NASA
Reference
Publication
1188

September 1987

Atlas of Absorption Lines From 0 to 17900 cm^{-1}

J. H. Park,
L. S. Rothman,
C. P. Rinsland,
H. M. Pickett,
D. J. Richardson,
and J. S. Namkung

(NASA-RP-1188) ATLAS OF ABSORPTION LINES FROM 0 TO 17900 cm (SUP)-1 (NASA) 197 p Avail: NTIS HC A09/MF A01 CSCL 04A
N87-28955
Unclas
H1/43 0098763

NASA

NASA
Reference
Publication
1188

1987

Atlas of Absorption Lines From 0 to 17900 cm^{-1}

J. H. Park
Langley Research Center
Hampton, Virginia

L. S. Rothman
Air Force Geophysics Laboratory
Hanscom Air Force Base, Massachusetts

C. P. Rinsland
Langley Research Center
Hampton, Virginia

H. M. Pickett
Jet Propulsion Laboratory
Pasadena, California

D. J. Richardson
and J. S. Namkung
ST Systems Corporation (STX)
Hampton, Virginia

National Aeronautics
and Space Administration

Scientific and Technical
Information Office

Description of the Atlas

This atlas is a pictorial representation of atmospheric absorption line parameters contained in the 1986 Air Force Geophysics Laboratory high-resolution transmission molecular absorption data base (HITRAN) compilation currently available on magnetic tape (Rothman et al. 1987). It is a revised edition of the atlas previously published by Park et al. (1981), which had been based on an earlier version of the compilation (Rothman et al. 1981a and 1981b). This earlier publication has become very useful as a quick reference for researchers in the fields of molecular spectroscopy and atmospheric remote sensing. Since a new, extensively revised version of the HITRAN line parameters compilation has recently been released, the authors felt that a new edition of the atlas was necessary.

In the atlas are presented plots of the logarithm (base 10) of absorption line strength (S converted from the HITRAN units of $cm^{-1}/(molecule\ cm^{-2})$ at 296 K to $atm^{-1}cm^{-2}$ at 296 K) versus wavenumber (in cm^{-1}) for atmospheric gases. The atlas covers the spectral range of the HITRAN compilation (0 to 17 900 cm^{-1}). Line parameters for all gases are taken from the 1986 version of the HITRAN compilation with additional data shown separately for $O(^3P)$, isotropic O_3 (668, 686, 667, and 676), and HO_2 from the 1984 JPL compilation in the spectral region 0 to 200 cm^{-1} (Poynter and Pickett 1985). Solar CO lines at 4500 K, calculated by C. P. Rinsland, are also shown for the fundamental and first overtone sequences (Park et al. 1981). As in the HITRAN compilation, intensities of all bands are scaled according to the terrestrial abundance of each isotopic species. Approximate infrared absorption cross sections (converted from the HITRAN units of cm^2/molecule to $atm^{-1}cm^{-1}$) of 11 heavy atmospheric molecules (base 10 logarithm) in the 700- to 1800-cm^{-1} region are plotted beneath the other data. These values were determined at equally spaced wavenumber intervals from room-temperature laboratory spectra (Massie et al. 1985) and are included as a separate file in the 1986 HITRAN database.

Figures 1 and 2 summarize the parameters on a compressed wavenumber scale. Figure 1 lists the molecules and shows the regions of spectral data coverage for each between 0 and 10 000 cm^{-1}. Figure 2 shows the absorption cross sections σ as continuous curves on a base 10 logarithm versus wavenumber scale for the 700- to 1800-cm^{-1} region. Figure 3 presents plots of the logarithm (base 10) of absorption line strength of the AFGL gases versus wavenumber for every 1000 cm^{-1} up to 5000 cm^{-1} with the strength scale the same on all plots for each gas. This provides a view of the band structures and their relative strengths. Above 10 000 cm^{-1}, only H_2O occurs in the atlas except for O_2 from 11 400 to 11 700 cm^{-1}, 12 800 to 13 200 cm^{-1}, 14 300 to 14 600 cm^{-1}, and 15 700 to 16 000 cm^{-1}.

On each page of the atlas, the plots of log (S) versus wavenumber for all gases having absorption lines in the same 10 cm^{-1} interval for the 0- to 200-cm^{-1} region, 50 cm^{-1} interval for the 200- to 6000-cm^{-1} region, and 100-cm^{-1} interval for the 6000- to 17 900-cm^{-1} region are presented in order of the integer gas codes given in figure 1. For the major gases (H_2O, CO_2, O_3, N_2O, CO, CH_4, and O_2), all lines having strengths within 10^{-6} of the maximum value for that interval are shown; and for the trace gases, all lines having strengths within 10^{-4} of the maximum are included. Because the maximum and minimum line strengths are redetermined for each interval, sudden changes may appear in the line strength scale from one plot to another, and some weak lines on the HITRAN compilation are not plotted in this atlas. Isolated weak bands may also appear, at first glance, to be much stronger than expected. For the 0- to 200-cm^{-1} region, some intervals are repeated on two pages because of the large number of gases which appear in the interval; in such cases, H_2O lines are repeated at the top to be used as reference. In other regions where the number of gases appearing in an interval is small, two or three consecutive intervals are presented on the same page. For the heavy molecule cross-section data, the strength scale for each molecule is normalized to the same value, so that the scale for each of these molecules is the same on all frames. Only cross sections within 10^{-2} of the maximum value are included in the atlas.

NASA Langley Research Center
Hampton, VA 23665–5225
July 17, 1987

References

Massie, Steven T.; Goldman, A.; Murcray, David G.; and Gille, John C. 1985: Approximate Absorption Cross Sections of F12, F11, $ClONO_2$, N_2O_5, HNO_3, CCl4, CF4, F21, F113, F114, and HNO_4. *Appl. Opt.*, vol. 24, no. 21, Nov. 1, pp. 3426–3429.

Park, Jae H.; Rothman, L. S.; Rinsland, C. P.; Smith, M. A. H.; Richardson, D. J.; and Larsen, J. C. 1981: *Atlas of Absorption Lines From 0 to 17 900 cm^{-1}*. NASA RP-1084.

Poynter, Robert L.; and Pickett, Herbert M. 1985: Submillimeter, Millimeter, and Microwave Spectral Line Catalog. *Appl. Opt.,* vol. 24, no. 14, July 15, pp. 2235–2240.

Rothman, L. S. 1981a: AFGL Atmospheric Absorption Line Parameters Compilation: 1980 Version. *Appl. Opt.,* vol. 20, no. 5, Mar. 1, 1981, pp. 791–795.

Rothman, L. S.; Goldman, A.; Gillis, J. R.; Tipping, R. H.; Brown, L. R.; Margolis, J. S.; Maki, A. G.; and Young, L. D. G. 1981b: AFGL Trace Gas Compilation: 1980 Version. *Appl. Opt.,* vol. 20, no. 8, Apr. 15, pp. 1323–1328.

Rothman, L. S.; Gamache, R. R.; Goldman, A.; Brown, L. R.; Toth, R. A.; Pickett, H. M.; Poynter, R.; Flaud, J.-M.; Camy-Peyret, C.; Barbe, A.; Husson, N.; Rinsland, C. P.; and Smith, M. A. H. 1987: The HITRAN Database: 1986 Edition. *Appl. Opt.,* vol. 26, no. 19, Oct. 1.

PAGE _____ INTENTIONALLY BLANK

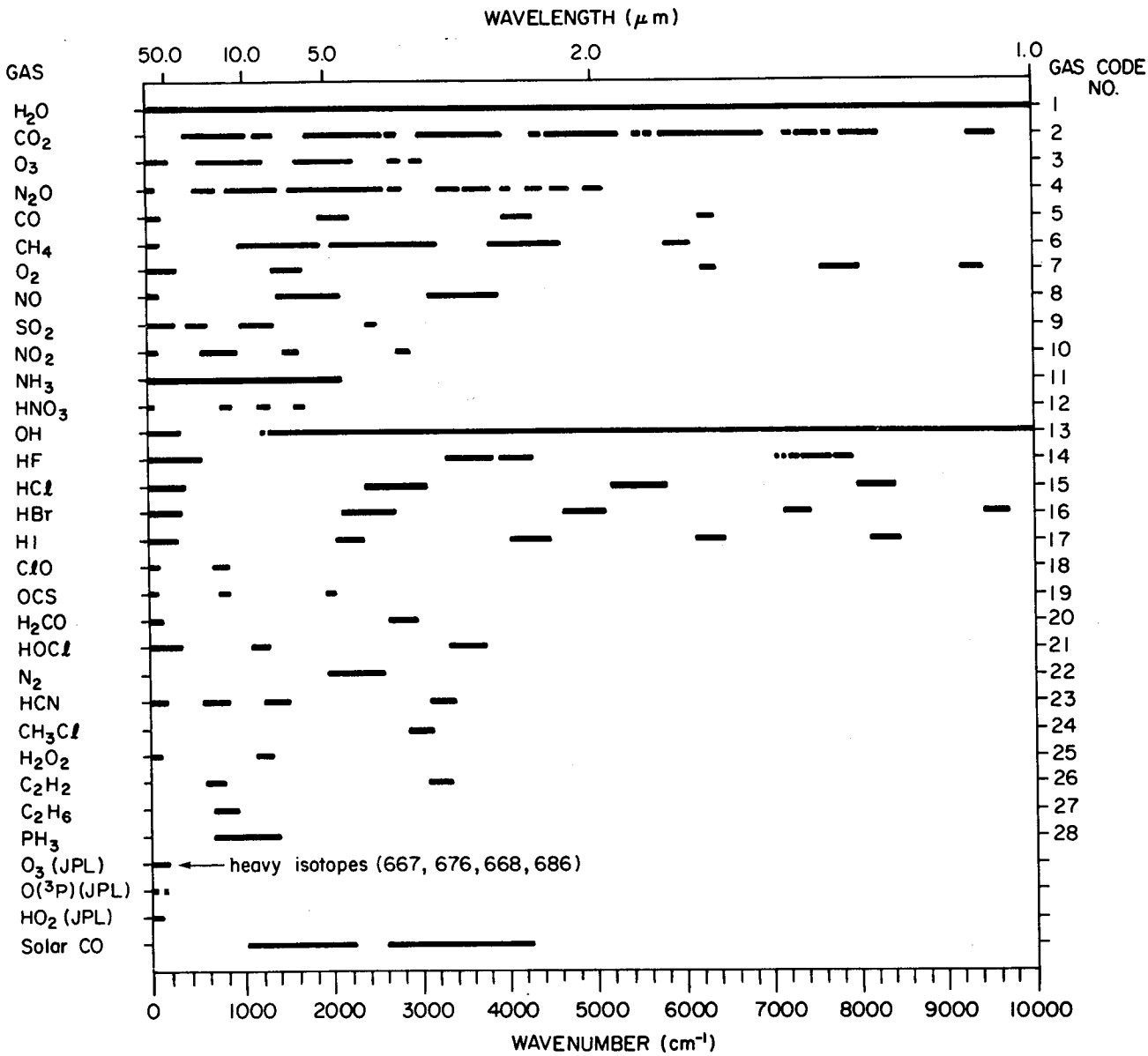


Figure 1. Spectral data coverage for each molecule between 0 and 10 000 cm^{-1}.

PRECEDING PAGE BLANK NOT FILMED

PAGE 3 INTENTIONALLY BLANK

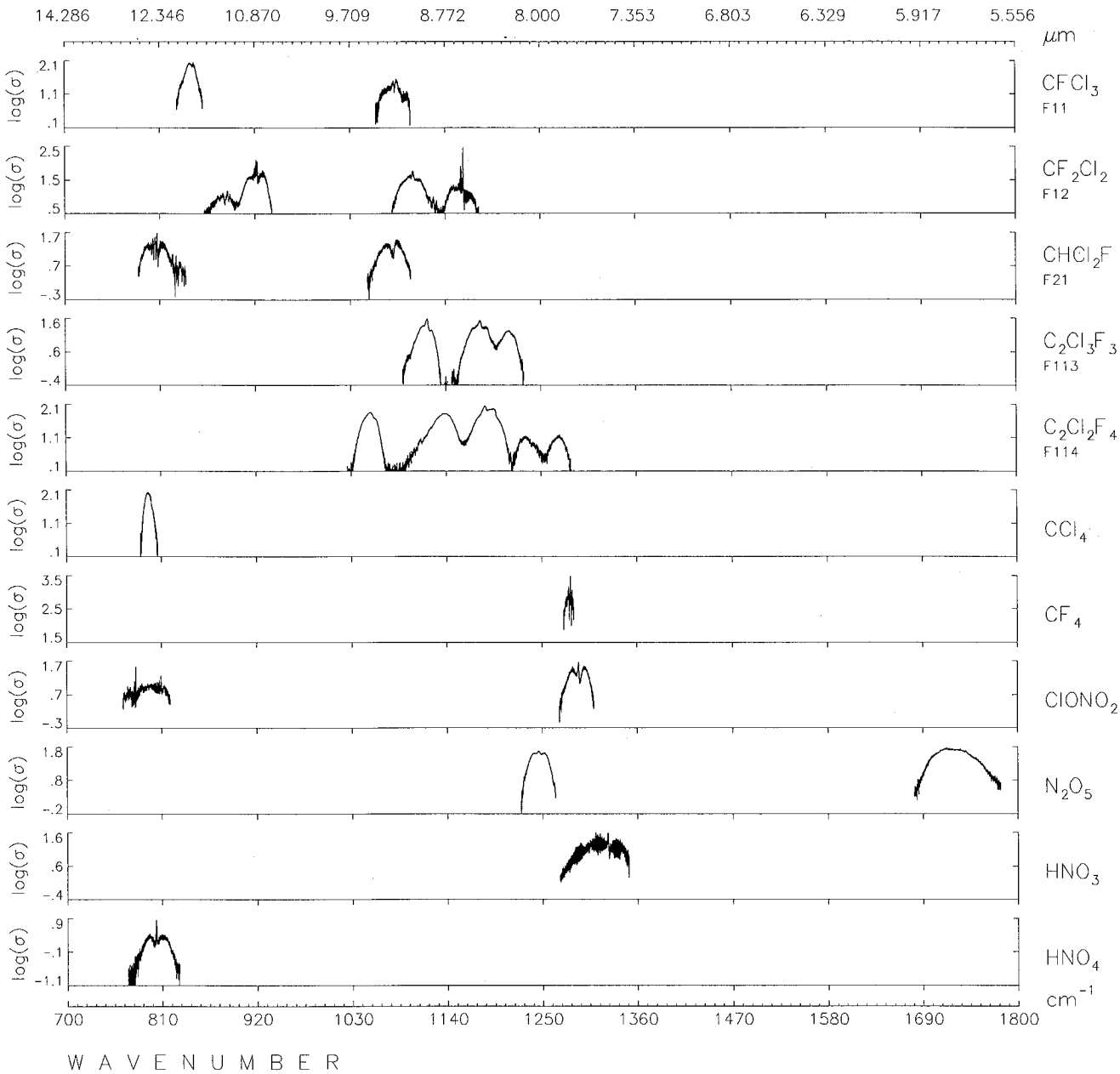


Figure 2. Absorption cross sections of 11 heavy molecules for the 700- to 1800-cm^{-1} region.

ORIGINAL PAGE IS
OF POOR QUALITY

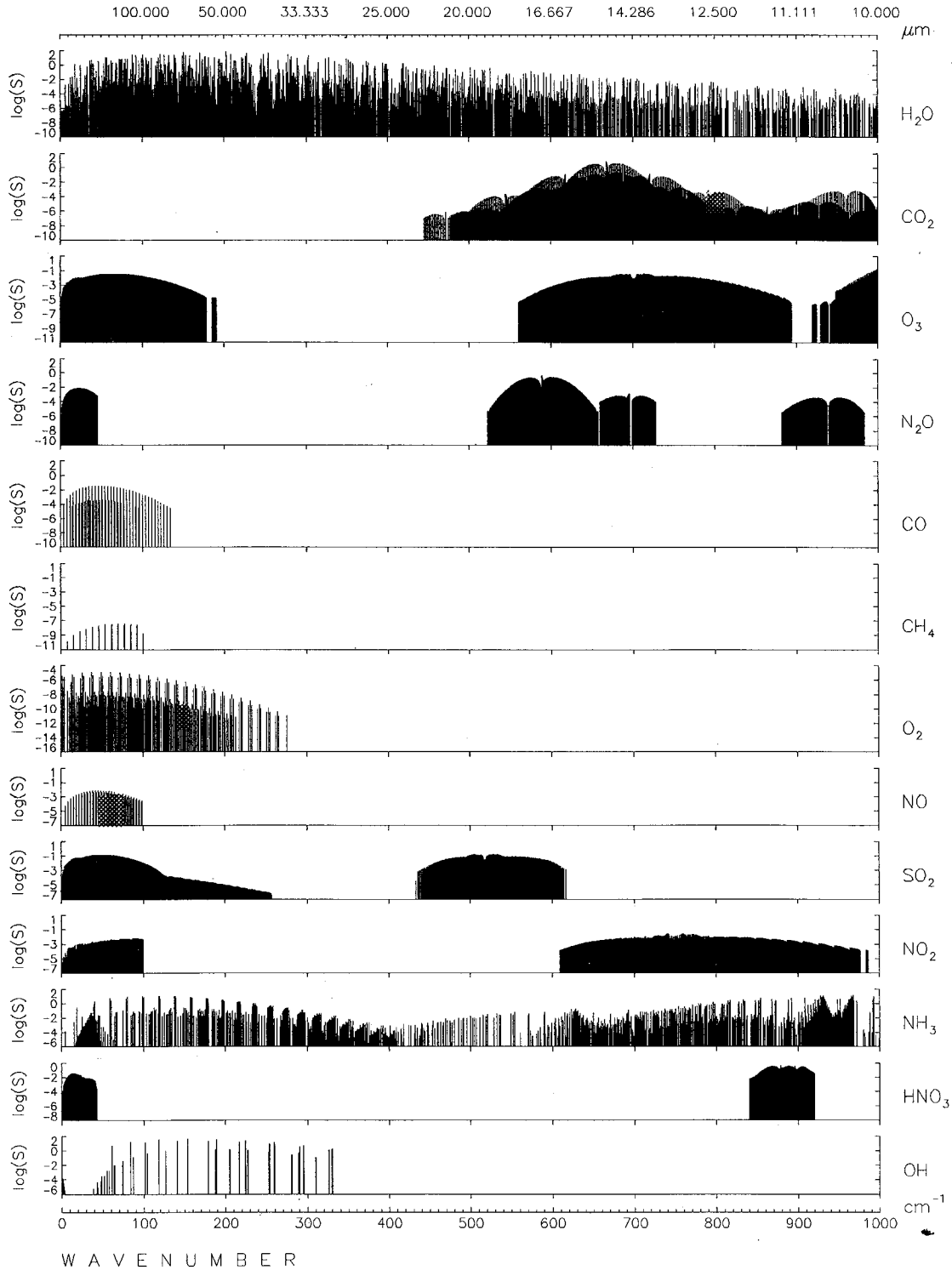


Figure 3. Absorption line strengths of AFGL gases versus wavenumber for every 1000 cm^{-1} up to 5000 cm^{-1}.

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

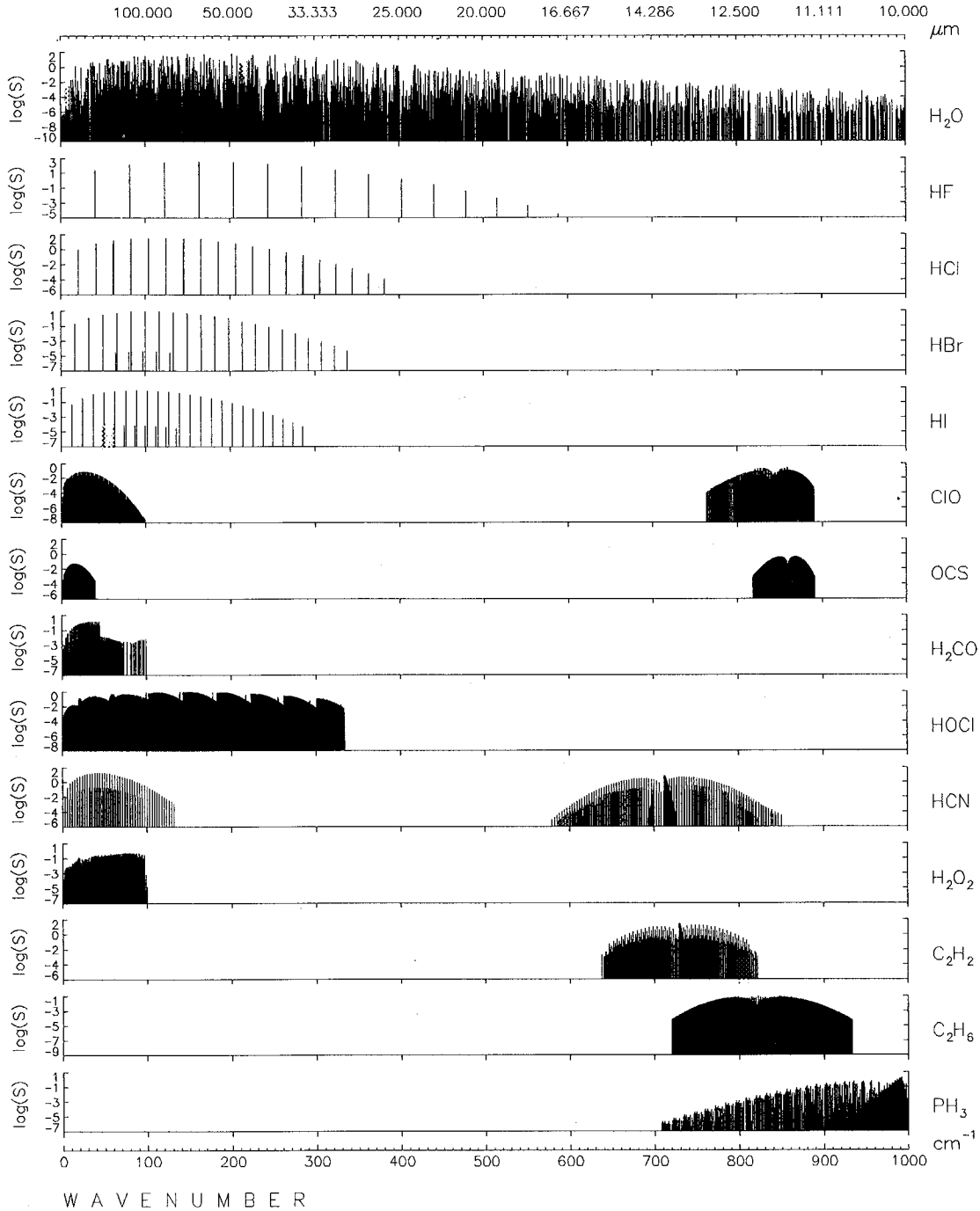


Figure 3. Continued.

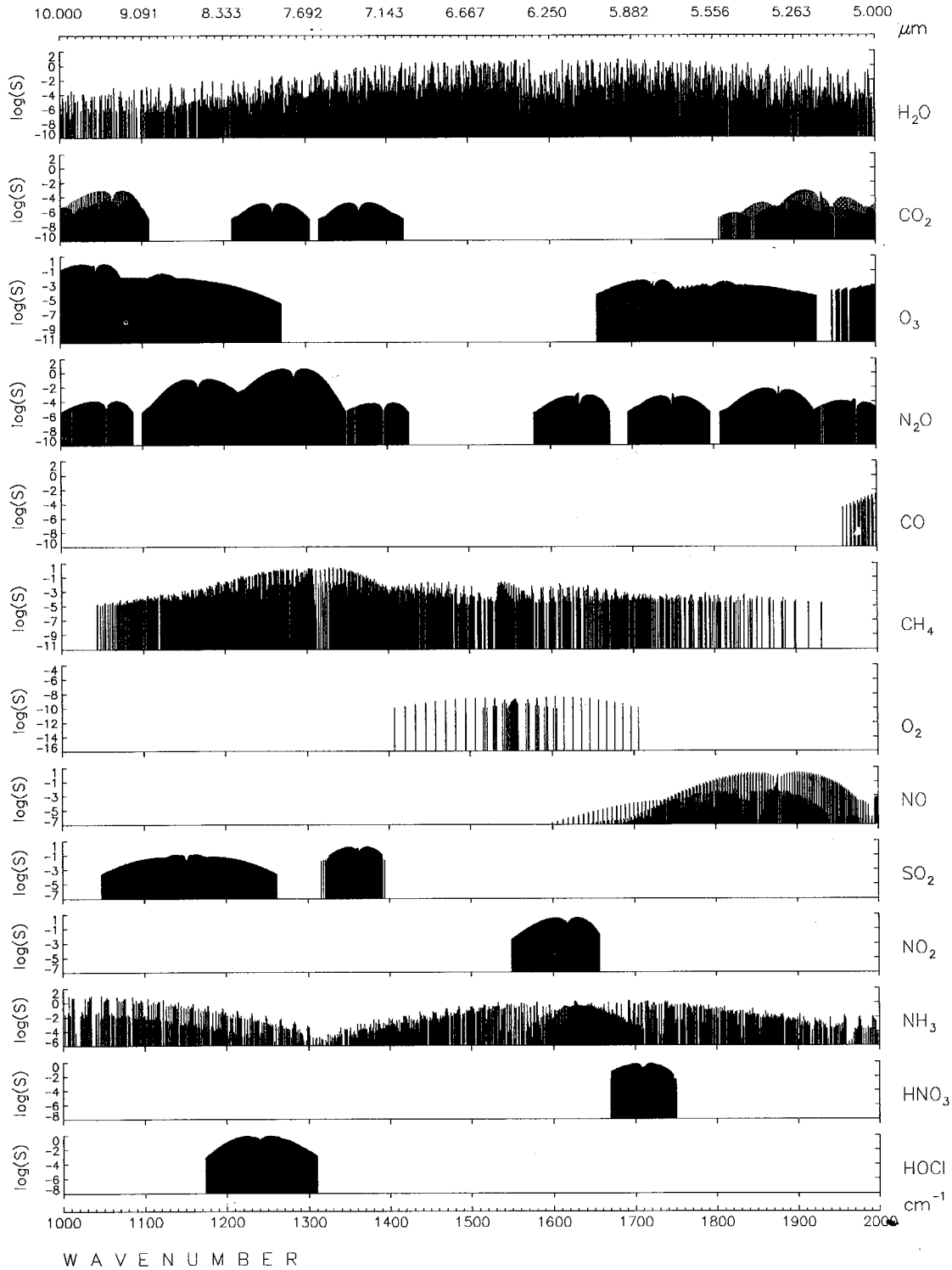


Figure 3. Continued.

ORIGINAL PAGE IS
OF POOR QUALITY

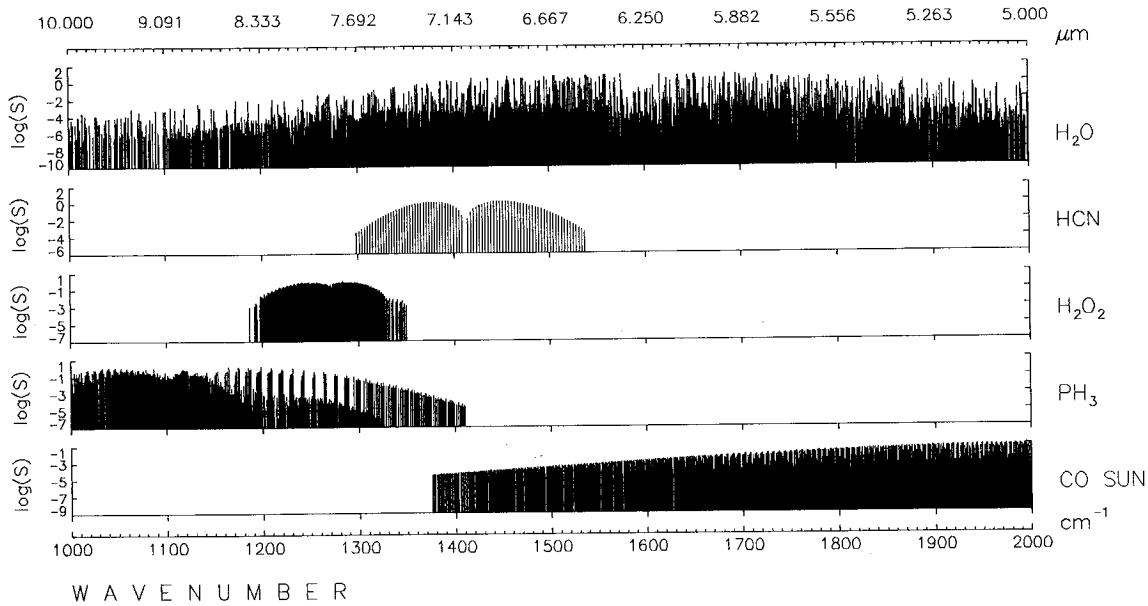


Figure 3. Continued.

ORIGINAL PAGE IS
OF POOR QUALITY

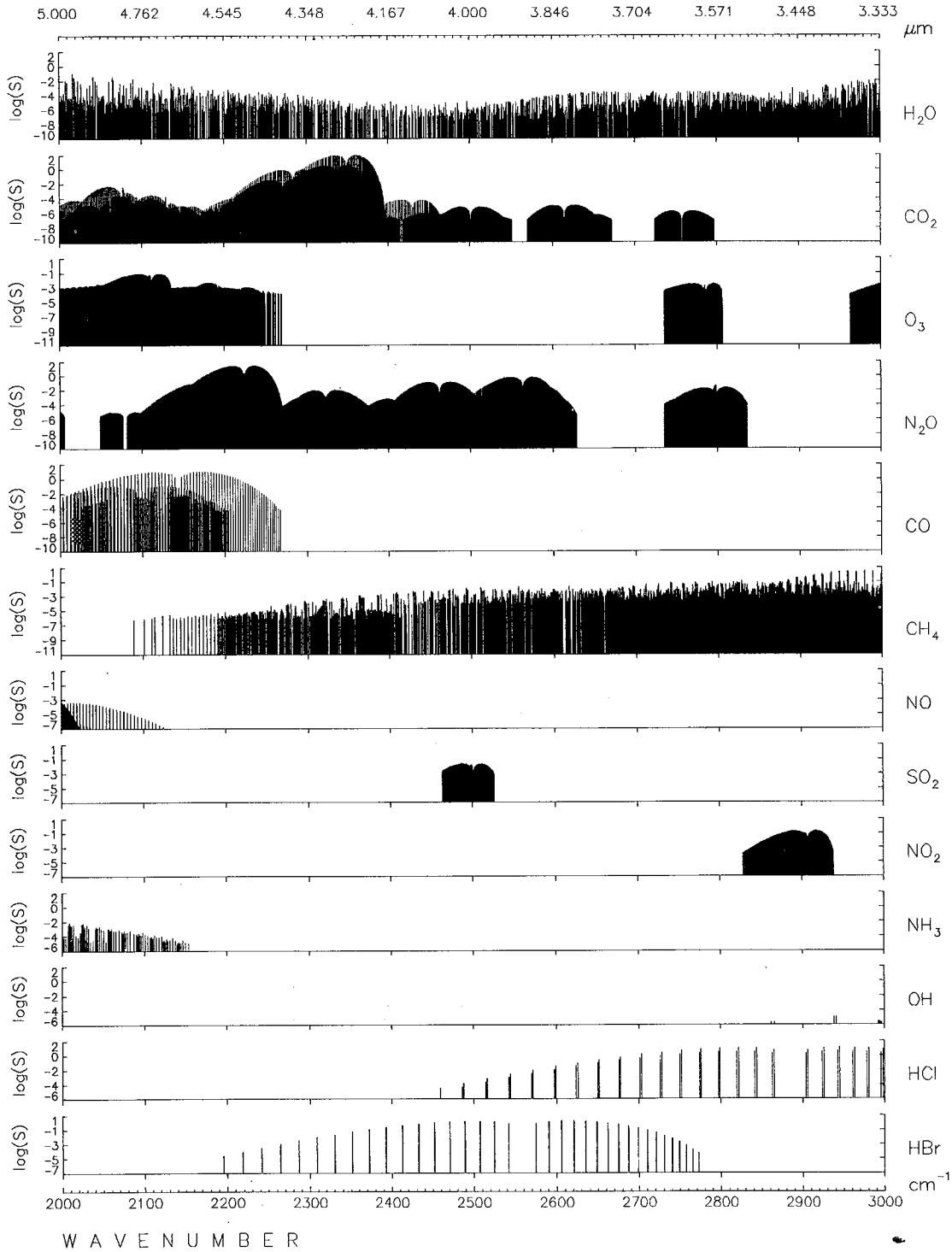


Figure 3. Continued.

ORIGINAL PAGE IS
OF POOR QUALITY

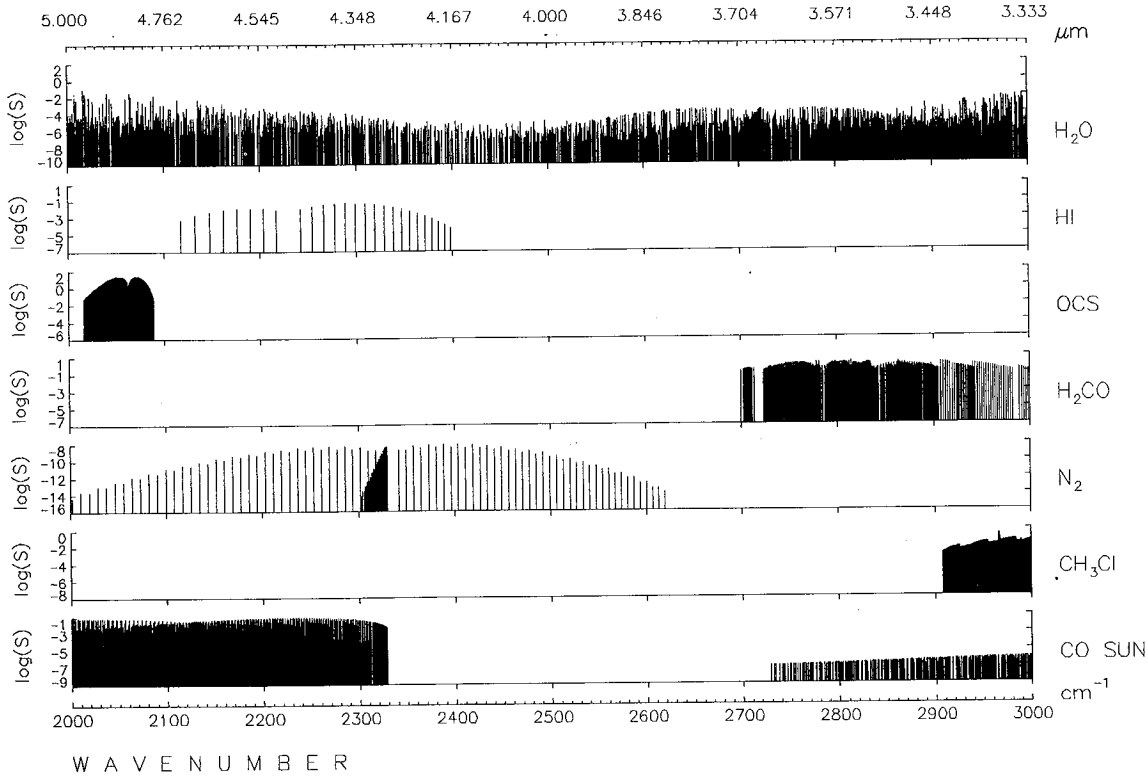


Figure 3. Continued.

ORIGINAL PAGE IS
OF POOR QUALITY

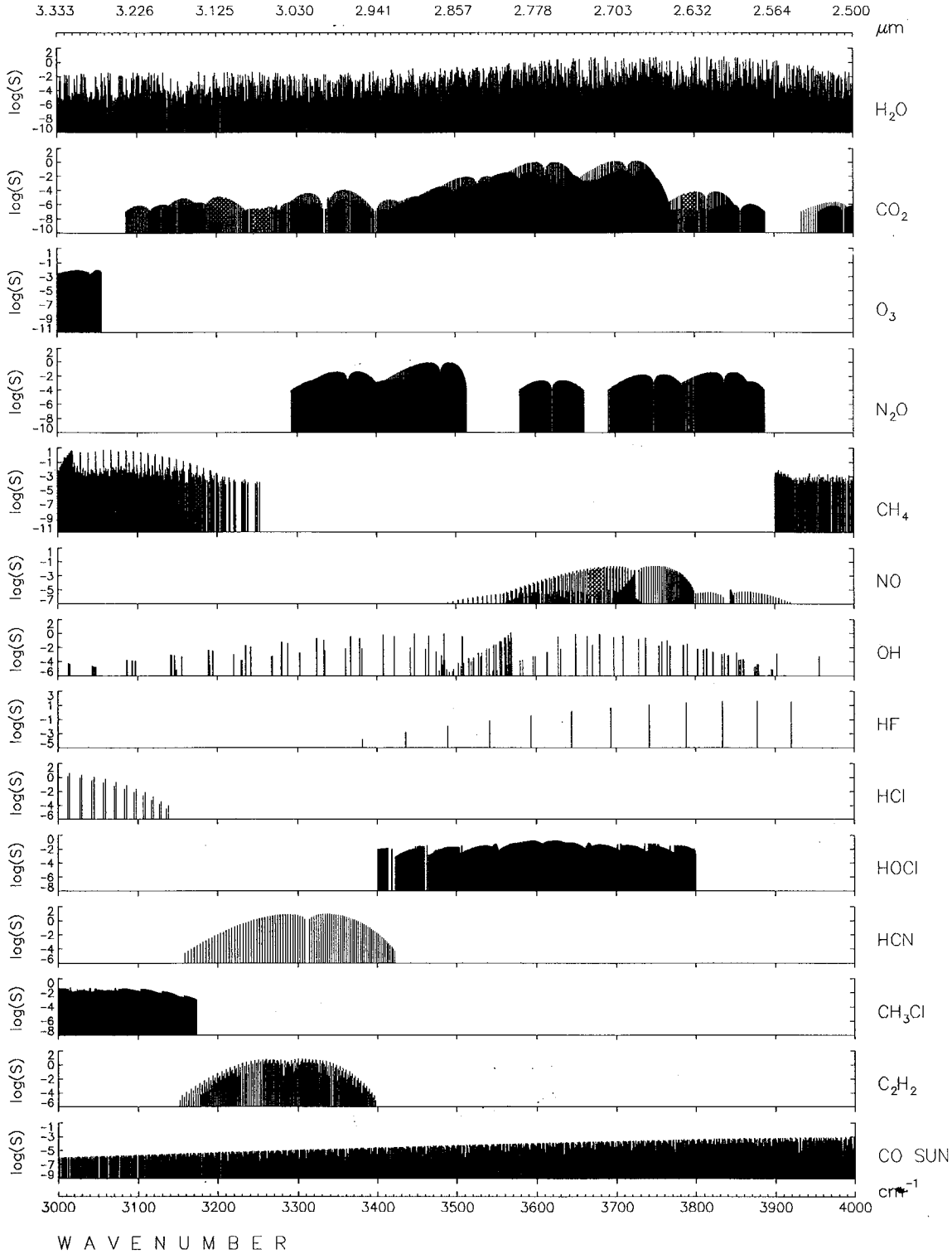


Figure 3. Continued.

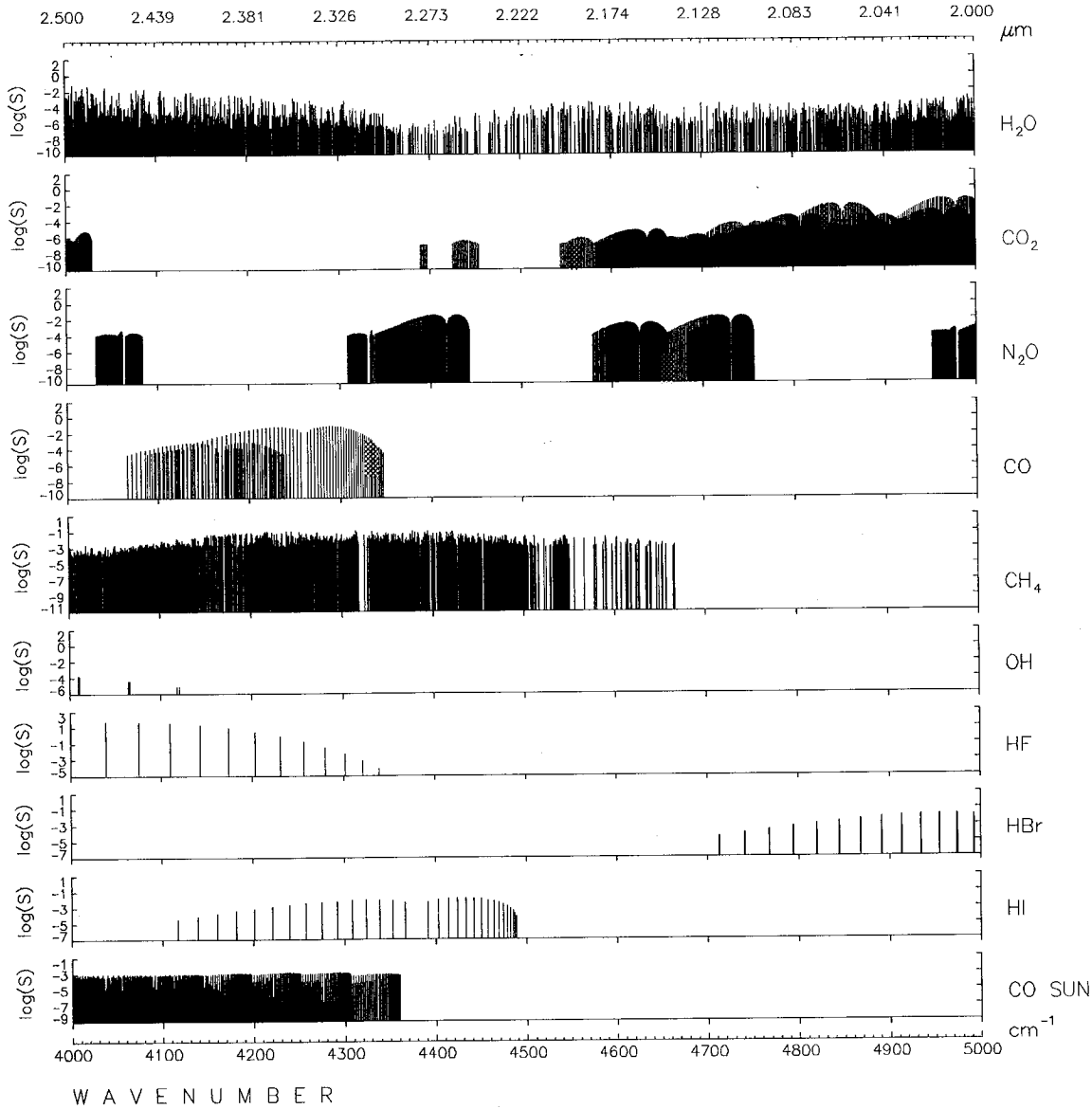


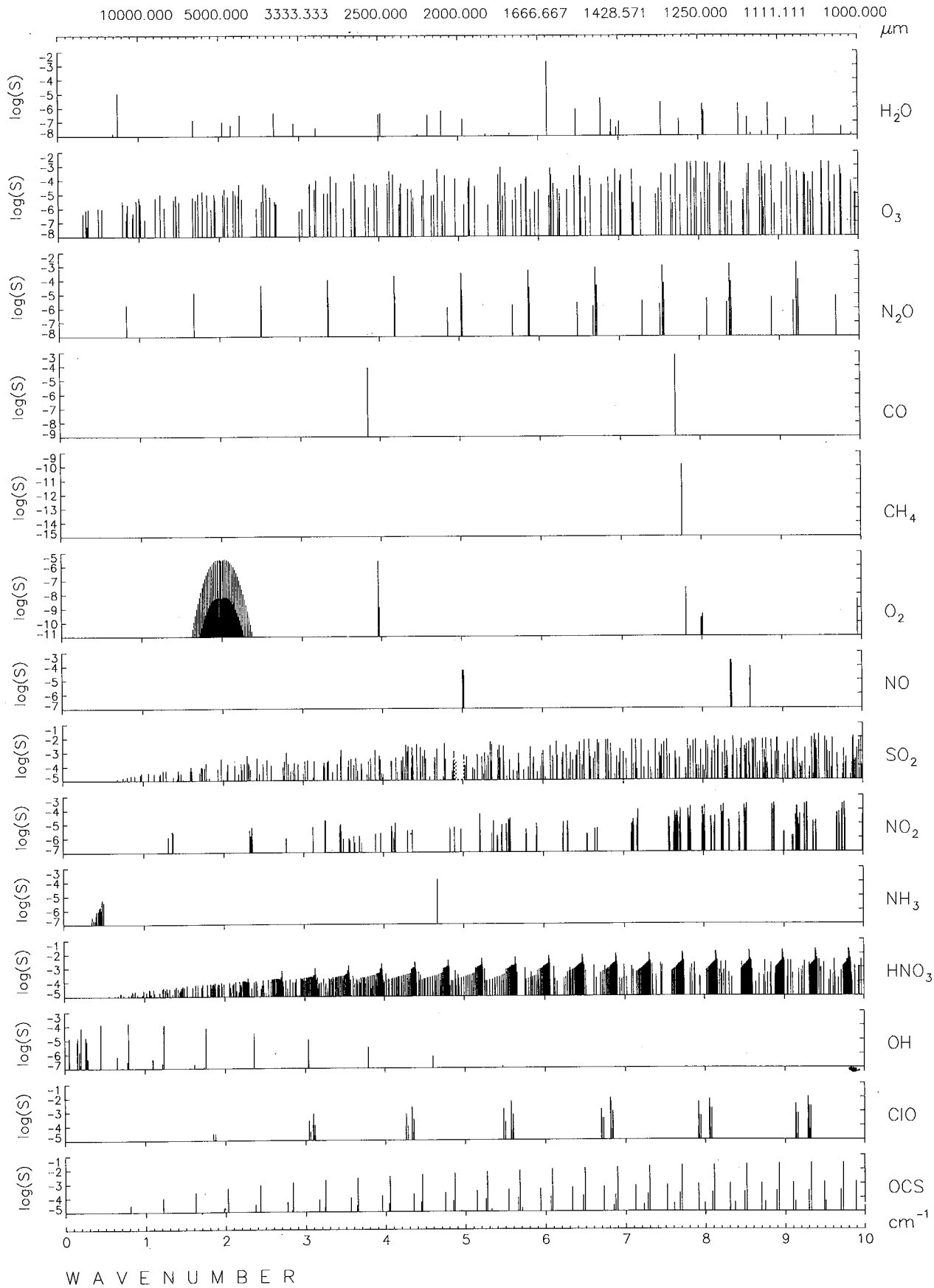
Figure 3. Concluded.

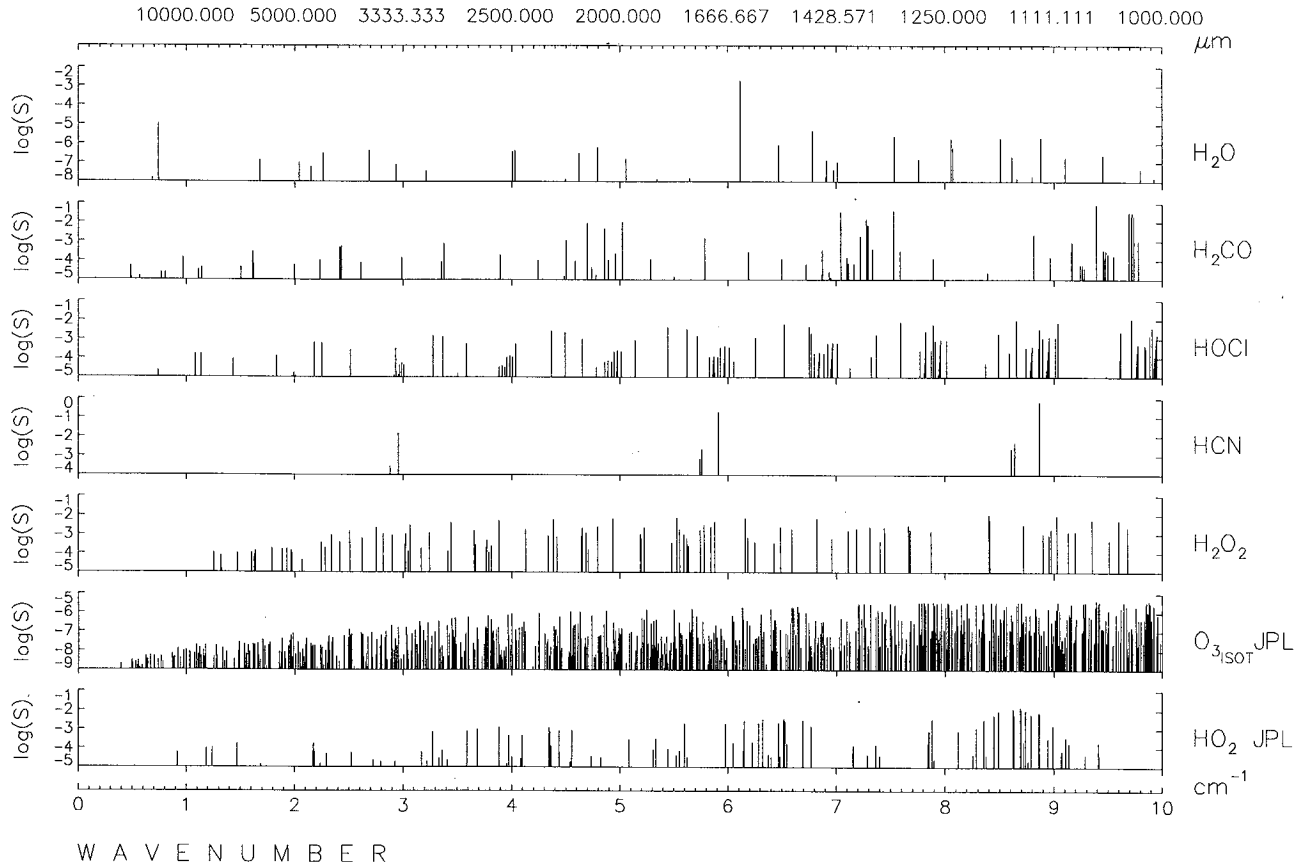
ORIGINAL PAGE IS
OF POOR QUALITY

ATLAS

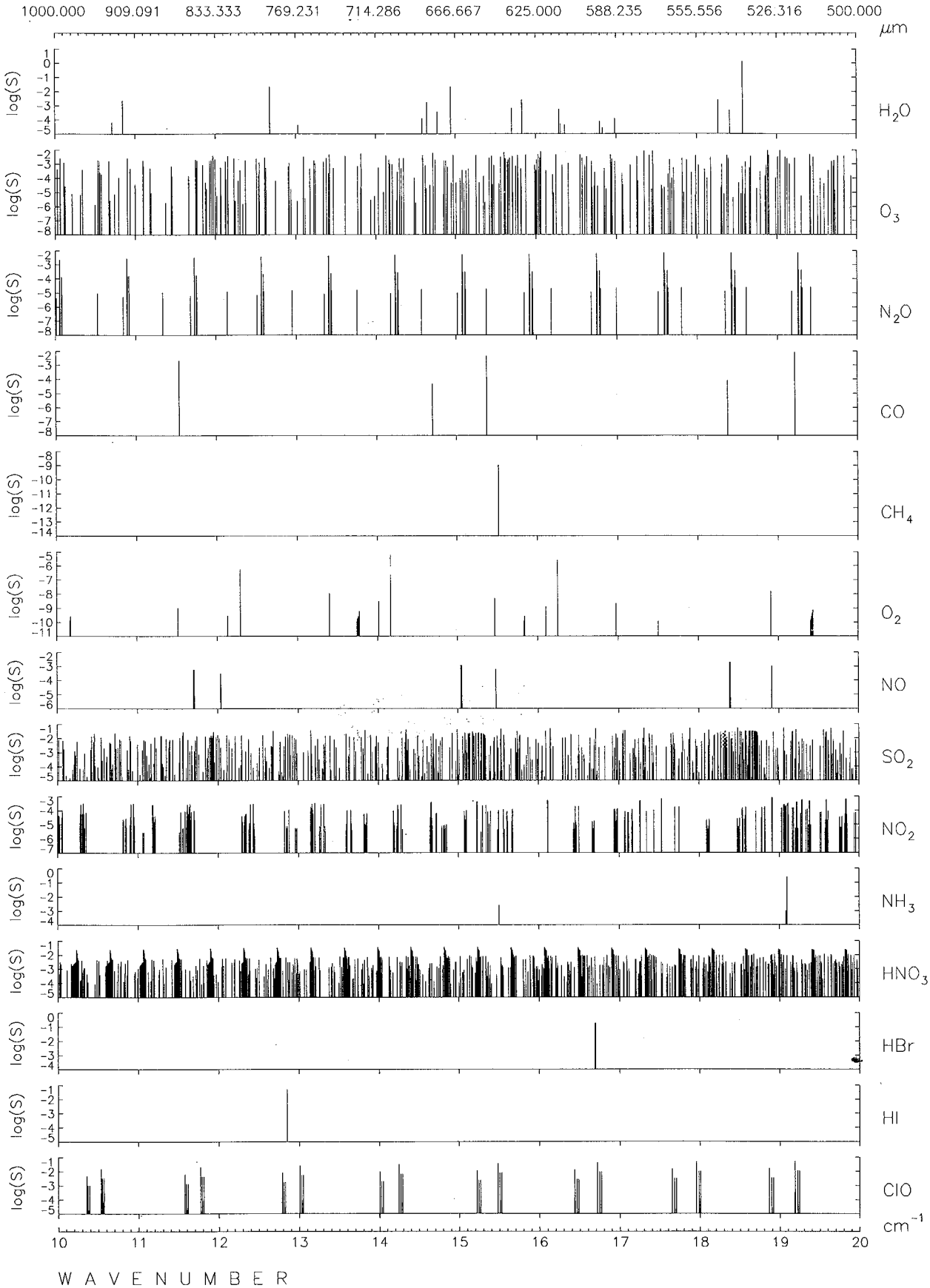
PRECEDING PAGE BLANK NOT FILMED

PAGE 14 INTENTIONALLY BLANK

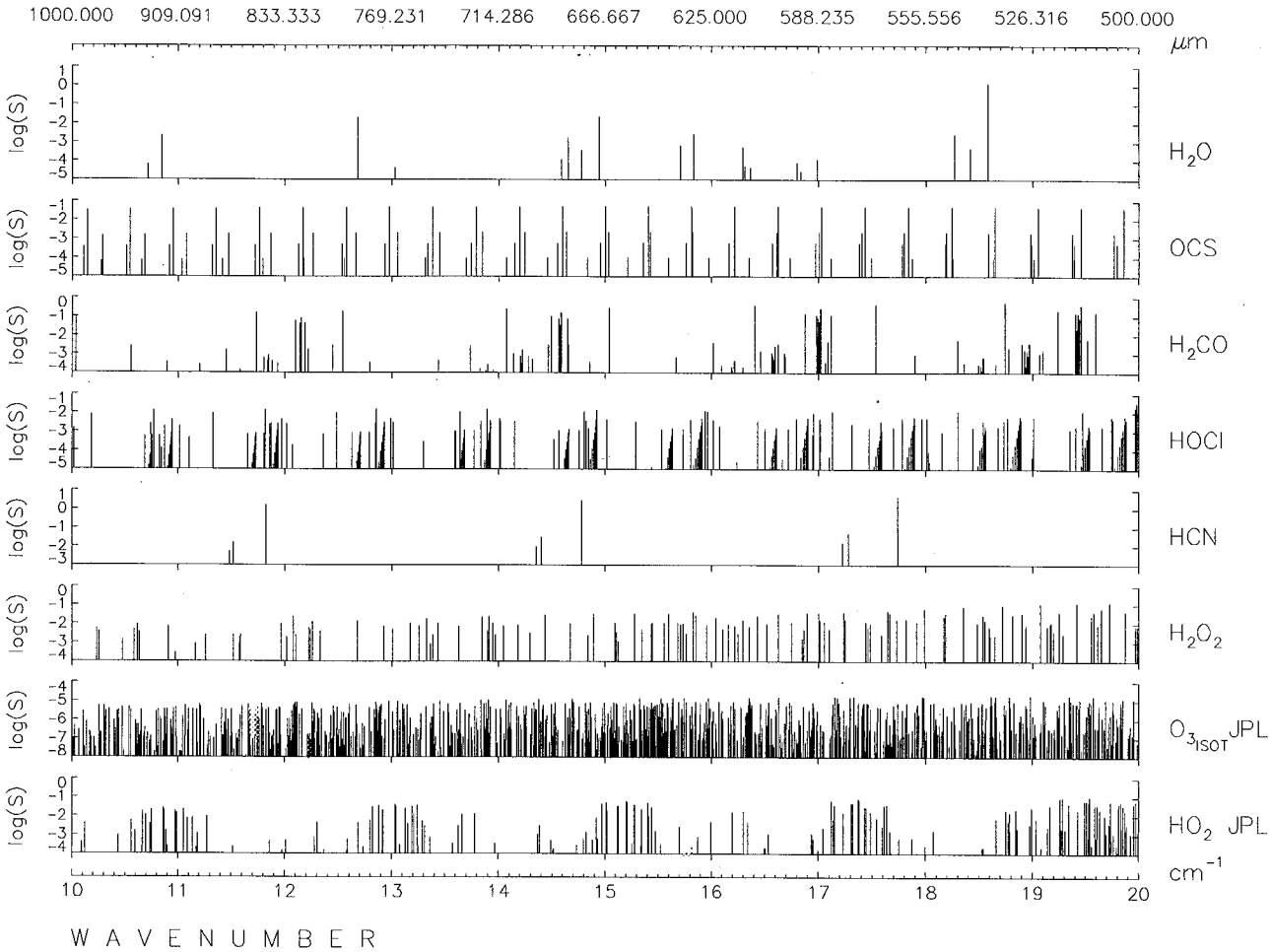

10000.000 5000.000 3333.333 2500.000 2000.000 1666.667 1428.571 1250.000 1111.111 1000.000
μm
log(S)
H2O
O3
N2O
CO
CH4
O2
NO
SO2
NO2
NH3
HNO3
OH
ClO
OCS
cm-1
0 1 2 3 4 5 6 7 8 9 10
WAVENUMBER

