Atmospheric, Oceanic
& Planetary Physics,
University of Oxford

Full Spectral Simulations

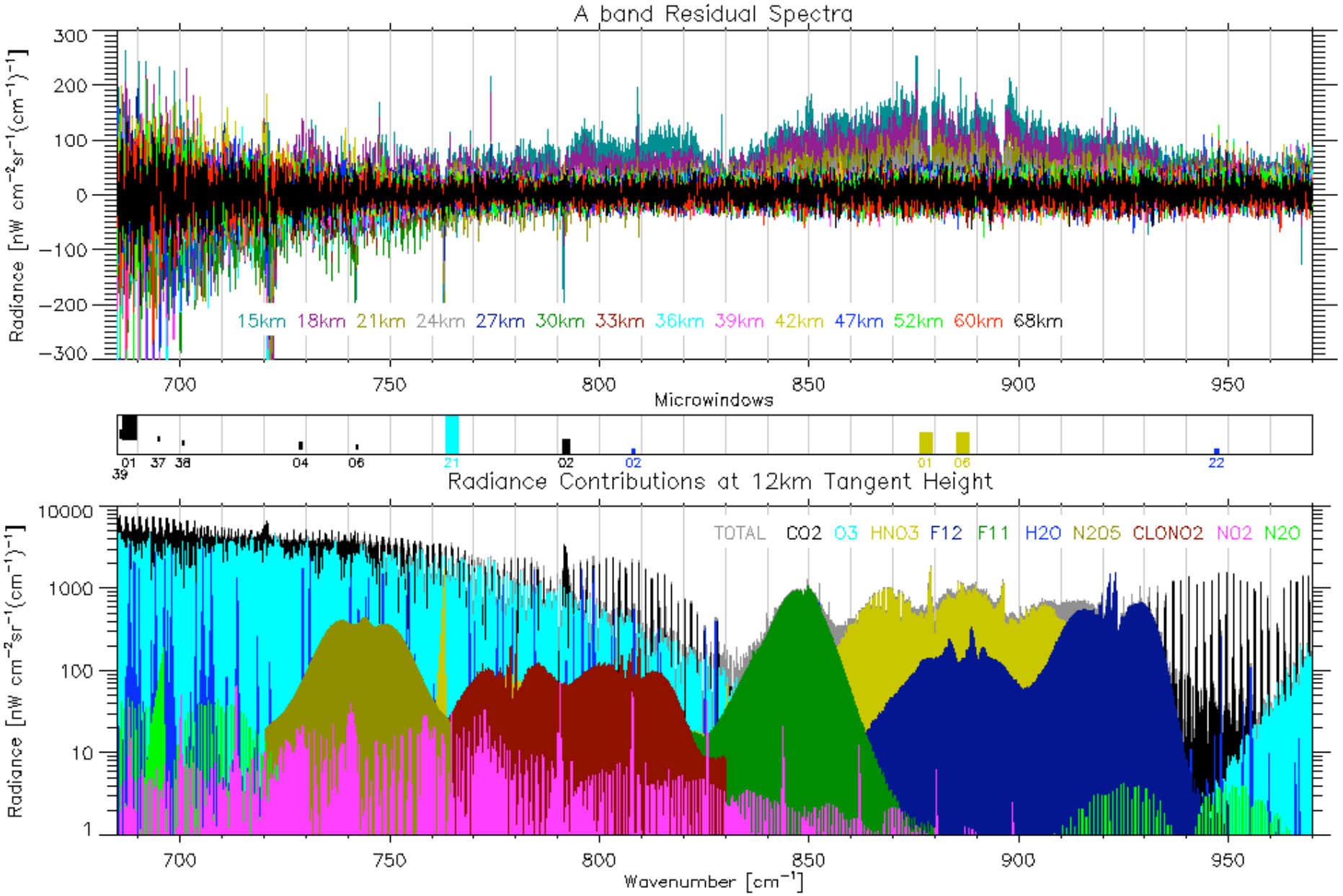
Anu Dudhia

Approach

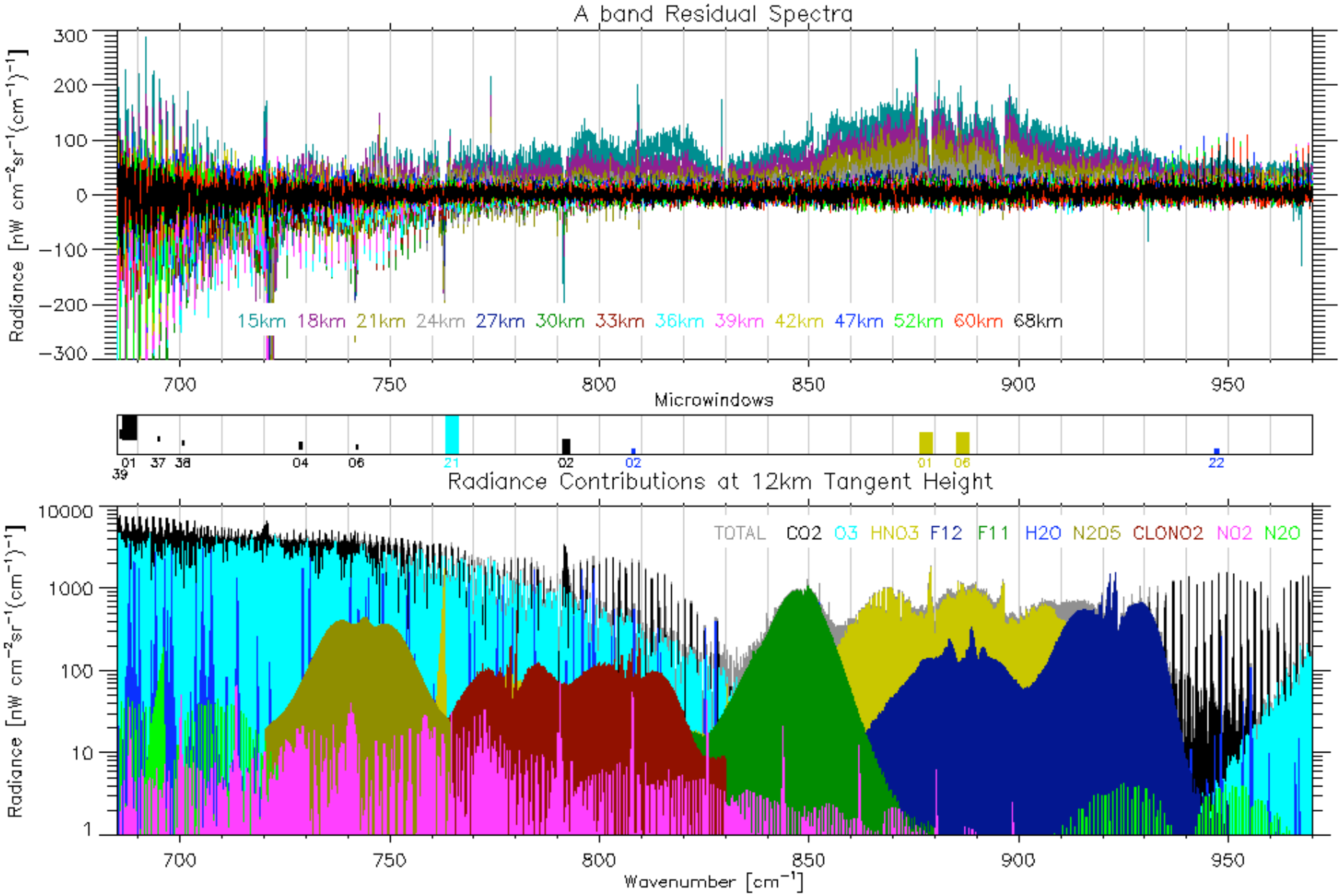
Atmospheric, Oceanic
& Planetary Physics,
University of Oxford

