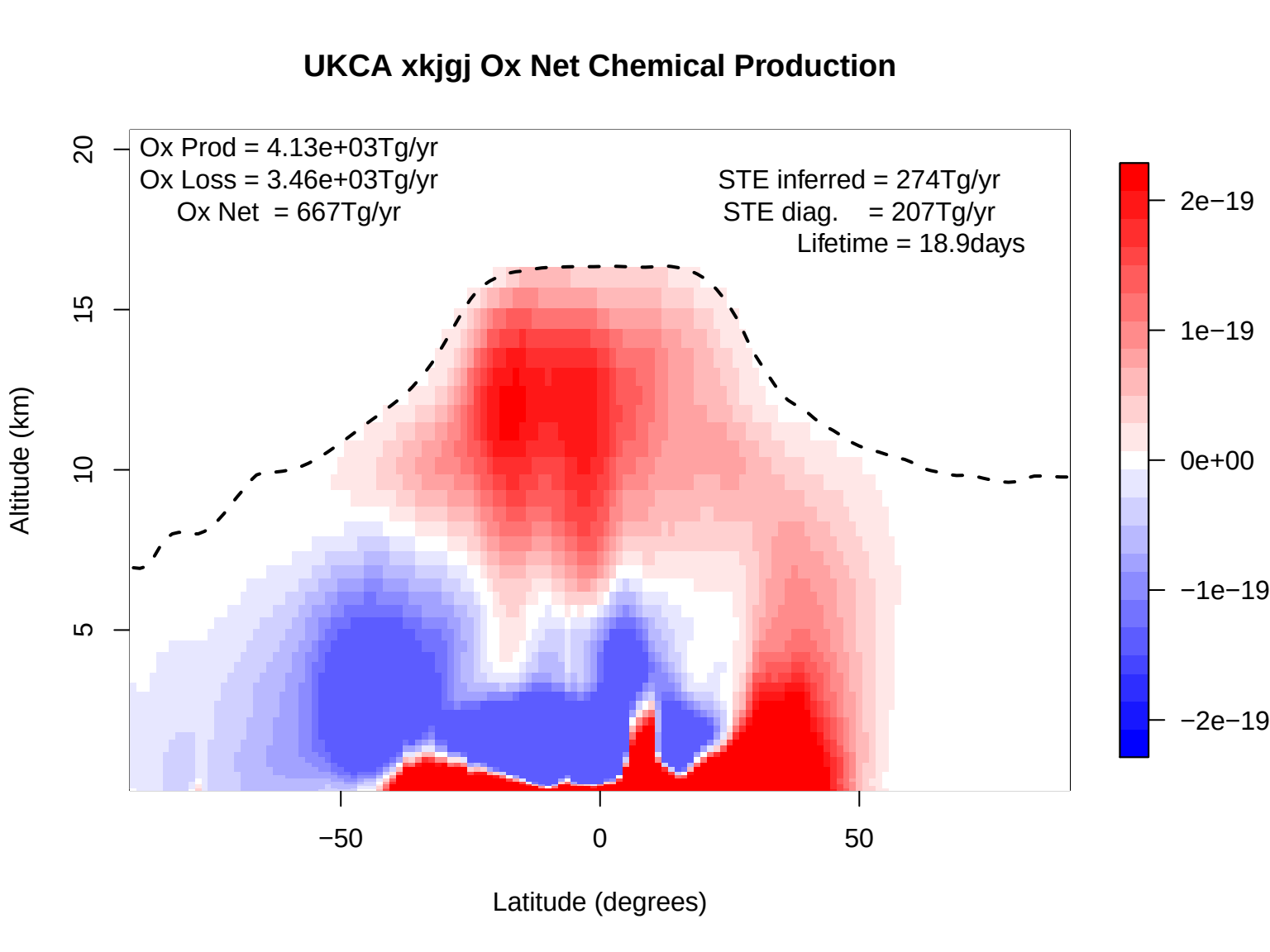


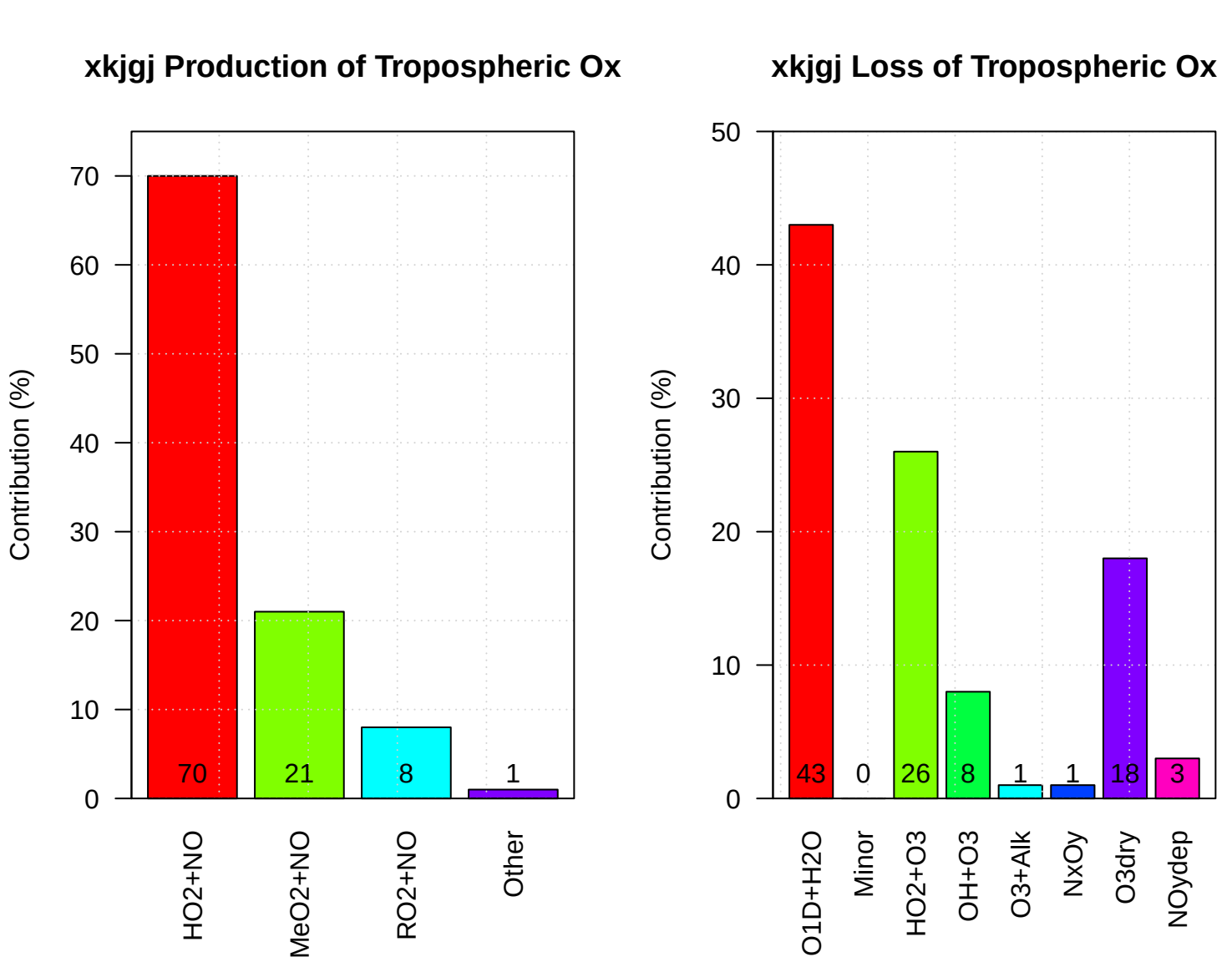
TRACE−A W−Africa Coast 1992 09
Lat −25 − −5 Lon 0 − 10

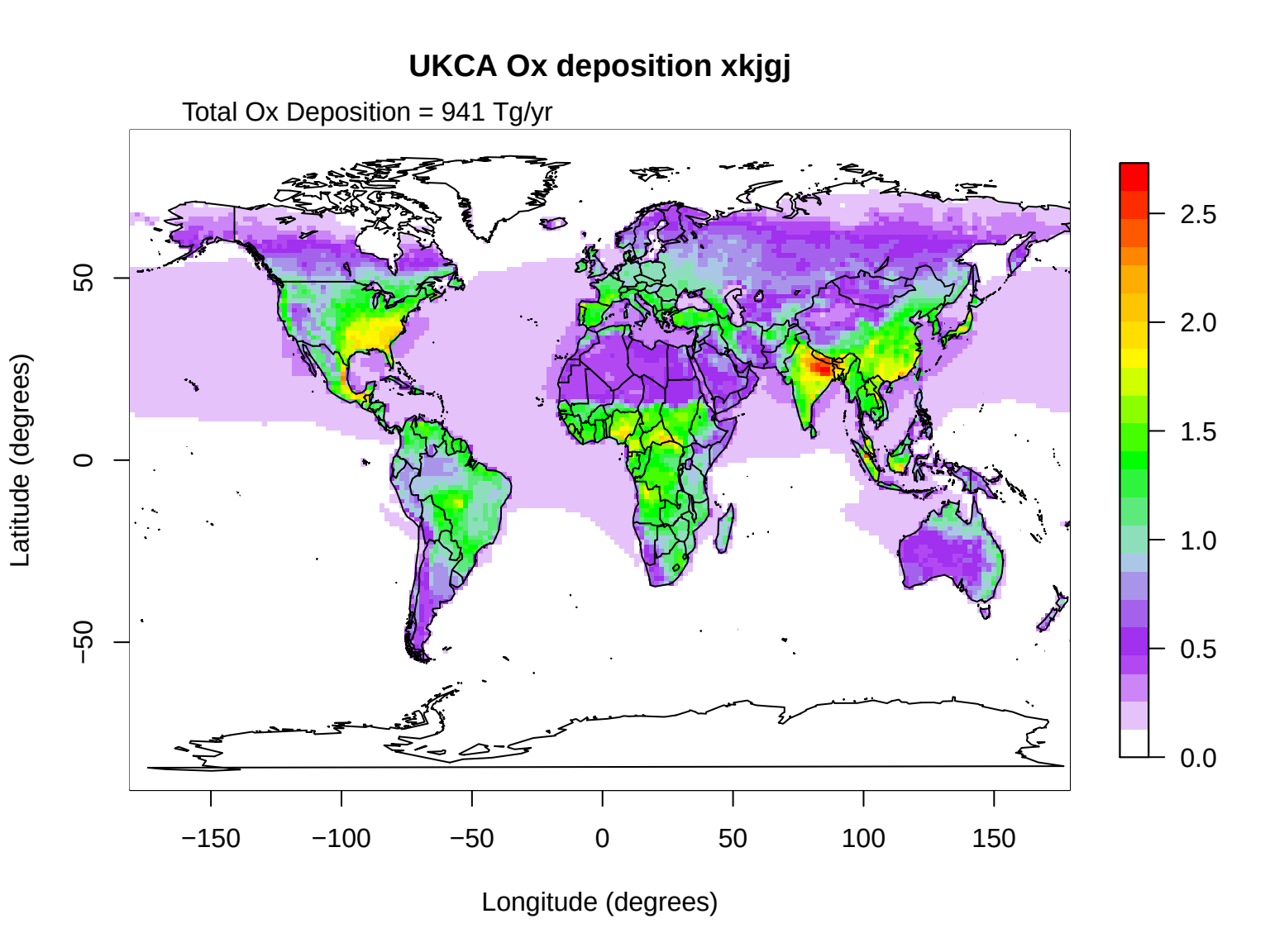


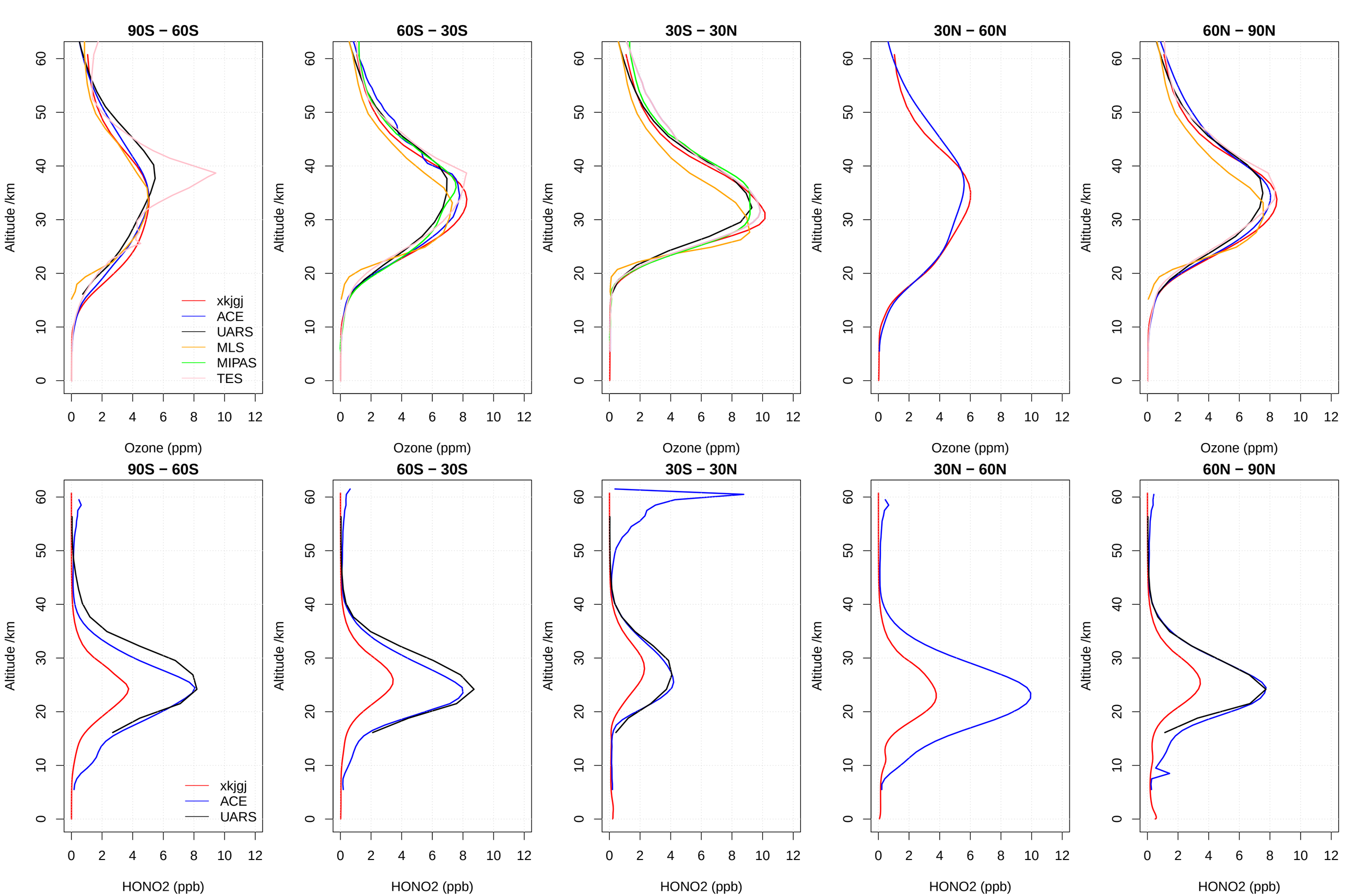

xkjgj − ERA Q bias
%
Min = −37.6 Mean = −0.0562 Max = 57.5
Altitude (hPa)
10
20
30
50
70
100
150
250
500
700
1000
−90
−75
−60
−45
−30
−15
0
15
30
45
60
75
90
Latitude (degrees)
100
50
0
−50
−100
0
10
20
30
40


[OH] Air mass weighted
(10^6 molecules cm^{-3})
UKCA xkjgj
Mean OH = 7.85e+05
Red: Spivakovsky values
Values in ( ): Std dev
0.22
0.64
(0.18)
0.78
1.43
(0.18)
0.93
1.36
(0.18)
0.43
0.64
(0.24)
0.28
0.72
(0.25)
1.3
2
(0.25)
1.5
1.99
(0.18)
0.63
0.88
(0.34)
0.24
0.47
(0.28)
1.4
1.44
(0.17)
1.8
1.52
(0.2)
0.74
0.76
(0.56)
Pressure (hPa)
250
500
750
1000
−50
0
50
Latitude


UKCA xkjgj Ox Net Chemical Production
Ox Prod = 4.13e+03Tg/yr
Ox Loss = 3.46e+03Tg/yr
Ox Net = 667Tg/yr
STE inferred = 274Tg/yr
STE diag. = 207Tg/yr
Lifetime = 18.9days
Altitude (km)
20
15
10
5
−50
0
50
Latitude (degrees)
2e−19
1e−19
0e+00
−1e−19
−2e−19


xkjgj Production of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
60
70
70
21
8
1
HO2+NO
MeO2+NO
RO2+NO
Other
xkjgj Loss of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
43
0
26
8
1
1
18
3
O1D+H2O
Minor
HO2+O3
OH+O3
O3+Alk
NxOy
O3dry
NOydep


UKCA Ox deposition xkjgj
Total Ox Deposition = 941 Tg/yr
Latitude (degrees)
50
0
−50
−150
−100
−50
0
50
100
150
Longitude (degrees)
2.5
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)
xkjgj
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

NO2 (ppb)

