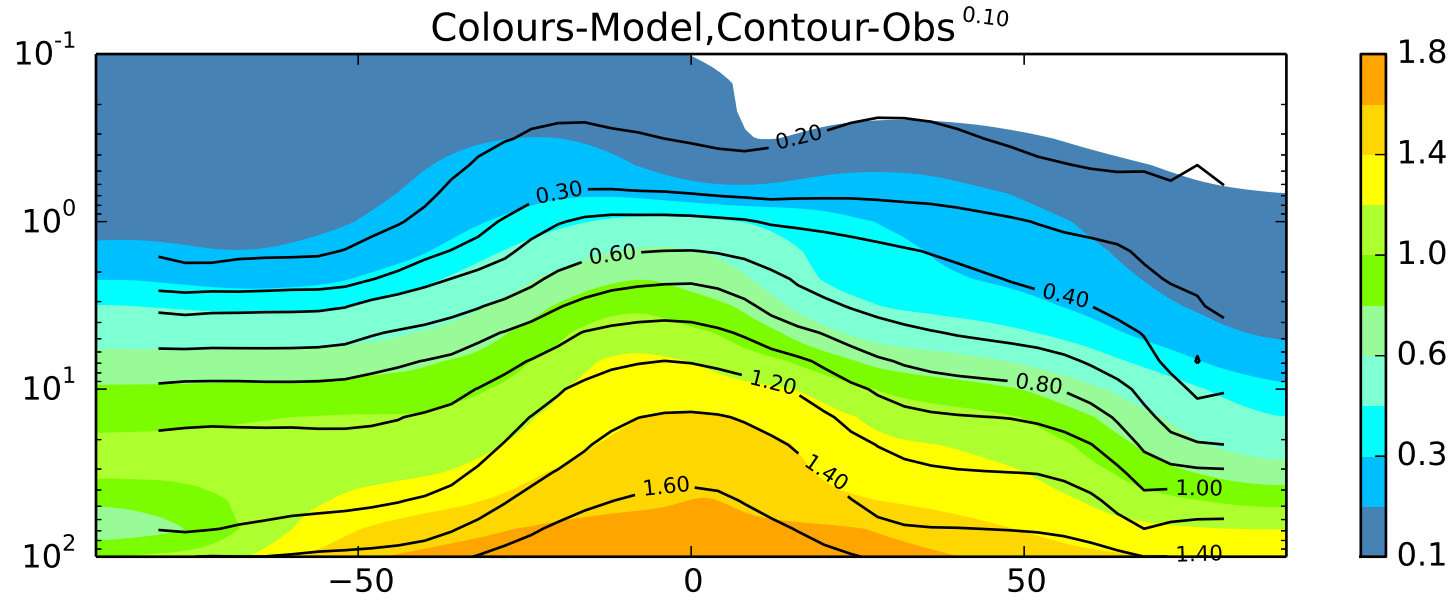
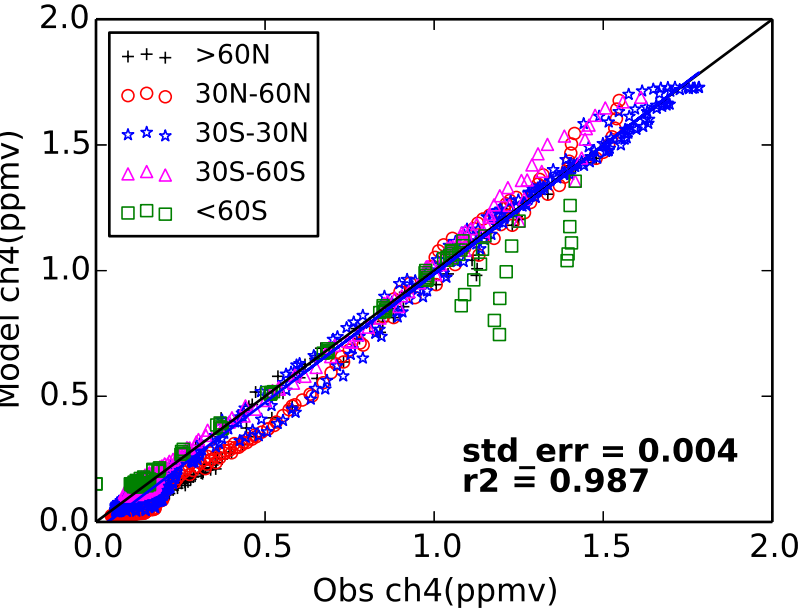
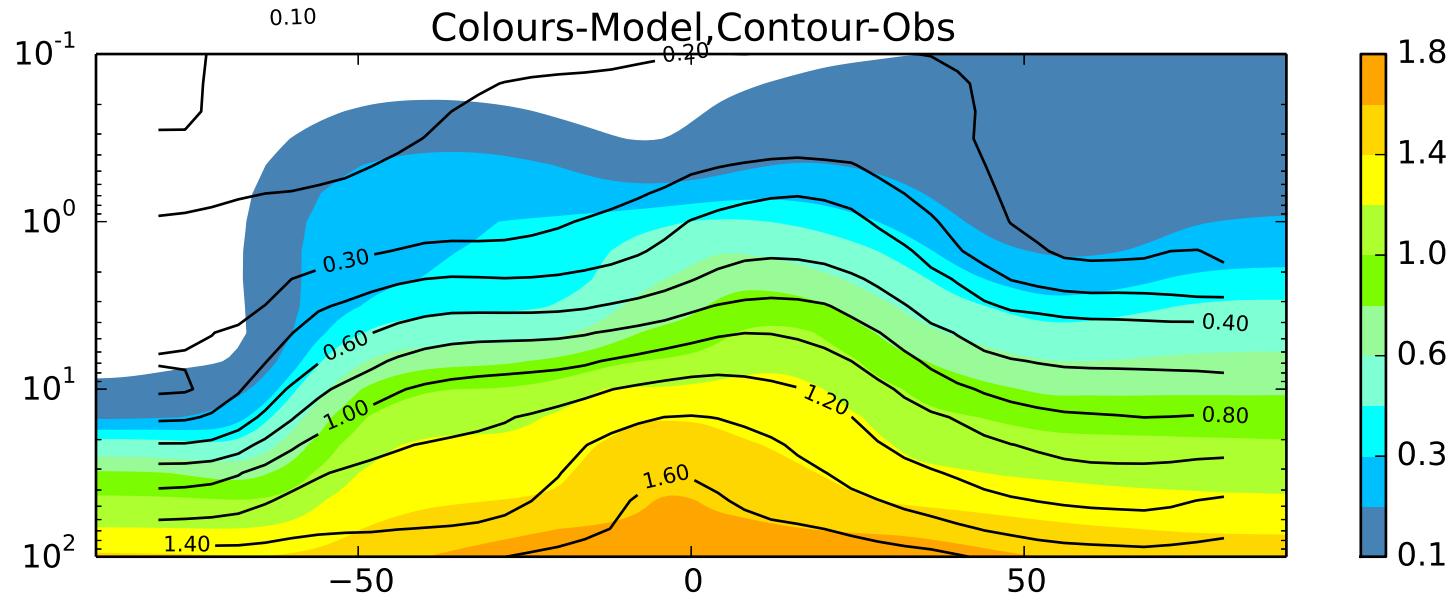
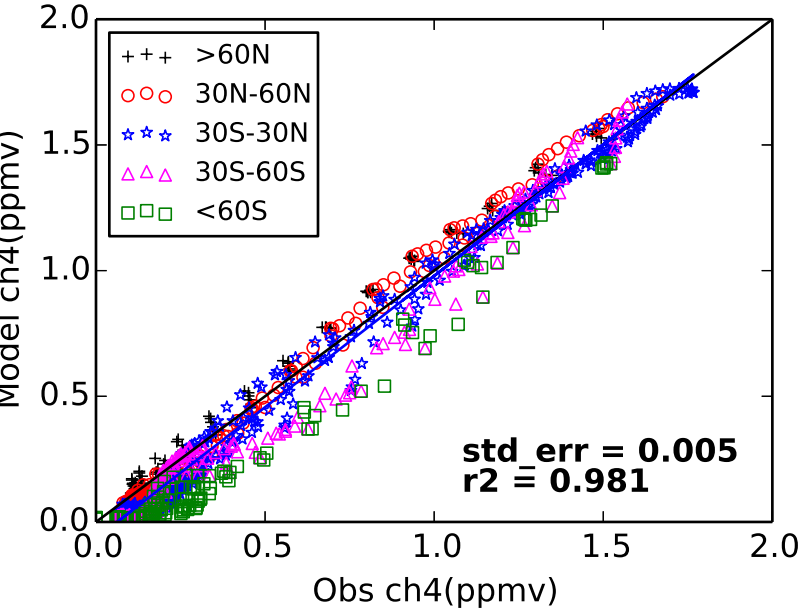