- Use MIPAS OFL L2 profiles plus IG data to define an atmospheric profile
- Run line-by-line model (RFM) to simulate full MIPAS spectra
- Compare with (apodised) L1B spectra (RFM-L1B)
- Aim is to investigate discrepancies *outside* microwindows
- Time consuming! (about 24 hours on an Alpha for one scan)

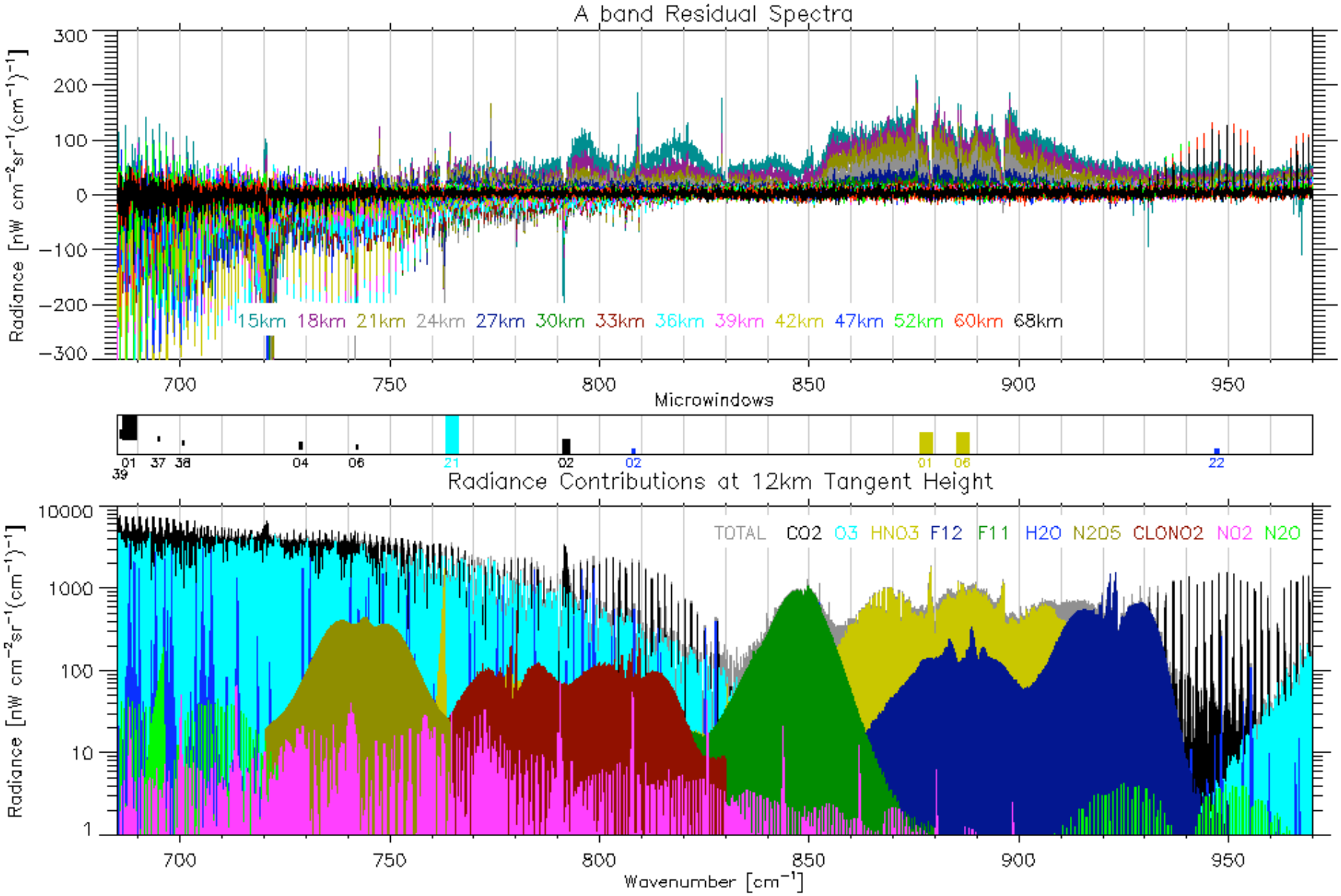
1 Scan


A band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
300
200
100
0
−100
−200
−300
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
700
750
800
850
900
950
Microwindows
01 37 38 39
04
06
21
02
02
01 06
22
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CO2 O3 HNO3 F12 F11 H2O N2O5 CLONO2 NO2 N2O
700
750
800
850
900
950
Wavenumber [cm^{-1}]