xkjgj
ACE
UARS

90S − 60S

60S − 30S

30S − 30N

30N − 60N

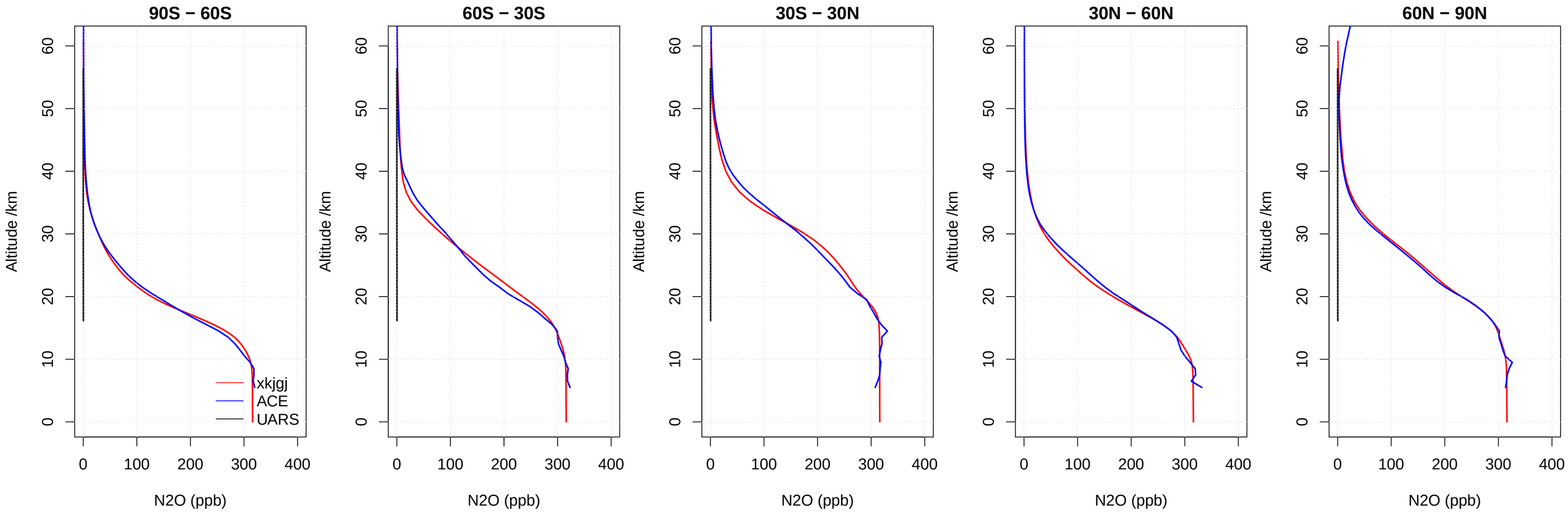
60N − 90N

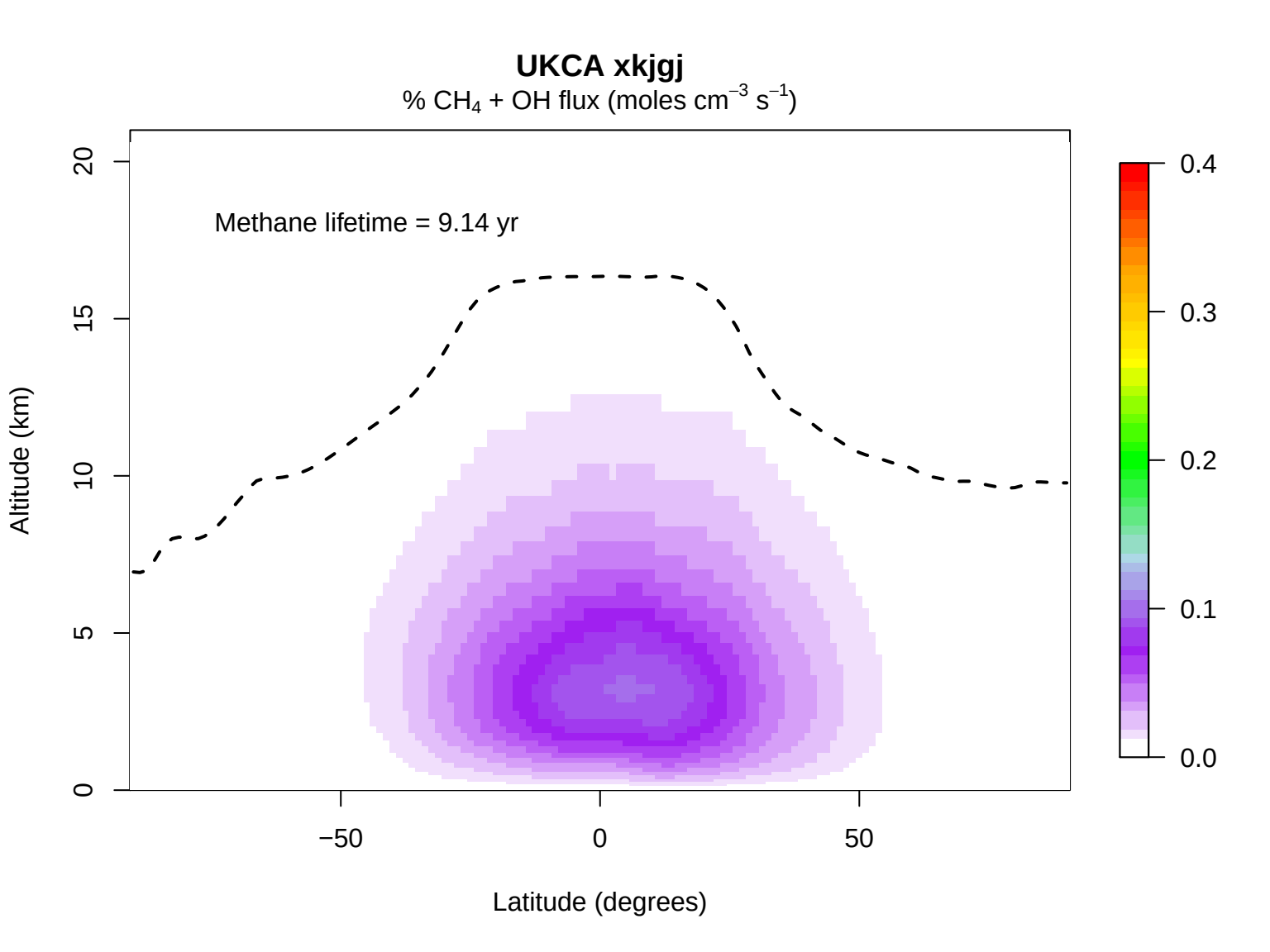
Altitude /km

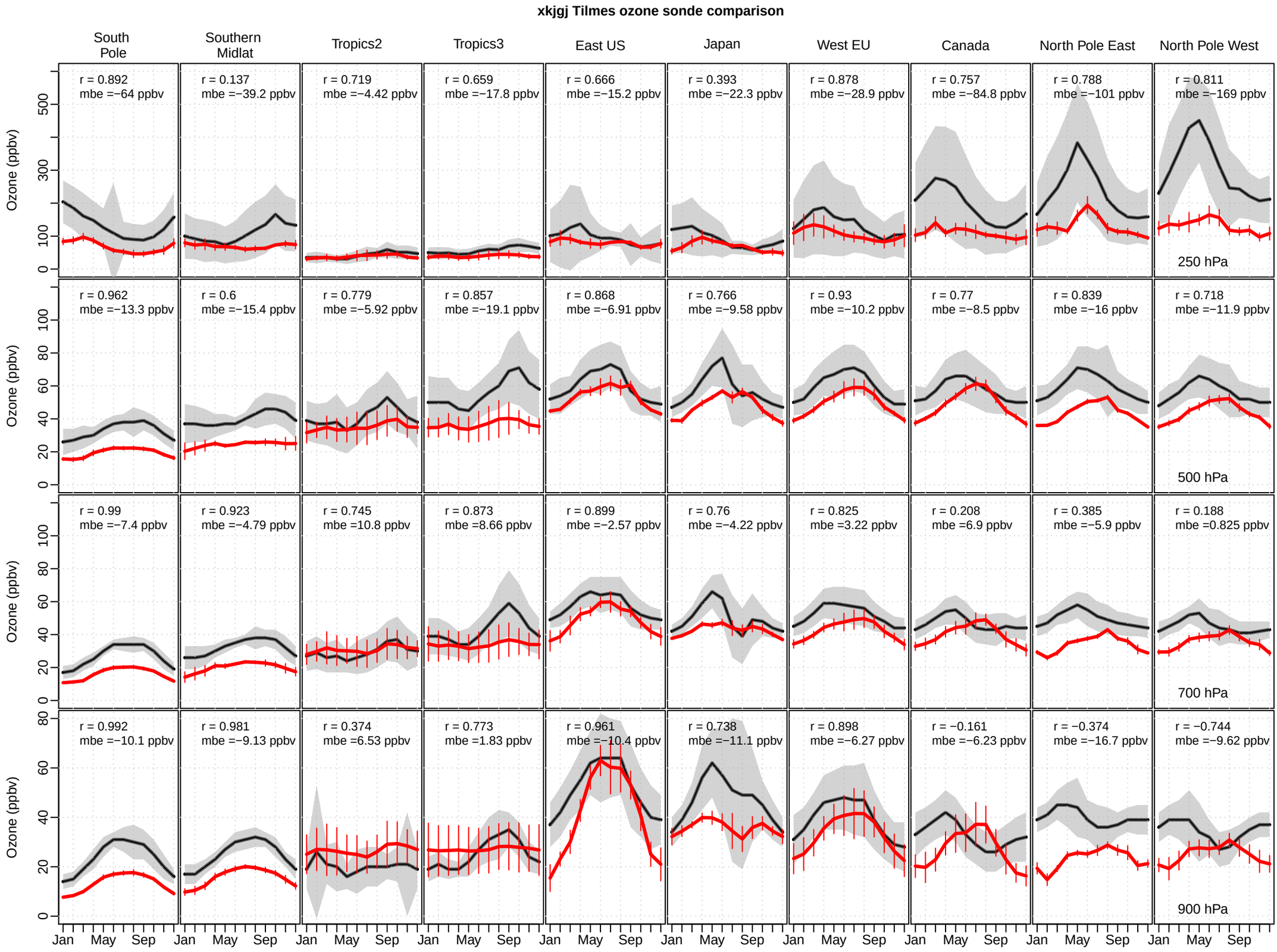
0 10 20 30 40 50 60

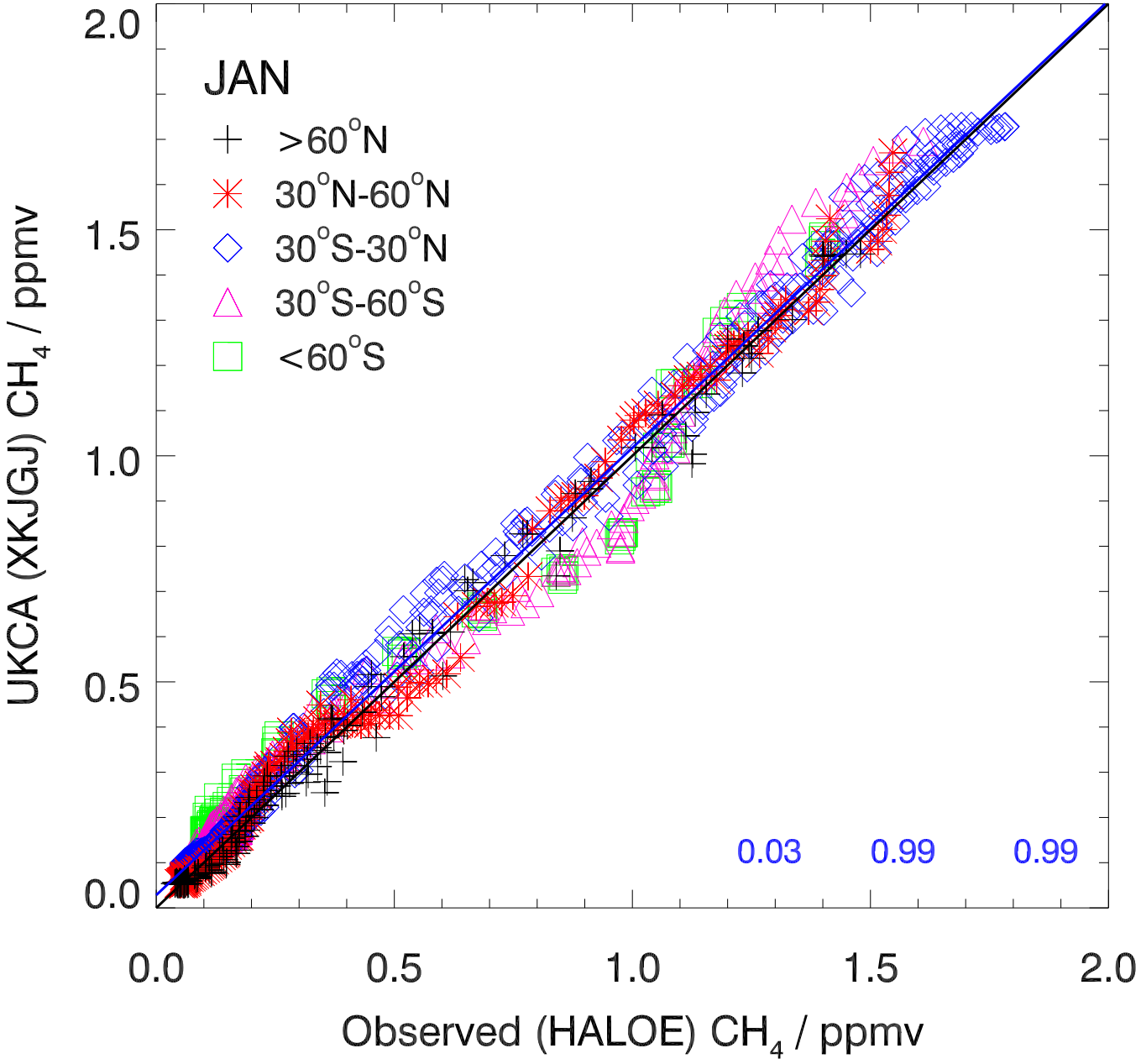
0 50 100 200 300

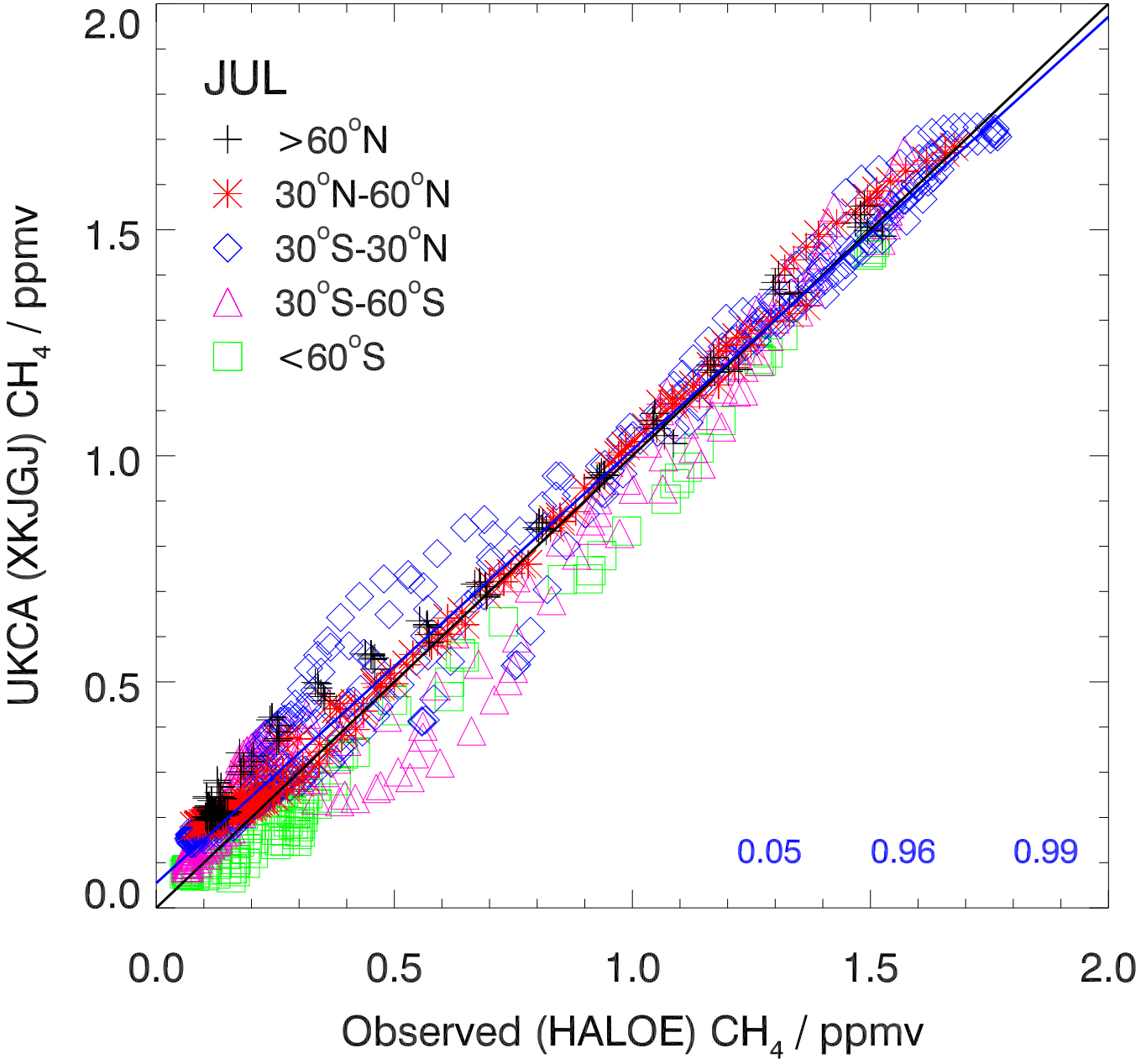
H2O (ppb)

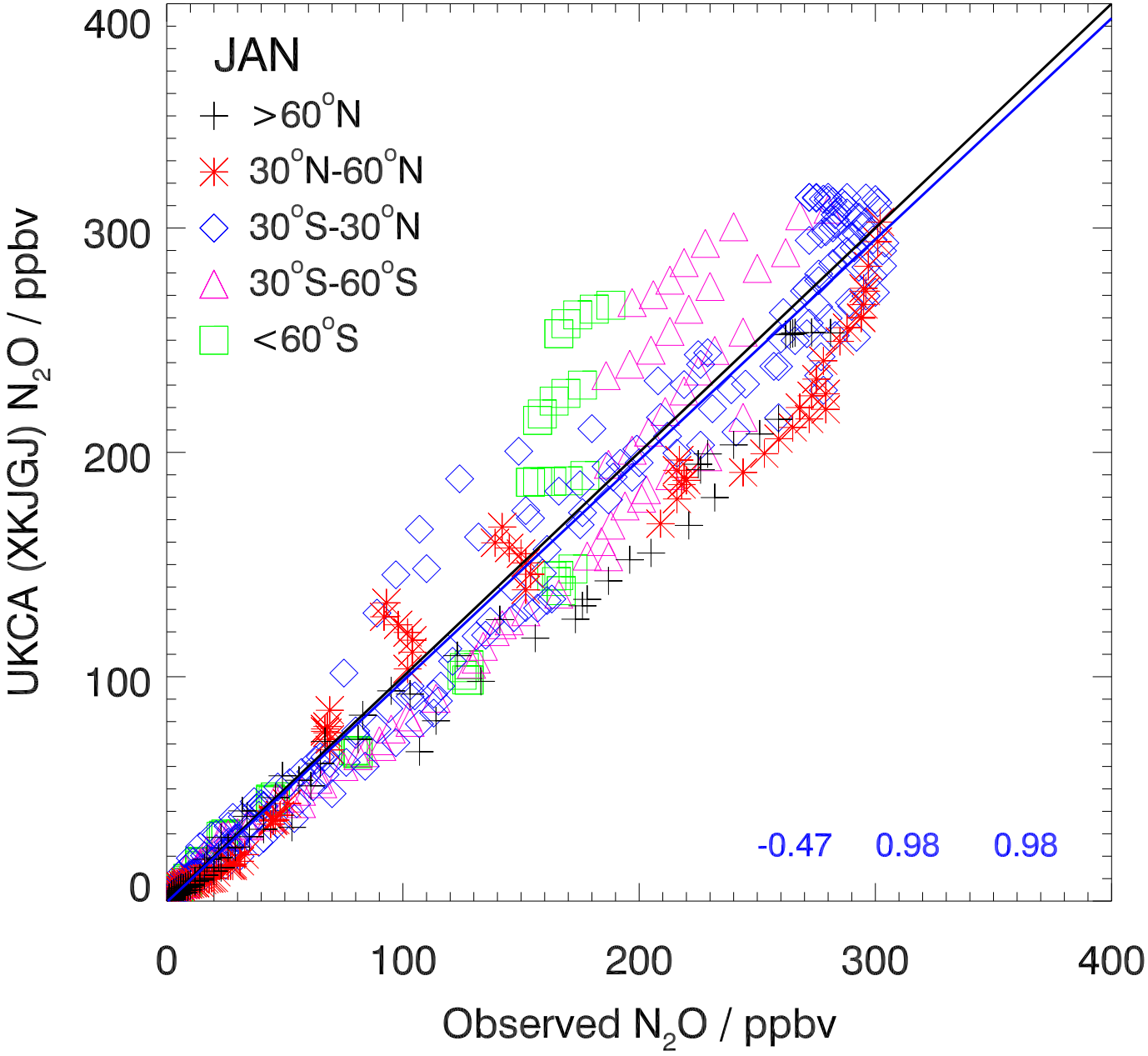

90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
N2O (ppb)
xkjgj
ACE
UARS
0
10
20
30
40
50
60
0
100
200
300
400

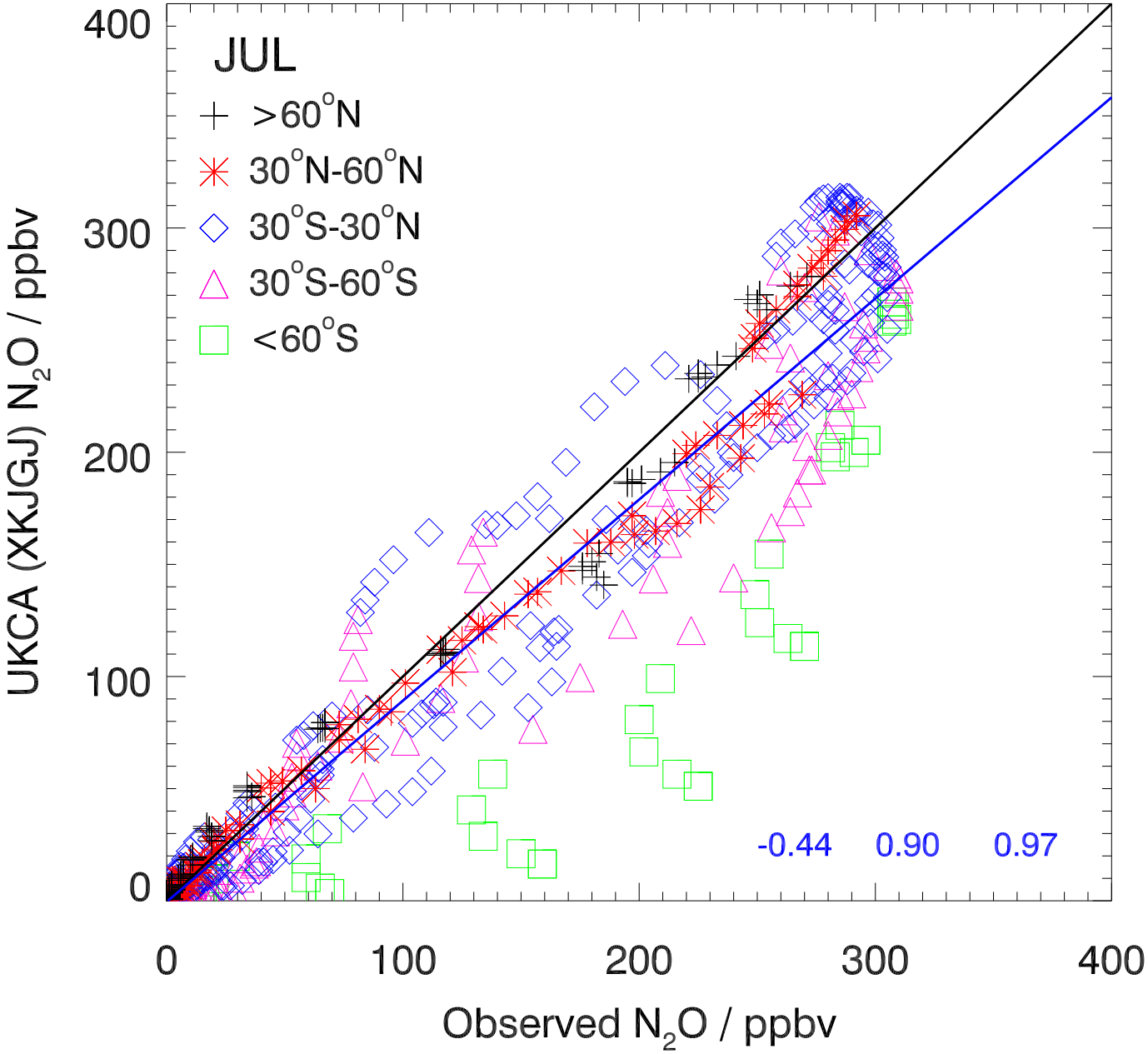

UKCA xkjgj
% CH4 + OH flux (moles cm−3 s−1)
Methane lifetime = 9.14 yr
Altitude (km)
0
5
10
15
20
−50
0
50
Latitude (degrees)
0.4
0.3
0.2
0.1
0.0