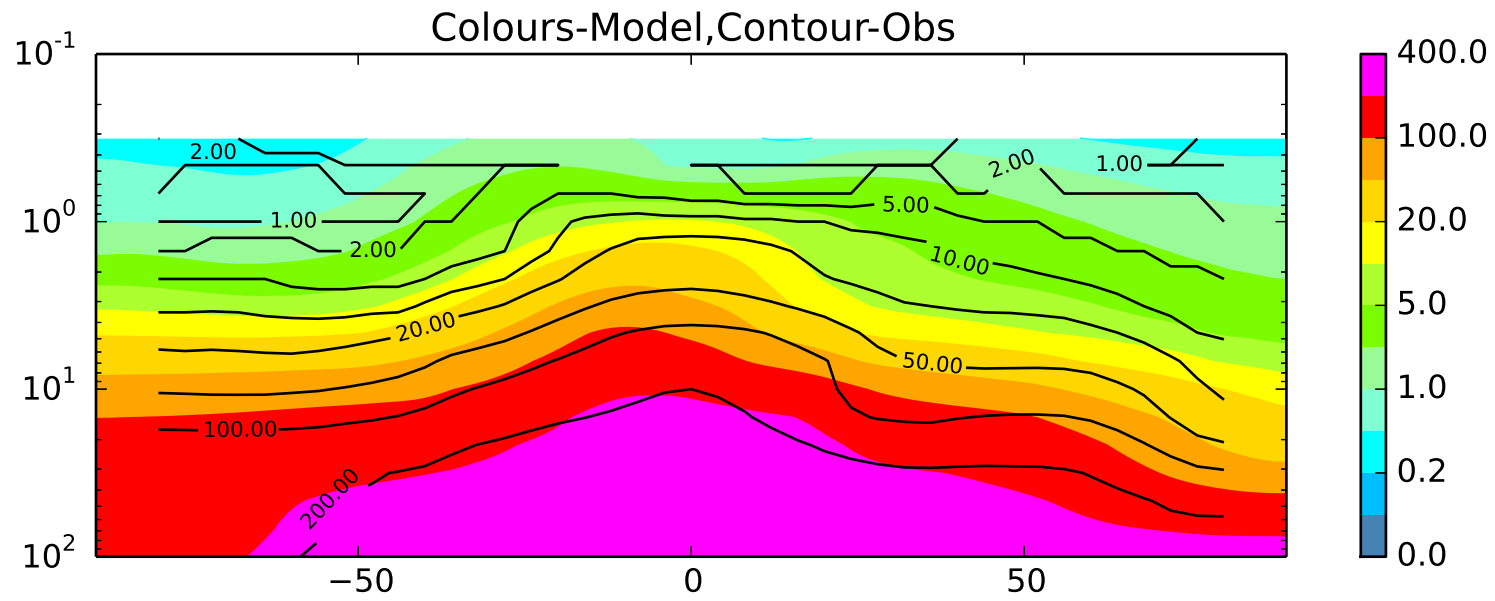


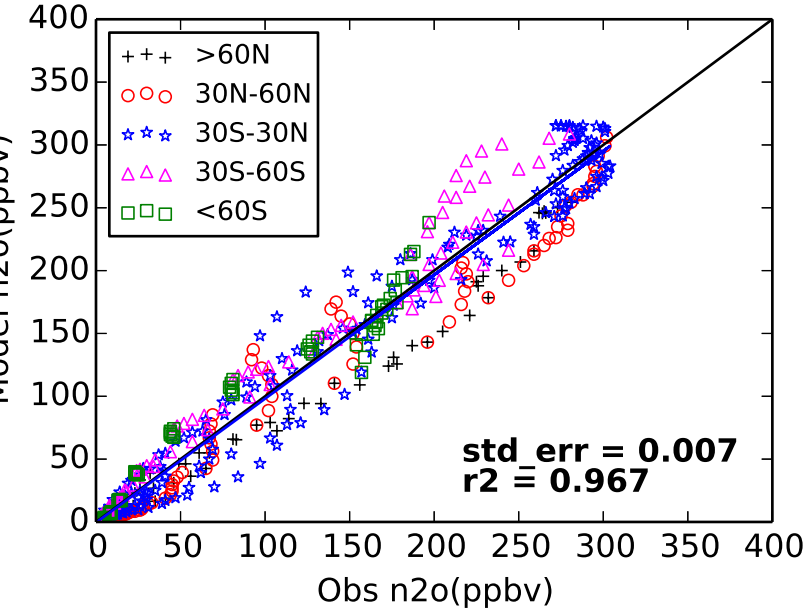
UKCA aj670 vs HALOE:
CH4 (ppmv) Jan



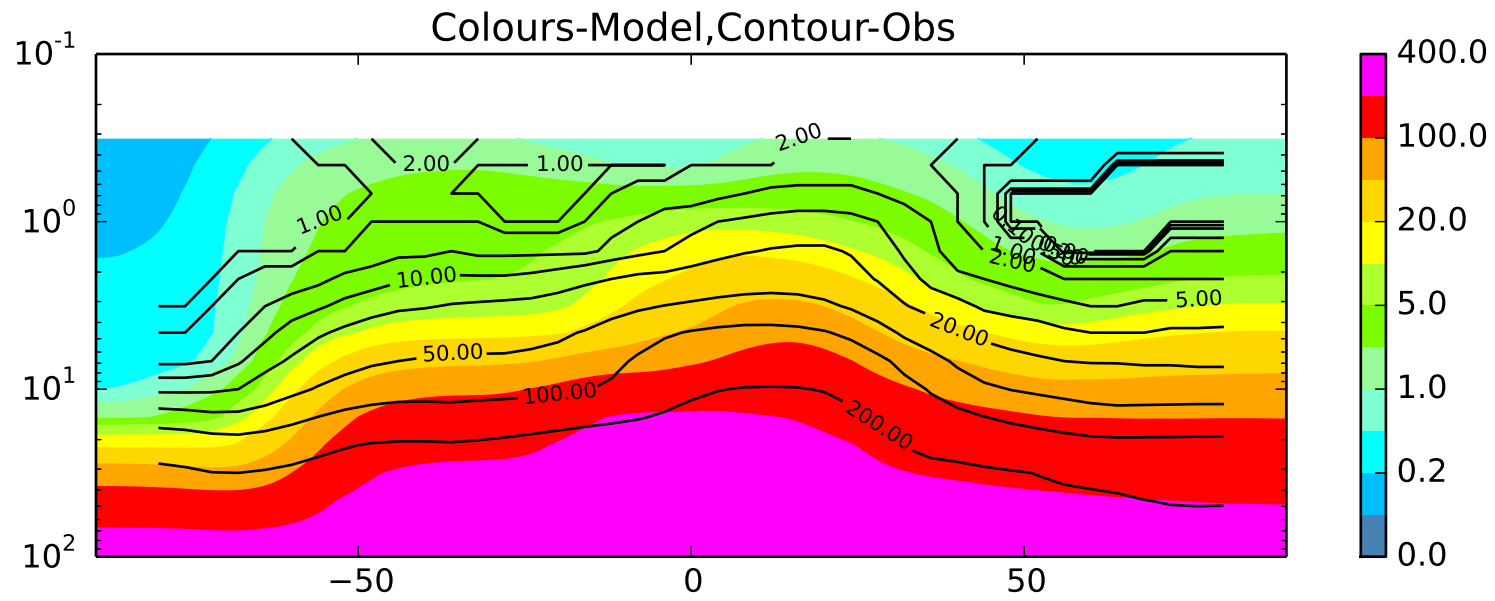


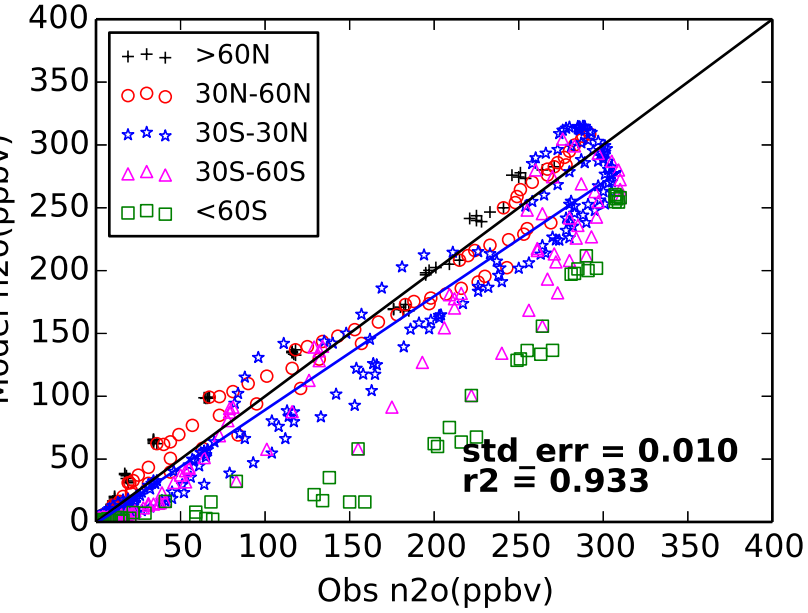
UKCA aj670 vs HALOE:
CH4 (ppmv) Jul



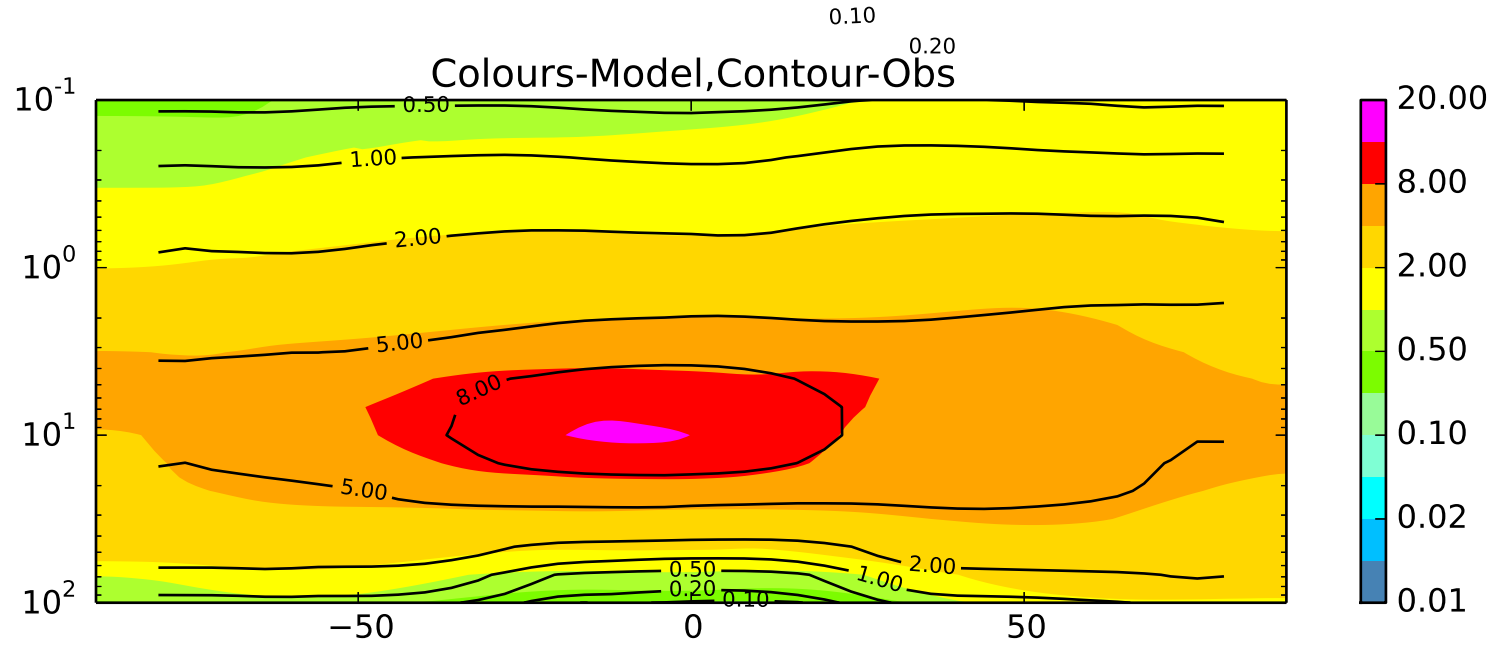


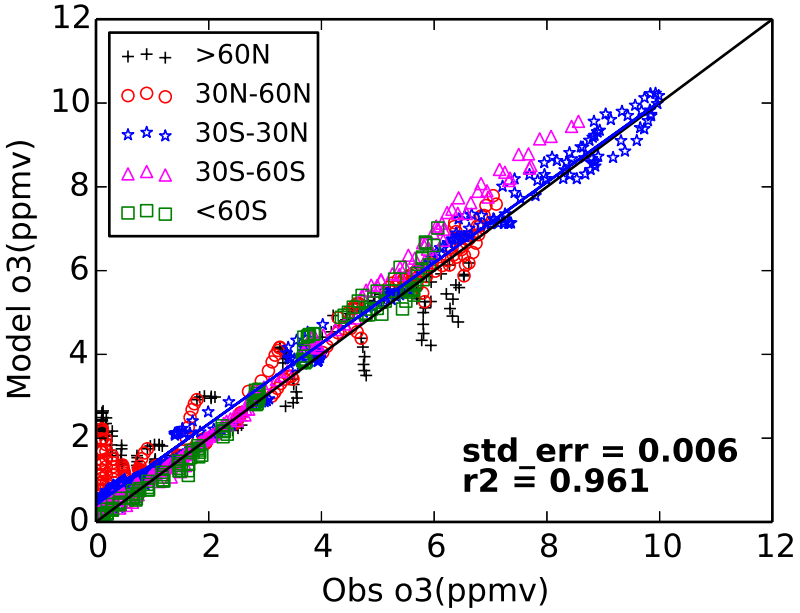
UKCA aj670 vs HALOE:
N2O (ppmv) Jan



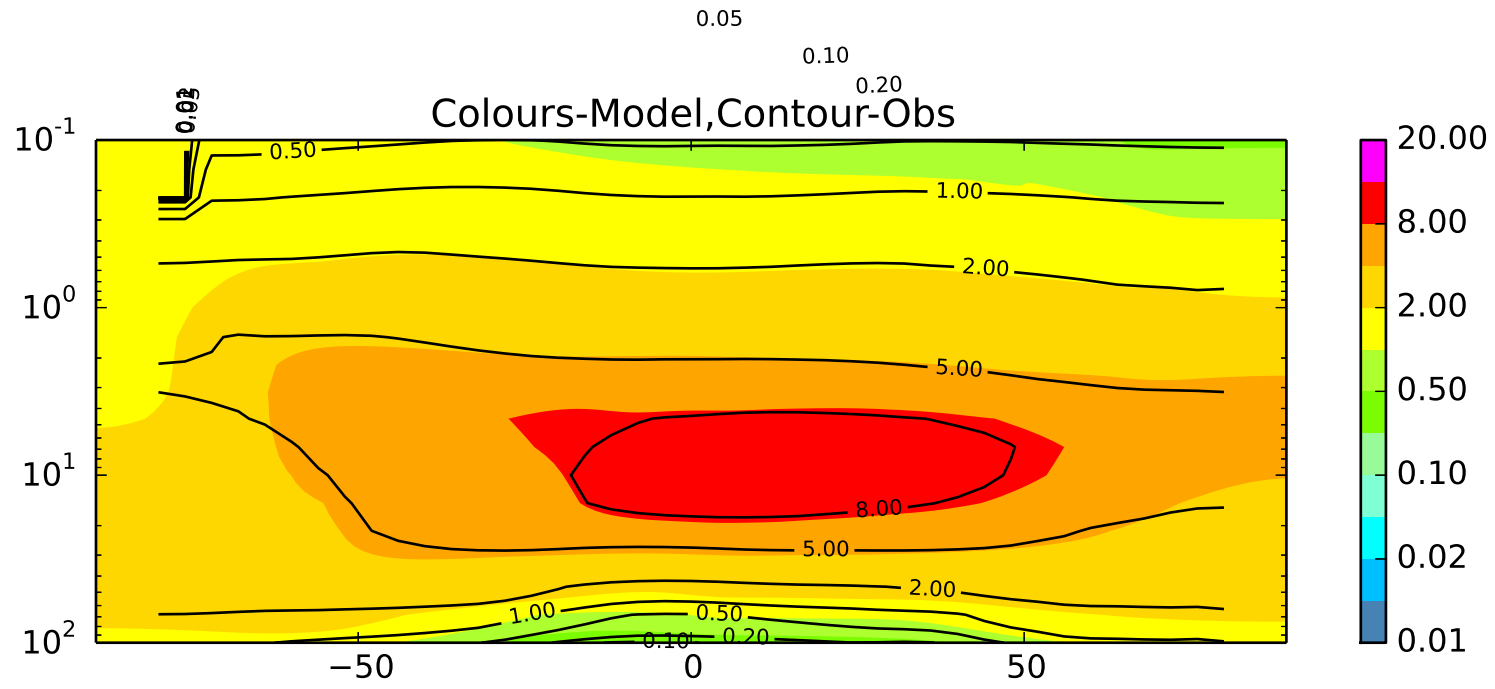


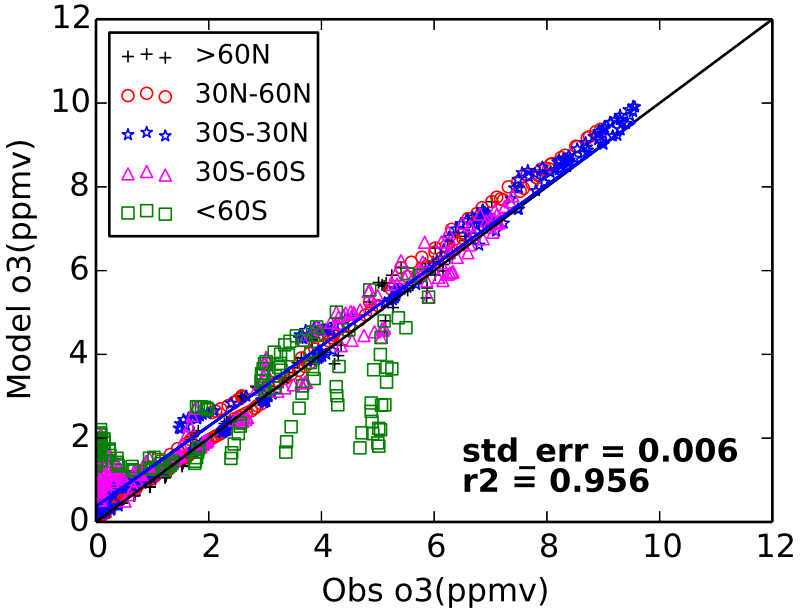
UKCA aj670 vs HALOE:
N2O (ppmv) Jul



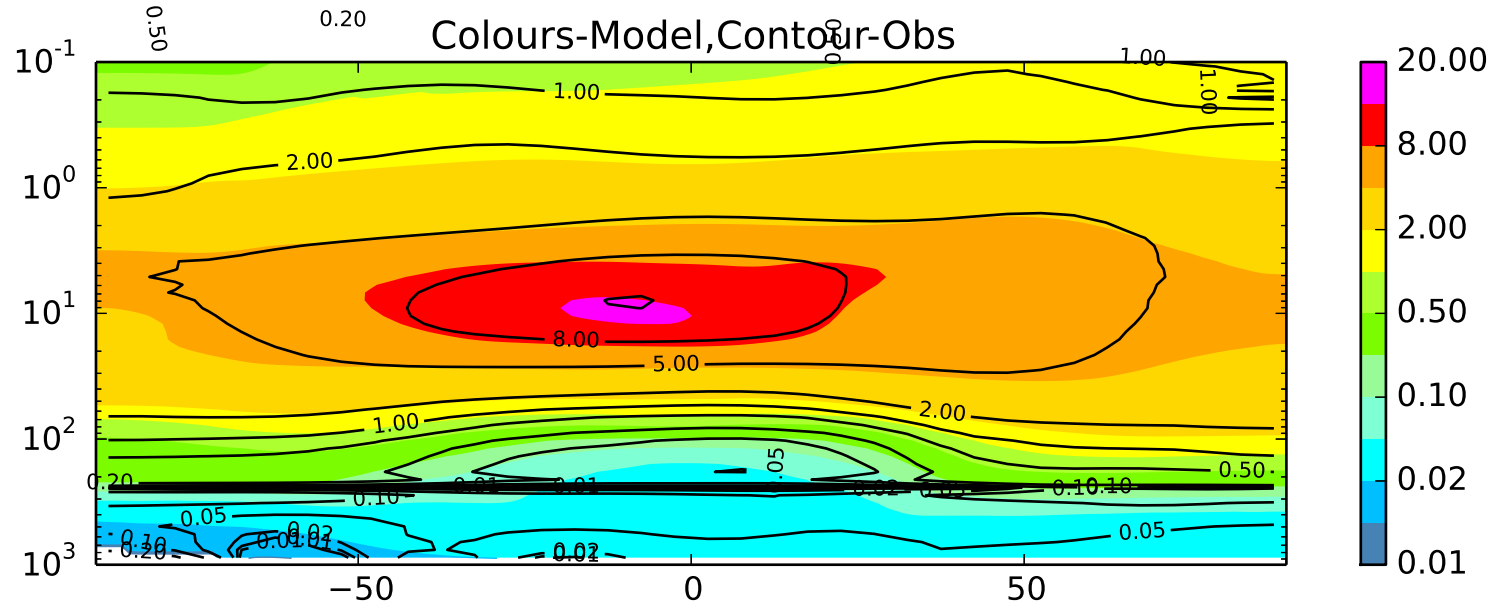


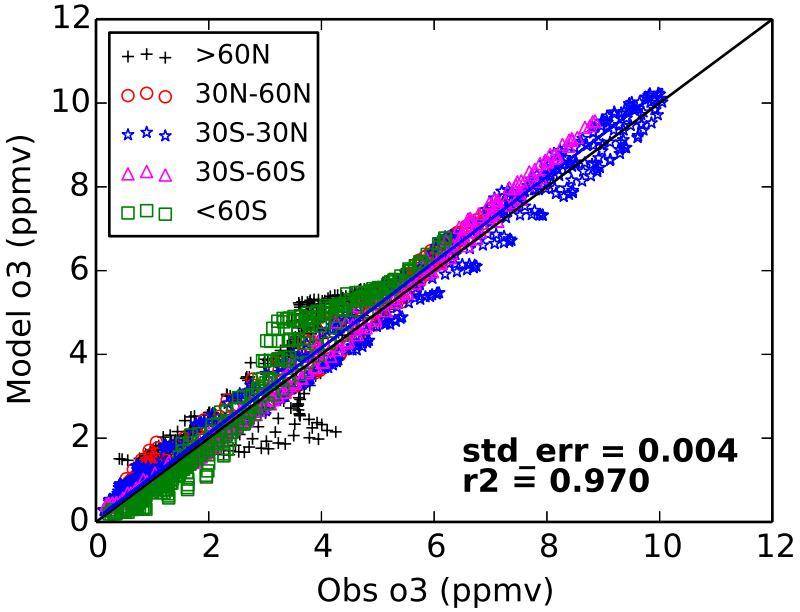
UKCA aj670 vs HALOE:
O3 (ppmv) Jan



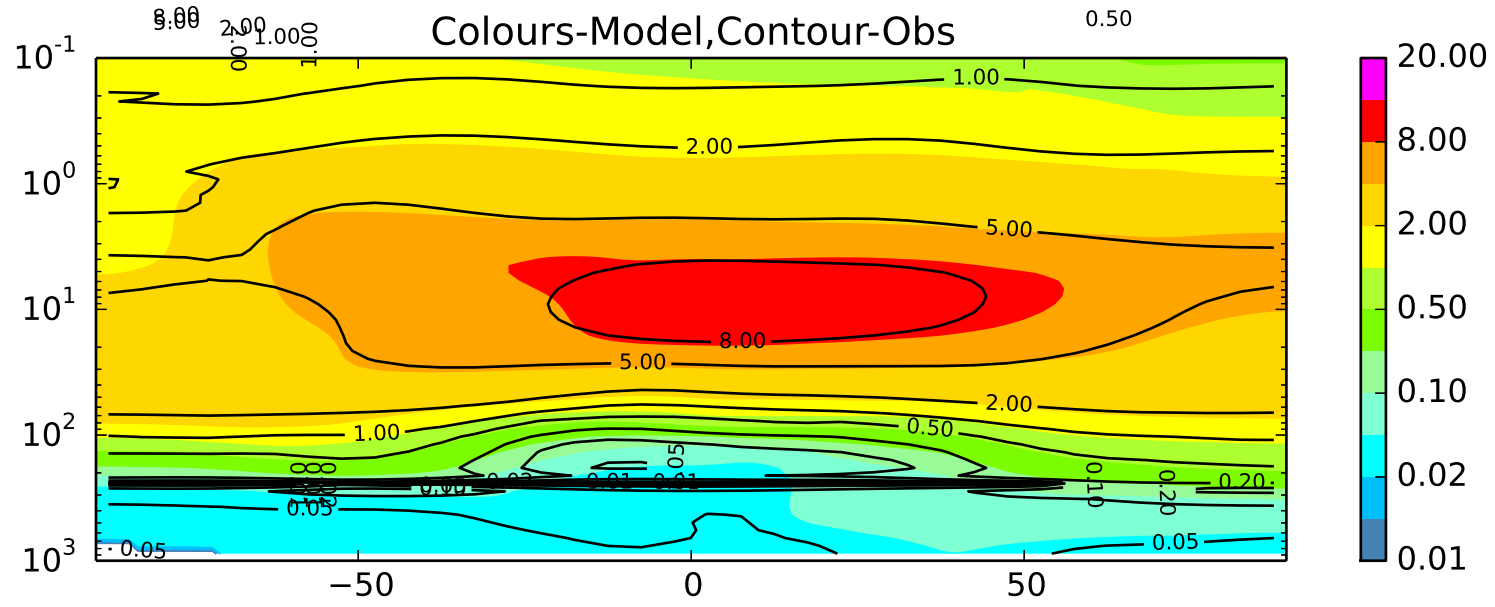


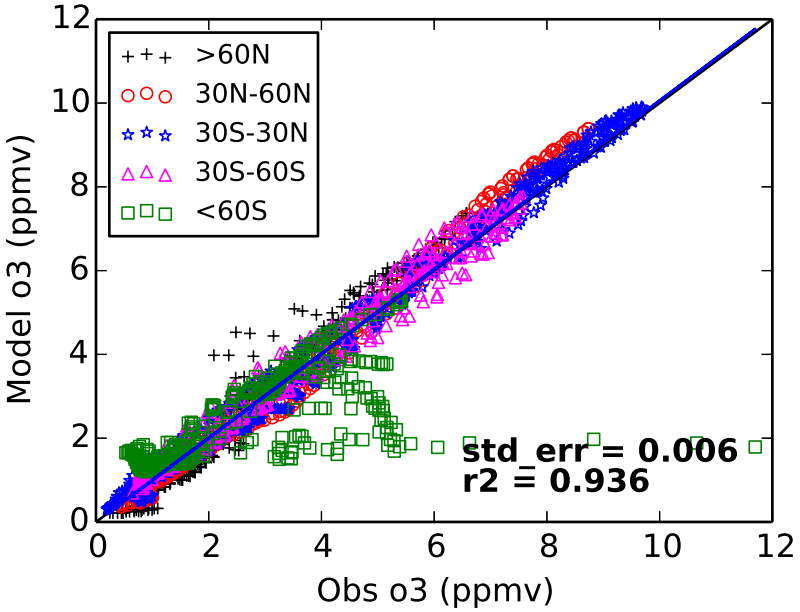
UKCA aj670 vs HALOE:
O3 (ppmv) Jul



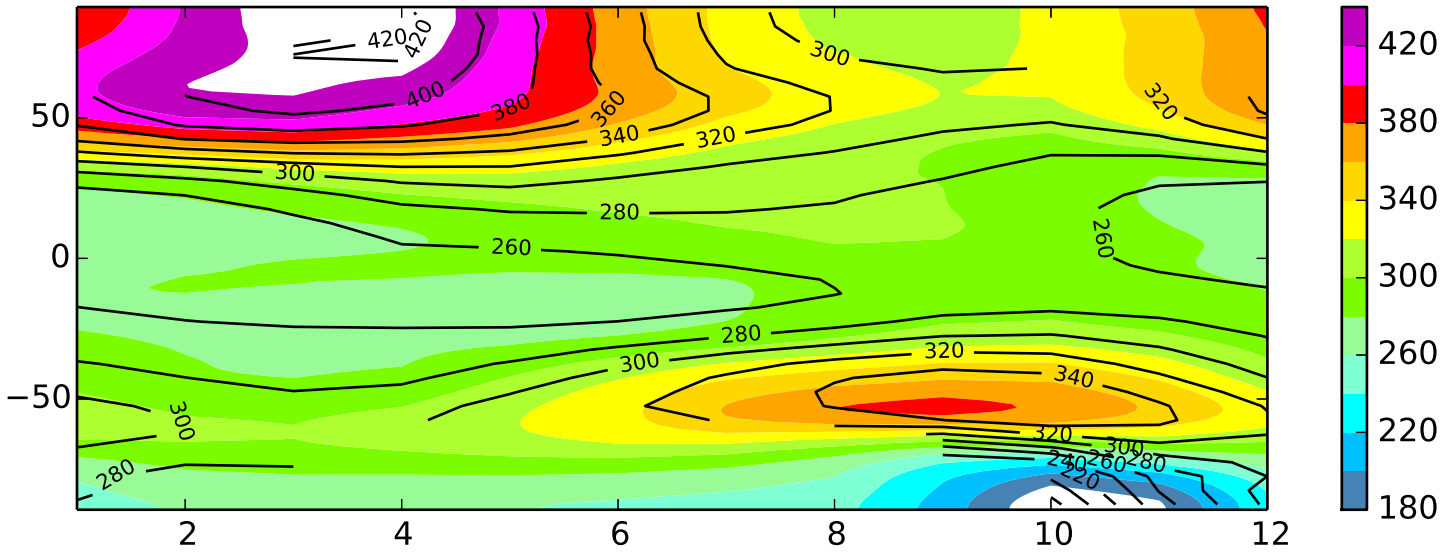


UKCA aj670 vs NIWA-CCMVal:
O3 (ppmv) Jan

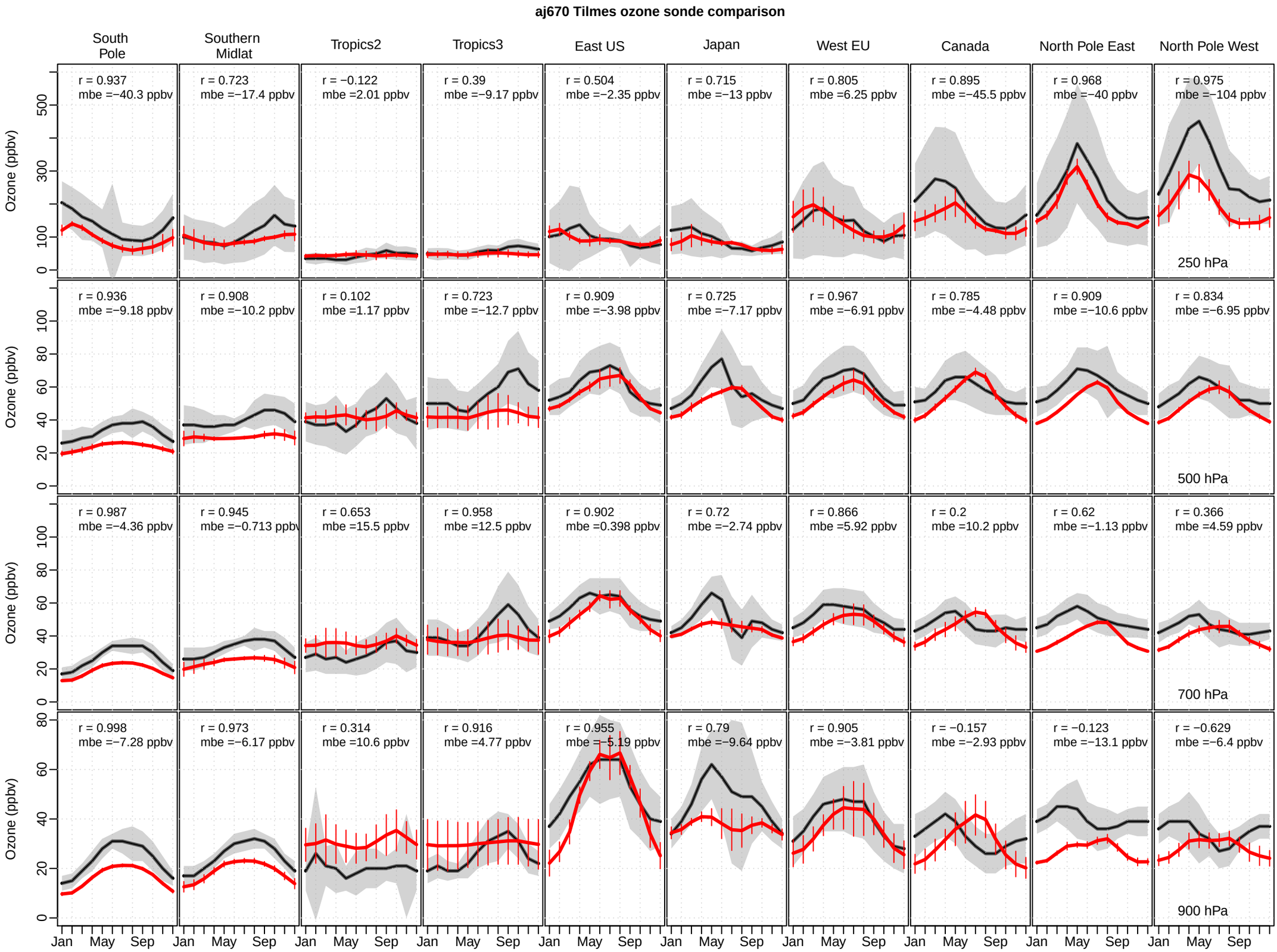




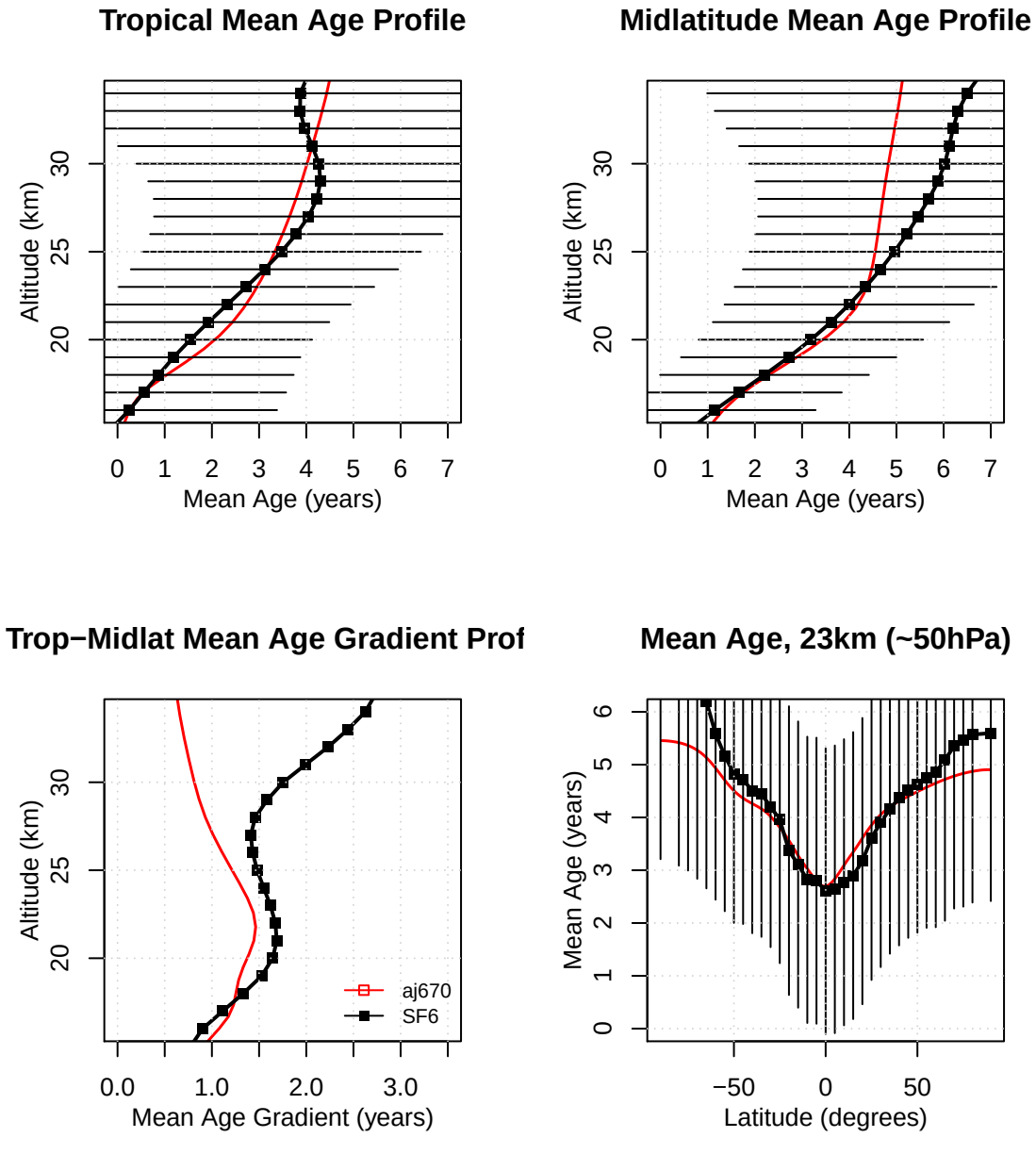
UKCA aj670 vs NIWA-CCMVal:
O3 (ppmv) Jul

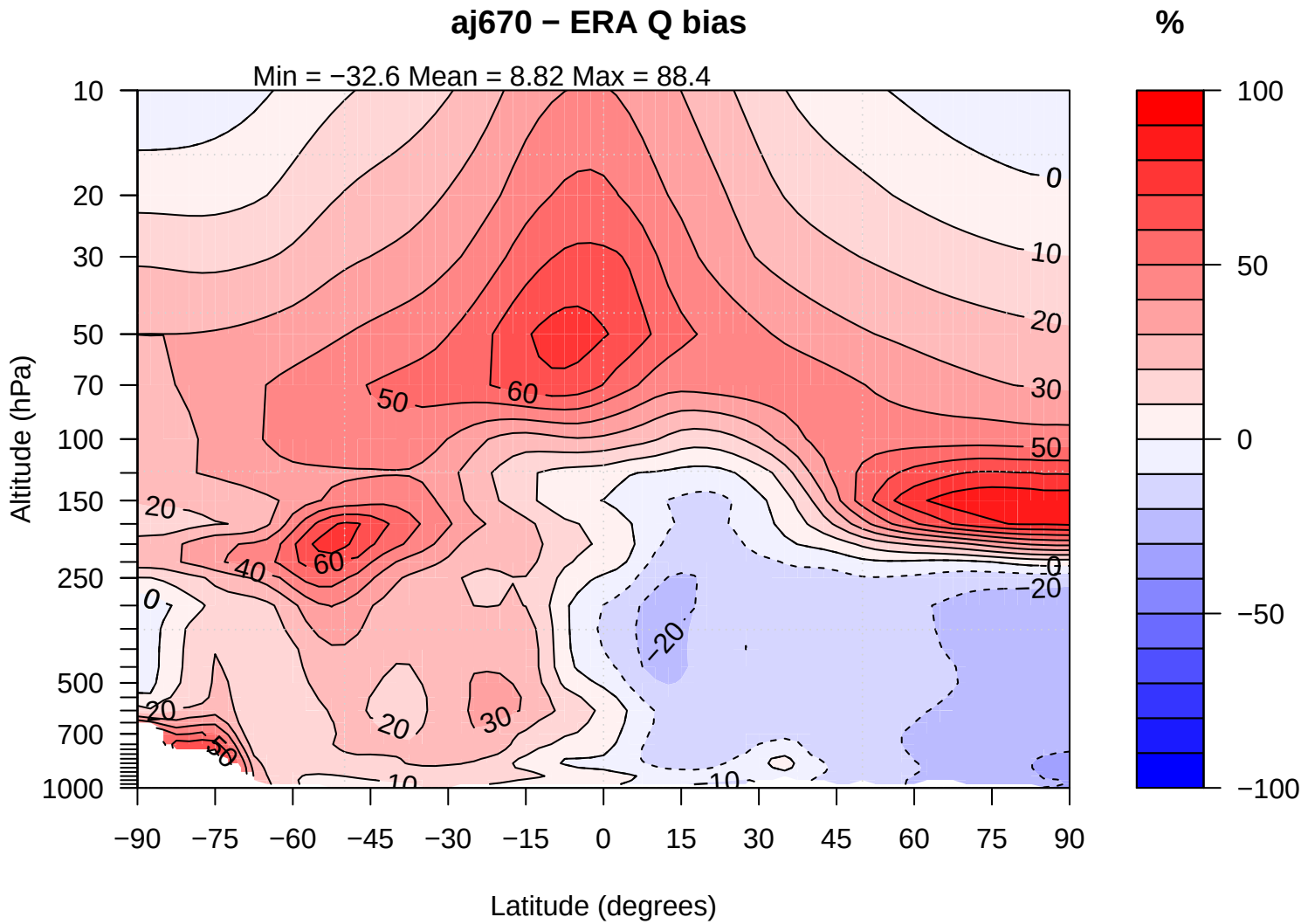


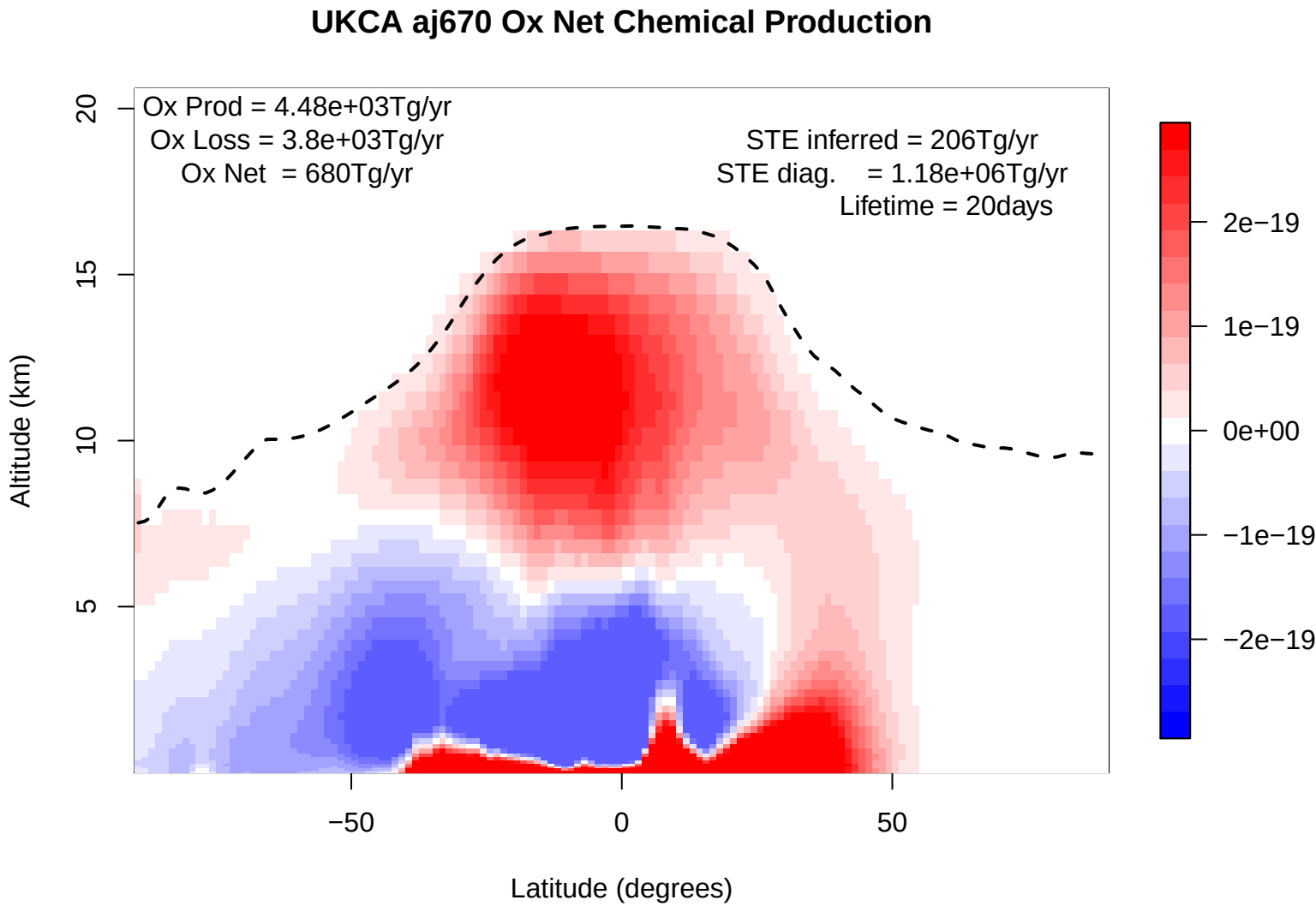
UKCA aj670 vs TOMS:
Column_Ozone (DU)

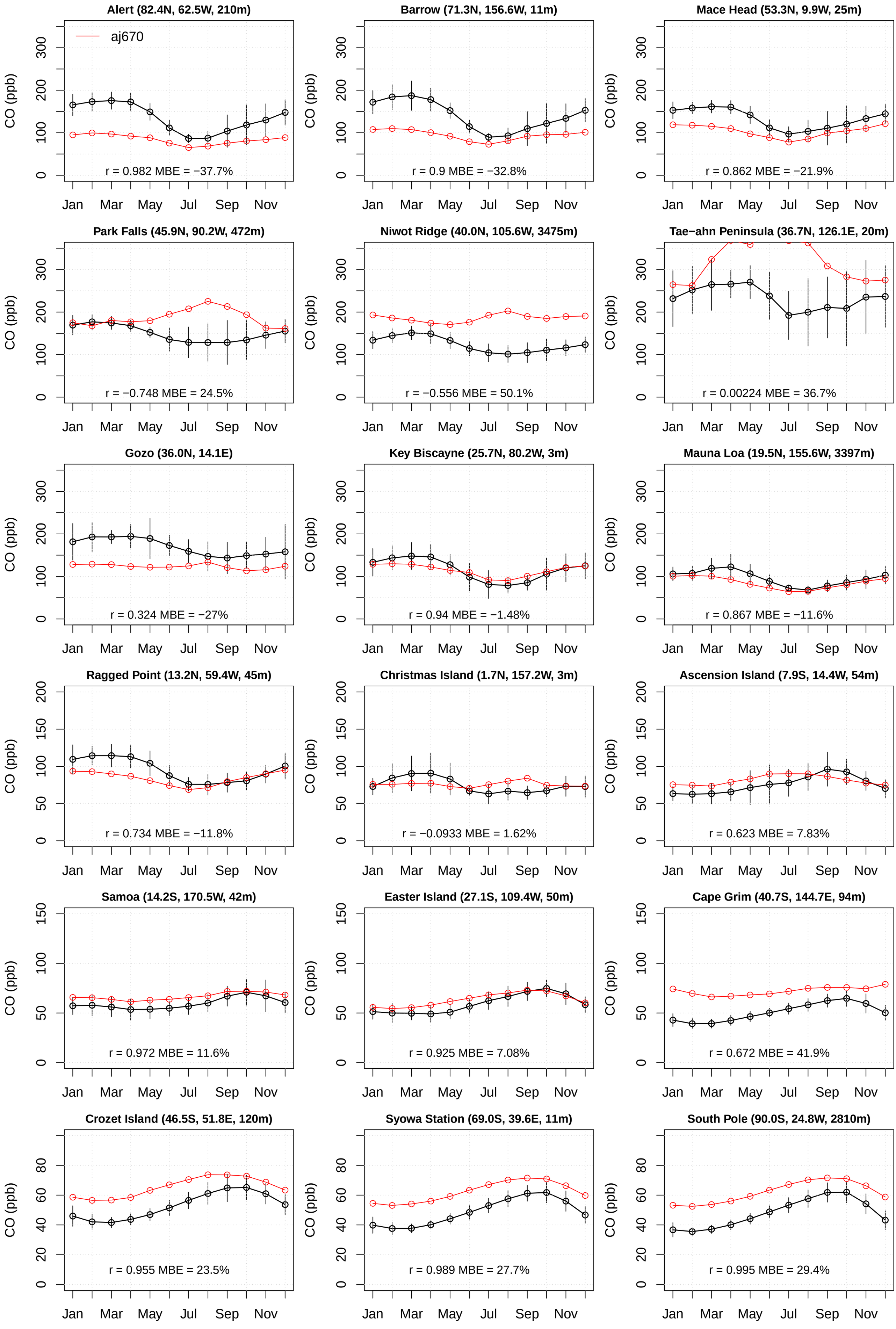

aj670 Tilmes ozone sonde comparison
South Pole