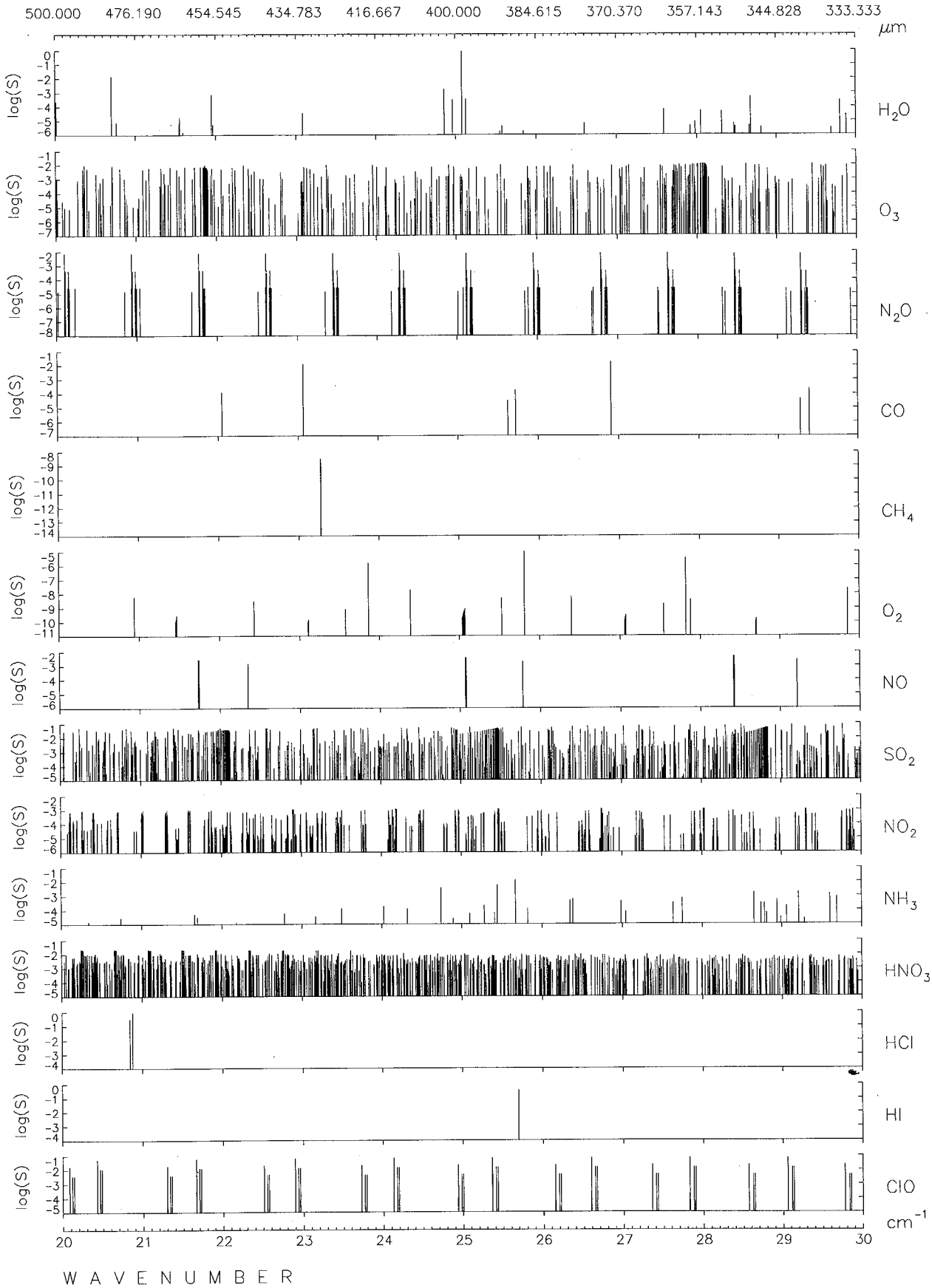


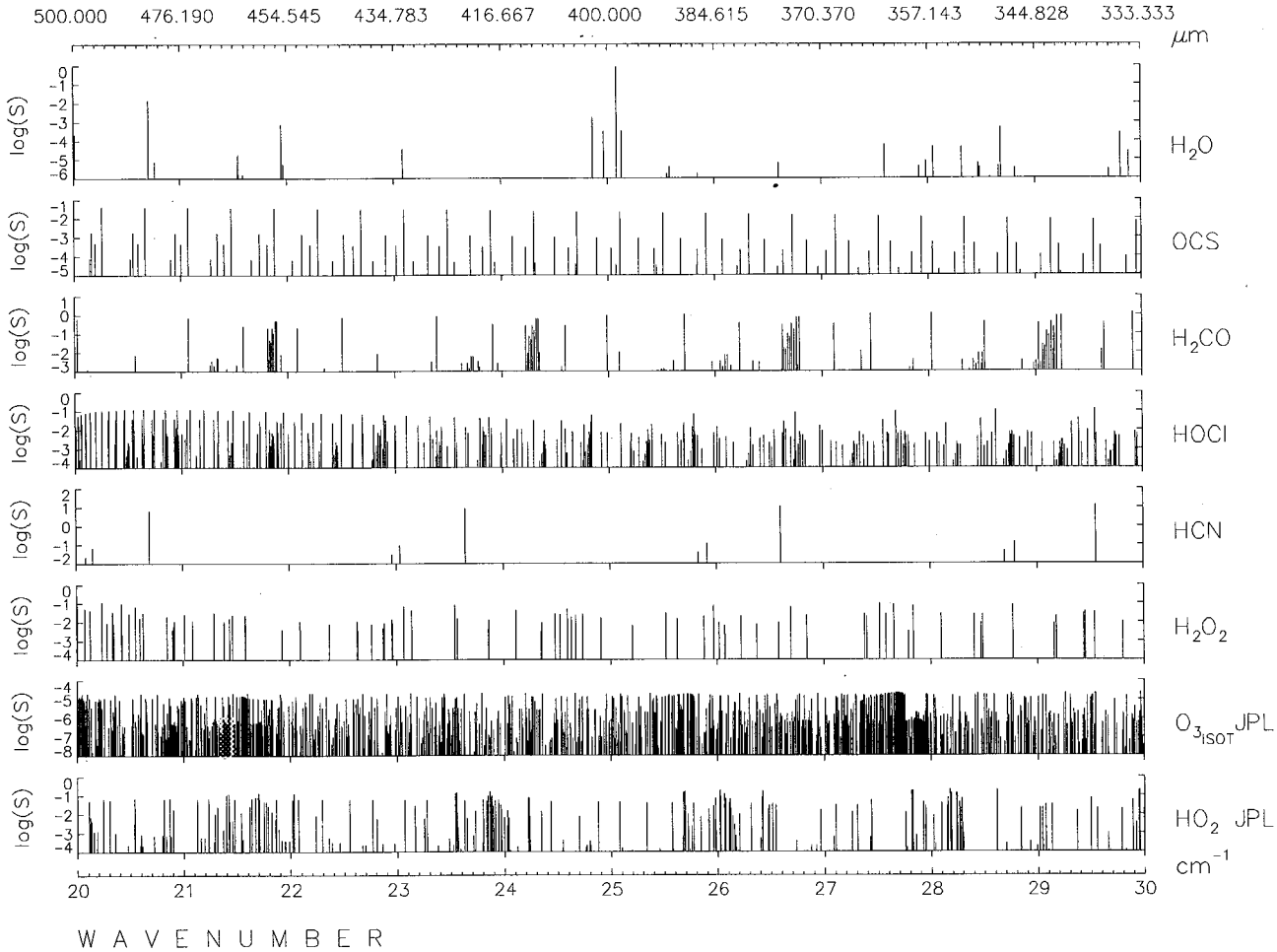
ORIGINAL PAGE IS
OF POOR QUALITY


1000.000
909.091
833.333
769.231
714.286
666.667
625.000
588.235
555.556
526.316
500.000
μm
log(S)
H2O
O3
N2O
CO
CH4
O2
NO
SO2
NO2
NH3
HNO3
HBr
HI
ClO
cm-1
10
11
12
13
14
15
16
17
18
19
20
WAVENUMBER

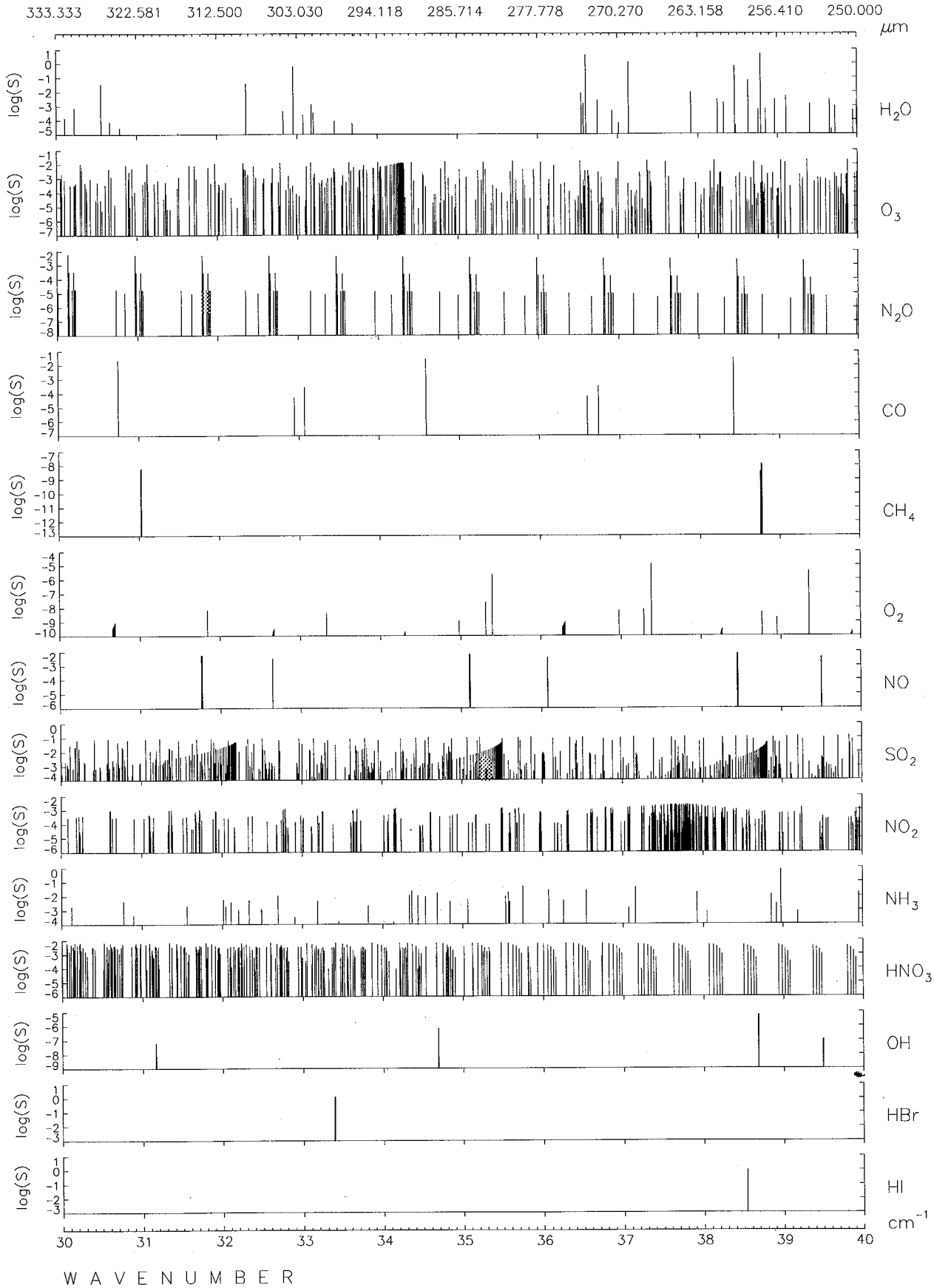
ORIGINAL PAGE IS OF POOR QUALITY

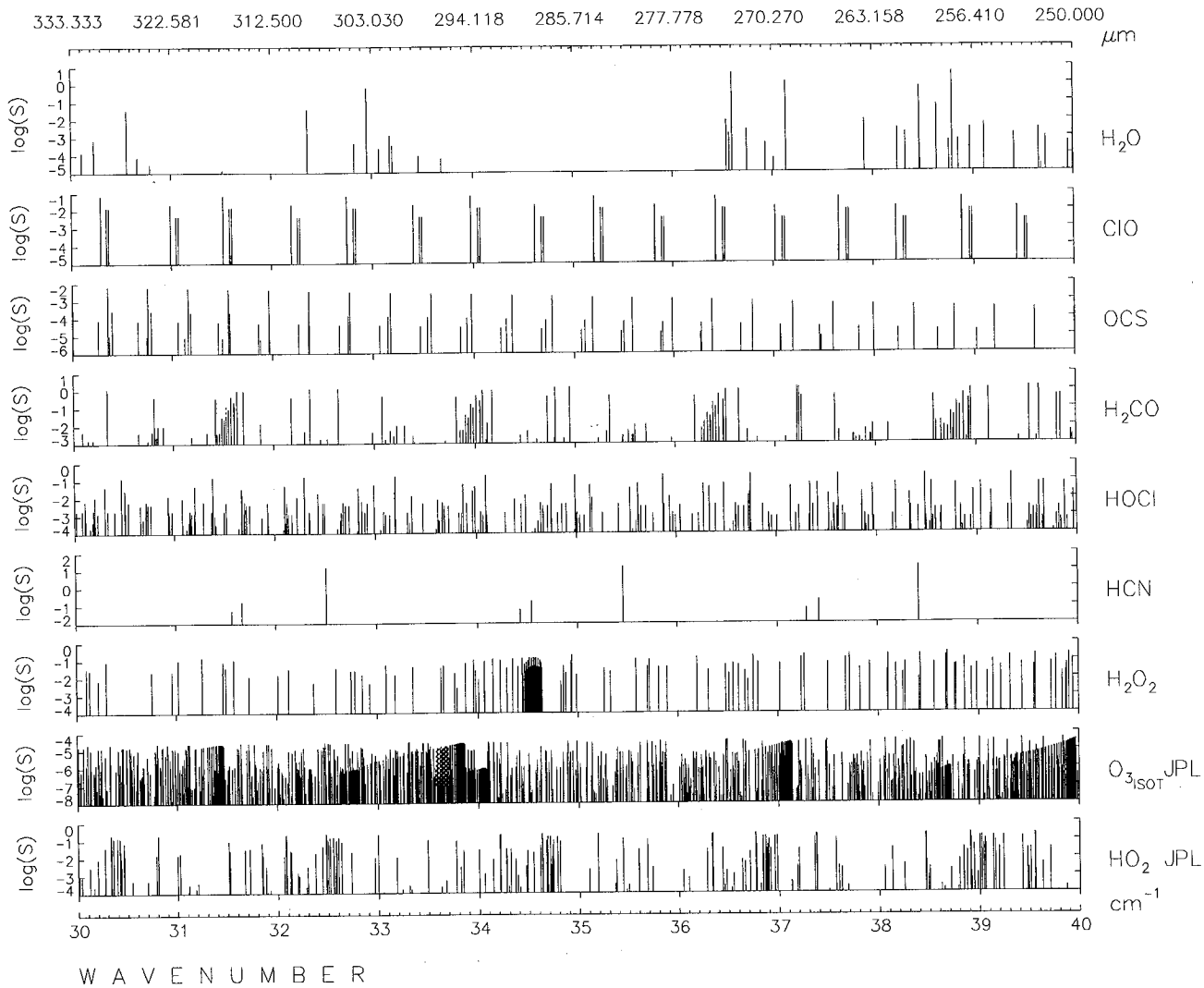



500.000
476.190
454.545
434.783
416.667
400.000
384.615
370.370
357.143
344.828
333.333
μm
log(S)
H2O
O3
N2O
CO
CH4
O2
NO
SO2
NO2
NH3
HNO3
HCl
HI
ClO
cm-1
20
21
22
23
24
25
26
27
28
29
30
WAVENUMBER

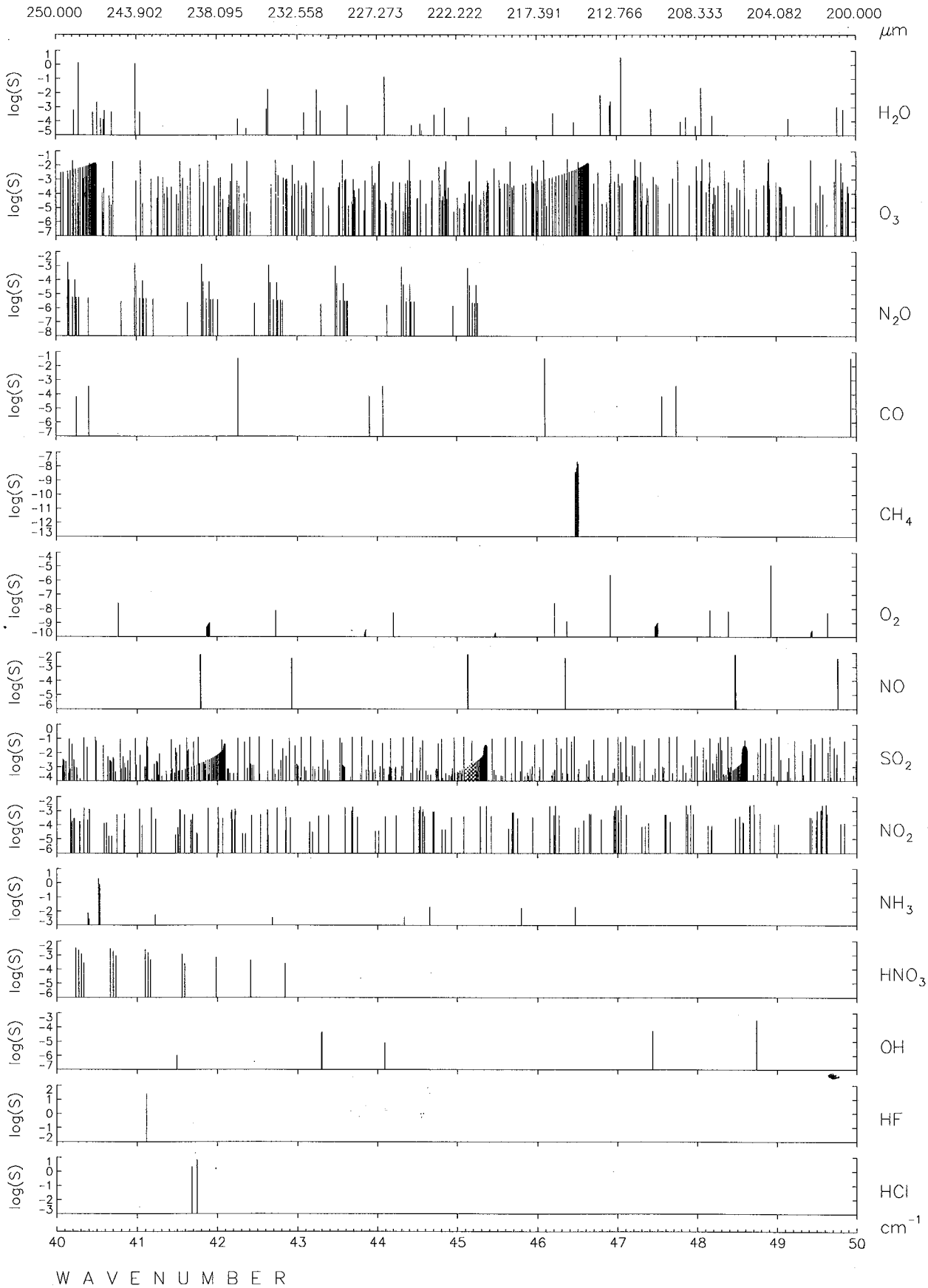


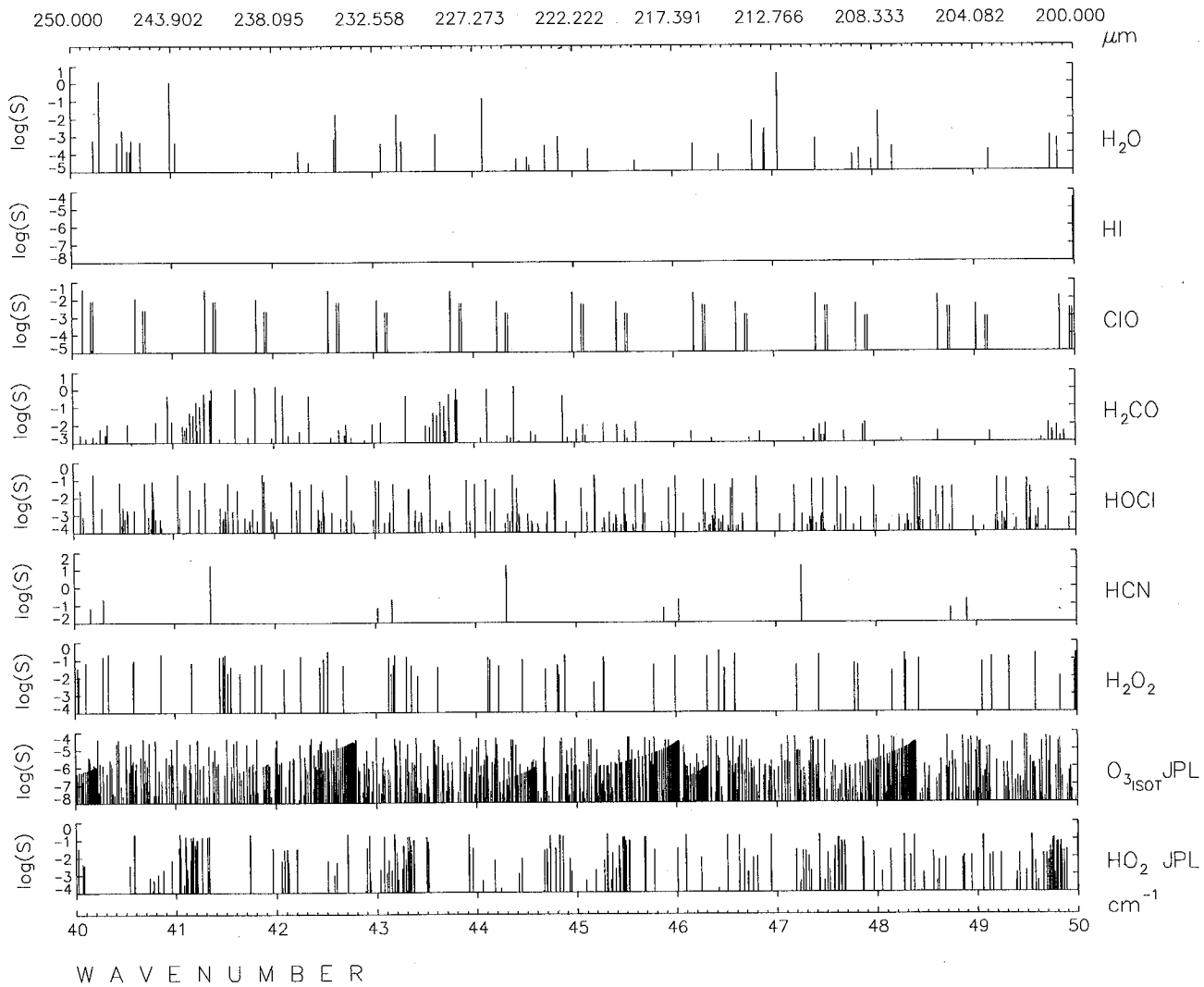
ORIGINAL PAGE IS
OF POOR QUALITY


333.333
322.581
312.500
303.030
294.118
285.714
277.778
270.270
263.158
256.410
250.000
μm
log(S)
H2O
O3
N2O
CO
CH4
O2
NO
SO2
NO2
NH3
HNO3
OH
HBr
HI
30
31
32
33
34
35
36
37
38
39
40
cm-1
WAVENUMBER

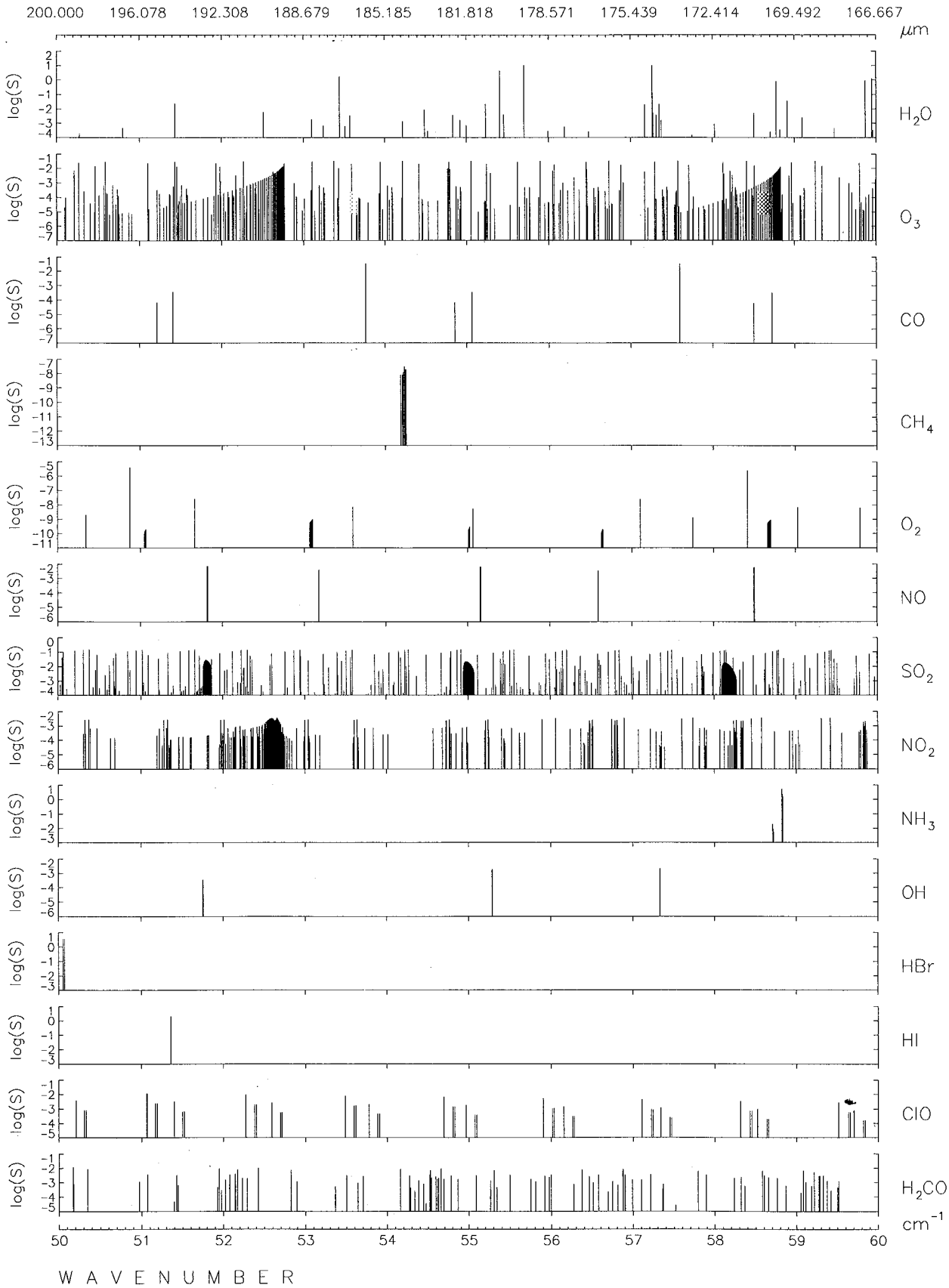


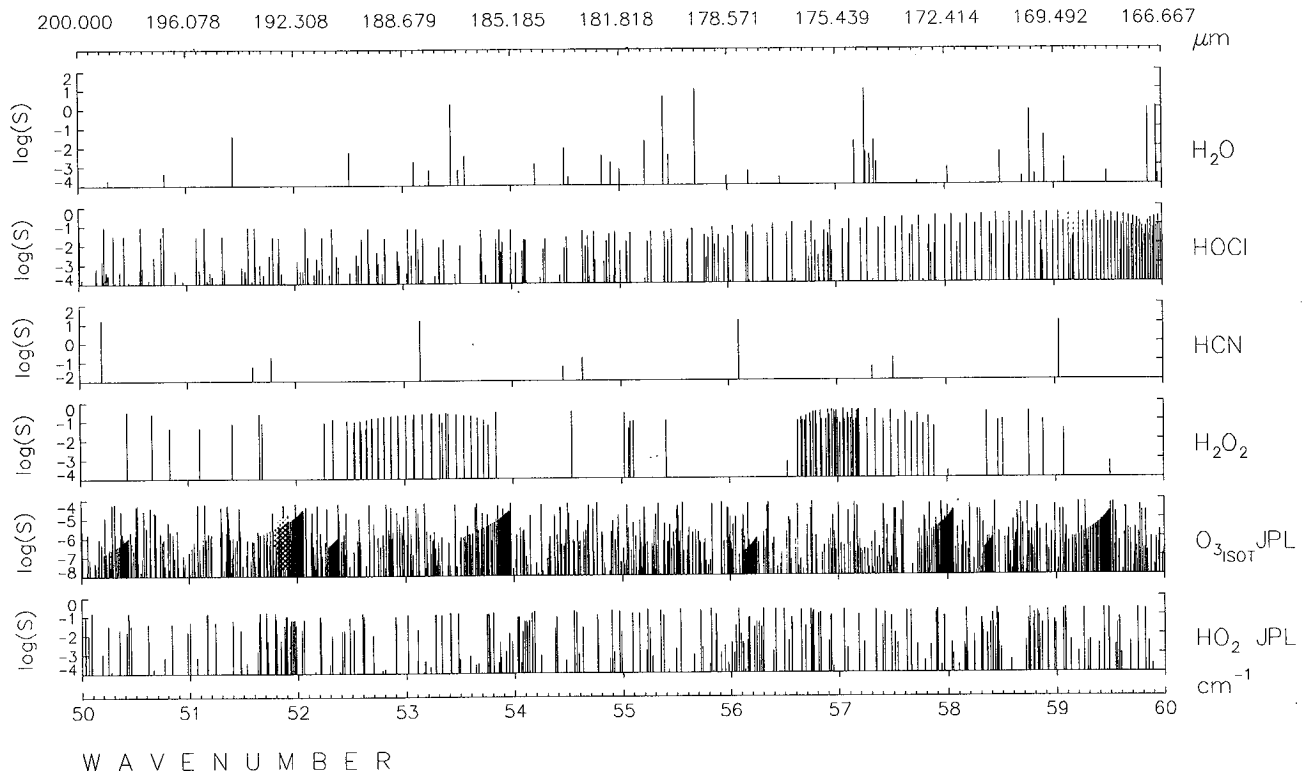
ORIGINAL PAGE IS
OF POOR QUALITY


250.000
243.902
238.095
232.558
227.273
222.222
217.391
212.766
208.333
204.082
200.000
μm
log(S)
H2O
O3
N2O
CO
CH4
O2
NO
SO2
NO2
NH3
HNO3
OH
HF
HCl
cm-1
40
41
42
43
44
45
46
47
48
49
50
WAVENUMBER

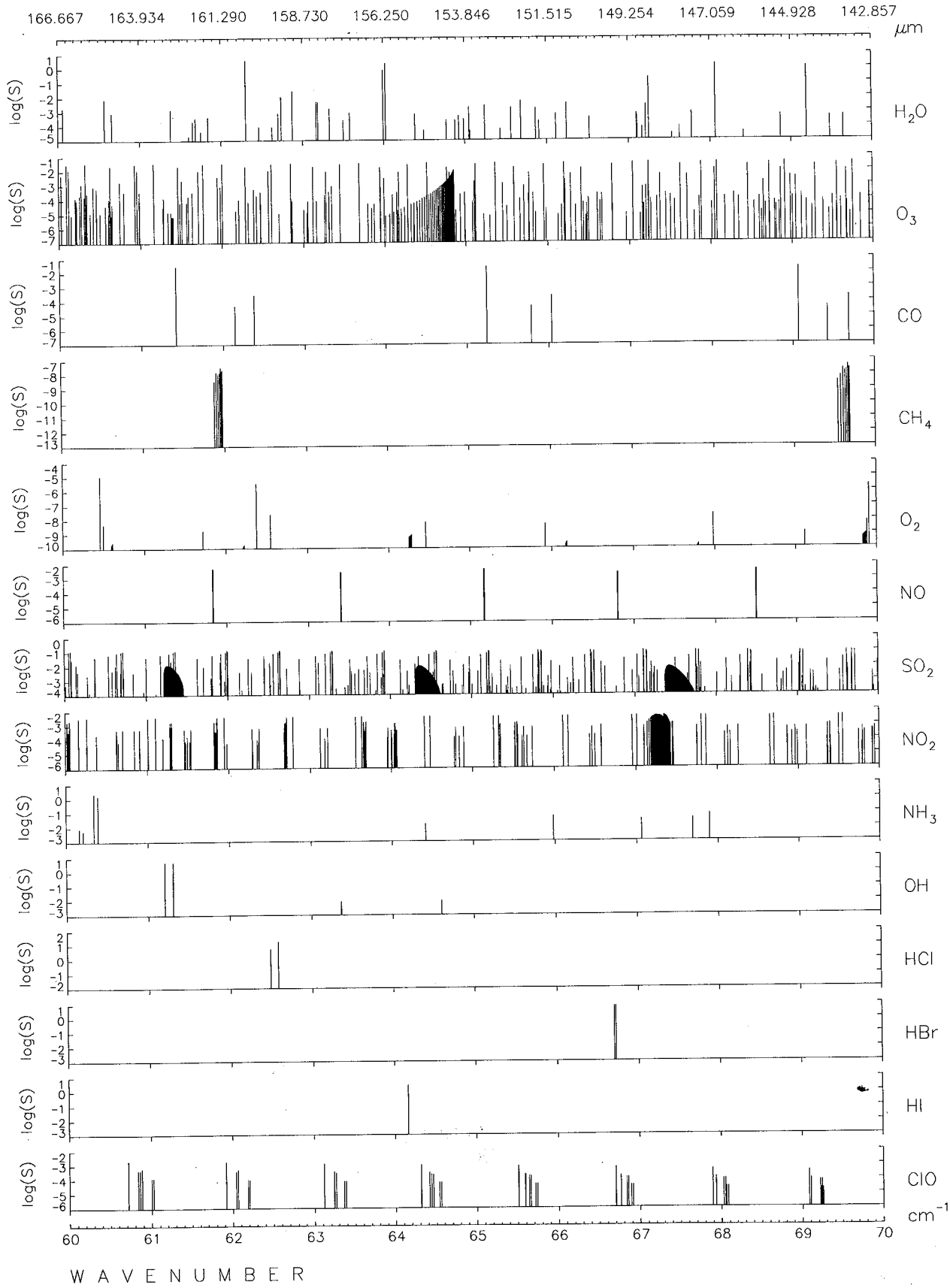


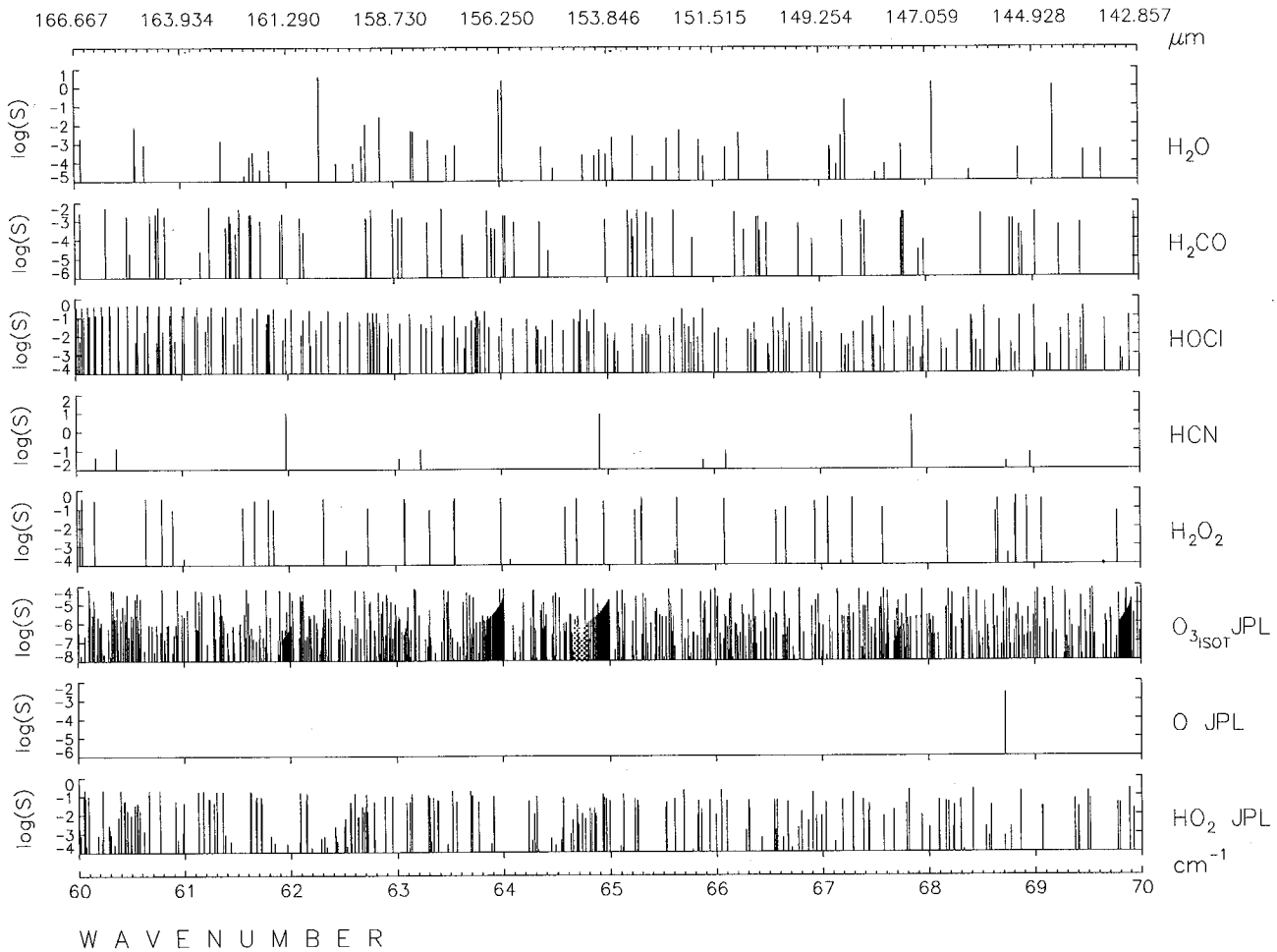
ORIGINAL PAGE IS
OF POOR QUALITY


200.000
196.078
192.308
188.679
185.185
181.818
178.571
175.439
172.414
169.492
166.667
μm
log(S)
H2O
O3
CO
CH4
O2
NO
SO2
NO2
NH3
OH
HBr
HI
ClO
H2CO
cm-1
50
51
52
53
54
55
56
57
58
59
60
WAVENUMBER

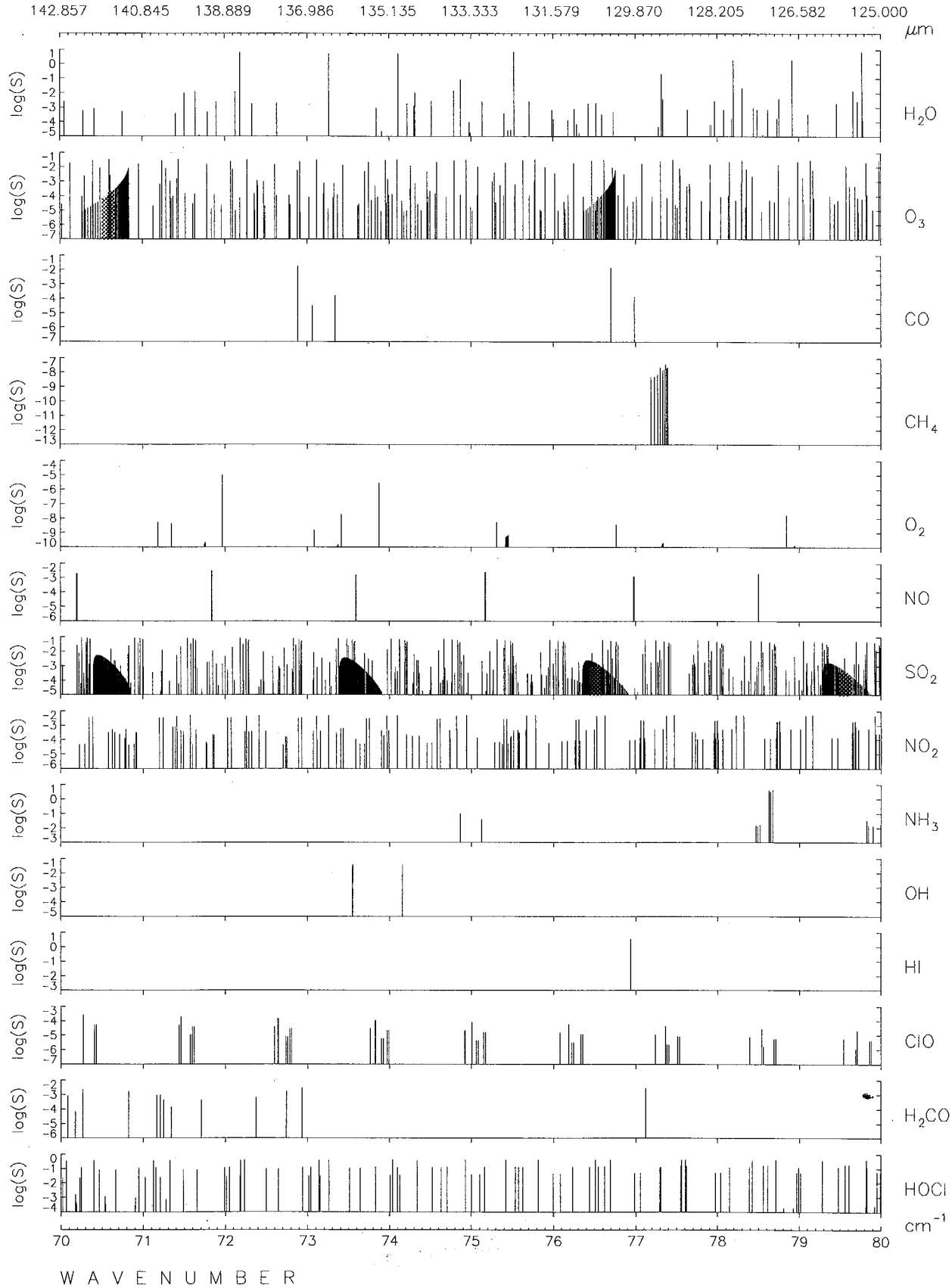


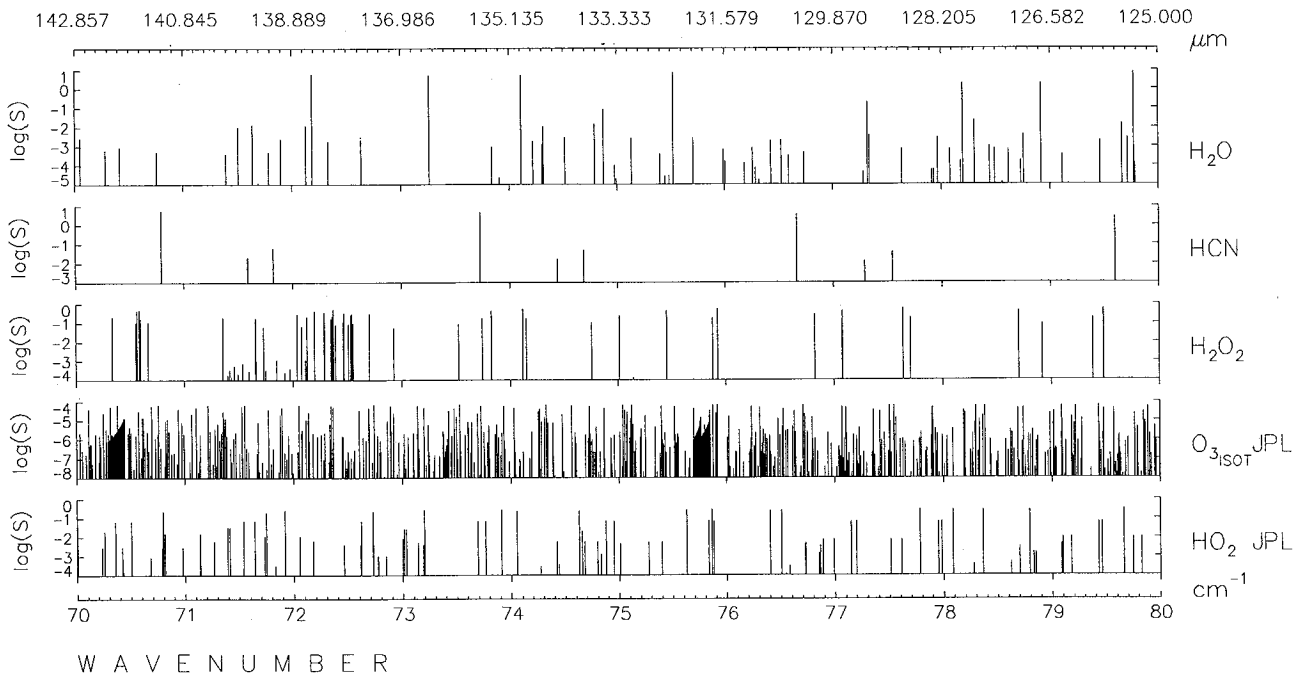
ORIGINAL PAGE IS
OF POOR QUALITY


166.667
163.934
161.290
158.730
156.250
153.846
151.515
149.254
147.059
144.928
142.857
μm
log(S)
H2O
O3
CO
CH4
O2
NO
SO2
NO2
NH3
OH
HCl
HBr
HI
ClO
cm-1
60
61
62
63
64
65
66
67
68
69
70
WAVENUMBER

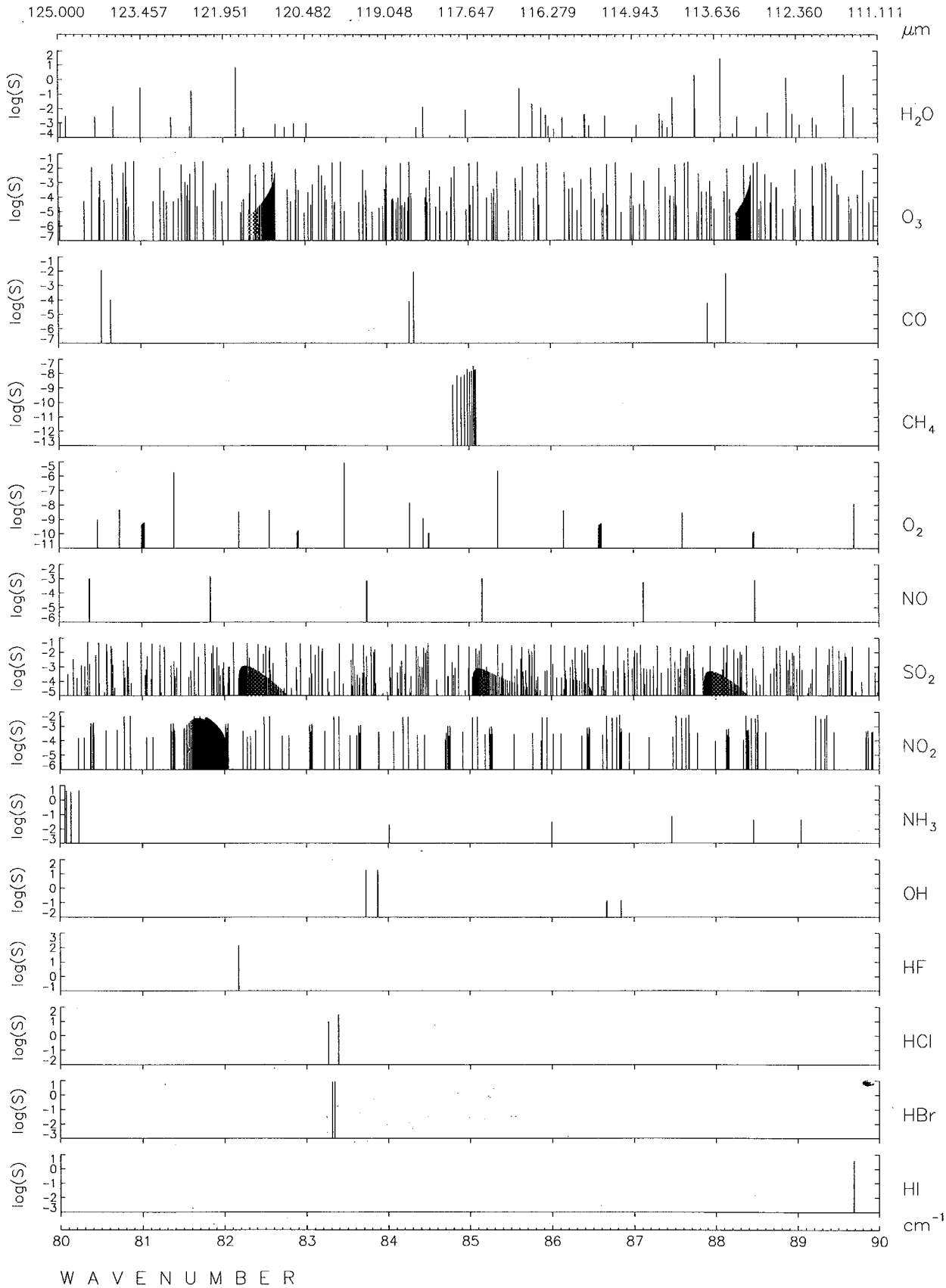


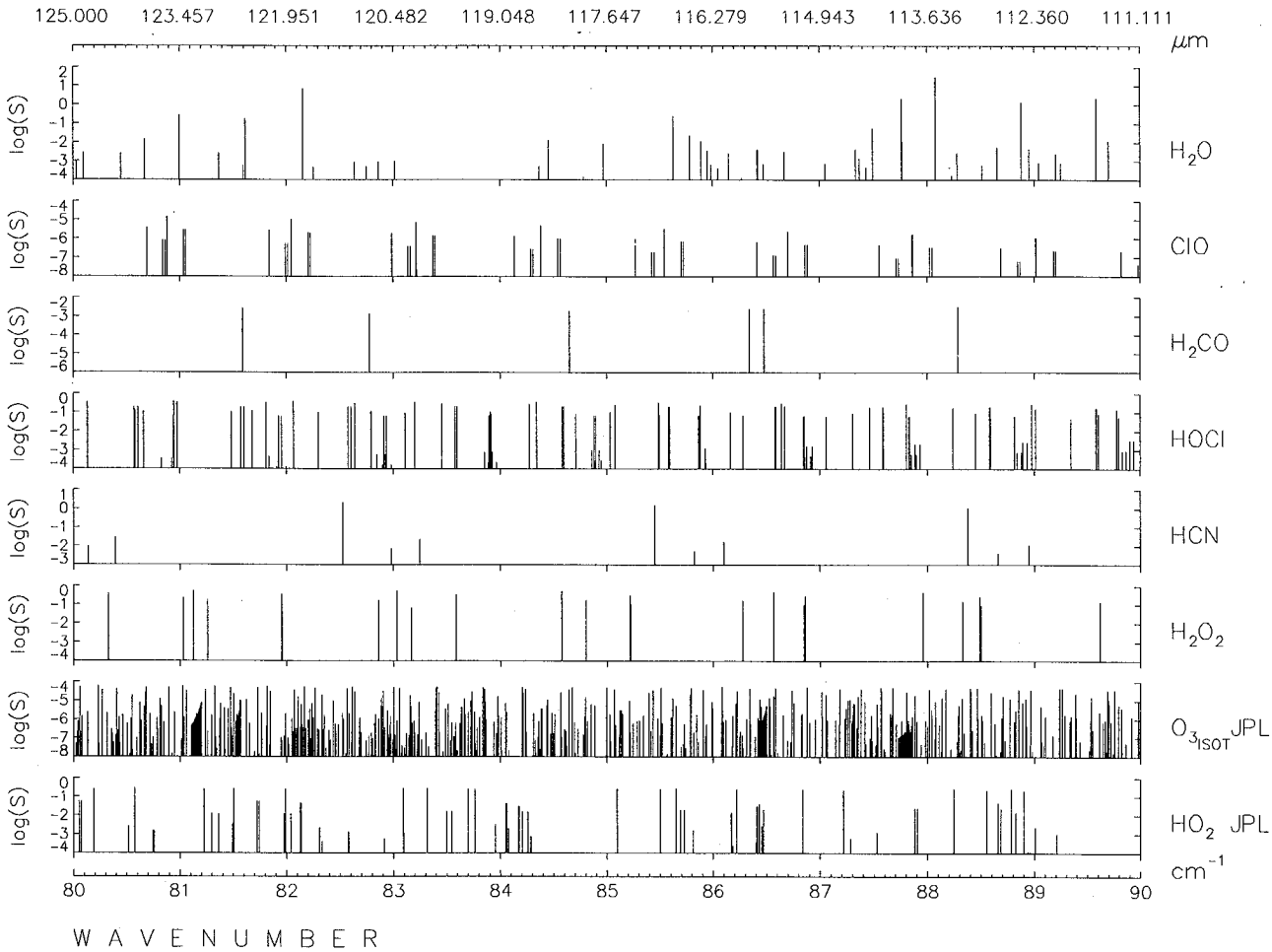
ORIGINAL PAGE IS
OF POOR QUALITY


142.857
140.845
138.889
136.986
135.135
133.333
131.579
129.870
128.205
126.582
125.000
μm
log(S)
H2O
O3
CO
CH4
O2
NO
SO2
NO2
NH3
OH
HI
ClO
H2CO
HOCl
cm-1
70
71
72
73
74
75
76
77
78
79
80
WAVENUMBER

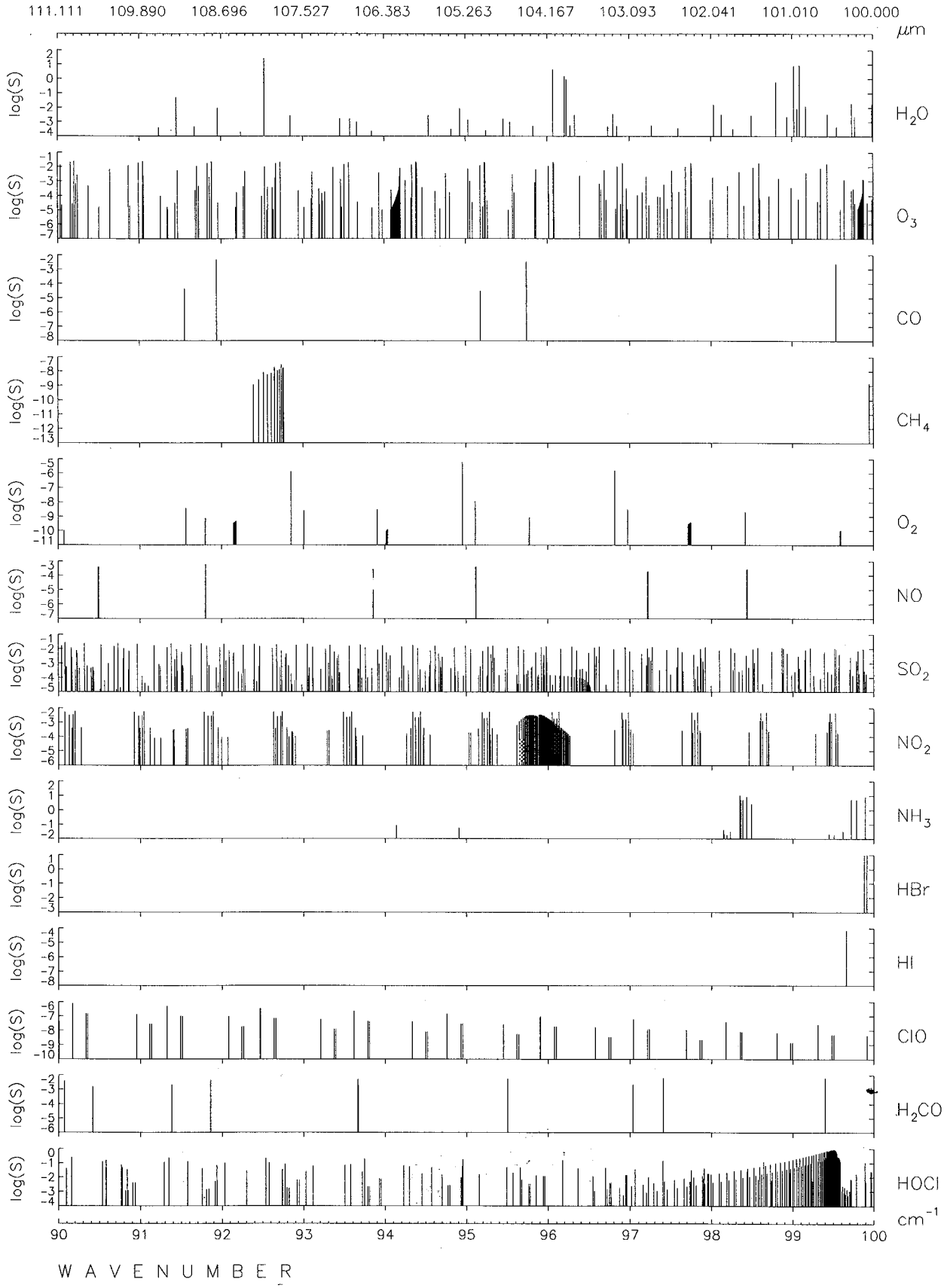


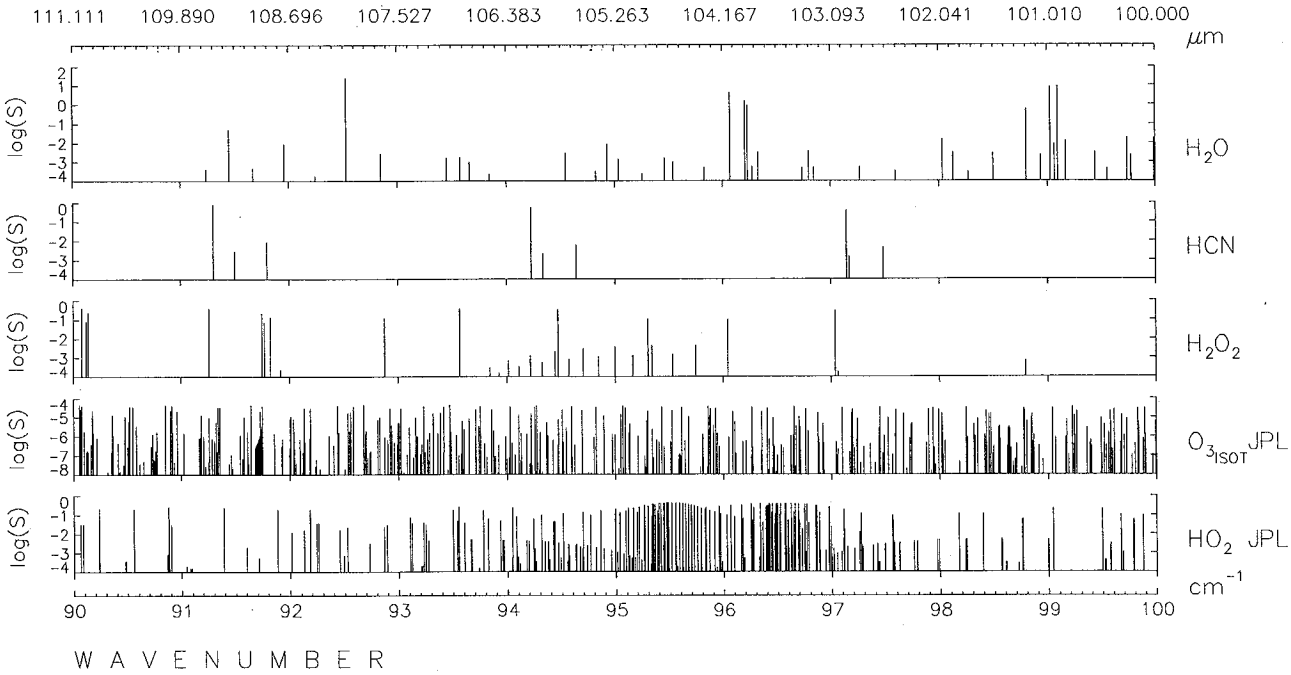
ORIGINAL PAGE IS
OF POOR QUALITY


125.000
123.457
121.951
120.482
119.048
117.647
116.279
114.943
113.636
112.360
111.111
μm
log(S)
H2O
O3
CO
CH4
O2
NO
SO2
NO2
NH3
OH
HF
HCl
HBr
HI
80
81
82
83
84
85
86
87
88
89
90
cm-1
WAVENUMBER

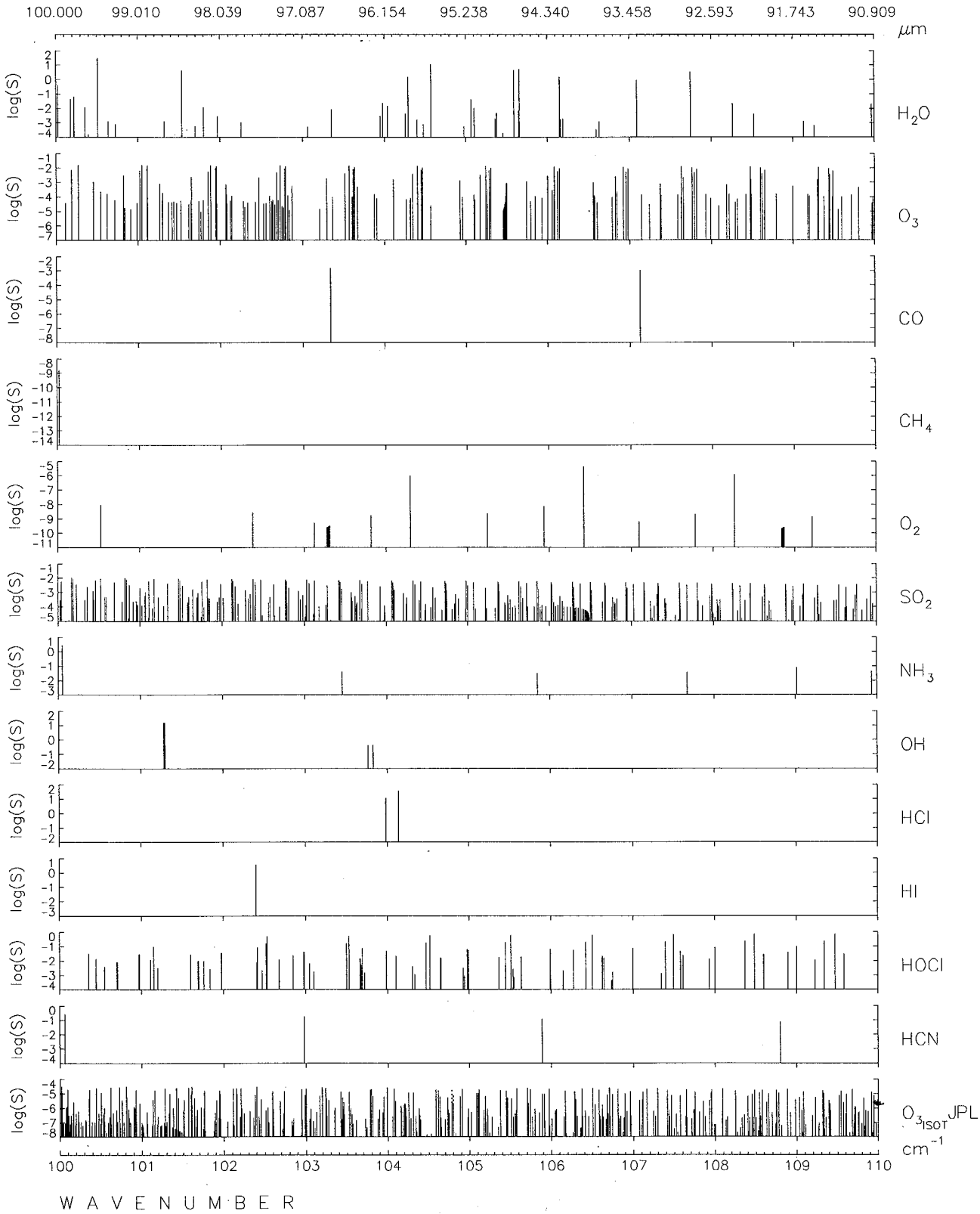


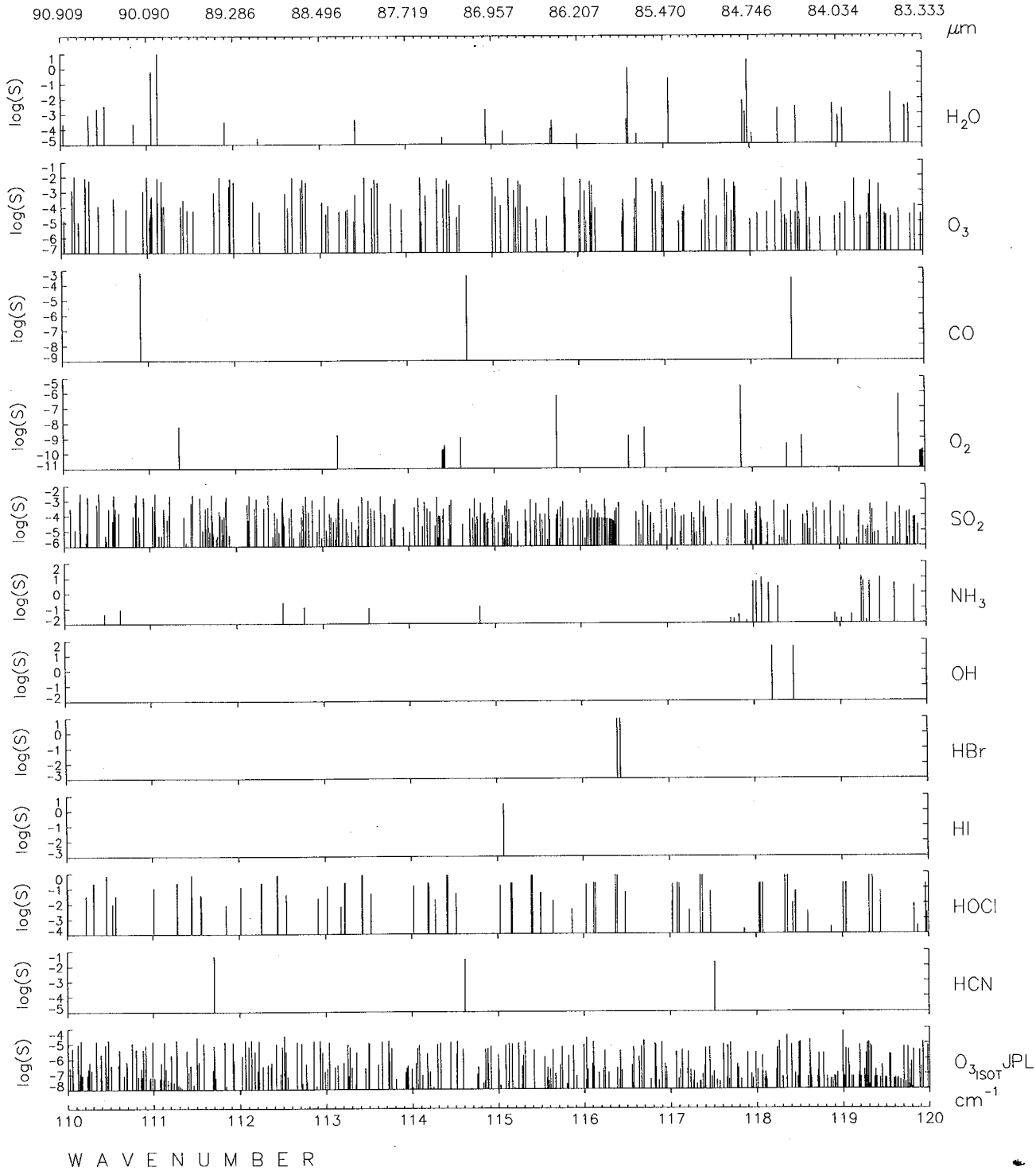
ORIGINAL PAGE IS
OF POOR QUALITY


111.111
109.890
108.696
107.527
106.383
105.263
104.167
103.093
102.041
101.010
100.000
μm
log(S)
H2O
O3
CO
CH4
O2
NO
SO2
NO2
NH3
HBr
HI
ClO
H2CO
HOCl
cm-1
90
91
92
93
94
95
96
97
98
99
100
WAVENUMBER