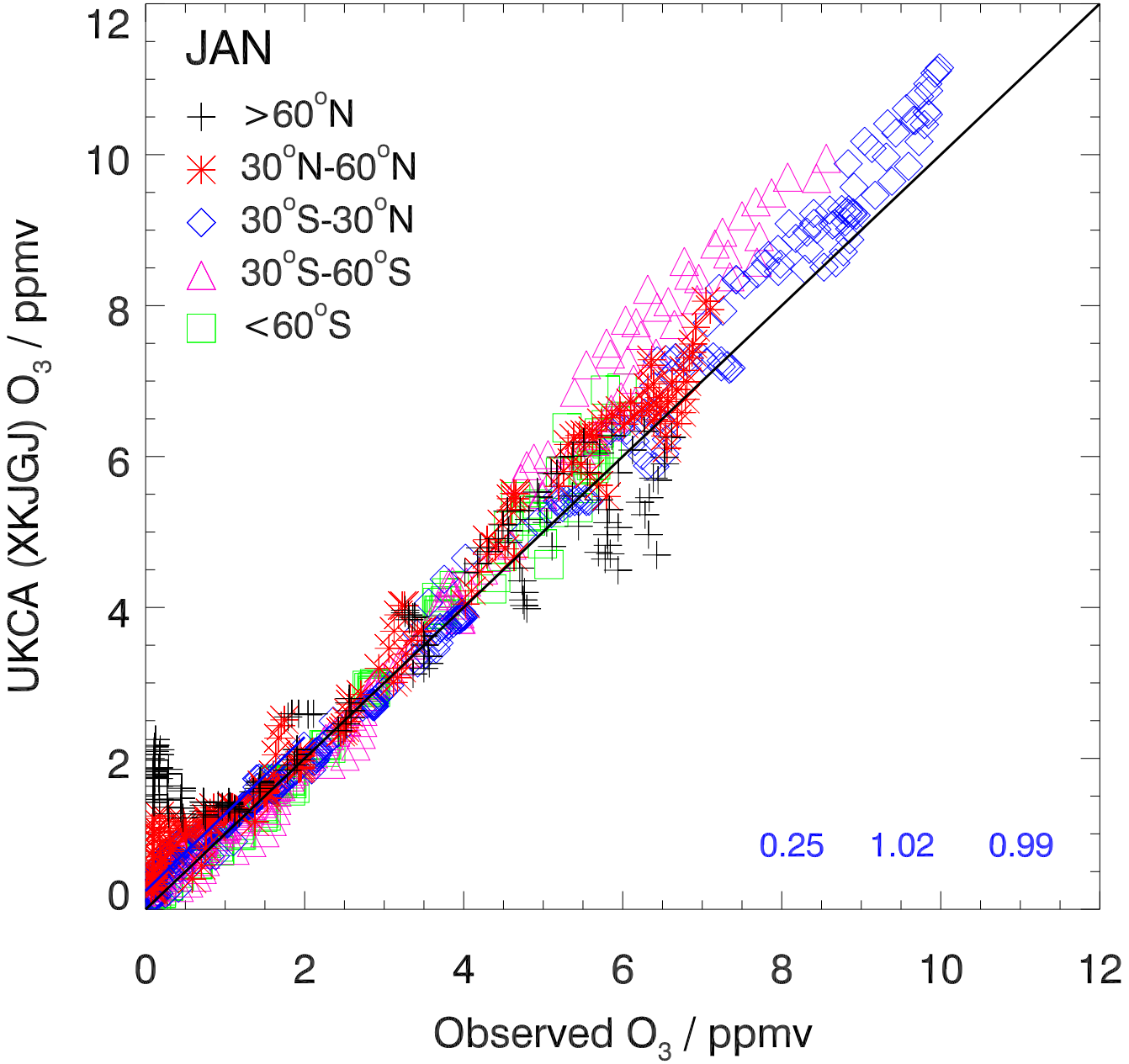

xkjgj Tilmes ozone sonde comparison
South Pole
Southern Midlat
Tropics2
Tropics3
East US
Japan
West EU
Canada
North Pole East
North Pole West
Ozone (ppbv)
r = 0.892
mbe =−64 ppbv
r = 0.137
mbe =−39.2 ppbv
r = 0.719
mbe =−4.42 ppbv
r = 0.659
mbe =−17.8 ppbv
r = 0.666
mbe =−15.2 ppbv
r = 0.393
mbe =−22.3 ppbv
r = 0.878
mbe =−28.9 ppbv
r = 0.757
mbe =−84.8 ppbv
r = 0.788
mbe =−101 ppbv
r = 0.811
mbe =−169 ppbv
250 hPa
r = 0.962
mbe =−13.3 ppbv
r = 0.6
mbe =−15.4 ppbv
r = 0.779
mbe =−5.92 ppbv
r = 0.857
mbe =−19.1 ppbv
r = 0.868
mbe =−6.91 ppbv
r = 0.766
mbe =−9.58 ppbv
r = 0.93
mbe =−10.2 ppbv
r = 0.77
mbe =−8.5 ppbv
r = 0.839
mbe =−16 ppbv
r = 0.718
mbe =−11.9 ppbv
500 hPa
r = 0.99
mbe =−7.4 ppbv
r = 0.923
mbe =−4.79 ppbv
r = 0.745
mbe =10.8 ppbv
r = 0.873
mbe =8.66 ppbv
r = 0.899
mbe =−2.57 ppbv
r = 0.76
mbe =−4.22 ppbv
r = 0.825
mbe =3.22 ppbv
r = 0.208
mbe =6.9 ppbv
r = 0.385
mbe =−5.9 ppbv
r = 0.188
mbe =0.825 ppbv
700 hPa
r = 0.992
mbe =−10.1 ppbv
r = 0.981
mbe =−9.13 ppbv
r = 0.374
mbe =6.53 ppbv
r = 0.773
mbe =1.83 ppbv
r = 0.961
mbe =−10.4 ppbv
r = 0.738
mbe =−11.1 ppbv
r = 0.898
mbe =−6.27 ppbv
r = −0.161
mbe =−6.23 ppbv
r = −0.374
mbe =−16.7 ppbv
r = −0.744
mbe =−9.62 ppbv
900 hPa
Jan
May
Sep

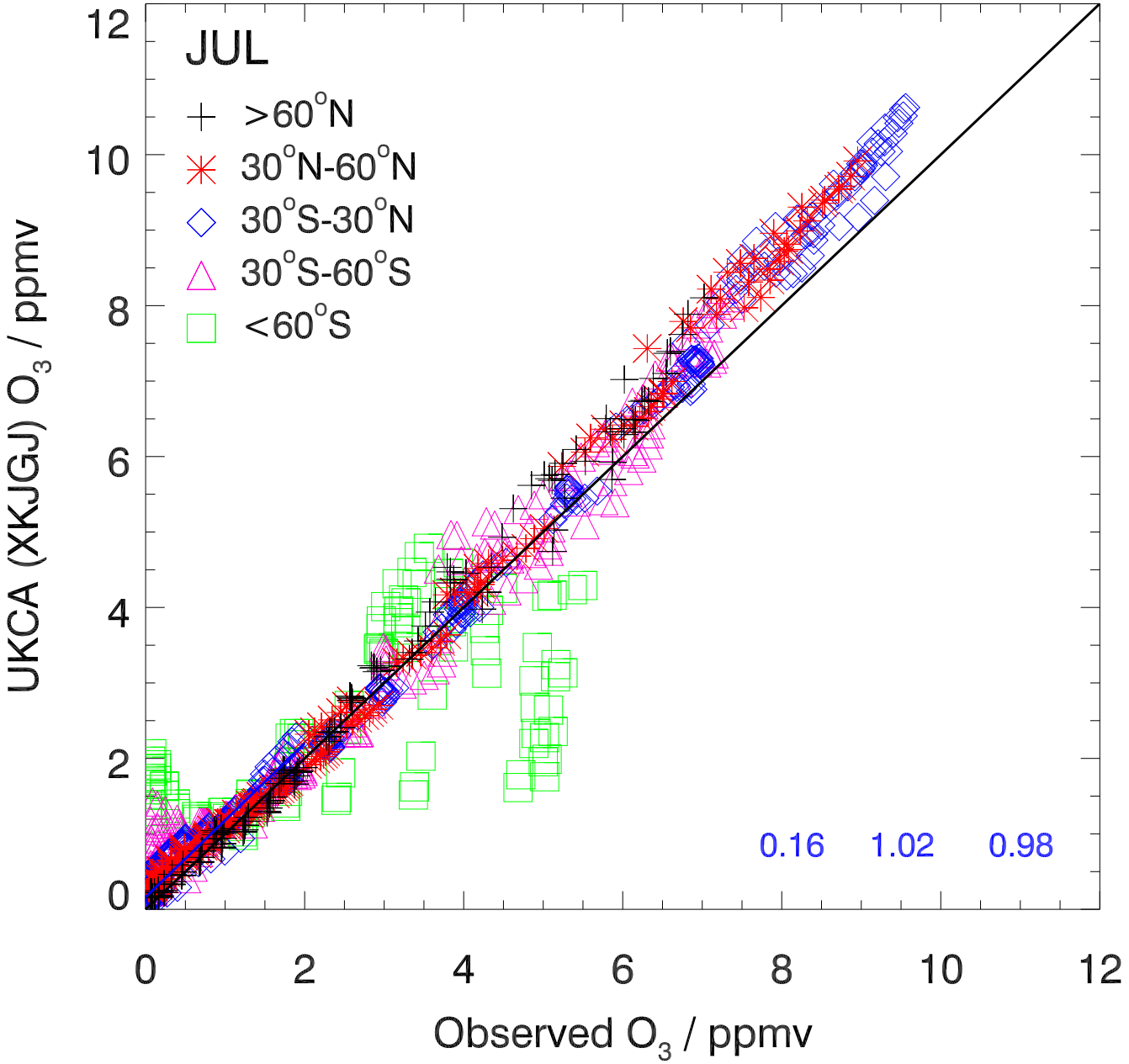

JAN
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
0.03
0.99
0.99
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
UKCA (XKJGJ) CH4 / ppmv
Observed (HALOE) CH4 / ppmv

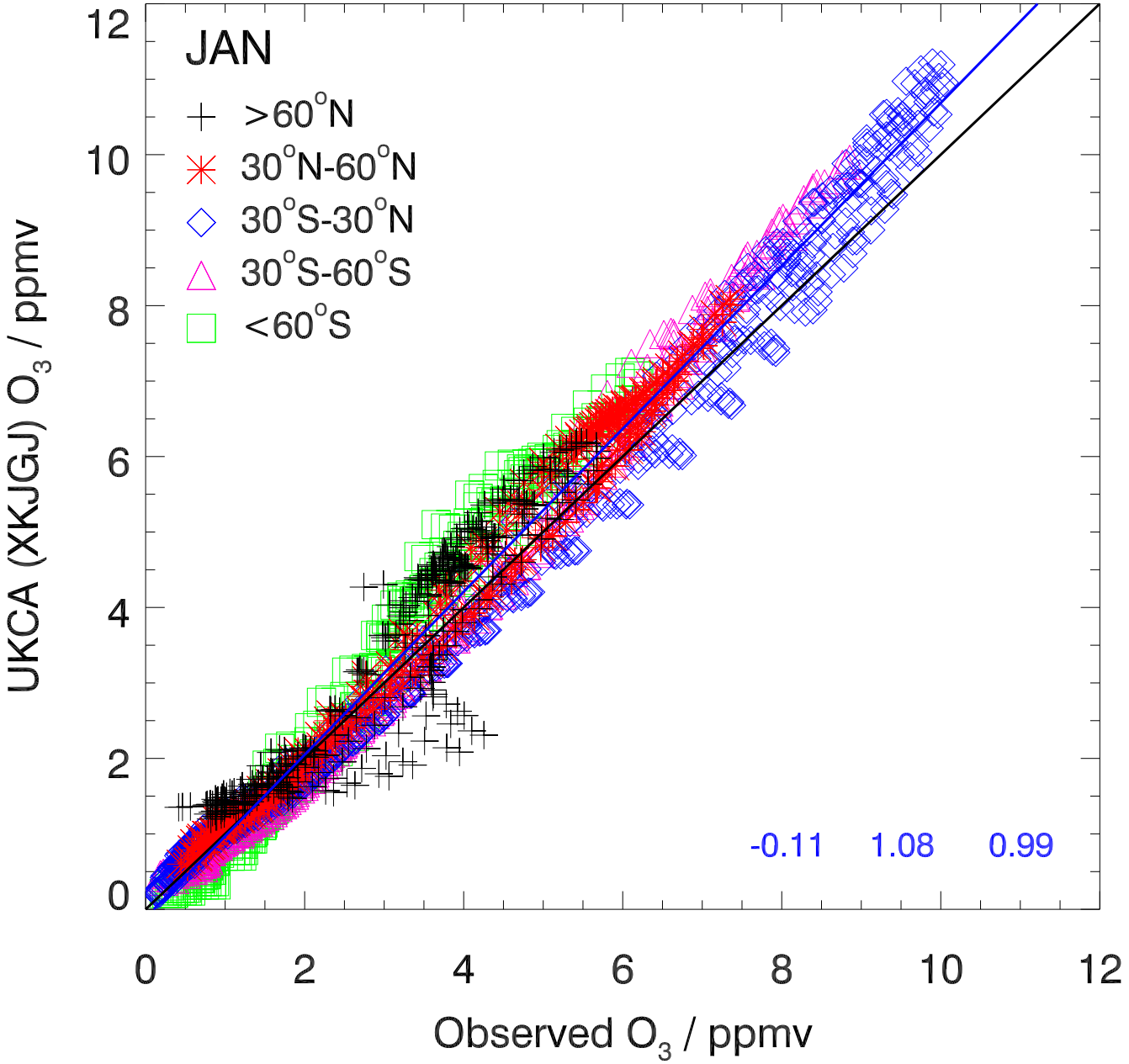

JUL
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
0.05
0.96
0.99
UKCA (XKJGJ) CH4 / ppmv
Observed (HALOE) CH4 / ppmv
0.0
0.5
1.0
1.5
2.0

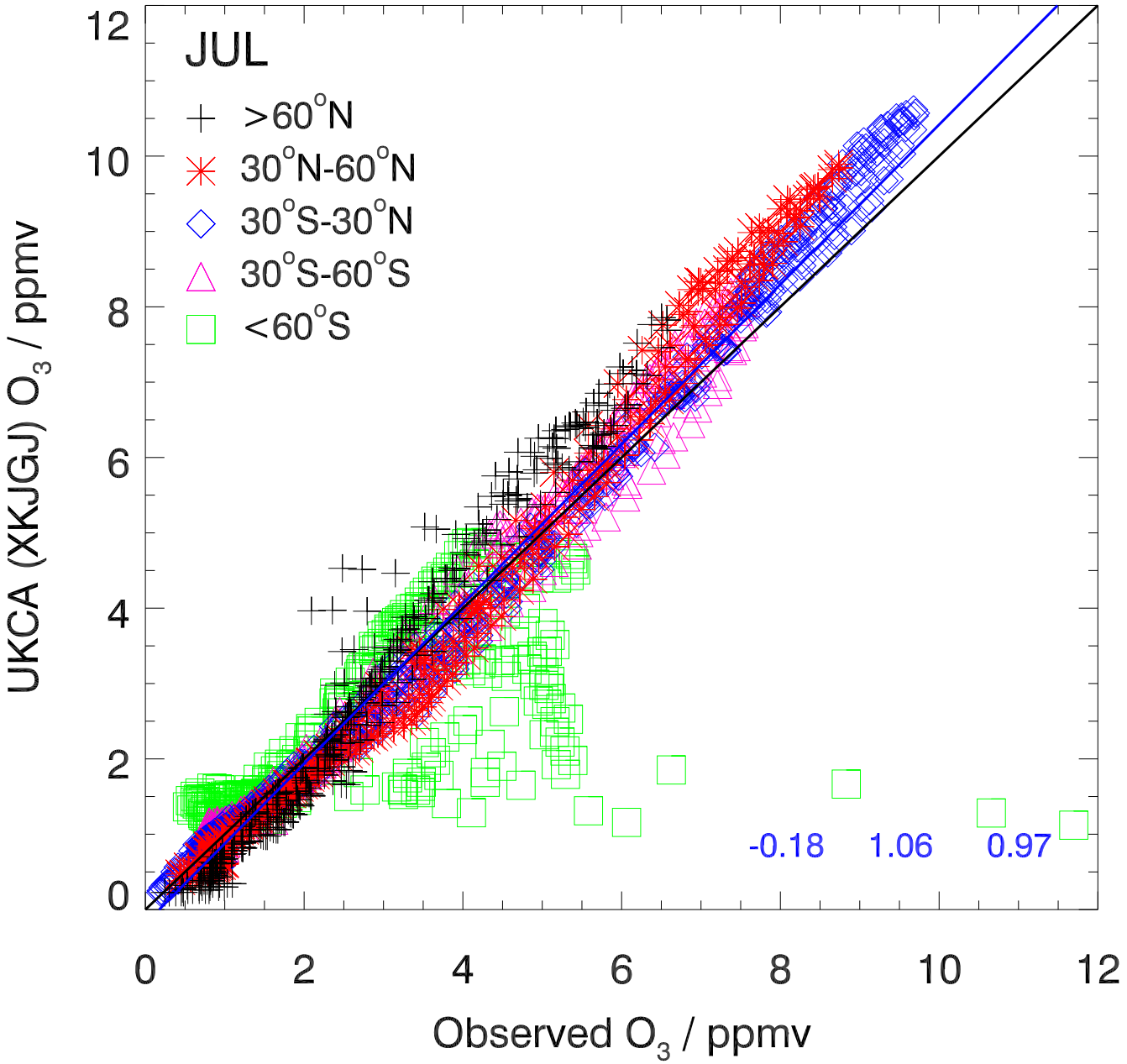

JAN
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
-0.47
0.98
0.98
UKCA (XKJGJ) N2O / ppbv
Observed N2O / ppbv
0
100
200
300
400

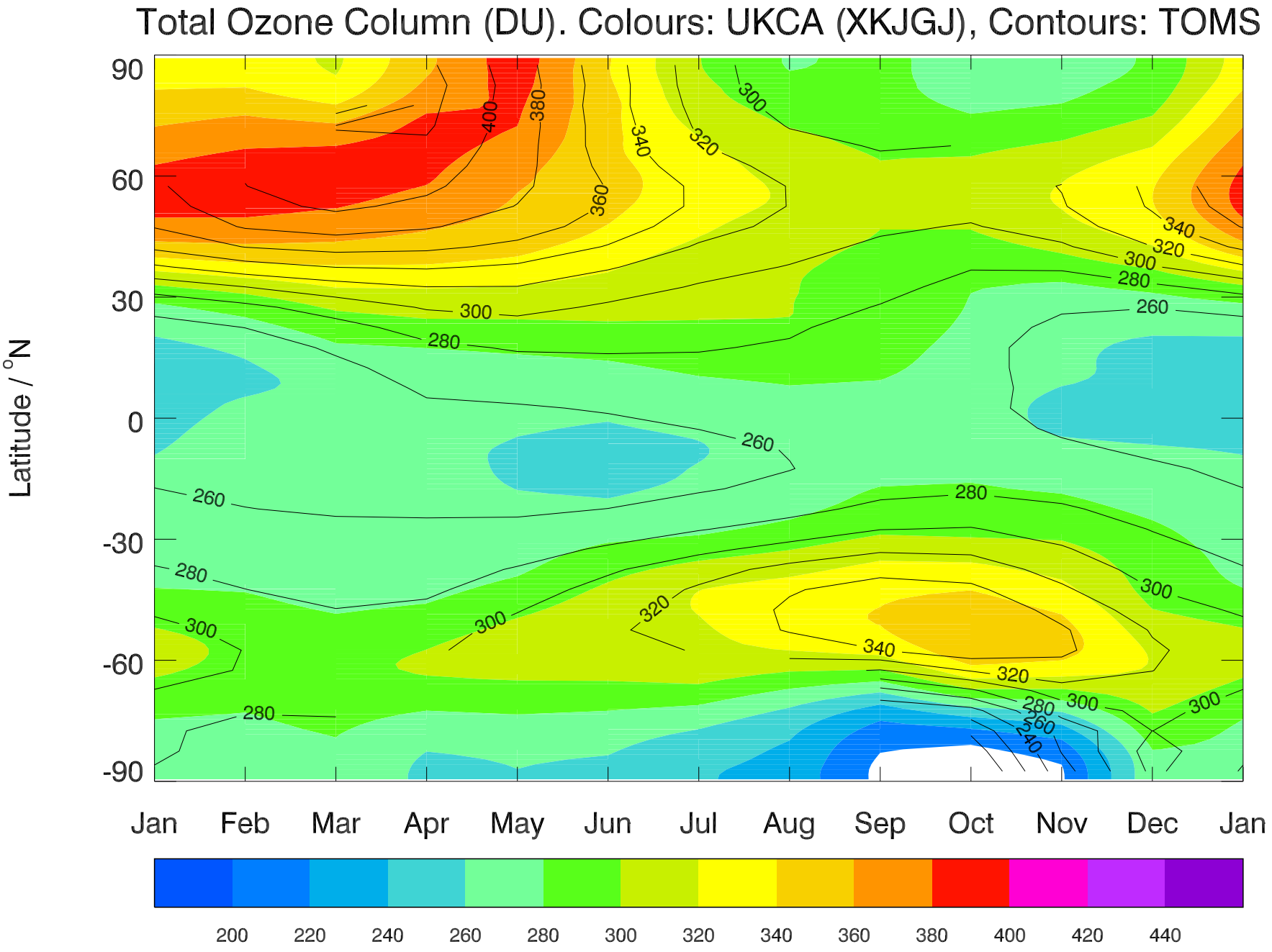

JUL
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
-0.44
0.90
0.97
UKCA (XKJGJ) N2O / ppbv
Observed N2O / ppbv
0
100
200
300
400