Southern Midlat
Tropics2
Tropics3
East US
Japan
West EU
Canada
North Pole East
North Pole West
Ozone (ppbv)
250 hPa
r = 0.937 mbe =−40.3 ppbv
r = 0.723 mbe =−17.4 ppbv
r = −0.122 mbe =2.01 ppbv
r = 0.39 mbe =−9.17 ppbv
r = 0.504 mbe =−2.35 ppbv
r = 0.715 mbe =−13 ppbv
r = 0.805 mbe =6.25 ppbv
r = 0.895 mbe =−45.5 ppbv
r = 0.968 mbe =−40 ppbv
r = 0.975 mbe =−104 ppbv
500 hPa
r = 0.936 mbe =−9.18 ppbv
r = 0.908 mbe =−10.2 ppbv
r = 0.102 mbe =1.17 ppbv
r = 0.723 mbe =−12.7 ppbv
r = 0.909 mbe =−3.98 ppbv
r = 0.725 mbe =−7.17 ppbv
r = 0.967 mbe =−6.91 ppbv
r = 0.785 mbe =−4.48 ppbv
r = 0.909 mbe =−10.6 ppbv
r = 0.834 mbe =−6.95 ppbv
700 hPa
r = 0.987 mbe =−4.36 ppbv
r = 0.945 mbe =−0.713 ppbv
r = 0.653 mbe =15.5 ppbv
r = 0.958 mbe =12.5 ppbv
r = 0.902 mbe =0.398 ppbv
r = 0.72 mbe =−2.74 ppbv
r = 0.866 mbe =5.92 ppbv
r = 0.2 mbe =10.2 ppbv
r = 0.62 mbe =−1.13 ppbv
r = 0.366 mbe =4.59 ppbv
900 hPa
r = 0.998 mbe =−7.28 ppbv
r = 0.973 mbe =−6.17 ppbv
r = 0.314 mbe =10.6 ppbv
r = 0.916 mbe =4.77 ppbv
r = 0.955 mbe =−5.19 ppbv
r = 0.79 mbe =−9.64 ppbv
r = 0.905 mbe =−3.81 ppbv
r = −0.157 mbe =−2.93 ppbv
r = −0.123 mbe =−13.1 ppbv
r = −0.629 mbe =−6.4 ppbv
Jan
May
Sep