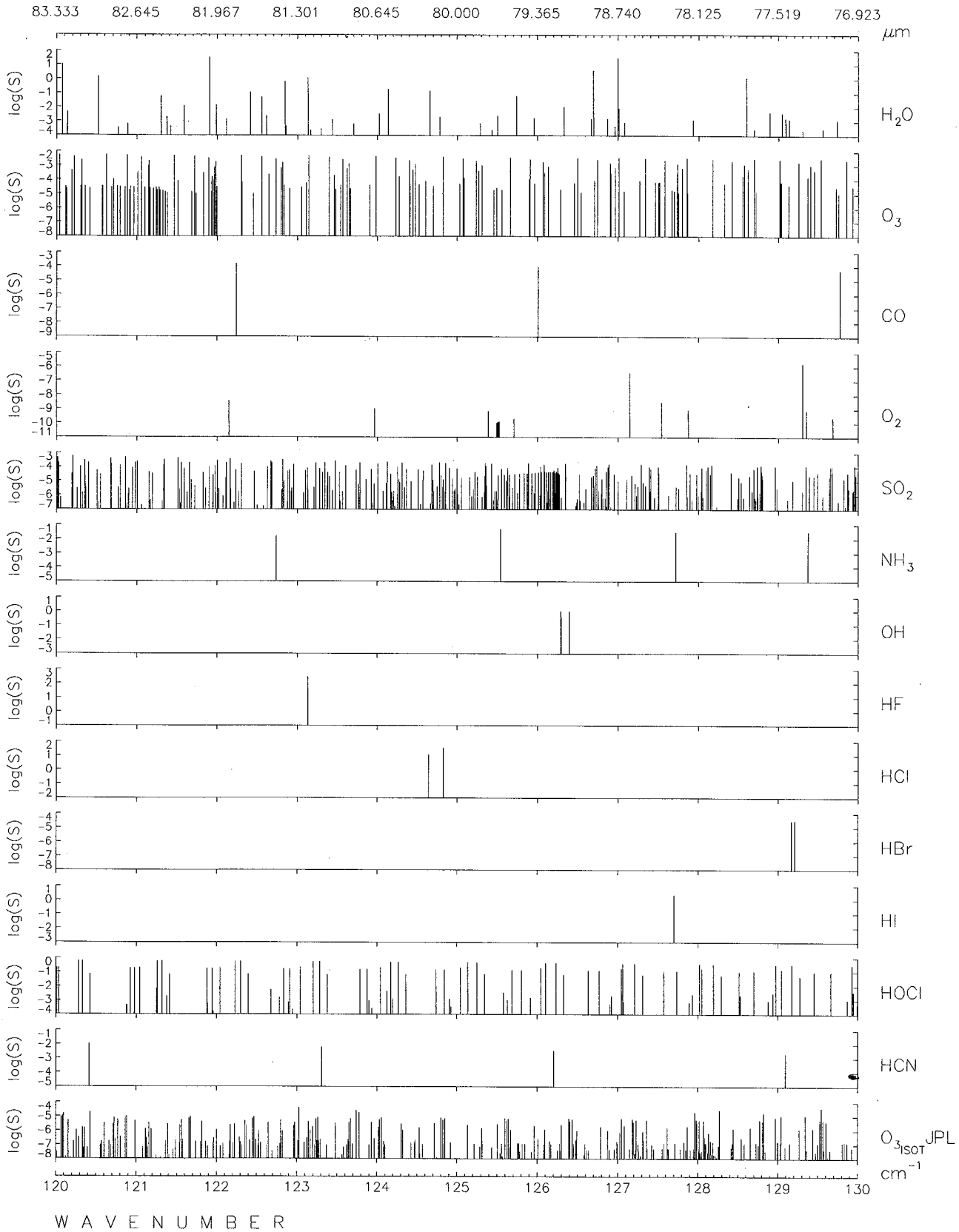


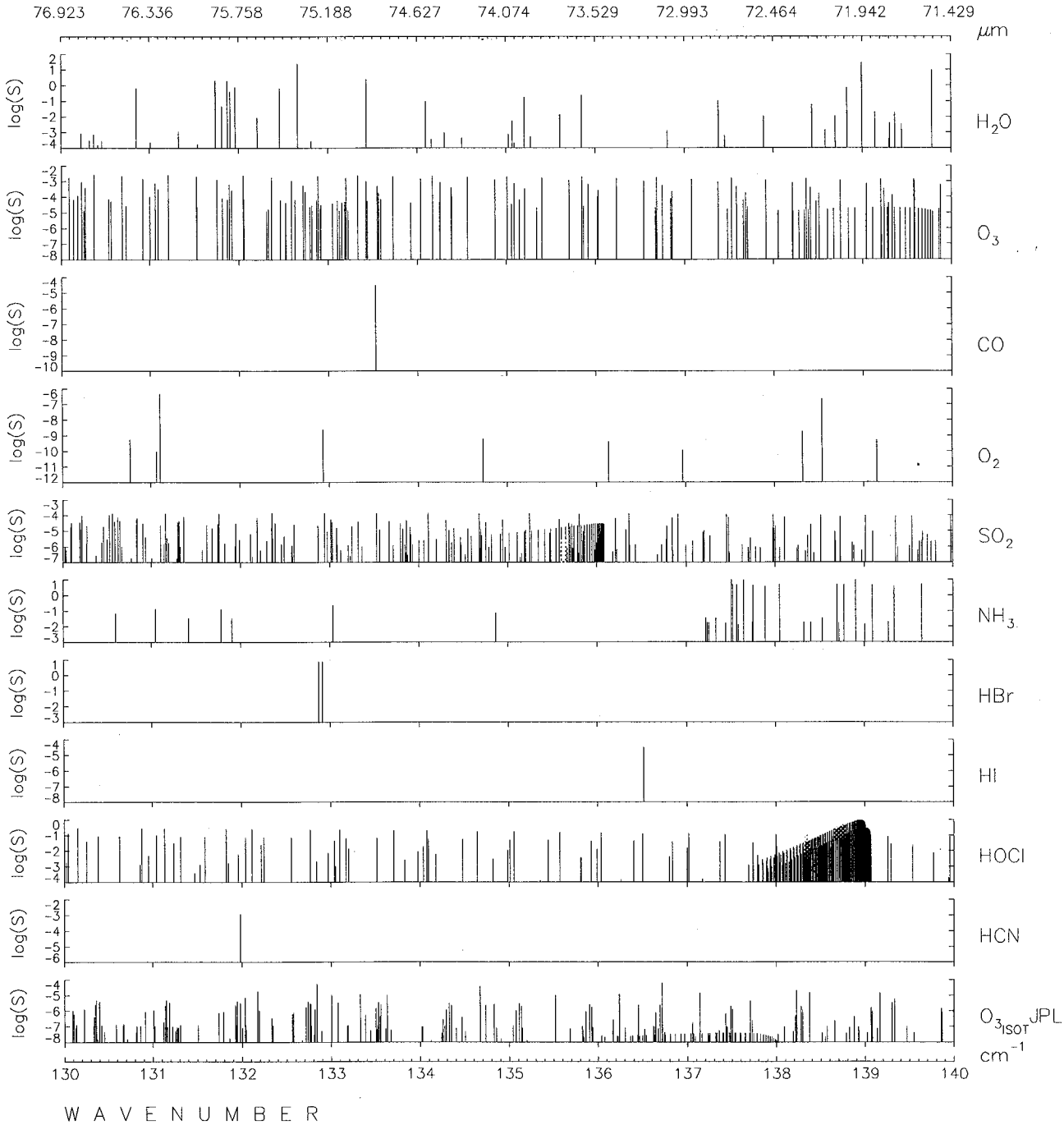
ORIGINAL PAGE IS
OF POOR QUALITY


100.000
99.010
98.039
97.087
96.154
95.238
94.340
93.458
92.593
91.743
90.909
μm
log(S)
H2O
O3
CO
CH4
O2
SO2
NH3
OH
HCl
HI
HOCl
HCN
O3ISOT JPL
cm-1
100
101
102
103
104
105
106
107
108
109
110
WAVENUMBER

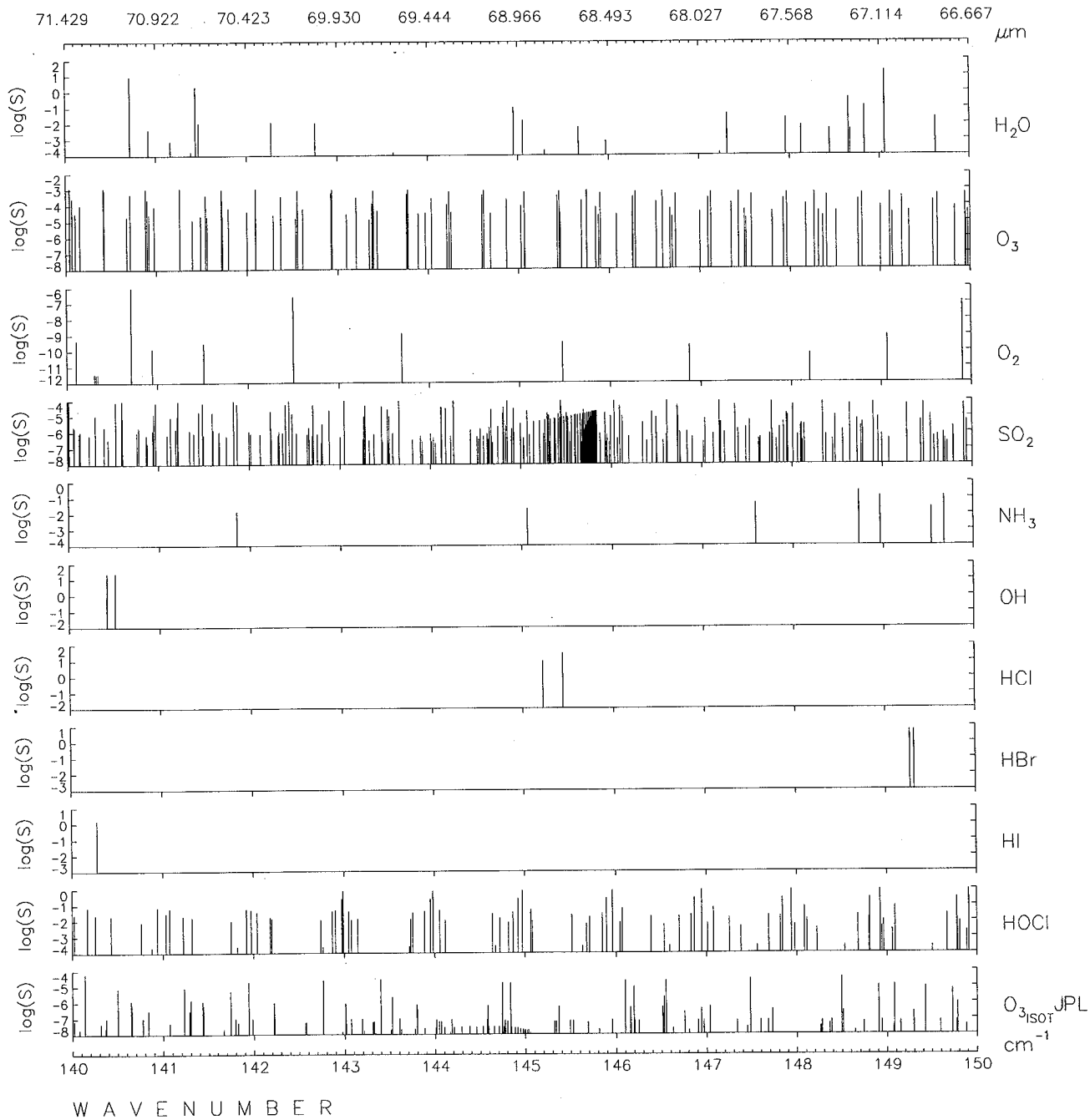


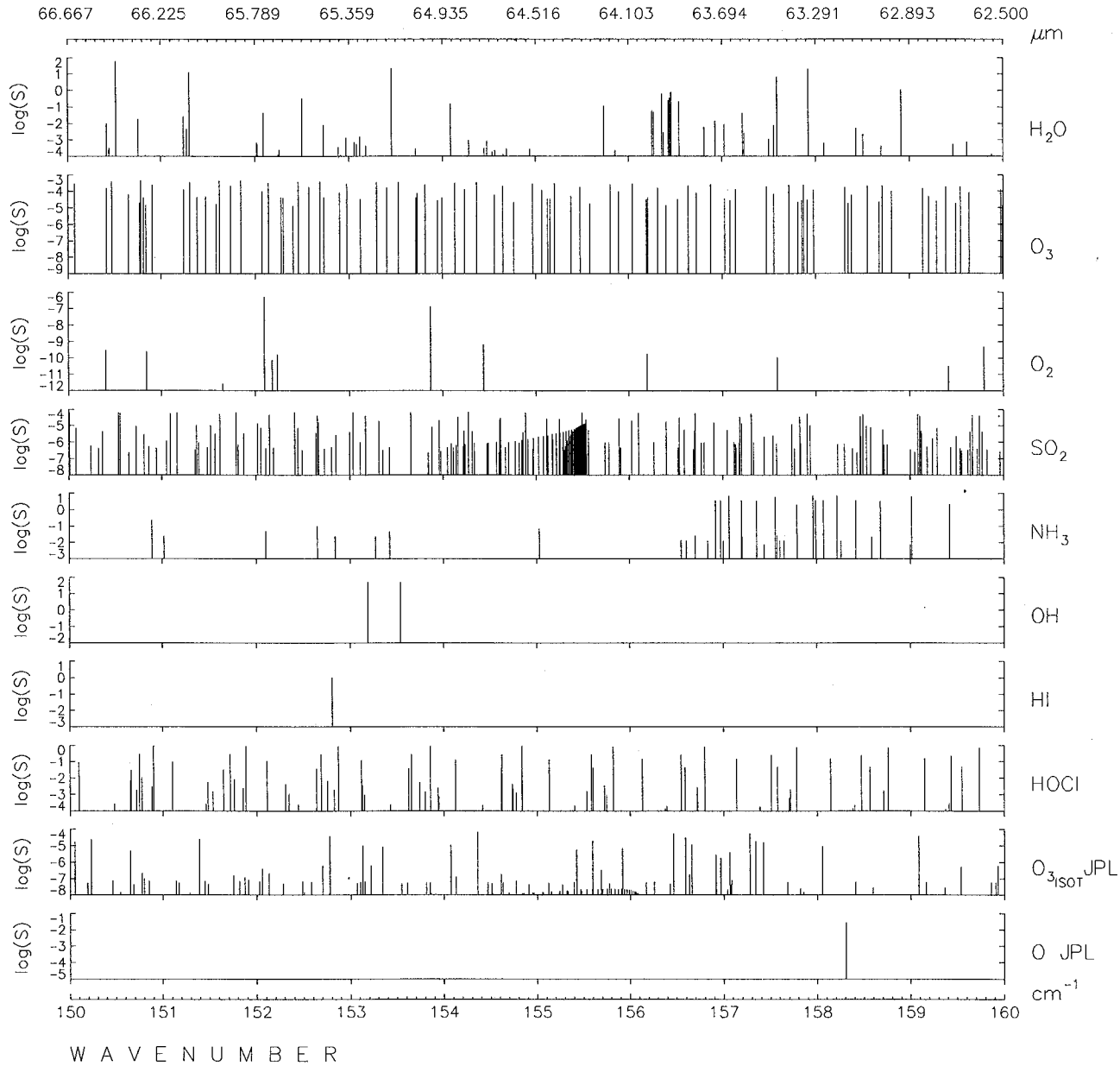
ORIGINAL PAGE IS
OF POOR QUALITY


83.333
82.645
81.967
81.301
80.645
80.000
79.365
78.740
78.125
77.519
76.923
μm
log(S)
H2O
O3
CO
O2
SO2
NH3
OH
HF
HCl
HBr
HI
HOCl
HCN
O3ISOT JPL
cm-1
120
121
122
123
124
125
126
127
128
129
130
WAVENUMBER

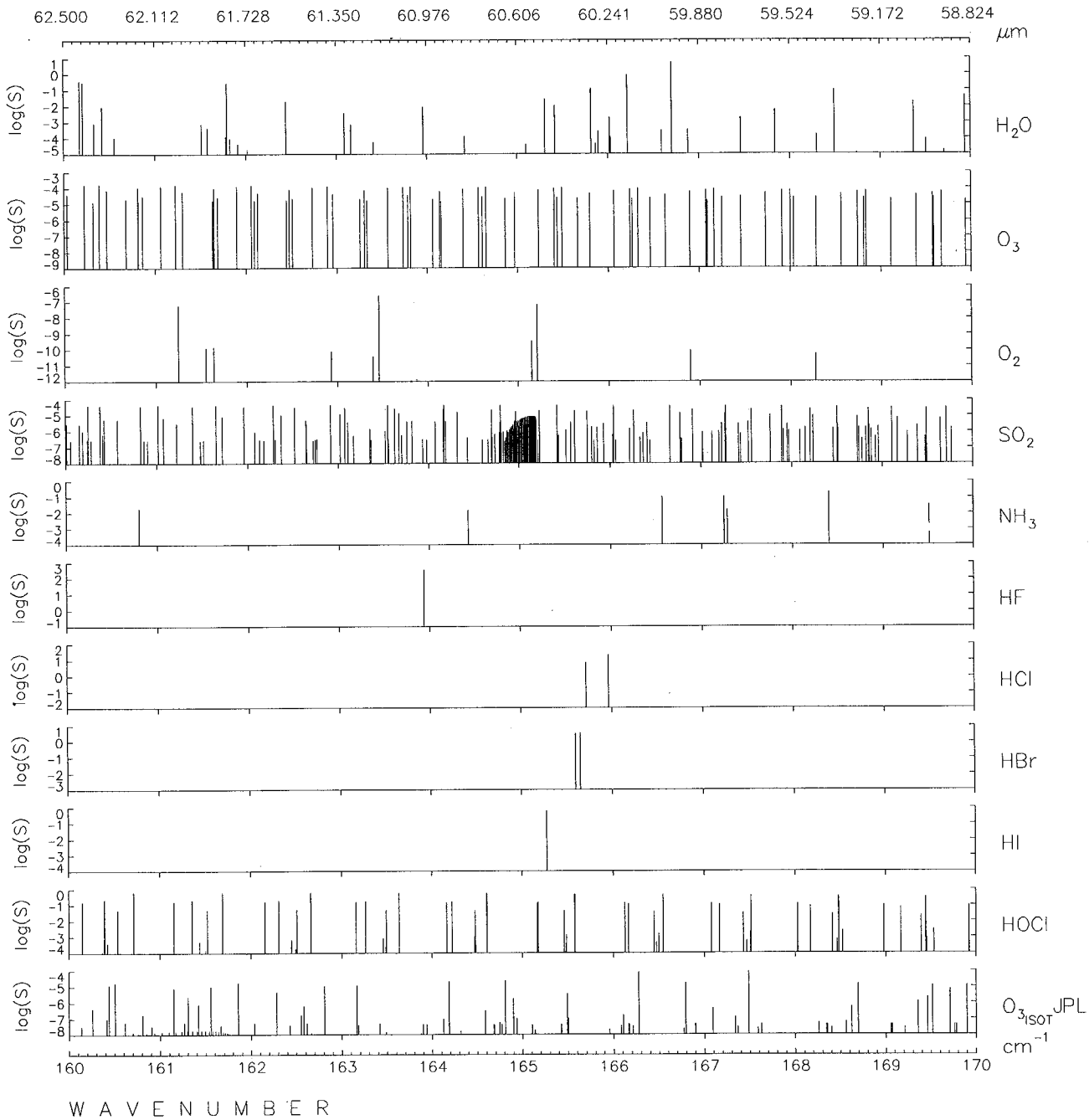


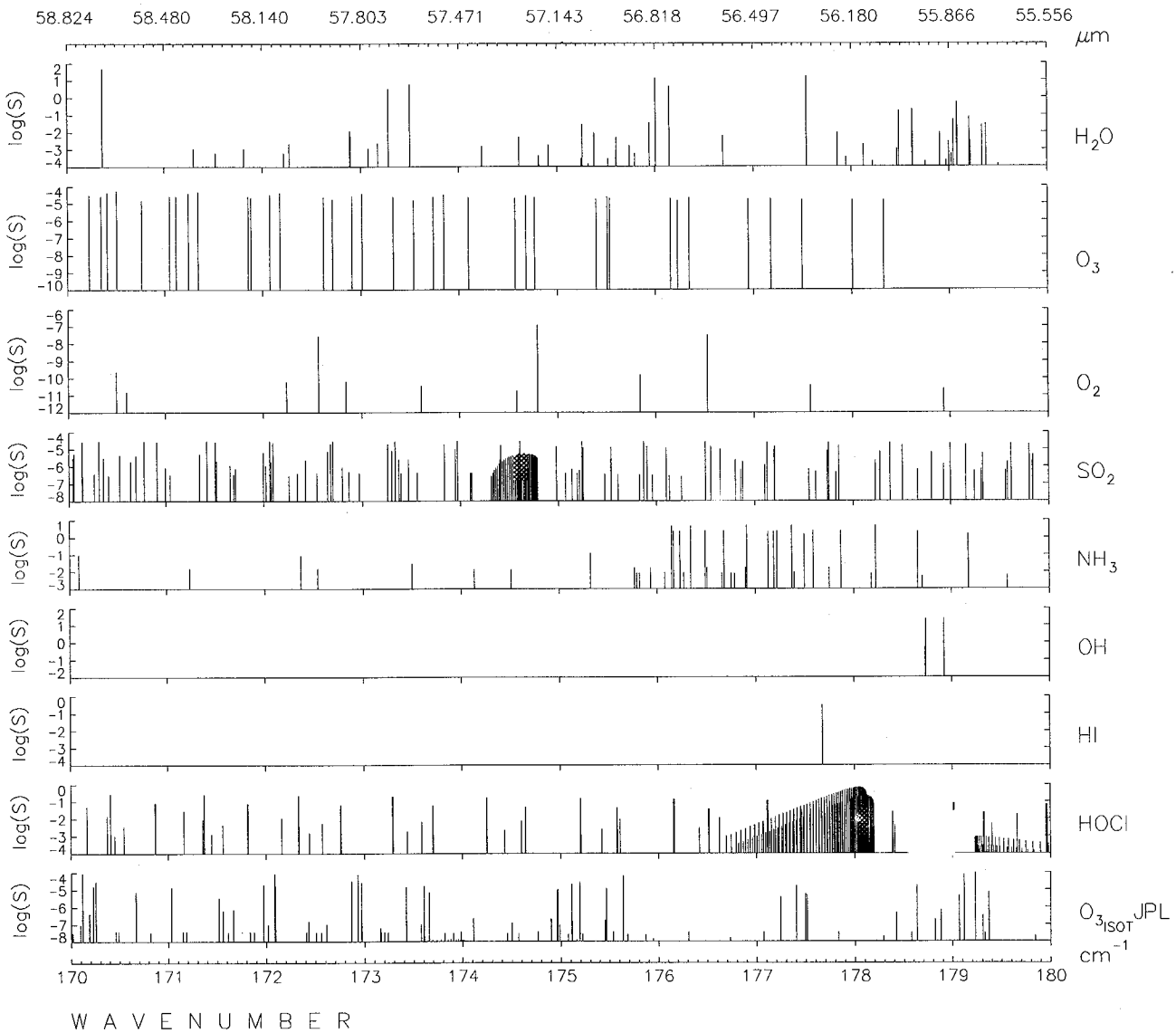
ORIGINAL PAGE IS
OF POOR QUALITY


71.429
70.922
70.423
69.930
69.444
68.966
68.493
68.027
67.568
67.114
66.667
μm
log(S)
H2O
O3
O2
SO2
NH3
OH
HCl
HBr
HI
HOCl
O3ISOT JPL
cm-1
140
141
142
143
144
145
146
147
148
149
150
WAVENUMBER

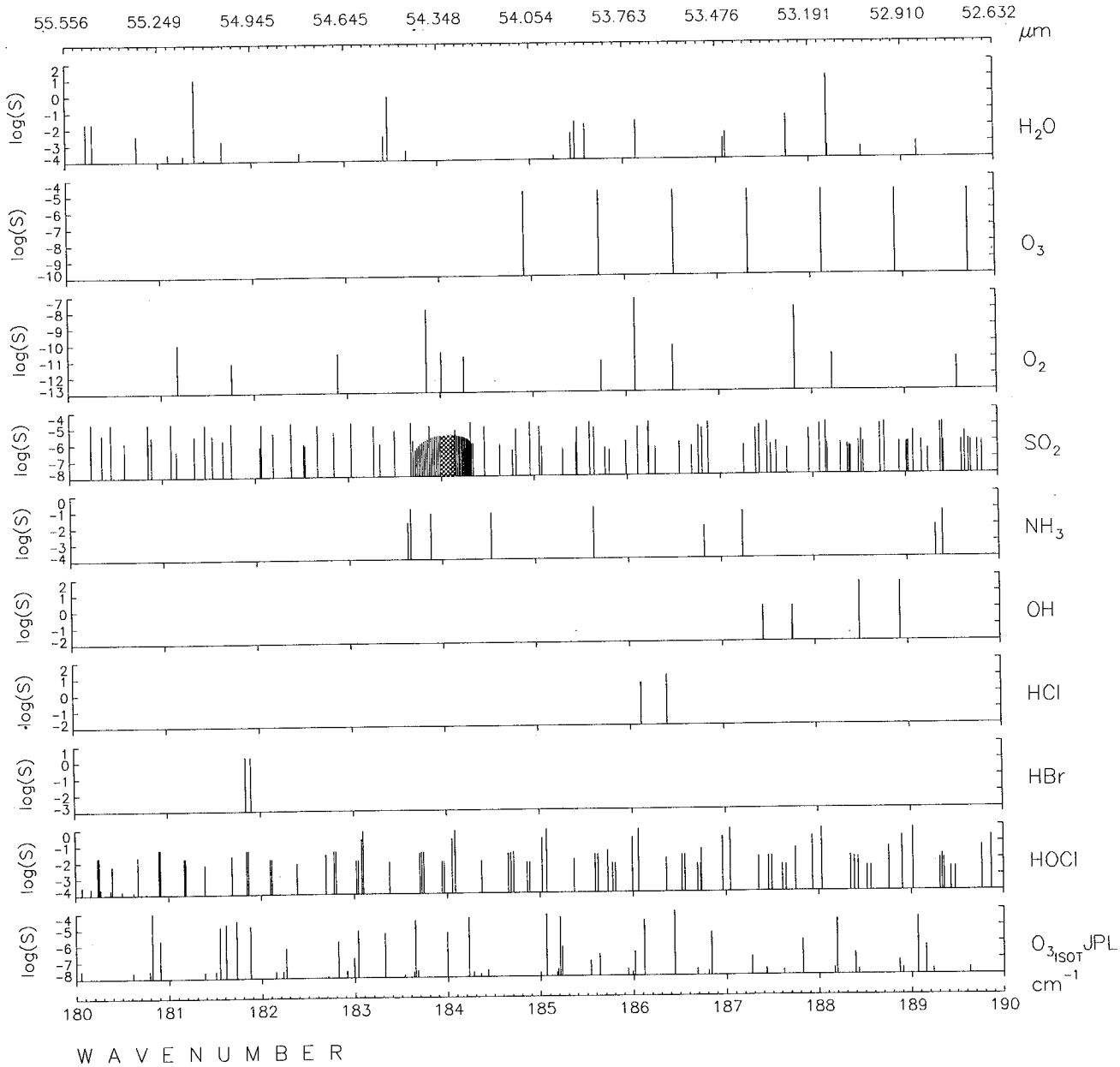


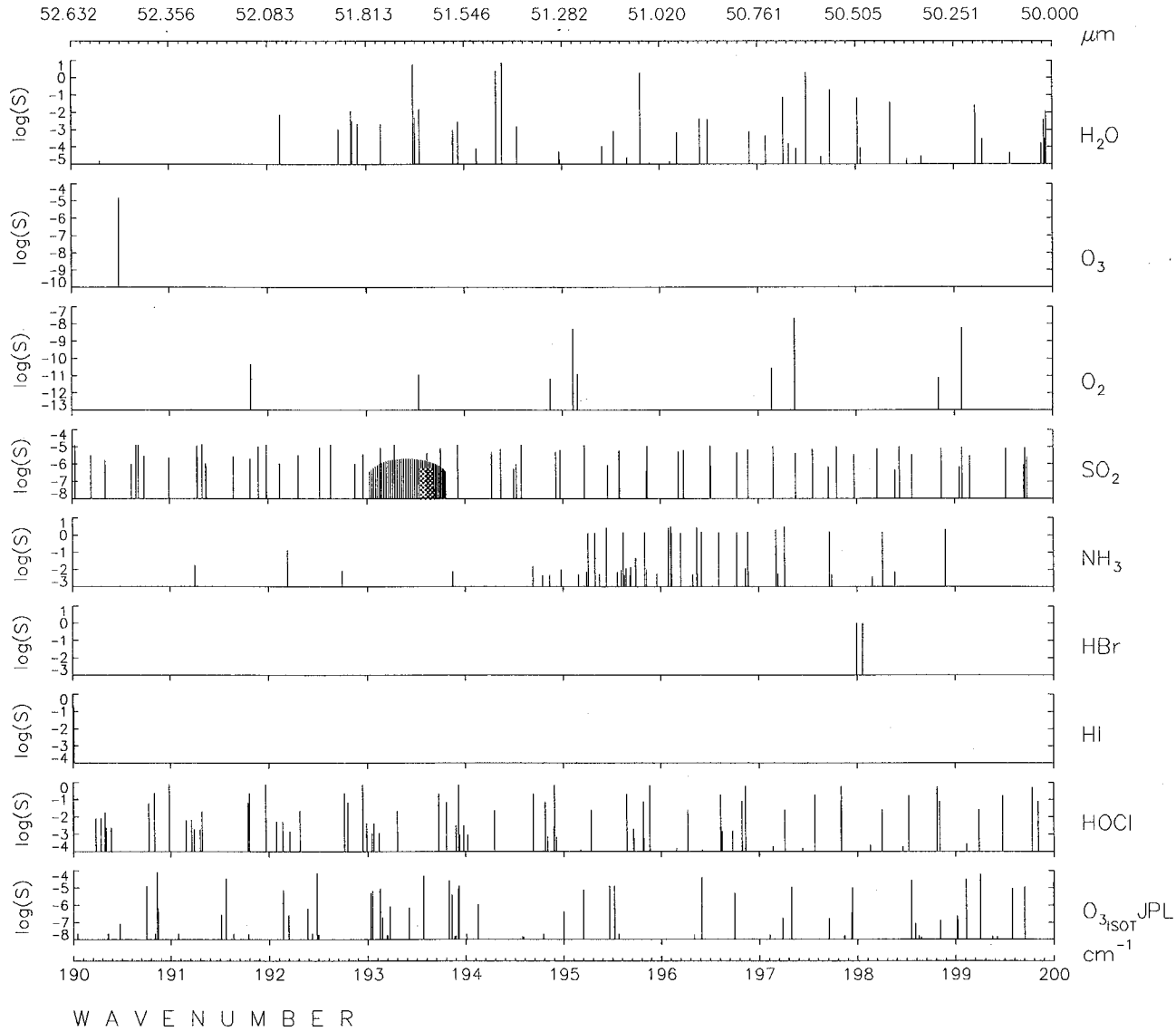
ORIGINAL PAGE IS
OF POOR QUALITY


62.500
62.112
61.728
61.350
60.976
60.606
60.241
59.880
59.524
59.172
58.824
μm
log(S)
H2O
O3
O2
SO2
NH3
HF
HCl
HBr
HI
HOCl
O3ISOT JPL
cm-1
160
161
162
163
164
165
166
167
168
169
170
WAVENUMBER

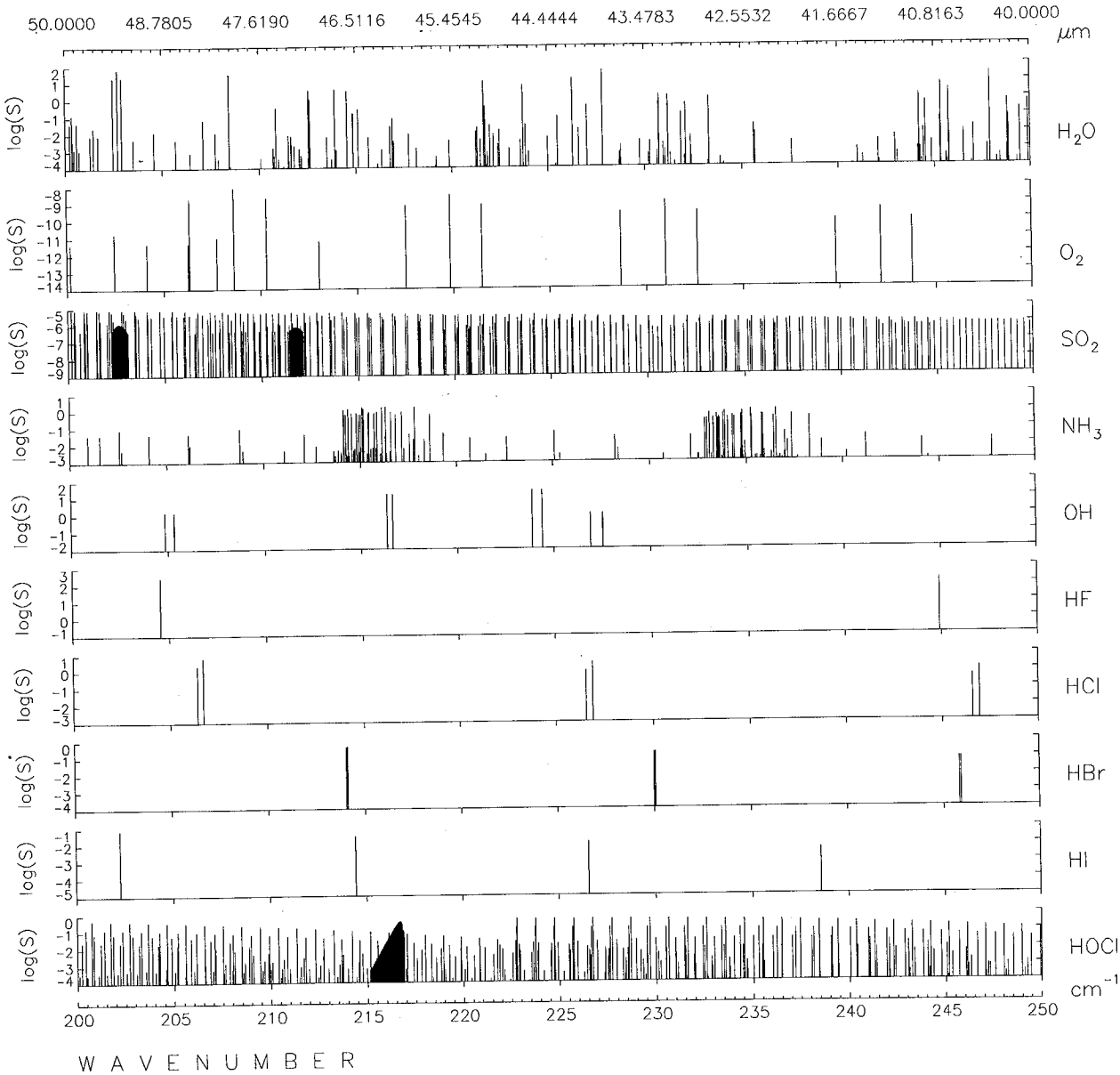


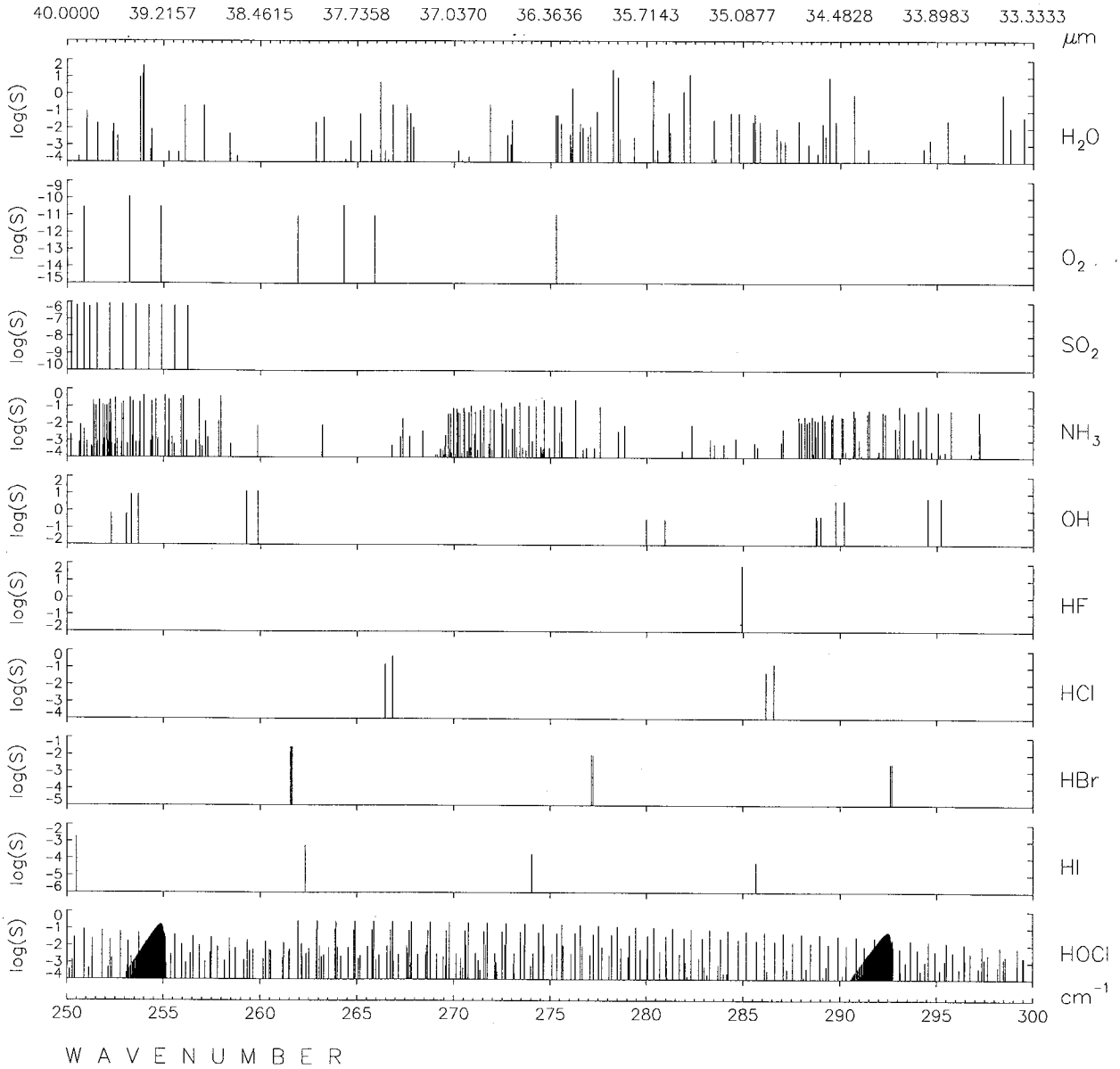
ORIGINAL PAGE IS
OF POOR QUALITY


55.556
55.249
54.945
54.645
54.348
54.054
53.763
53.476
53.191
52.910
52.632
μm
log(S)
H2O
O3
O2
SO2
NH3
OH
HCl
HBr
HOCl
O3ISOT JPL
cm-1
180
181
182
183
184
185
186
187
188
189
190
WAVENUMBER

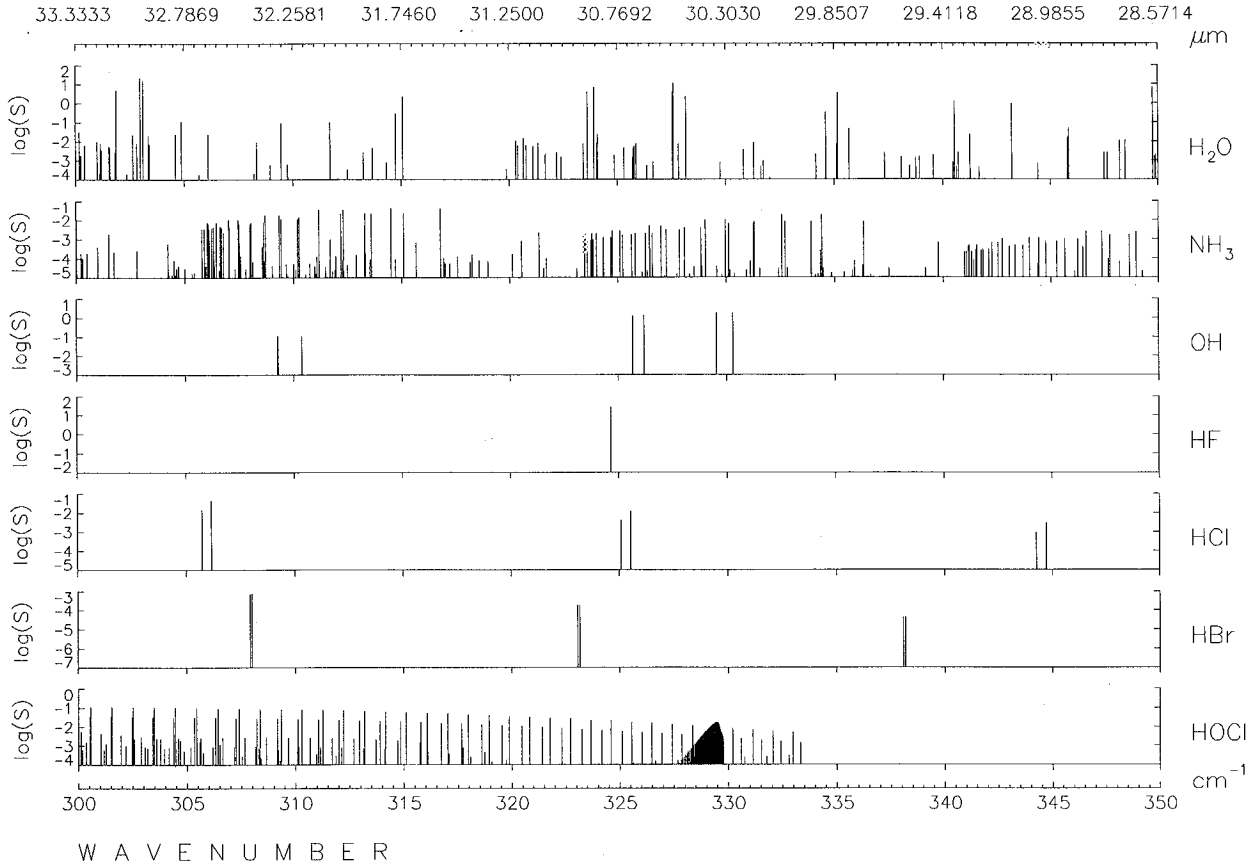


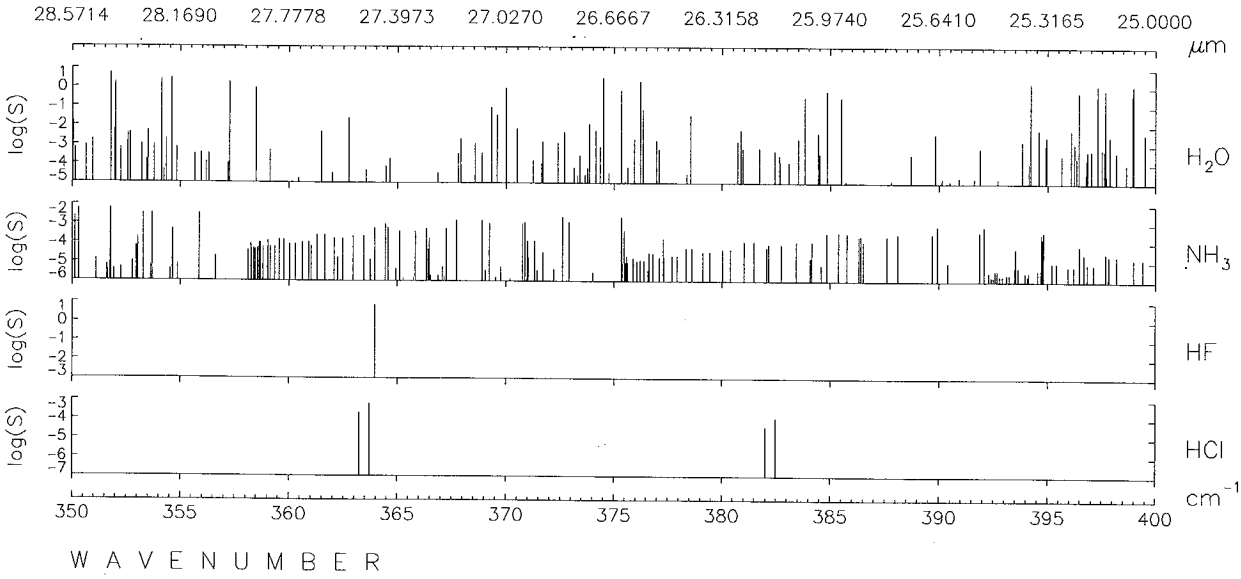
ORIGINAL PAGE IS
OF POOR QUALITY


50.0000
48.7805
47.6190
46.5116
45.4545
44.4444
43.4783
42.5532
41.6667
40.8163
40.0000
μm
log(S)
H2O
O2
SO2
NH3
OH
HF
HCl
HBr
HI
HOCl
cm-1
200
205
210
215
220
225
230
235
240
245
250
WAVENUMBER

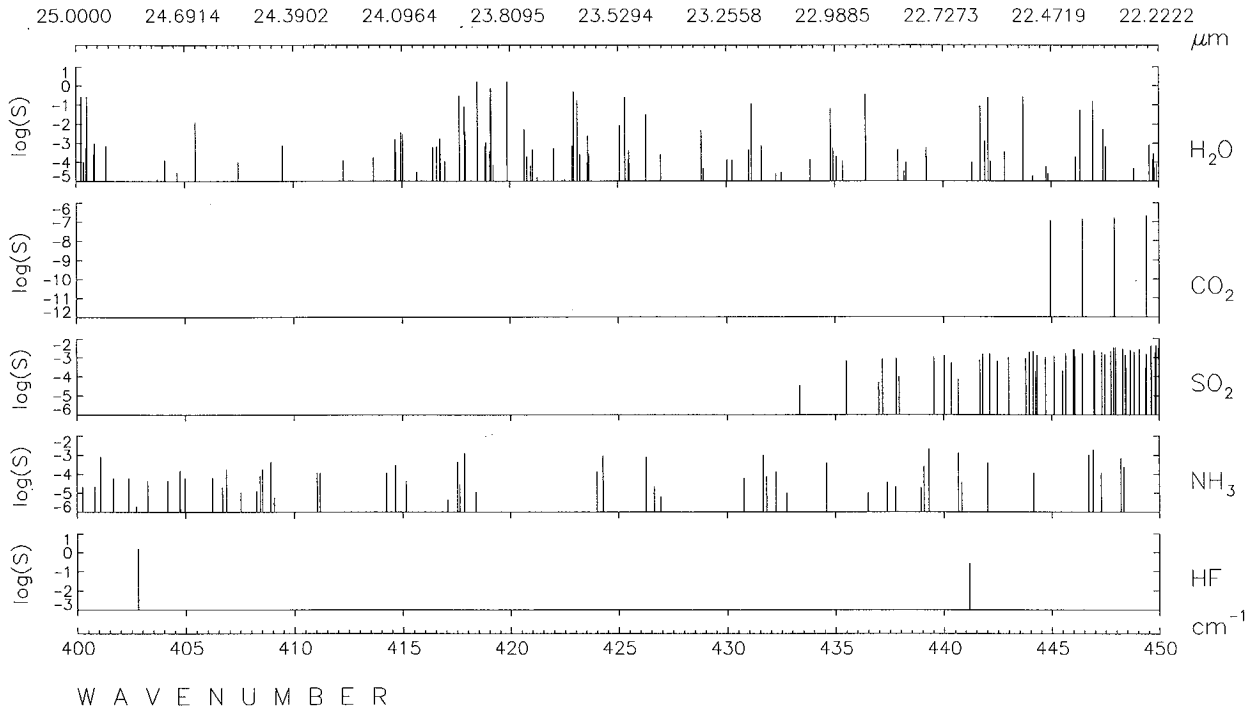


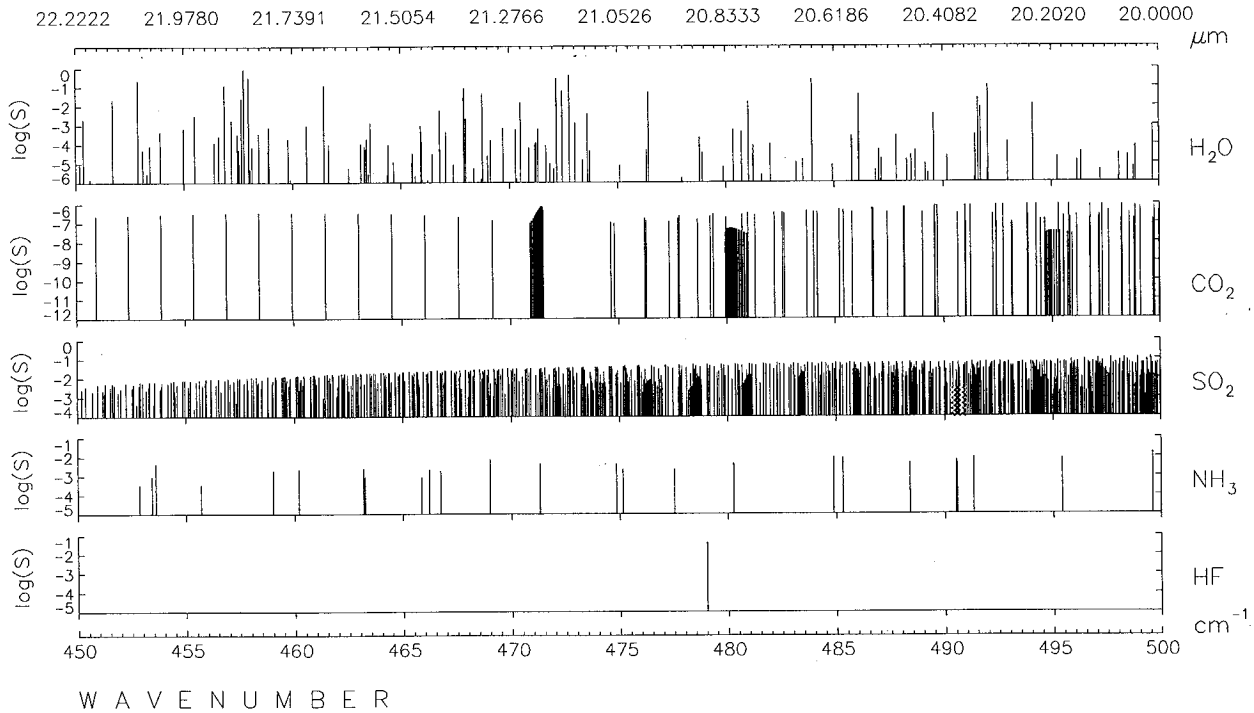
ORIGINAL PAGE IS
OF POOR QUALITY


33.3333
32.7869
32.2581
31.7460
31.2500
30.7692
30.3030
29.8507
29.4118
28.9855
28.5714
μm
log(S)
H2O
NH3
OH
HF
HCl
HBr
HOCl
cm-1
300
305
310
315
320
325
330
335
340
345
350
WAVENUMBER

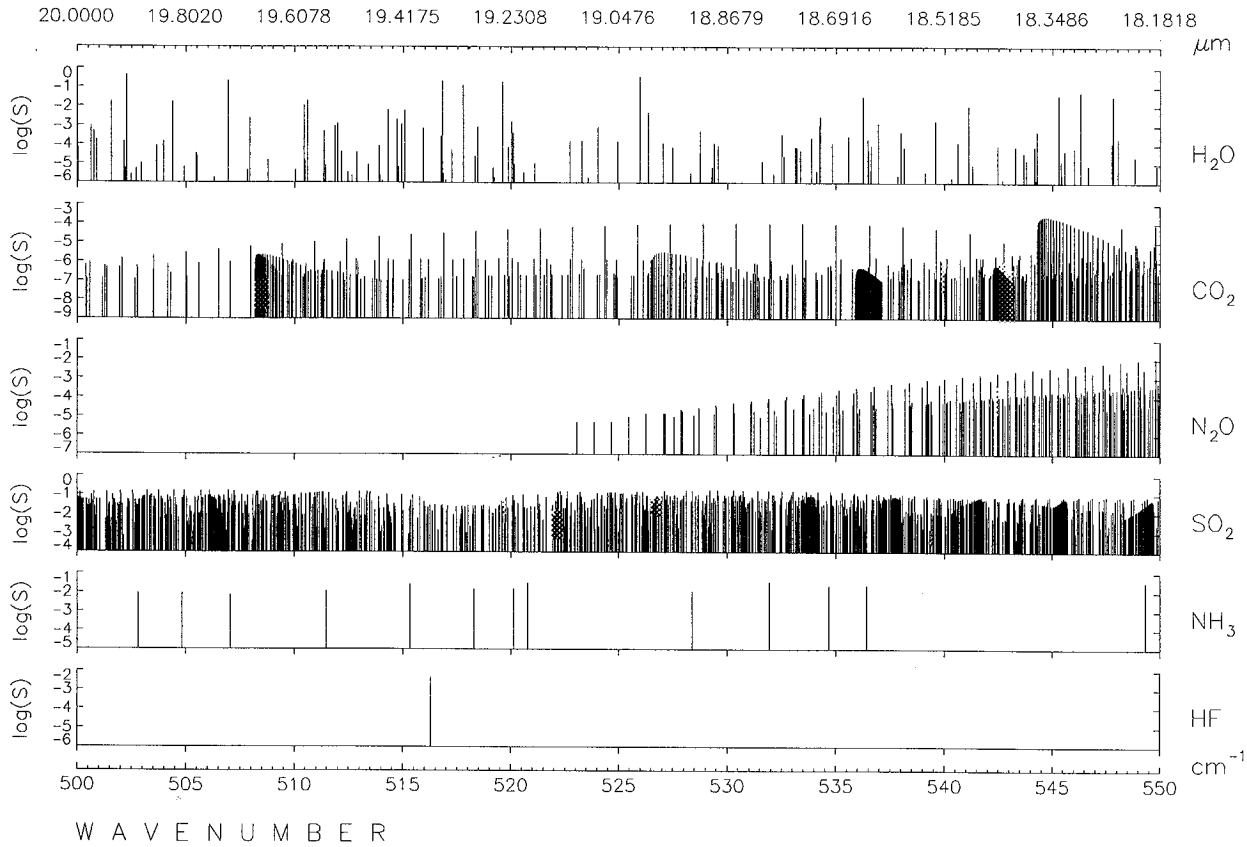


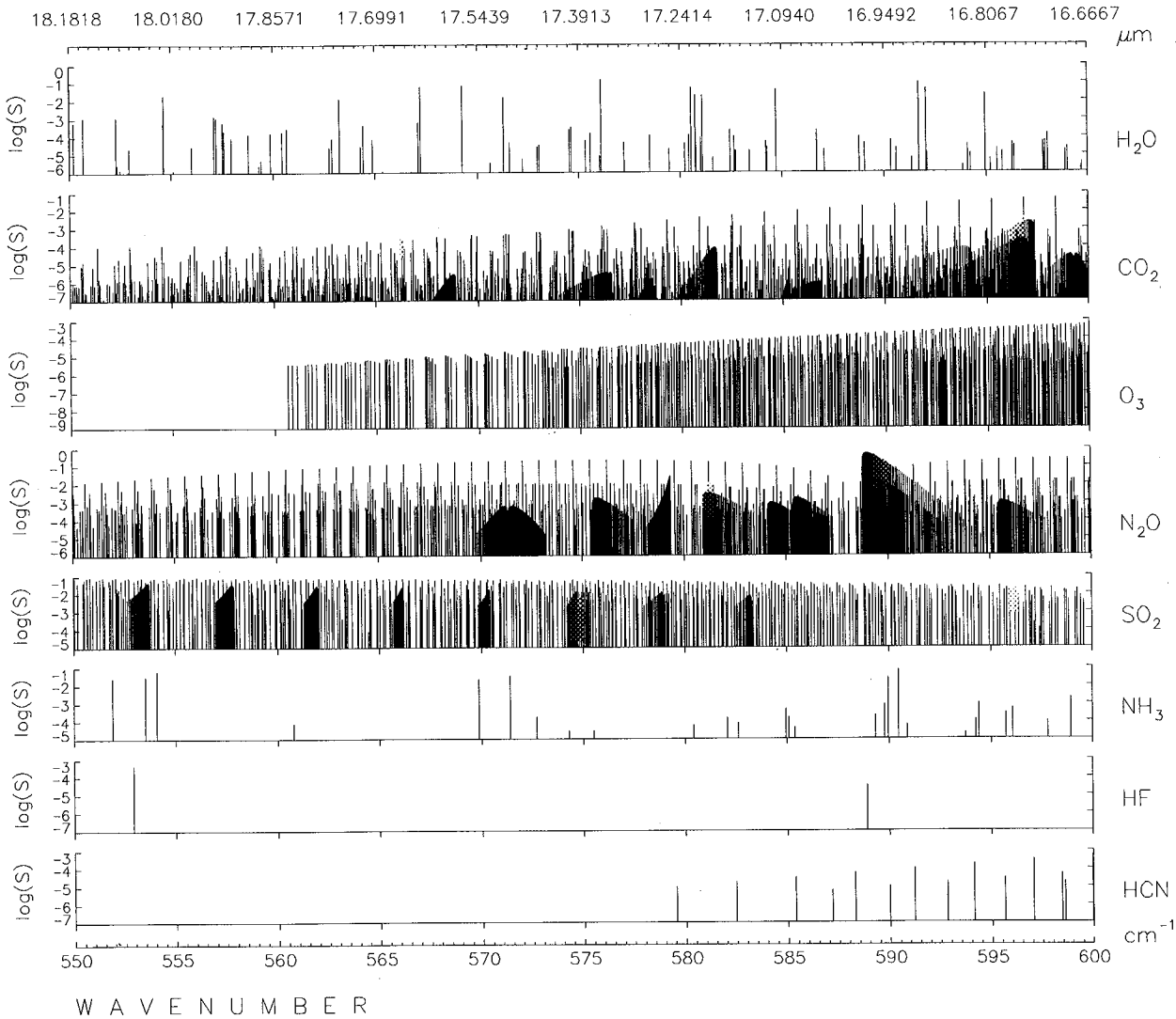
ORIGINAL PAGE IS
OF POOR QUALITY


25.0000
24.6914
24.3902
24.0964
23.8095
23.5294
23.2558
22.9885
22.7273
22.4719
22.2222
μm
log(S)
H2O
CO2
SO2
NH3
HF
cm-1
400
405
410
415
420
425
430
435
440
445
450
WAVENUMBER