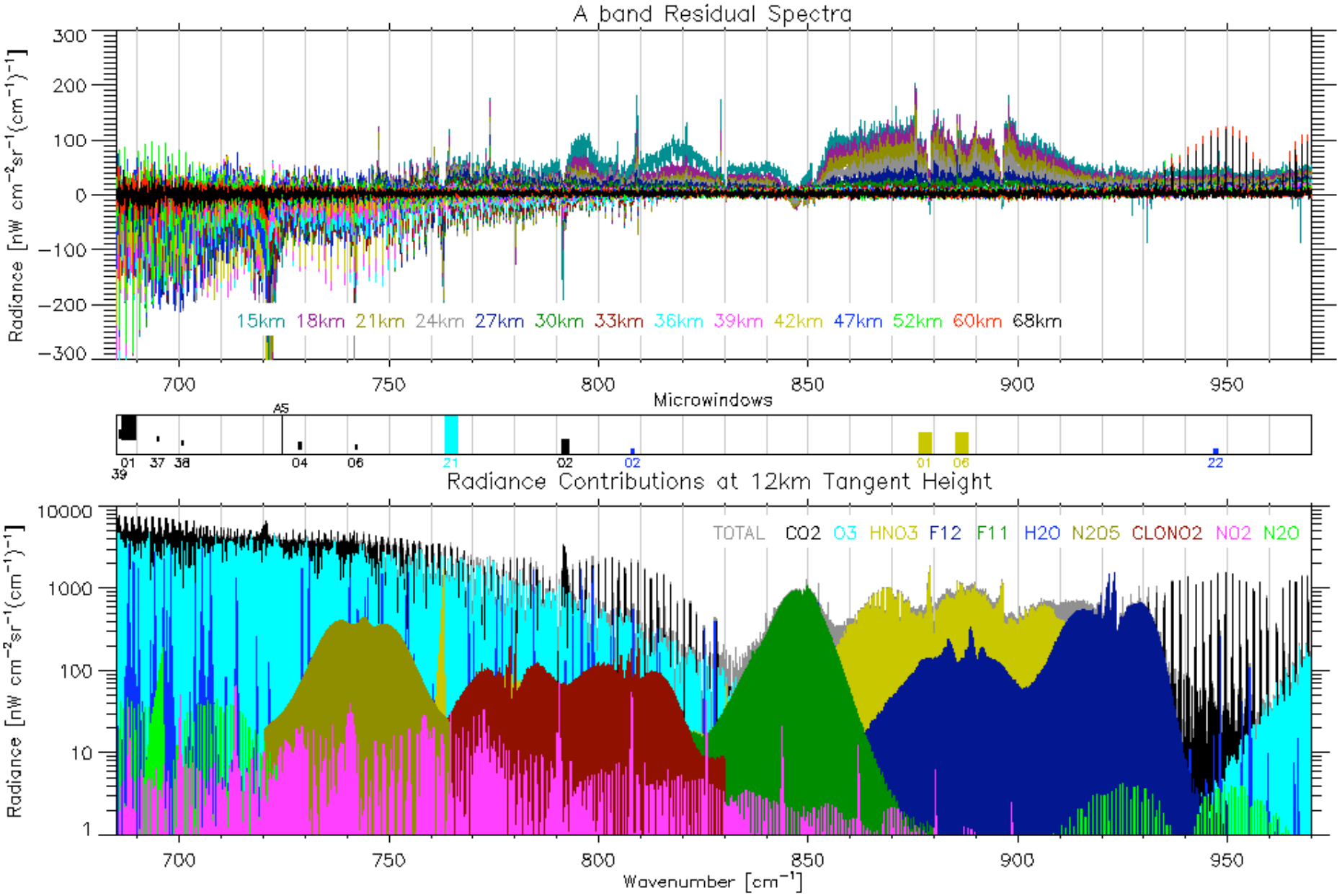
3 Scans

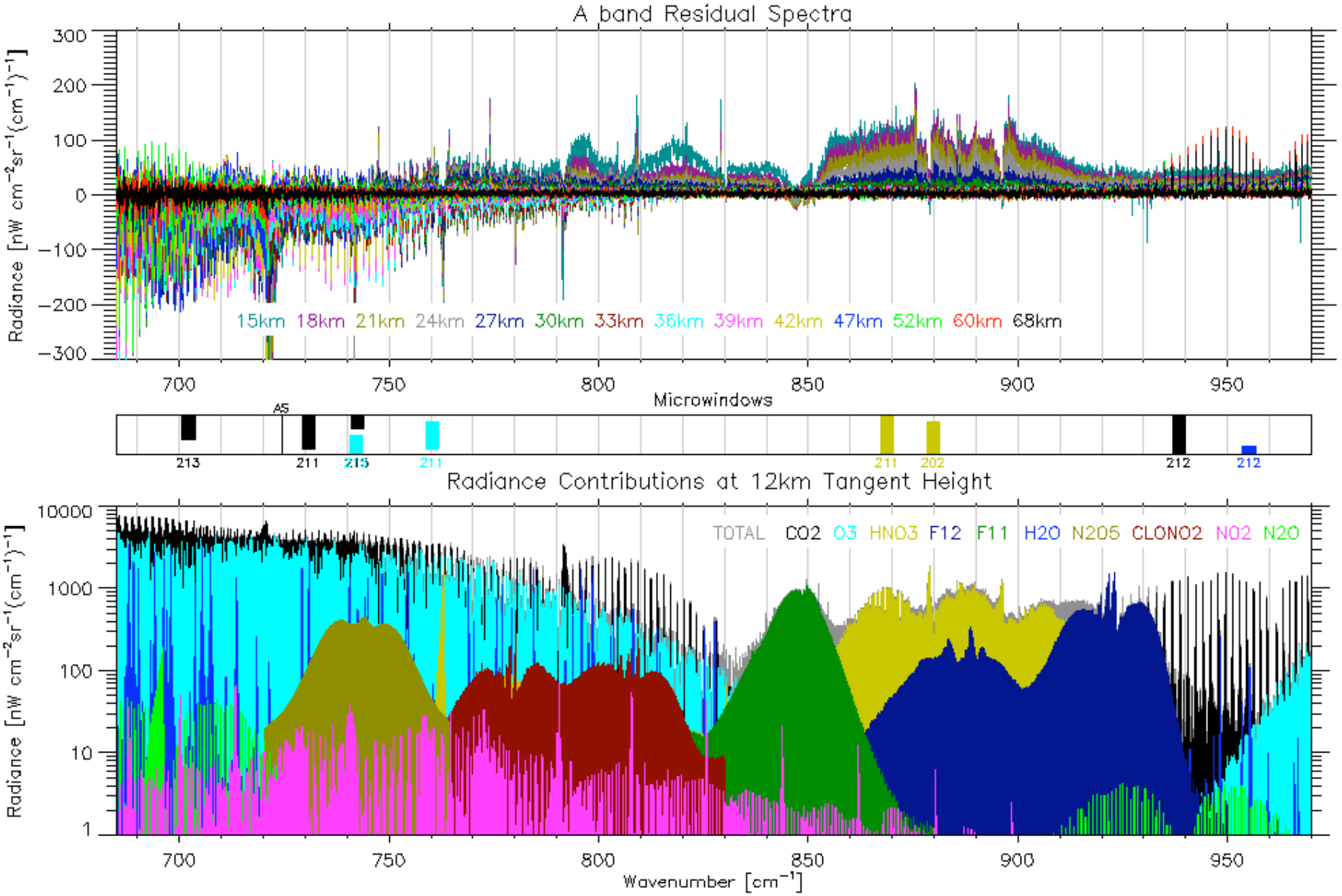

A band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
300
200
100
0
−100
−200
−300
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
700
750
800
850
900
950
Microwindows
01 37 38 39
04
06
21
02
02
01 06
22
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CO2 O3 HNO3 F12 F11 H2O N2O5 CLONO2 NO2 N2O
700
750
800
850
900
950
Wavenumber [cm^{-1}]