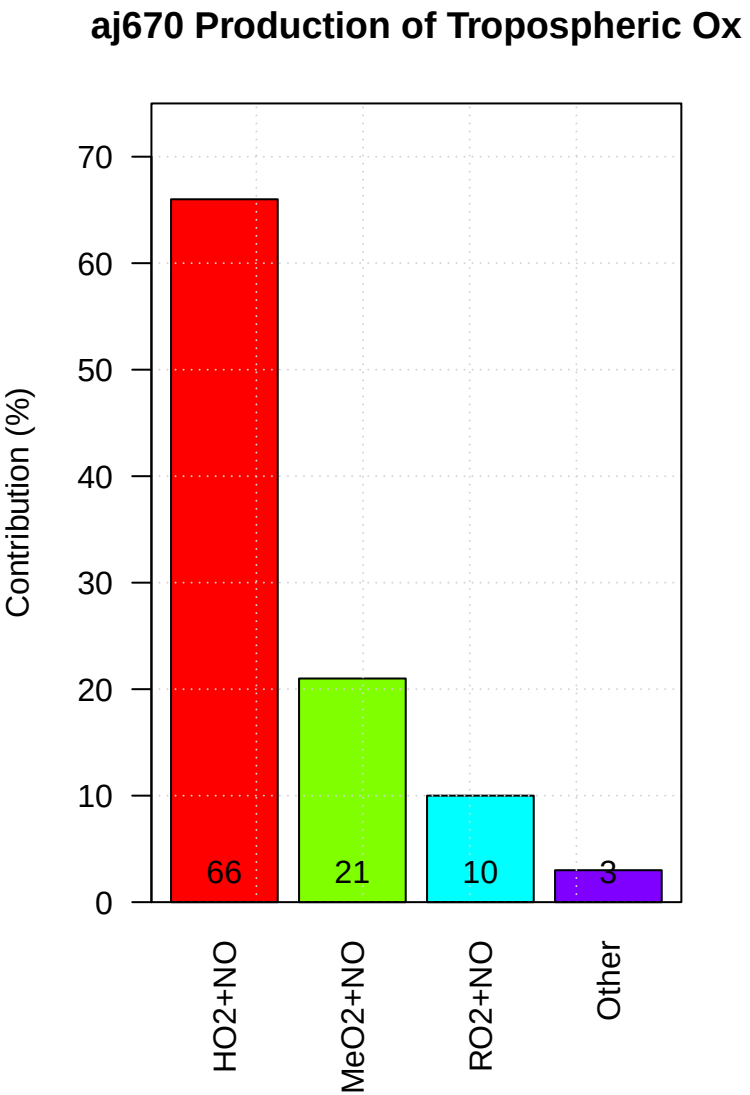
UKCA aj670 Mean Age of Air

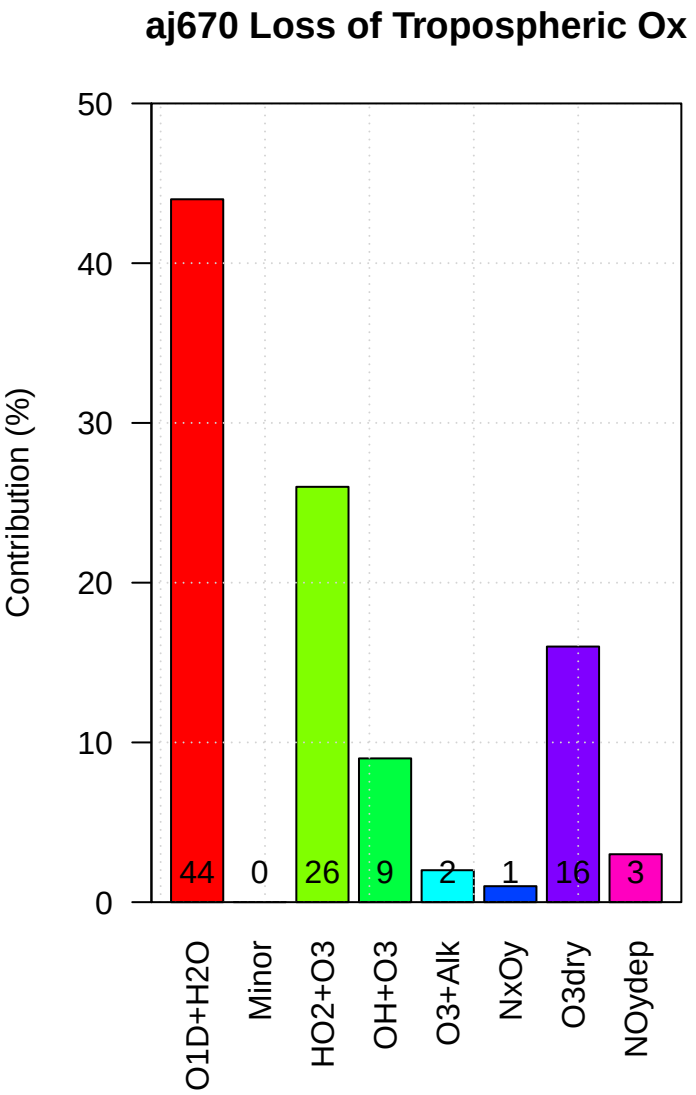


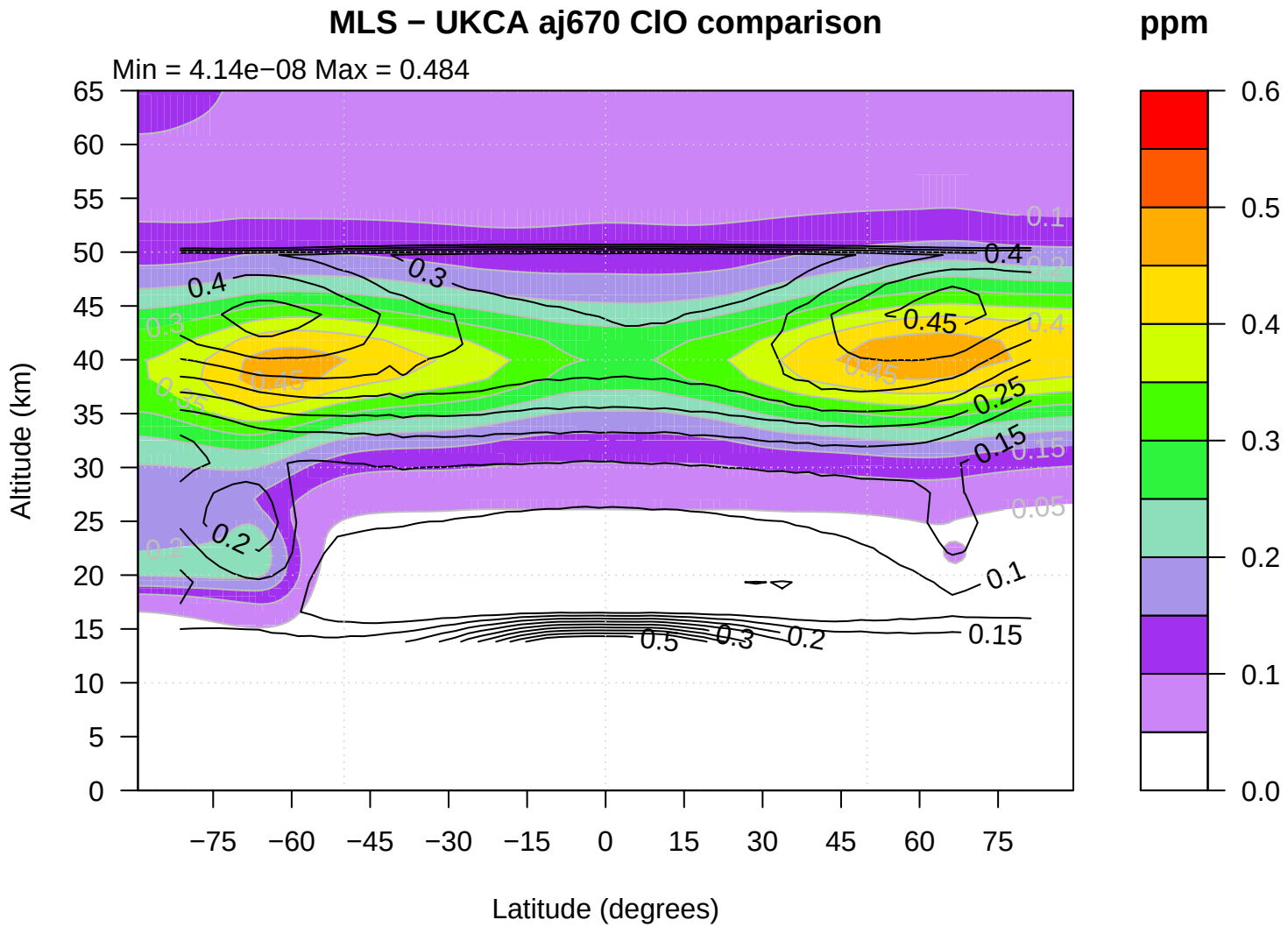

aj670 − ERA Q bias
Min = −32.6 Mean = 8.82 Max = 88.4
%
Altitude (hPa)
Latitude (degrees)
10
20
30
50
70
100
150
250
500
700
1000
−90
−75
−60
−45
−30
−15
0
15
30
45
60
75
90
100
50
0
−50
−100

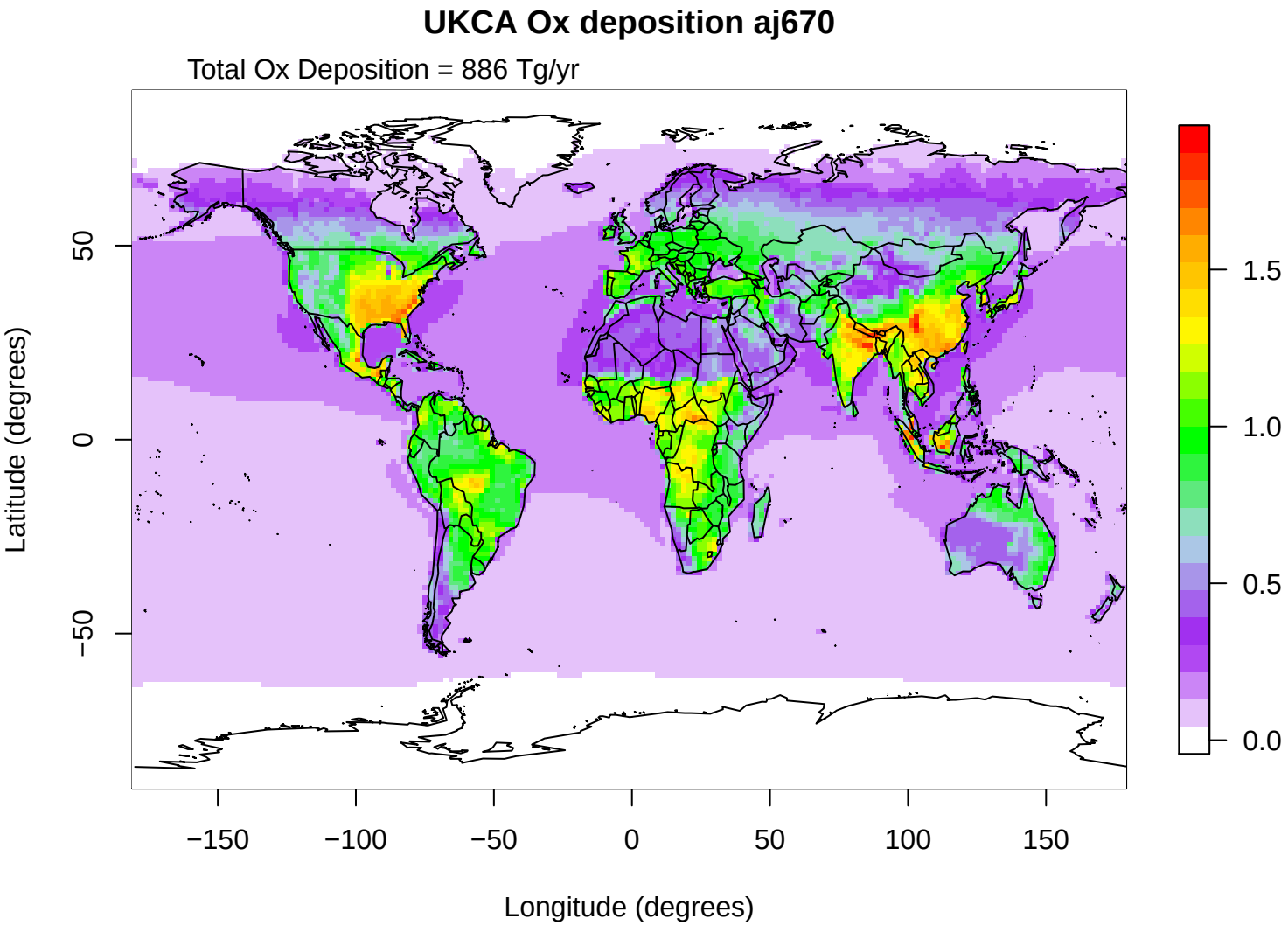

UKCA aj670 Ox Net Chemical Production
Ox Prod = 4.48e+03Tg/yr
Ox Loss = 3.8e+03Tg/yr
Ox Net = 680Tg/yr
STE inferred = 206Tg/yr
STE diag. = 1.18e+06Tg/yr
Lifetime = 20days
Altitude (km)
20
15
10
5
−50
0
50
Latitude (degrees)
2e−19
1e−19
0e+00
−1e−19
−2e−19


Alert (82.4N, 62.5W, 210m)
aj670
r = 0.982 MBE = −37.7%
Barrow (71.3N, 156.6W, 11m)
r = 0.9 MBE = −32.8%
Mace Head (53.3N, 9.9W, 25m)
r = 0.862 MBE = −21.9%
Park Falls (45.9N, 90.2W, 472m)
r = −0.748 MBE = 24.5%
Niwot Ridge (40.0N, 105.6W, 3475m)
r = −0.556 MBE = 50.1%
Tae−ahn Peninsula (36.7N, 126.1E, 20m)
r = 0.00224 MBE = 36.7%
Gozo (36.0N, 14.1E)
r = 0.324 MBE = −27%
Key Biscayne (25.7N, 80.2W, 3m)
r = 0.94 MBE = −1.48%
Mauna Loa (19.5N, 155.6W, 3397m)
r = 0.867 MBE = −11.6%
Ragged Point (13.2N, 59.4W, 45m)
r = 0.734 MBE = −11.8%
Christmas Island (1.7N, 157.2W, 3m)
r = −0.0933 MBE = 1.62%
Ascension Island (7.9S, 14.4W, 54m)
r = 0.623 MBE = 7.83%
Samoa (14.2S, 170.5W, 42m)
r = 0.972 MBE = 11.6%
Easter Island (27.1S, 109.4W, 50m)
r = 0.925 MBE = 7.08%
Cape Grim (40.7S, 144.7E, 94m)
r = 0.672 MBE = 41.9%
Crozet Island (46.5S, 51.8E, 120m)
r = 0.955 MBE = 23.5%
Syowa Station (69.0S, 39.6E, 11m)
r = 0.989 MBE = 27.7%
South Pole (90.0S, 24.8W, 2810m)
r = 0.995 MBE = 29.4%
CO (ppb)
Jan
Mar
May
Jul
Sep
Nov

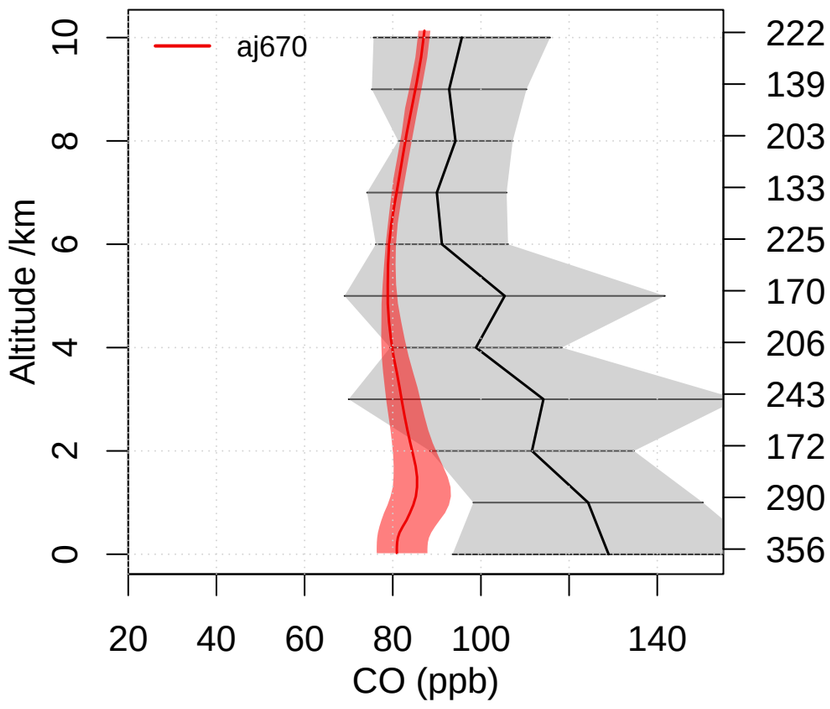

aj670 Production of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
60
70
66
21
10
3
HO2+NO
MeO2+NO
RO2+NO
Other

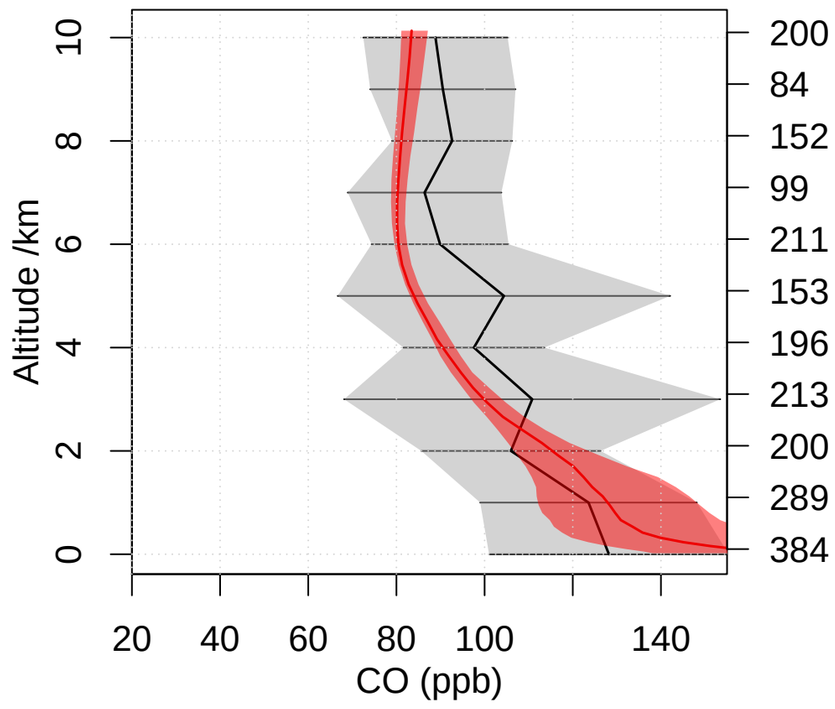

aj670 Loss of Tropospheric Ox
Contribution (%)
0
10
20
30
40
50
44
0
26
9
2
1
16
3
O1D+H2O
Minor
HO2+O3
OH+O3
O3+Alk
NxOy
O3dry
NOydep

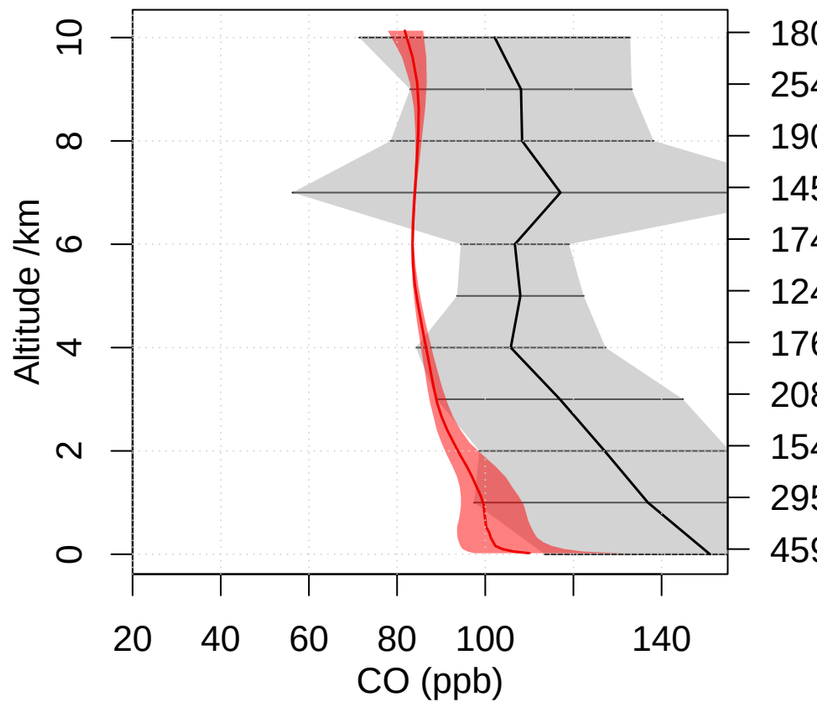

MLS − UKCA aj670 ClO comparison
ppm
Min = 4.14e−08 Max = 0.484
Altitude (km)
Latitude (degrees)
65
60
55
50
45
40
35
30
25
20
15
10
5
0
−75
−60
−45
−30
−15
0
15
30
45
60
75
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.4
0.3
0.45
0.25
0.15
0.2
0.1
0.5
0.3
0.2
0.15
0.05