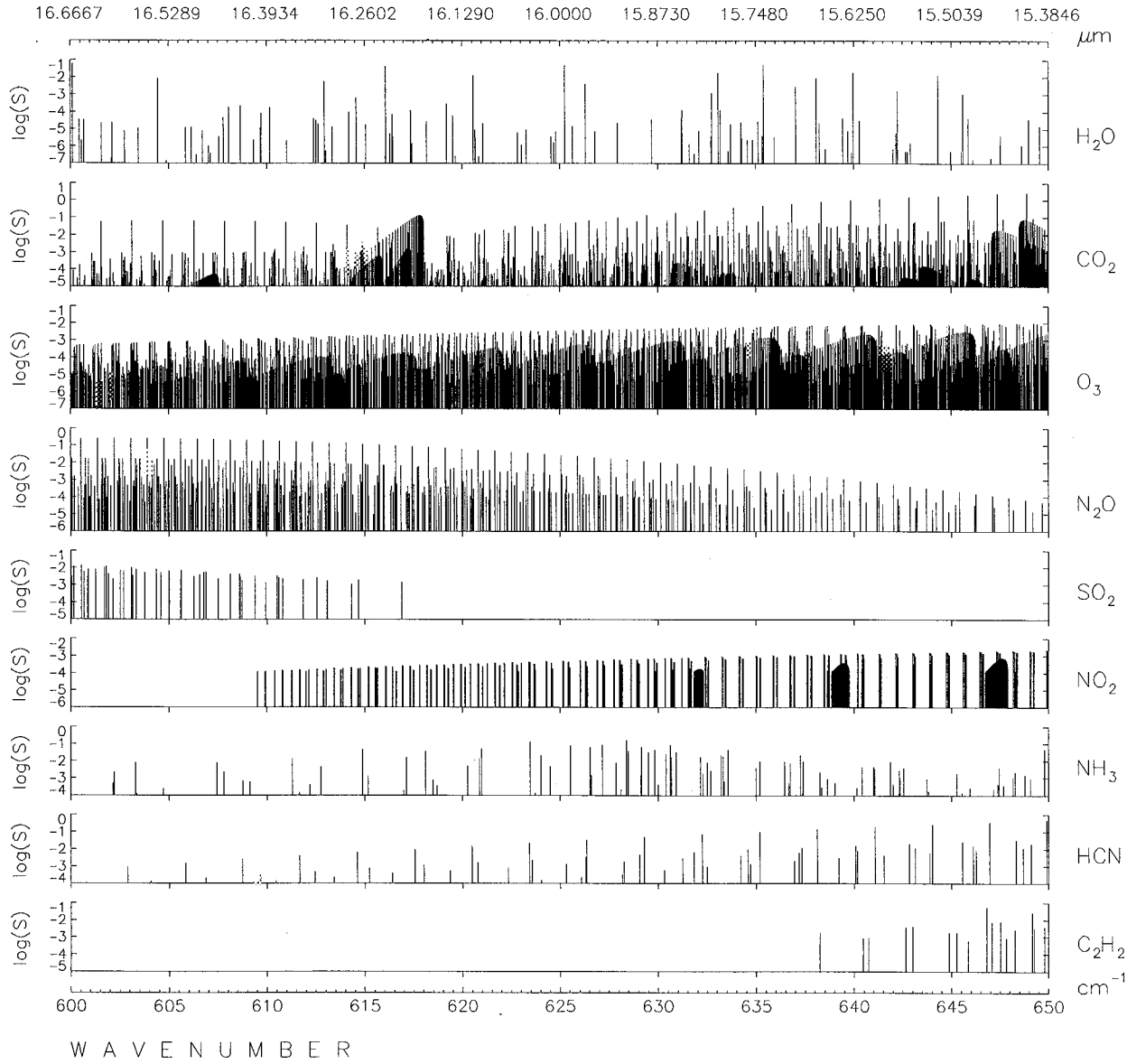


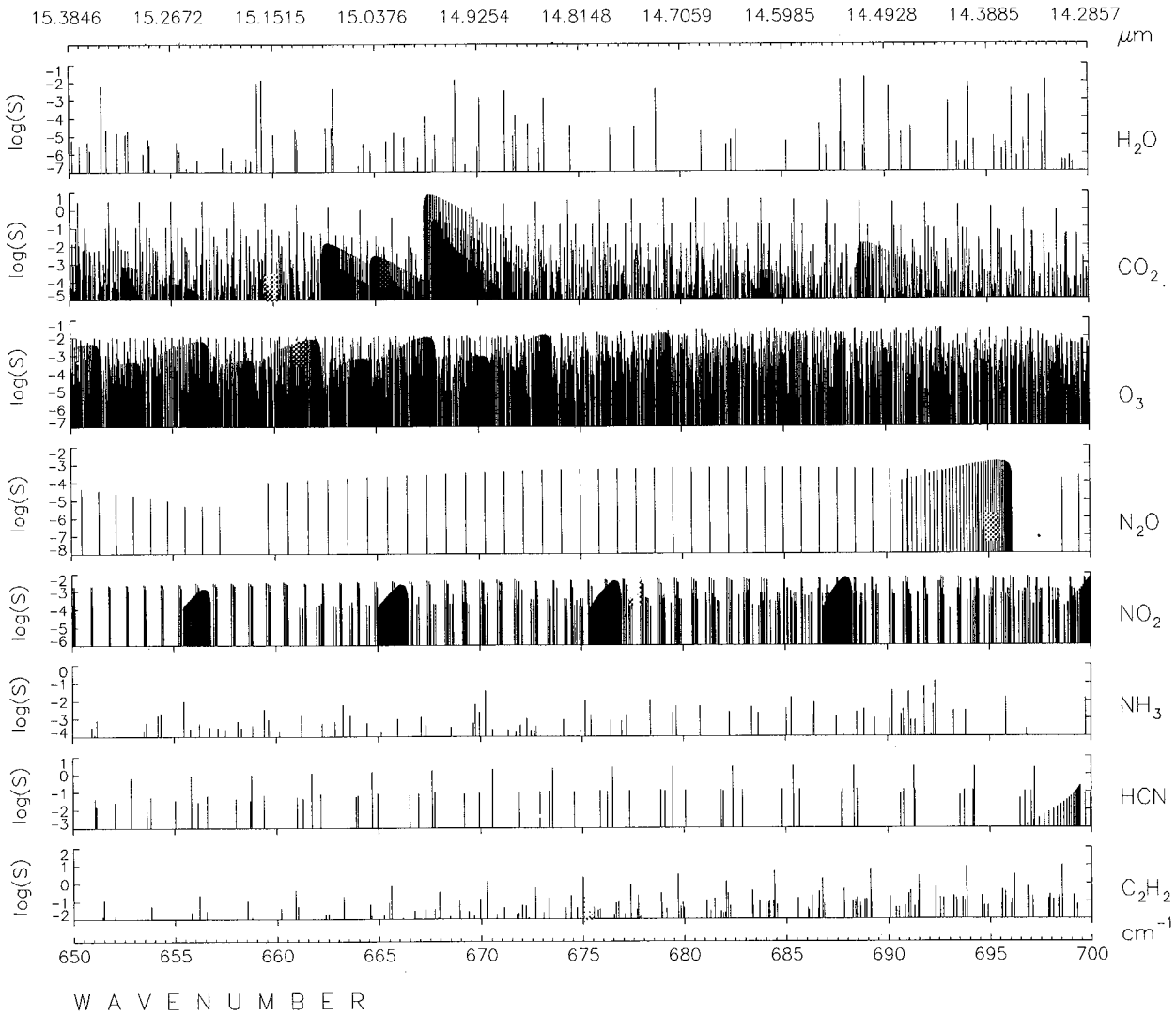
ORIGINAL PAGE IS
OF POOR QUALITY


20.0000
19.8020
19.6078
19.4175
19.2308
19.0476
18.8679
18.6916
18.5185
18.3486
18.1818
μm
log(S)
H2O
CO2
N2O
SO2
NH3
HF
cm-1
500
505
510
515
520
525
530
535
540
545
550
WAVENUMBER

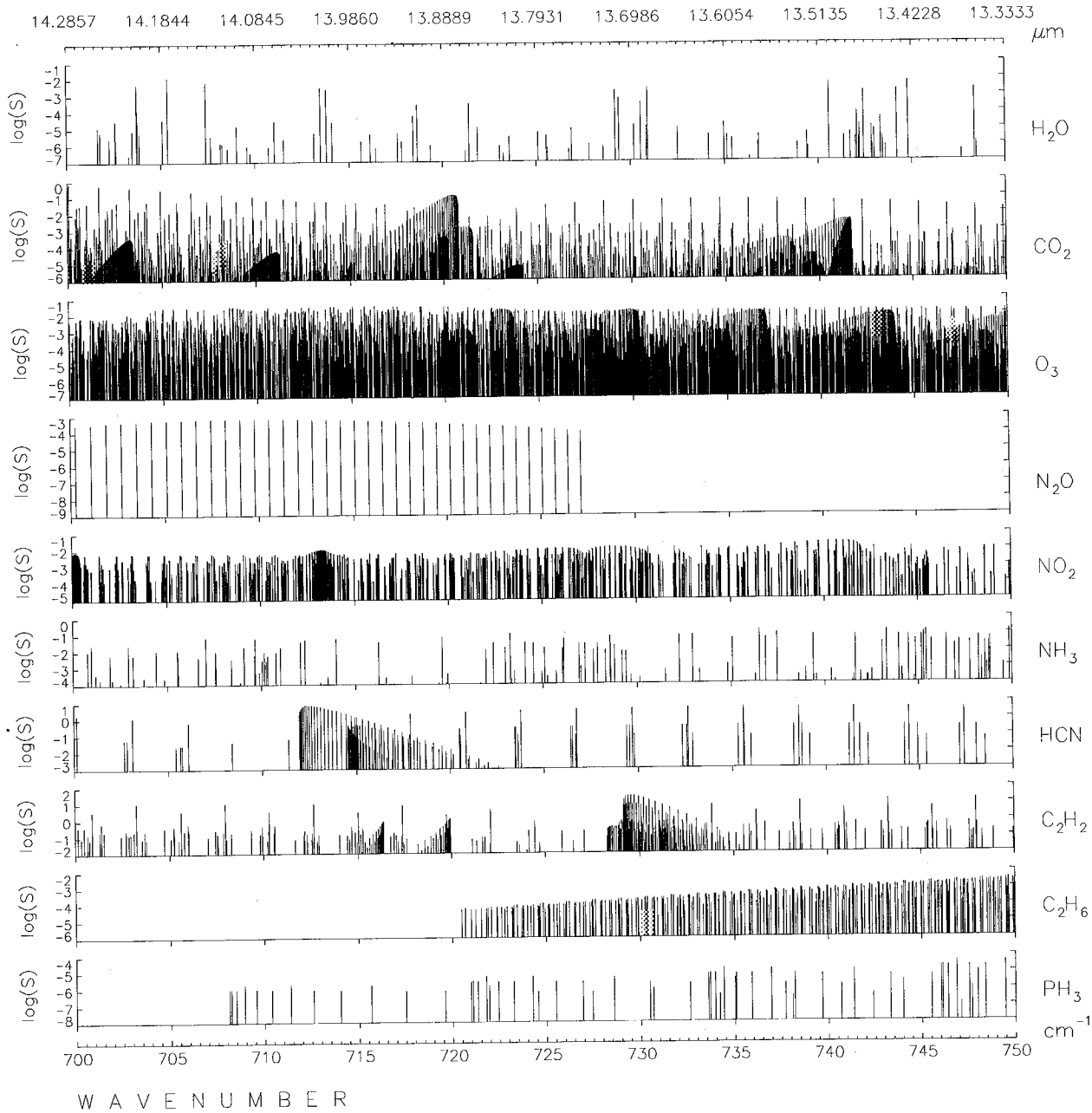


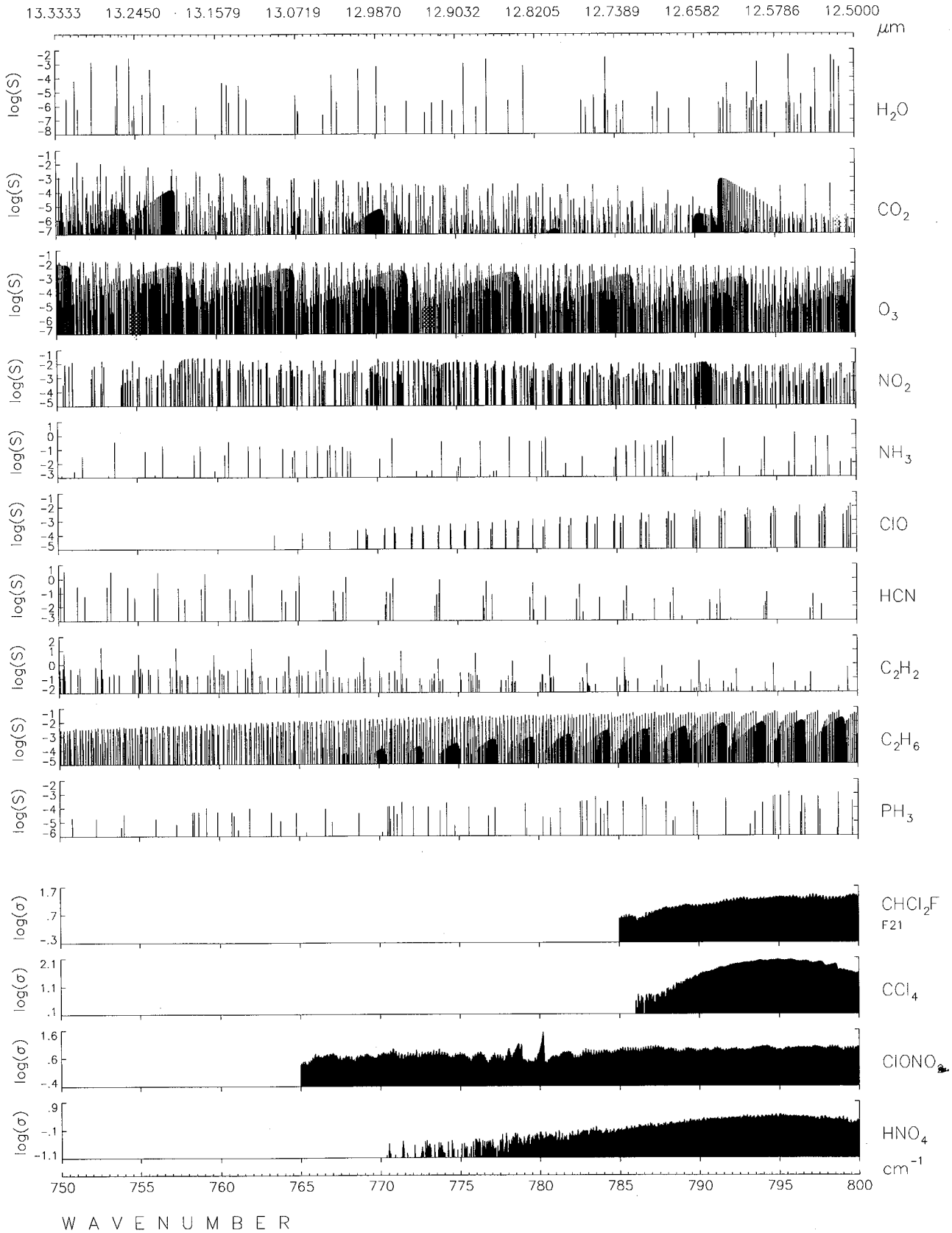
ORIGINAL PAGE IS
OF POOR QUALITY


16.6667
16.5289
16.3934
16.2602
16.1290
16.0000
15.8730
15.7480
15.6250
15.5039
15.3846
μm
log(S)
H2O
CO2
O3
N2O
SO2
NO2
NH3
HCN
C2H2
cm-1
600
605
610
615
620
625
630
635
640
645
650
WAVENUMBER

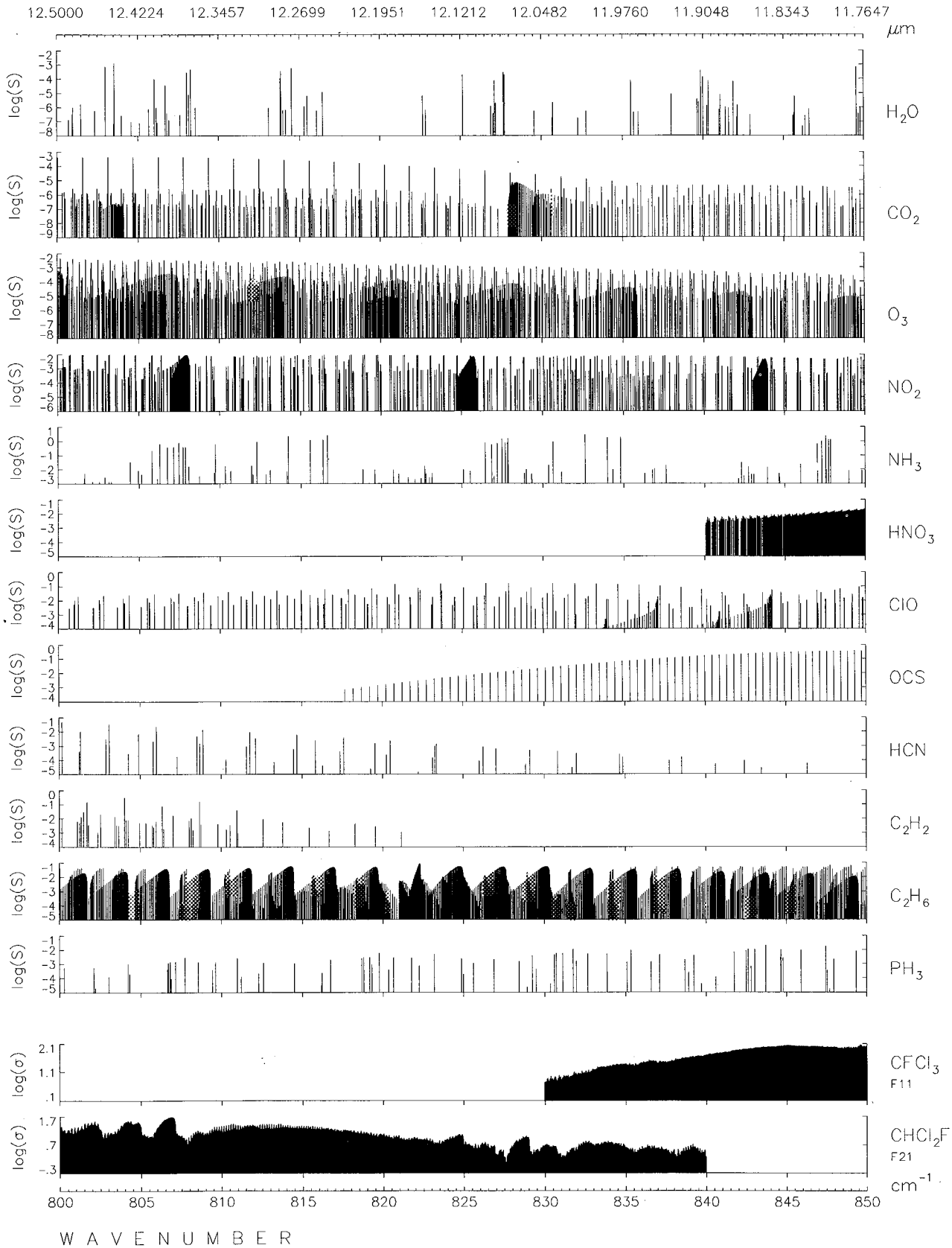


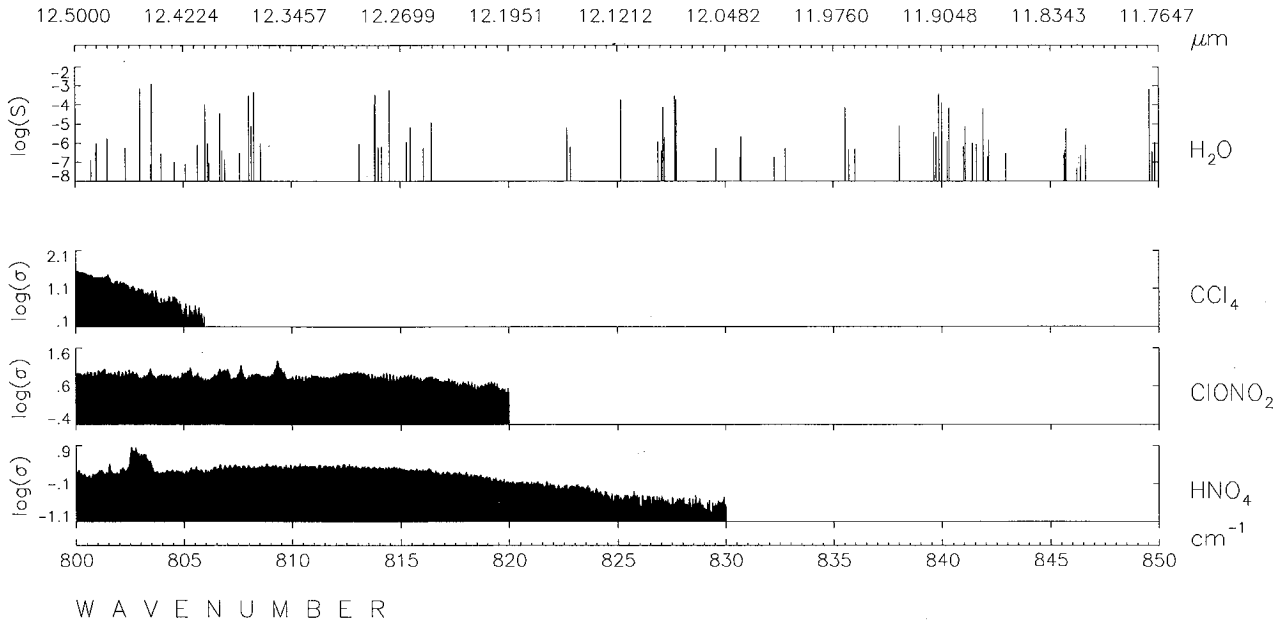
ORIGINAL PAGE IS
OF POOR QUALITY


14.2857
14.1844
14.0845
13.9860
13.8889
13.7931
13.6986
13.6054
13.5135
13.4228
13.3333
μm
log(S)
H2O
CO2
O3
N2O
NO2
NH3
HCN
C2H2
C2H6
PH3
cm-1
700
705
710
715
720
725
730
735
740
745
750
WAVENUMBER

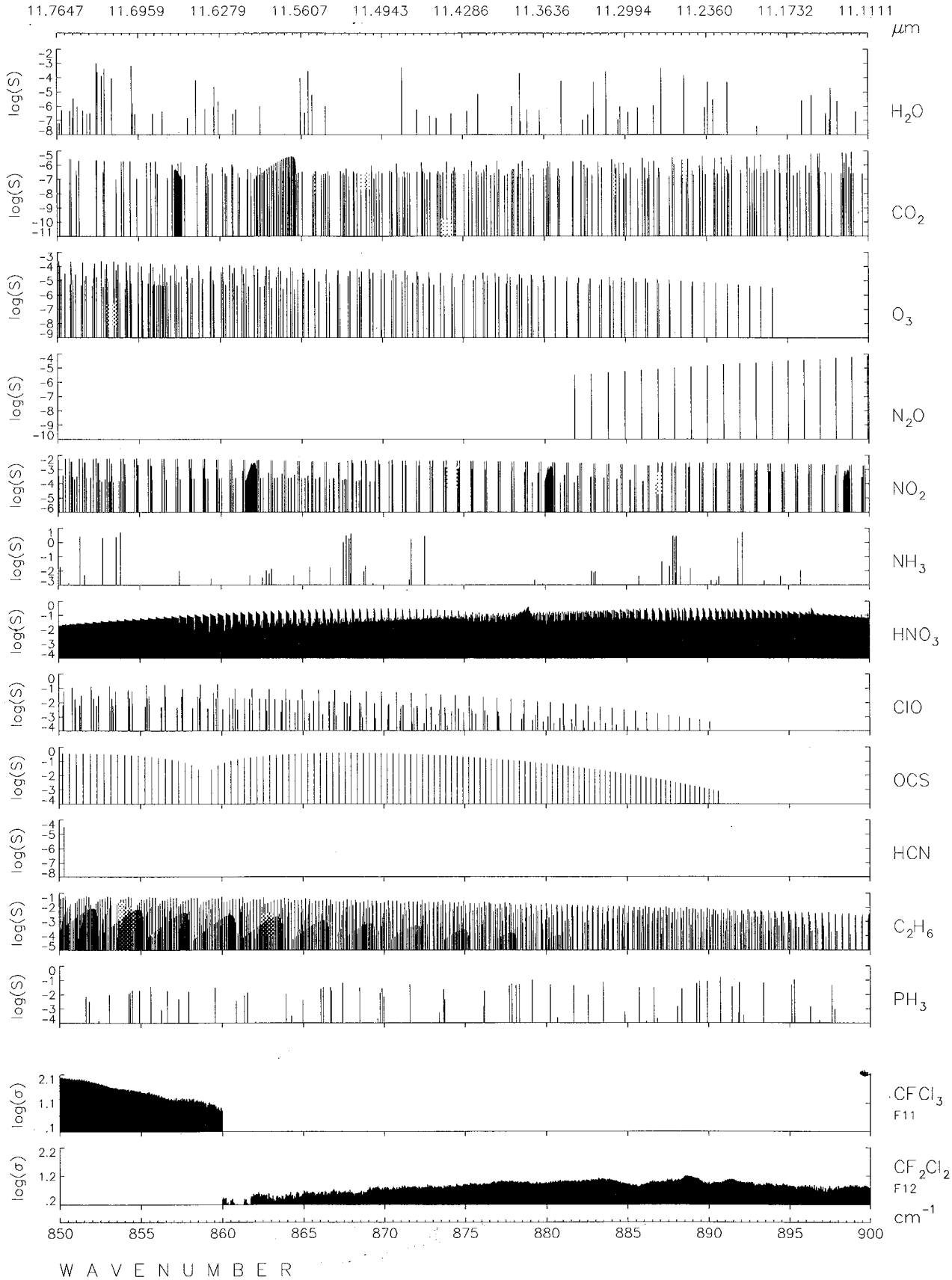


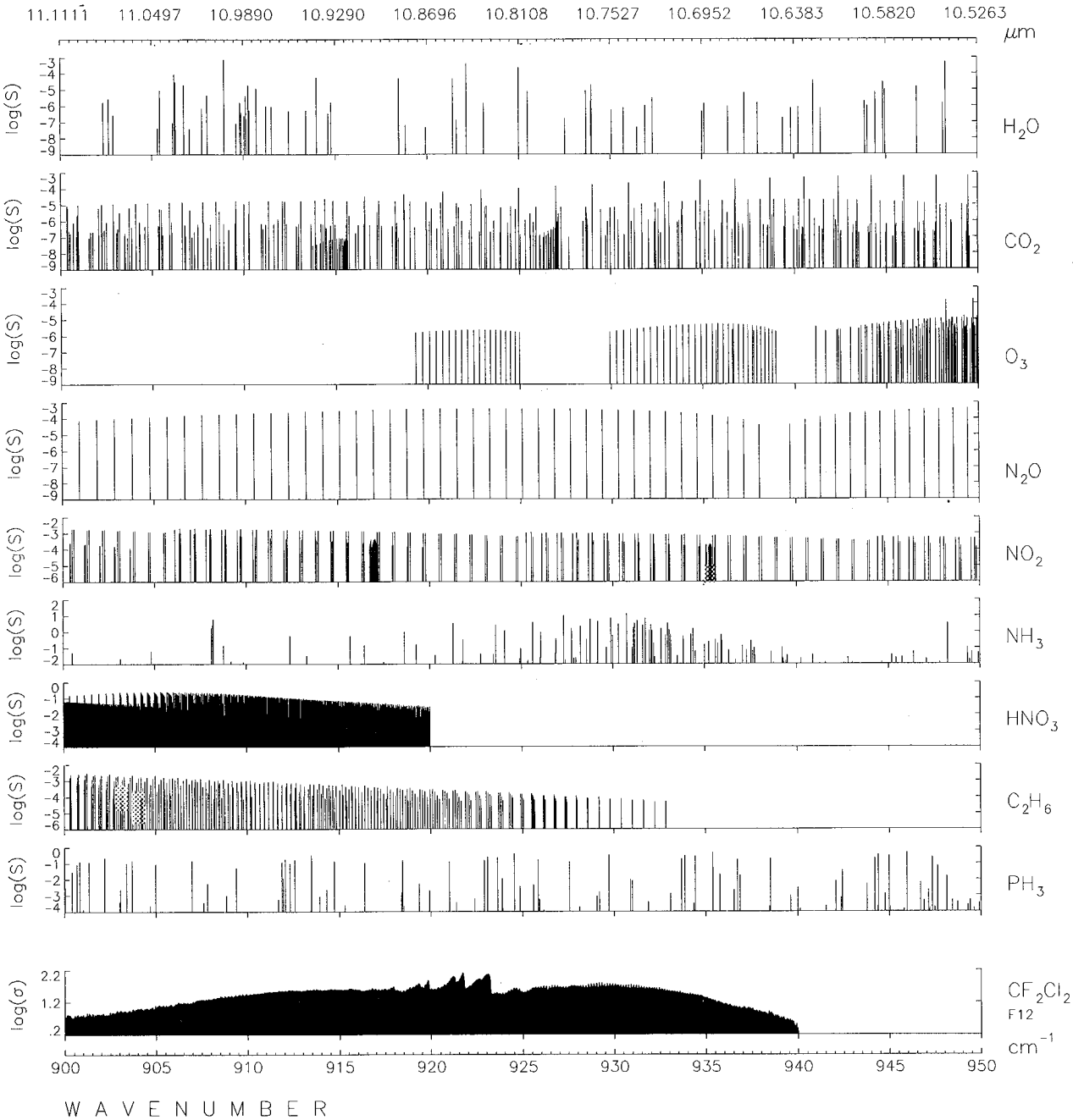
ORIGINAL PAGE IS
OF POOR QUALITY


12.5000
12.4224
12.3457
12.2699
12.1951
12.1212
12.0482
11.9760
11.9048
11.8343
11.7647
μm
log(S)
H2O
CO2
O3
NO2
NH3
HNO3
ClO
OCS
HCN
C2H2
C2H6
PH3
log(σ)
CFCl3
F11
CHCl2F
F21
cm-1
800
805
810
815
820
825
830
835
840
845
850
WAVENUMBER

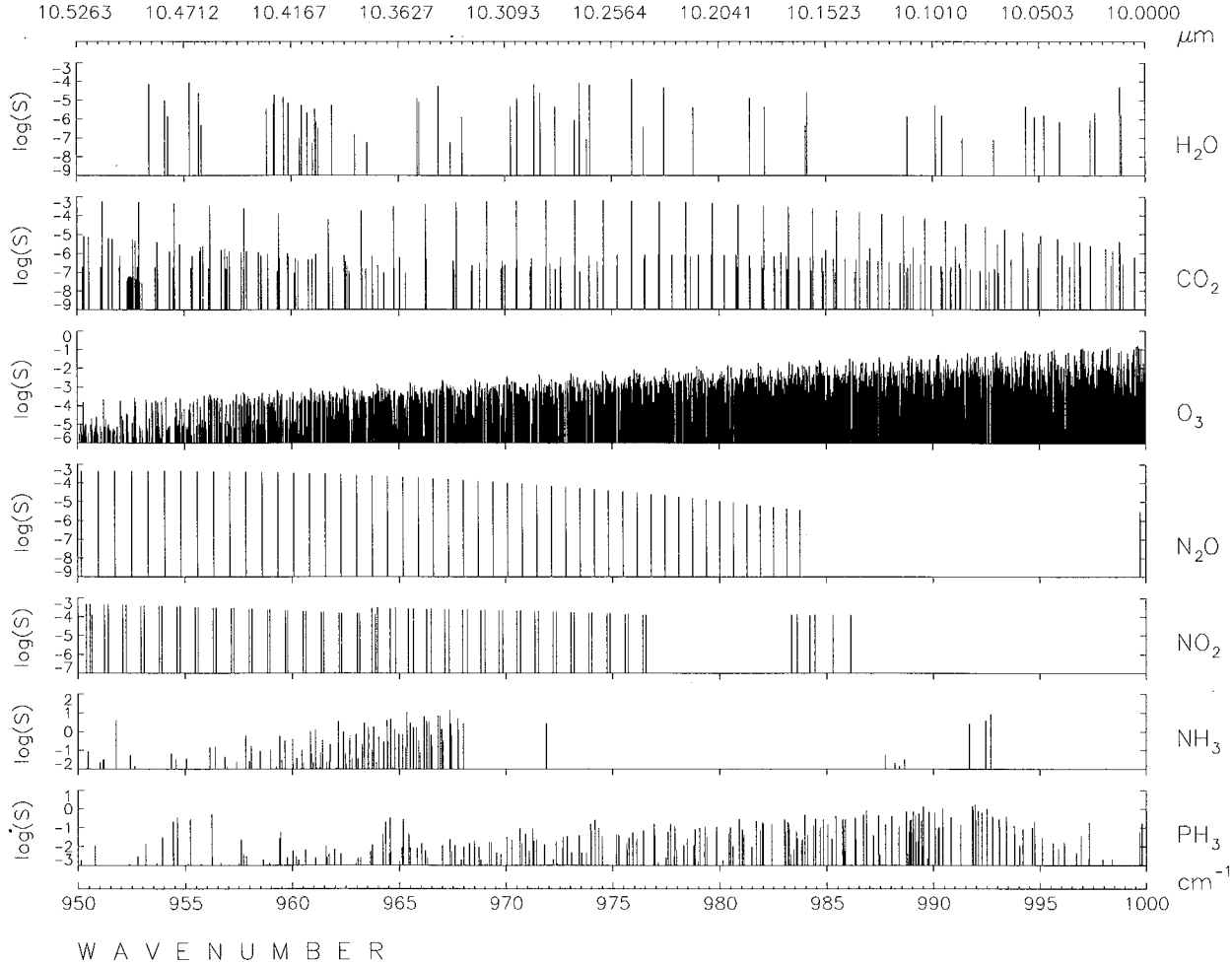


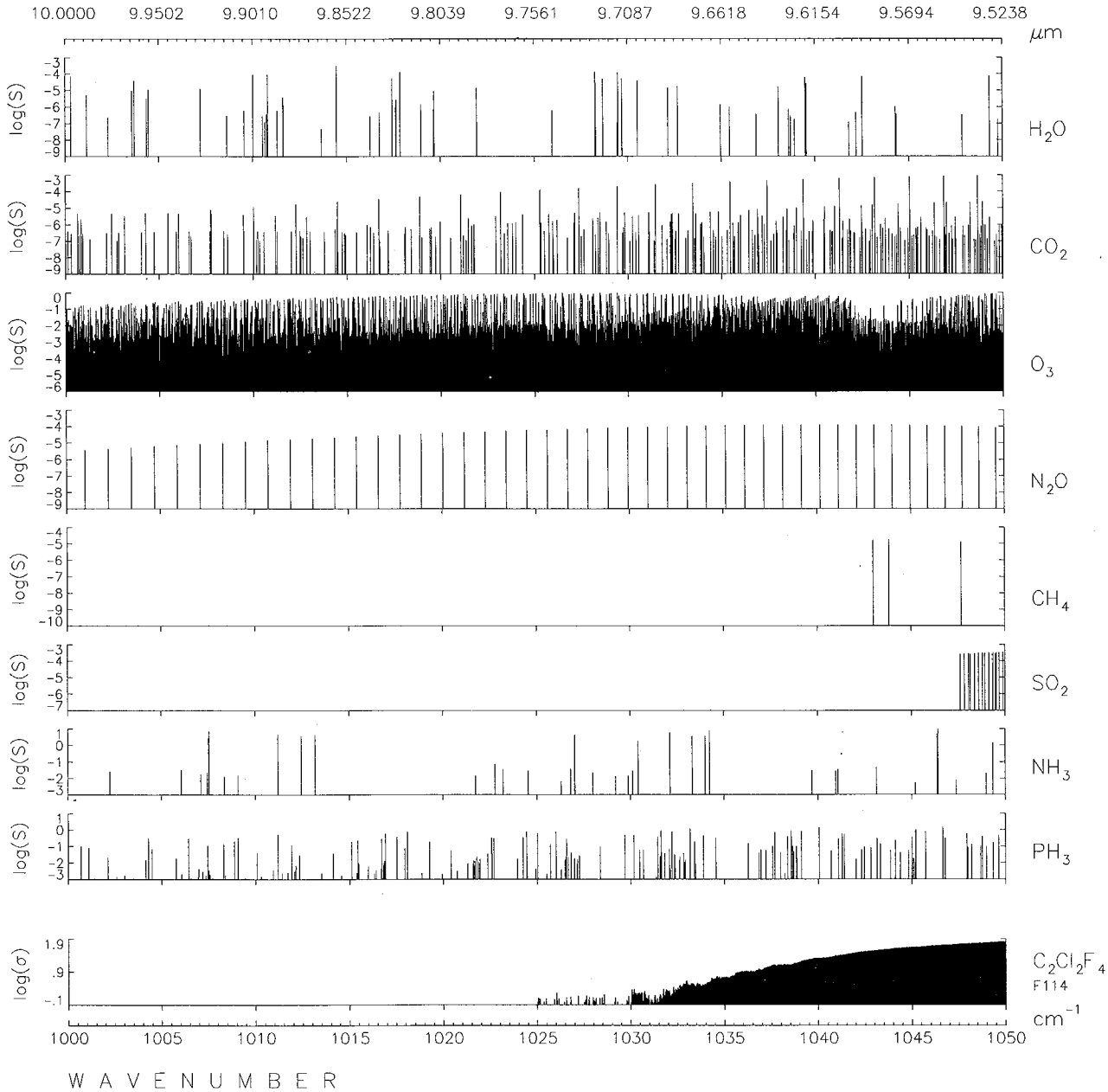
ORIGINAL PAGE IS
OF POOR QUALITY


11.7647
11.6959
11.6279
11.5607
11.4943
11.4286
11.3636
11.2994
11.2360
11.1732
11.1111
μm
log(S)
H2O
CO2
O3
N2O
NO2
NH3
HNO3
ClO
OCS
HCN
C2H6
PH3
log(σ)
CFCl3
F11
CF2Cl2
F12
850
855
860
865
870
875
880
885
890
895
900
cm-1
WAVENUMBER

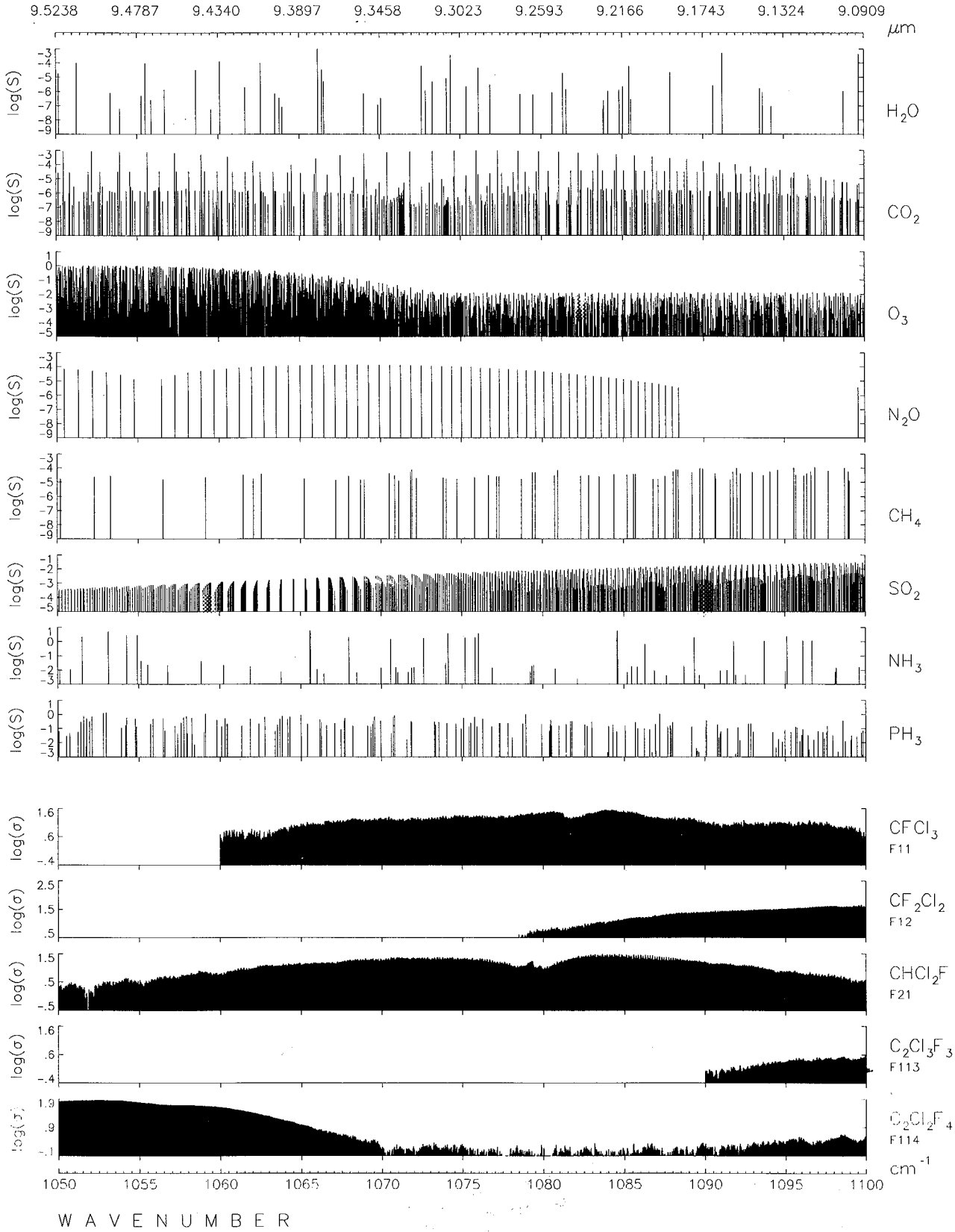


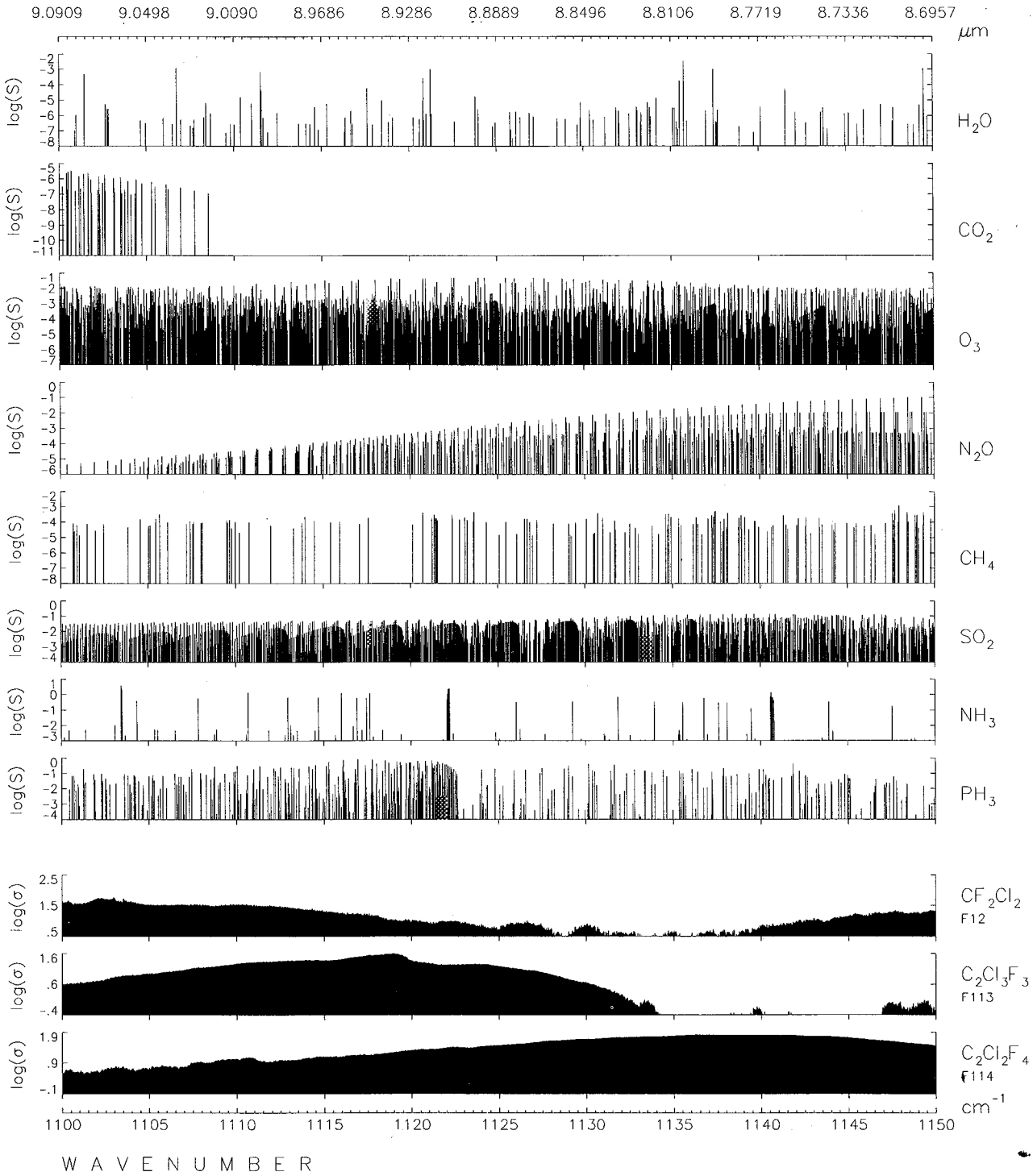
ORIGINAL PAGE IS
OF POOR QUALITY


10.5263
10.4712
10.4167
10.3627
10.3093
10.2564
10.2041
10.1523
10.1010
10.0503
10.0000
μm
log(S)
H2O
CO2
O3
N2O
NO2
NH3
PH3
950
955
960
965
970
975
980
985
990
995
1000
cm-1
WAVENUMBER

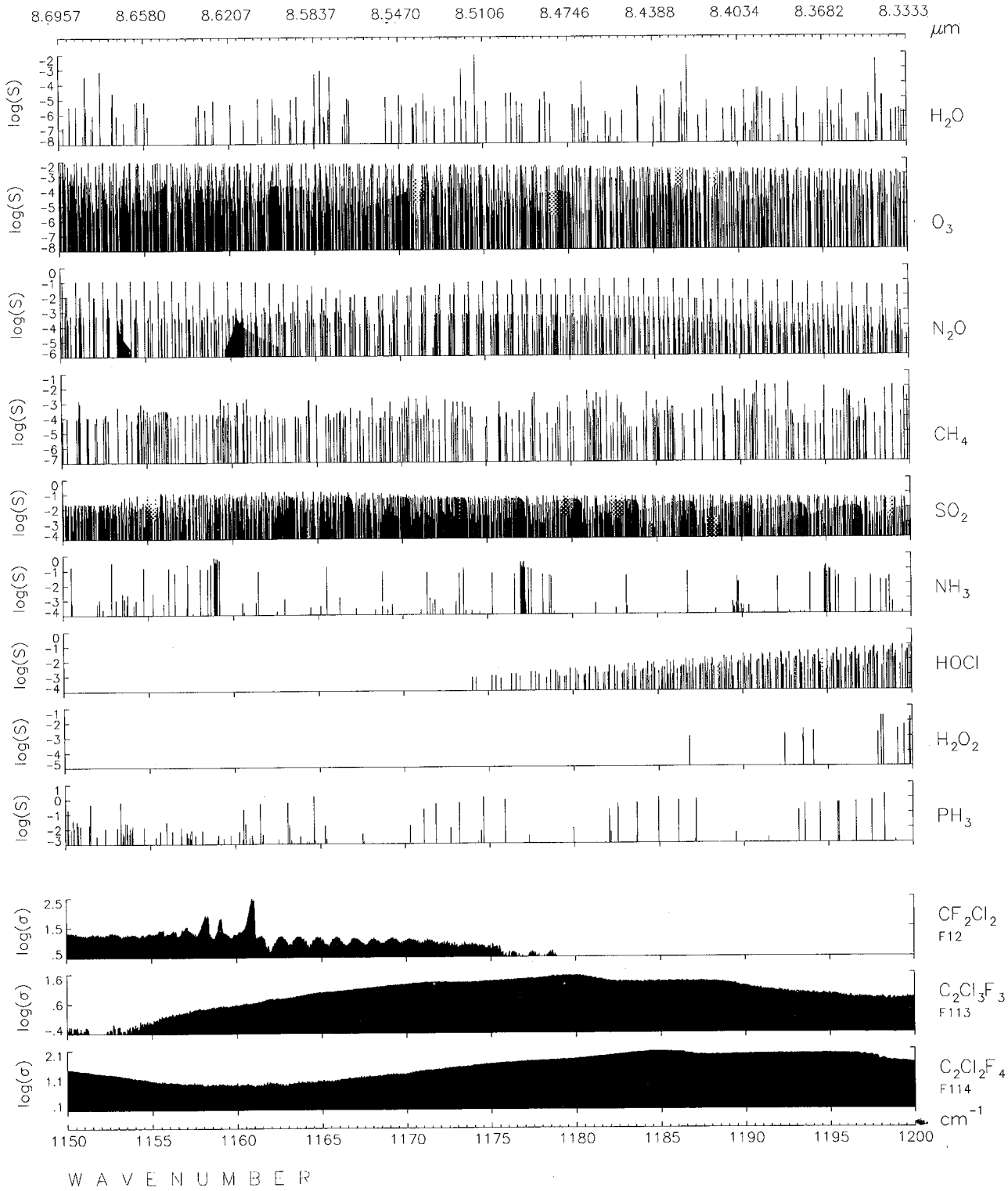


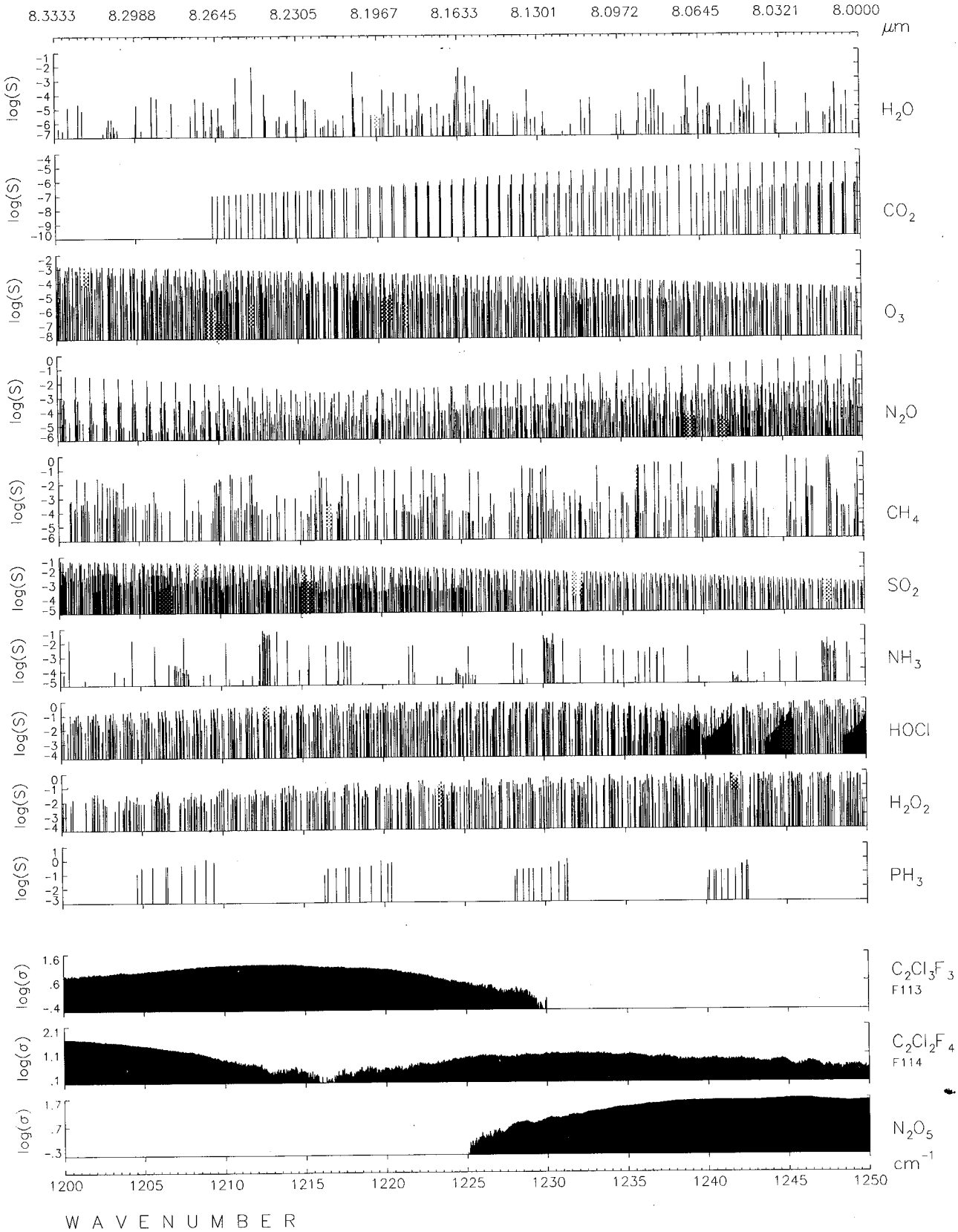
ORIGINAL PAGE IS
OF POOR QUALITY


9.5238
9.4787
9.4340
9.3897
9.3458
9.3023
9.2593
9.2166
9.1743
9.1324
9.0909
μm
log(S)
H2O
CO2
O3
N2O
CH4
SO2
NH3
PH3
log(σ)
CFCl3
F11
CF2Cl2
F12
CHCl2F
F21
C2Cl3F3
F113
C2Cl2F4
F114
cm-1
1050
1055
1060
1065
1070
1075
1080
1085
1090
1095
1100
WAVENUMBER

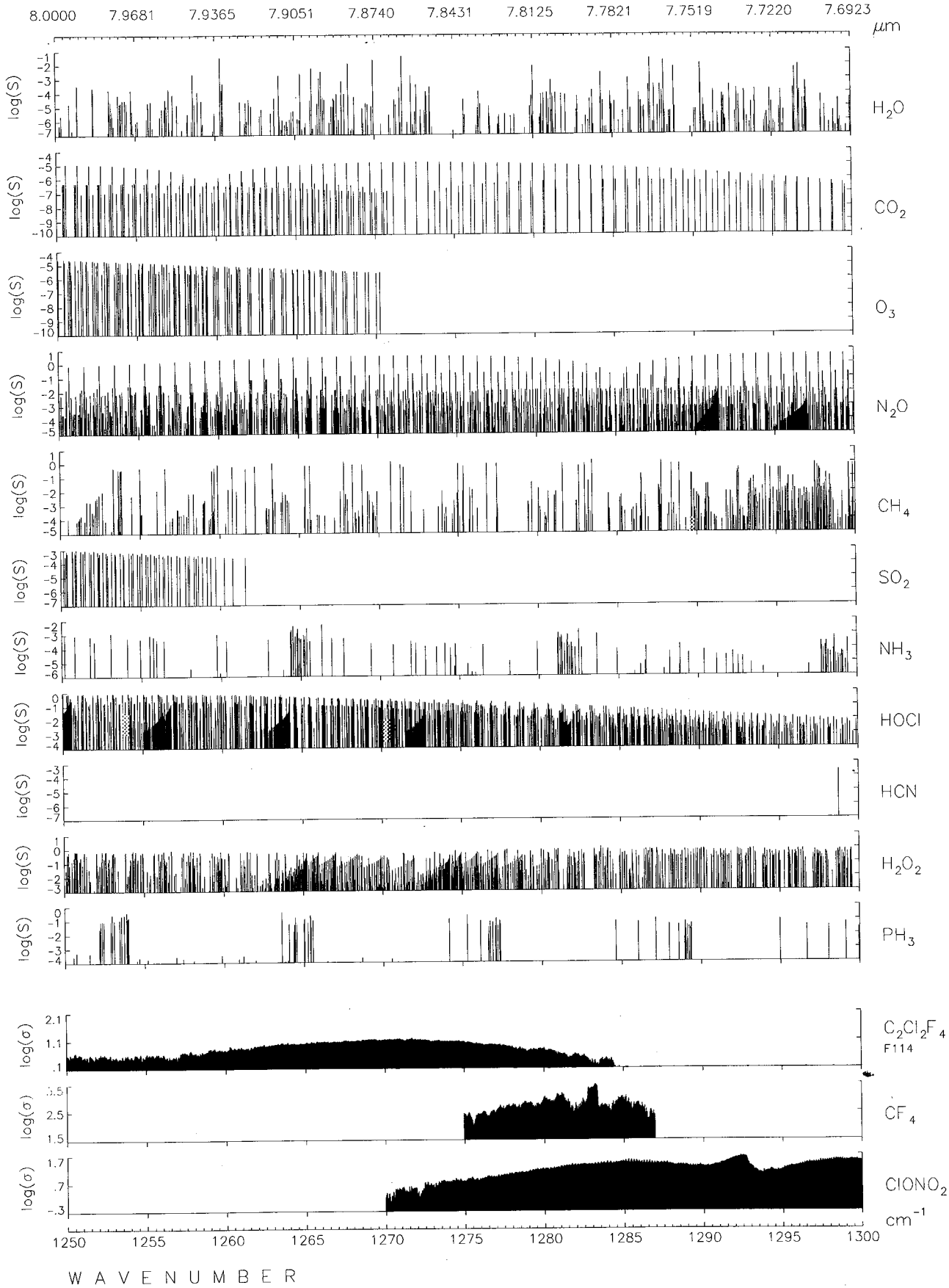


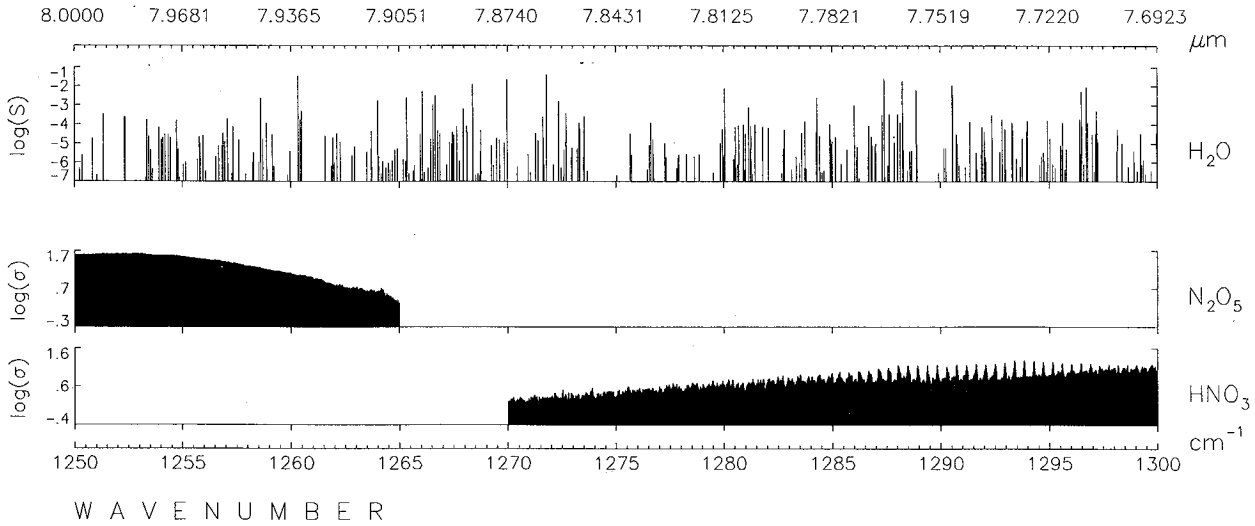
ORIGINAL PAGE IS
OF POOR QUALITY


8.6957
8.6580
8.6207
8.5837
8.5470
8.5106
8.4746
8.4388
8.4034
8.3682
8.3333
μm
log(S)
H2O
O3
N2O
CH4
SO2
NH3
HOCl
H2O2
PH3
log(σ)
CF2Cl2
F12
C2Cl3F3
F113
C2Cl2F4
F114
cm-1
1150
1155
1160
1165
1170
1175
1180
1185
1190
1195
1200
WAVENUMBER