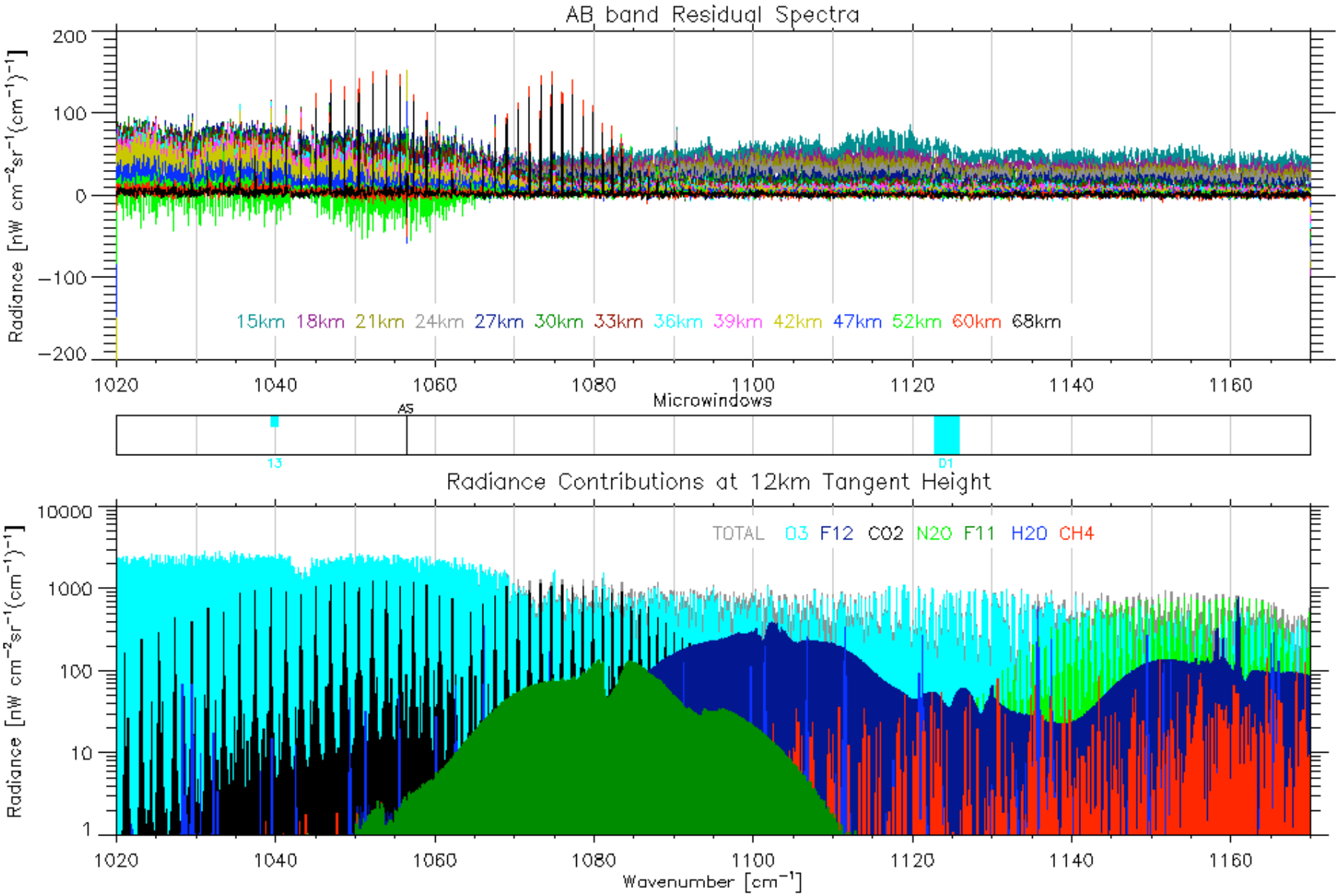
10 Scans

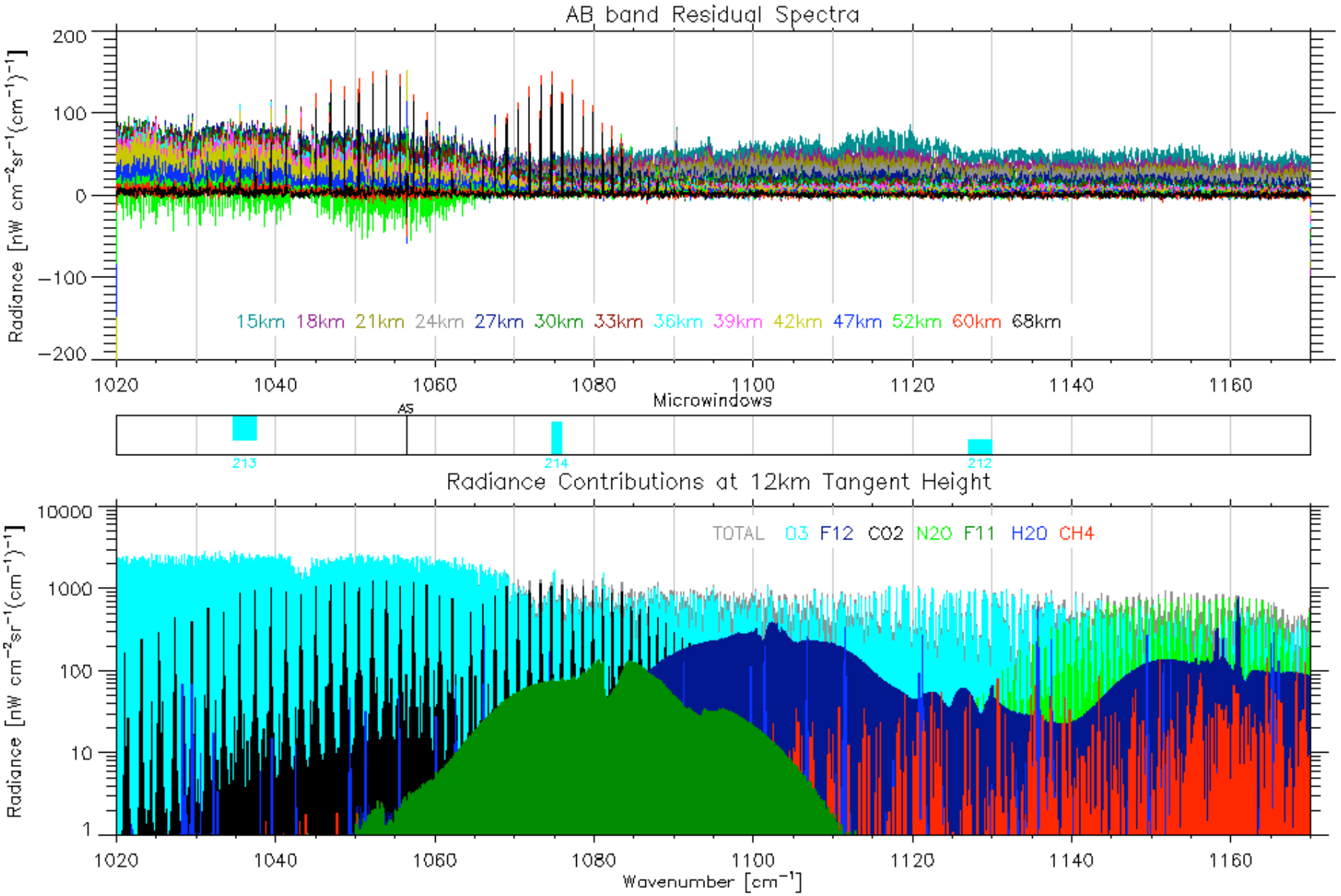

A band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
300
200
100
0
−100
−200
−300
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
700
750
800
850
900
950
Microwindows
01 37 38 39
04
06
21
02
02
01 06
22
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CO2 O3 HNO3 F12 F11 H2O N2O5 CLONO2 NO2 N2O
700
750
800
850
900
950
Wavenumber [cm^{-1}]