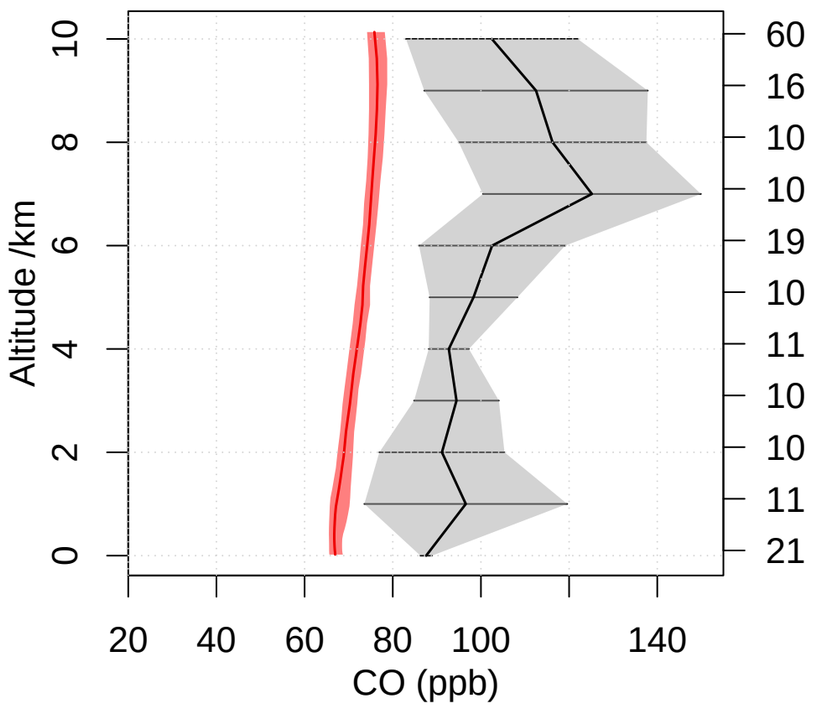

UKCA Ox deposition aj670
Total Ox Deposition = 886 Tg/yr
Latitude (degrees)
50
0
−50
−150
−100
−50
0
50
100
150
Longitude (degrees)
1.5
1.0
0.5
0.0