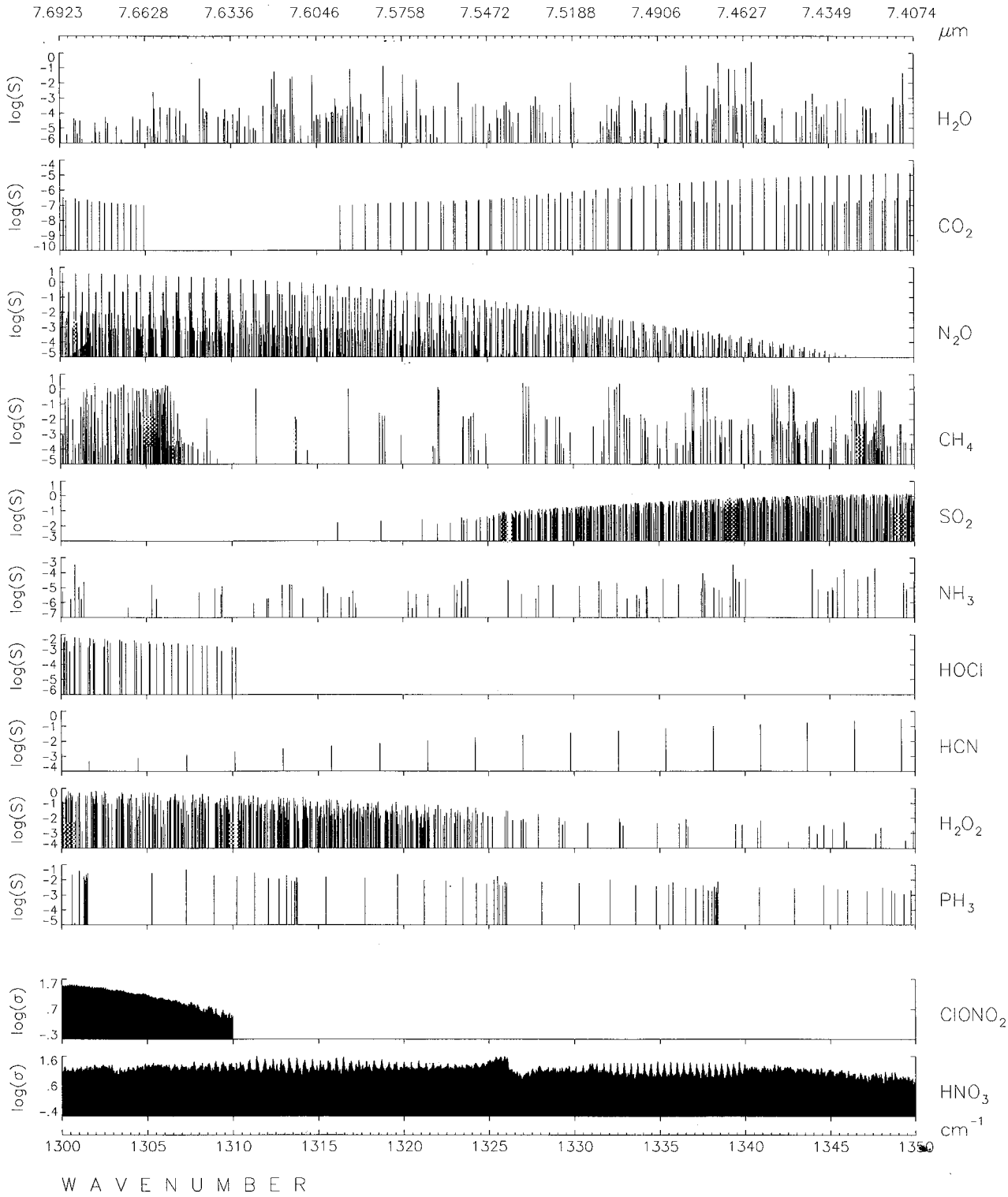


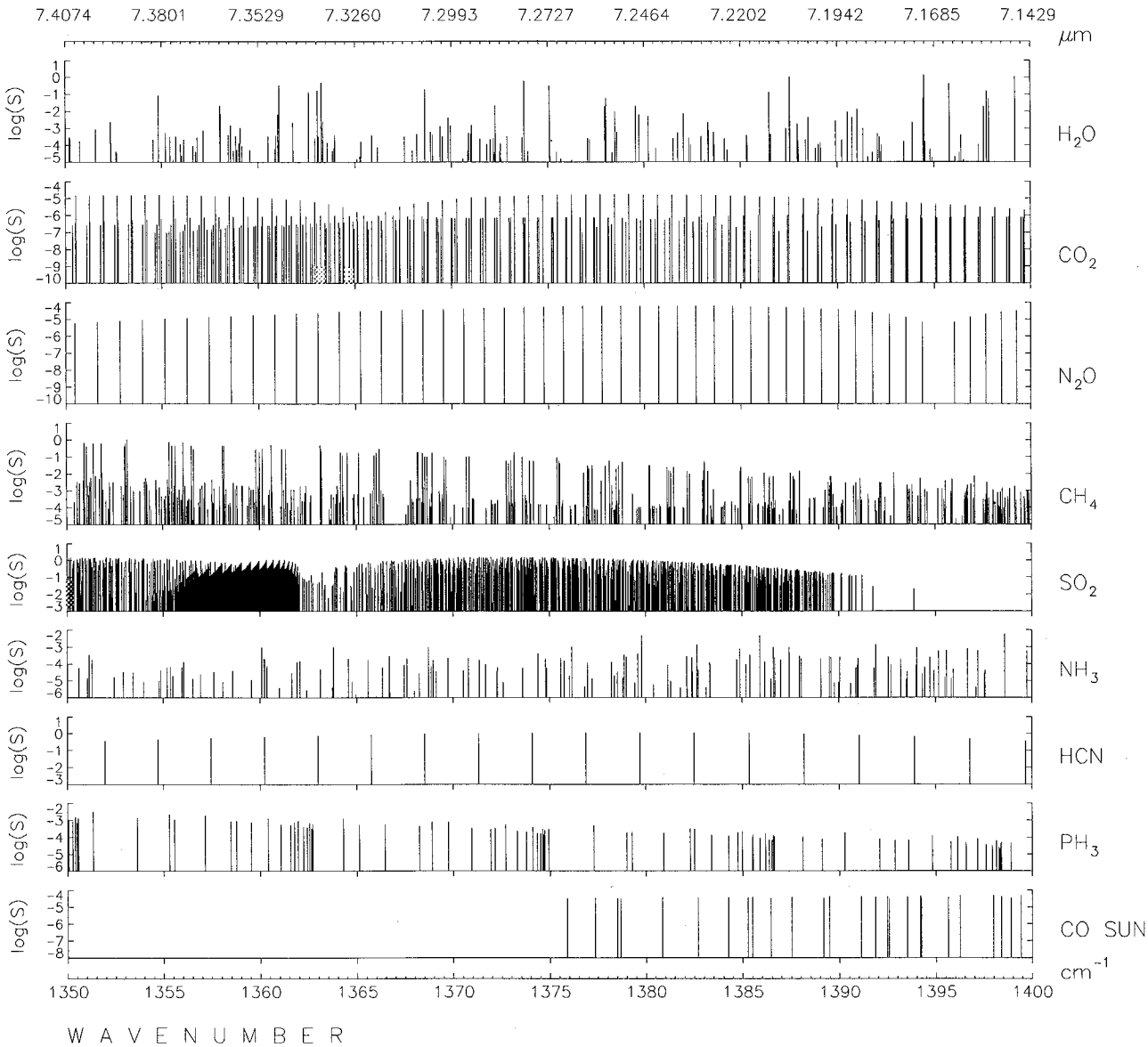
ORIGINAL PAGE IS
OF POOR QUALITY


8.0000
7.9681
7.9365
7.9051
7.8740
7.8431
7.8125
7.7821
7.7519
7.7220
7.6923
μm
log(S)
H2O
CO2
O3
N2O
CH4
SO2
NH3
HOCl
HCN
H2O2
PH3
log(σ)
C2Cl2F4
F114
CF4
ClONO2
cm-1
1250
1255
1260
1265
1270
1275
1280
1285
1290
1295
1300
WAVENUMBER

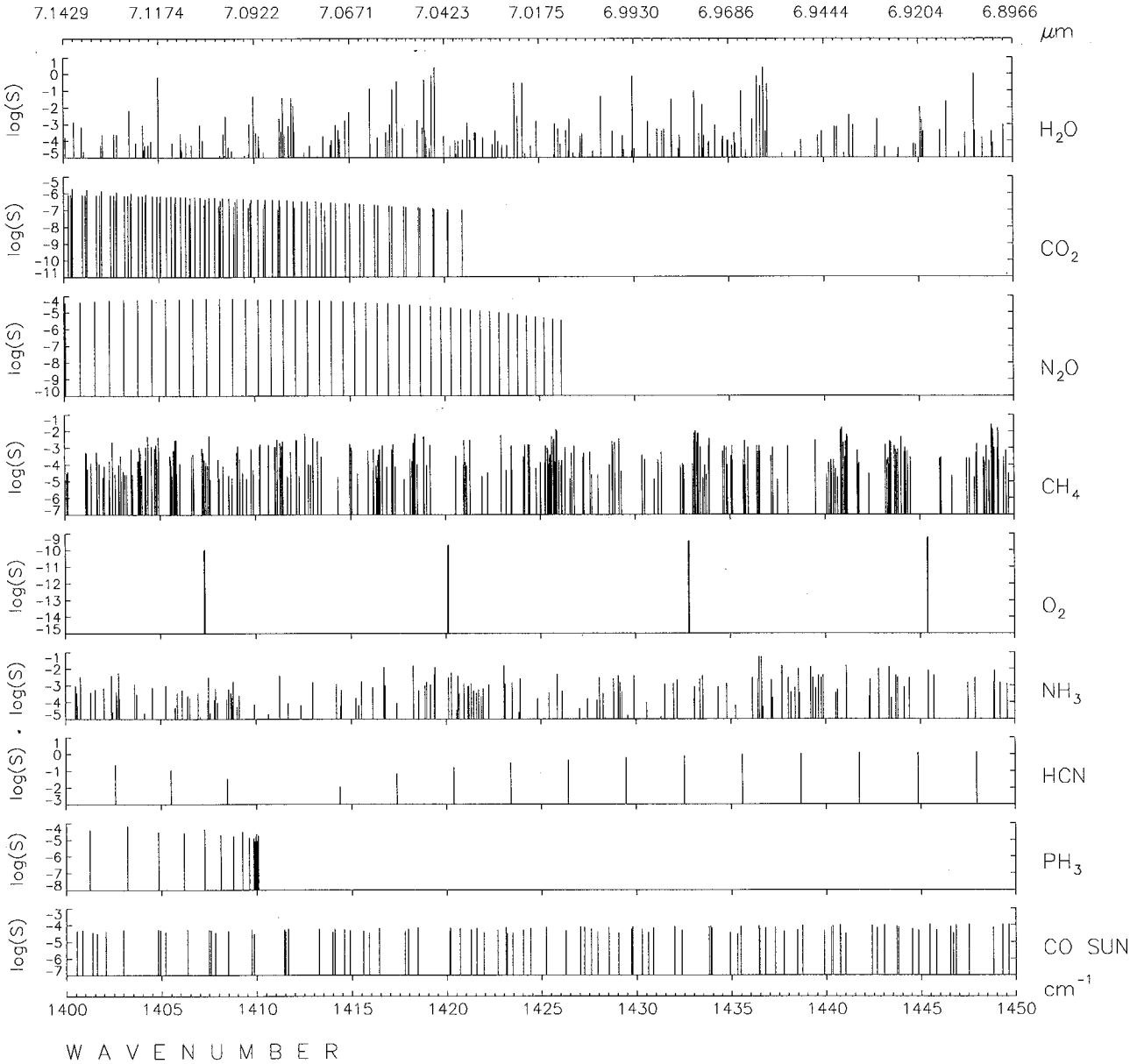


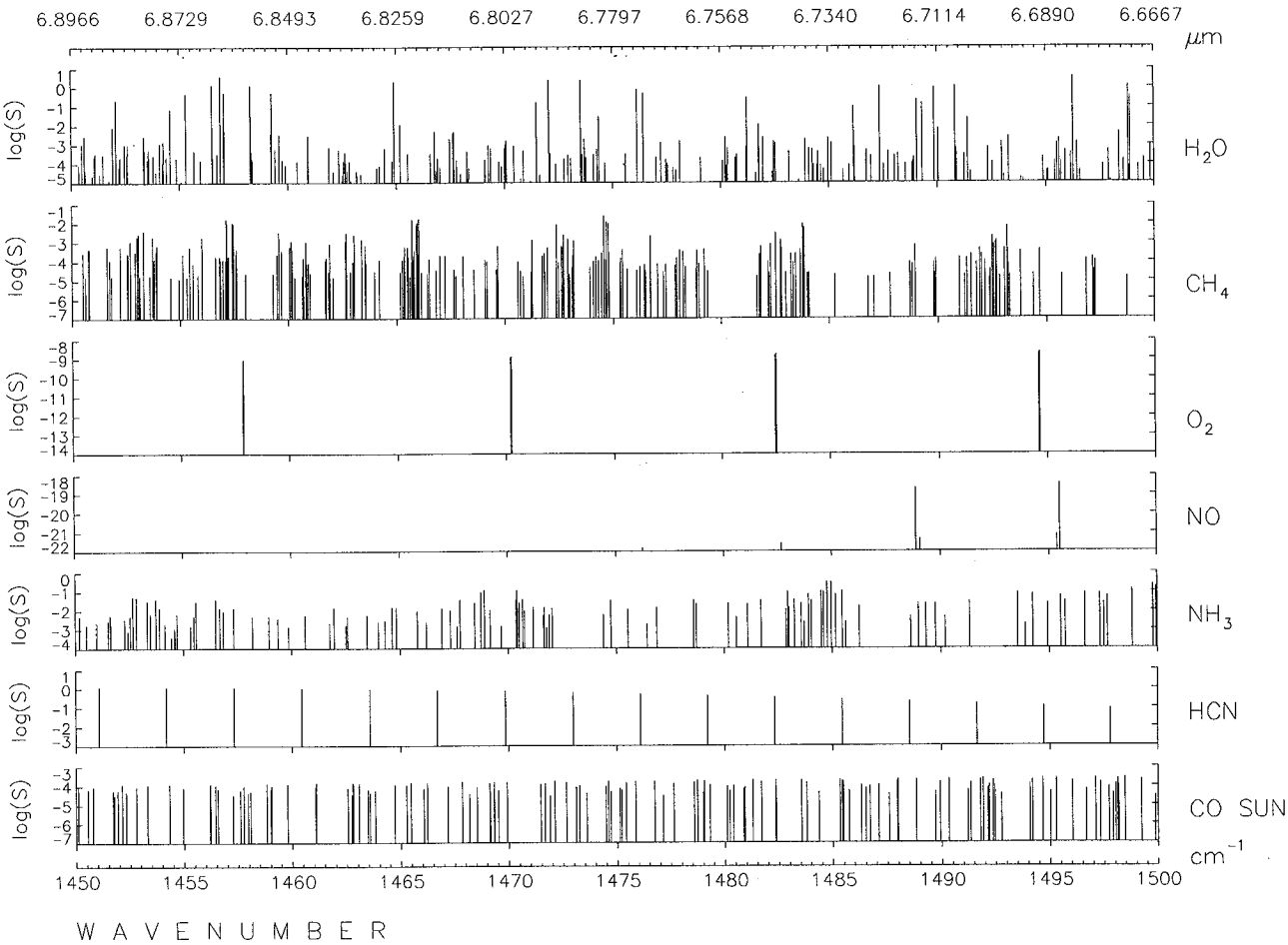
ORIGINAL PAGE IS
OF POOR QUALITY


7.6923
7.6628
7.6336
7.6046
7.5758
7.5472
7.5188
7.4906
7.4627
7.4349
7.4074
μm
log(S)
H2O
CO2
N2O
CH4
SO2
NH3
HOCl
HCN
H2O2
PH3
log(σ)
ClONO2
HNO3
cm-1
1300
1305
1310
1315
1320
1325
1330
1335
1340
1345
1350
WAVENUMBER

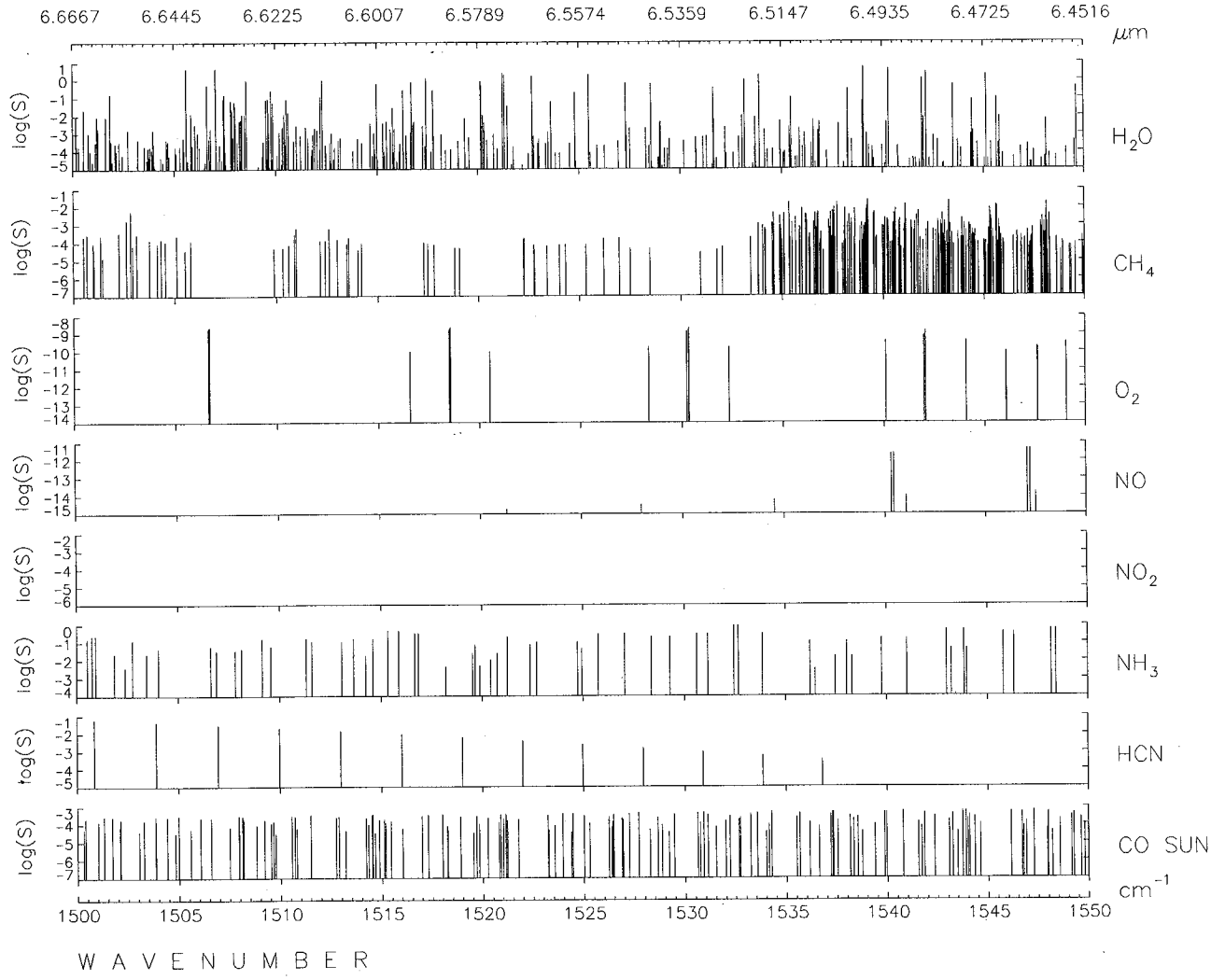


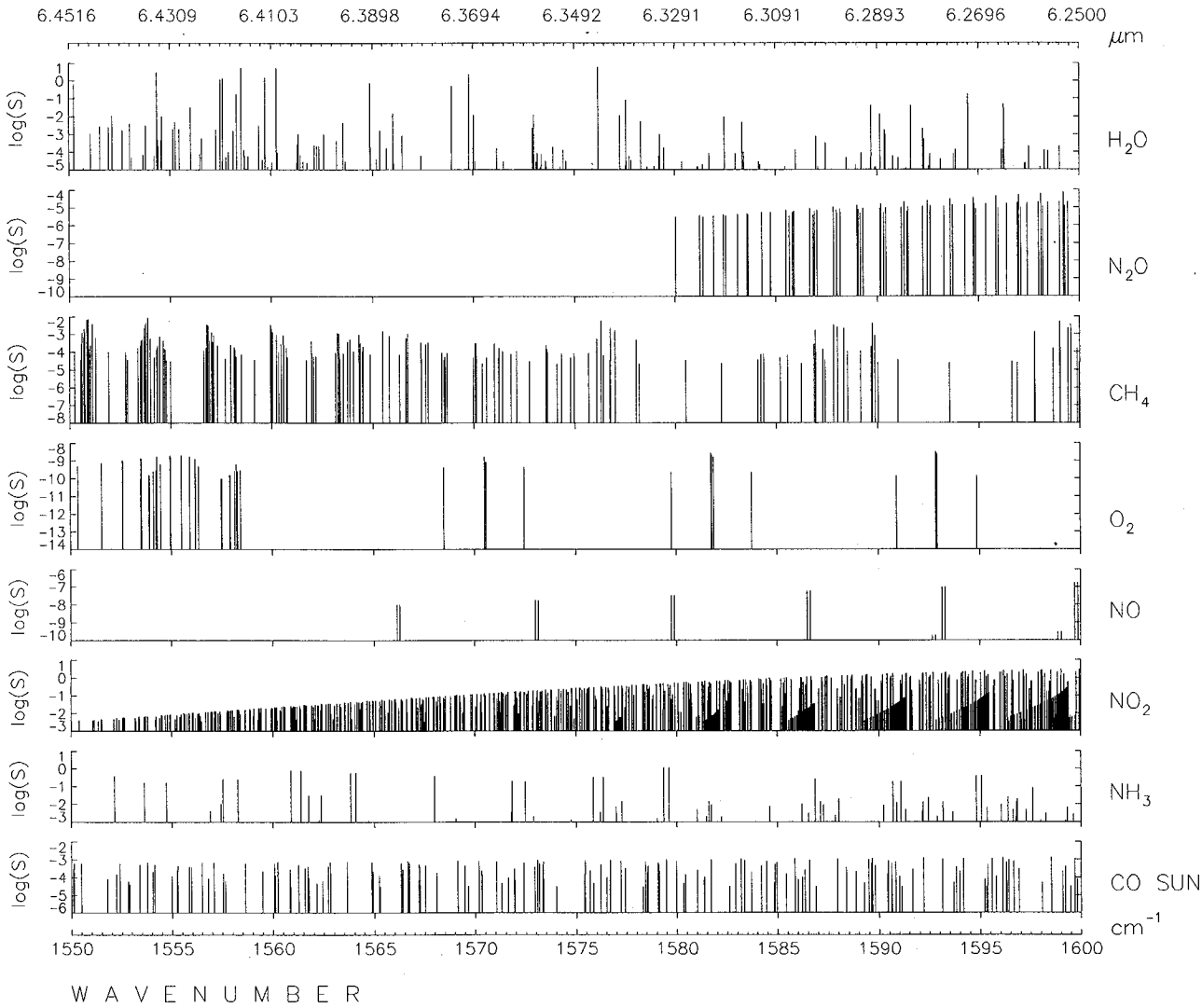
ORIGINAL PAGE IS
OF POOR QUALITY


7.1429
7.1174
7.0922
7.0671
7.0423
7.0175
6.9930
6.9686
6.9444
6.9204
6.8966
μm
log(S)
H2O
CO2
N2O
CH4
O2
NH3
HCN
PH3
CO SUN
cm-1
1400
1405
1410
1415
1420
1425
1430
1435
1440
1445
1450
WAVENUMBER

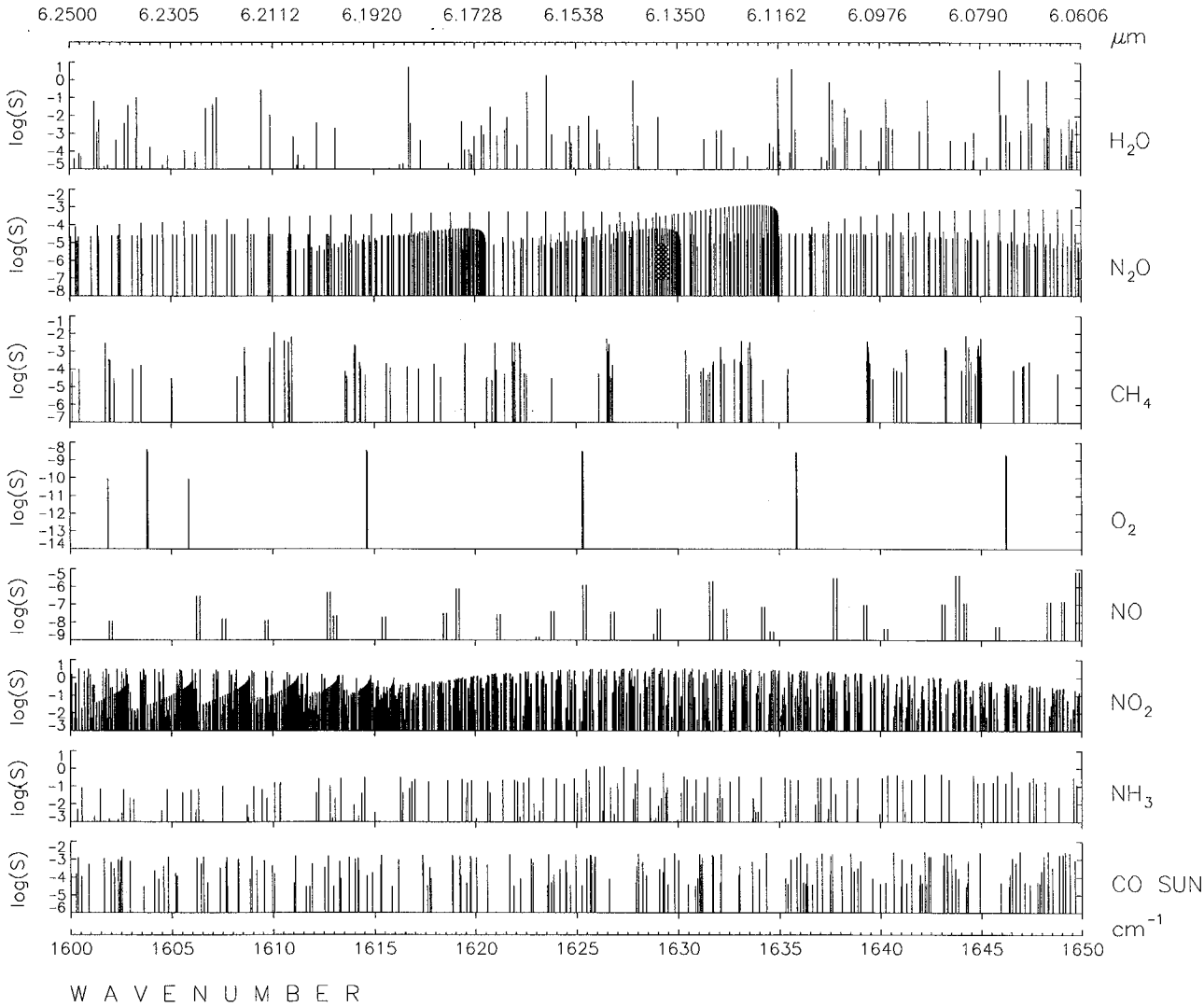


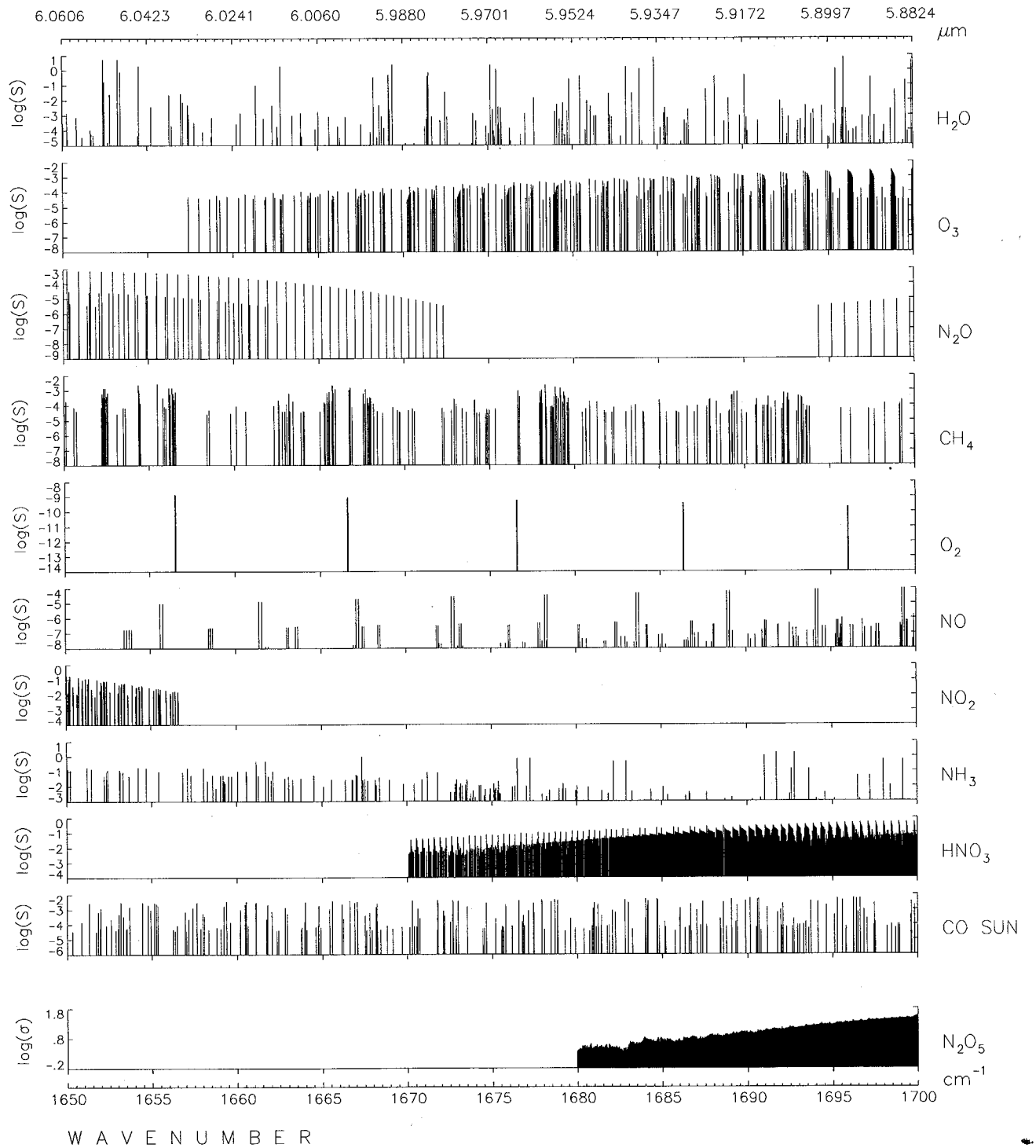
ORIGINAL PAGE IS
OF POOR QUALITY


6.6667
6.6445
6.6225
6.6007
6.5789
6.5574
6.5359
6.5147
6.4935
6.4725
6.4516
μm
log(S)
H2O
CH4
O2
NO
NO2
NH3
HCN
CO SUN
cm-1
1500
1505
1510
1515
1520
1525
1530
1535
1540
1545
1550
WAVENUMBER

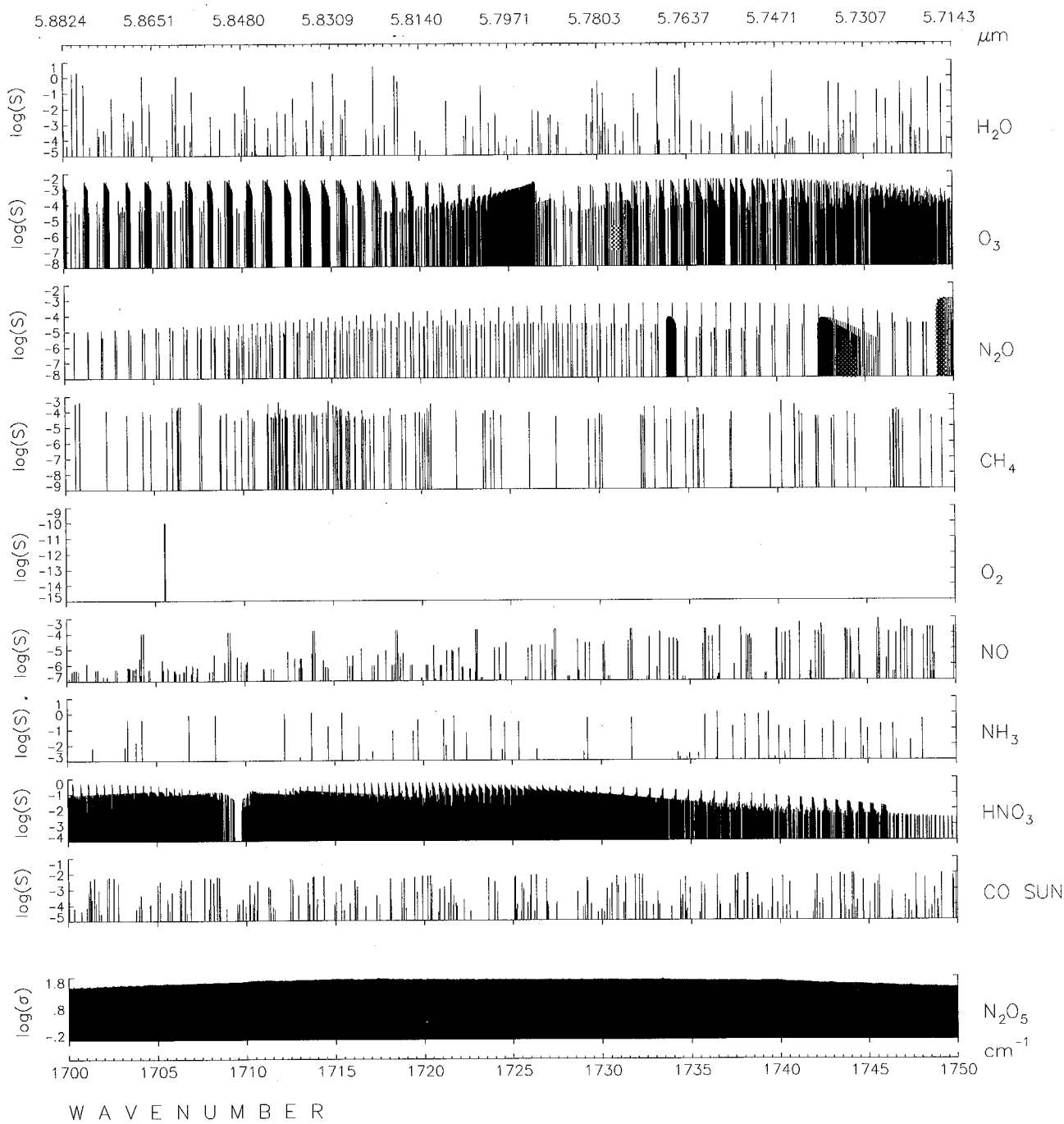


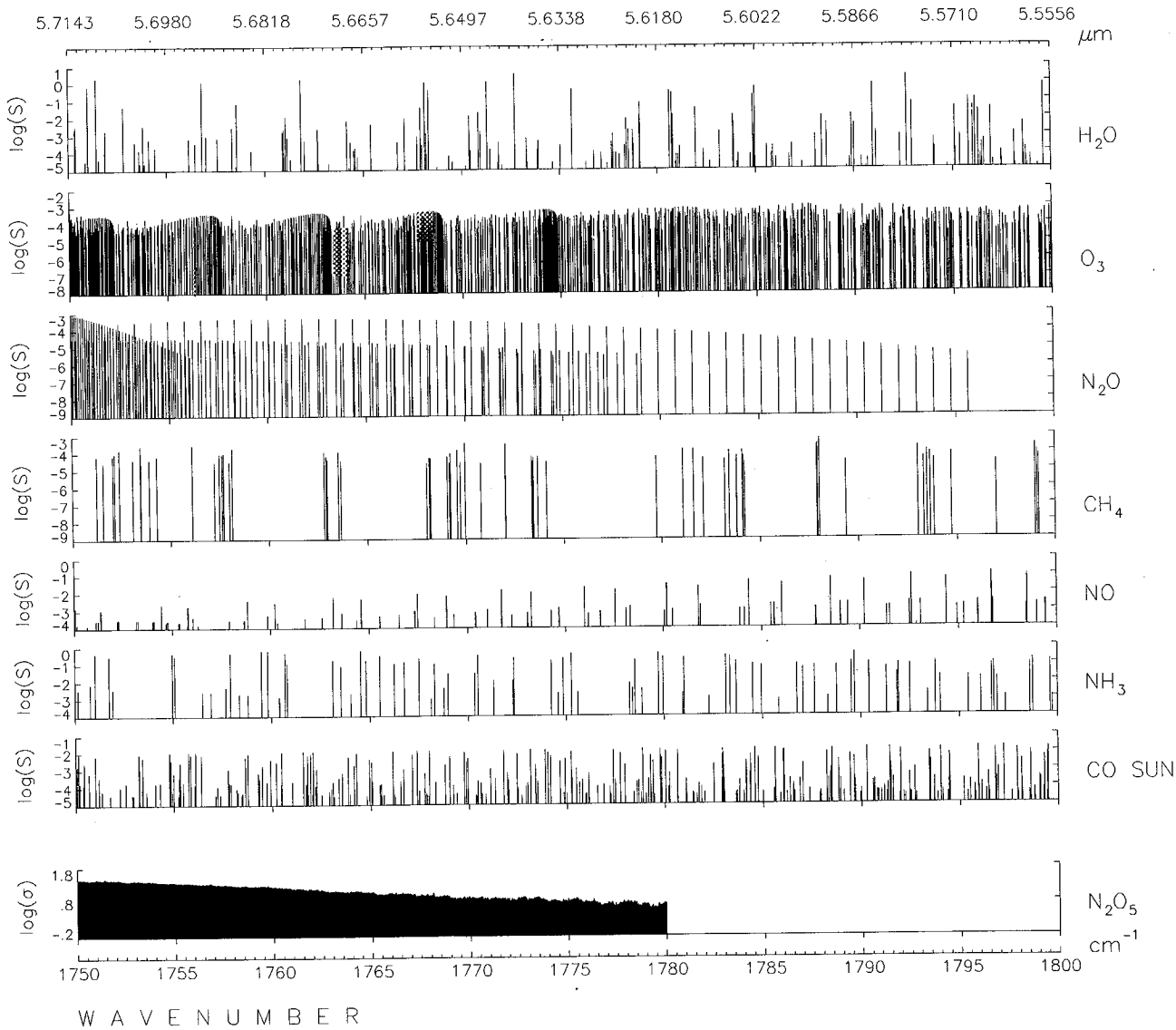
ORIGINAL PAGE IS
OF POOR QUALITY


6.2500
6.2305
6.2112
6.1920
6.1728
6.1538
6.1350
6.1162
6.0976
6.0790
6.0606
μm
log(S)
H2O
N2O
CH4
O2
NO
NO2
NH3
CO SUN
cm-1
1600
1605
1610
1615
1620
1625
1630
1635
1640
1645
1650
WAVENUMBER

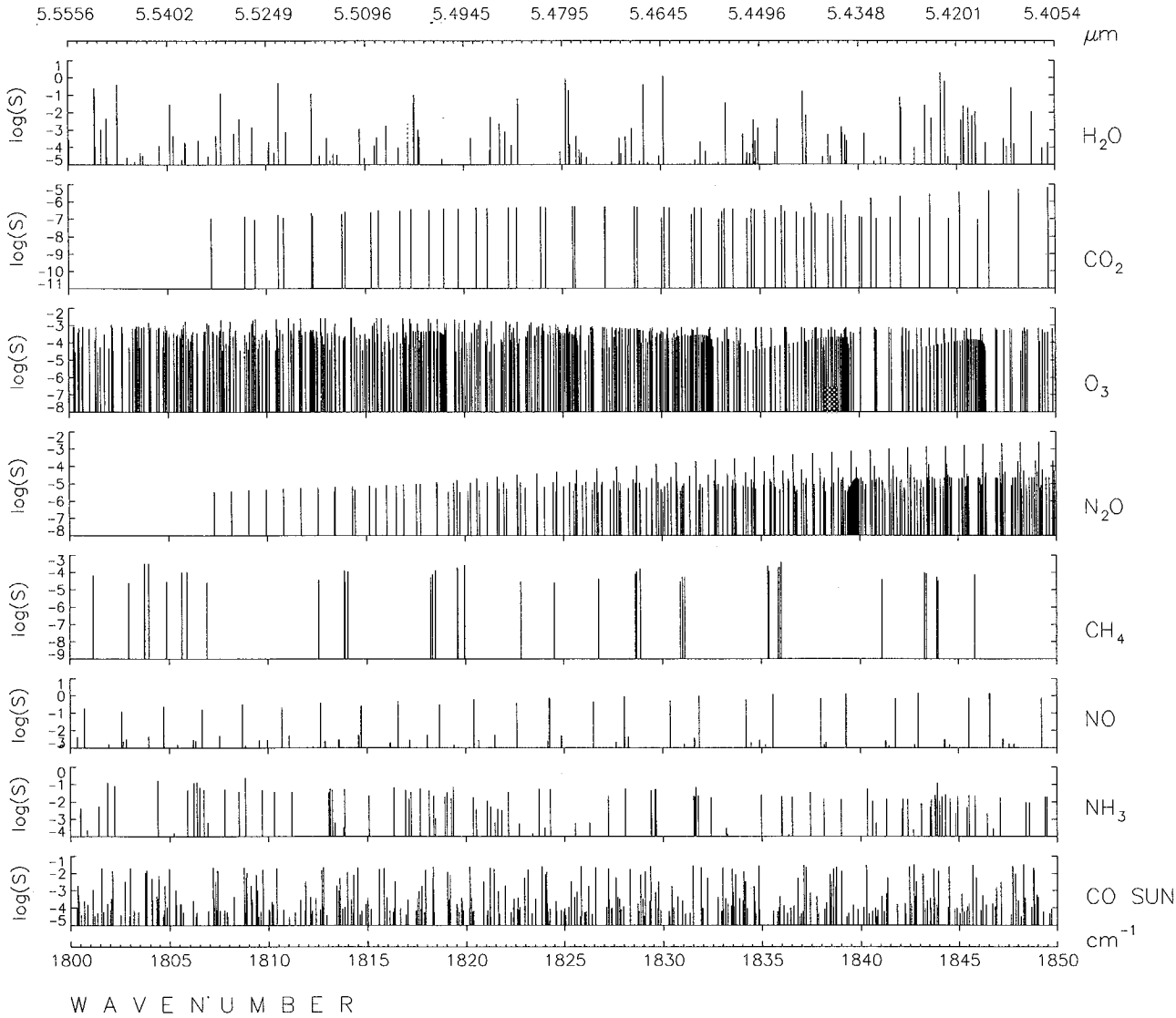


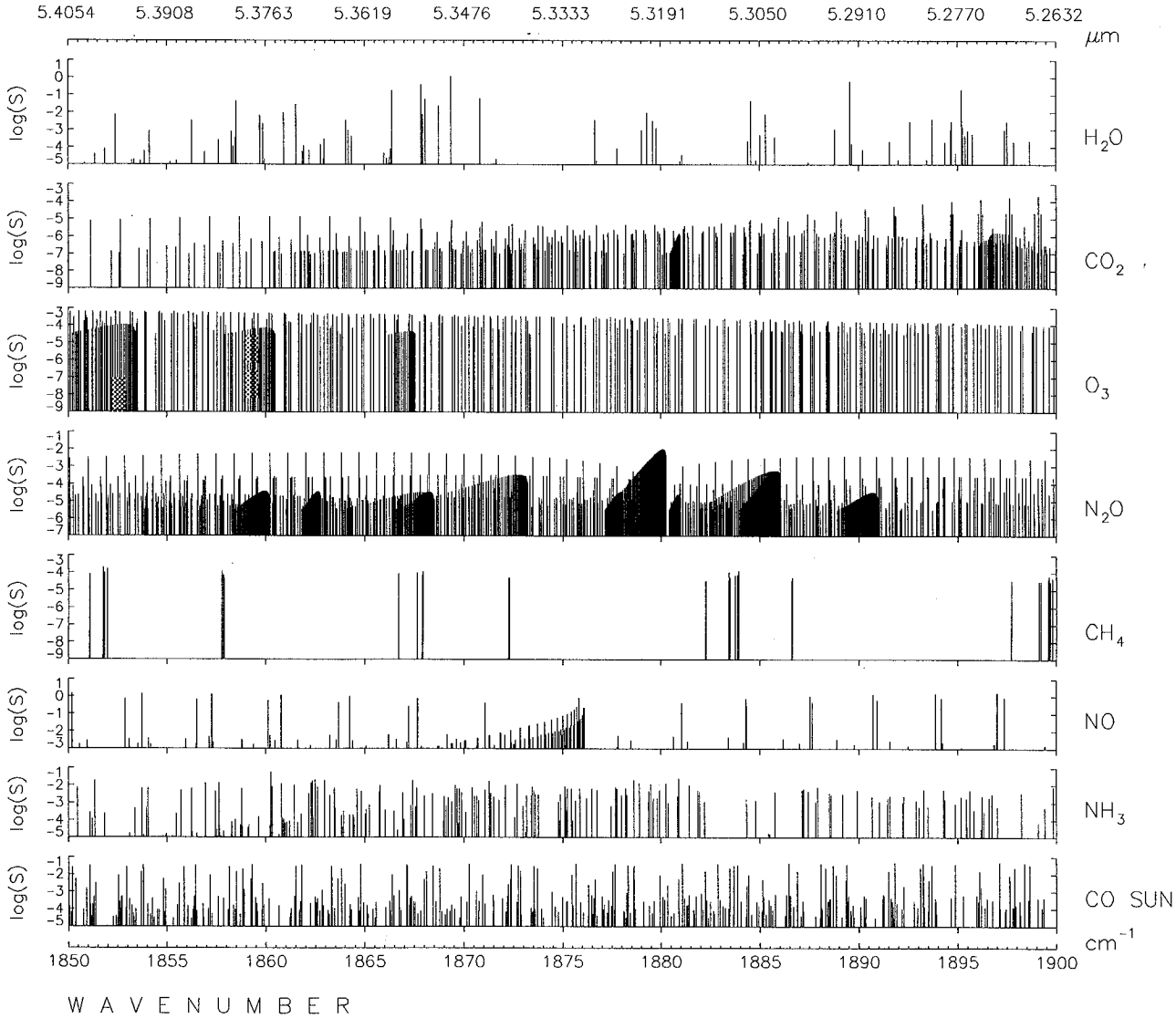
ORIGINAL PAGE IS
OF POOR QUALITY


5.8824
5.8651
5.8480
5.8309
5.8140
5.7971
5.7803
5.7637
5.7471
5.7307
5.7143
μm
log(S)
H2O
O3
N2O
CH4
O2
NO
NH3
HNO3
CO SUN
log(σ)
N2O5
cm-1
1700
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
WAVENUMBER

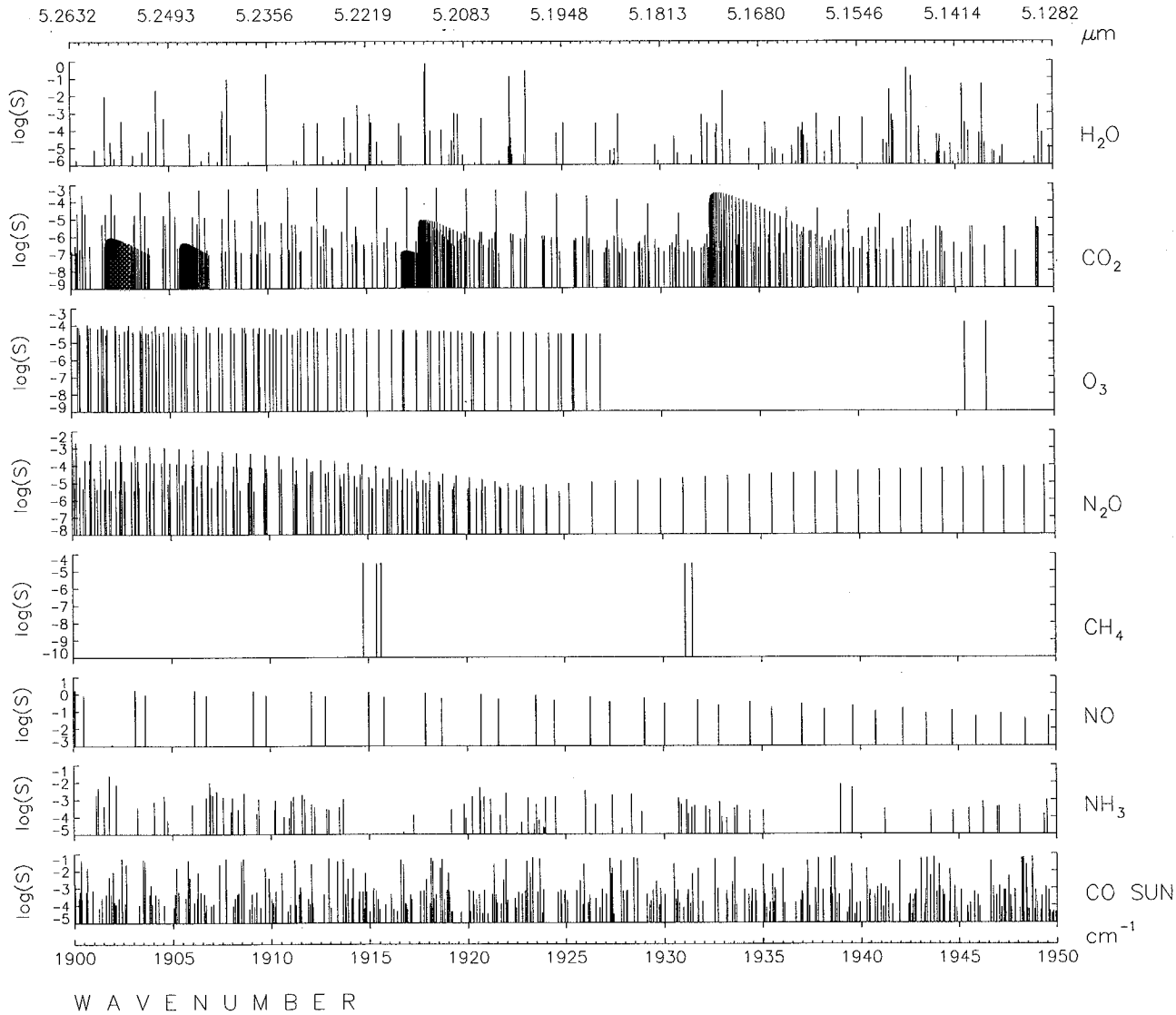


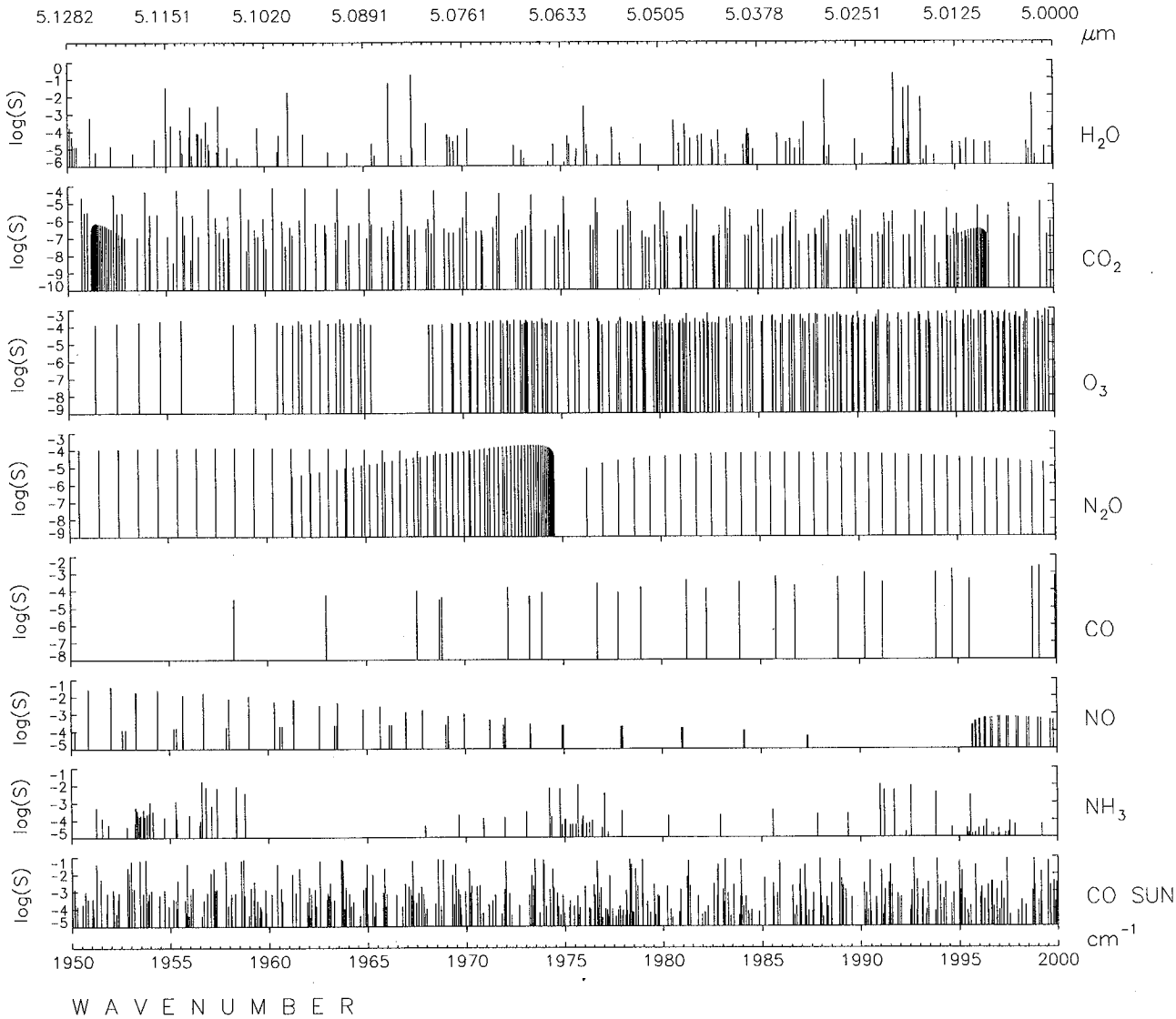
ORIGINAL PAGE IS
OF POOR QUALITY


5.5556
5.5402
5.5249
5.5096
5.4945
5.4795
5.4645
5.4496
5.4348
5.4201
5.4054
μm
log(S)
H2O
CO2
O3
N2O
CH4
NO
NH3
CO SUN
cm-1
1800
1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
WAVENUMBER

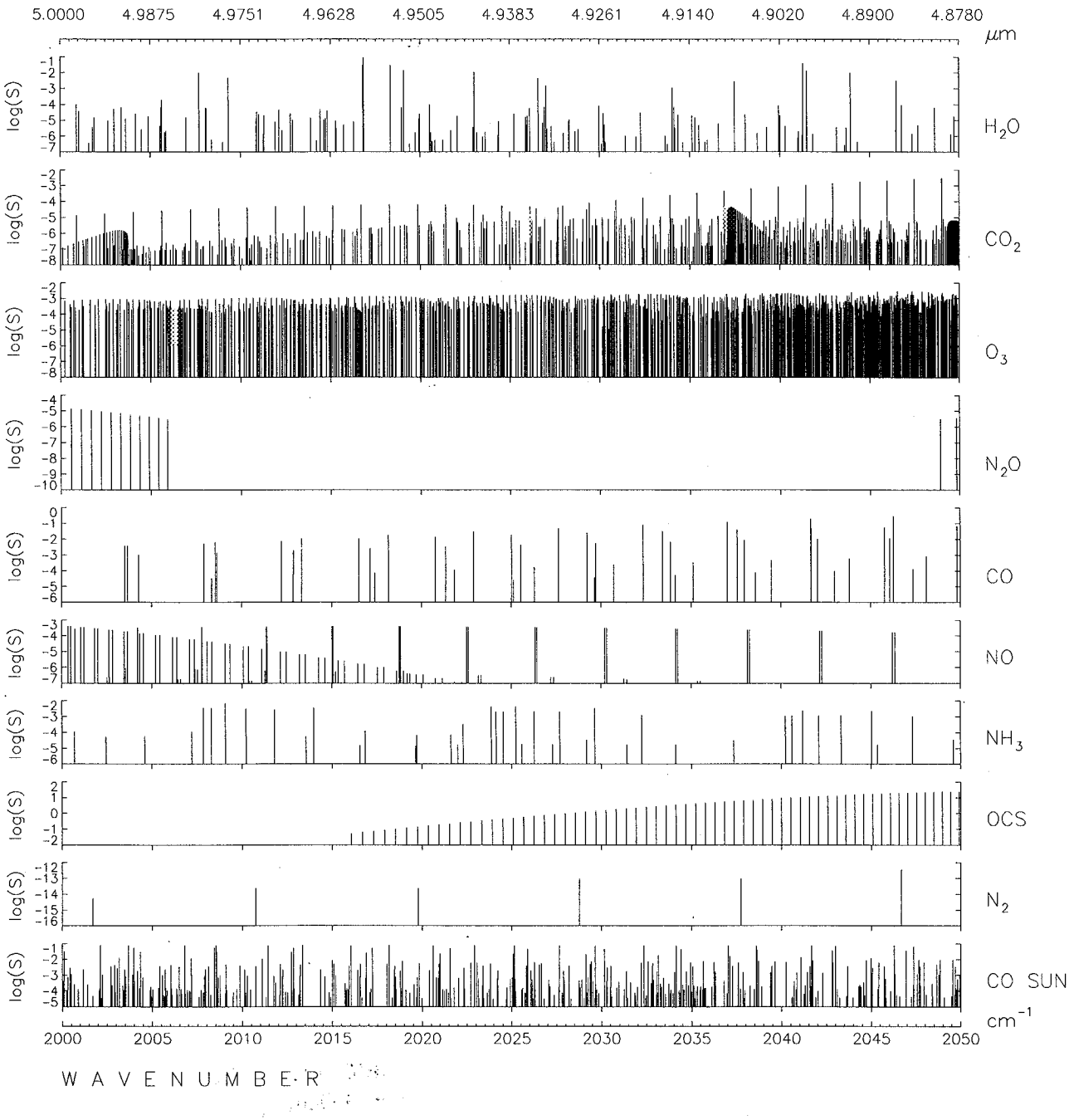


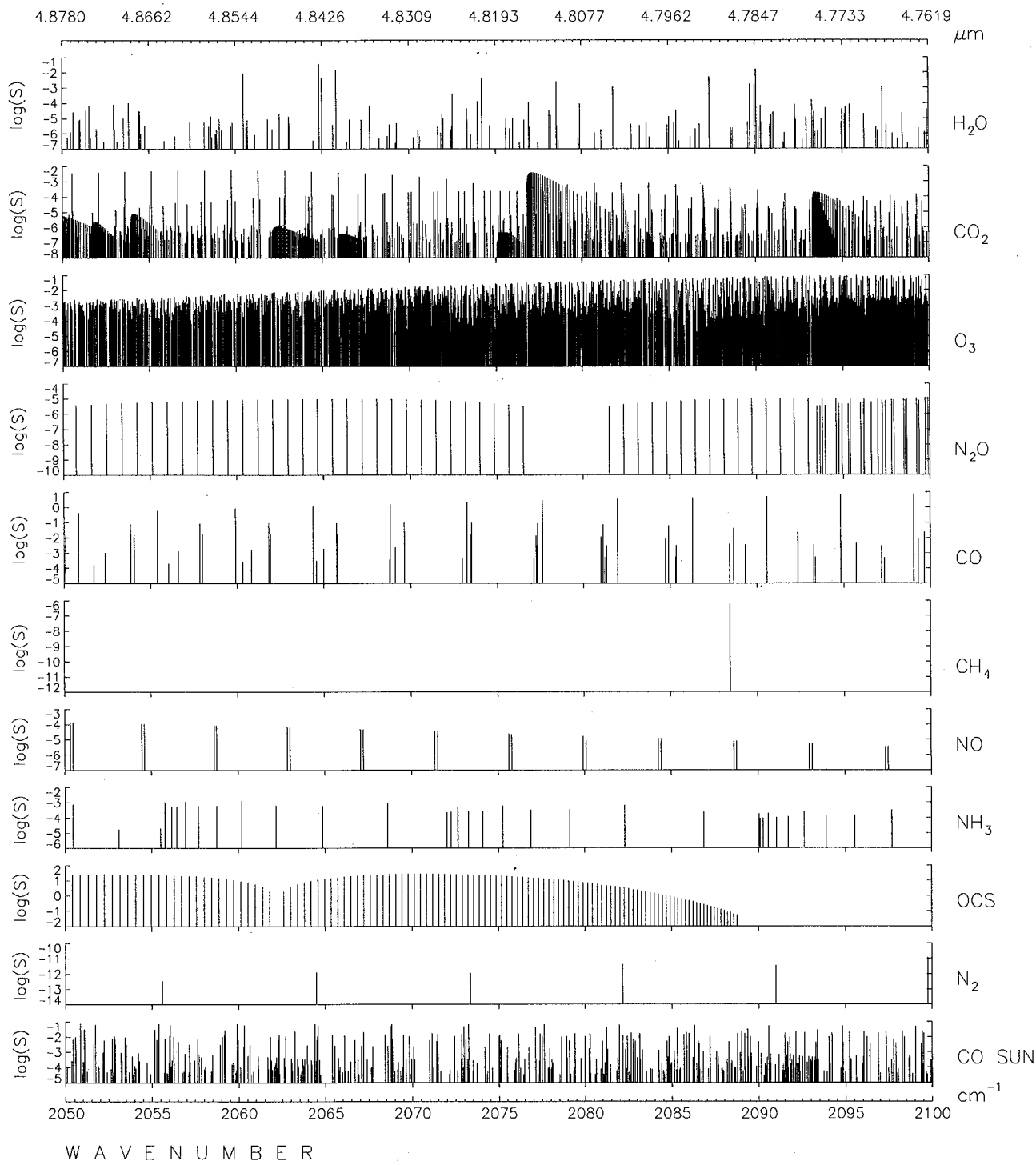
ORIGINAL PAGE IS
OF POOR QUALITY


5.2632
5.2493
5.2356
5.2219
5.2083
5.1948
5.1813
5.1680
5.1546
5.1414
5.1282
μm
log(S)
H2O
CO2
O3
N2O
CH4
NO
NH3
CO SUN
cm-1
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
WAVENUMBER