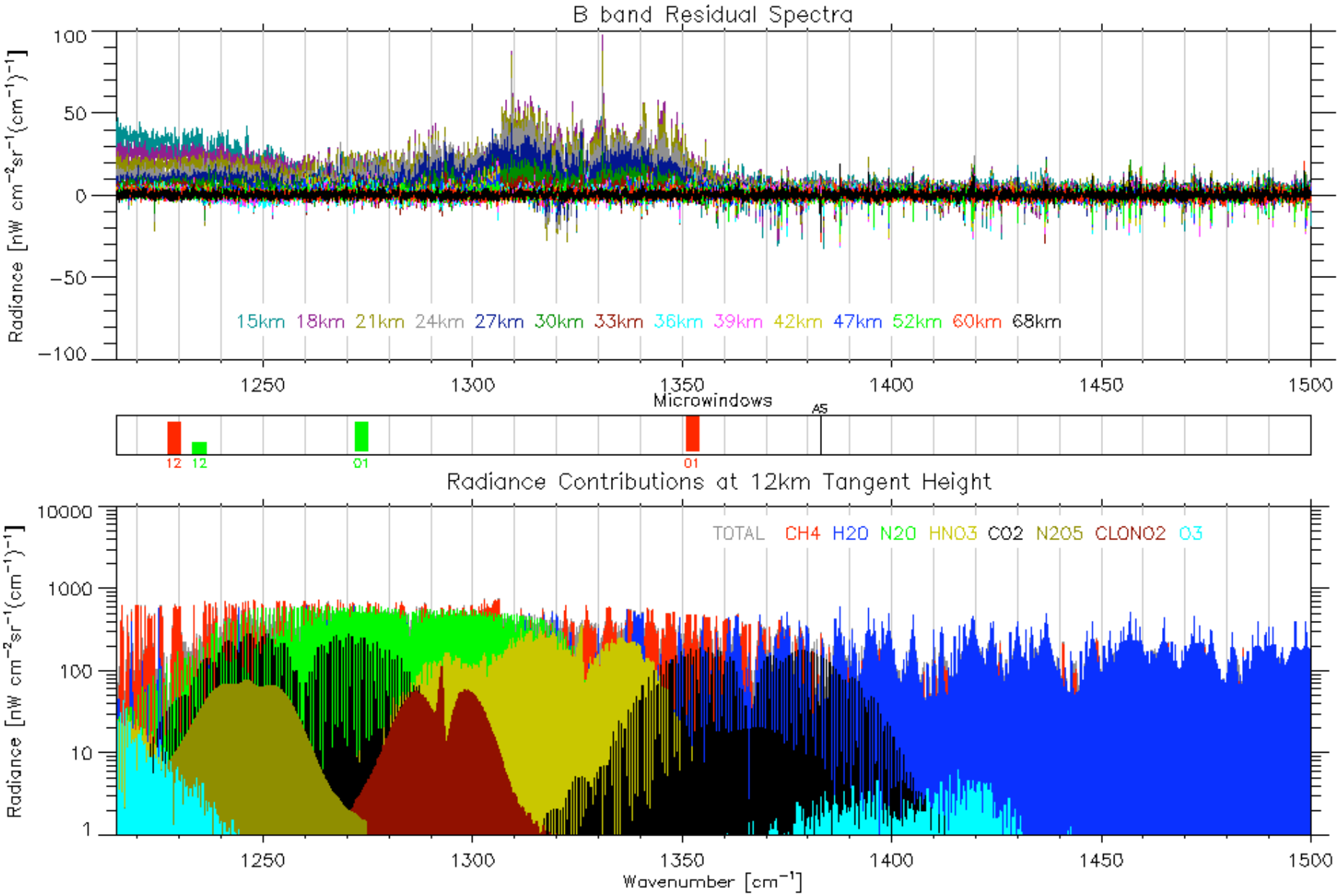
20 Scans

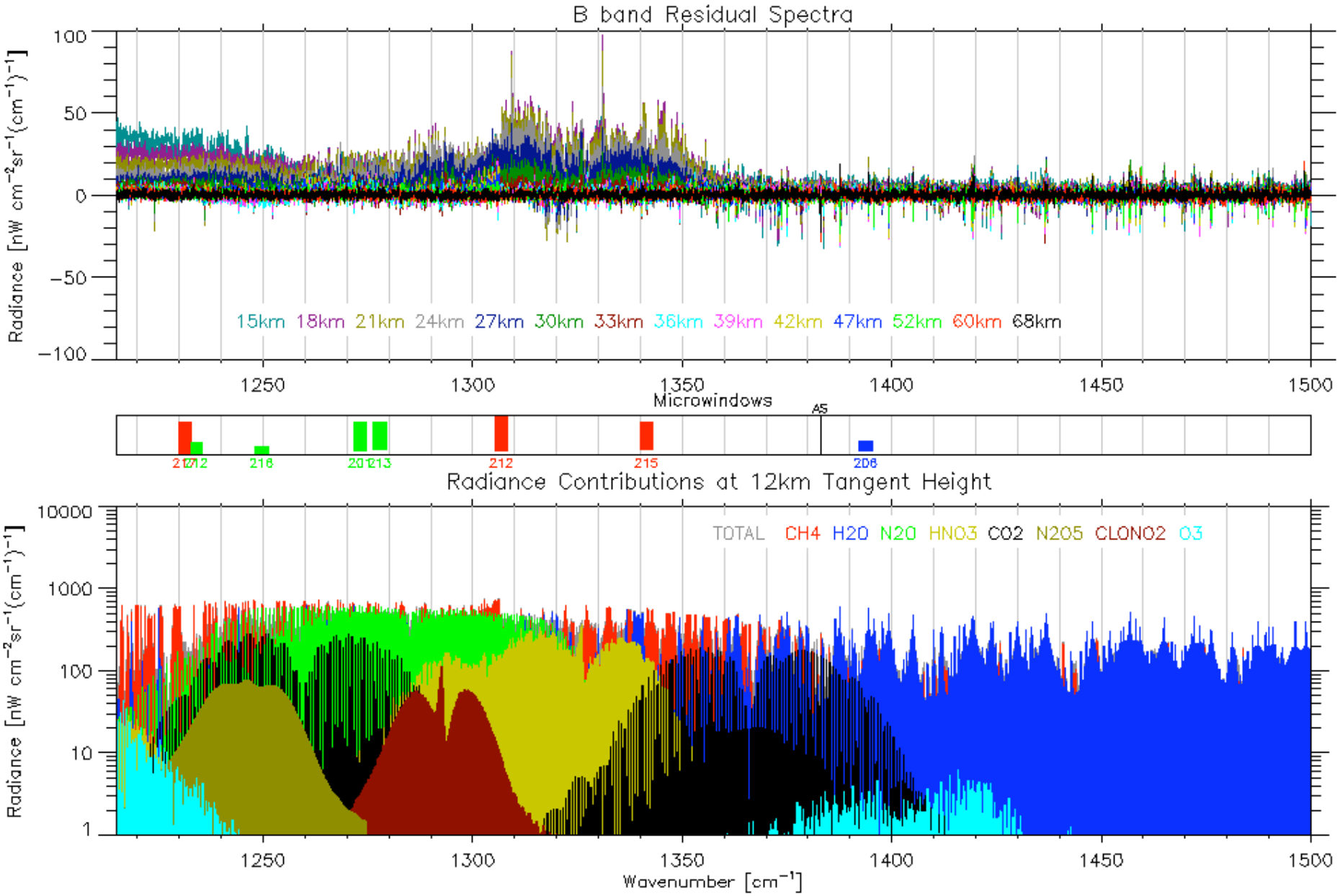

A band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
300
200
100
0
−100
−200
−300
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
700
750
800
850
900
950
Microwindows
AS
01 37 38 39
04
06
21
02
02
01 06
22
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CO2 O3 HNO3 F12 F11 H2O N2O5 CLONO2 NO2 N2O
700
750
800
850
900
950
Wavenumber [cm^{-1}]