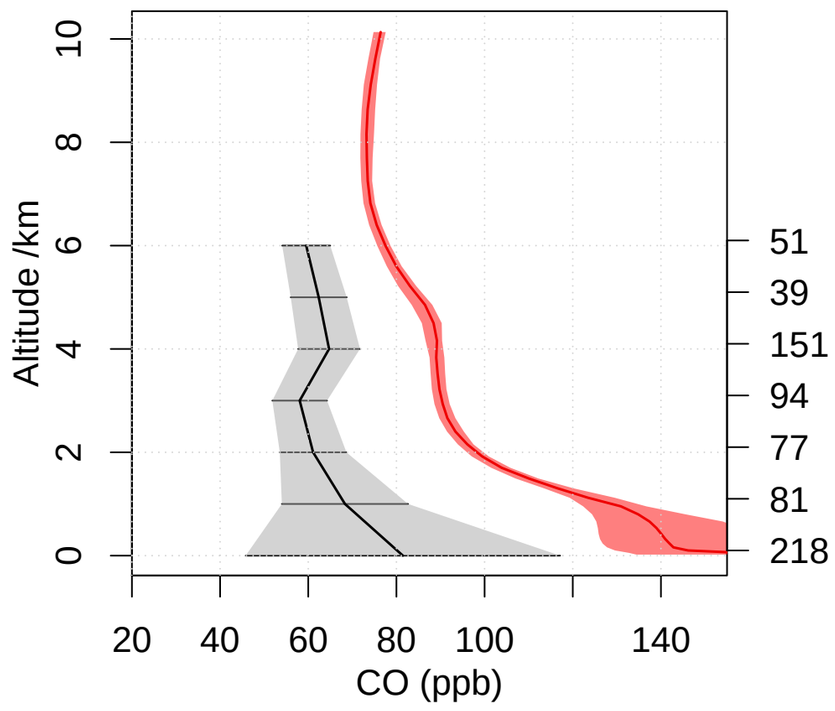
Emmons CO comparison

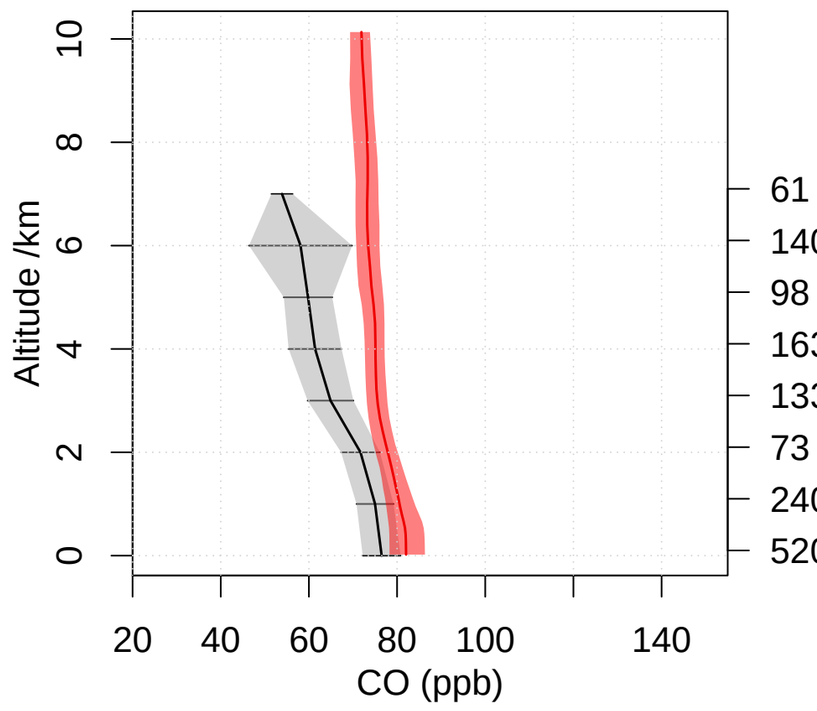


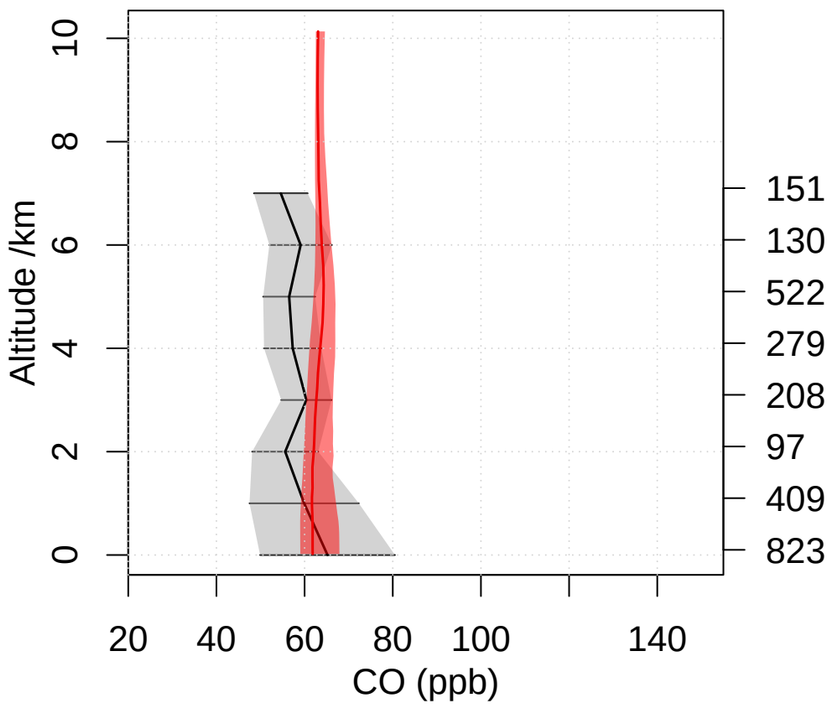


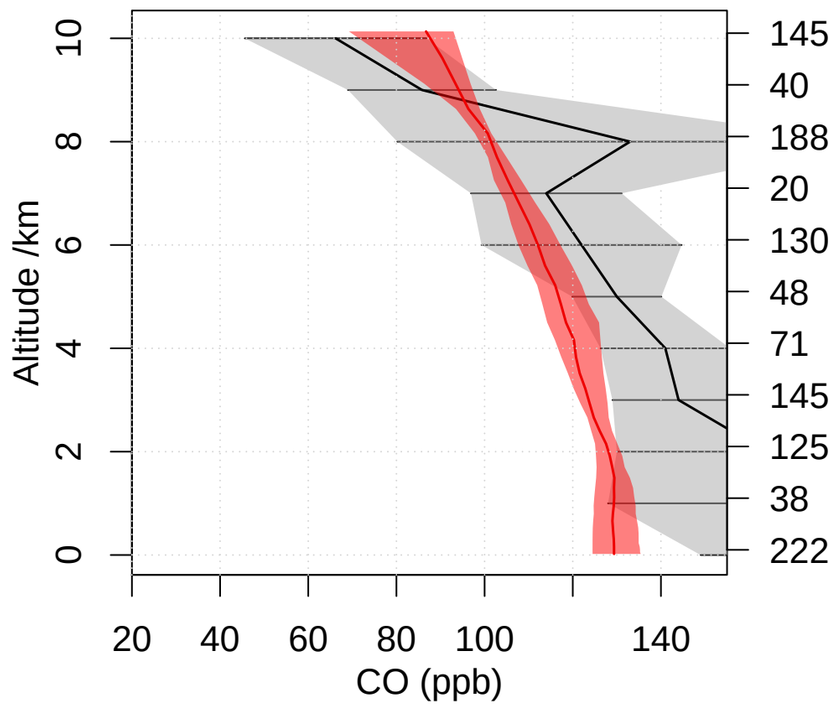


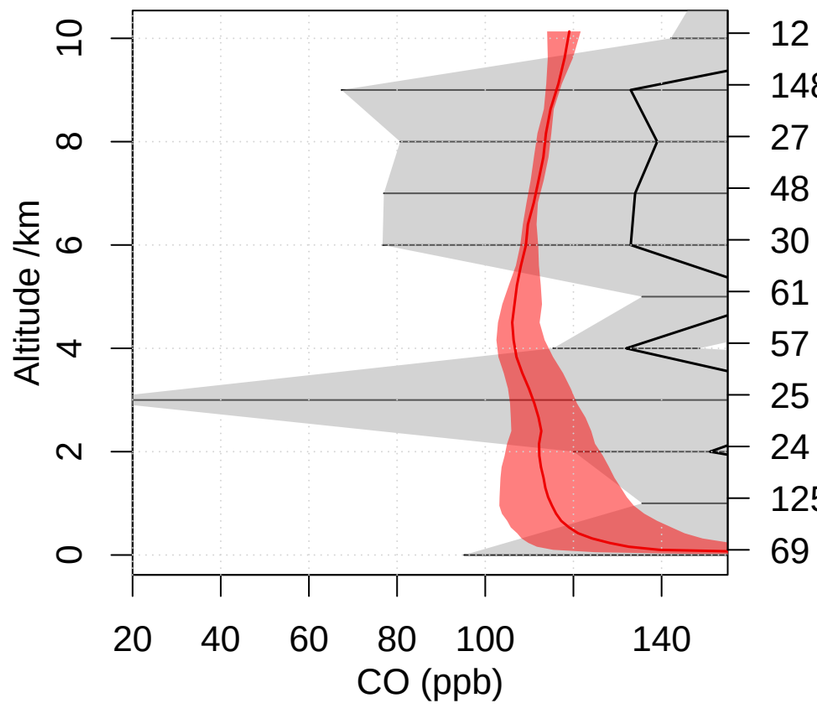


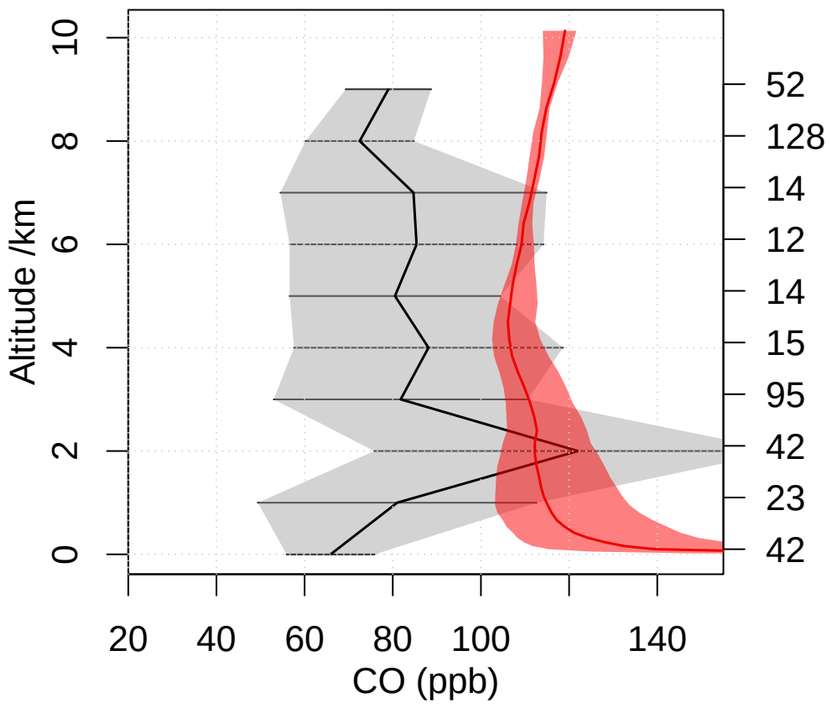


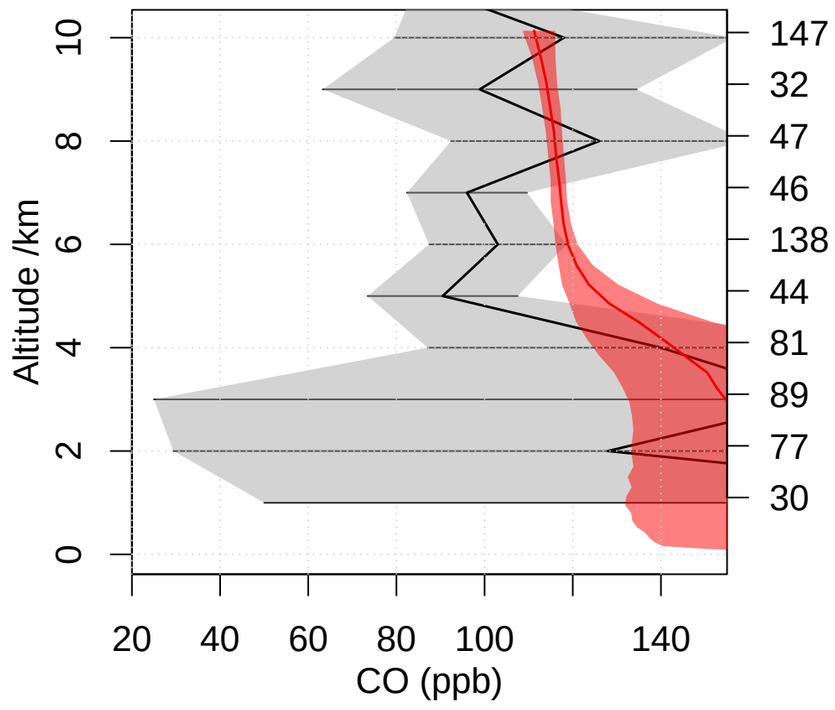


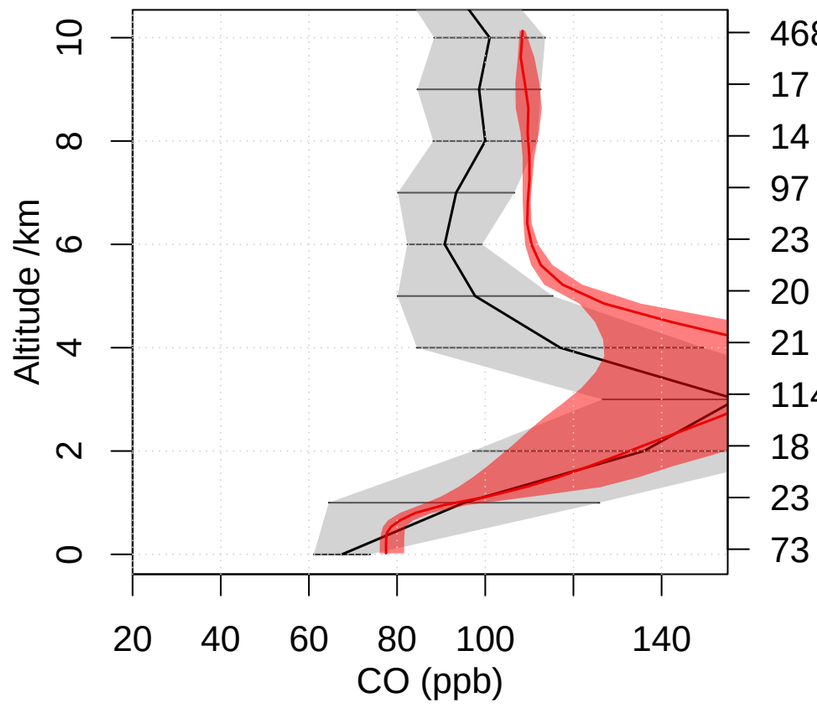


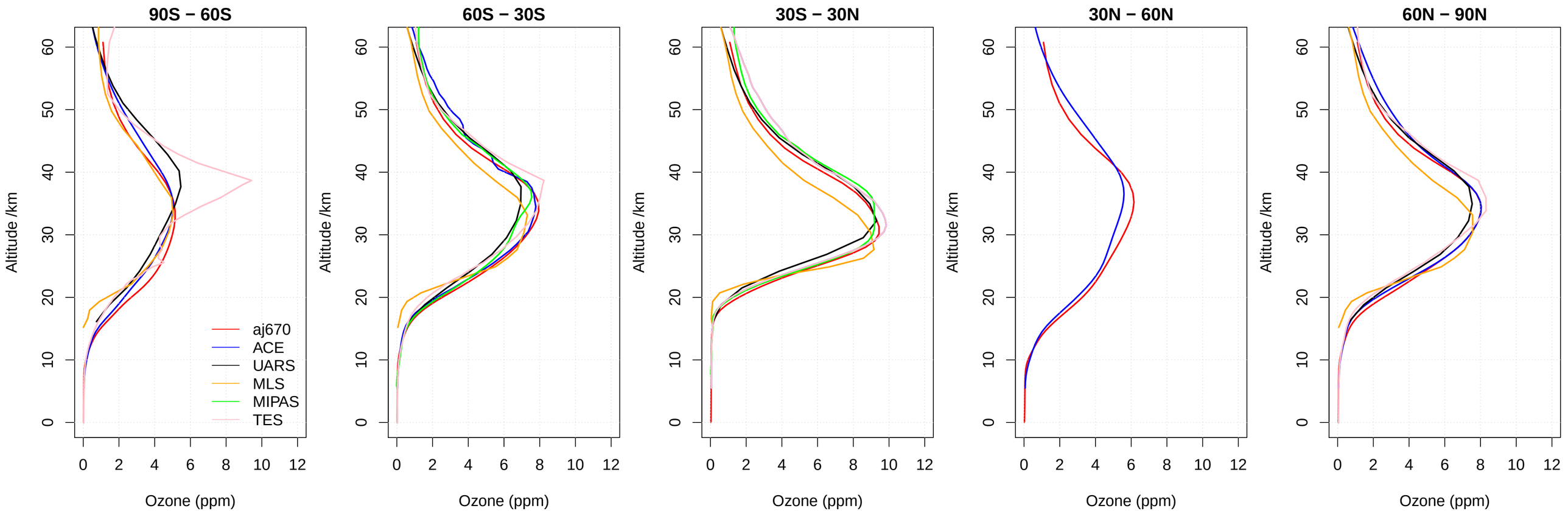


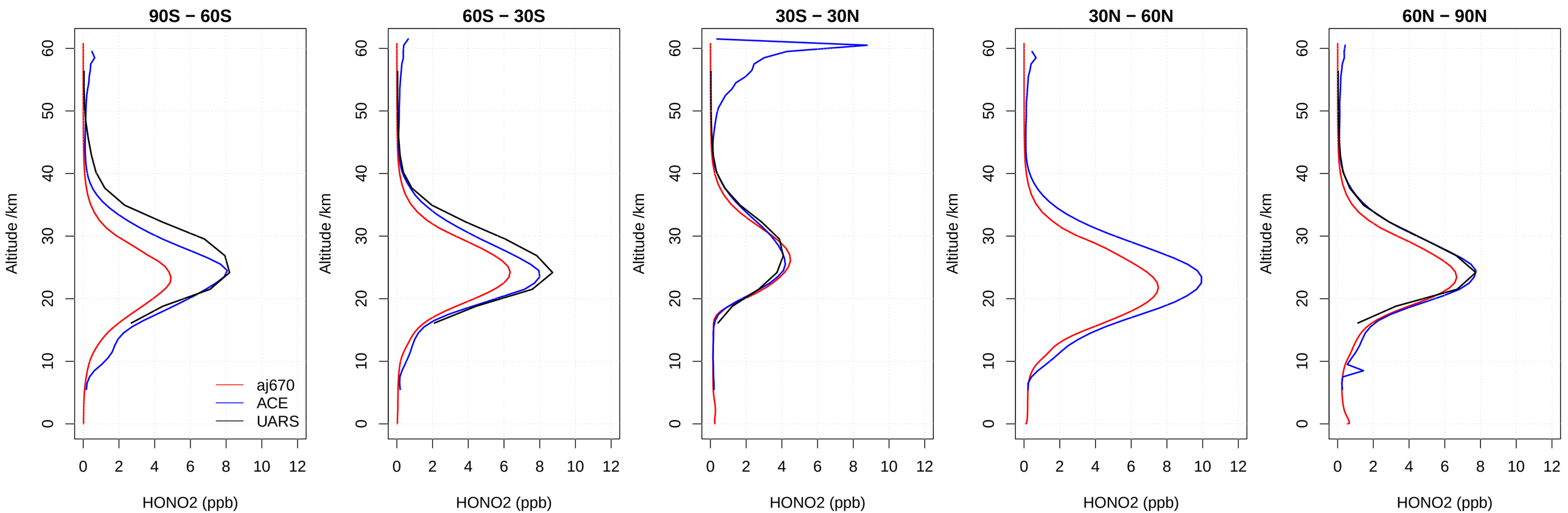


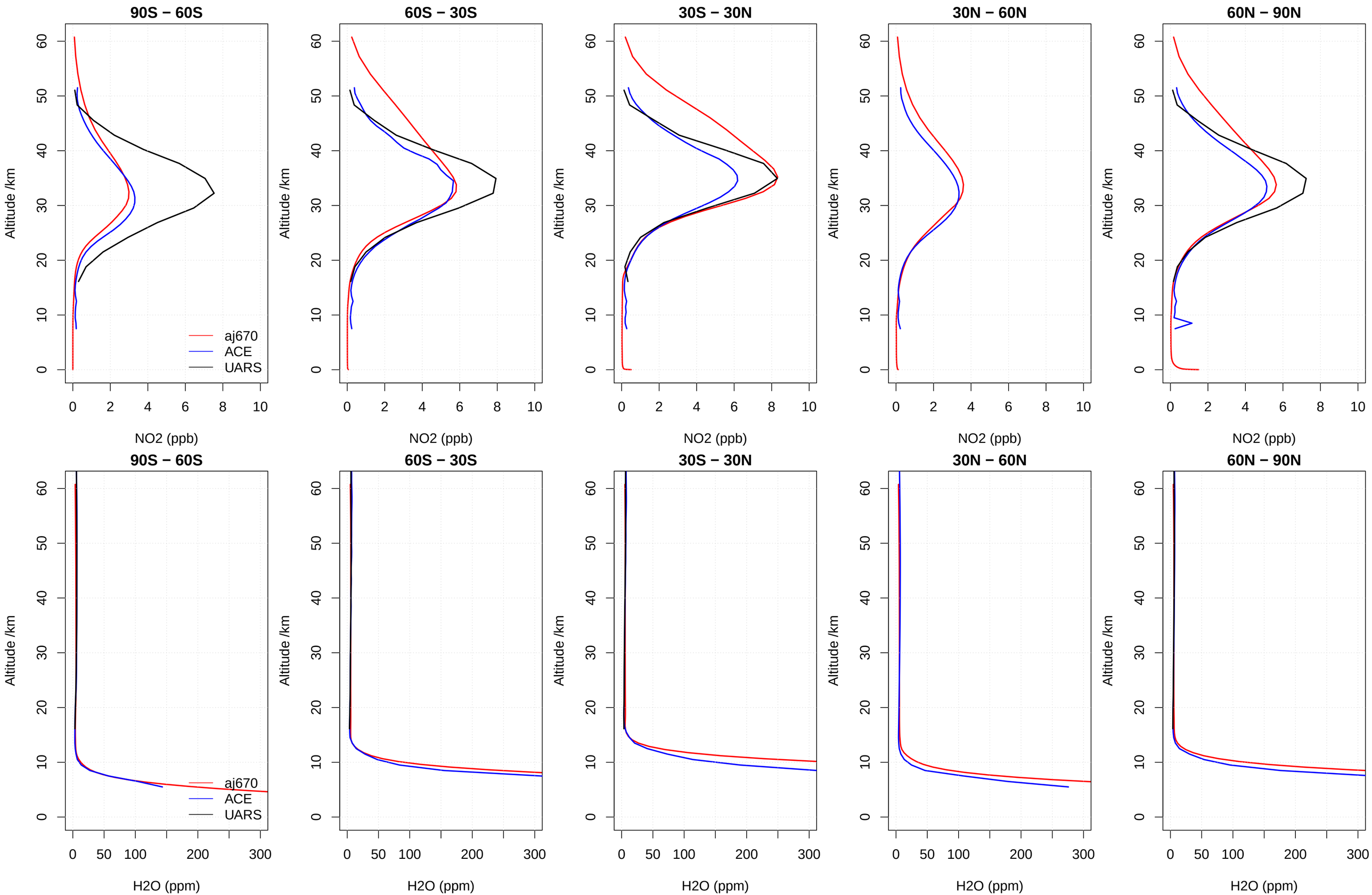


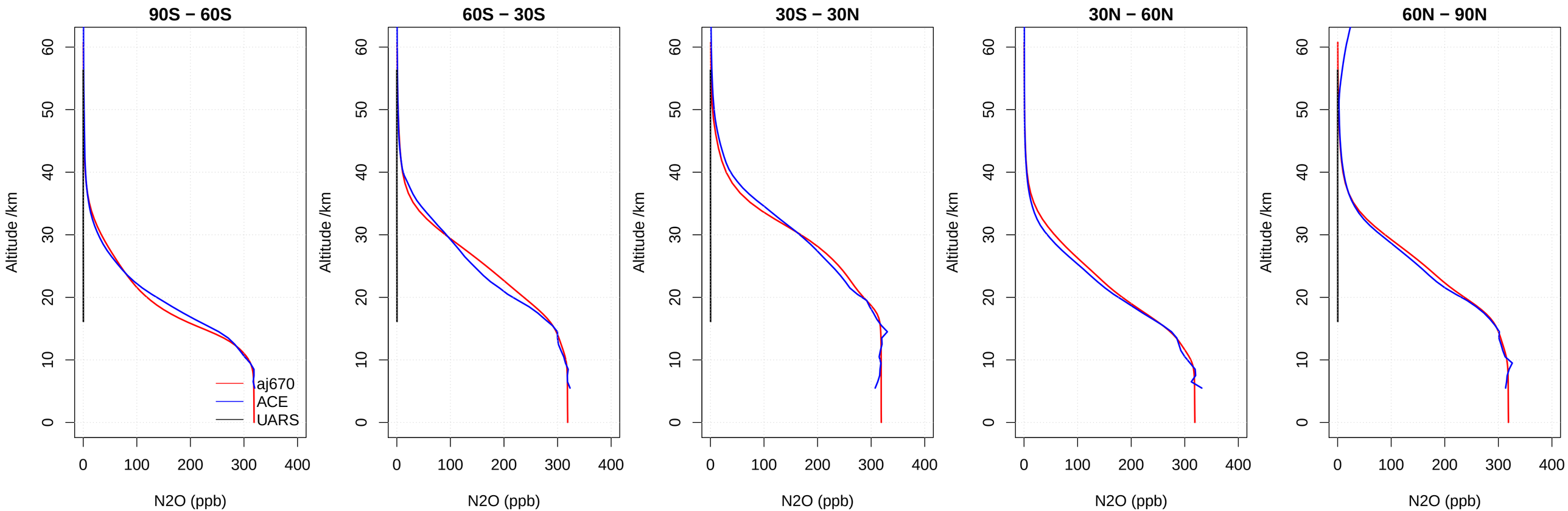




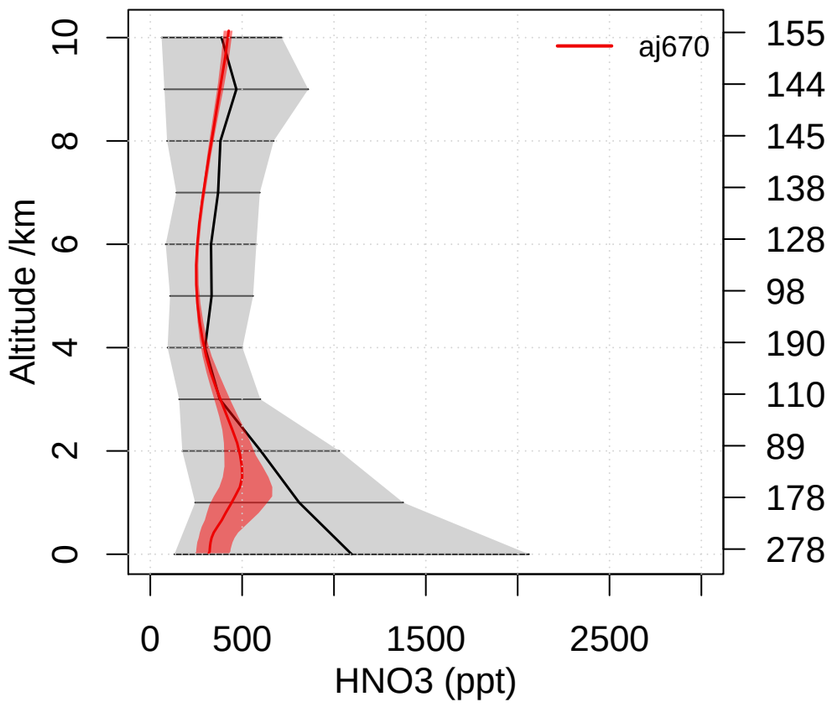

90S – 60S
60S – 30S
30S – 30N
30N – 60N
60N – 90N
Altitude /km
Ozone (ppm)
aj670
ACE
UARS
MLS
MIPAS
TES

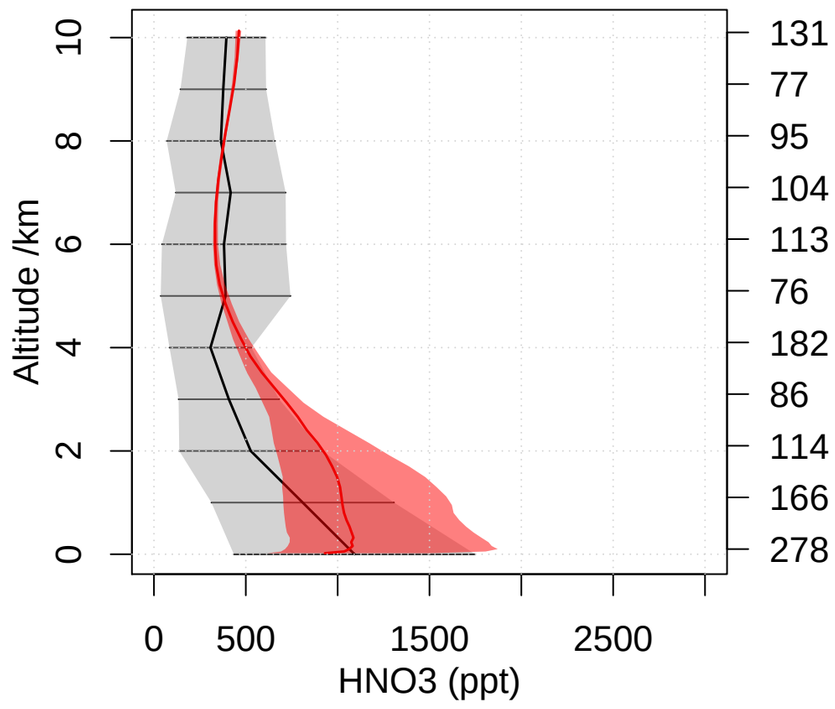

90S – 60S
60S – 30S
30S – 30N
30N – 60N
60N – 90N
Altitude /km
HONO2 (ppb)
aj670
ACE
UARS

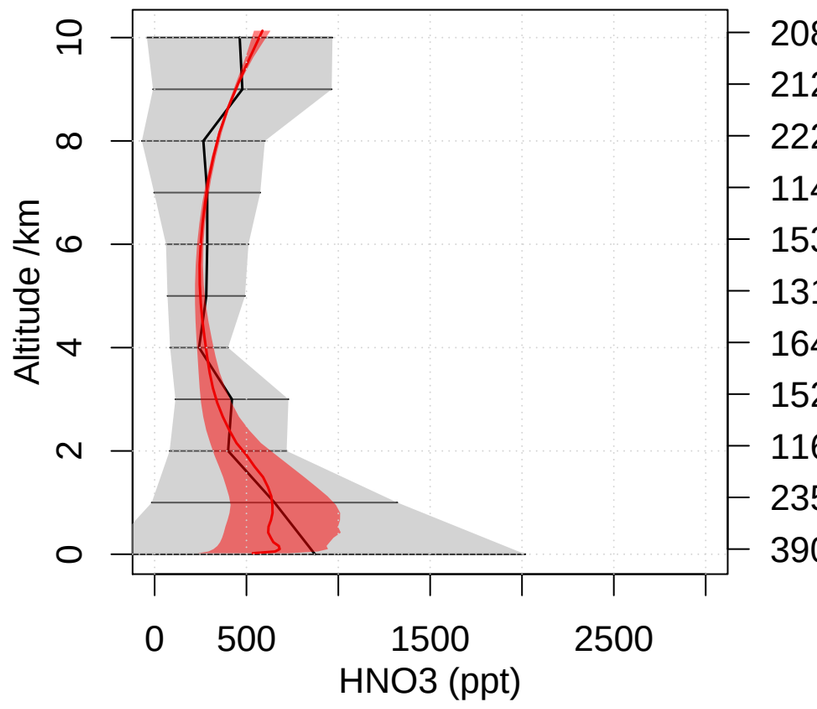

90S – 60S
60S – 30S
30S – 30N
30N – 60N
60N – 90N
Altitude /km
NO2 (ppb)
aj670
ACE
UARS
H2O (ppm)

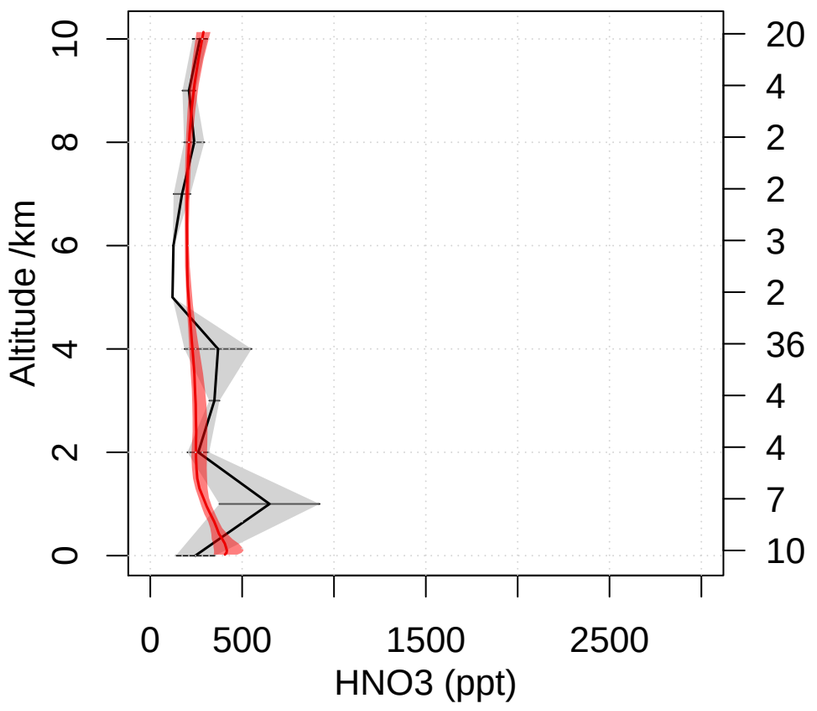

90S − 60S
60S − 30S
30S − 30N
30N − 60N
60N − 90N
Altitude /km
N2O (ppb)
aj670
ACE
UARS
0
10
20
30
40
50
60
0
100
200
300
400