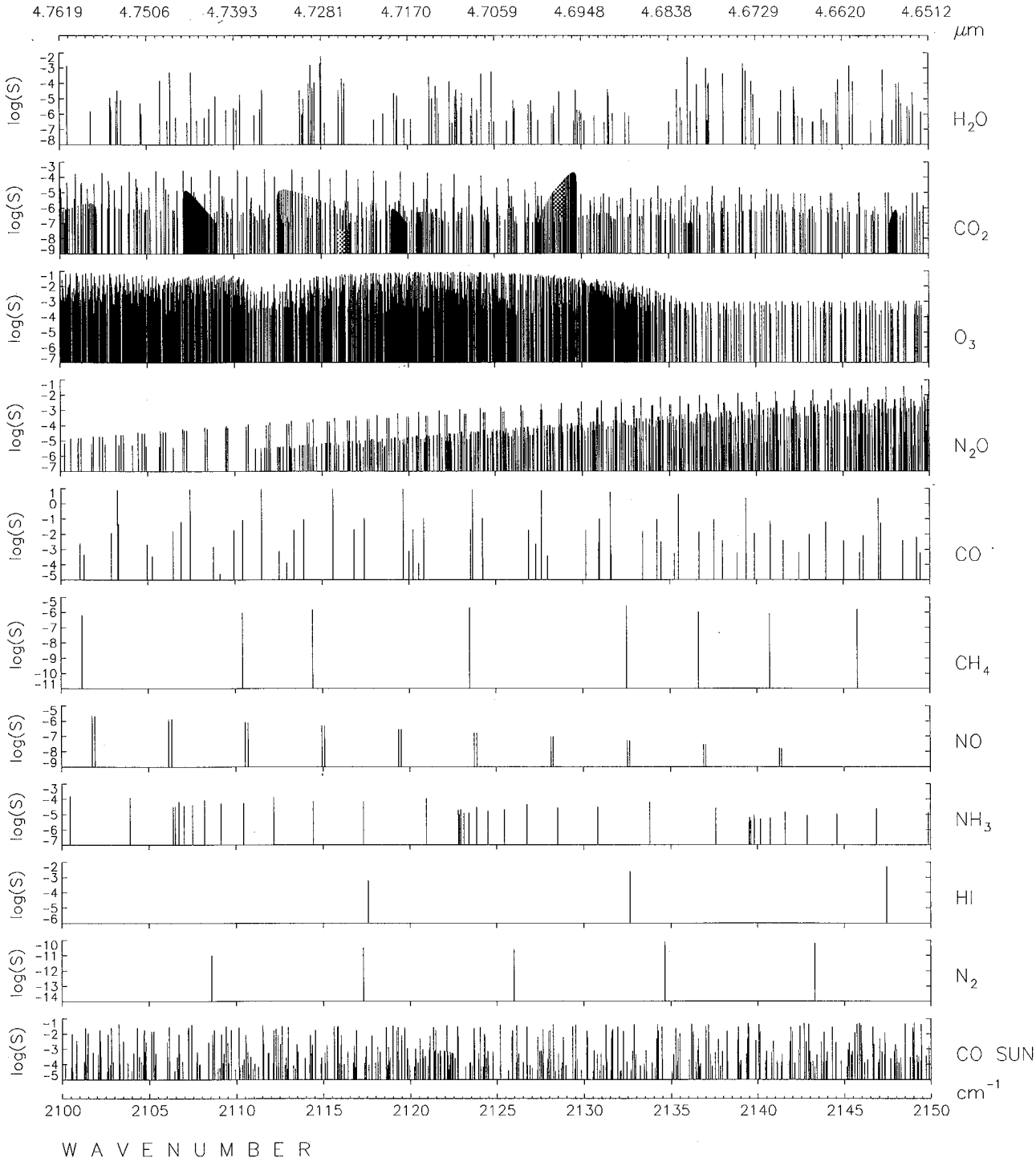


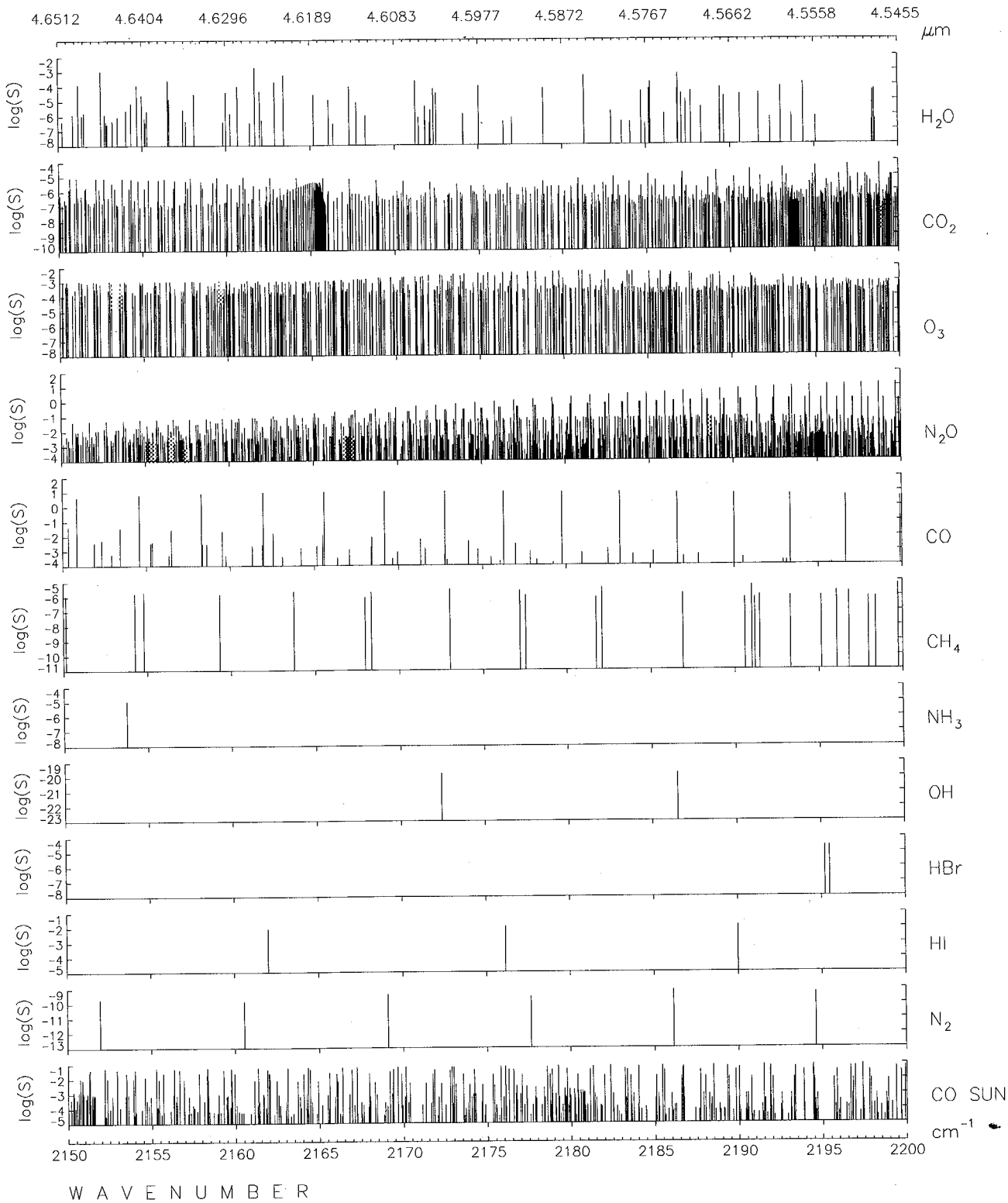
ORIGINAL PAGE IS
OF POOR QUALITY


5.0000
4.9875
4.9751
4.9628
4.9505
4.9383
4.9261
4.9140
4.9020
4.8900
4.8780
μm
log(S)
H2O
CO2
O3
N2O
CO
NO
NH3
OCS
N2
CO SUN
cm-1
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
WAVENUMBER

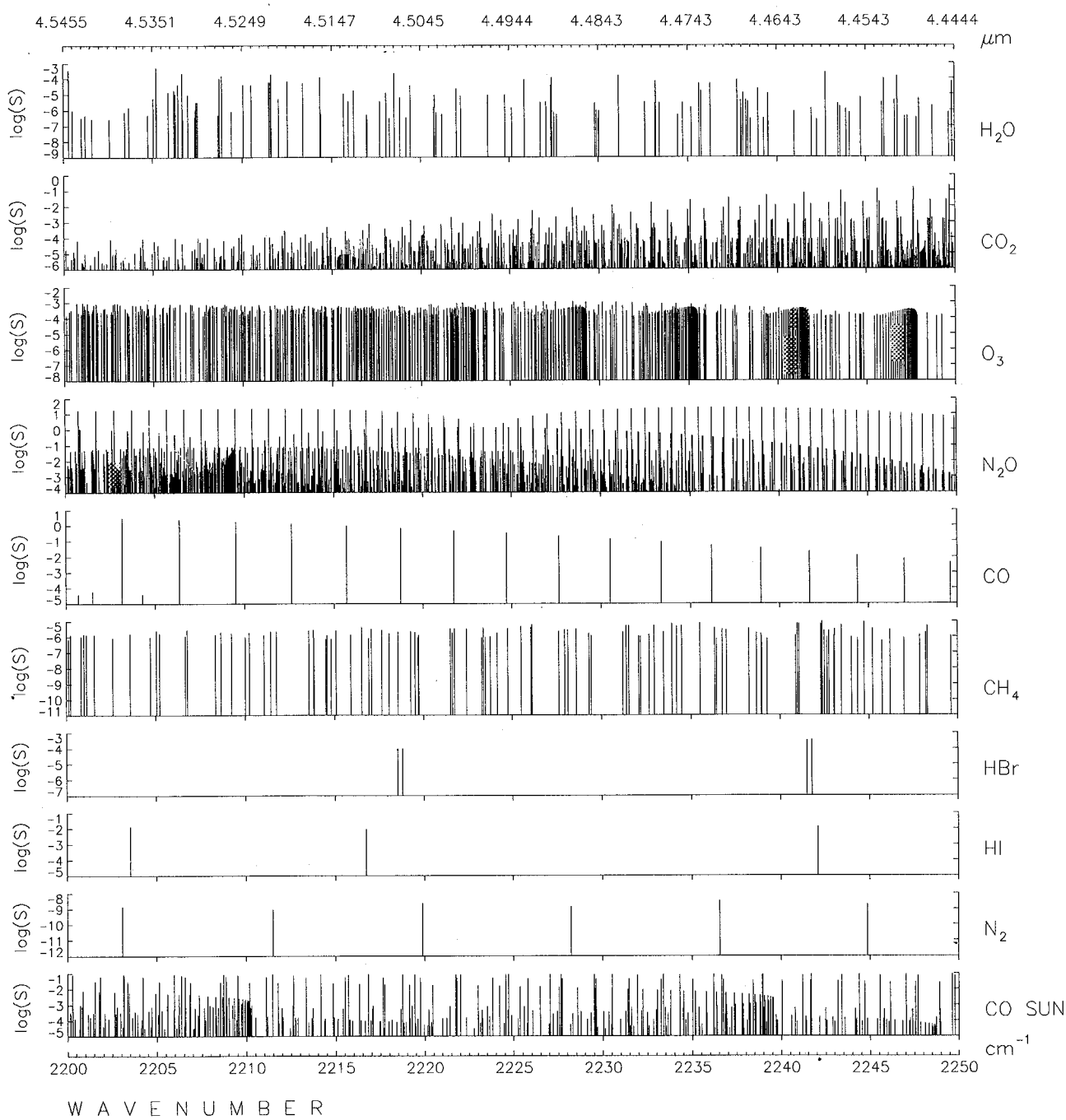


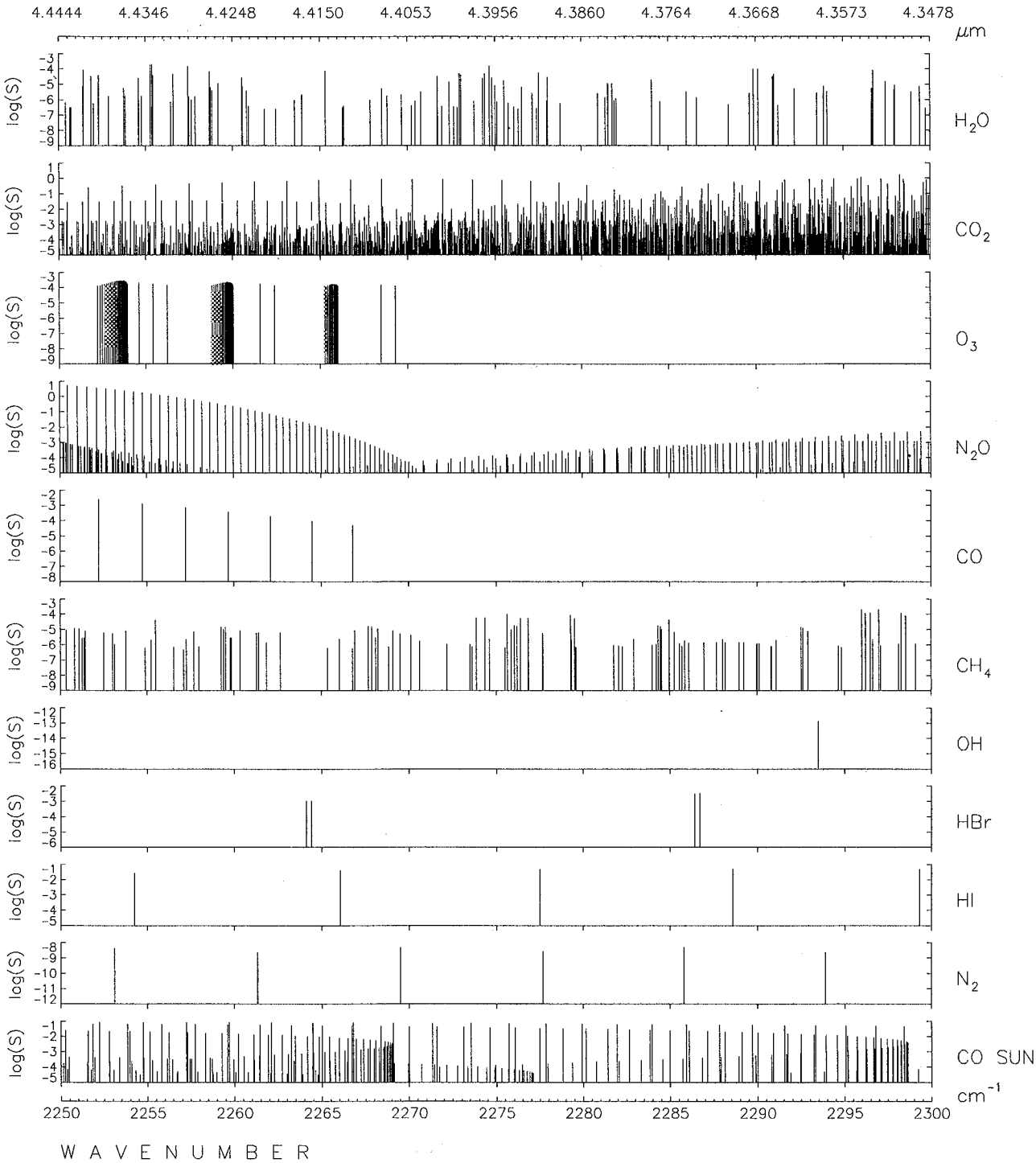
ORIGINAL PAGE IS
OF POOR QUALITY


4.7619
4.7506
4.7393
4.7281
4.7170
4.7059
4.6948
4.6838
4.6729
4.6620
4.6512
μm
log(S)
H2O
CO2
O3
N2O
CO
CH4
NO
NH3
HI
N2
CO SUN
cm-1
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150
WAVENUMBER

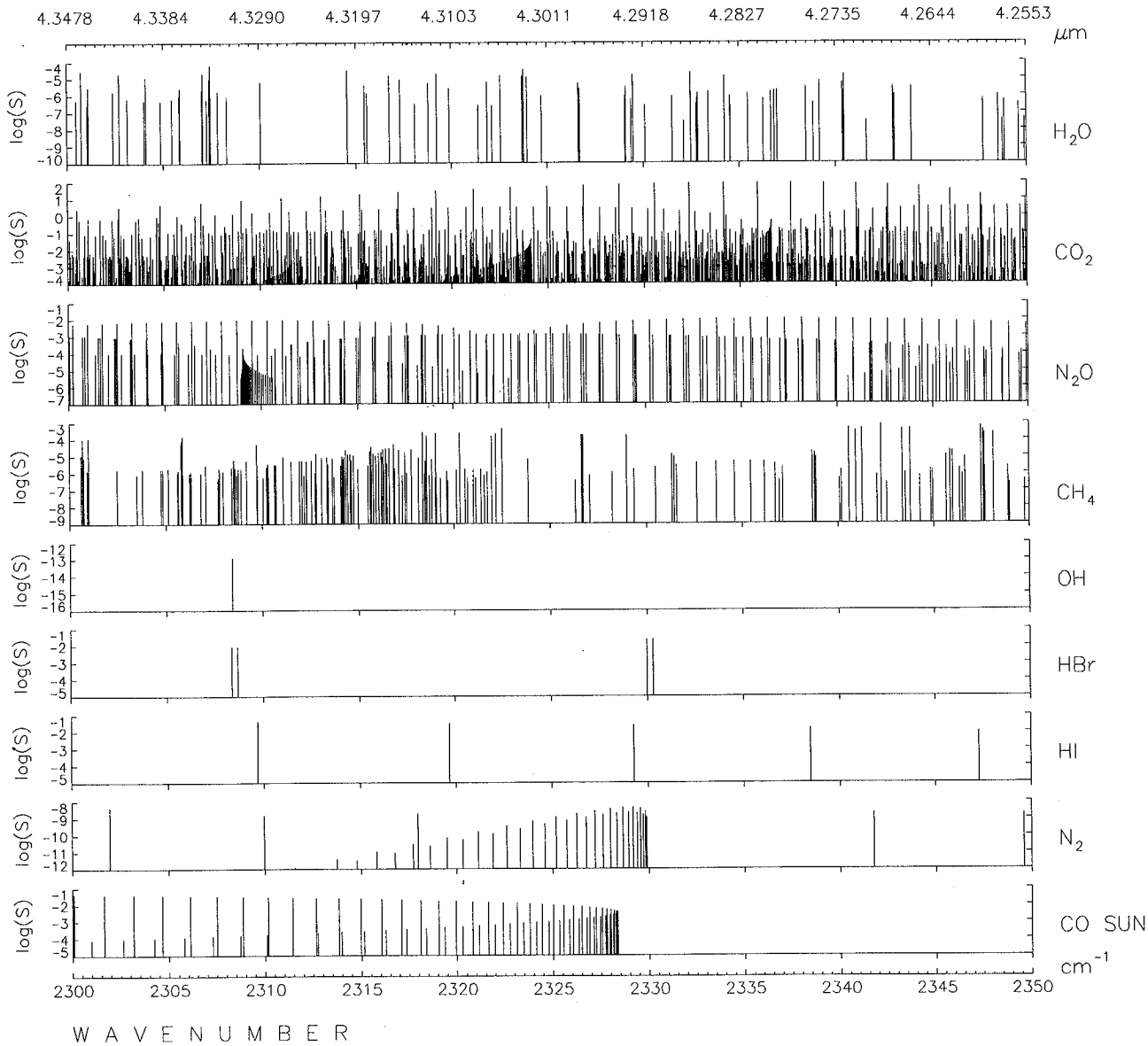


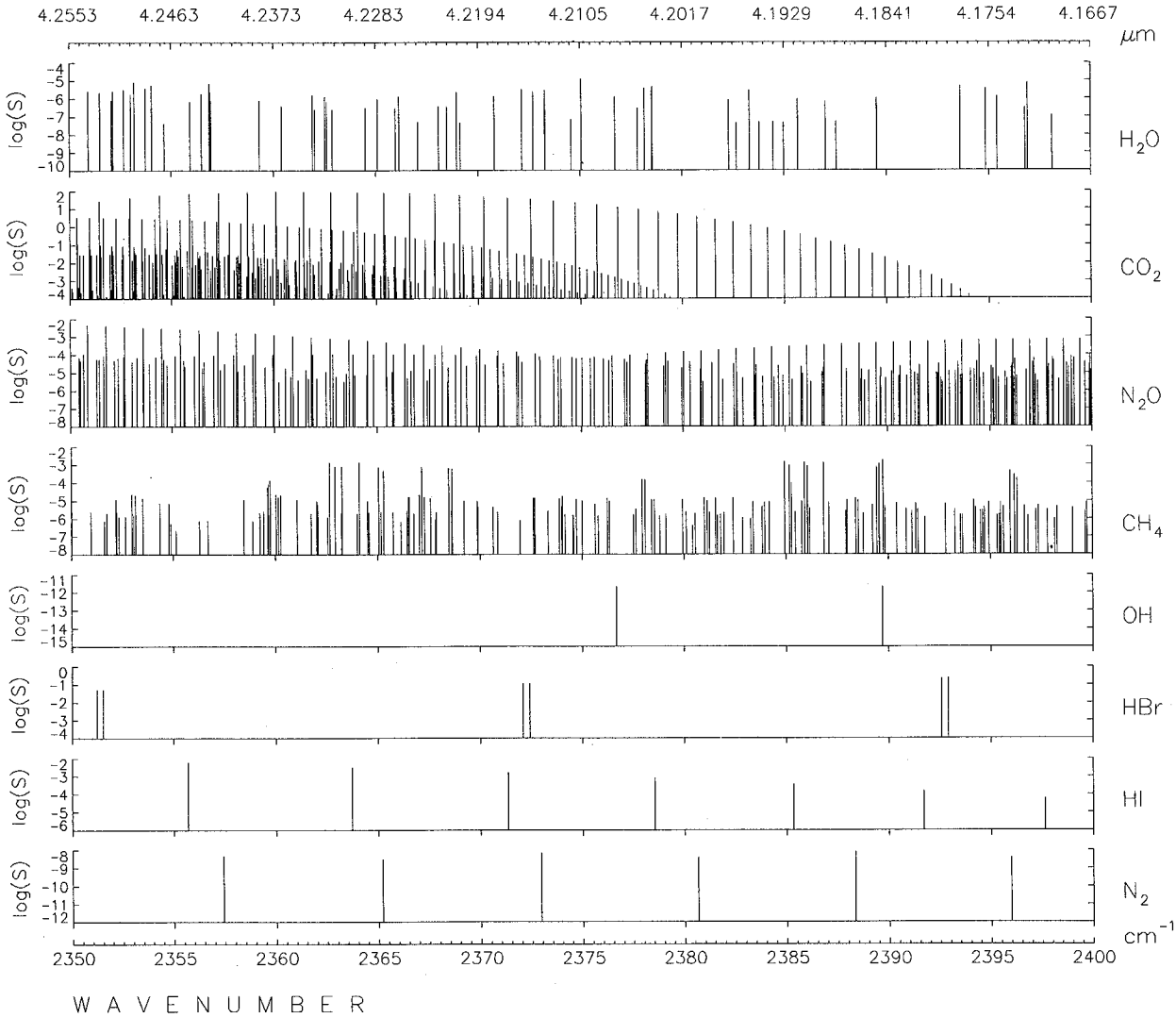
ORIGINAL PAGE IS
OF POOR QUALITY


4.5455
4.5351
4.5249
4.5147
4.5045
4.4944
4.4843
4.4743
4.4643
4.4543
4.4444
μm
log(S)
H2O
CO2
O3
N2O
CO
CH4
HBr
HI
N2
CO SUN
cm-1
2200
2205
2210
2215
2220
2225
2230
2235
2240
2245
2250
WAVENUMBER

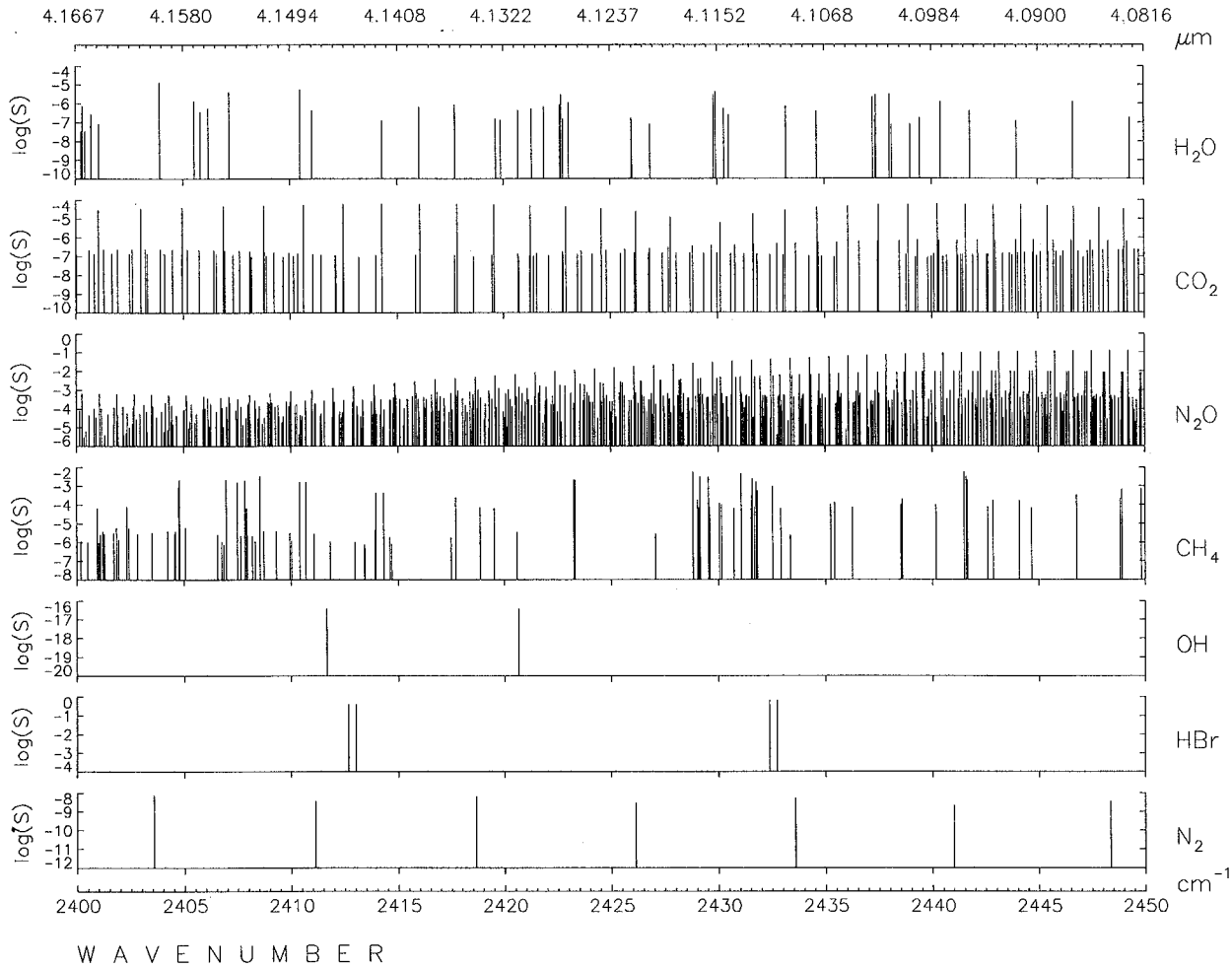


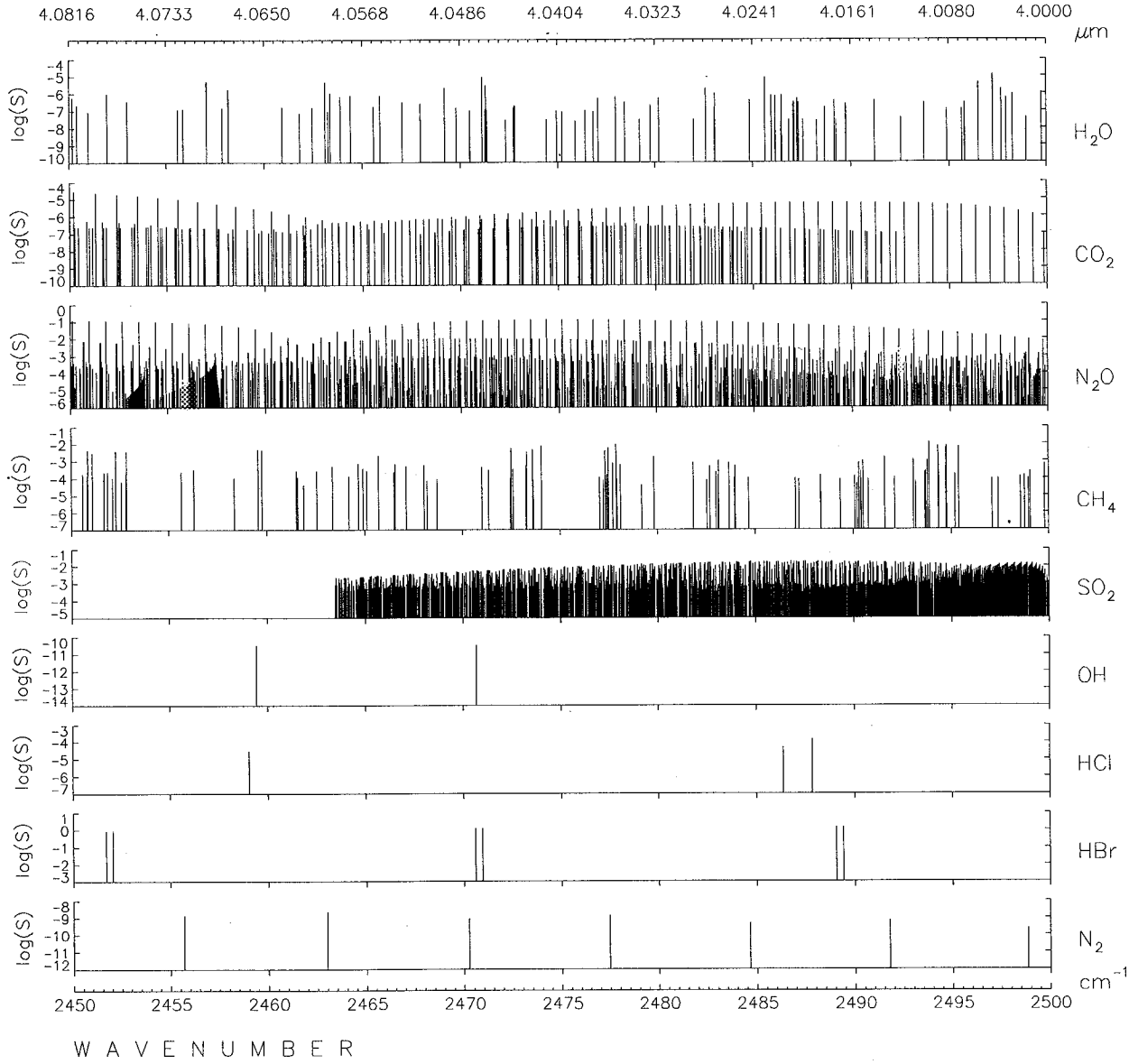
ORIGINAL PAGE IS
OF POOR QUALITY


4.3478
4.3384
4.3290
4.3197
4.3103
4.3011
4.2918
4.2827
4.2735
4.2644
4.2553
μm
log(S)
H2O
CO2
N2O
CH4
OH
HBr
HI
N2
CO SUN
cm-1
2300
2305
2310
2315
2320
2325
2330
2335
2340
2345
2350
WAVENUMBER

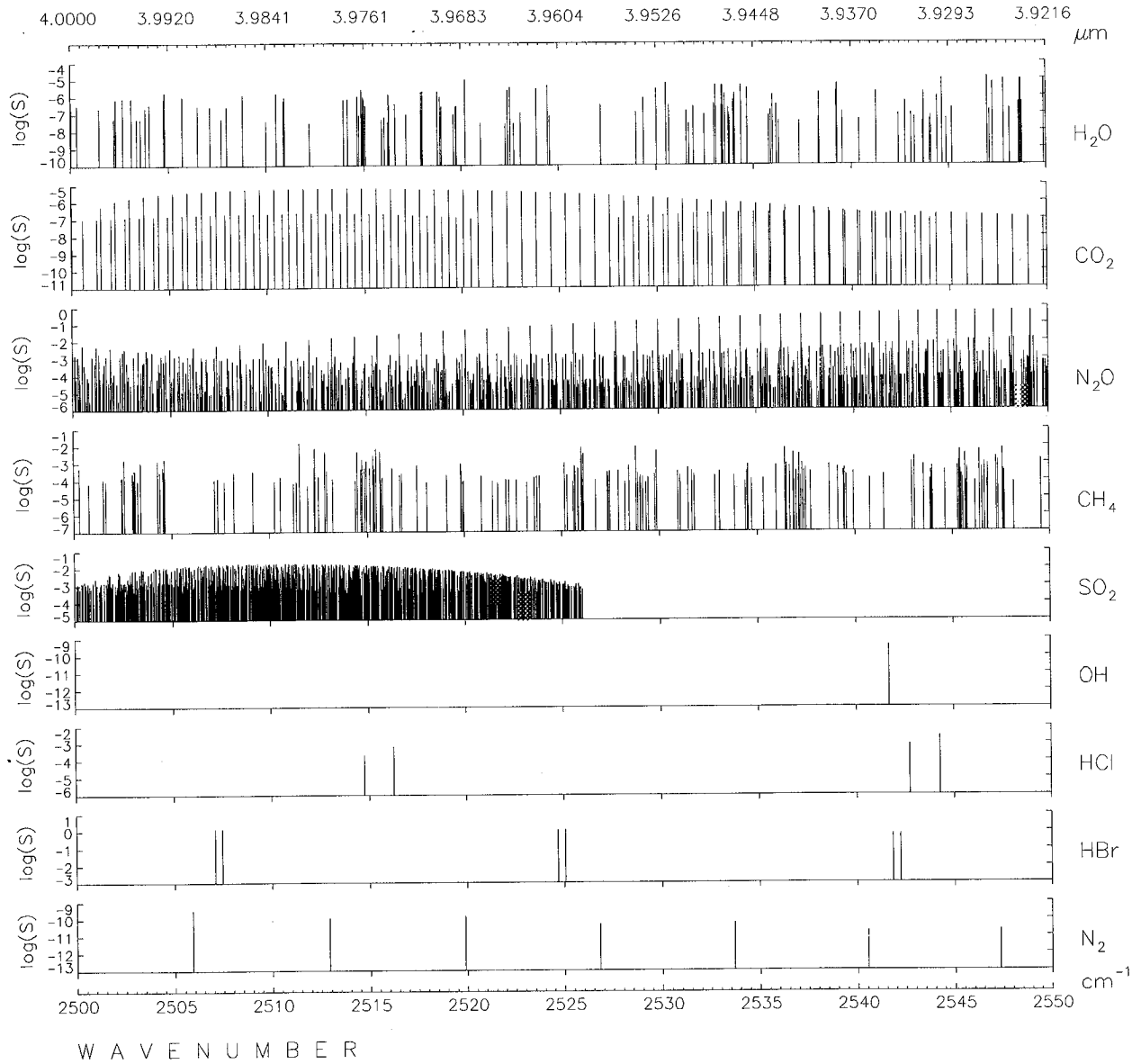


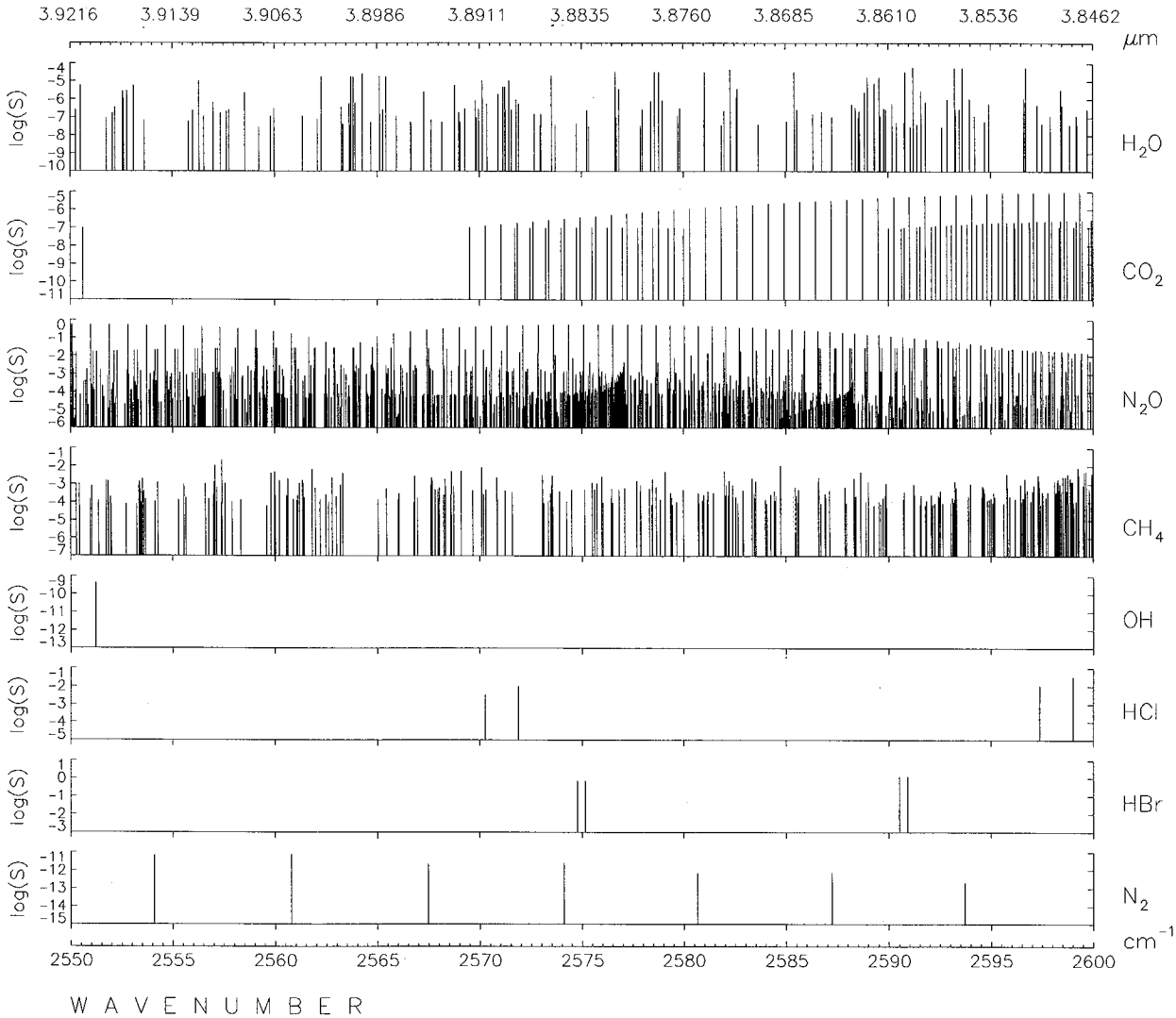
ORIGINAL PAGE IS
OF POOR QUALITY


4.1667
4.1580
4.1494
4.1408
4.1322
4.1237
4.1152
4.1068
4.0984
4.0900
4.0816
μm
log(S)
H2O
CO2
N2O
CH4
OH
HBr
N2
cm-1
2400
2405
2410
2415
2420
2425
2430
2435
2440
2445
2450
WAVENUMBER

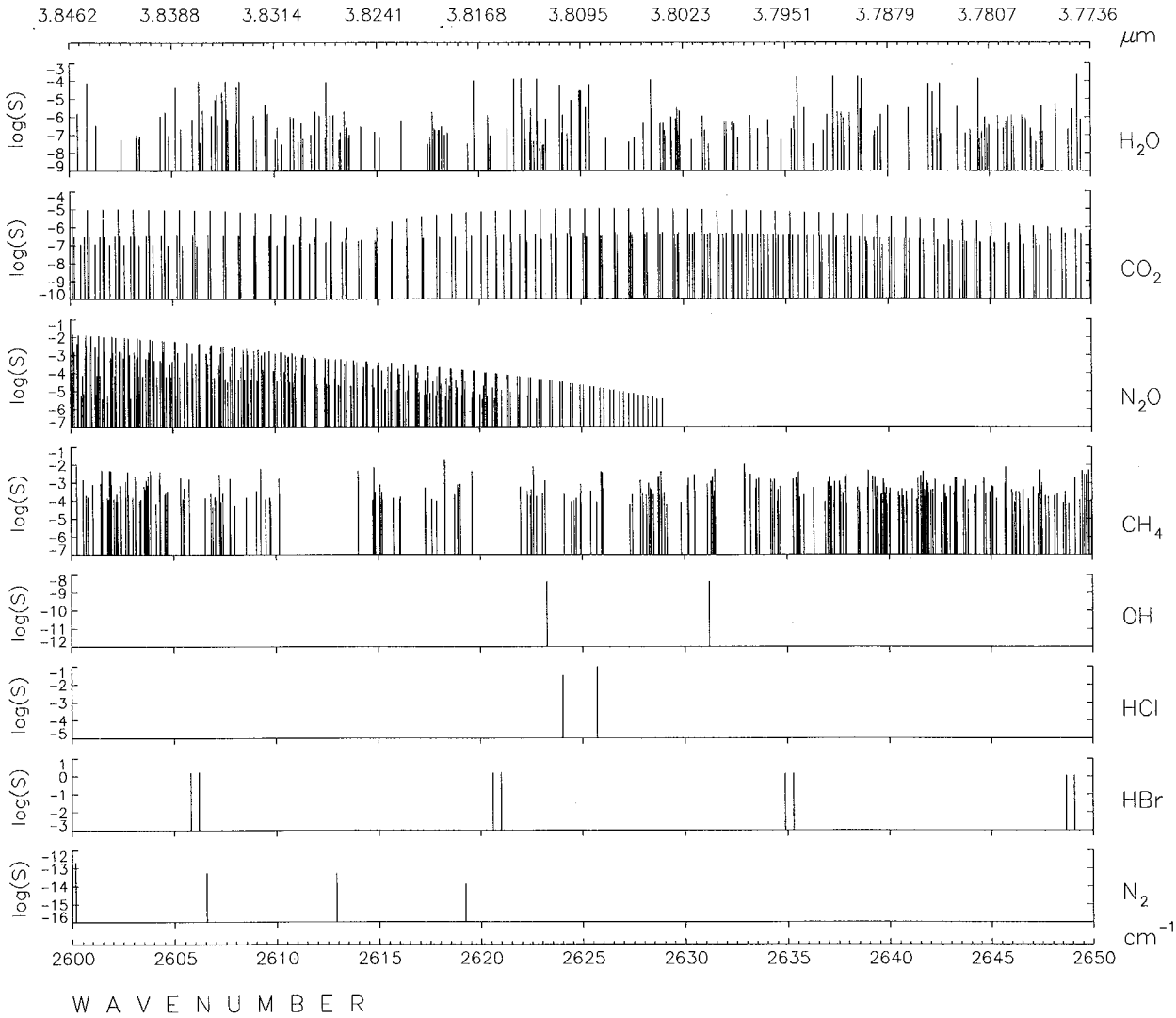


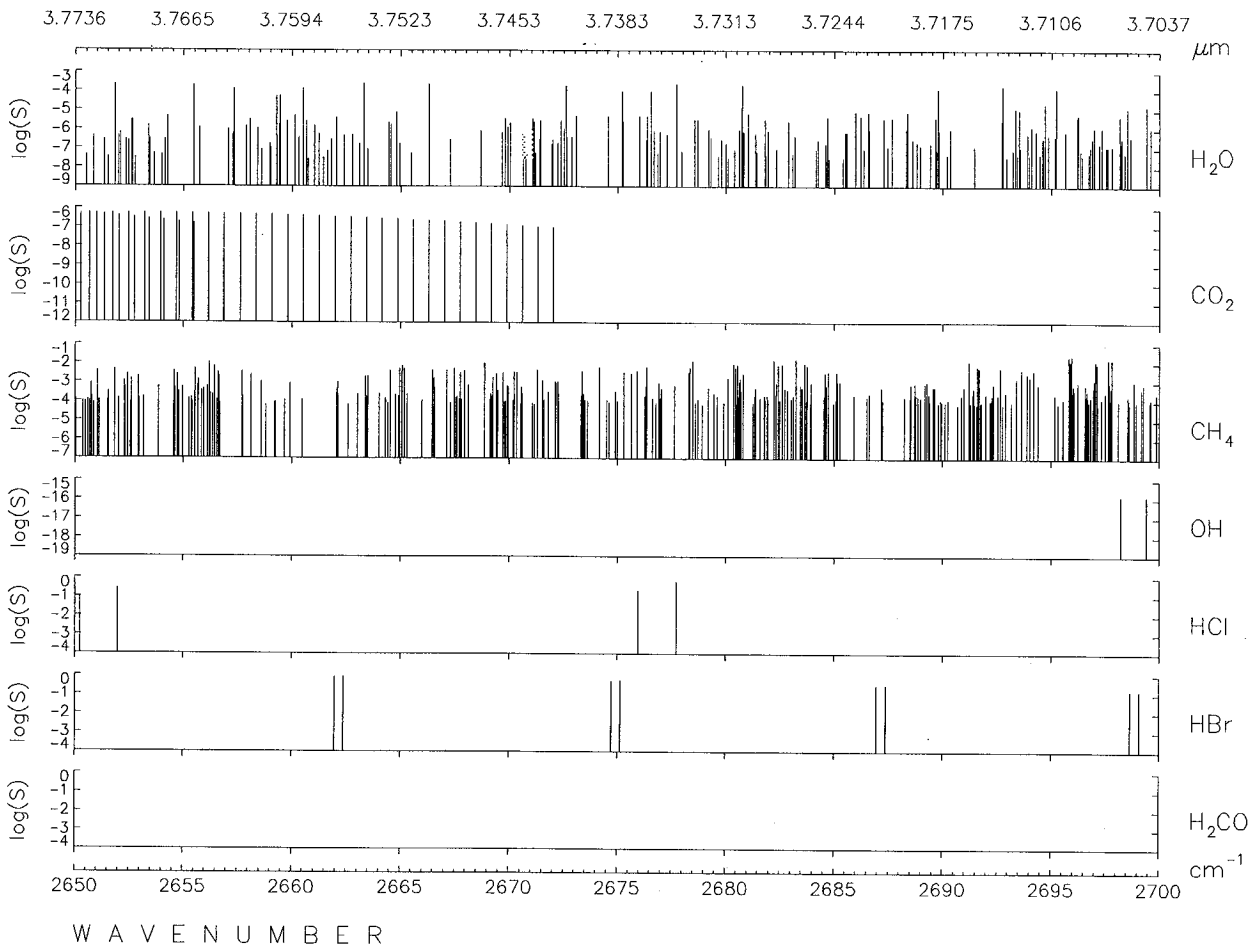
ORIGINAL PAGE IS
OF POOR QUALITY


4.0000
3.9920
3.9841
3.9761
3.9683
3.9604
3.9526
3.9448
3.9370
3.9293
3.9216
μm
log(S)
H2O
CO2
N2O
CH4
SO2
OH
HCl
HBr
N2
cm-1
2500
2505
2510
2515
2520
2525
2530
2535
2540
2545
2550
WAVENUMBER



ORIGINAL PAGE IS
OF POOR QUALITY

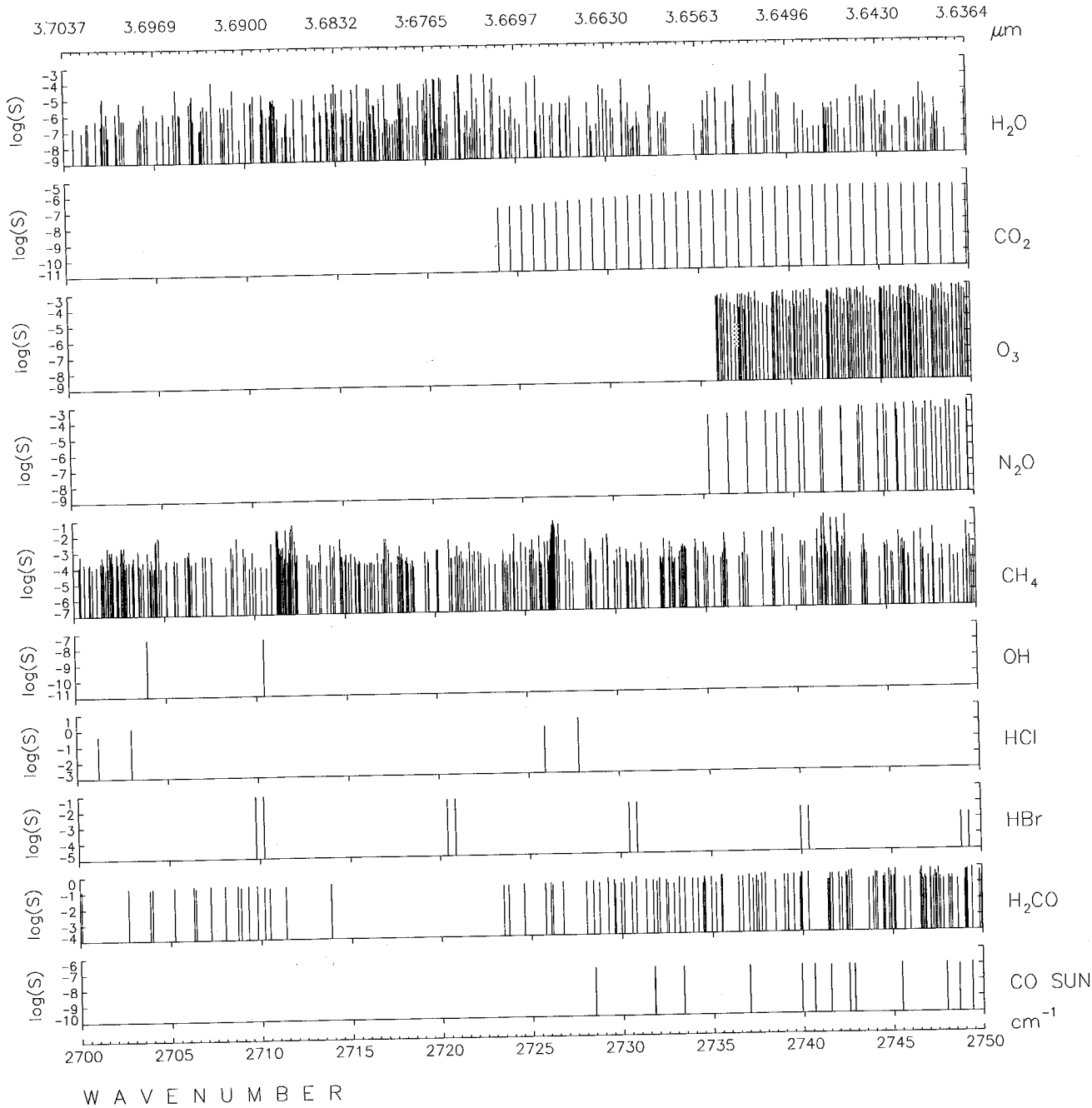

3.8462
3.8388
3.8314
3.8241
3.8168
3.8095
3.8023
3.7951
3.7879
3.7807
3.7736
μm
log(S)
H2O
CO2
N2O
CH4
OH
HCl
HBr
N2
cm-1
2600
2605
2610
2615
2620
2625
2630
2635
2640
2645
2650
WAVENUMBER