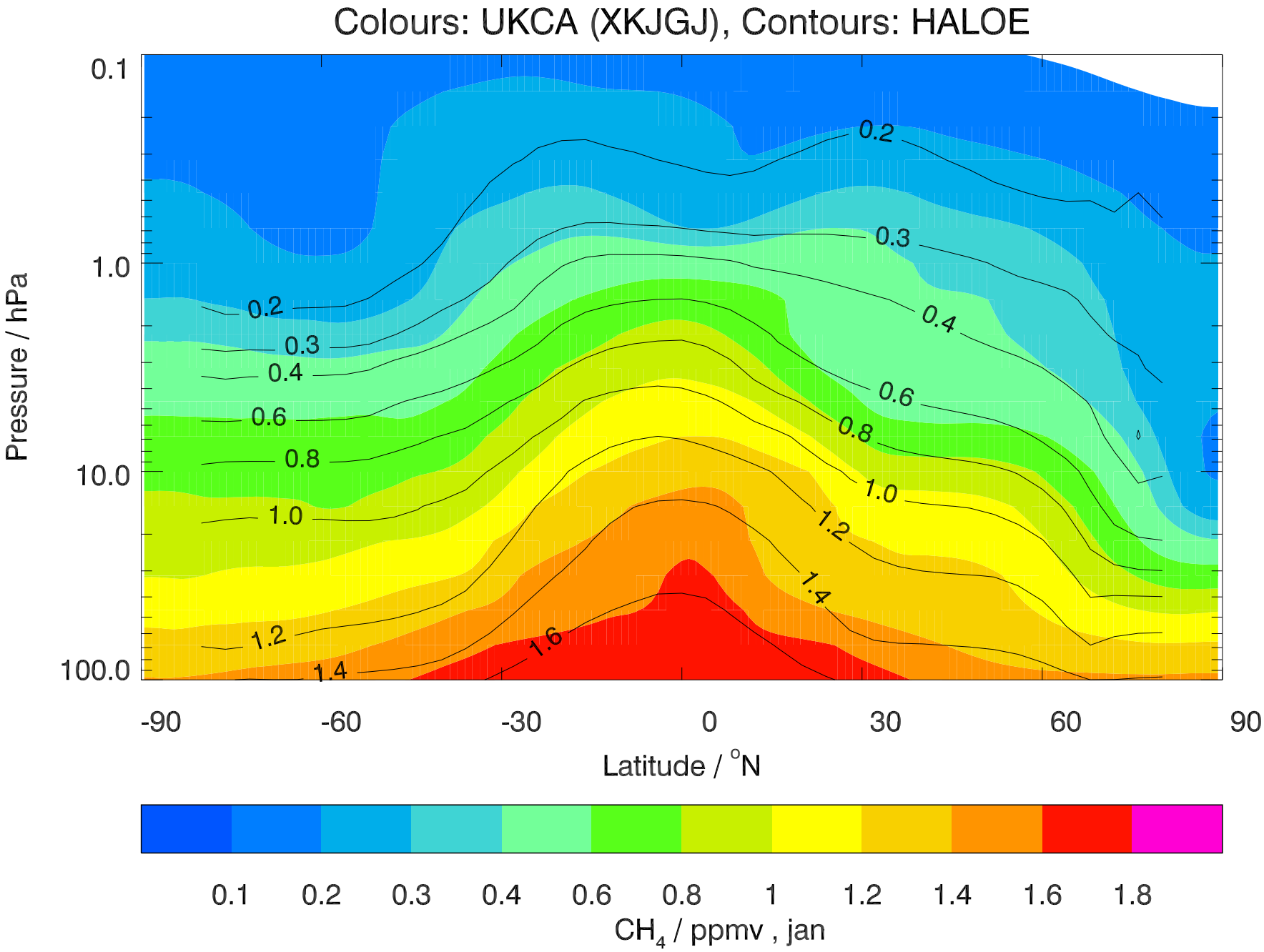

JAN
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
0.25
1.02
0.99
UKCA (XKJGJ) O3 / ppmv
Observed O3 / ppmv
0
2
4
6
8
10
12

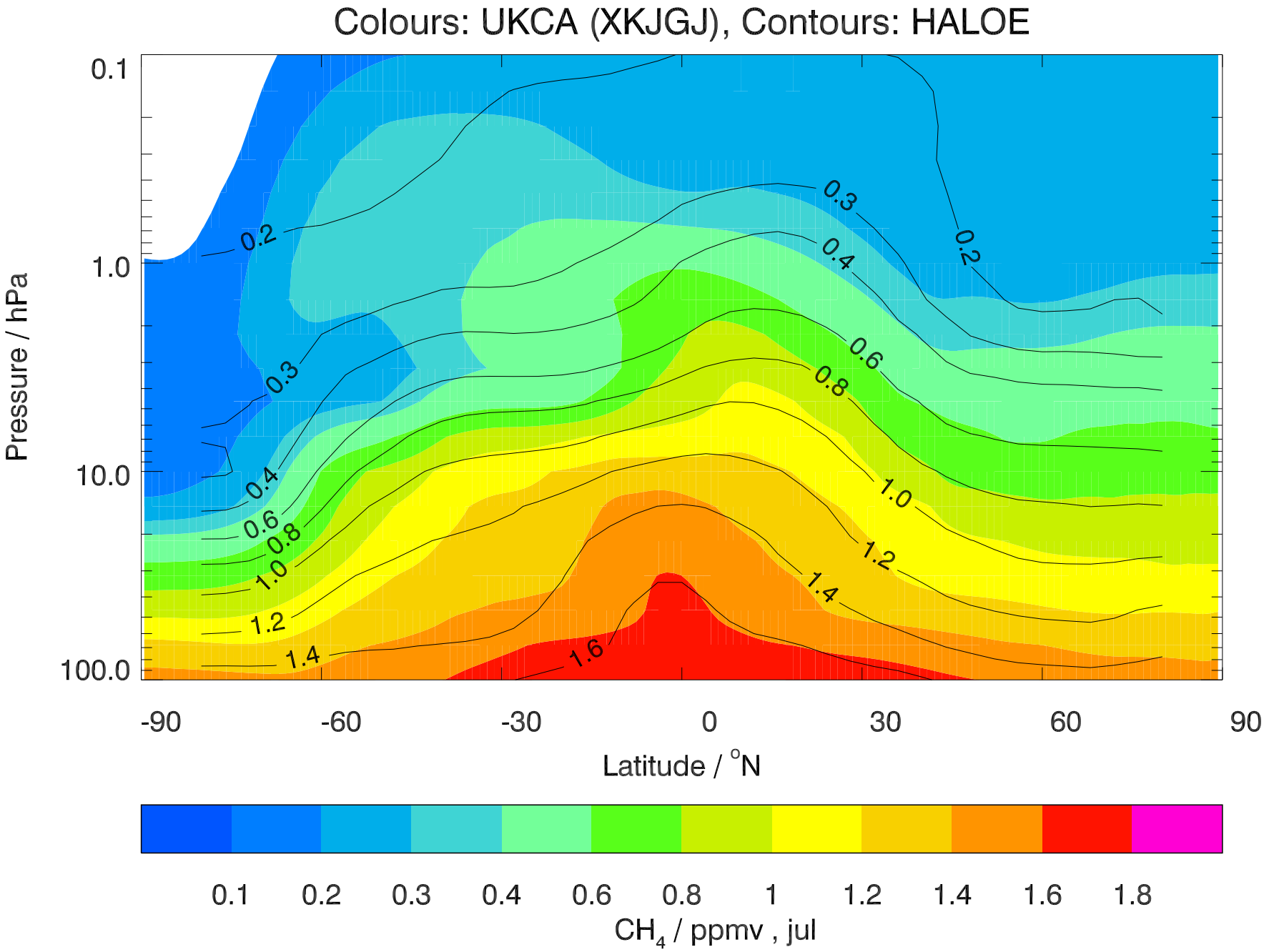

JUL
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
0.16
1.02
0.98
UKCA (XKJGJ) O3 / ppmv
Observed O3 / ppmv
0
2
4
6
8
10
12

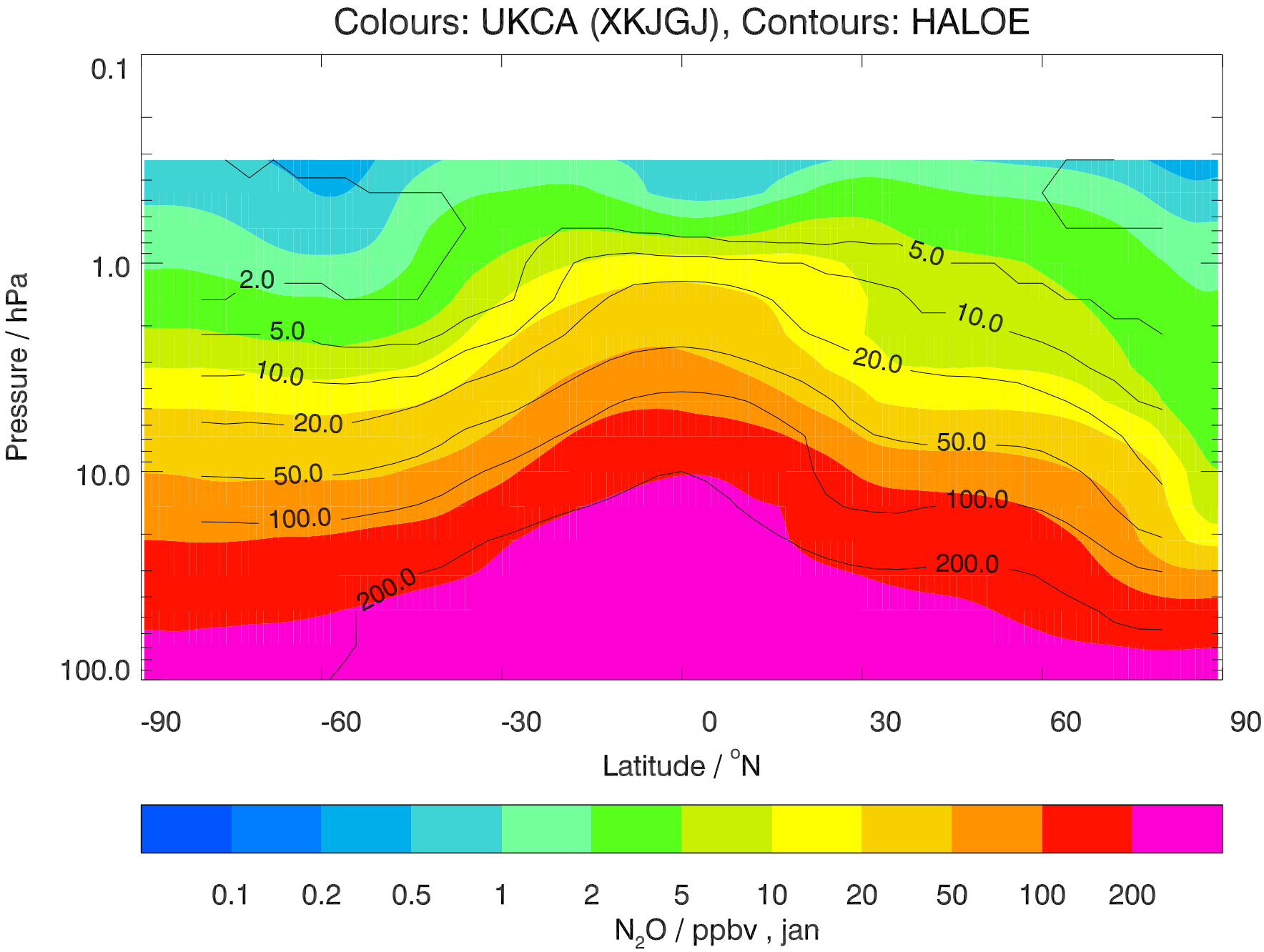

JAN
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
-0.11
1.08
0.99
UKCA (XKJGJ) O3 / ppmv
Observed O3 / ppmv
0
2
4
6
8
10
12

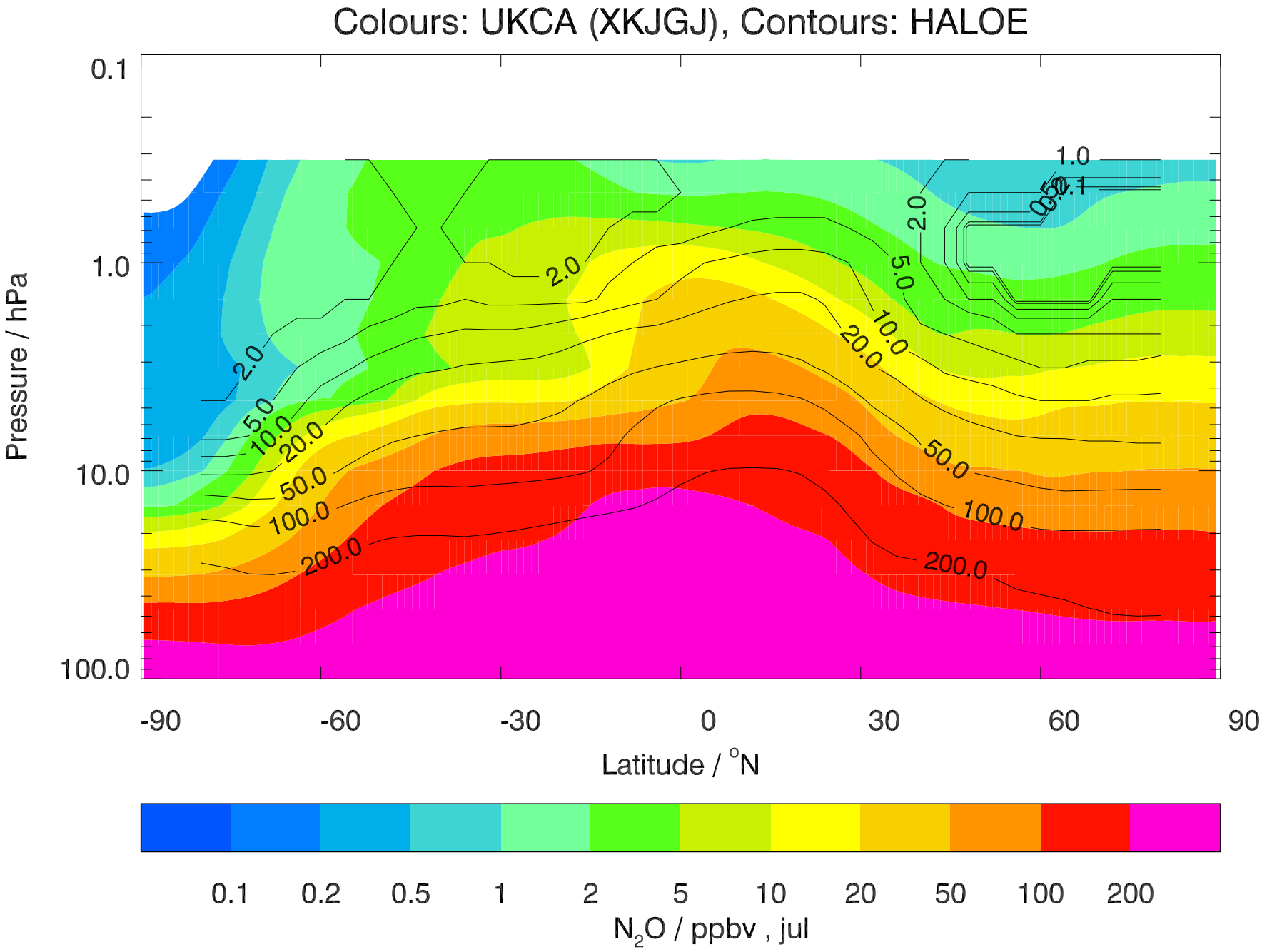

JUL
>60°N
30°N-60°N
30°S-30°N
30°S-60°S
<60°S
-0.18
1.06
0.97
UKCA (XKJGJ) O3 / ppmv
Observed O3 / ppmv
0
2
4
6
8
10
12

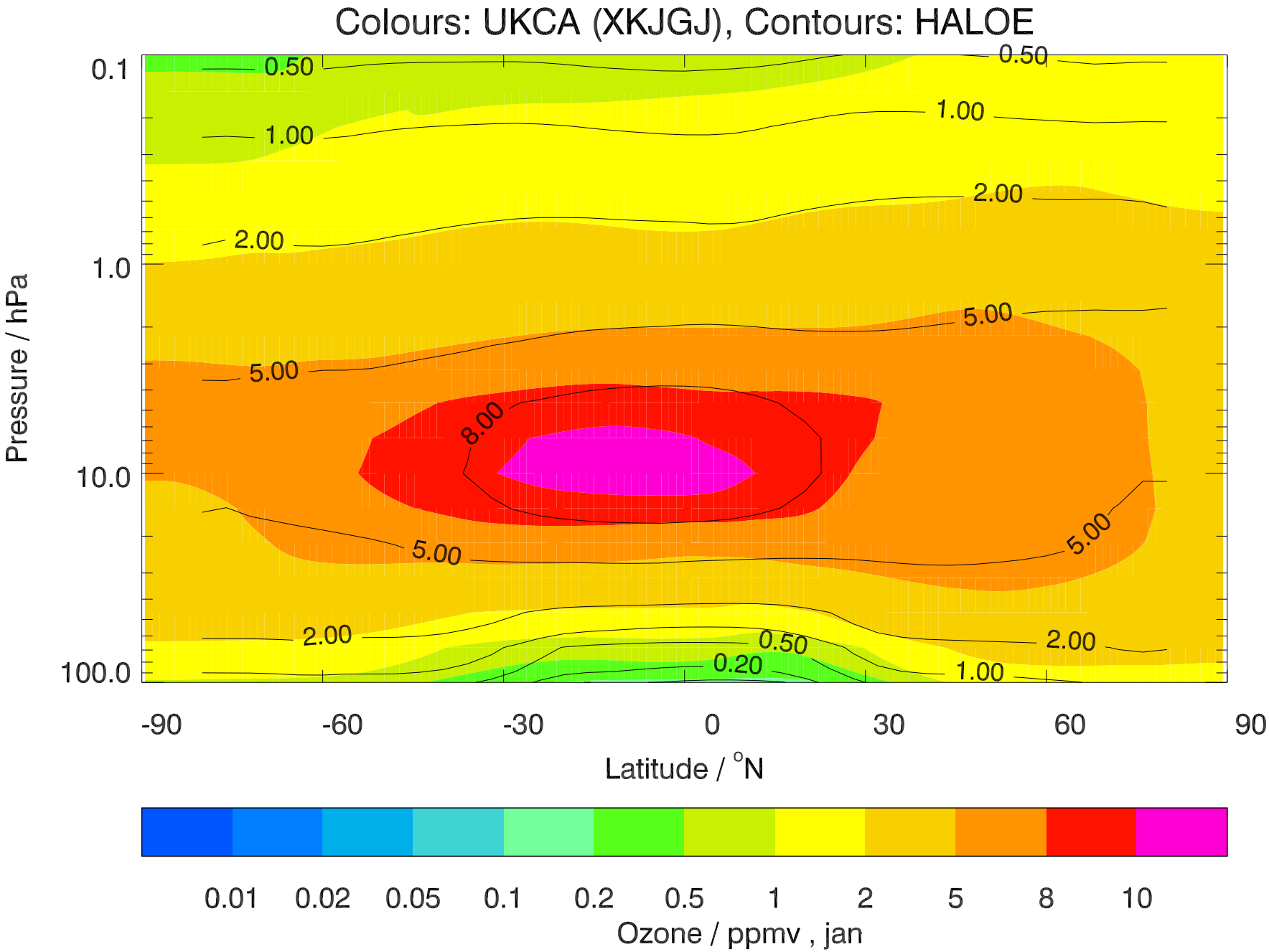

Total Ozone Column (DU). Colours: UKCA (XKJGJ), Contours: TOMS
Latitude / °N
90
60
30
0
-30
-60
-90
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
200
220
240
260
280
300
320
340
360
380
400
420
440