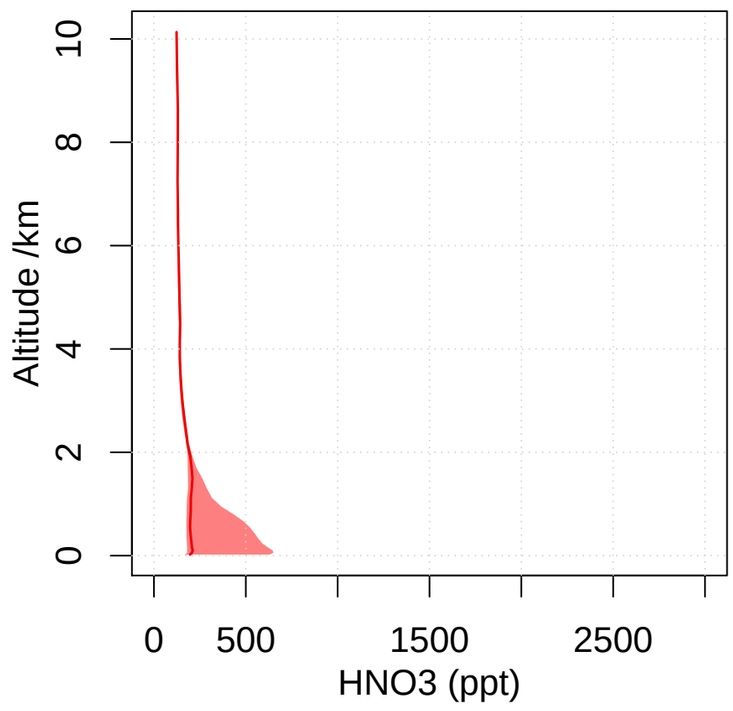
Emmons HNO3 comparison

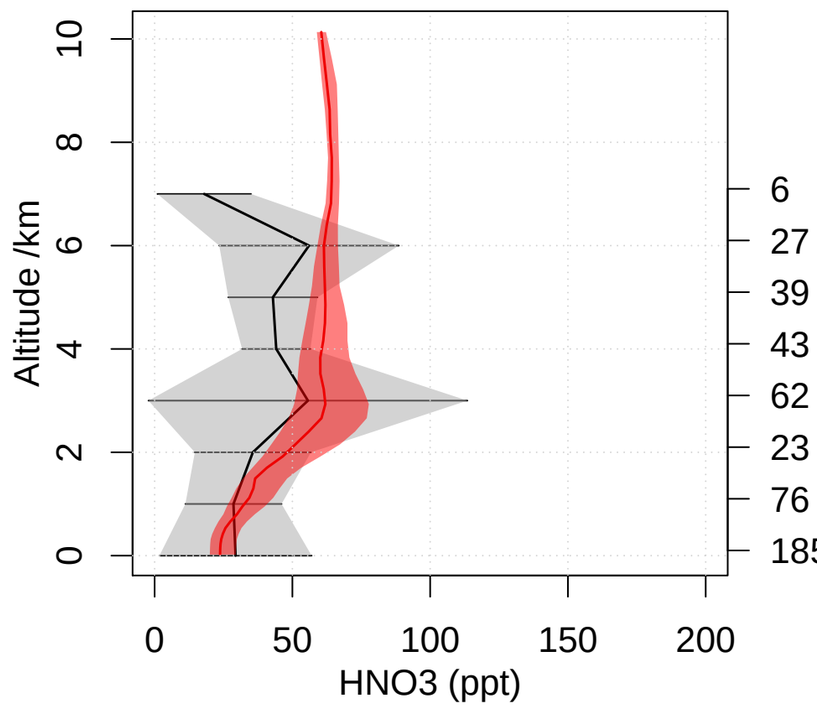


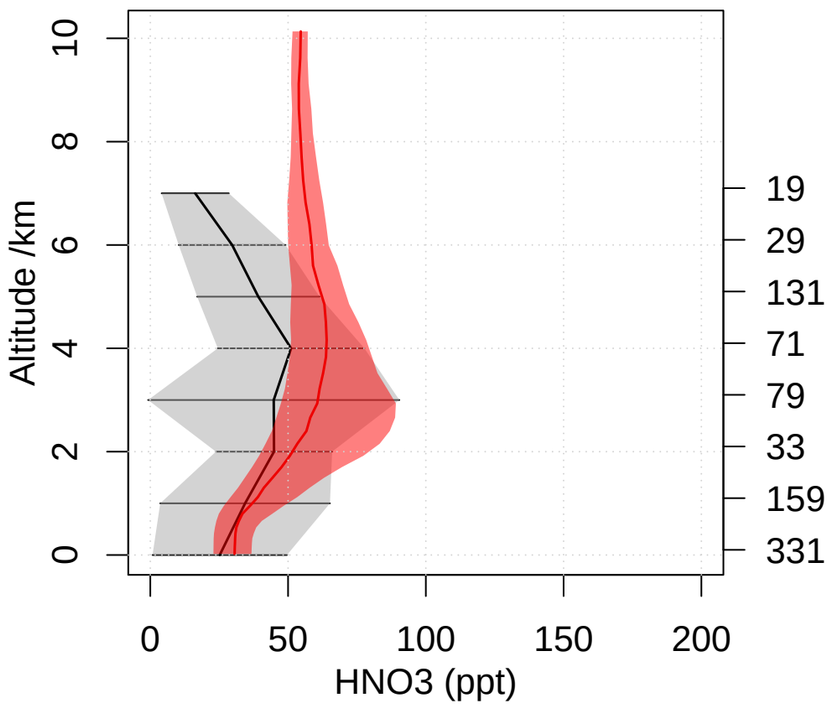


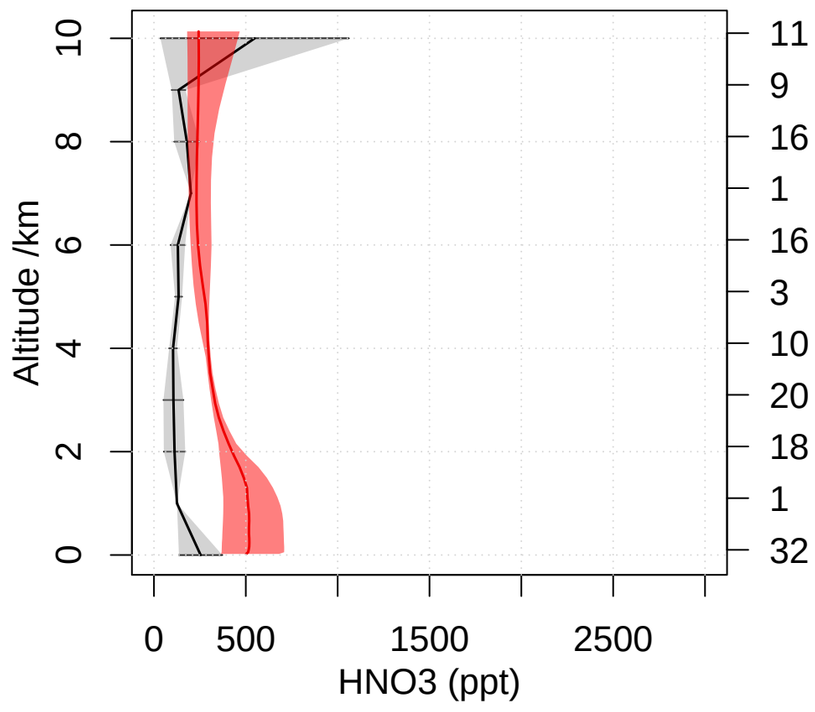


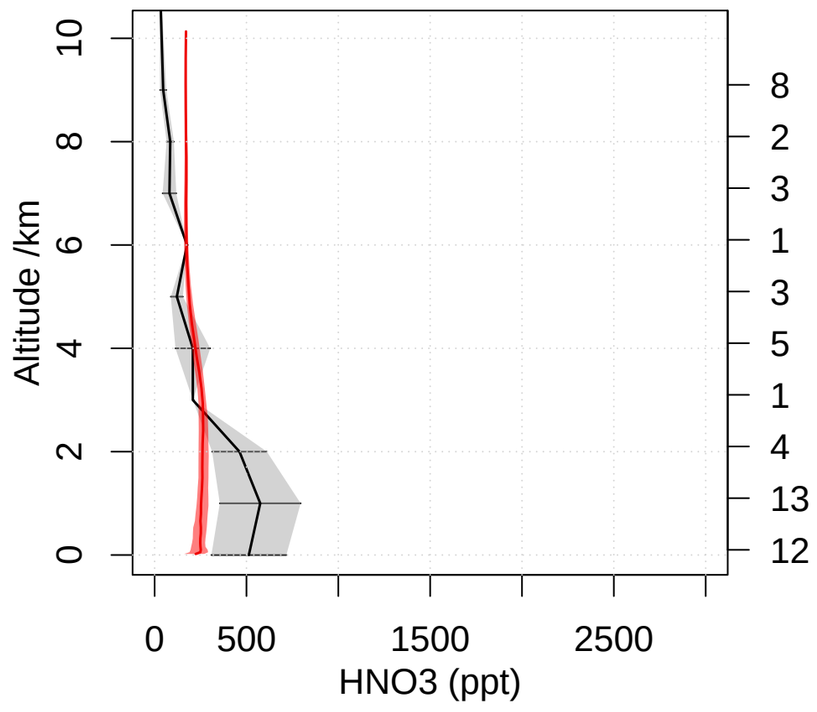


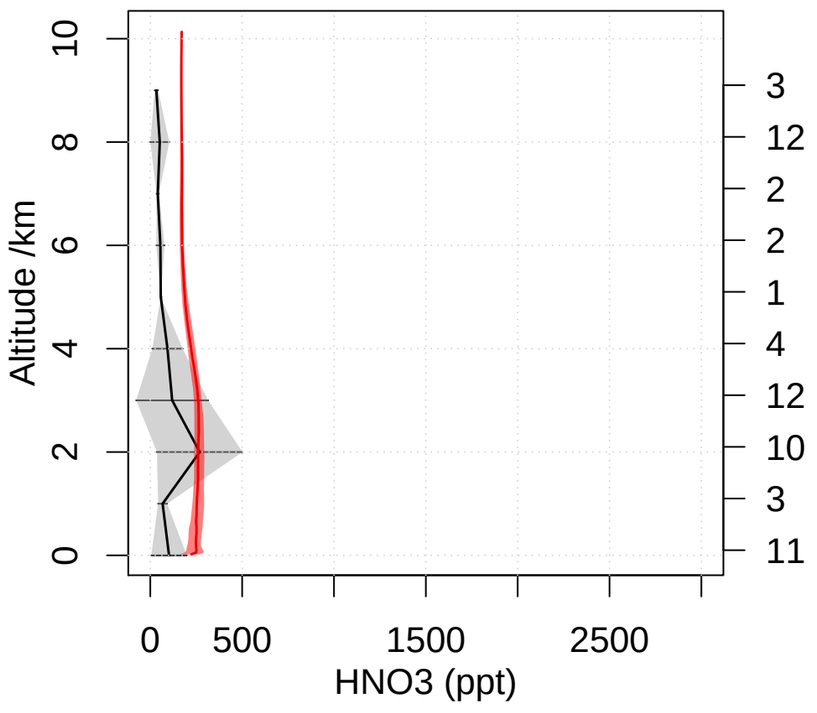


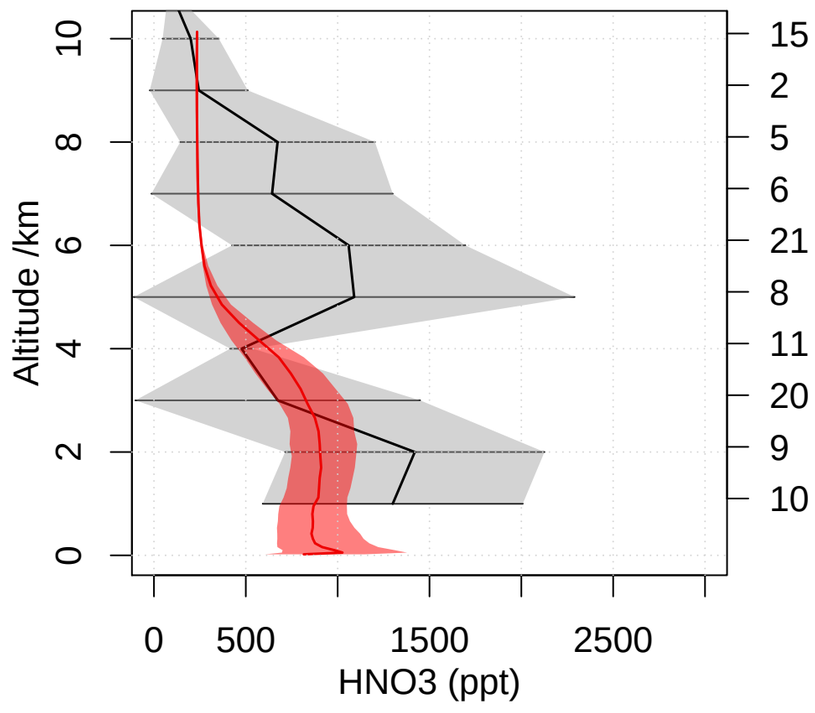


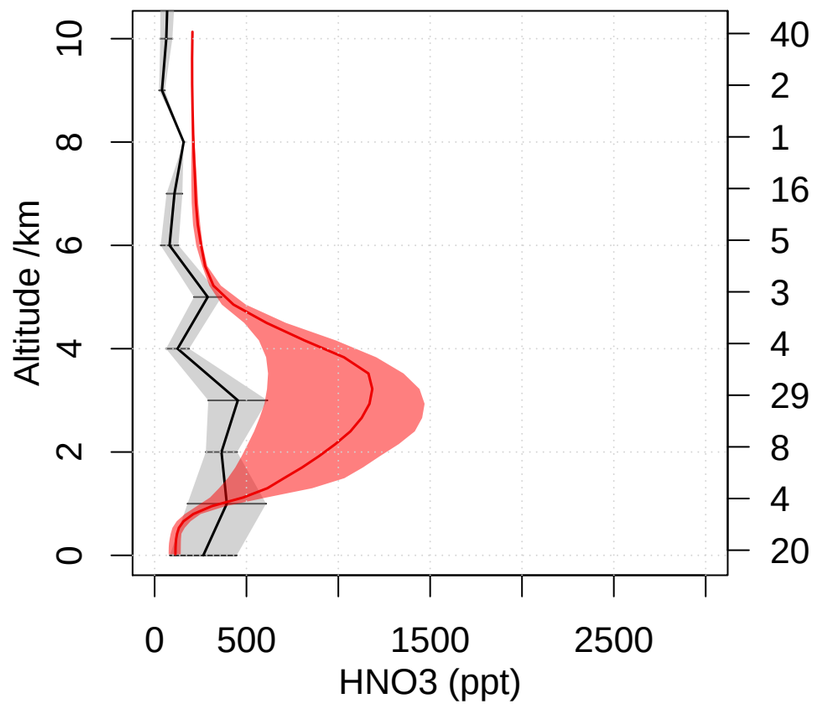


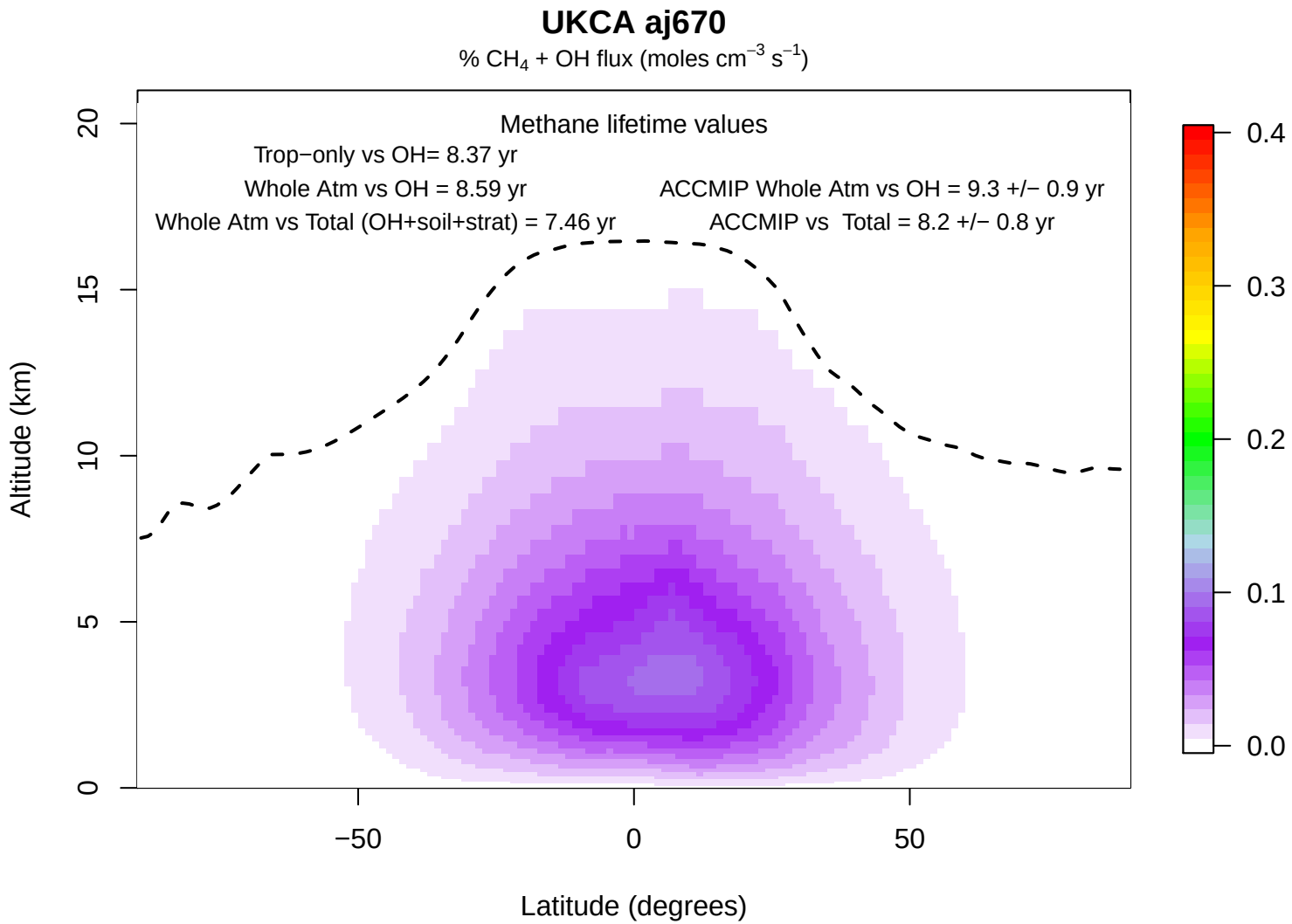




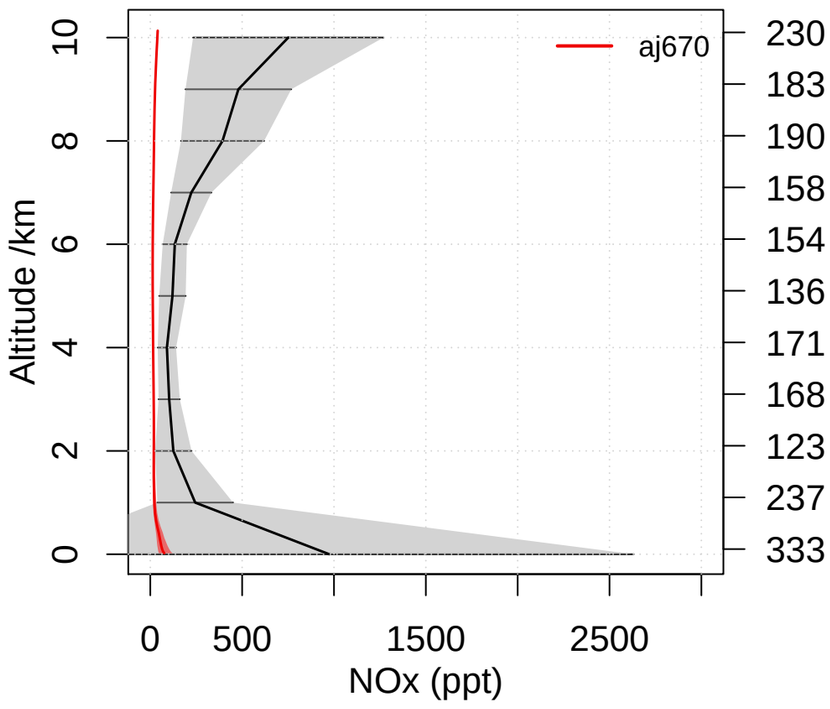


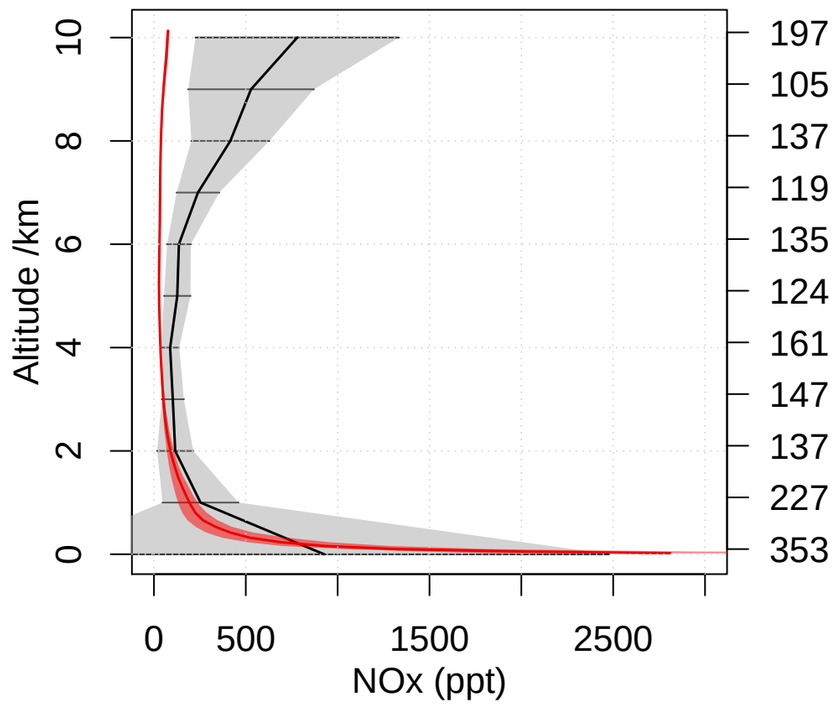


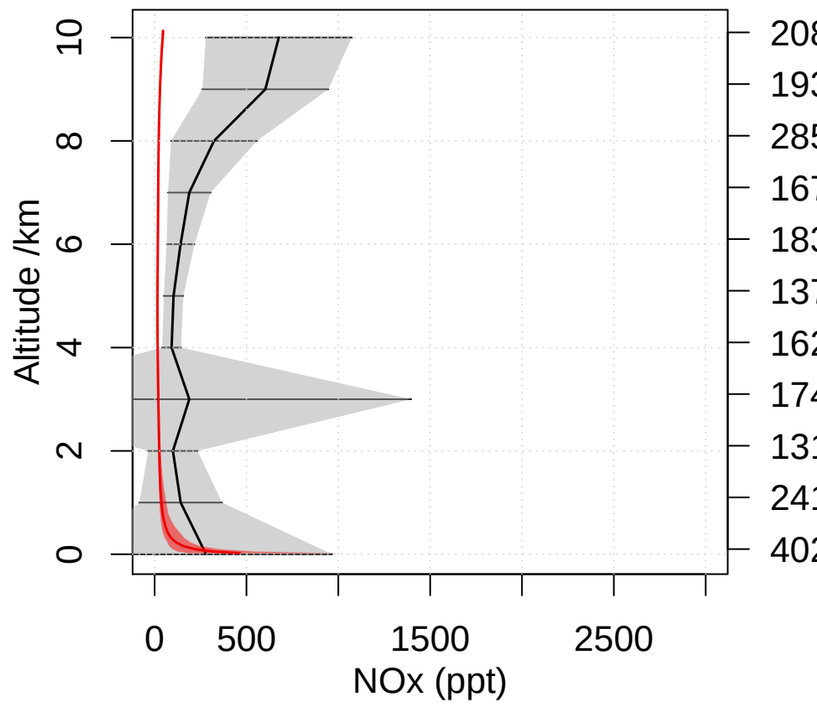


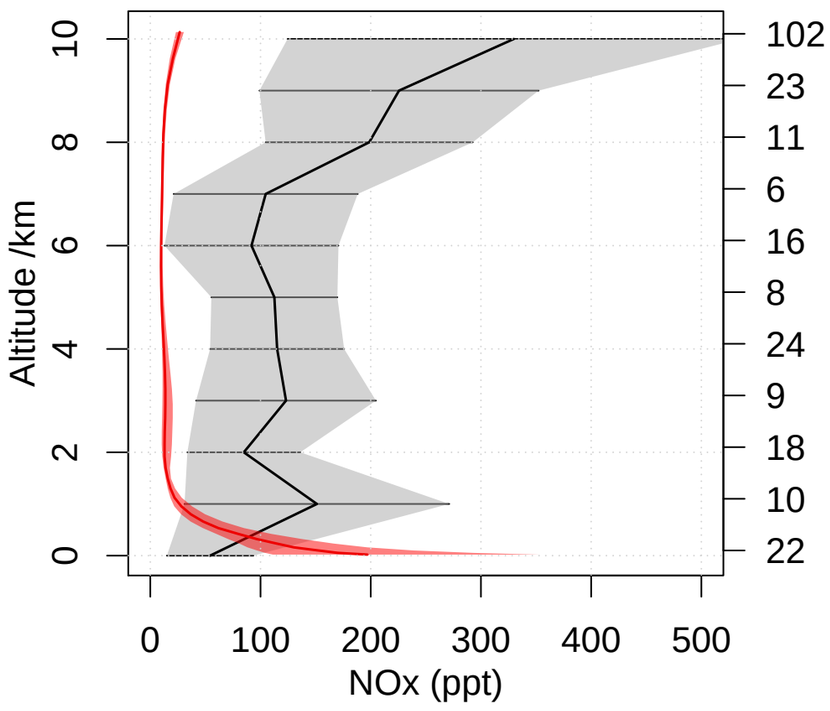

UKCA aj670
% CH4 + OH flux (moles cm−3 s−1)
Methane lifetime values
Trop−only vs OH= 8.37 yr
Whole Atm vs OH = 8.59 yr
Whole Atm vs Total (OH+soil+strat) = 7.46 yr
ACCMIP Whole Atm vs OH = 9.3 +/− 0.9 yr
ACCMIP vs Total = 8.2 +/− 0.8 yr
Altitude (km)
0
5
10
15
20
−50
0
50
Latitude (degrees)
0.0
0.1
0.2
0.3
0.4