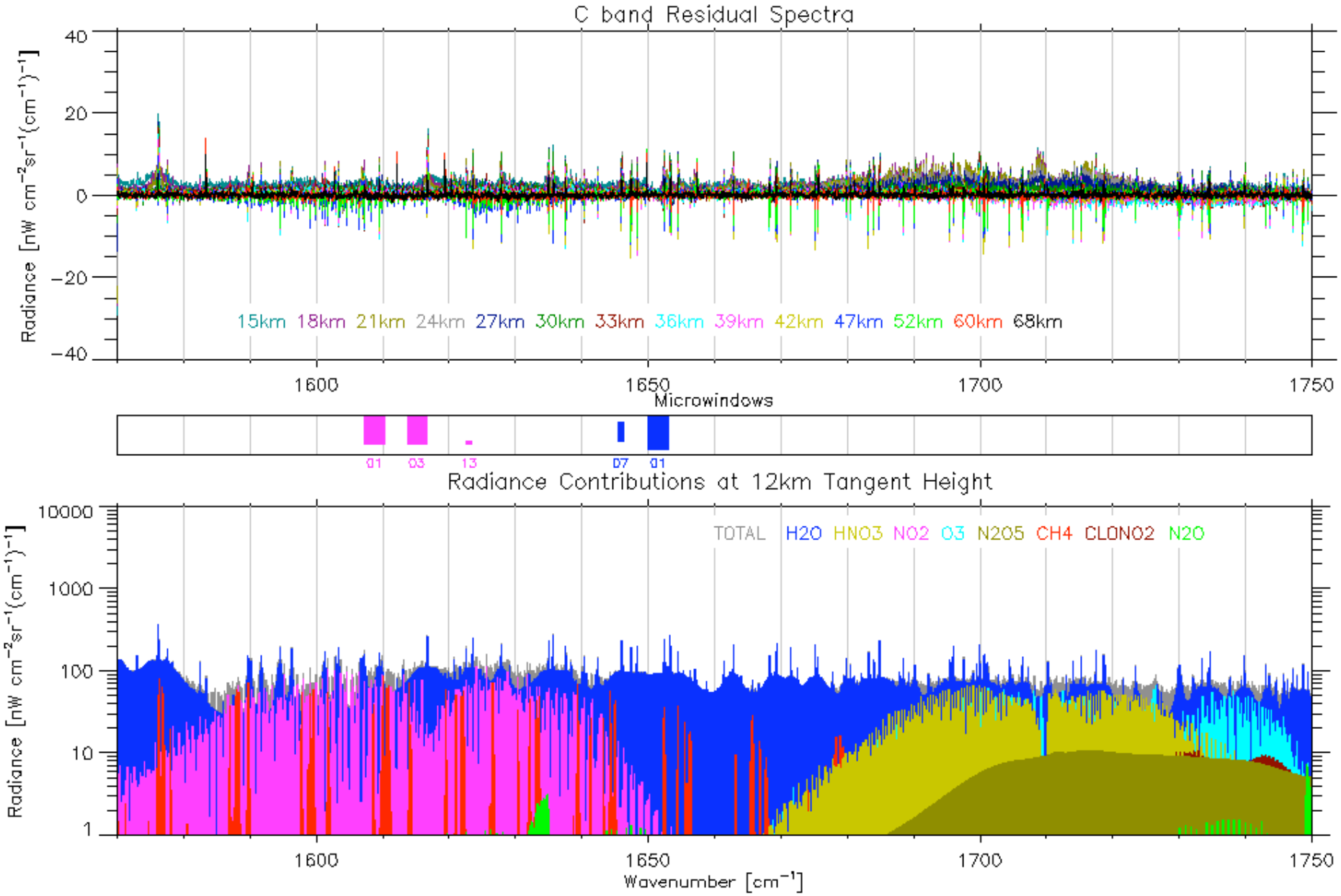

A band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
300
200
100
0
−100
−200
−300
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
700
750
800
850
900
950
Microwindows
AS
213
211
215
211
211
202
212
212
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CO2 O3 HNO3 F12 F11 H2O N2O5 CLONO2 NO2 N2O
700
750
800
850