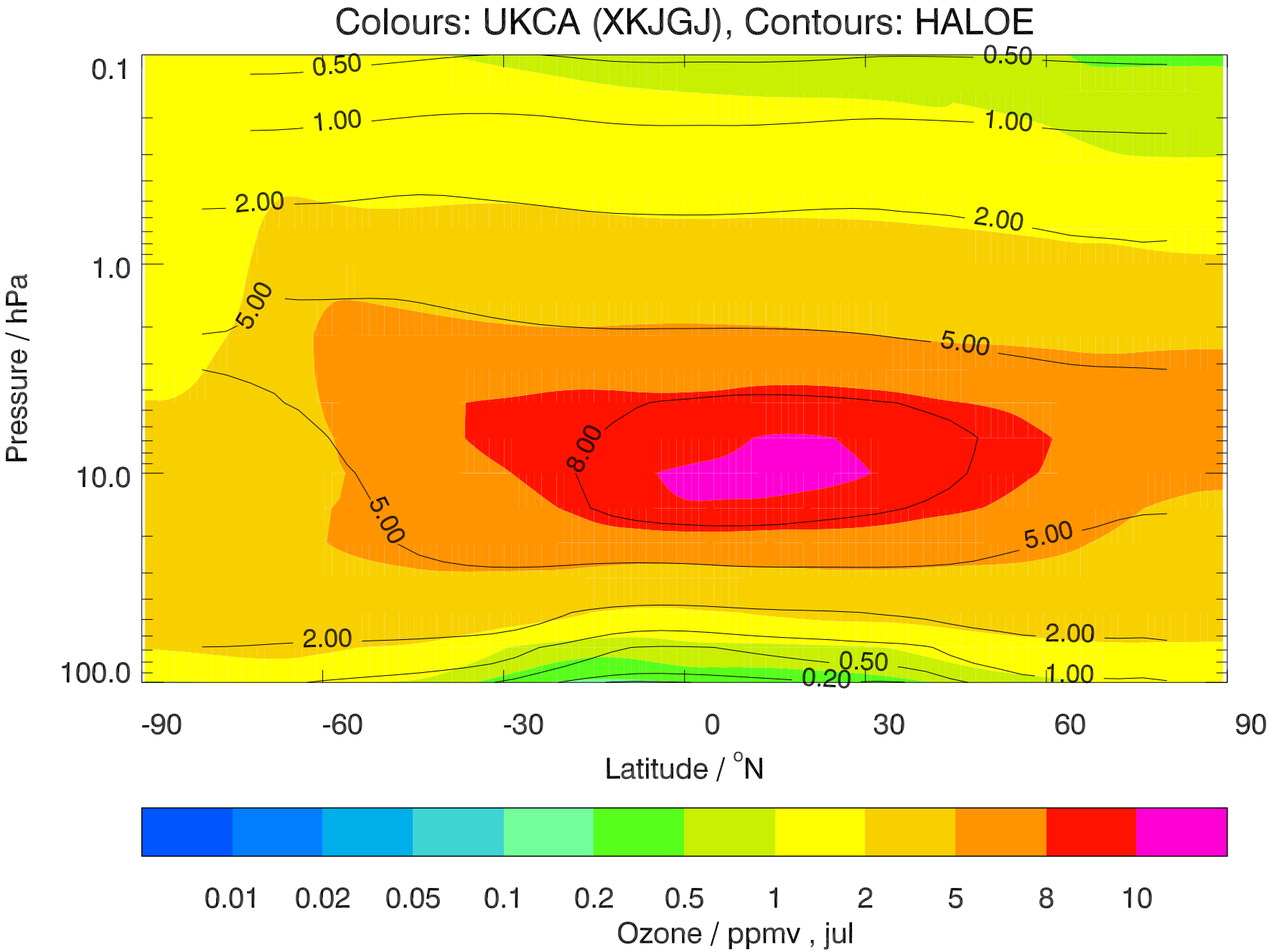

Colours: UKCA (XKJGJ), Contours: HALOE
Pressure / hPa
0.1
1.0
10.0
100.0
0.2
0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6
-90
-60
-30
0
30
60
90
Latitude / °N
0.1
0.2
0.3
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
CH4 / ppmv , jan

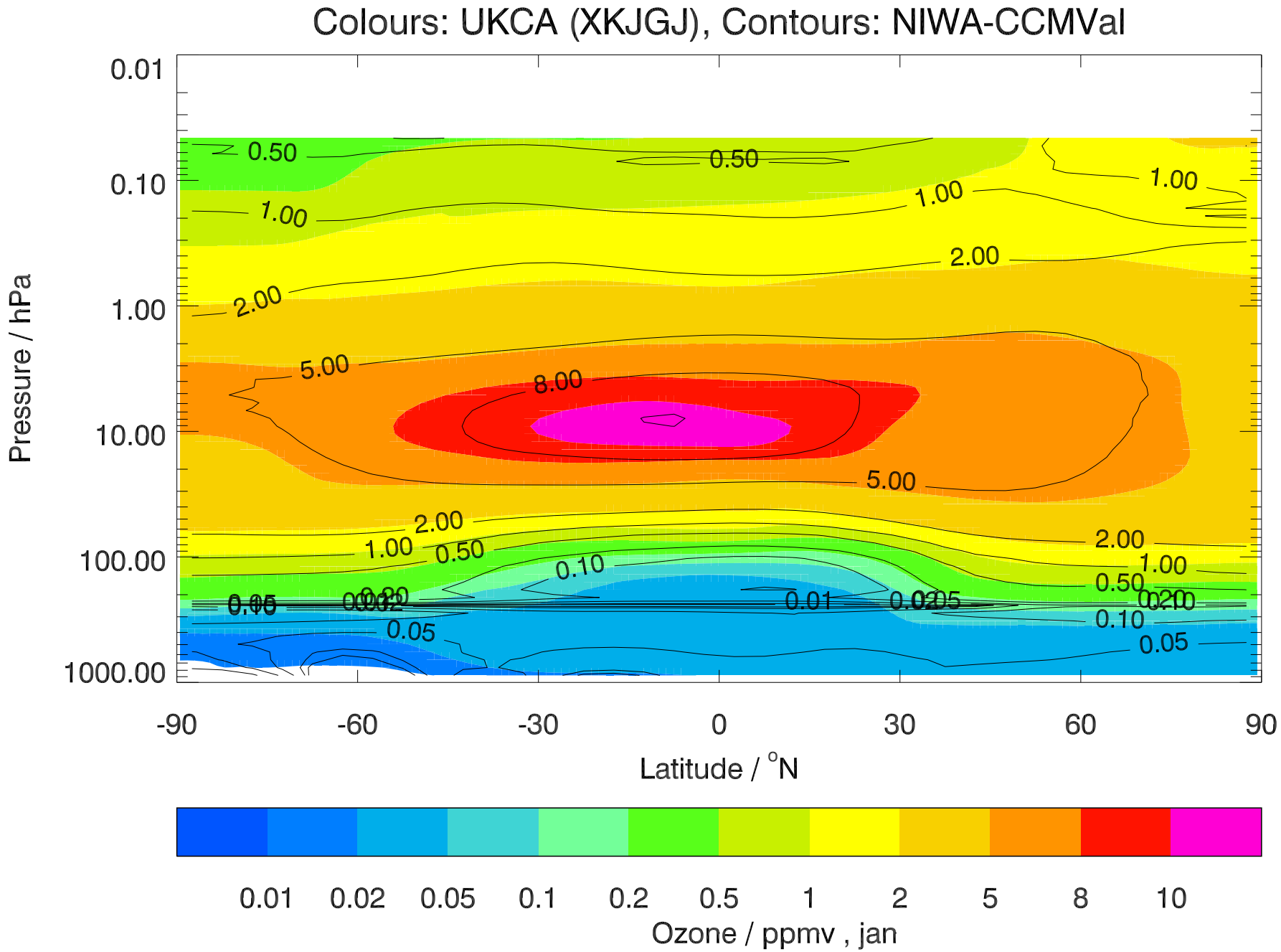

Colours: UKCA (XKJGJ), Contours: HALOE
Pressure / hPa
0.1
1.0
10.0
100.0
0.2
0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6
-90
-60
-30
0
30
60
90
Latitude / °N
0.1
0.2
0.3
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
CH4 / ppmv , jul

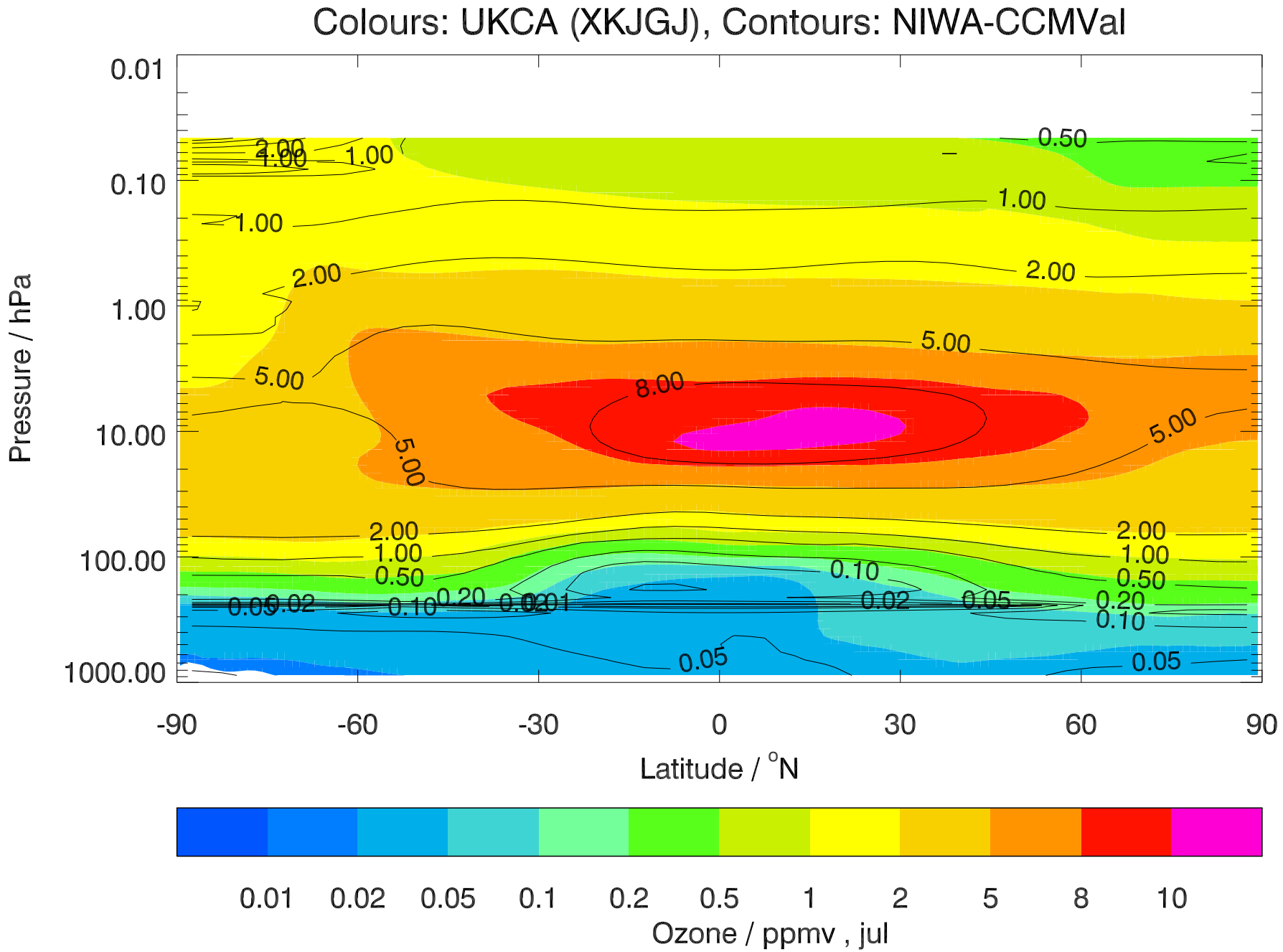

Colours: UKCA (XKJGJ), Contours: HALOE
Pressure / hPa
0.1
1.0
10.0
100.0
2.0
5.0
10.0
20.0
50.0
100.0
200.0
-90
-60
-30
0
30
60
90
Latitude / °N
0.1
0.2
0.5
1
2
5
10
20
50
100
200
N2O / ppbv , jan

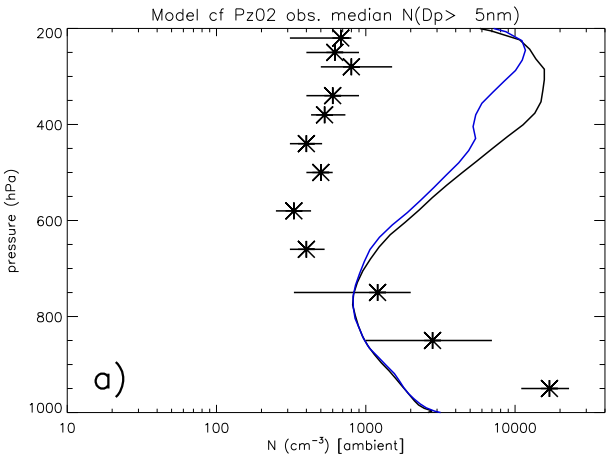

Colours: UKCA (XKJGJ), Contours: HALOE
Pressure / hPa
0.1
1.0
10.0
100.0
-90
-60
-30
0
30
60
90
Latitude / °N
0.1
0.2
0.5
1
2
5
10
20
50
100
200
N2O / ppbv , jul

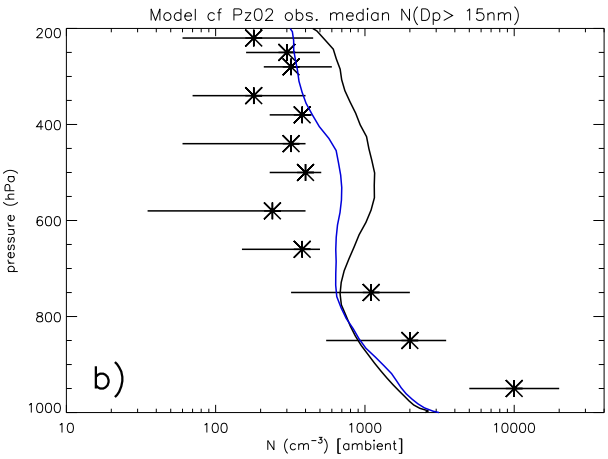

Colours: UKCA (XKJGJ), Contours: HALOE
Pressure / hPa
0.1
1.0
10.0
100.0
0.50
1.00
2.00
5.00
8.00
0.20
-90
-60
-30
0
30
60
90
Latitude / °N
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
8
10
Ozone / ppmv , jan

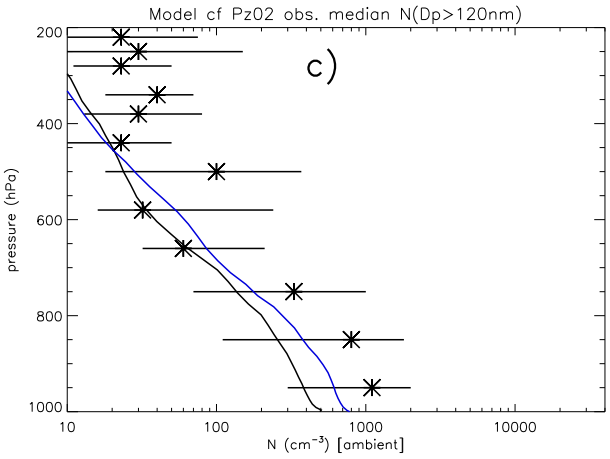

Colours: UKCA (XKJGJ), Contours: HALOE
Pressure / hPa
0.1
1.0
10.0
100.0
0.50
1.00
2.00
5.00
8.00
0.20
-90
-60
-30
0
30
60
90
Latitude / °N
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
8
10
Ozone / ppmv , jul


Colours: UKCA (XKJGJ), Contours: NIWA-CCMVal
Pressure / hPa
0.01
0.10
1.00
10.00
100.00
1000.00
-90
-60
-30
0
30
60
90
Latitude / °N
0.50
1.00
2.00
5.00
8.00
0.10
0.05
0.01
0.02
0.01
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
8
10
Ozone / ppmv , jan

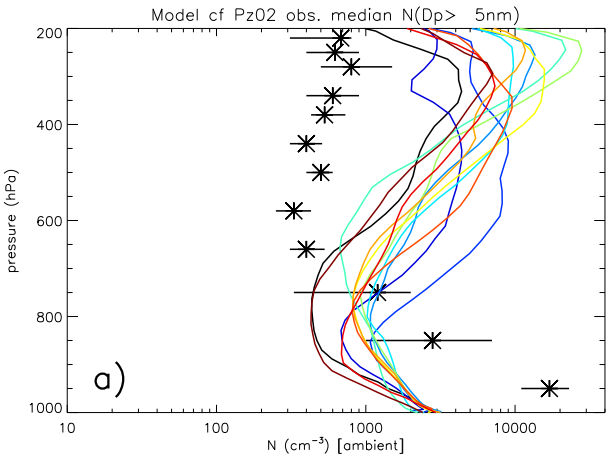

Colours: UKCA (XKJGJ), Contours: NIWA-CCMVal
Pressure / hPa
0.01
0.10
1.00
10.00
100.00
1000.00
-90
-60
-30
0
30
60
90
Latitude / °N
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
8
10
Ozone / ppmv , jul

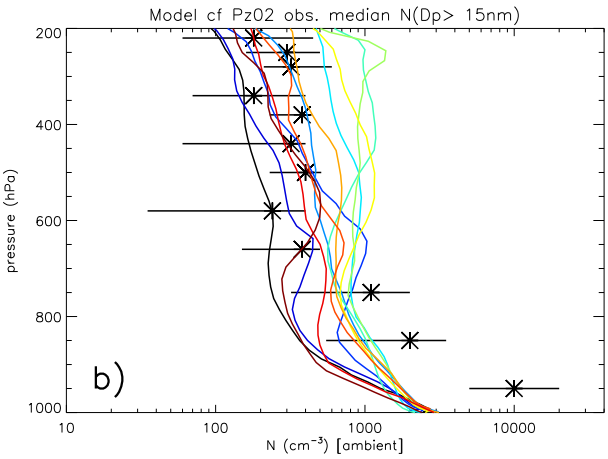


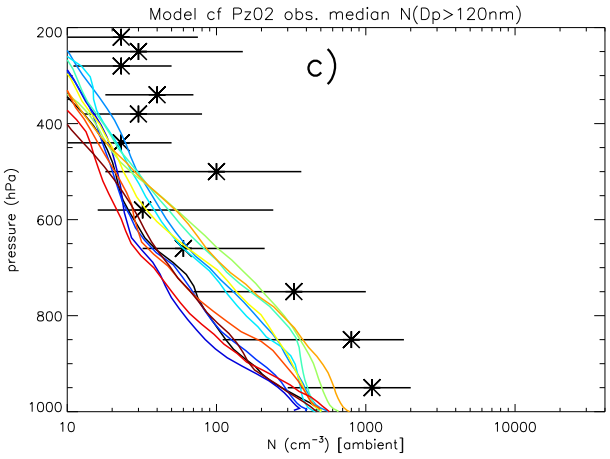




HadGEM3UKCA_XKJGJ_1998







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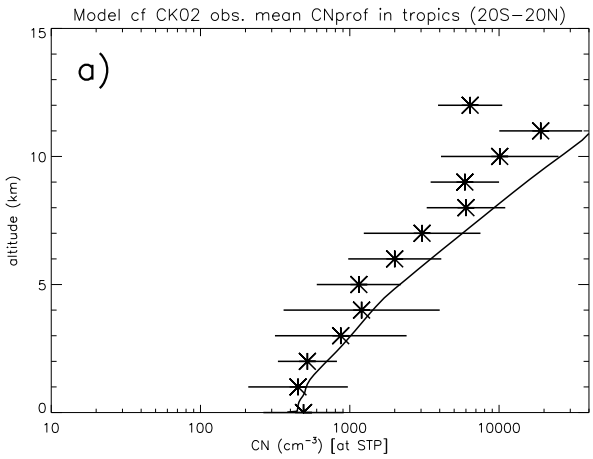

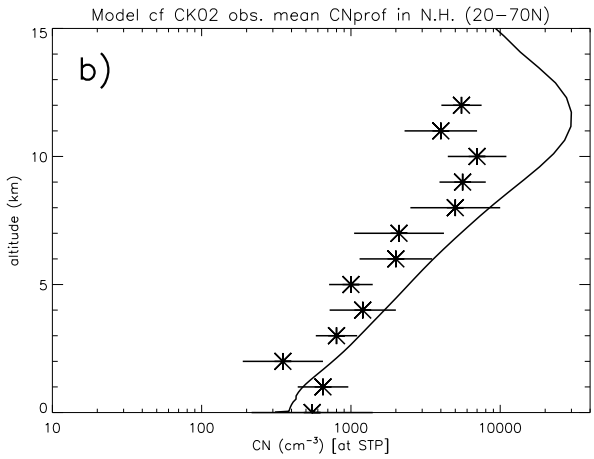

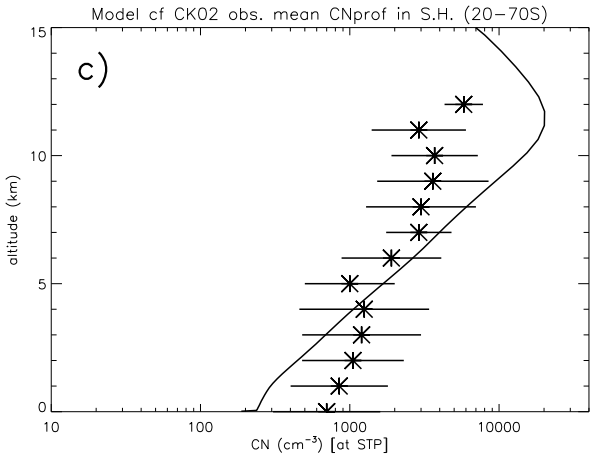

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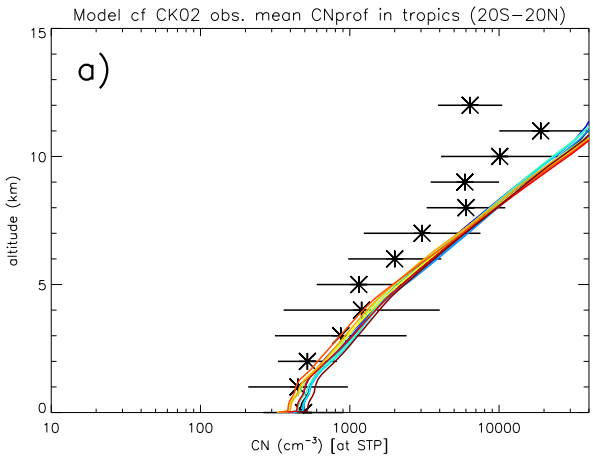