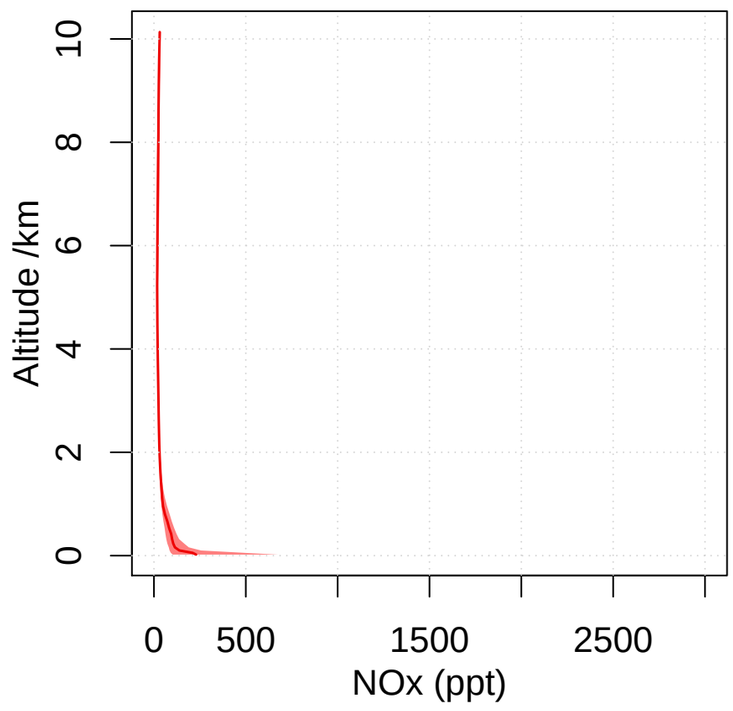
Emmons NOx comparison

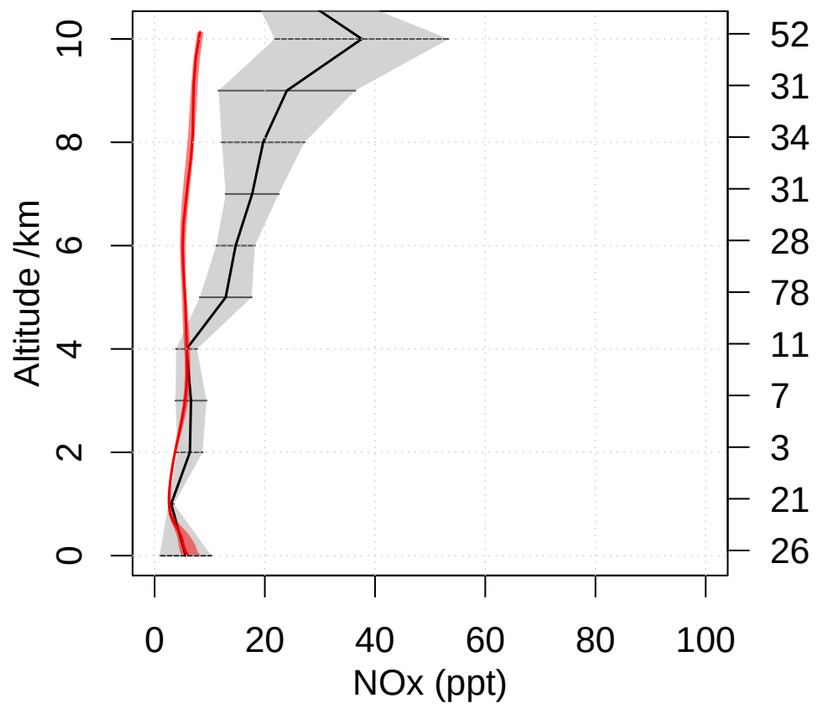


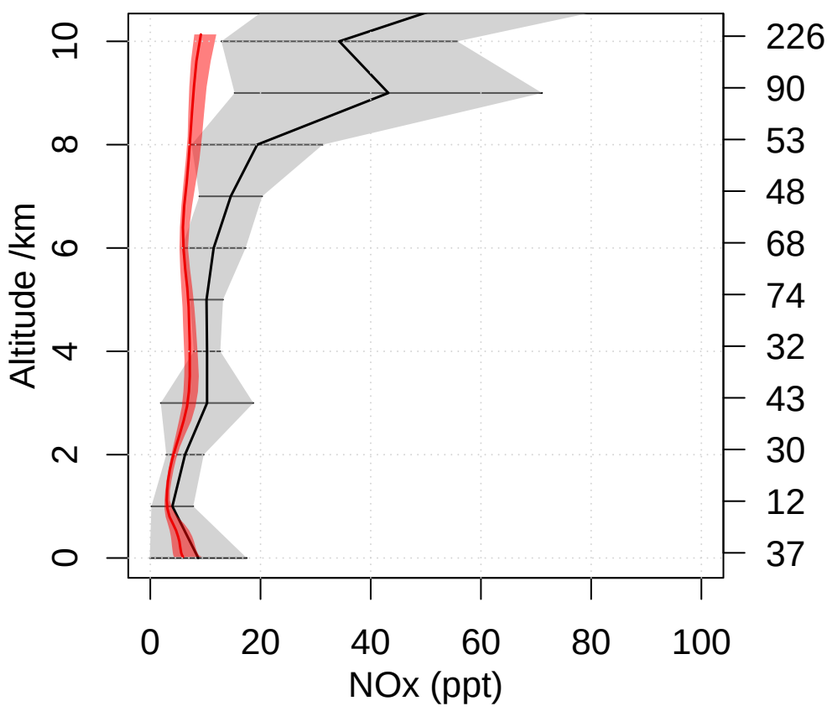


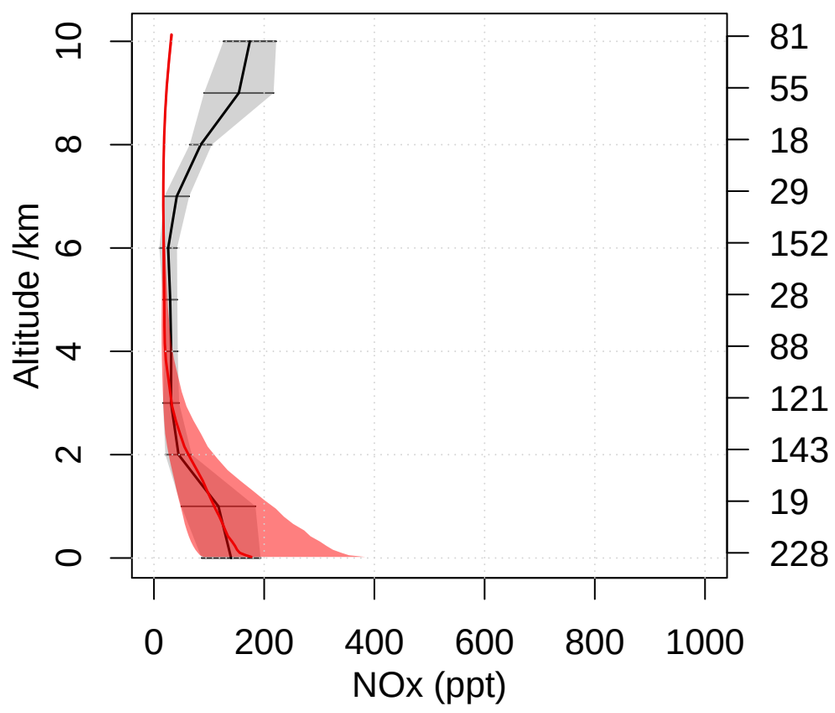


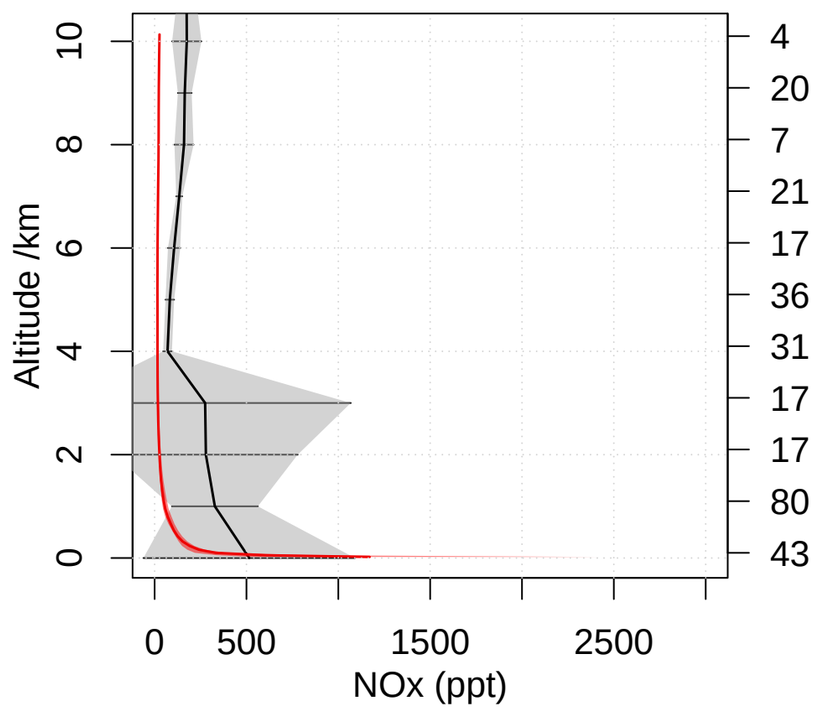


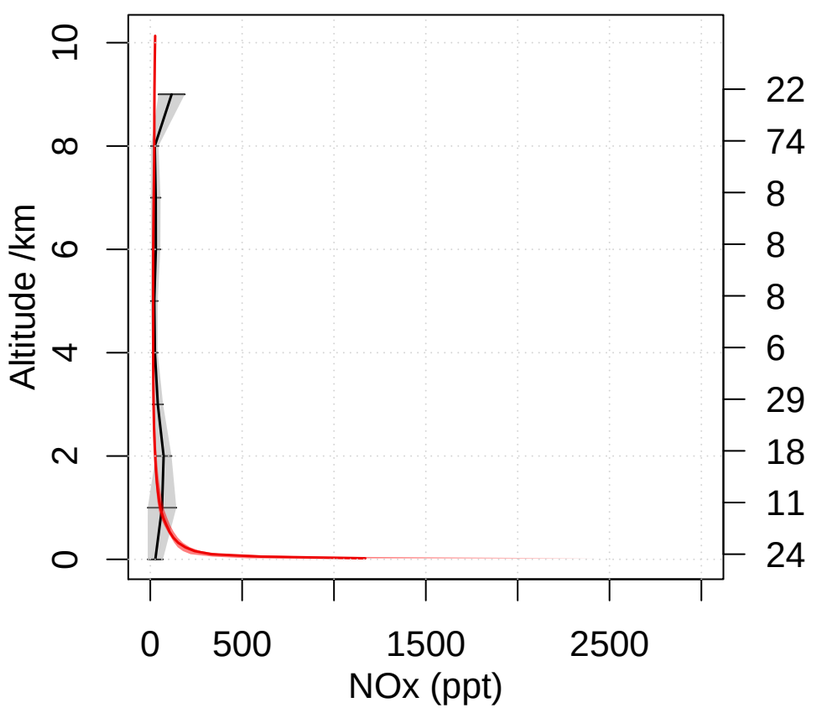


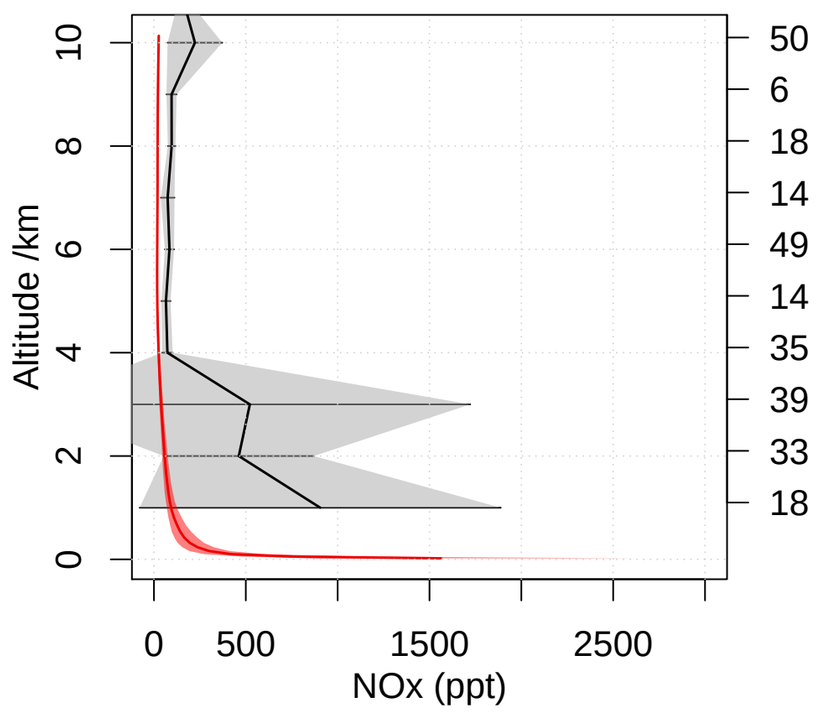


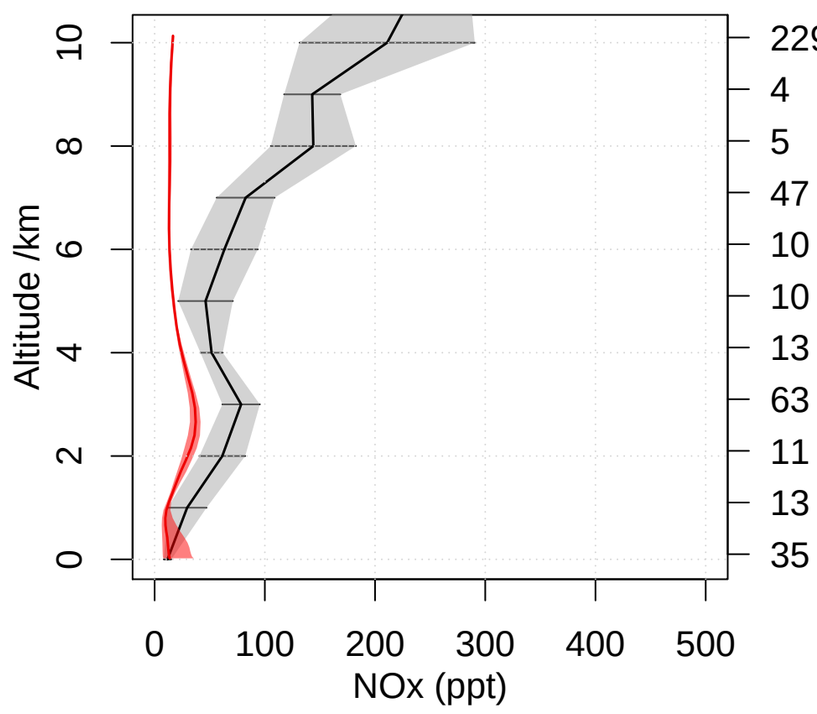


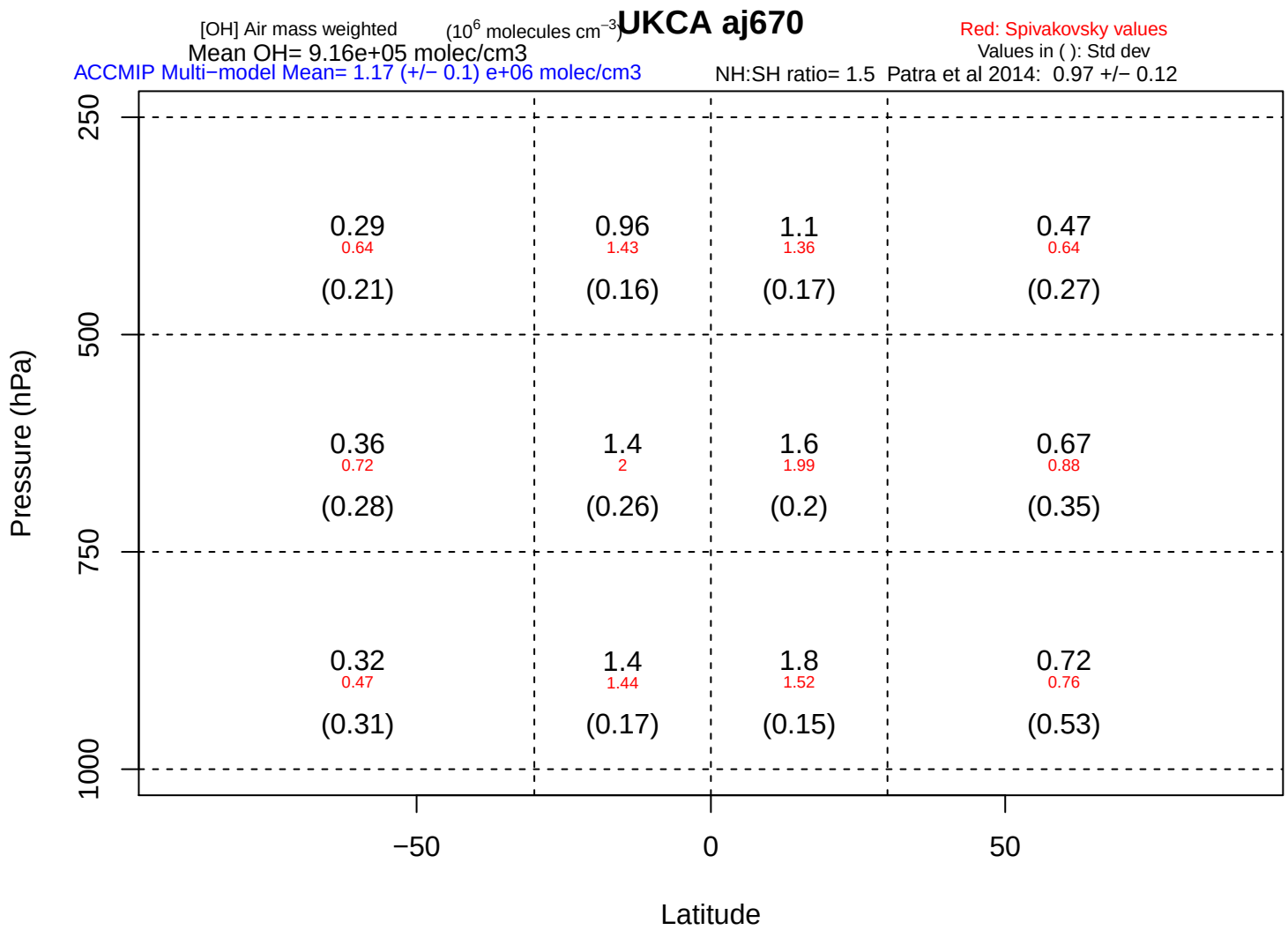











[OH] Air mass weighted
(10^6 molecules cm^{-3})
UKCA aj670
Red: Spivakovsky values
Values in ( ): Std dev
Mean OH= 9.16e+05 molec/cm3
ACCMIP Multi−model Mean= 1.17 (+/− 0.1) e+06 molec/cm3
NH:SH ratio= 1.5 Patra et al 2014: 0.97 +/− 0.12
0.29
0.64
(0.21)
0.96
1.43
(0.16)
1.1
1.36
(0.17)
0.47
0.64
(0.27)
0.36
0.72
(0.28)
1.4
2
(0.26)
1.6
1.99
(0.2)
0.67
0.88
(0.35)
0.32
0.47
(0.31)
1.4
1.44
(0.17)
1.8
1.52
(0.15)
0.72
0.76
(0.53)
Pressure (hPa)
250
500
750
1000
−50
0
50
Latitude