900
950
Wavenumber [cm^{-1}]

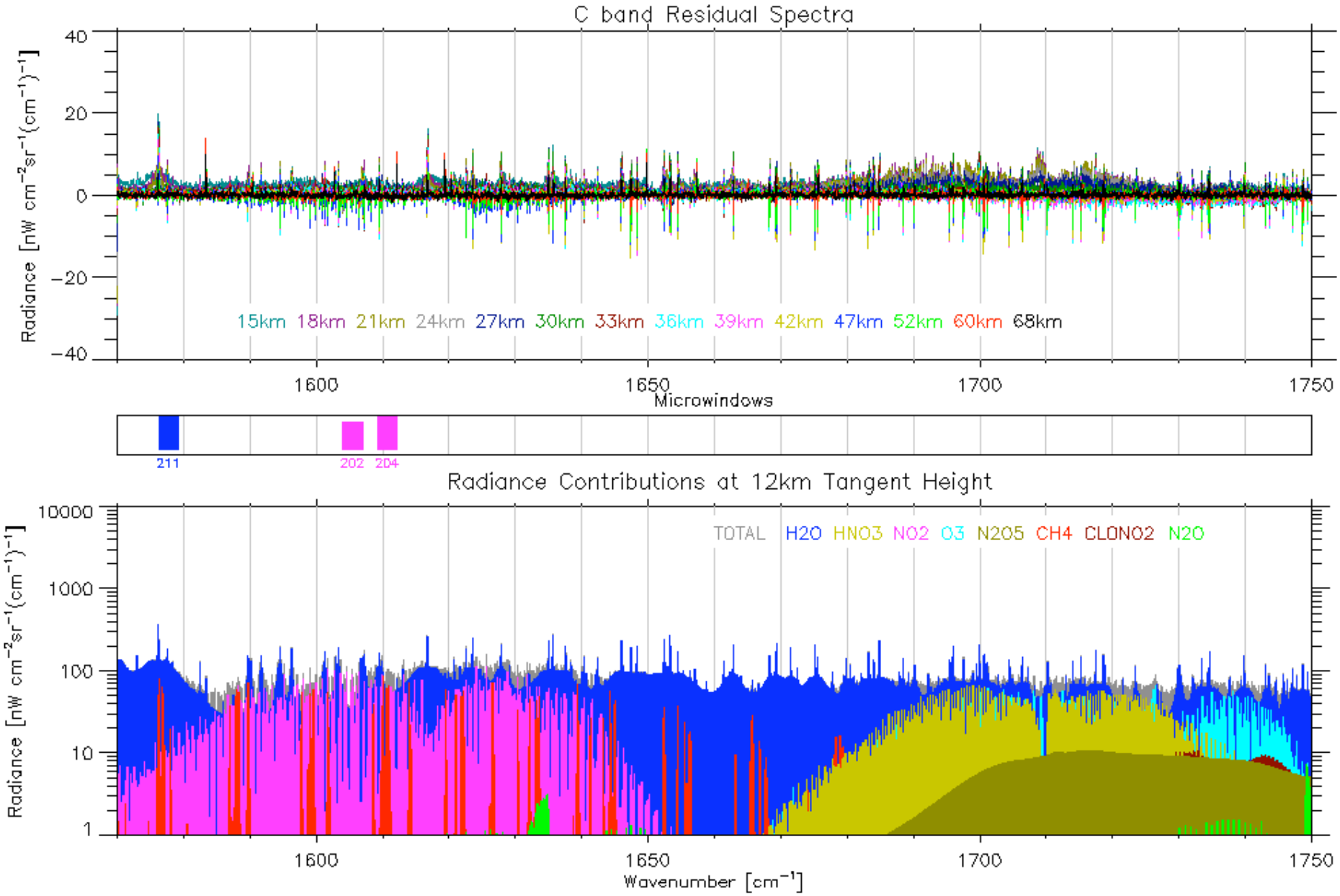

AB band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
200
100
0
−100
−200
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
1020
1040
1060
1080
1100
1120
1140
1160
Microwindows
AS
13
D1
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL O3 F12 CO2 N2O F11 H2O CH4
Wavenumber [cm^{-1}]