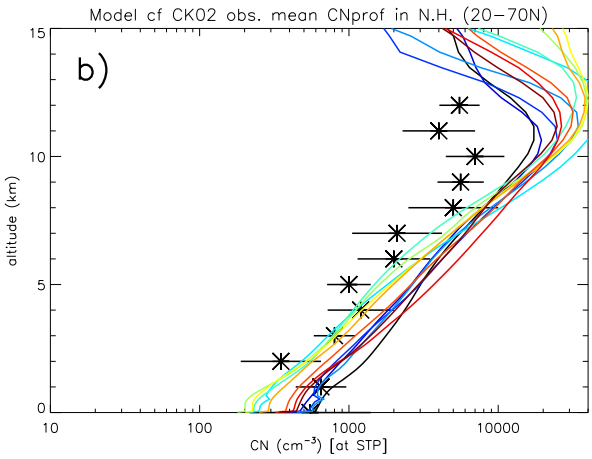

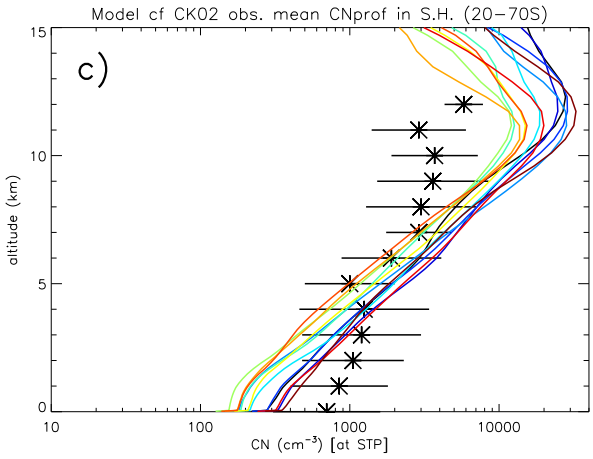

HadGEM3UKCA_XKJGJ_1998

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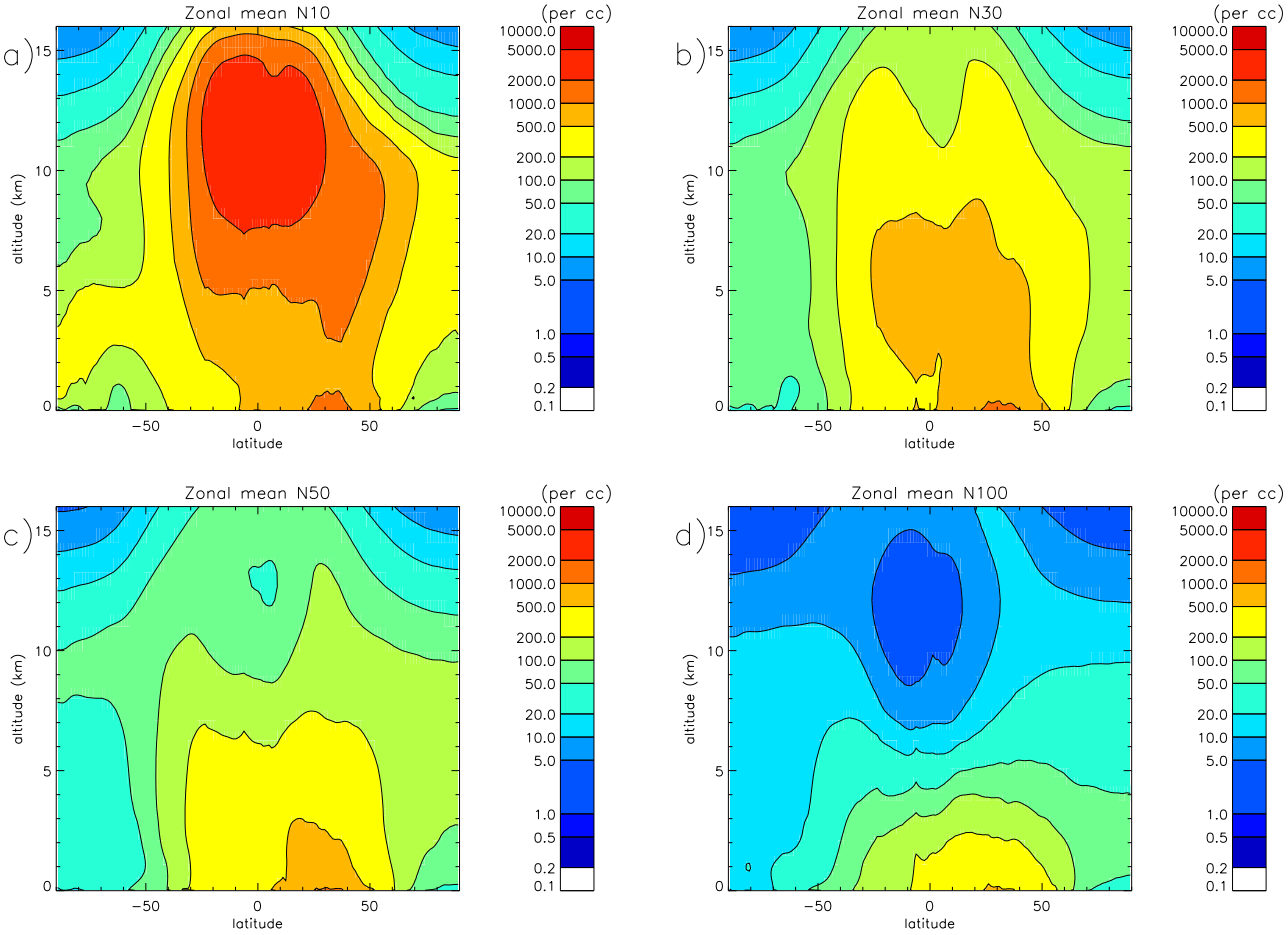

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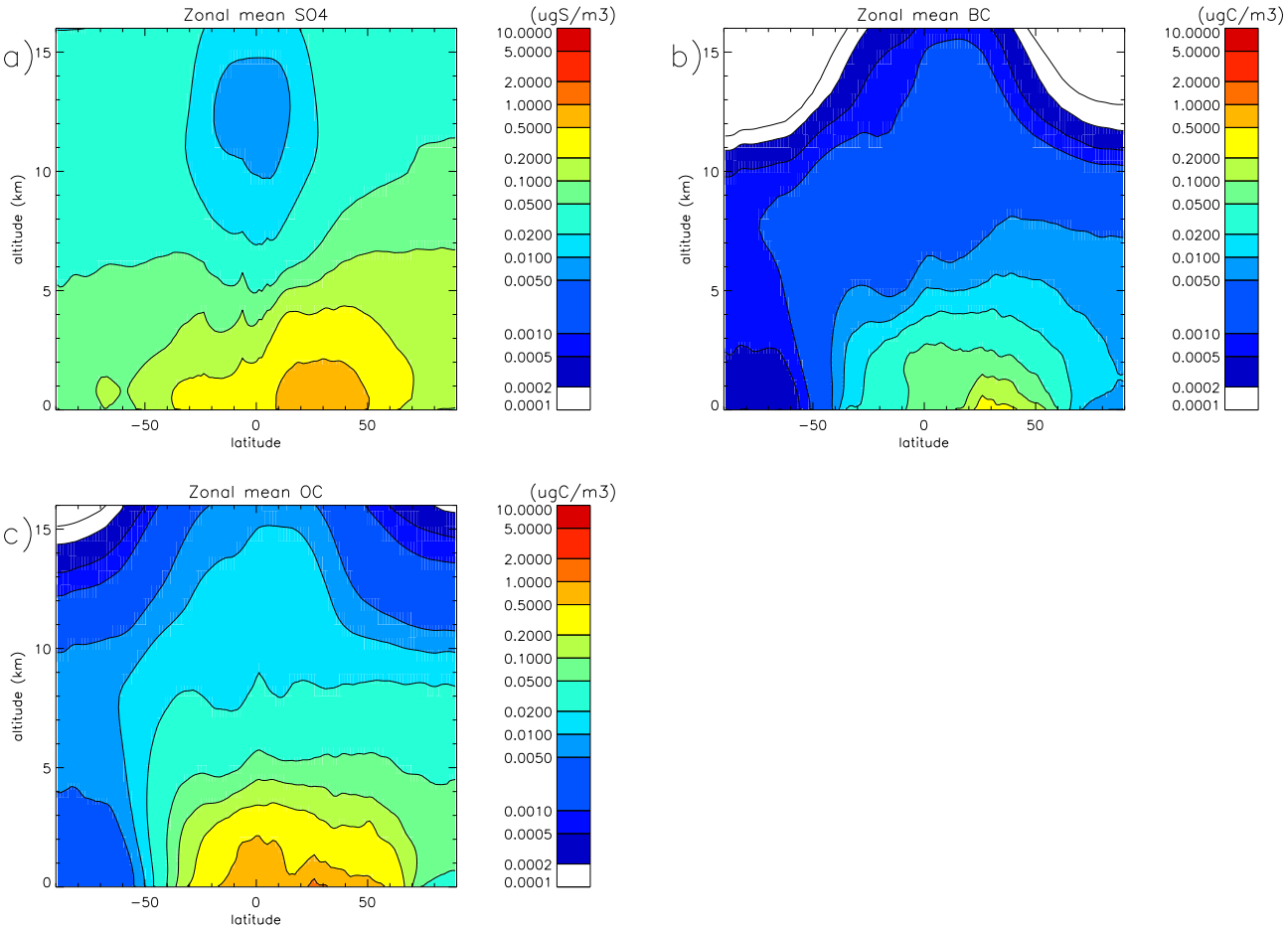
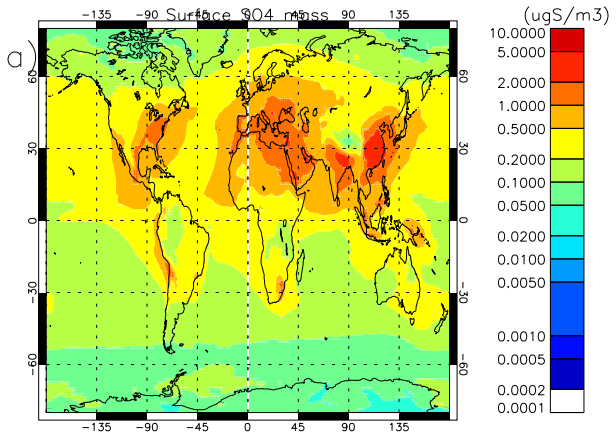
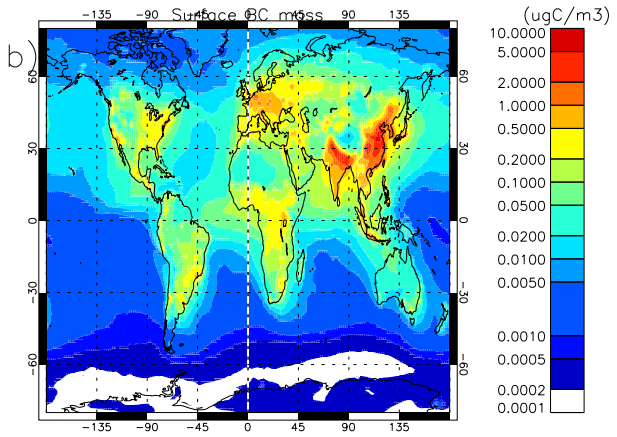
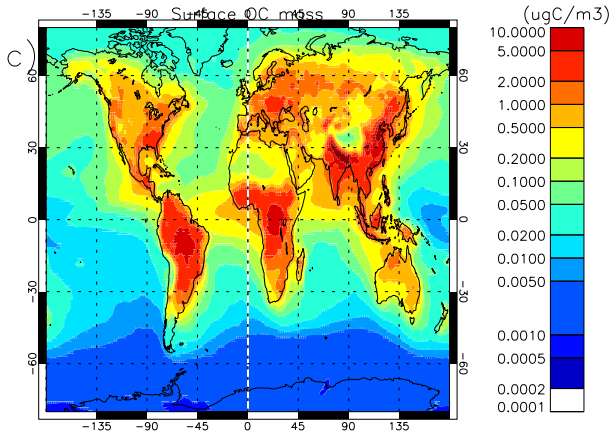


HadGEM3UKCA_XKJGJ_1998







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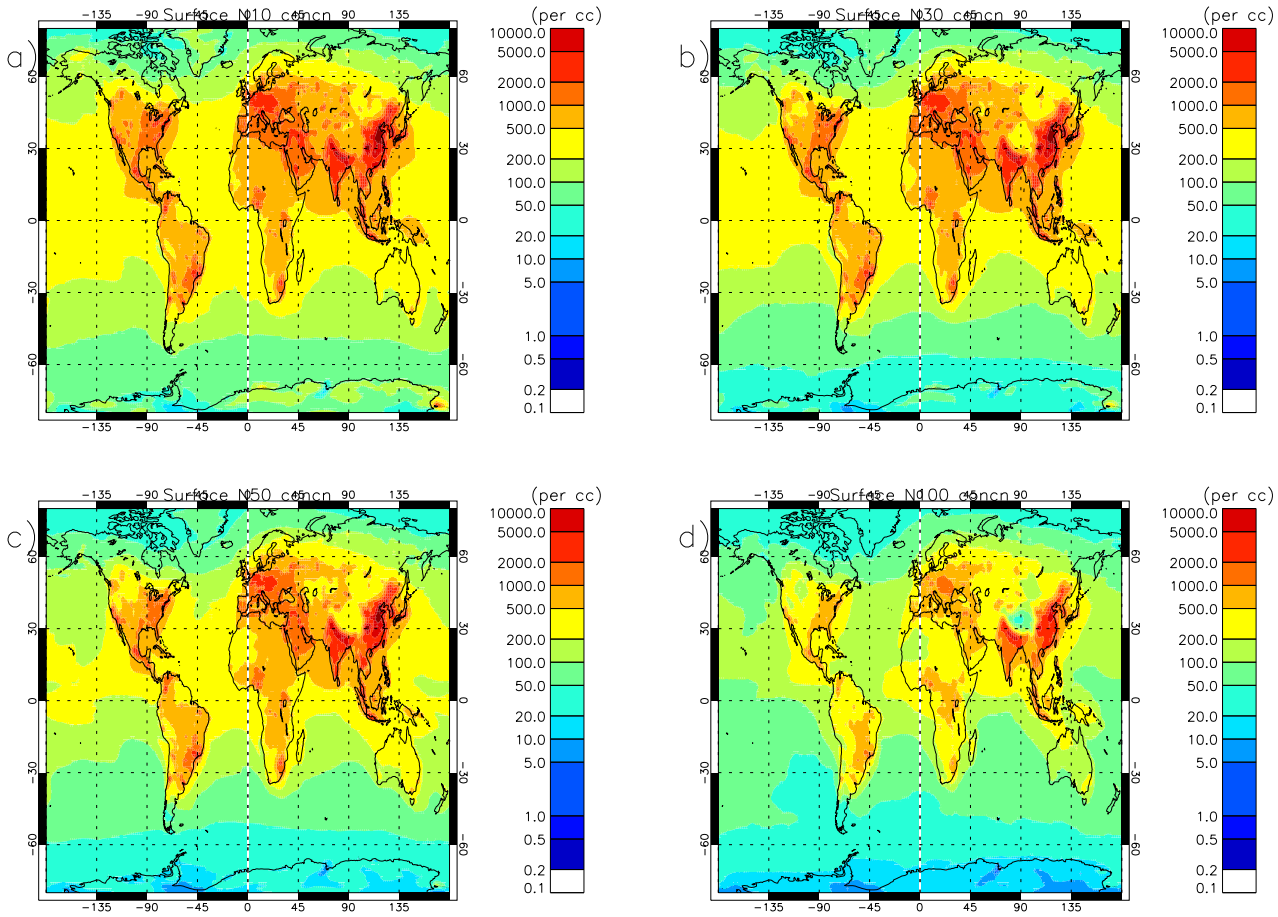
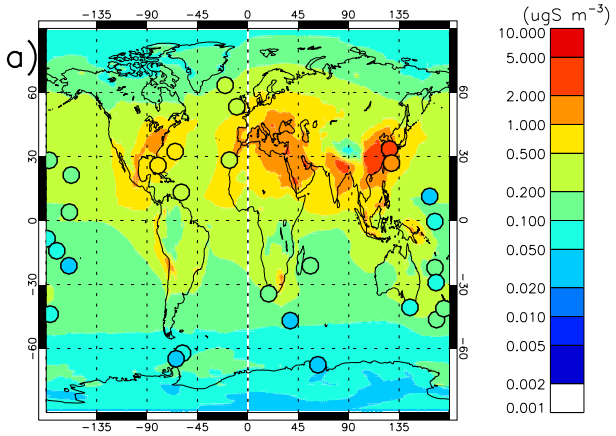
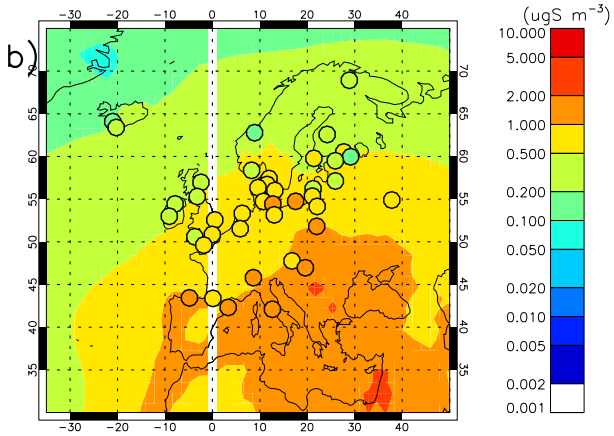
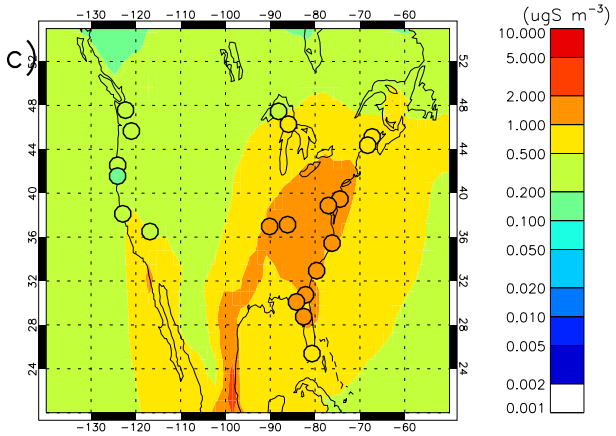
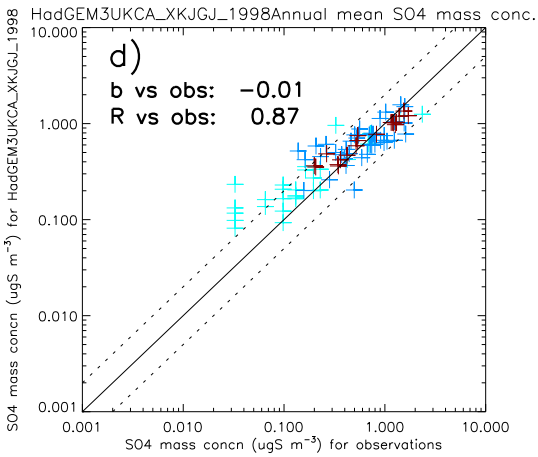
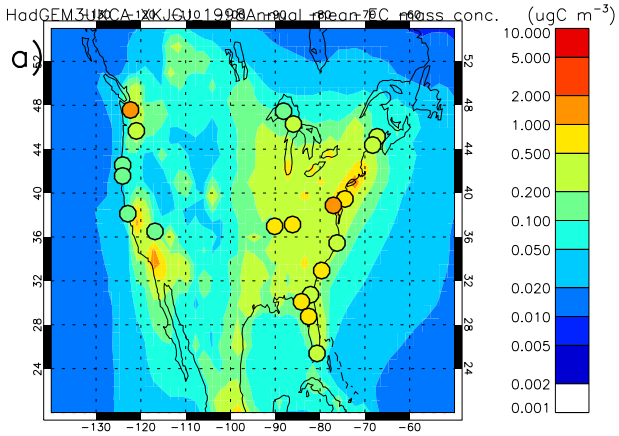


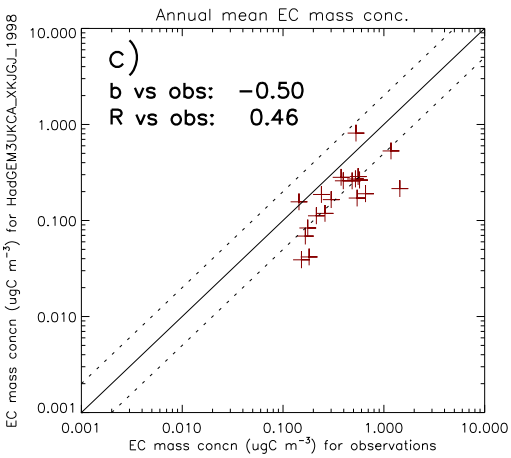

a)
(ugS m^{-3})
10.000
5.000
2.000
1.000
0.500
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.001