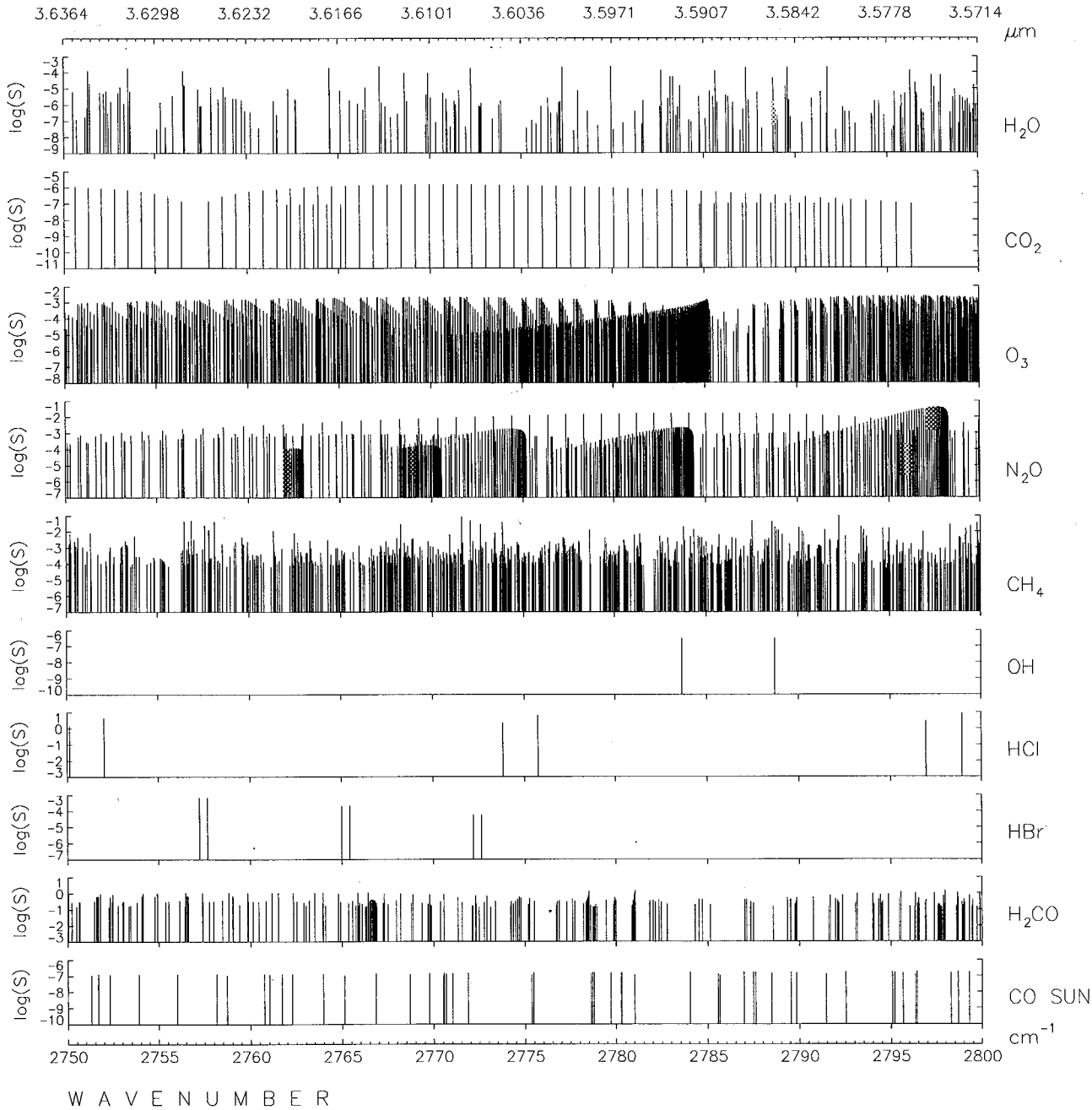
ORIGINAL PAGE IS
OF POOR QUALITY

C-2

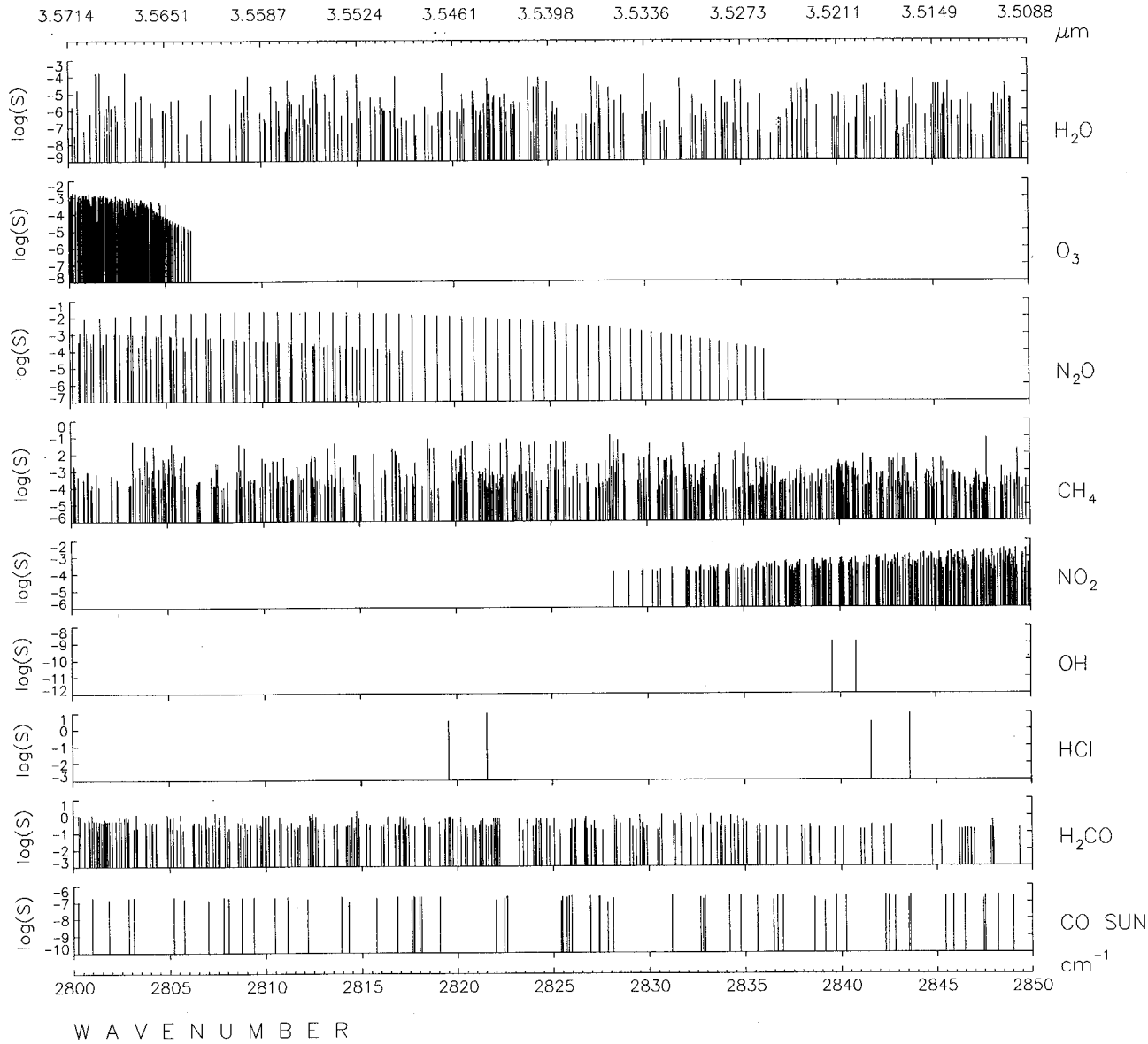
ORIGINAL PAGE IS
OF POOR QUALITY



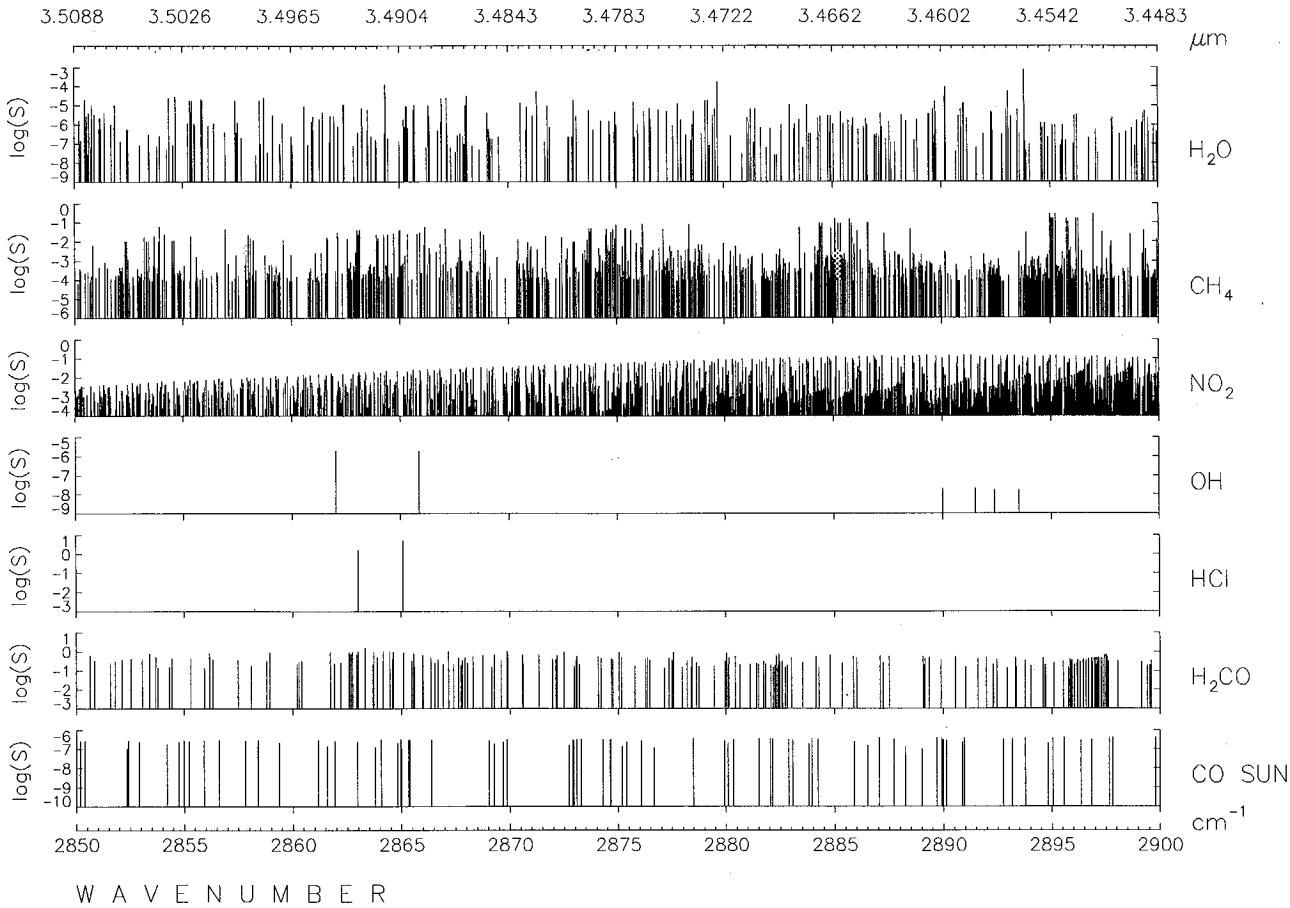
C-2

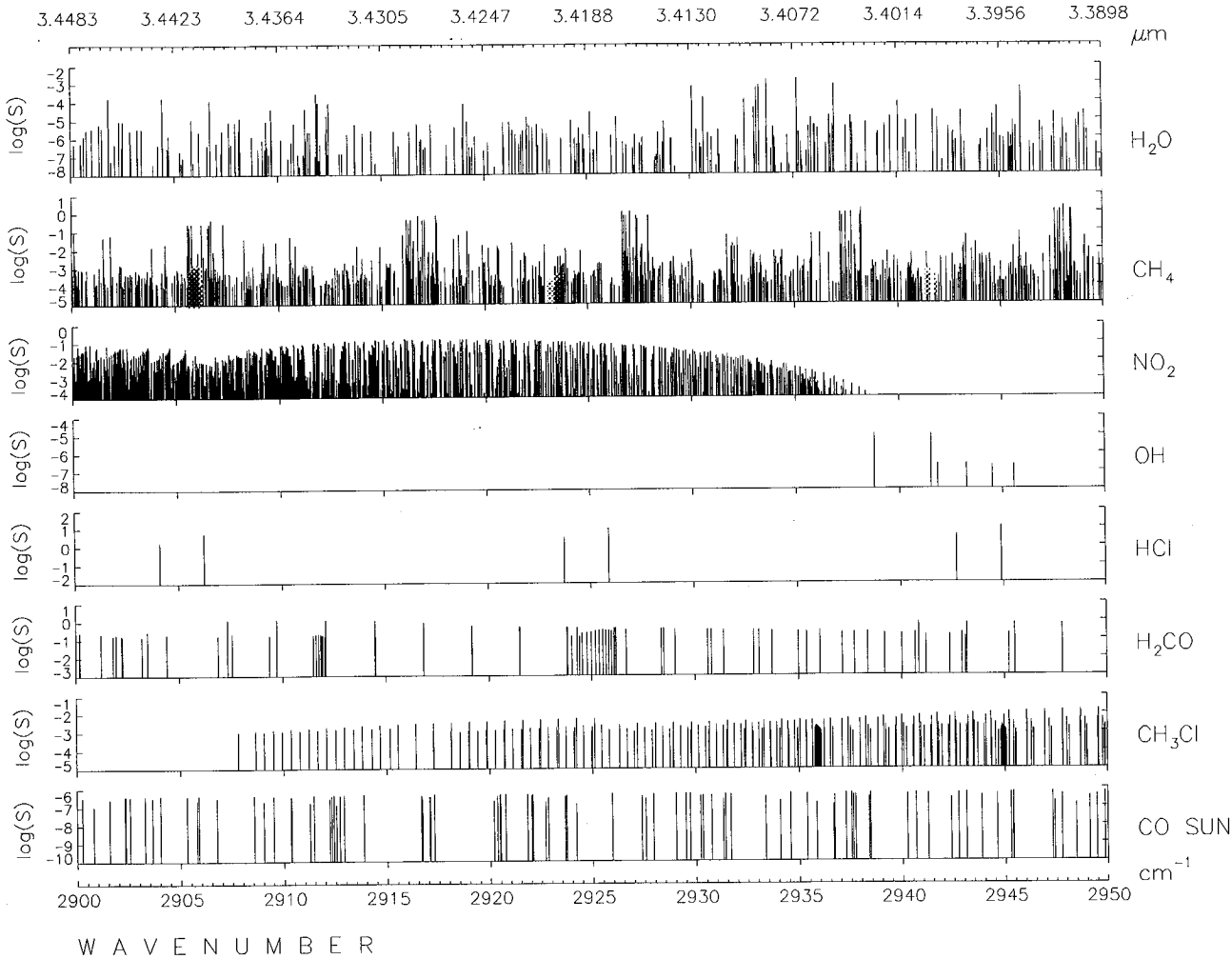


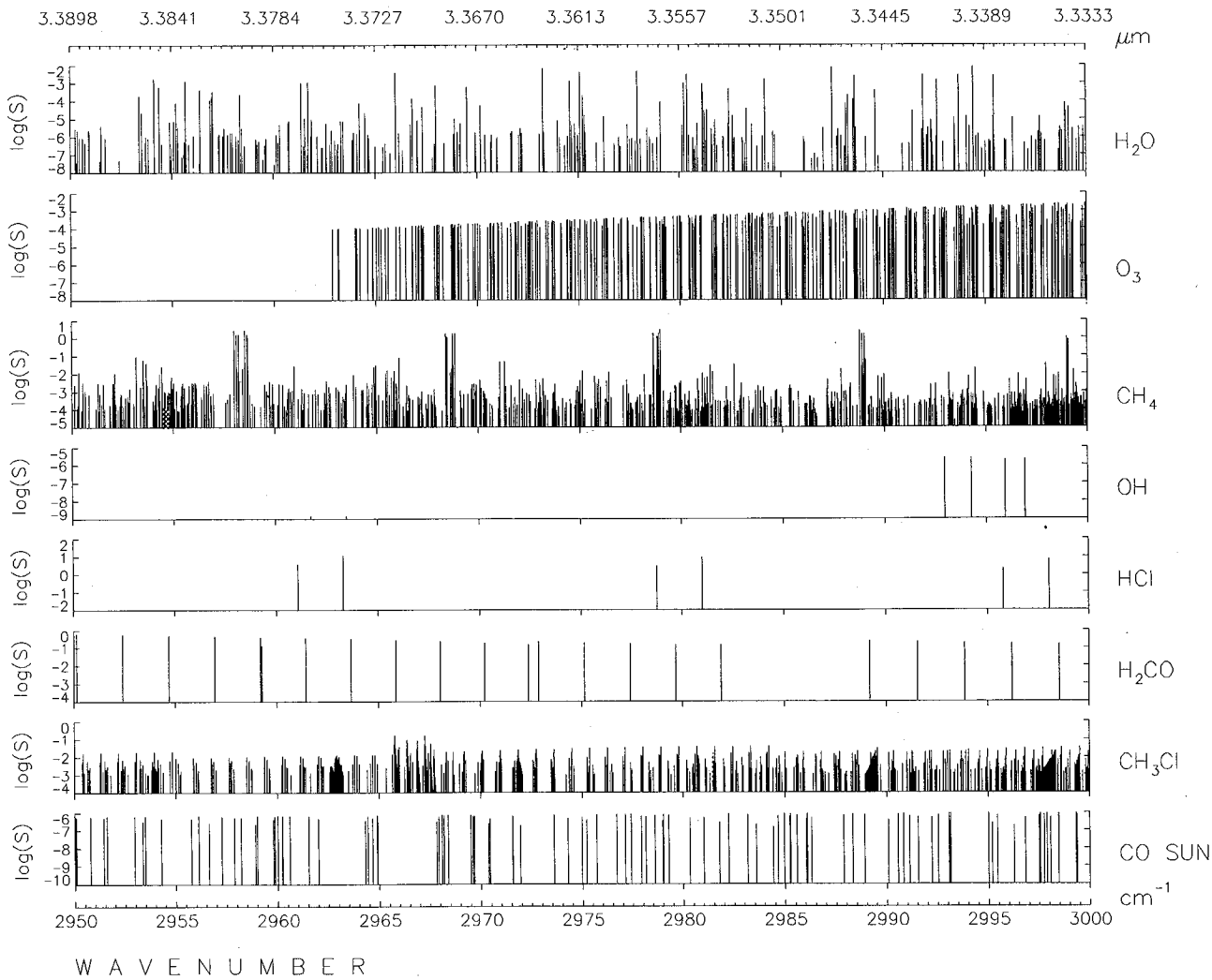
ORIGINAL PAGE IS
OF POOR QUALITY


3.5714
3.5651
3.5587
3.5524
3.5461
3.5398
3.5336
3.5273
3.5211
3.5149
3.5088
μm
log(S)
H2O
O3
N2O
CH4
NO2
OH
HCl
H2CO
CO SUN
cm-1
2800
2805
2810
2815
2820
2825
2830
2835
2840
2845
2850
WAVENUMBER

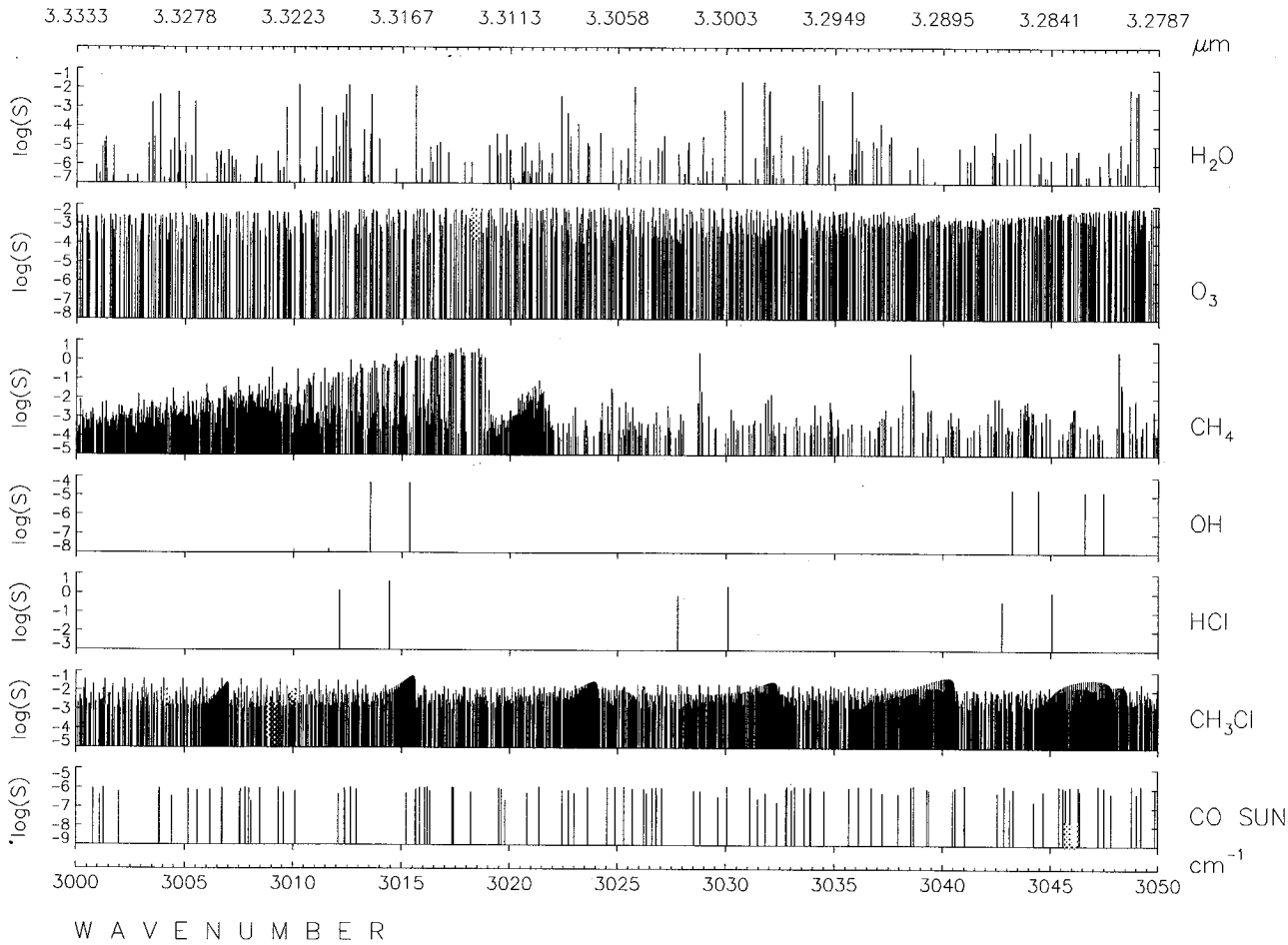
ORIGINAL PAGE IS
OF POOR QUALITY



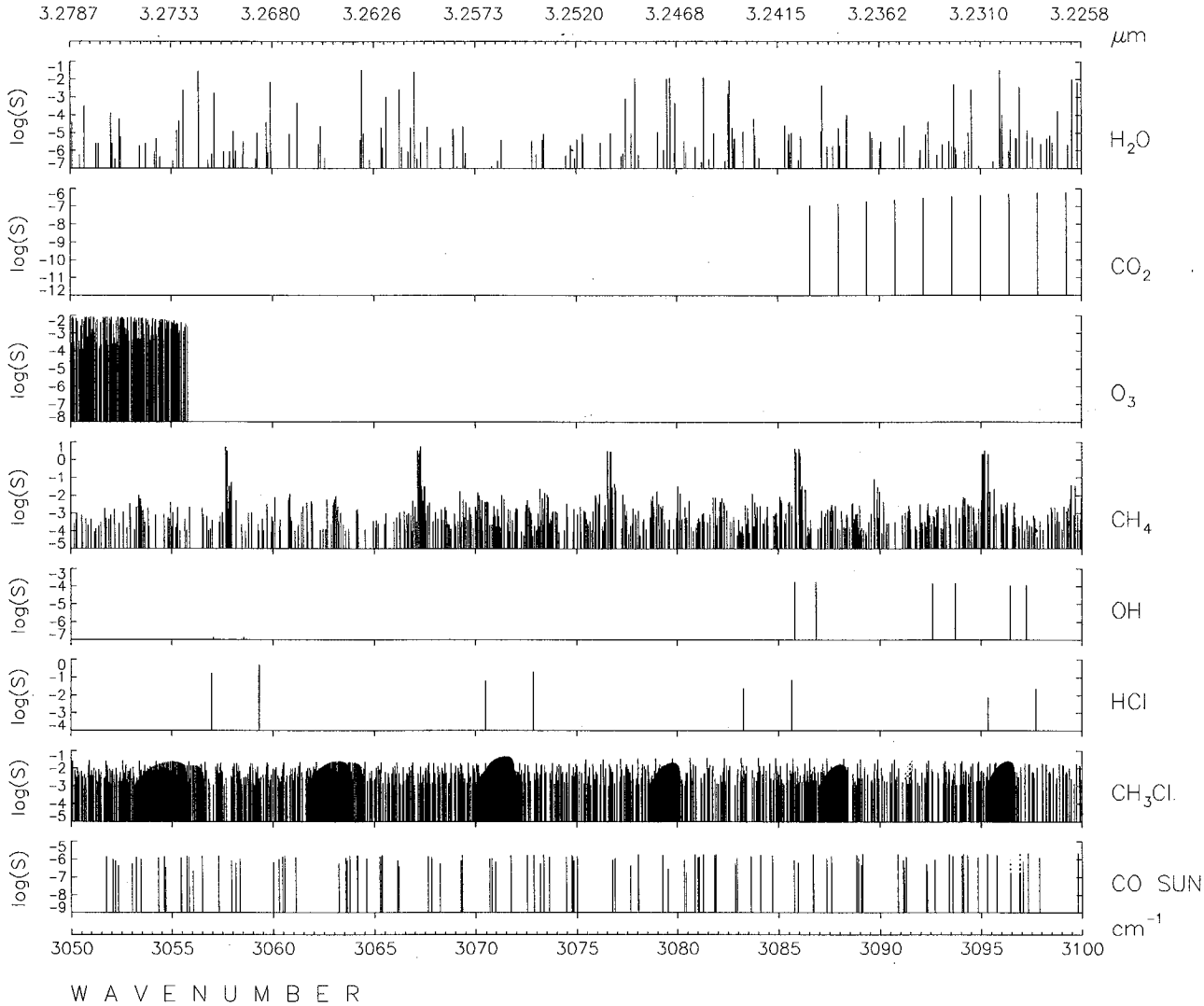

3.4483
3.4423
3.4364
3.4305
3.4247
3.4188
3.4130
3.4072
3.4014
3.3956
3.3898
μm
log(S)
H2O
CH4
NO2
OH
HCl
H2CO
CH3Cl
CO SUN
cm-1
2900
2905
2910
2915
2920
2925
2930
2935
2940
2945
2950
WAVENUMBER

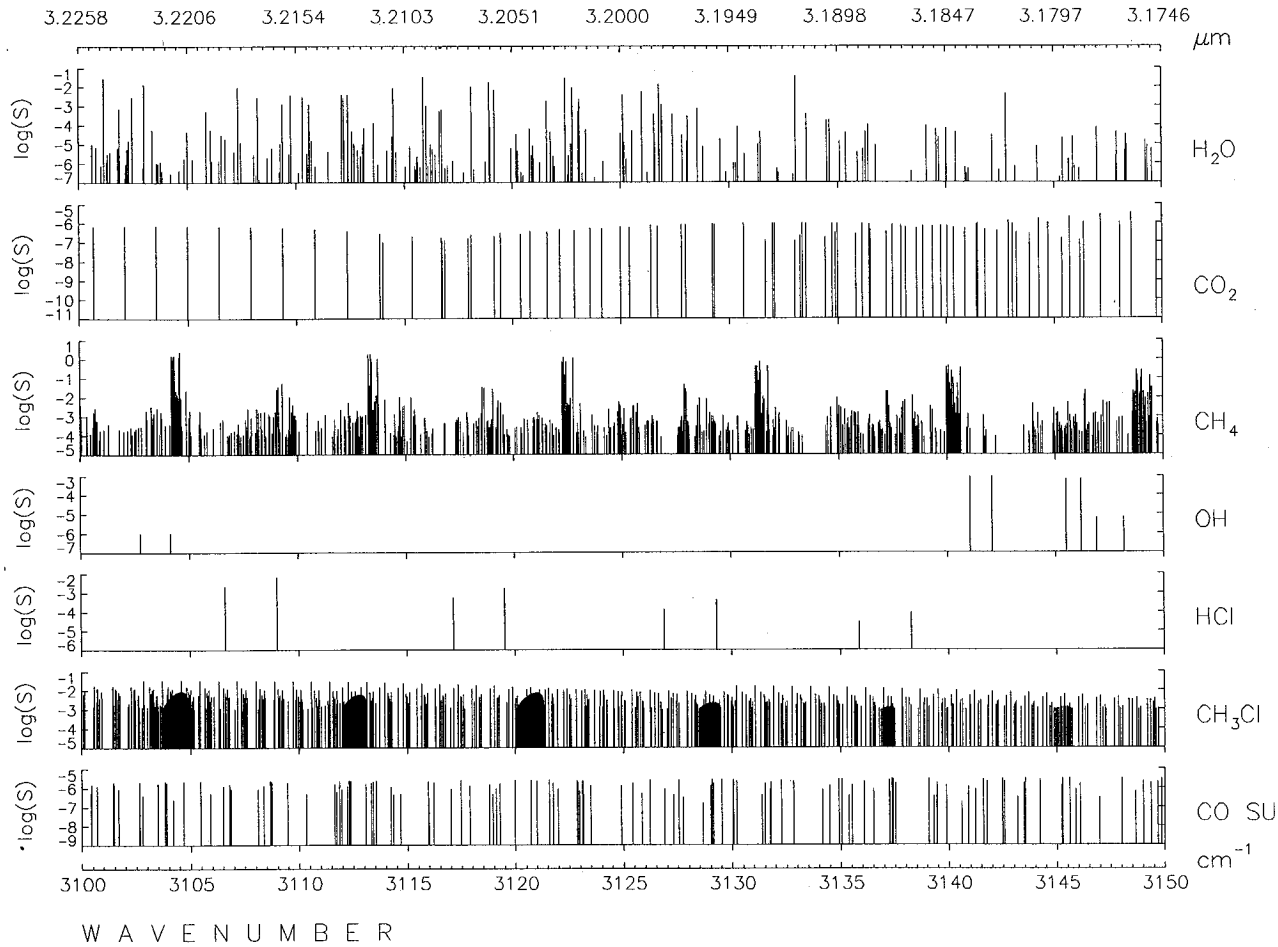


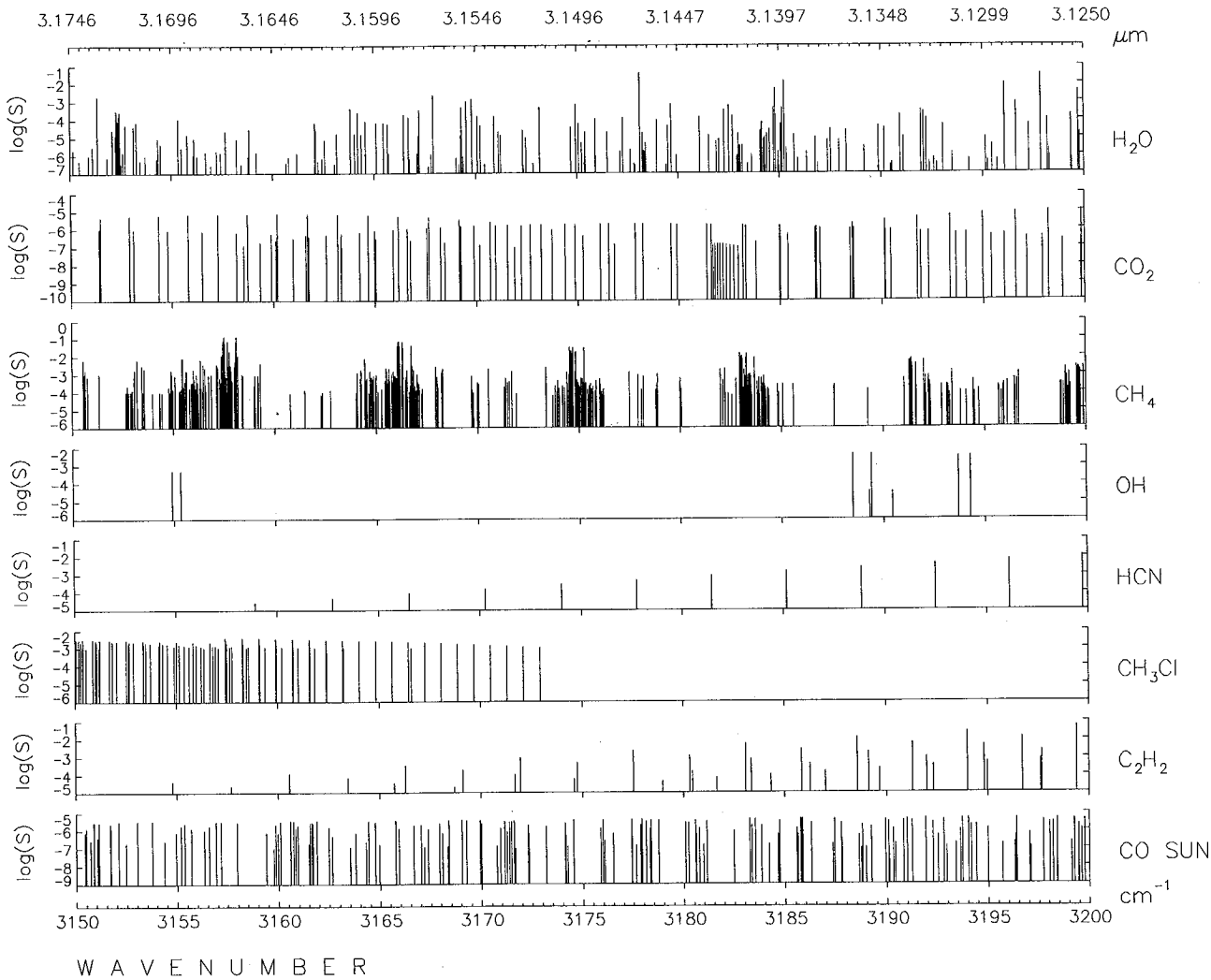
ORIGINAL PAGE IS
OF POOR QUALITY


3.3333
3.3278
3.3223
3.3167
3.3113
3.3058
3.3003
3.2949
3.2895
3.2841
3.2787
μm
log(S)
H2O
O3
CH4
OH
HCl
CH3Cl
CO SUN
cm-1
3000
3005
3010
3015
3020
3025
3030
3035
3040
3045
3050
WAVENUMBER

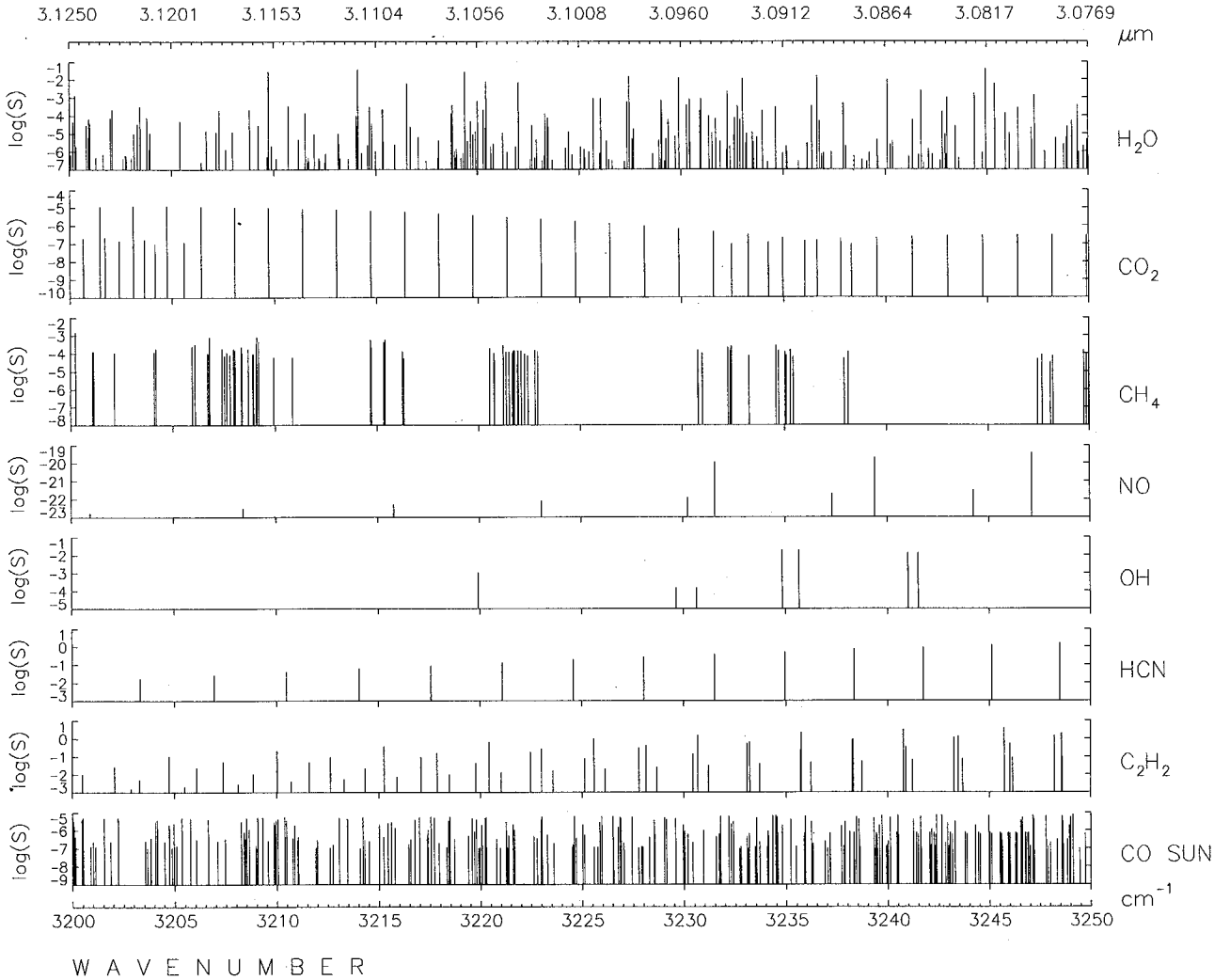
ORIGINAL PAGE IS
OF POOR QUALITY

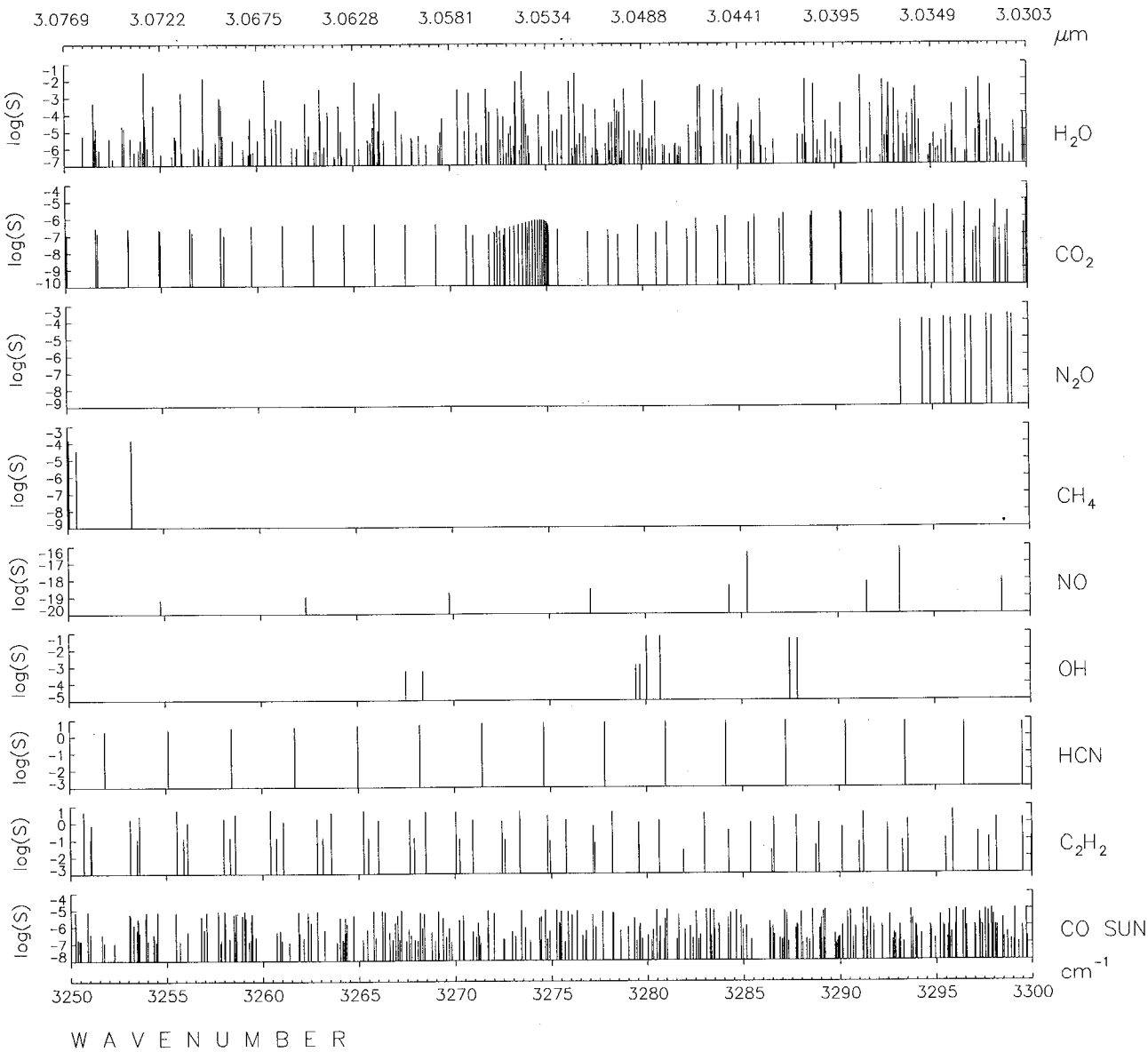



3.2258
3.2206
3.2154
3.2103
3.2051
3.2000
3.1949
3.1898
3.1847
3.1797
3.1746
μm
log(S)
H2O
CO2
CH4
OH
HCl
CH3Cl
CO SU
cm-1
3100
3105
3110
3115
3120
3125
3130
3135
3140
3145
3150
WAVENUMBER

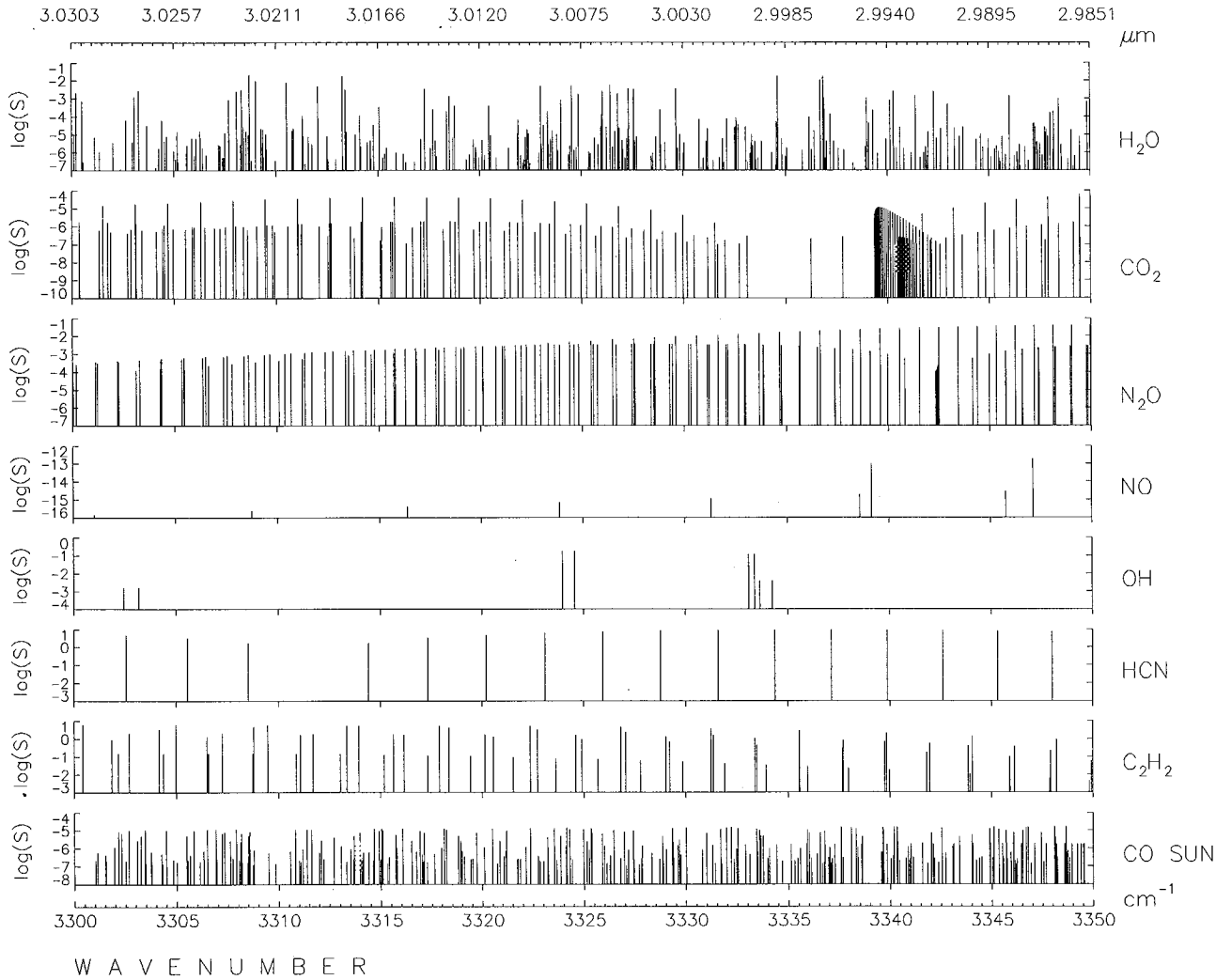


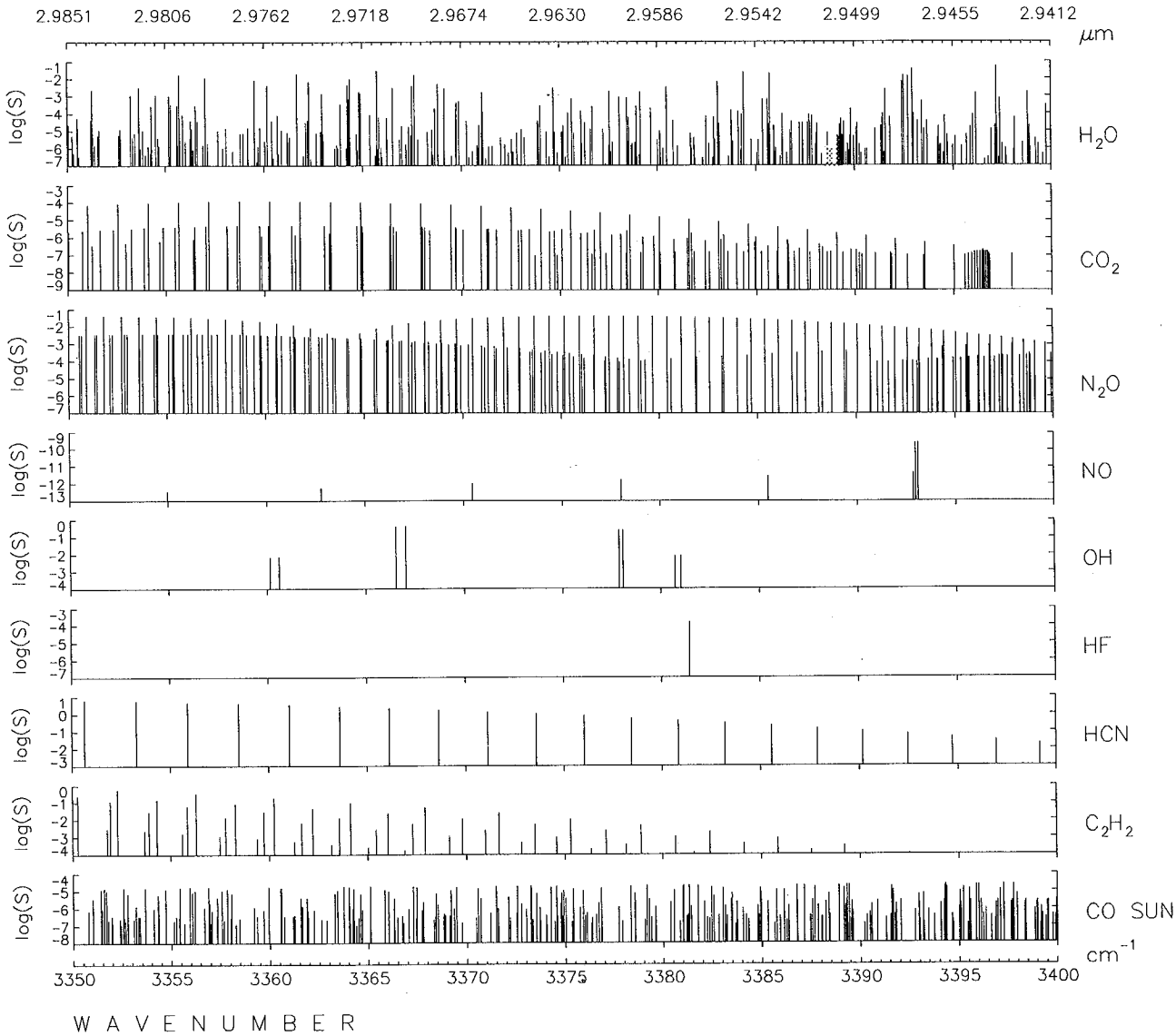
ORIGINAL PAGE IS
OF POOR QUALITY


3.1250
3.1201
3.1153
3.1104
3.1056
3.1008
3.0960
3.0912
3.0864
3.0817
3.0769
μm
log(S)
H2O
CO2
CH4
NO
OH
HCN
C2H2
CO SUN
cm-1
3200
3205
3210
3215
3220
3225
3230
3235
3240
3245
3250
WAVENUMBER

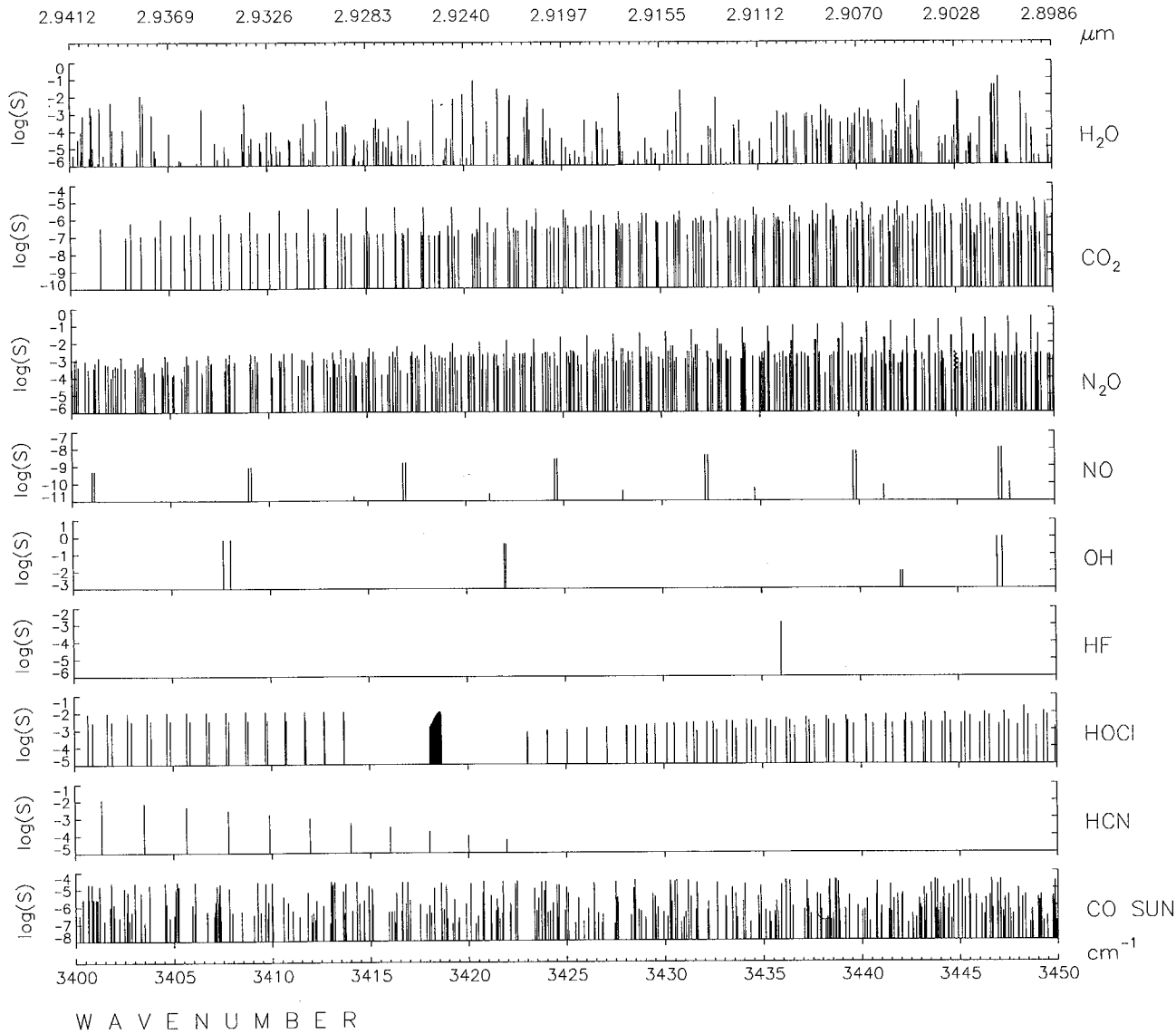


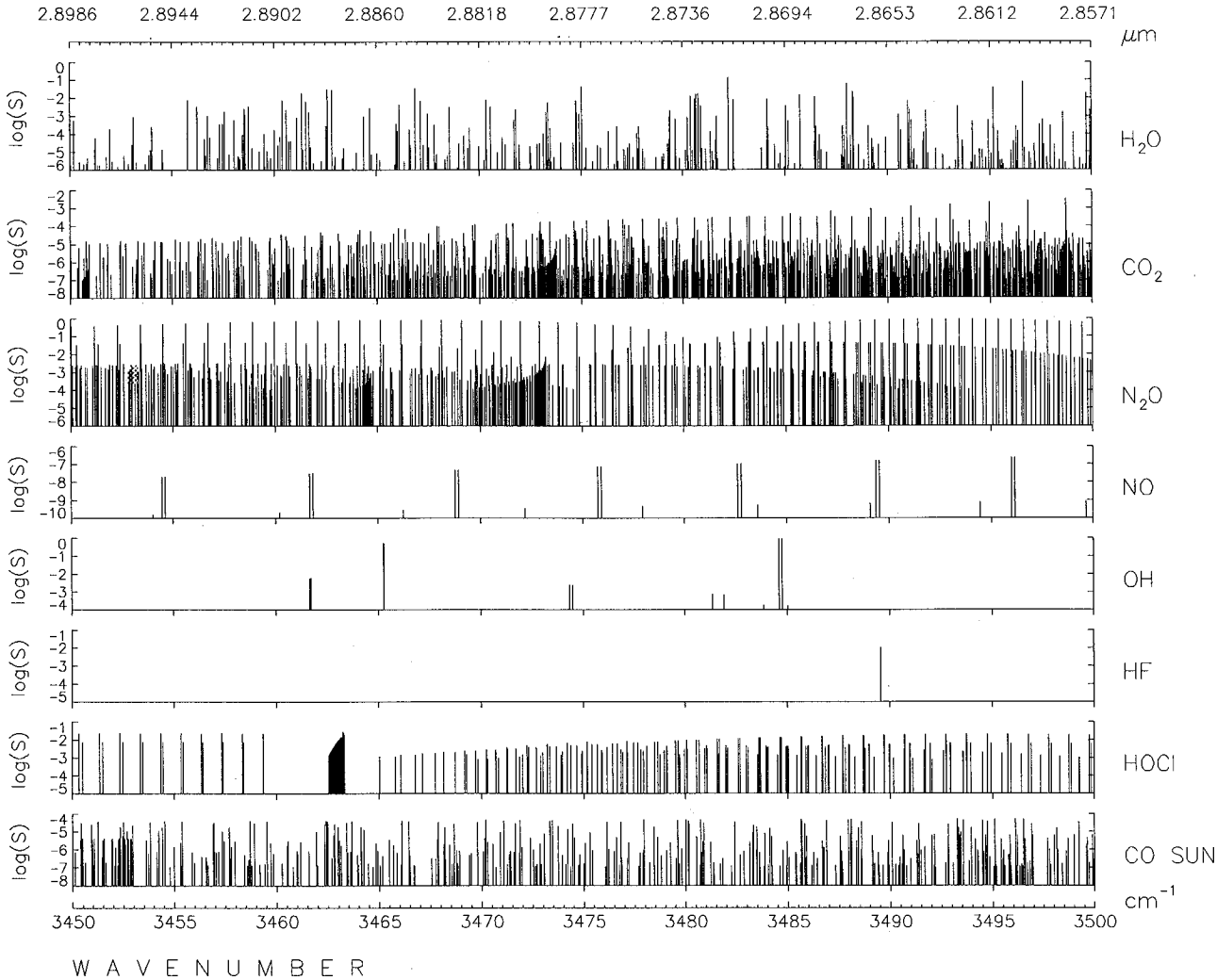
ORIGINAL PAGE IS
OF POOR QUALITY


3.0303
3.0257
3.0211
3.0166
3.0120
3.0075
3.0030
2.9985
2.9940
2.9895
2.9851
μm
log(S)
H2O
CO2
N2O
NO
OH
HCN
C2H2
CO SUN
3300
3305
3310
3315
3320
3325
3330
3335
3340
3345
3350
cm-1
WAVENUMBER

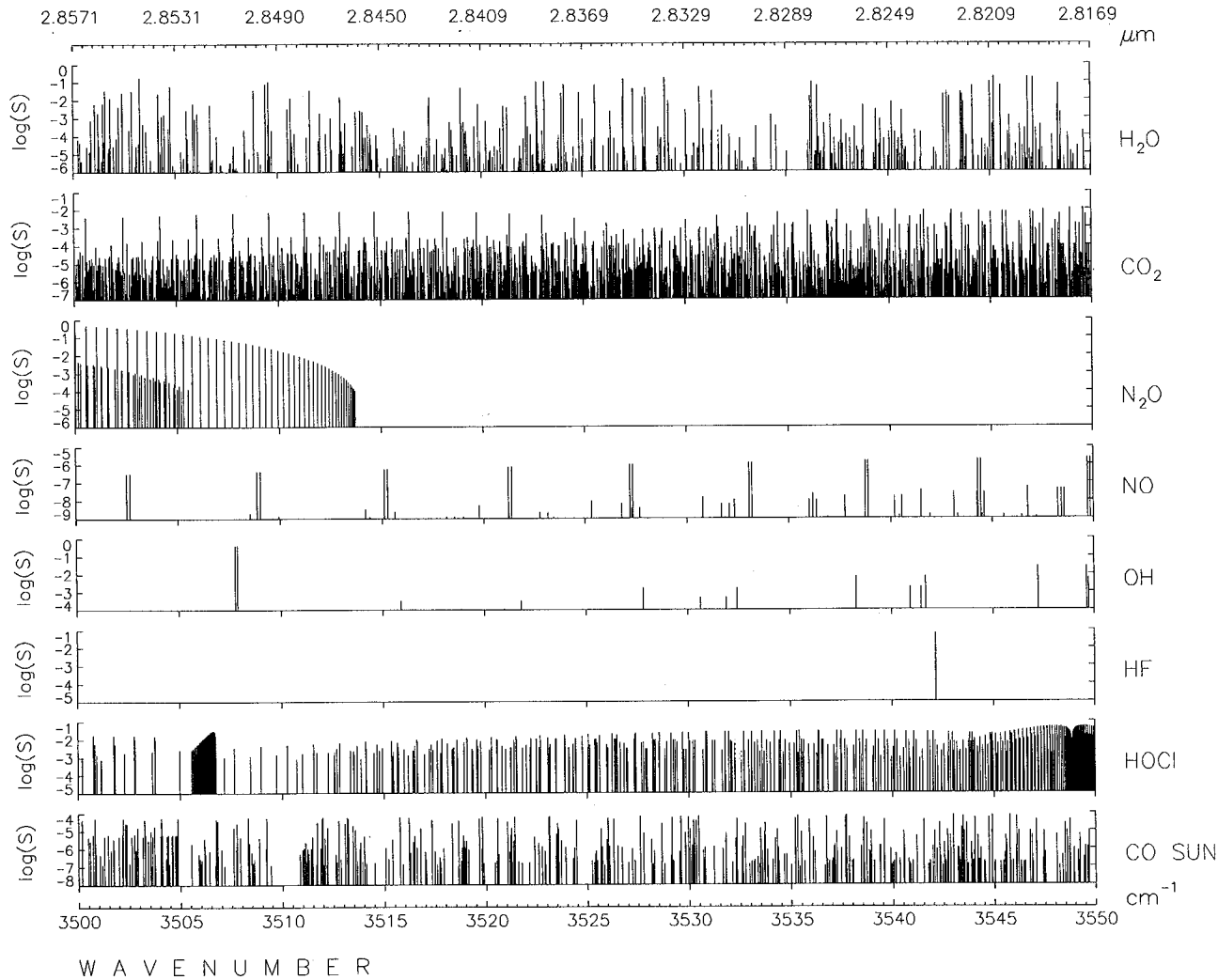


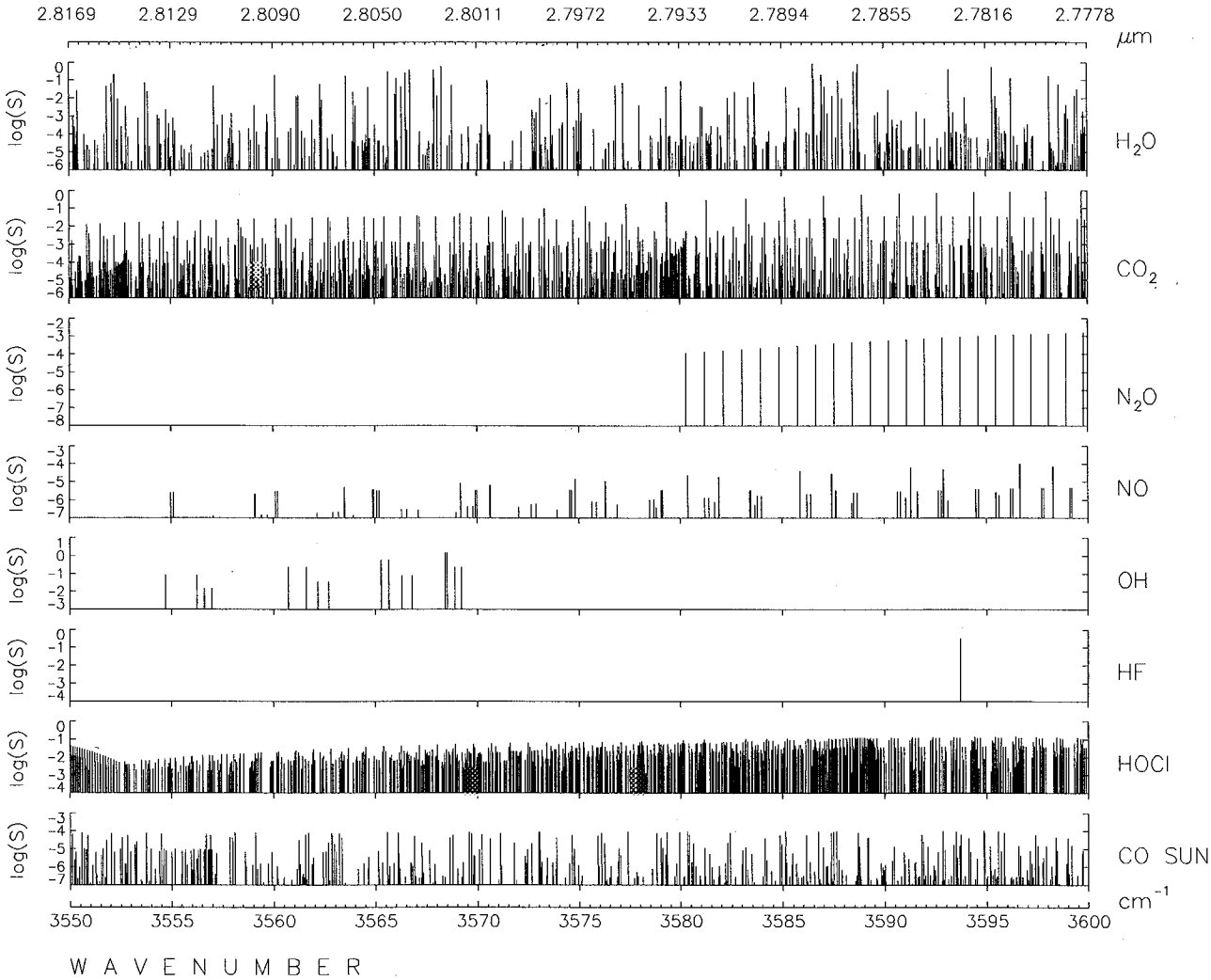
ORIGINAL PAGE IS
OF POOR QUALITY


2.9412
2.9369
2.9326
2.9283
2.9240
2.9197
2.9155
2.9112
2.9070
2.9028
2.8986
μm
log(S)
H2O
CO2
N2O
NO
OH
HF
HOCl
HCN
CO SUN
cm-1
3400
3405
3410
3415
3420
3425
3430
3435
3440
3445
3450
WAVENUMBER

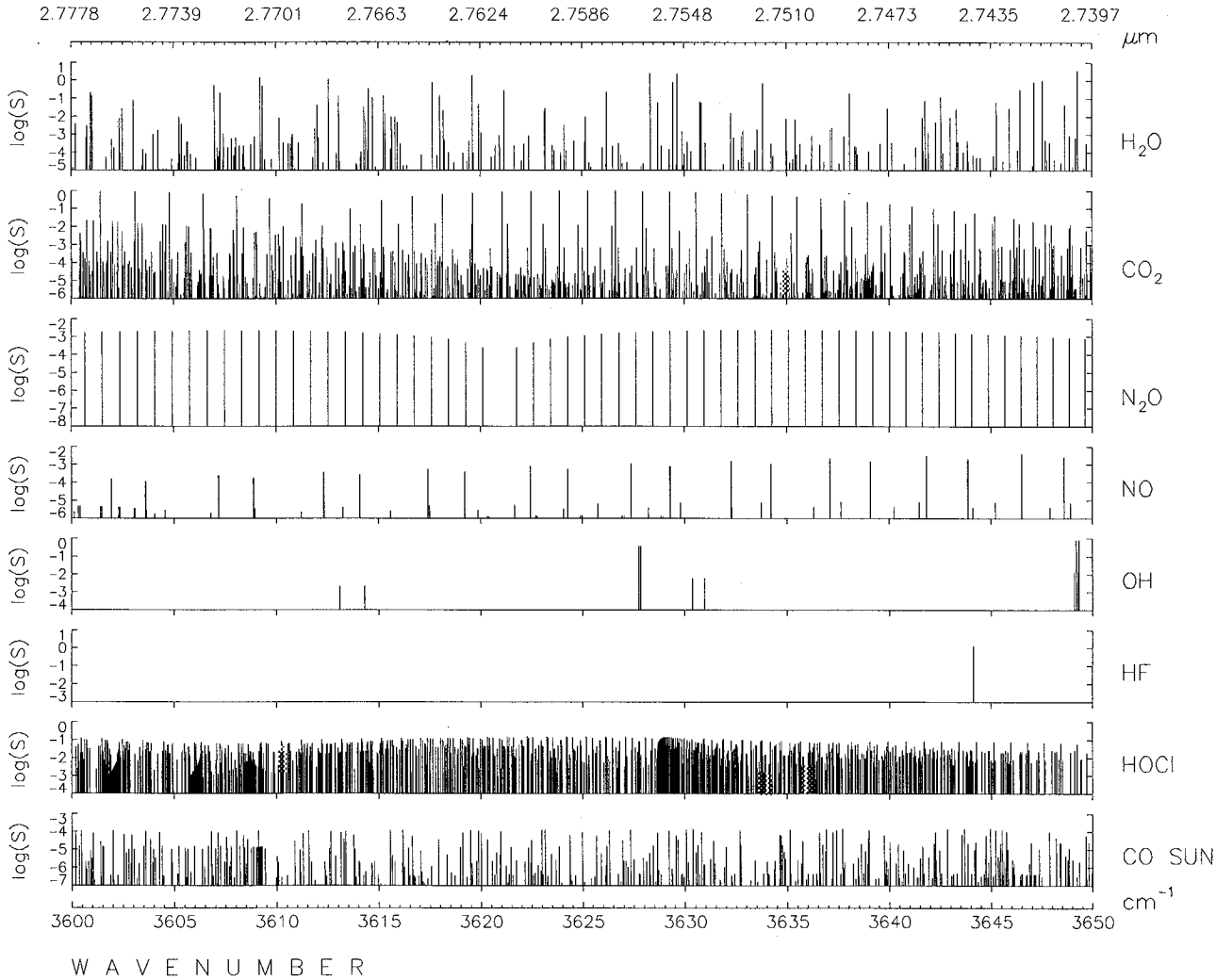


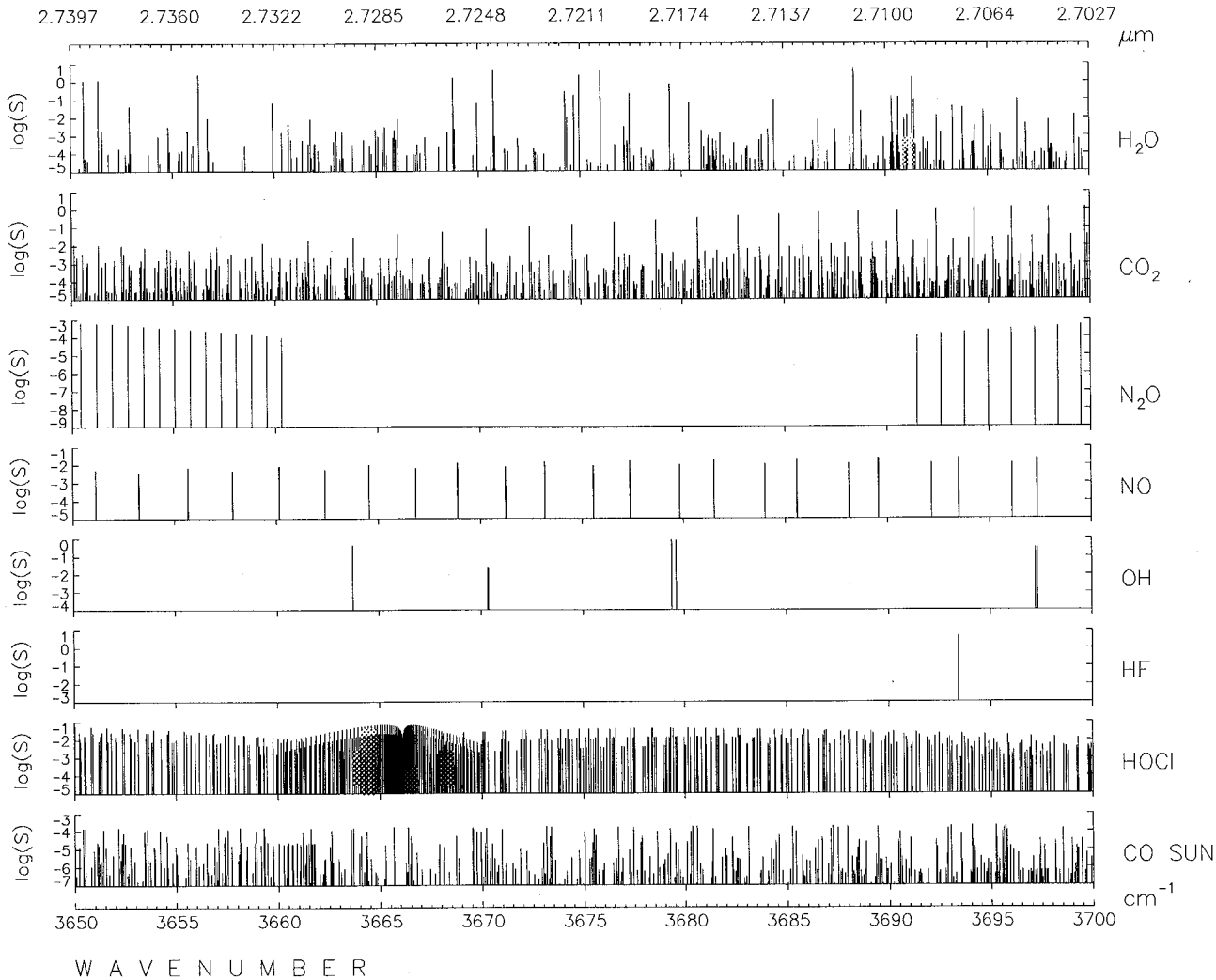
ORIGINAL PAGE IS
OF POOR QUALITY


2.8571
2.8531
2.8490
2.8450
2.8409
2.8369
2.8329
2.8289
2.8249
2.8209
2.8169
μm
log(S)
H2O
CO2
N2O
NO
OH
HF
HOCl
CO SUN
cm-1
3500
3505
3510
3515
3520
3525
3530
3535
3540
3545
3550
WAVENUMBER