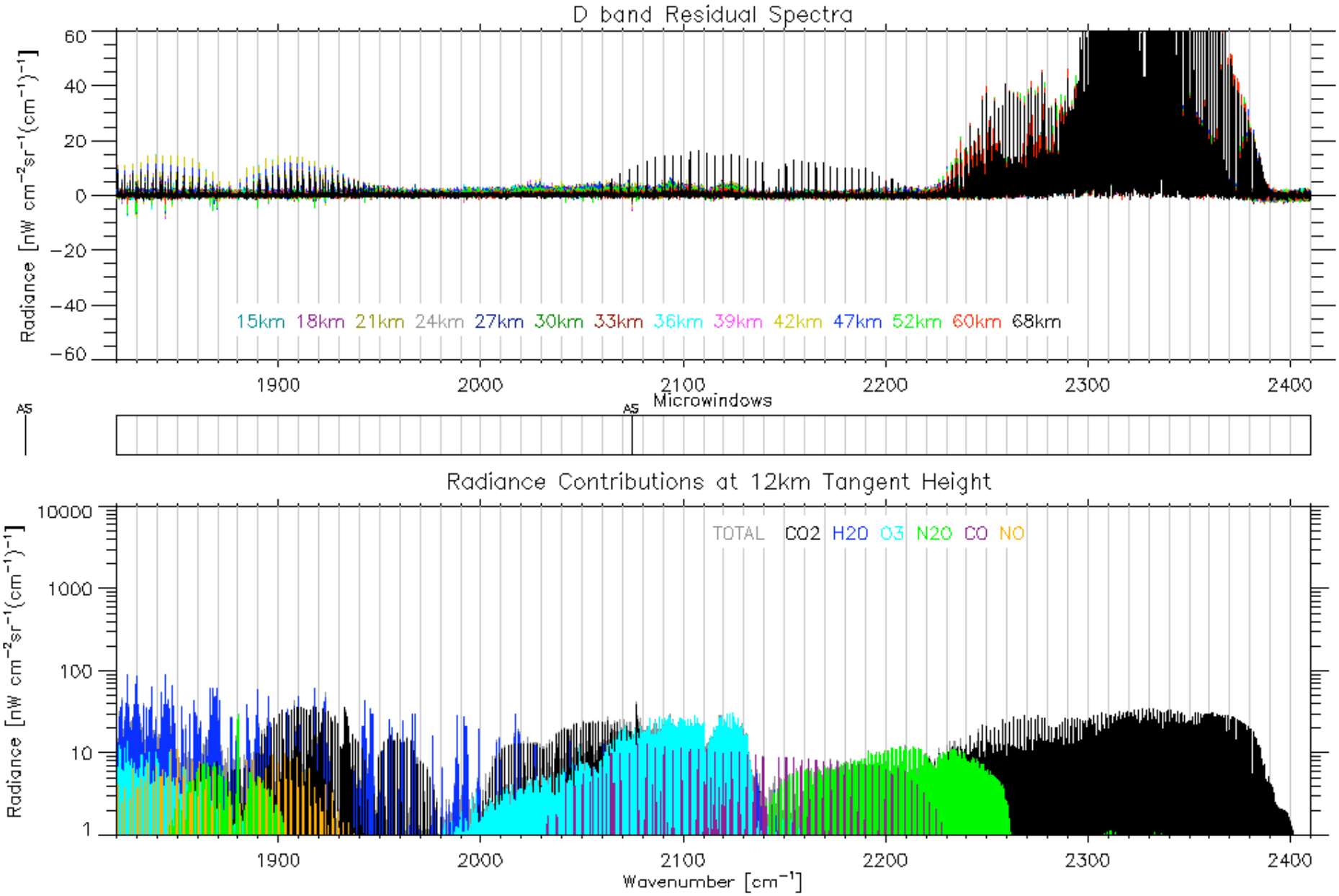

AB band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
200
100
0
−100
−200
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
1020
1040
1060
1080
1100
1120
1140
1160
Microwindows
AS
213
214
212
Radiance Contributions at 12km Tangent Height
TOTAL O3 F12 CO2 N2O F11 H2O CH4
10000
1000
100
10
1
Wavenumber [cm^{-1}]


B band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
100
50
0
−50
−100
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
1250
1300
1350
1400
1450
1500
Microwindows
A5
12 12
01
01
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CH4 H20 N20 HNO3 CO2 N2O5 CLONO2 O3
1250
1300
1350
1400
1450
1500
Wavenumber [cm^{-1}]


B band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
100
50
0
−50
−100
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
1250
1300
1350
1400
1450
1500
Microwindows
A5
2D12
2I6
2D13
2I2
2I5
2D6
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CH4 H2O N2O HNO3 CO2 N2O5 CLONO2 O3
1250
1300
1350
1400
1450
1500
Wavenumber [cm^{-1}]


C band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
40
20
0
−20
−40
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
1600
1650
1700
1750
Microwindows
01 03 13 07 01
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL H2O HNO3 NO2 O3 N2O5 CH4 CLONO2 N2O
1600
1650
1700
1750
Wavenumber [cm^{-1}]


C band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
40
20
0
−20
−40
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
1600
1650
1700
1750
Microwindows
211
202 204
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL H2O HNO3 NO2 O3 N2O5 CH4 CLONO2 N2O
1600
1650
1700
1750
Wavenumber [cm^{-1}]


D band Residual Spectra
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
60
40
20
0
−20
−40
−60
15km 18km 21km 24km 27km 30km 33km 36km 39km 42km 47km 52km 60km 68km
1900
2000
2100
2200
2300
2400
AS
Microwindows
AS
Radiance Contributions at 12km Tangent Height
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000
1000
100
10
1
TOTAL CO2 H2O O3 N2O CO NO
1900
2000
2100
2200
2300
2400
Wavenumber [cm^{-1}]

Future Work

Atmospheric, Oceanic
& Planetary Physics,
University of Oxford

- Complete simulations for full orbit
- Separate residuals by day/ngt and latitude
- Run REC analysis
- Repeat for ~1 orbit per month (or 1 day/month?)