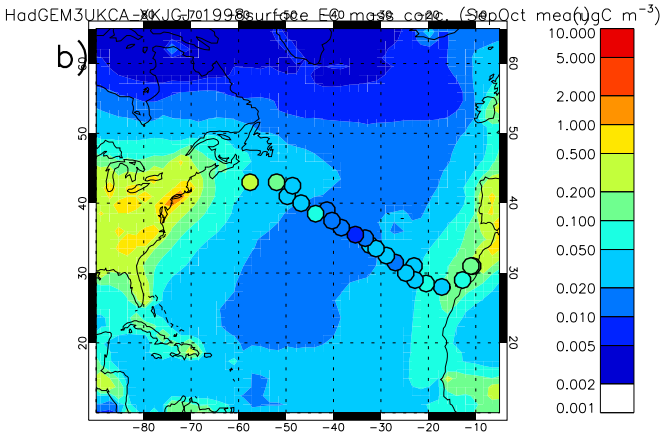

b)
(ugS m^{-3})
10.000
5.000
2.000
1.000
0.500
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.001

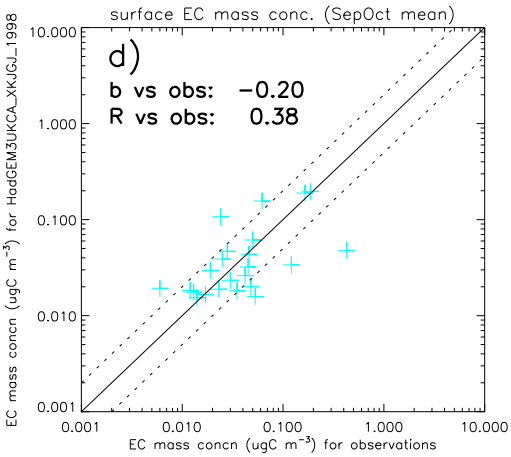

c)
(ugS m^{-3})
10.000
5.000
2.000
1.000
0.500
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.001

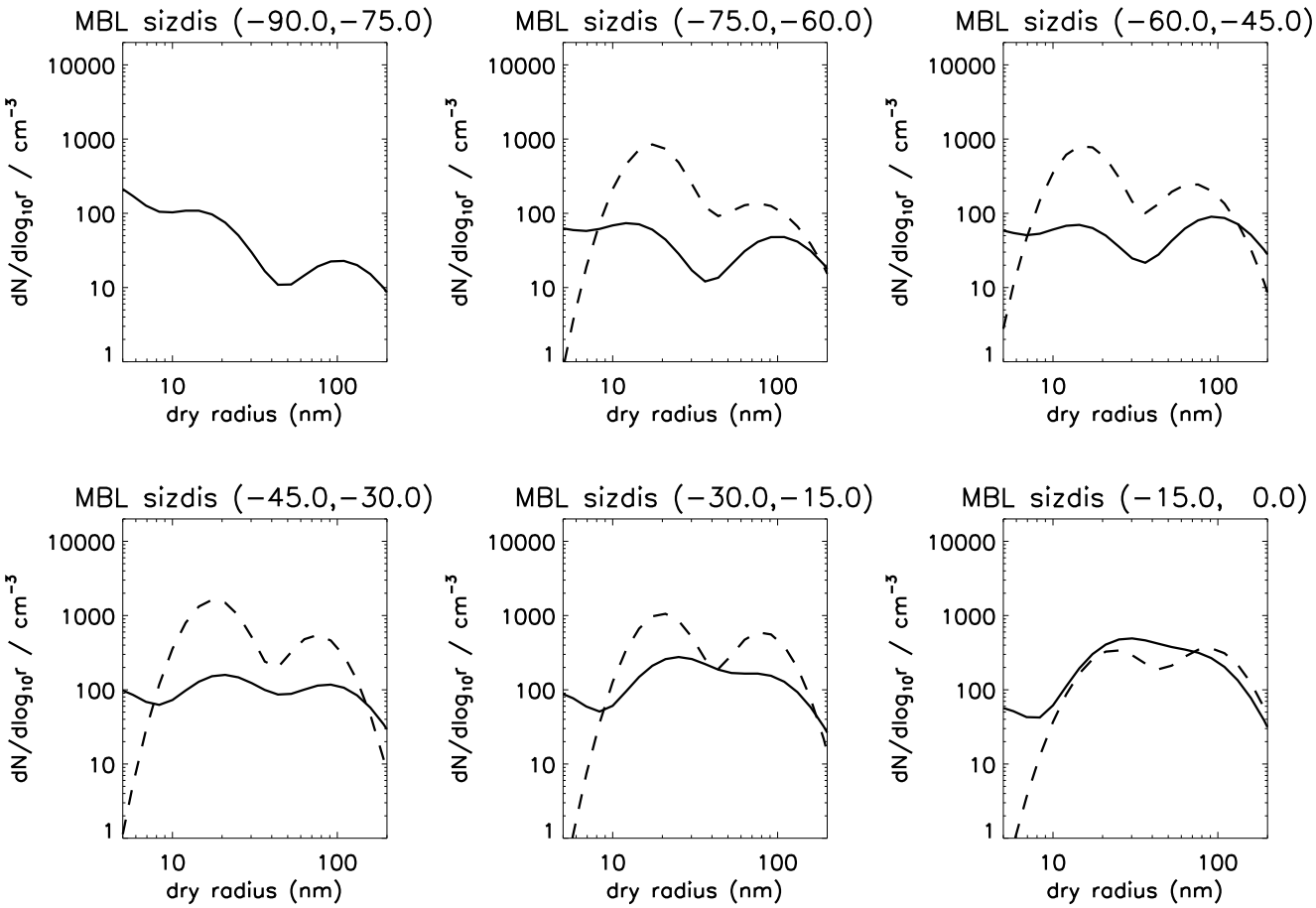

HadGEM3UKCA_XKJGJ_1998Annual mean SO4 mass conc.
d)
b vs obs: −0.01
R vs obs: 0.87
SO4 mass concn (ugS m^{-3}) for HadGEM3UKCA_XKJGJ_1998
SO4 mass concn (ugS m^{-3}) for observations
10.000
1.000
0.100
0.010
0.001

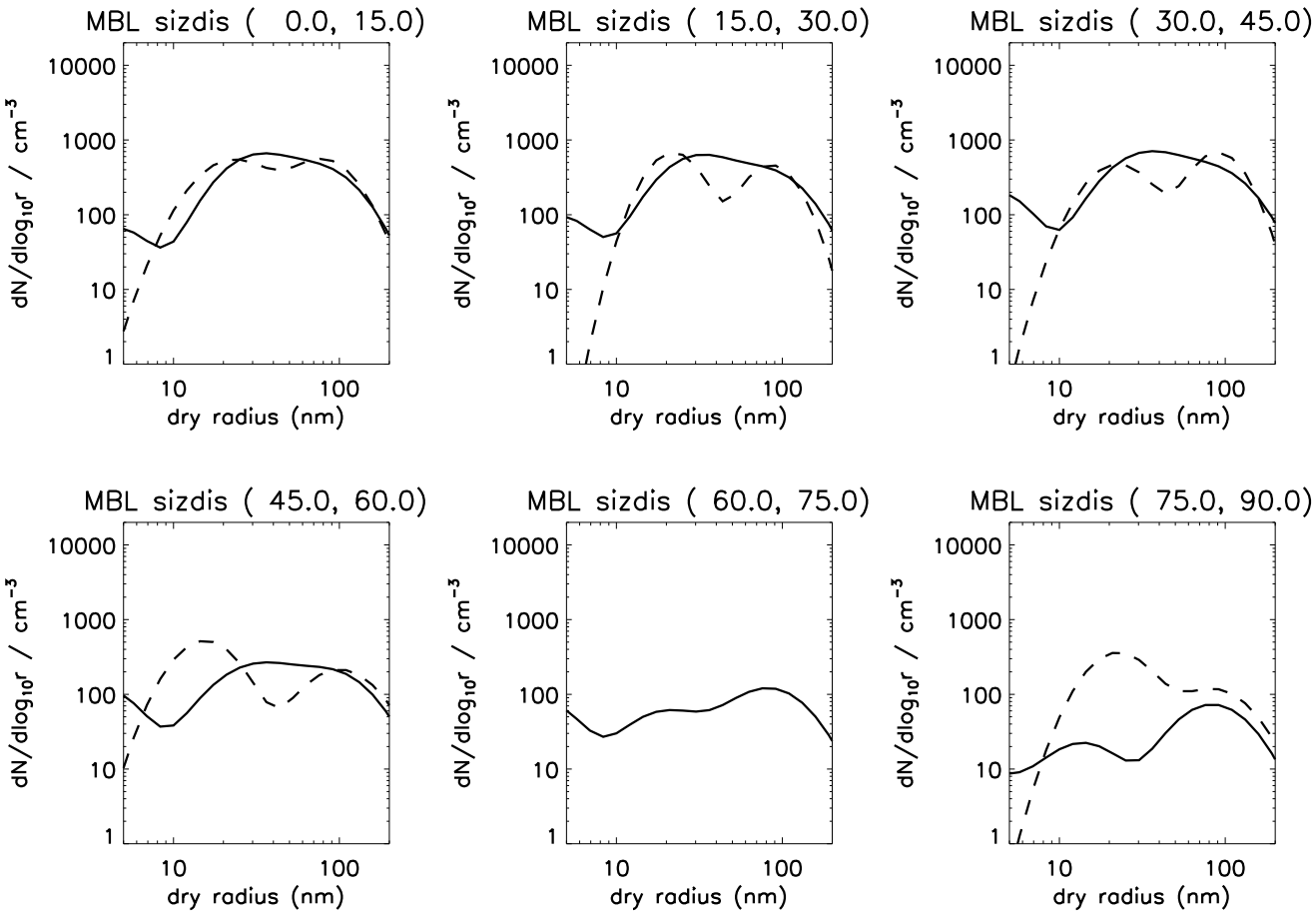

a)
HadGEM3UKCA-XKJGJ1998 Annual mean EC mass conc. (ugC m^{-3})
10.000
5.000
2.000
1.000
0.500
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.001

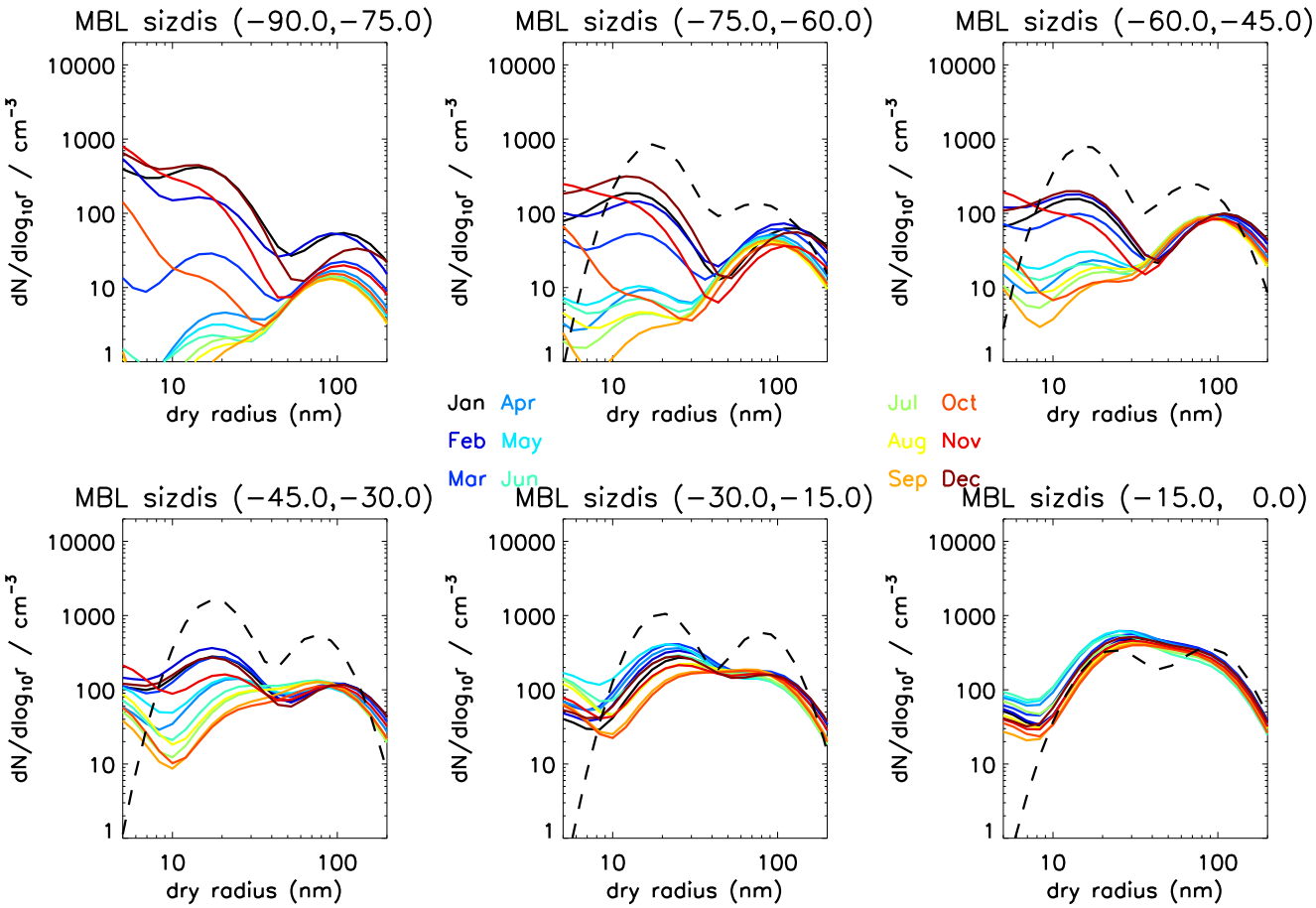

Annual mean EC mass conc.
c)
b vs obs: −0.50
R vs obs: 0.46
EC mass concn (ugC m^{-3}) for HadGEM3UKCA_XKJGJ_1998
EC mass concn (ugC m^{-3}) for observations
0.001
0.010
0.100
1.000
10.000

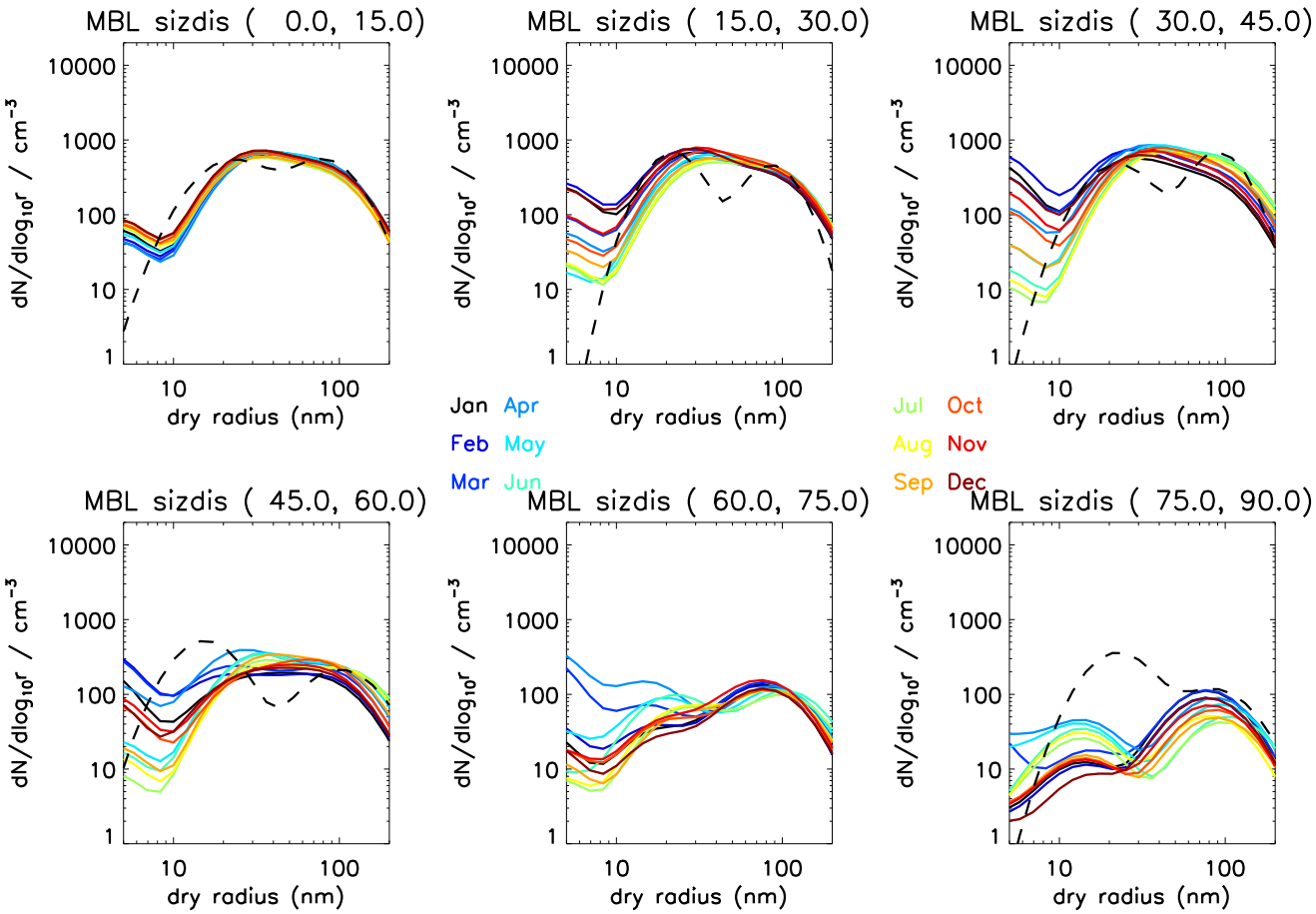

b)
HadGEM3UKCA-XKJGJ1998 surface EC mass conc. (SepOct mean) (ugC m^{-3})
10.000
5.000
2.000
1.000
0.500
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.001

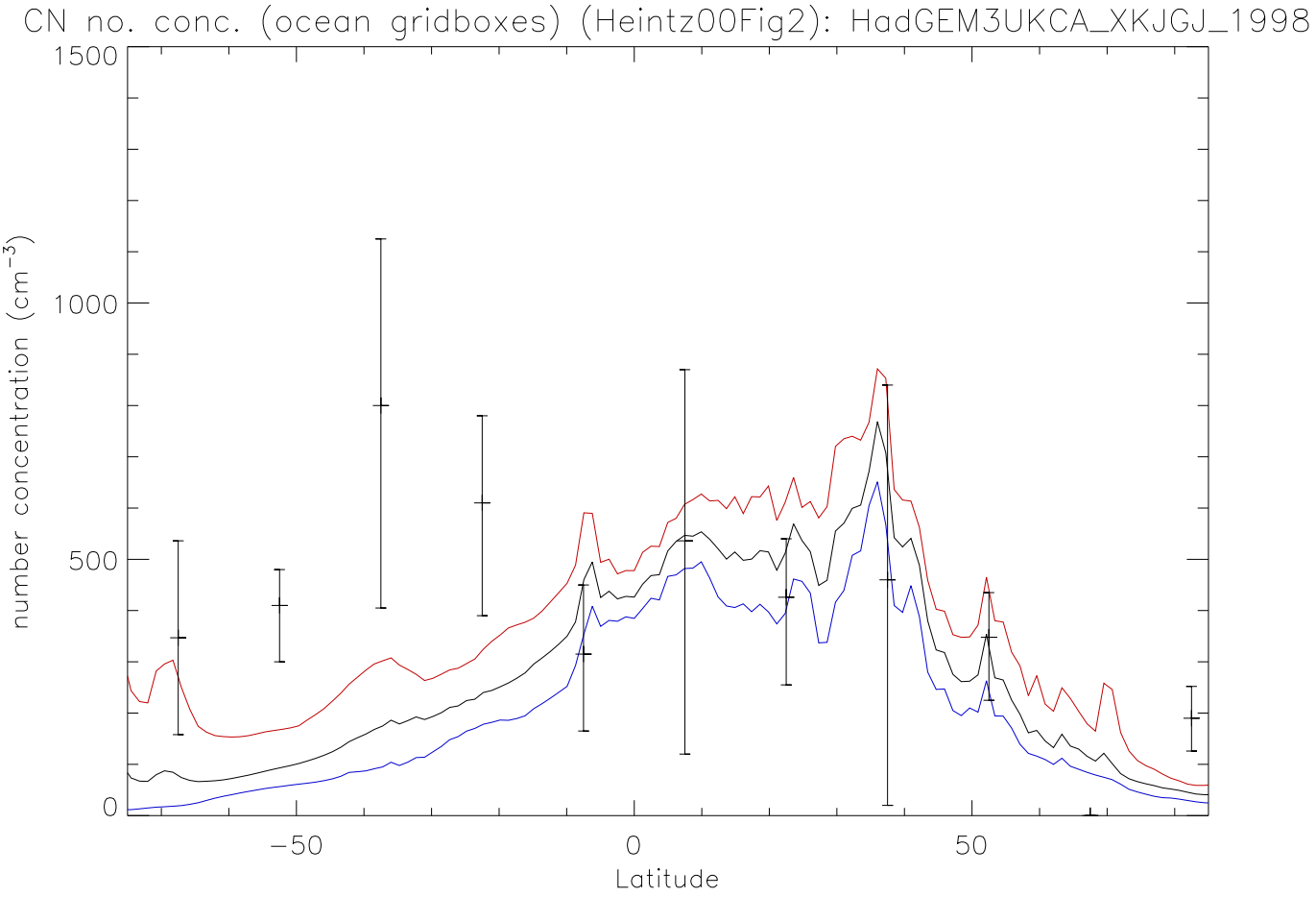

surface EC mass conc. (SepOct mean)
d)
b vs obs: −0.20
R vs obs: 0.38
EC mass concn (ugC m^{-3}) for HadGEM3UKCA_XKJGJ_1998
EC mass concn (ugC m^{-3}) for observations
0.001
0.010
0.100
1.000
10.000

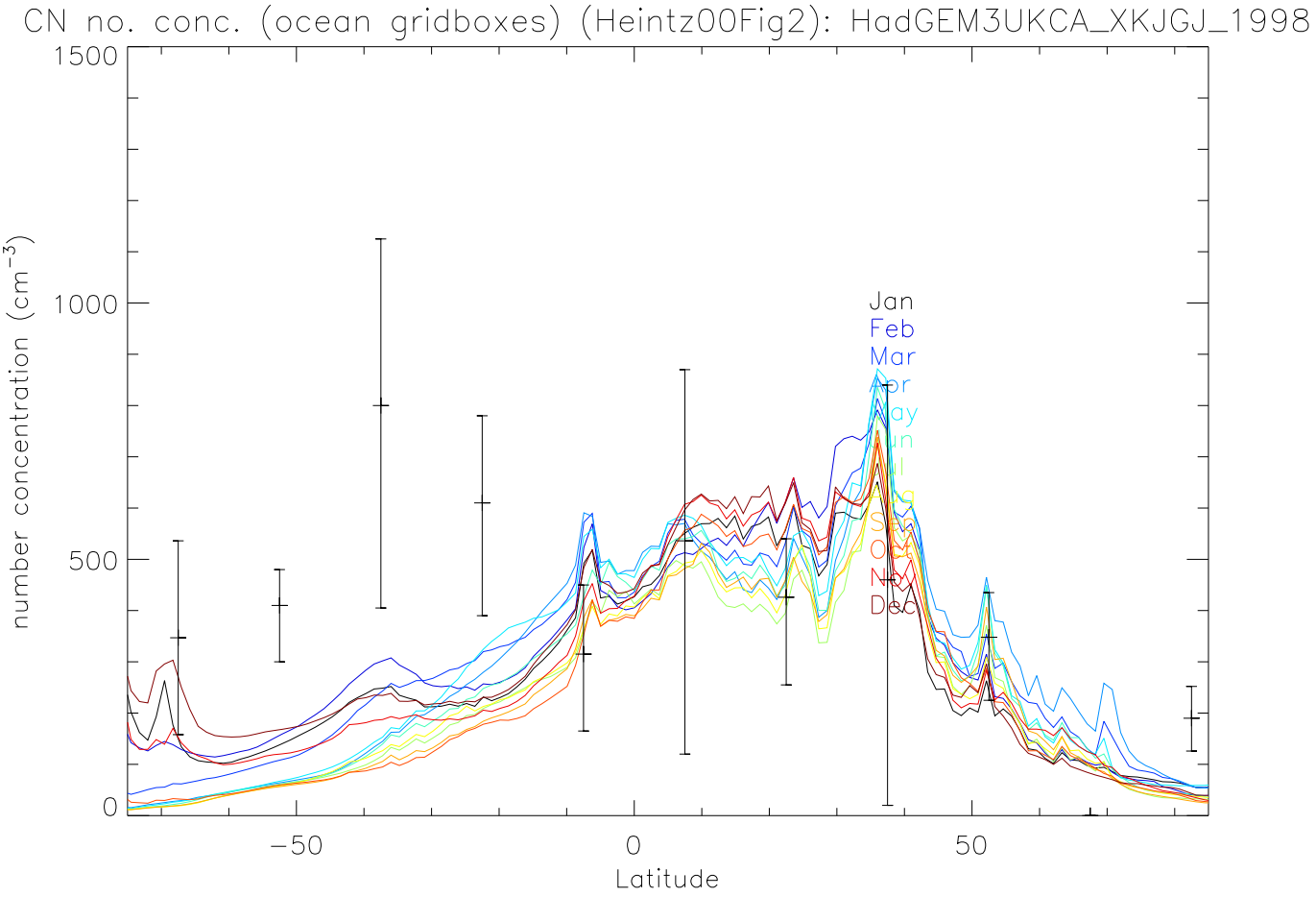

MBL sizdis (−90.0,−75.0)
MBL sizdis (−75.0,−60.0)
MBL sizdis (−60.0,−45.0)
MBL sizdis (−45.0,−30.0)
MBL sizdis (−30.0,−15.0)
MBL sizdis (−15.0, 0.0)
dN/dlog10r / cm−3
dry radius (nm)
10000
1000
100
10
1
10
100

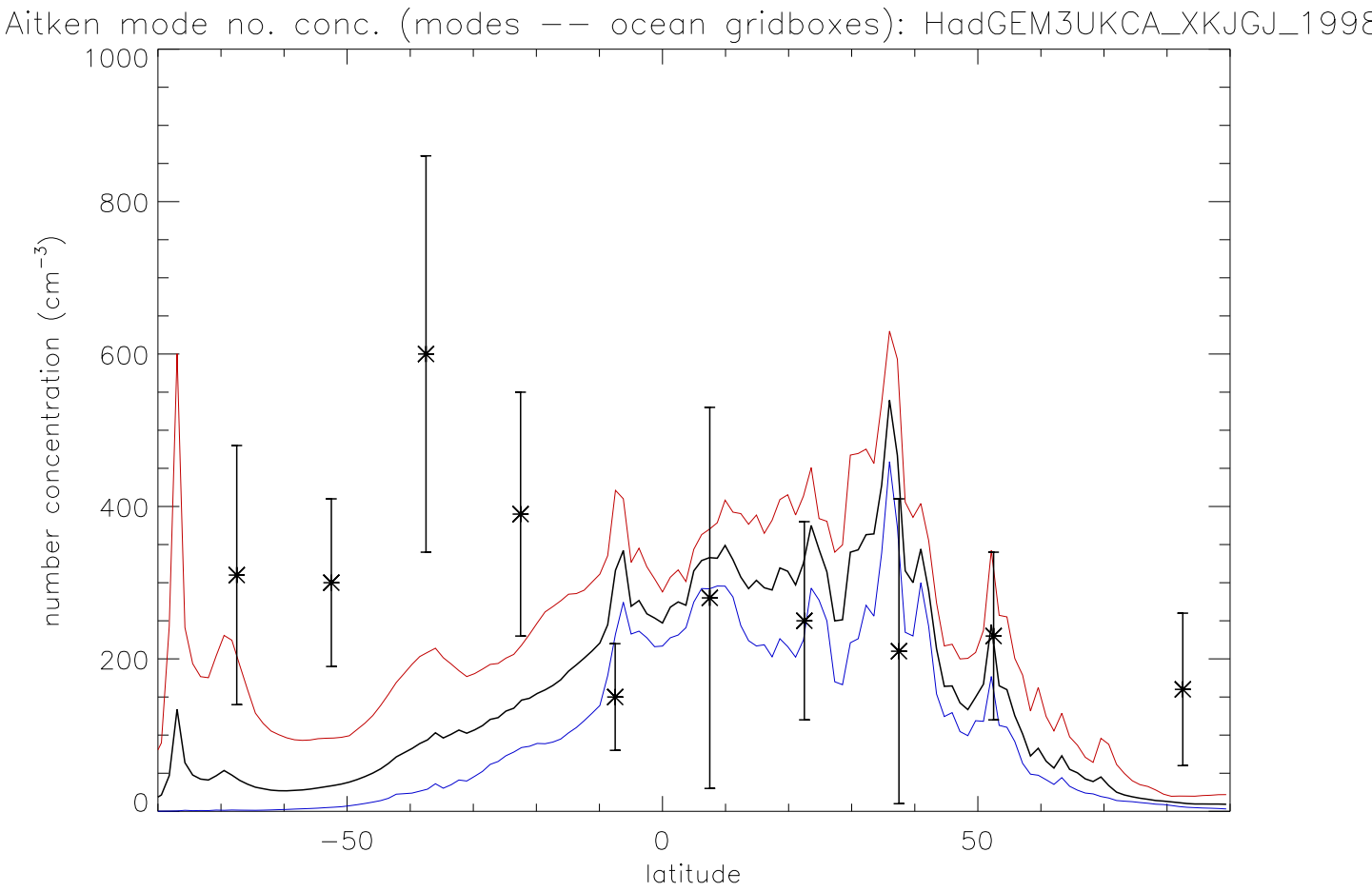

MBL sizdis (0.0, 15.0)
MBL sizdis (15.0, 30.0)
MBL sizdis (30.0, 45.0)
MBL sizdis (45.0, 60.0)
MBL sizdis (60.0, 75.0)
MBL sizdis (75.0, 90.0)
dN/dlog10r / cm-3
dry radius (nm)
10000
1000
100
10
1
10
100

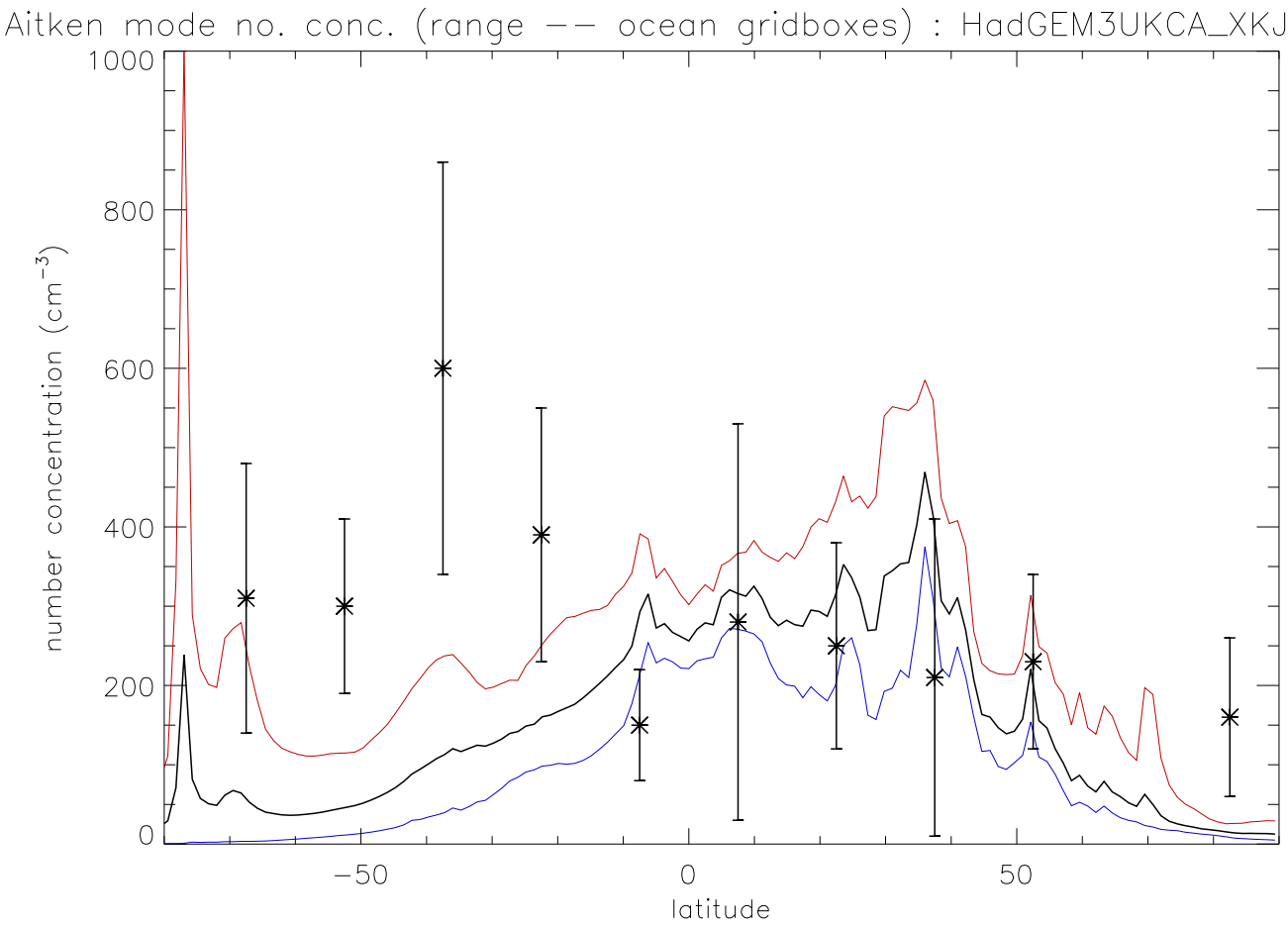

MBL sizdis (−90.0,−75.0)
MBL sizdis (−75.0,−60.0)
MBL sizdis (−60.0,−45.0)
MBL sizdis (−45.0,−30.0)
MBL sizdis (−30.0,−15.0)
MBL sizdis (−15.0, 0.0)
dN/dlog10r / cm−3
dry radius (nm)
10000
1000
100
10
1
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

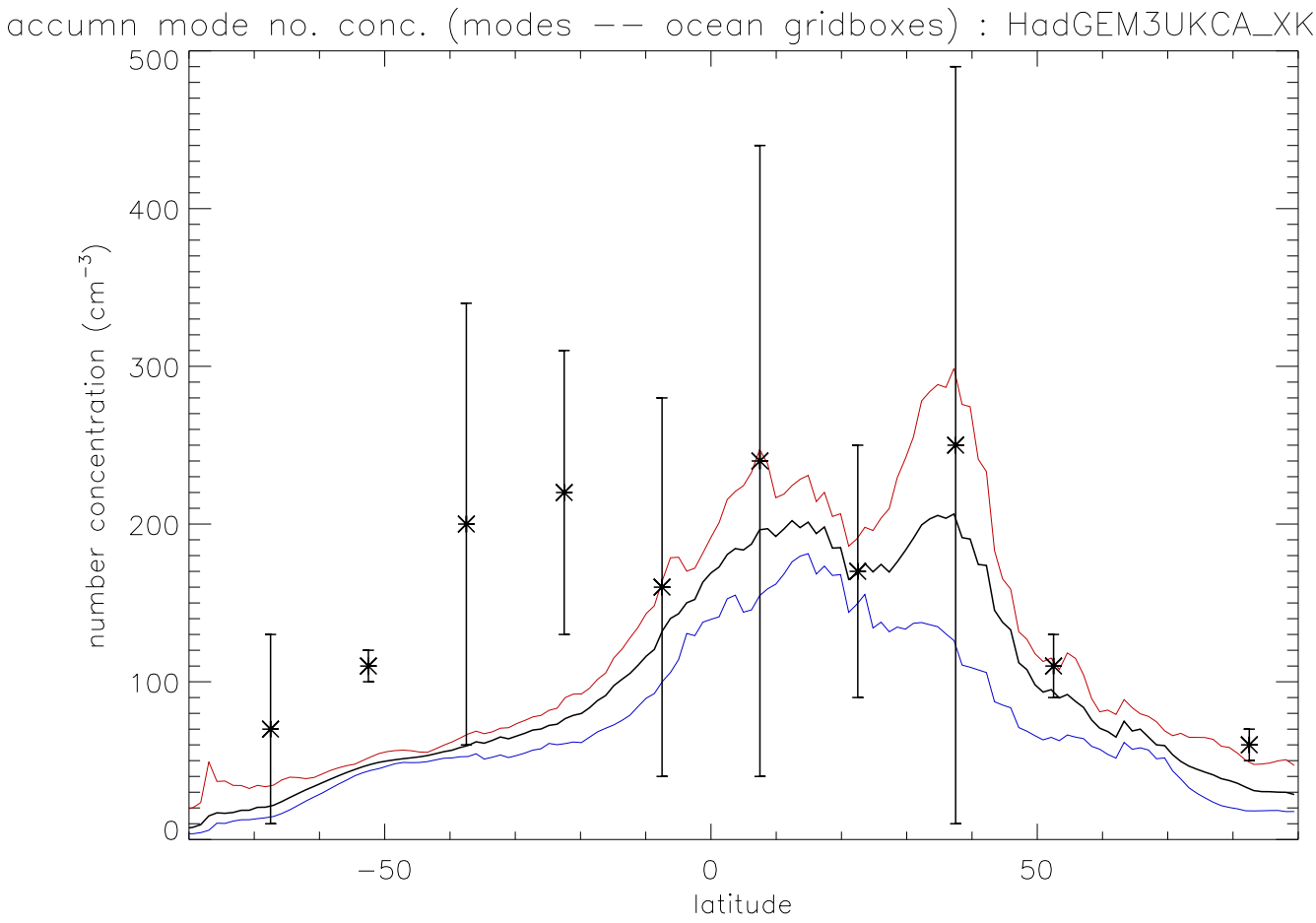

MBL sizdis (0.0, 15.0)
MBL sizdis (15.0, 30.0)
MBL sizdis (30.0, 45.0)
MBL sizdis (45.0, 60.0)
MBL sizdis (60.0, 75.0)
MBL sizdis (75.0, 90.0)
dN/dlog10r / cm-3
dry radius (nm)
10000
1000
100
10
1
10
100
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

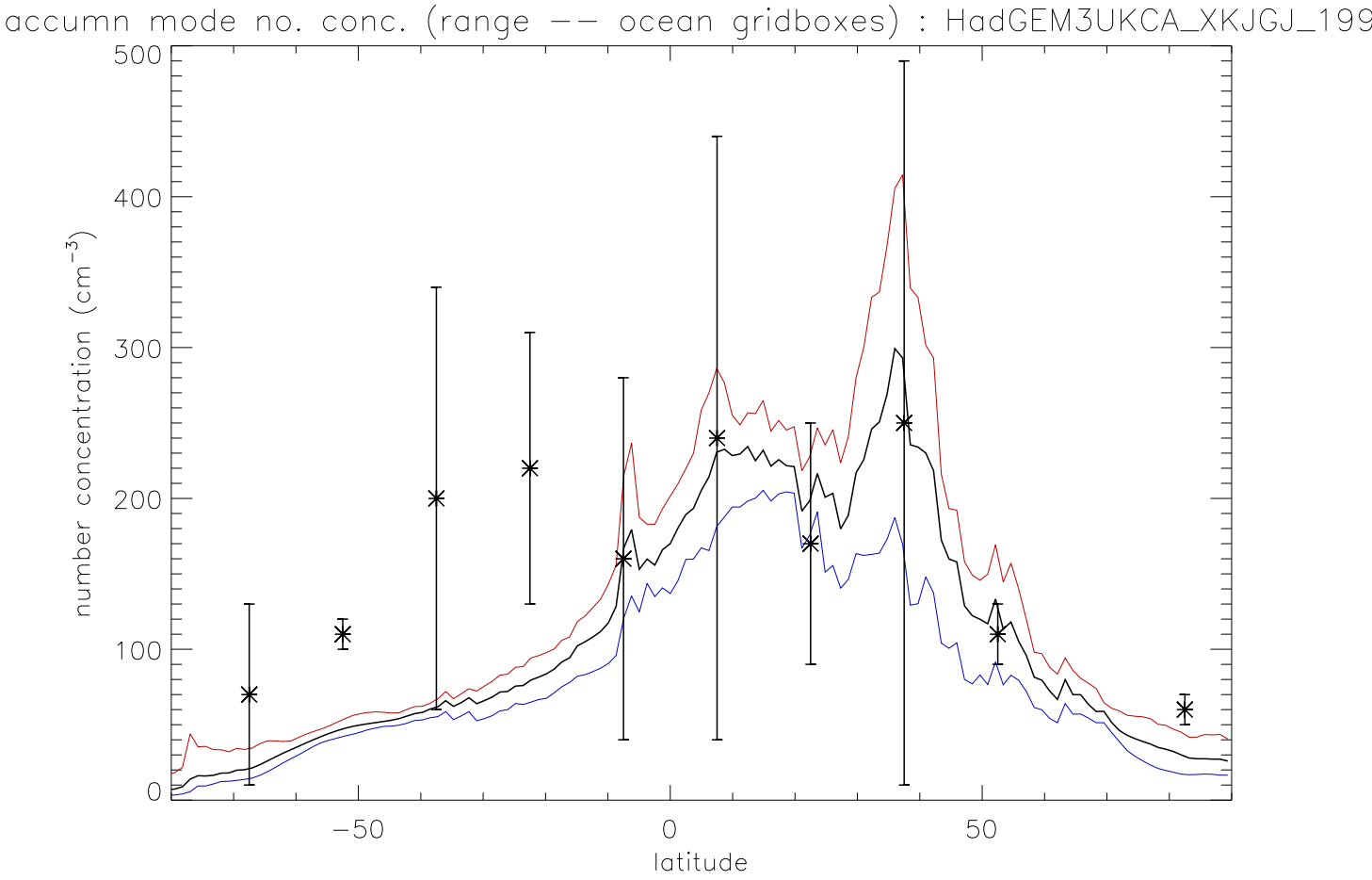

CN no. conc. (ocean gridboxes) (Heintz00Fig2): HadGEM3UKCA_XKJGJ_1998
1500
1000
500
0
number concentration (cm^{-3})
−50
0
50
Latitude


CN no. conc. (ocean gridboxes) (Heintz00Fig2): HadGEM3UKCA_XKJGJ_1998
number concentration (cm^{-3})
1500
1000
500
0
−50
0
50
Latitude
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Aitken mode no. conc. (modes -- ocean gridboxes): HadGEM3UKCA_XKJGJ_1998
1000
800
600
400
200
0
number concentration (cm^{-3})
−50
0
50
latitude


Aitken mode no. conc. (range −− ocean gridboxes) : HadGEM3UKCA_XKJGJ_1998
number concentration (cm^{-3})
1000
800
600
400
200
0
−50
0
50
latitude


accumn mode no. conc. (modes -- ocean gridboxes) : HadGEM3UKCA_XKJGJ_199
number concentration (cm^{-3})
500
400
300
200
100
0
−50
0
50
latitude


accumn mode no. conc. (range -- ocean gridboxes) : HadGEM3UKCA_XKJGJ_199
number concentration (cm^{-3})
500
400
300
200
100
0
−50
0
50
latitude