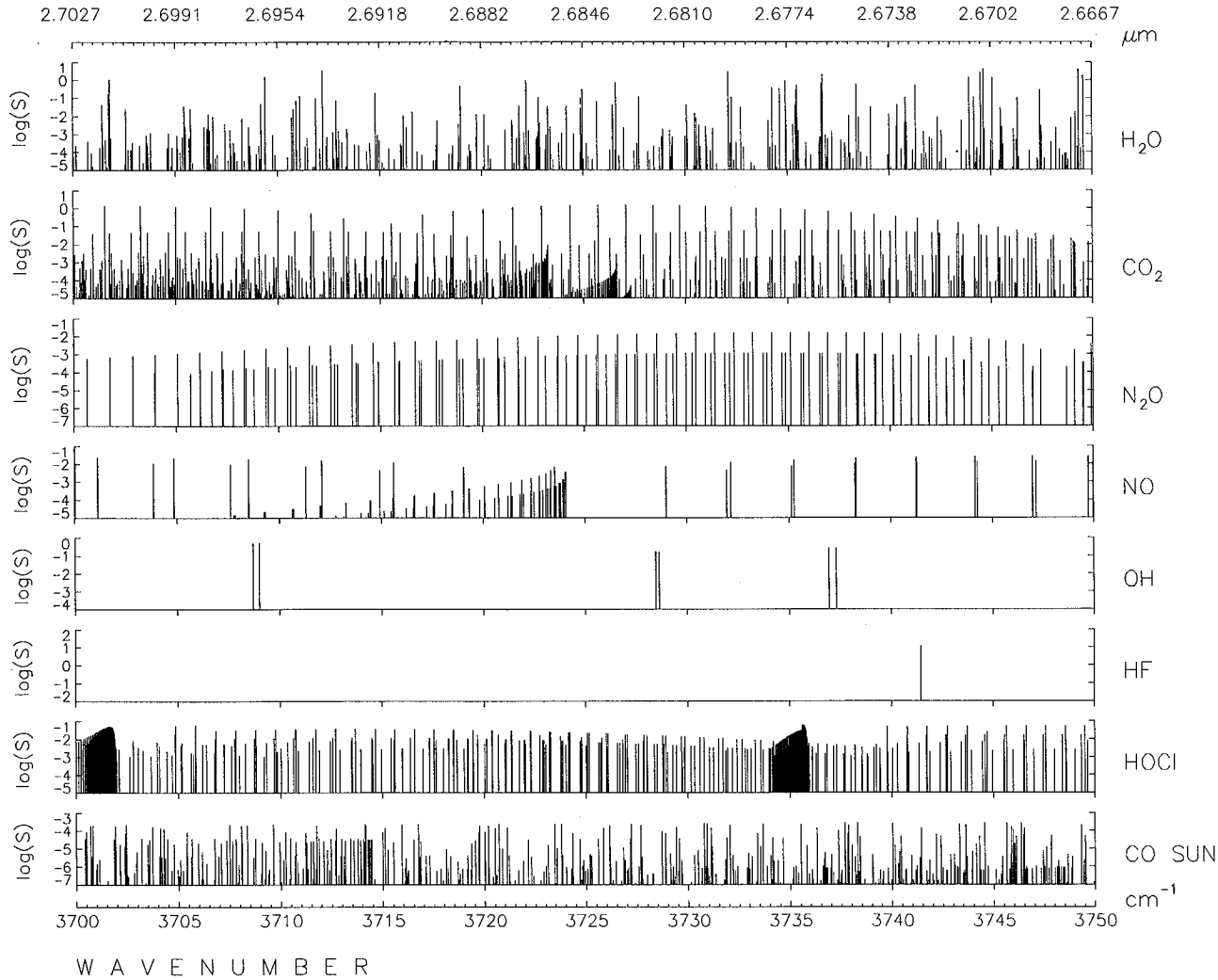


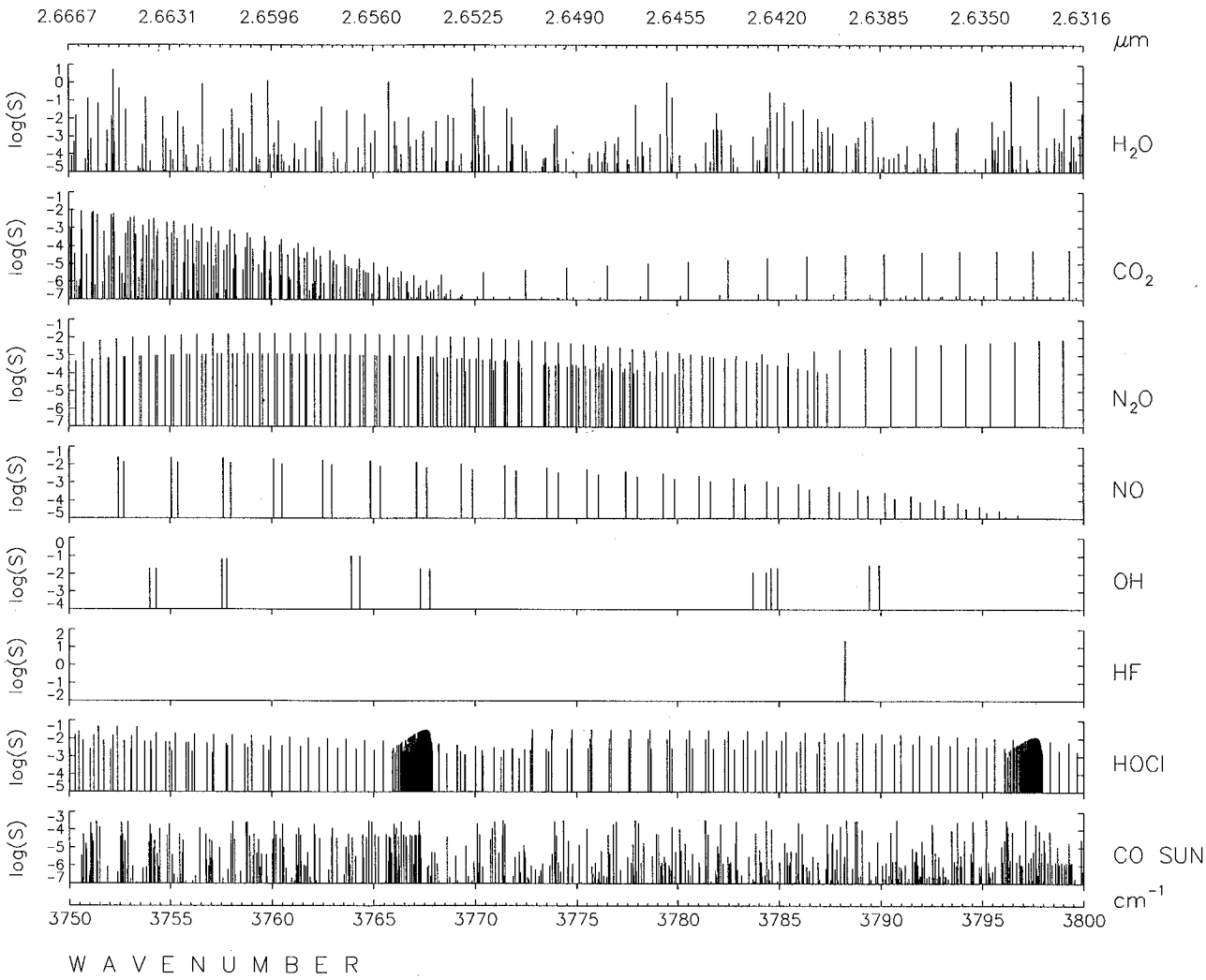
ORIGINAL PAGE IS
OF POOR QUALITY


2.7778
2.7739
2.7701
2.7663
2.7624
2.7586
2.7548
2.7510
2.7473
2.7435
2.7397
μm
log(S)
H2O
CO2
N2O
NO
OH
HF
HOCl
CO SUN
cm-1
3600
3605
3610
3615
3620
3625
3630
3635
3640
3645
3650
WAVENUMBER

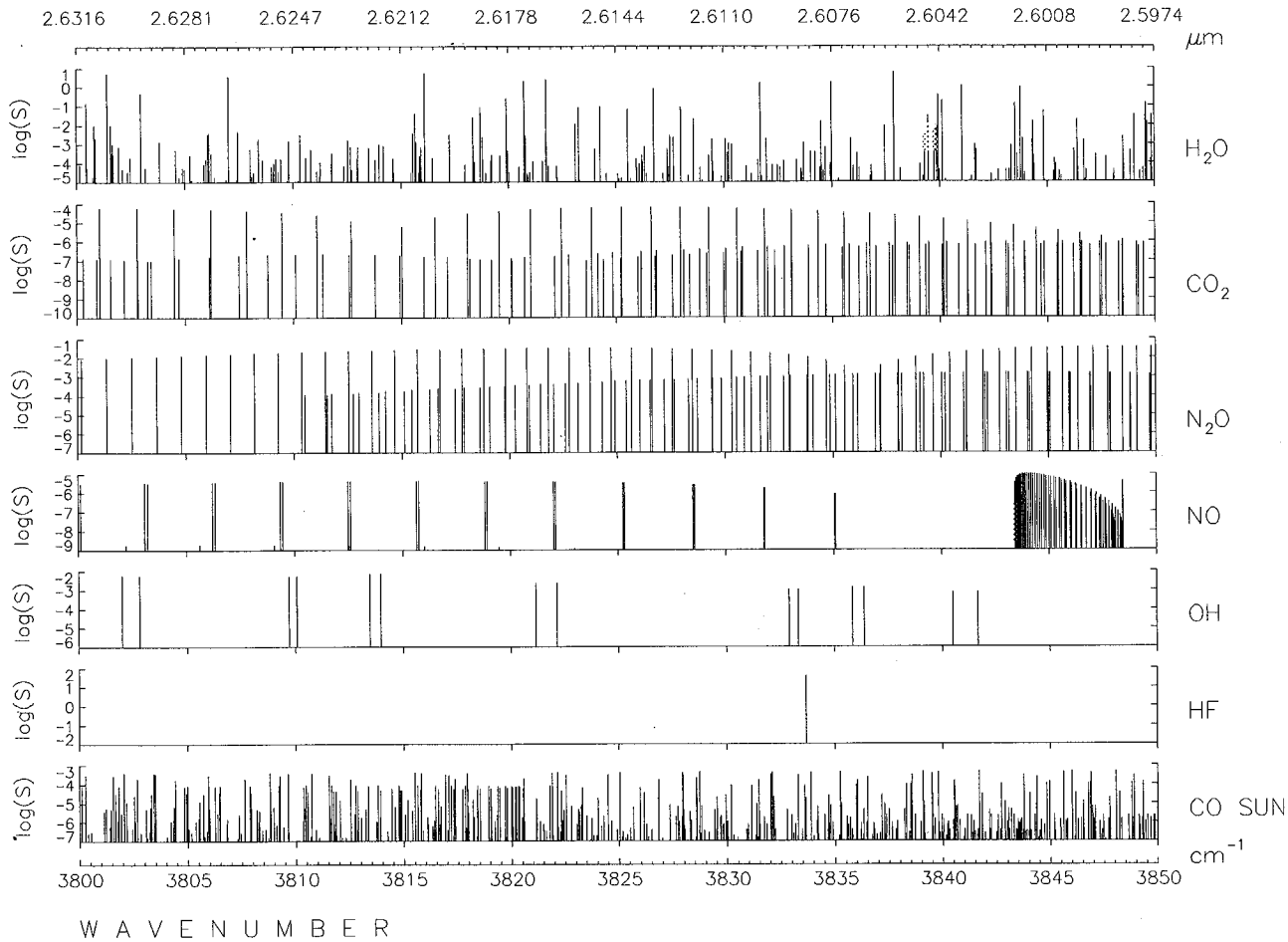


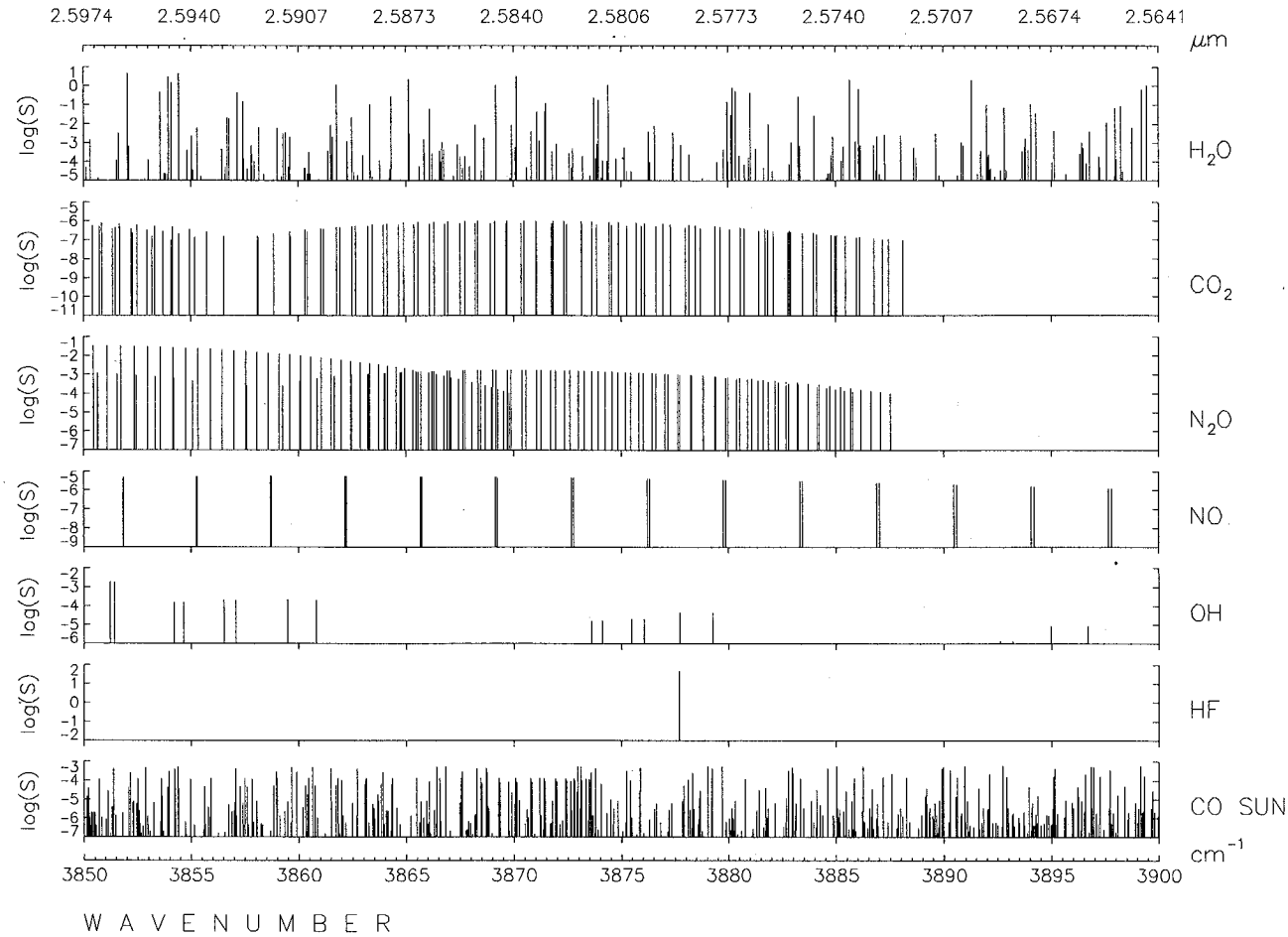
ORIGINAL PAGE IS
OF POOR QUALITY


2.7027
2.6991
2.6954
2.6918
2.6882
2.6846
2.6810
2.6774
2.6738
2.6702
2.6667
μm
log(S)
H2O
CO2
N2O
NO
OH
HF
HOCl
CO SUN
cm-1
3700
3705
3710
3715
3720
3725
3730
3735
3740
3745
3750
WAVENUMBER

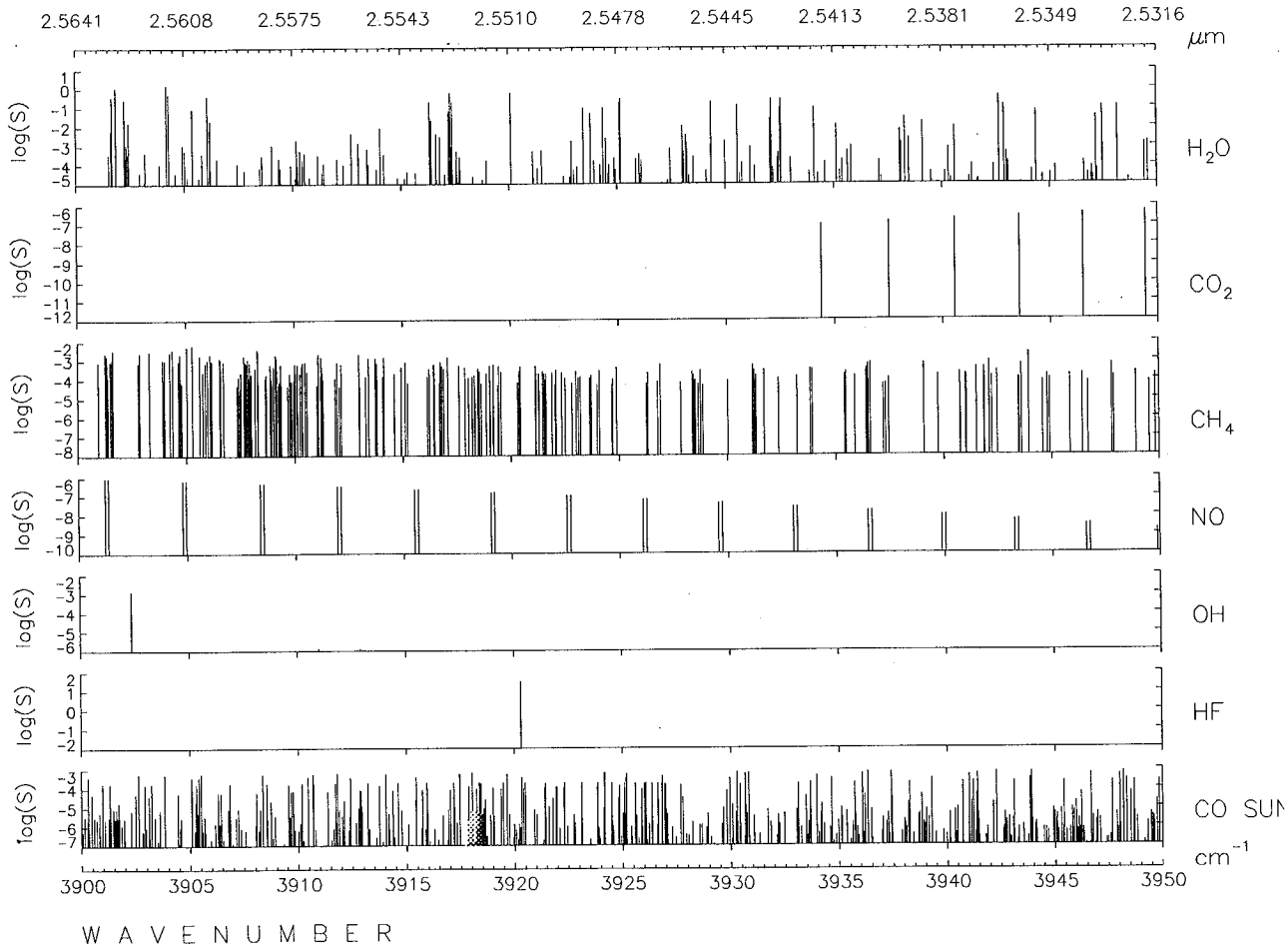


ORIGINAL PAGE IS
OF POOR QUALITY

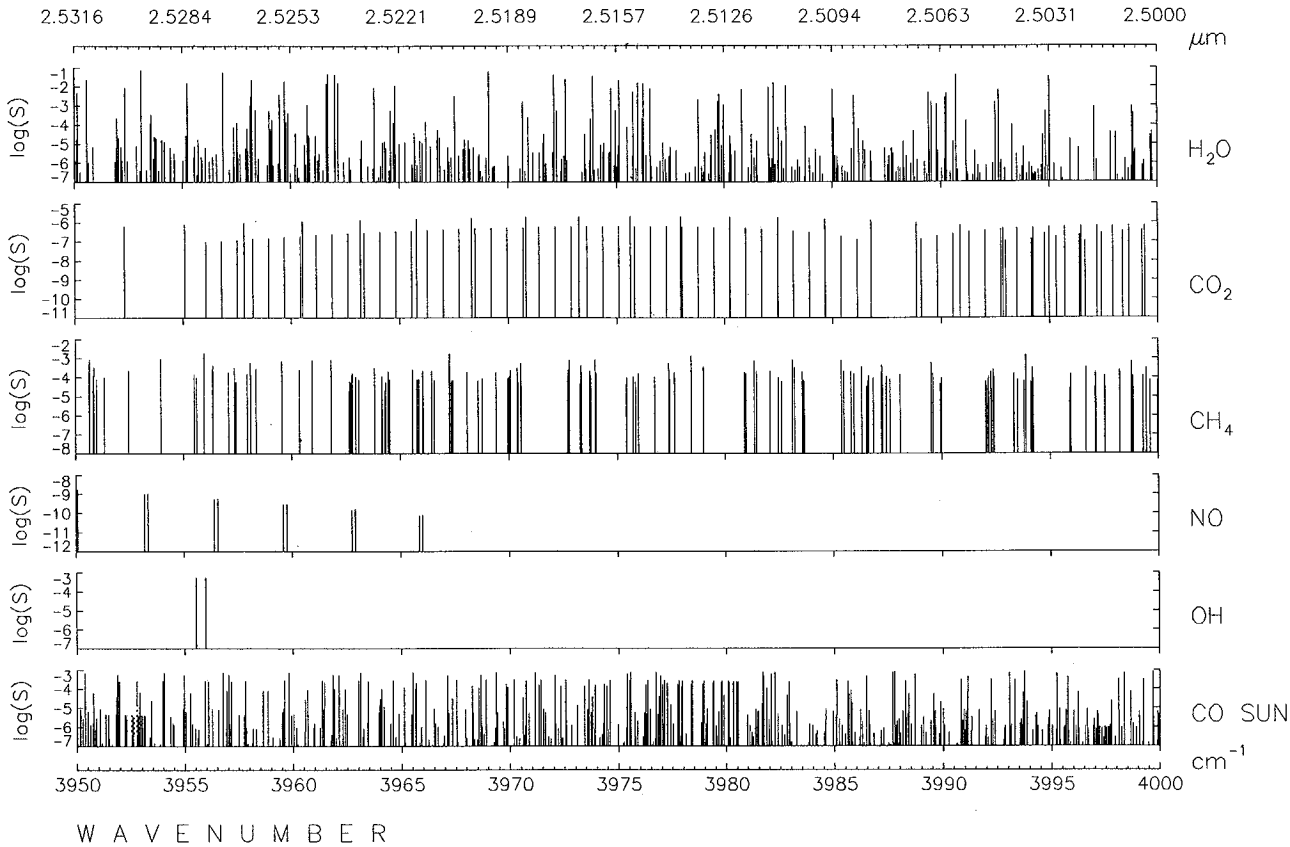

2.6316
2.6281
2.6247
2.6212
2.6178
2.6144
2.6110
2.6076
2.6042
2.6008
2.5974
μm
log(S)
H2O
CO2
N2O
NO
OH
HF
CO SUN
cm-1
3800
3805
3810
3815
3820
3825
3830
3835
3840
3845
3850
WAVENUMBER

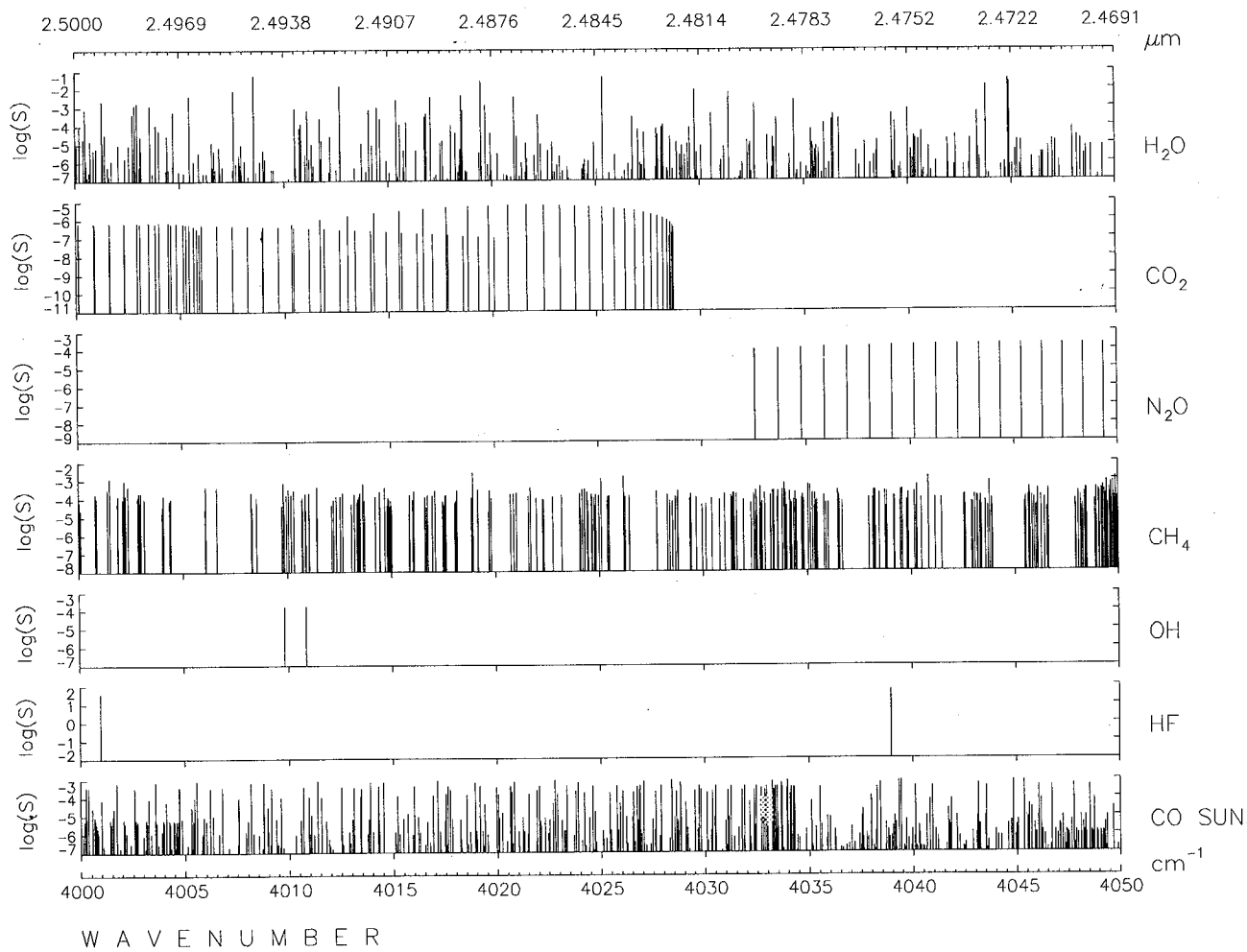


ORIGINAL PAGE IS
OF POOR QUALITY

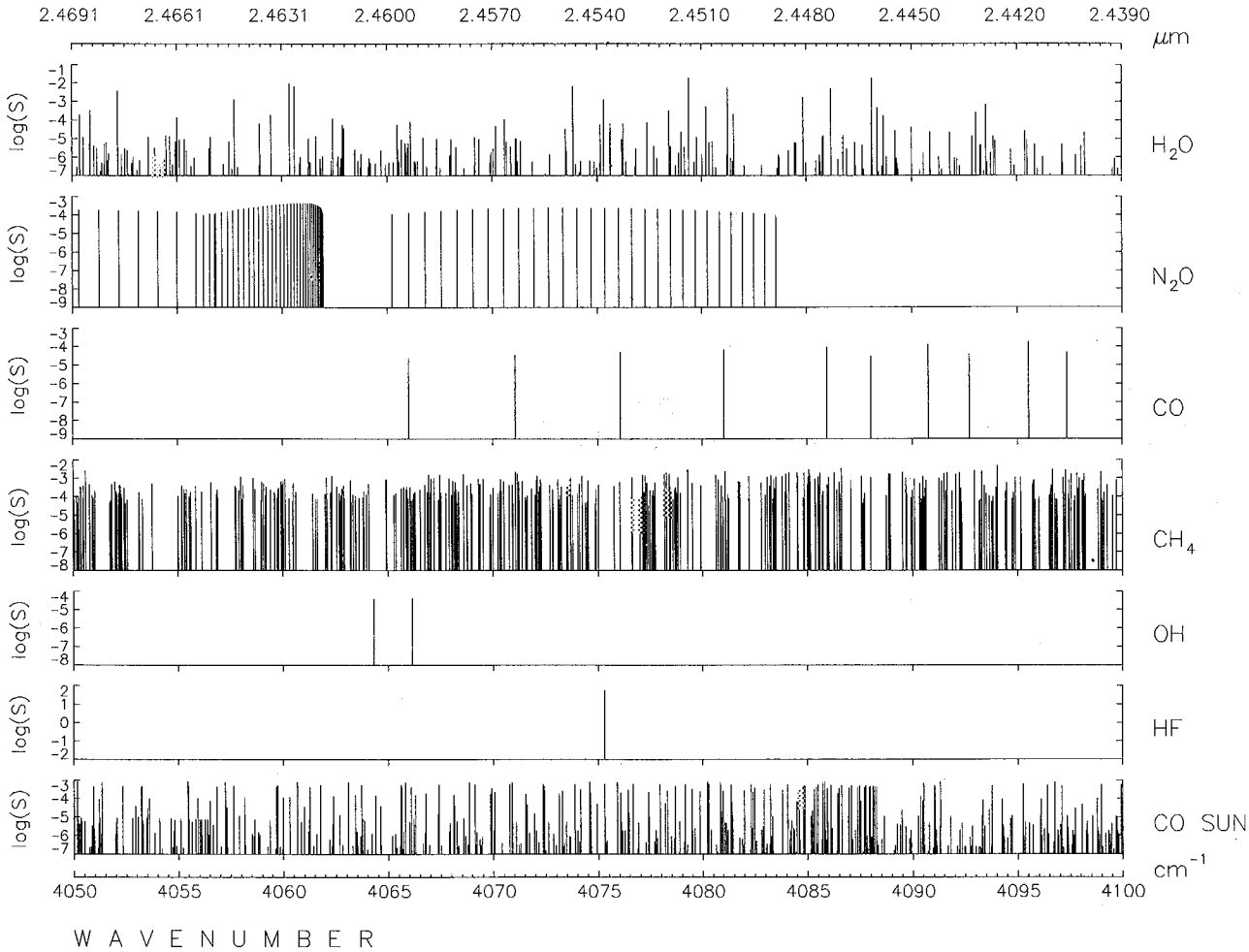

2.5641
2.5608
2.5575
2.5543
2.5510
2.5478
2.5445
2.5413
2.5381
2.5349
2.5316
μm
log(S)
H2O
CO2
CH4
NO
OH
HF
CO SUN
cm-1
3900
3905
3910
3915
3920
3925
3930
3935
3940
3945
3950
WAVENUMBER

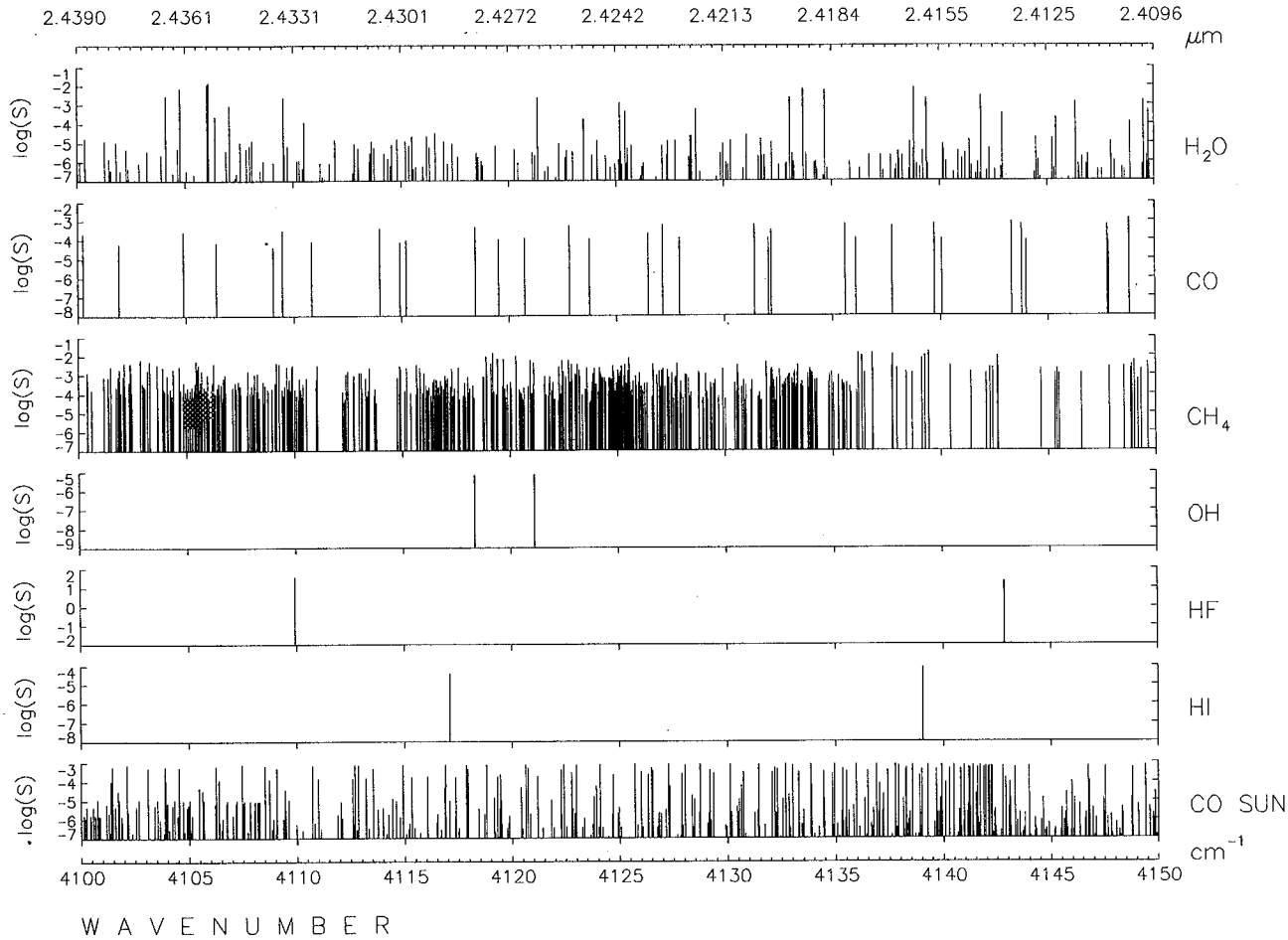
ORIGINAL PAGE IS
OF POOR QUALITY



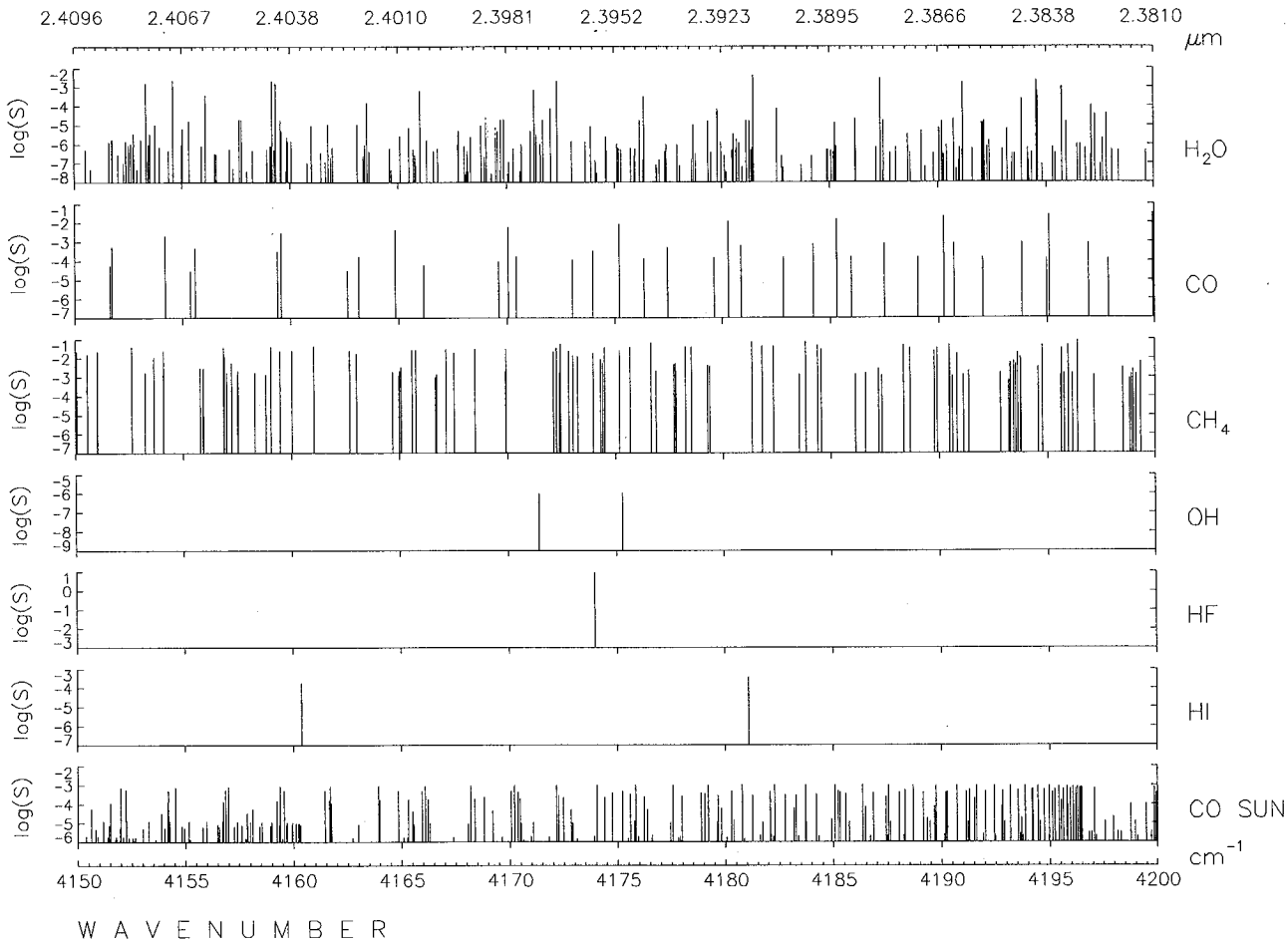

2.5000
2.4969
2.4938
2.4907
2.4876
2.4845
2.4814
2.4783
2.4752
2.4722
2.4691
μm
log(S)
H2O
CO2
N2O
CH4
OH
HF
CO SUN
cm-1
4000
4005
4010
4015
4020
4025
4030
4035
4040
4045
4050
WAVENUMBER

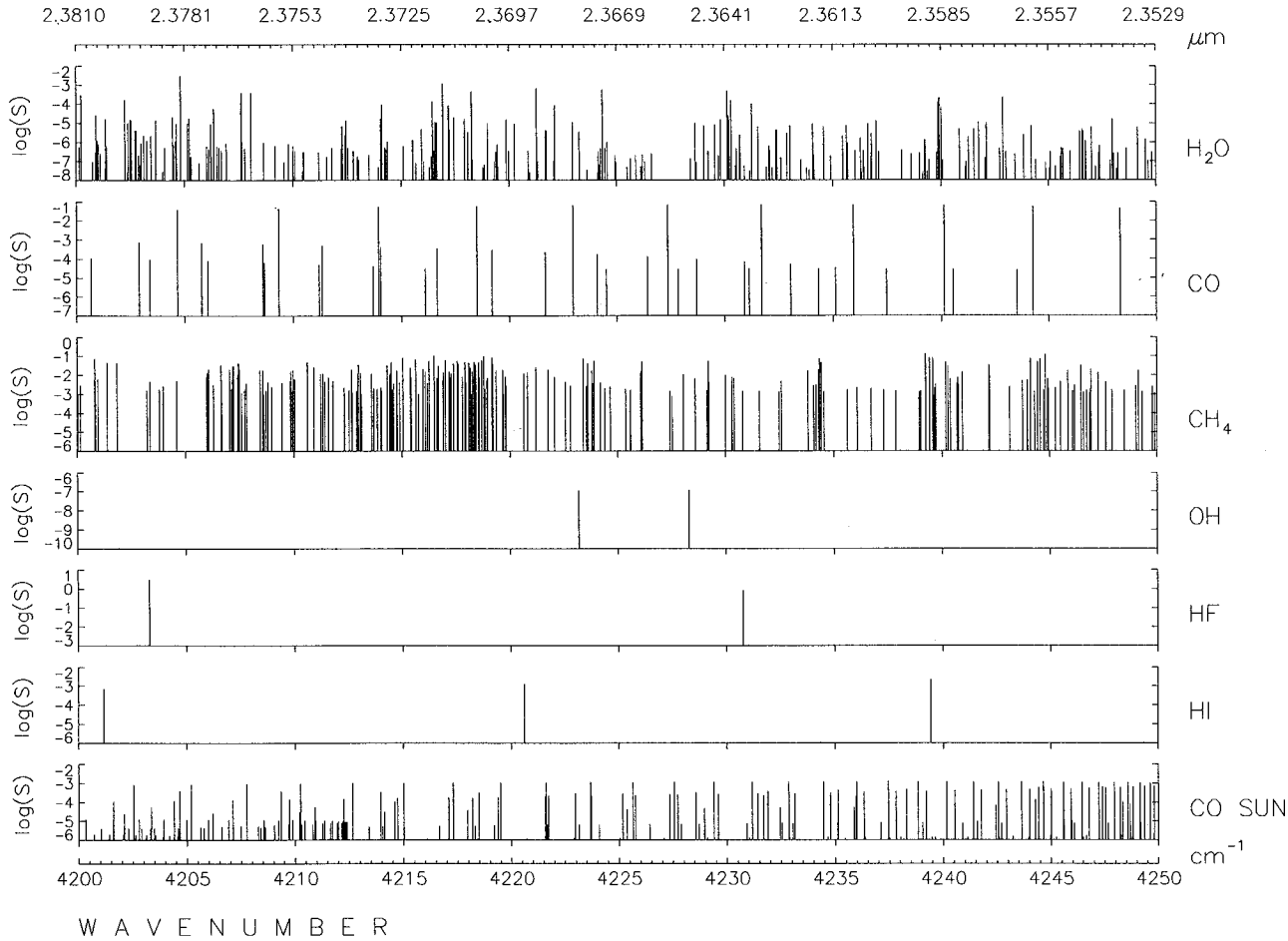
ORIGINAL PAGE IS
OF POOR QUALITY



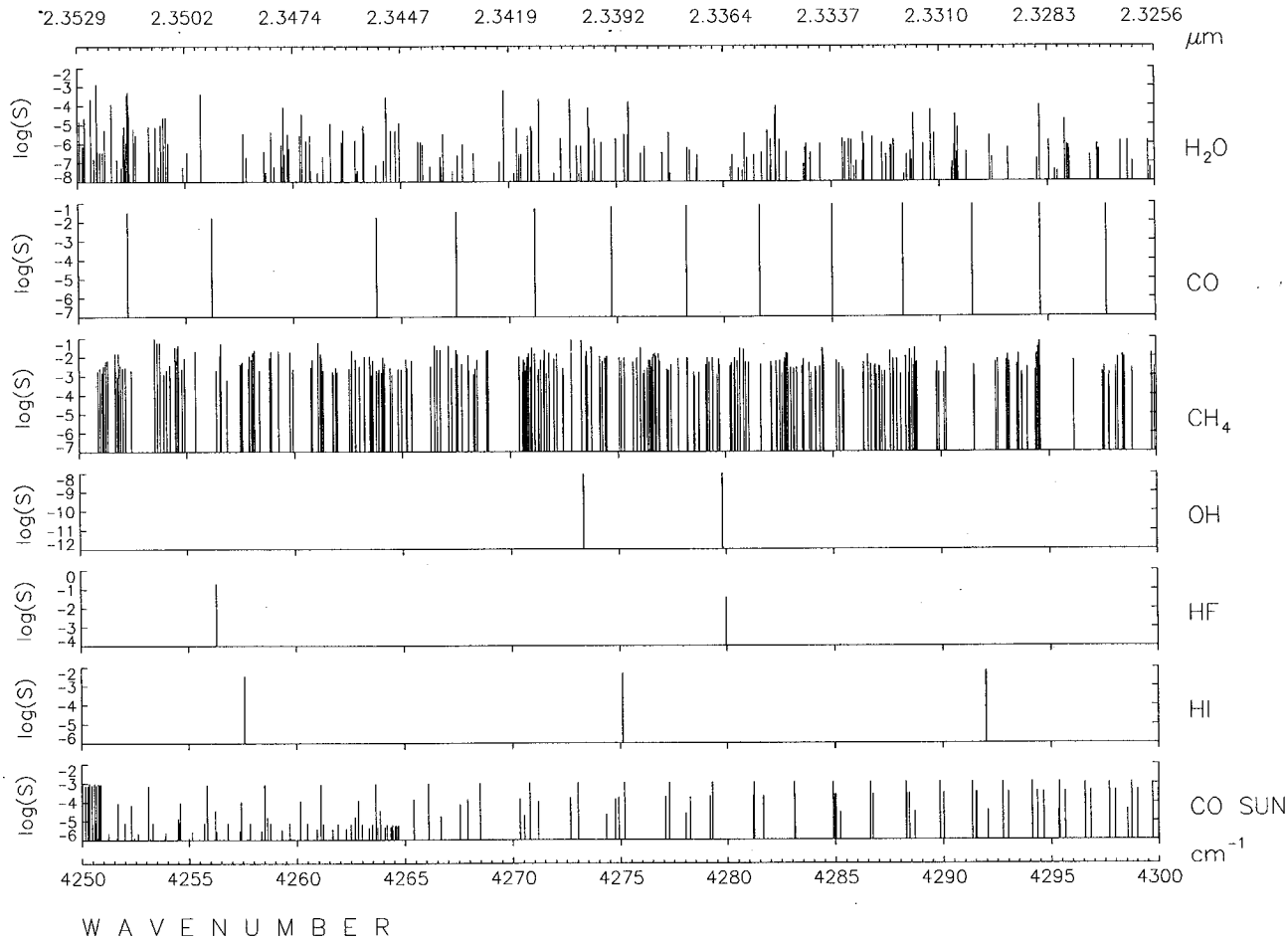

2.4390
2.4361
2.4331
2.4301
2.4272
2.4242
2.4213
2.4184
2.4155
2.4125
2.4096
μm
log(S)
H2O
CO
CH4
OH
HF
HI
CO SUN
cm-1
4100
4105
4110
4115
4120
4125
4130
4135
4140
4145
4150
WAVENUMBER

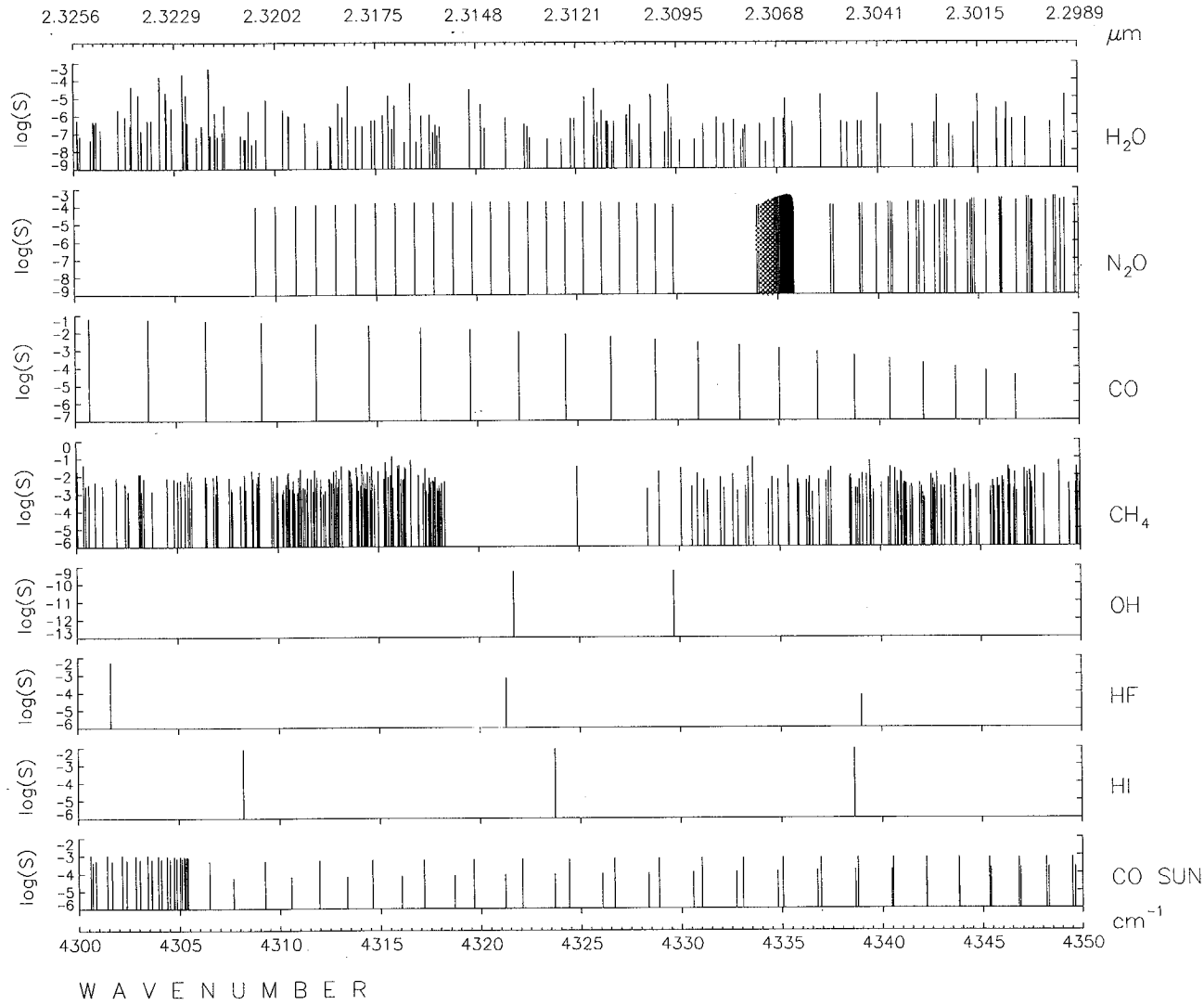
ORIGINAL PAGE IS
OF POOR QUALITY



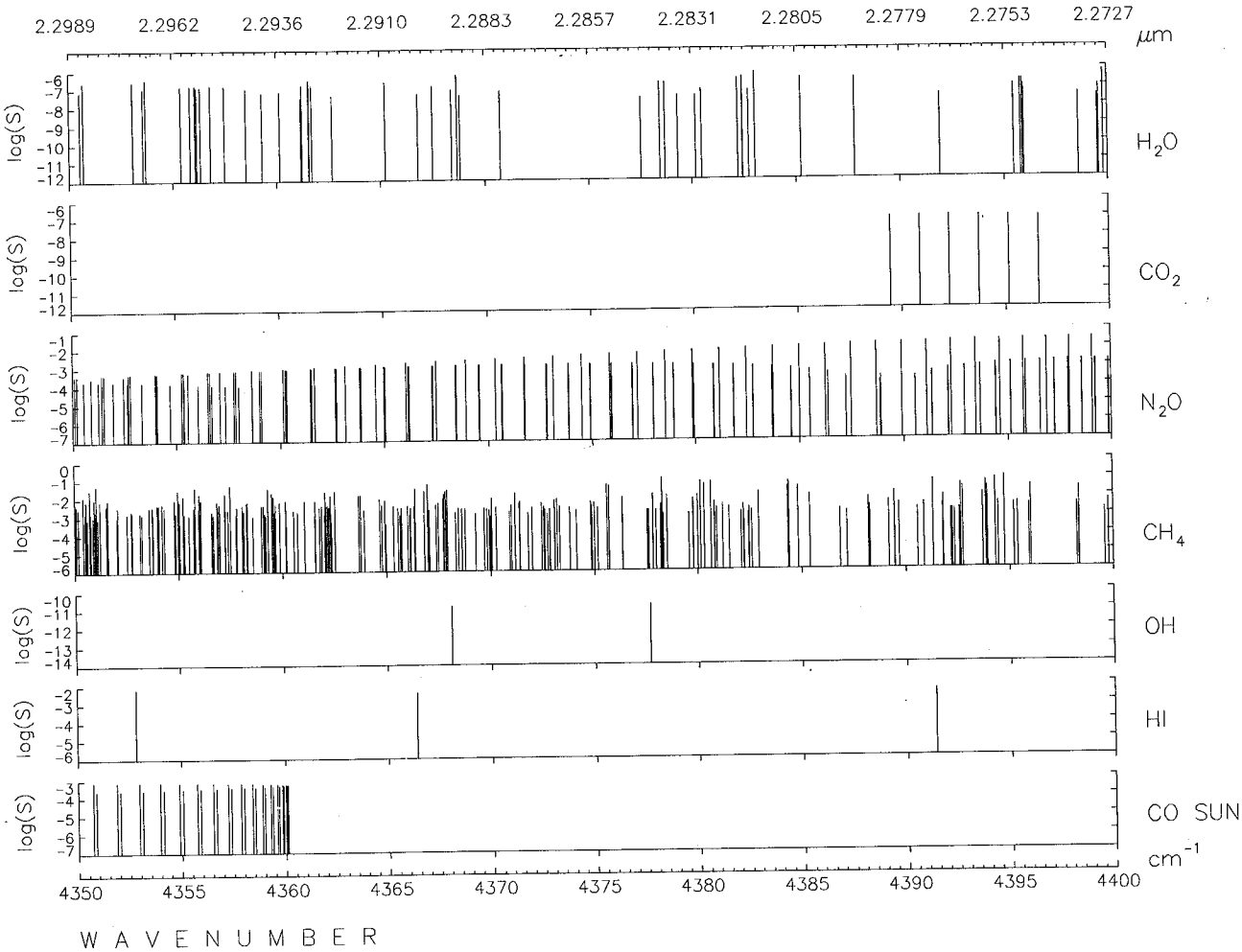

2.3810
2.3781
2.3753
2.3725
2.3697
2.3669
2.3641
2.3613
2.3585
2.3557
2.3529
μm
log(S)
H2O
CO
CH4
OH
HF
HI
CO SUN
cm-1
4200
4205
4210
4215
4220
4225
4230
4235
4240
4245
4250
WAVENUMBER

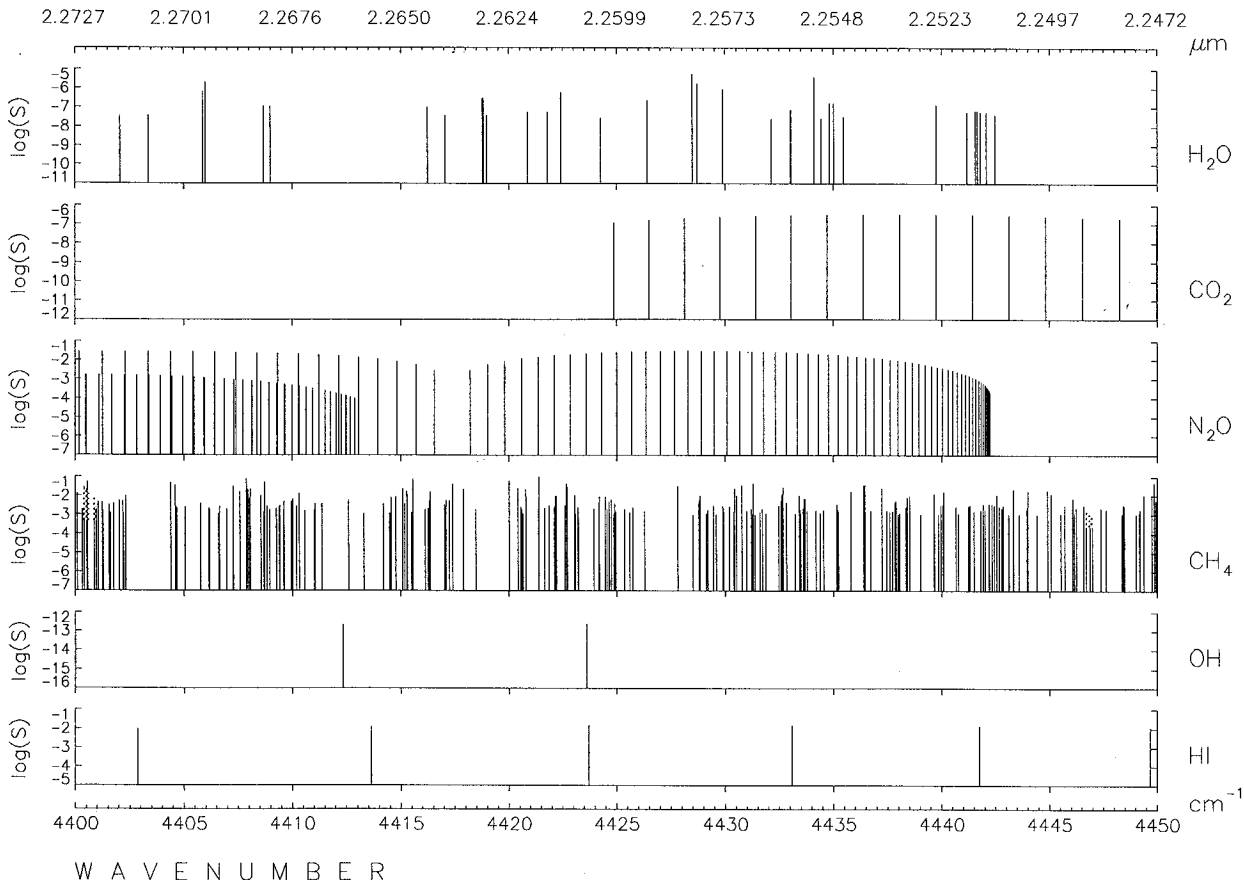
ORIGINAL PAGE IS
OF POOR QUALITY



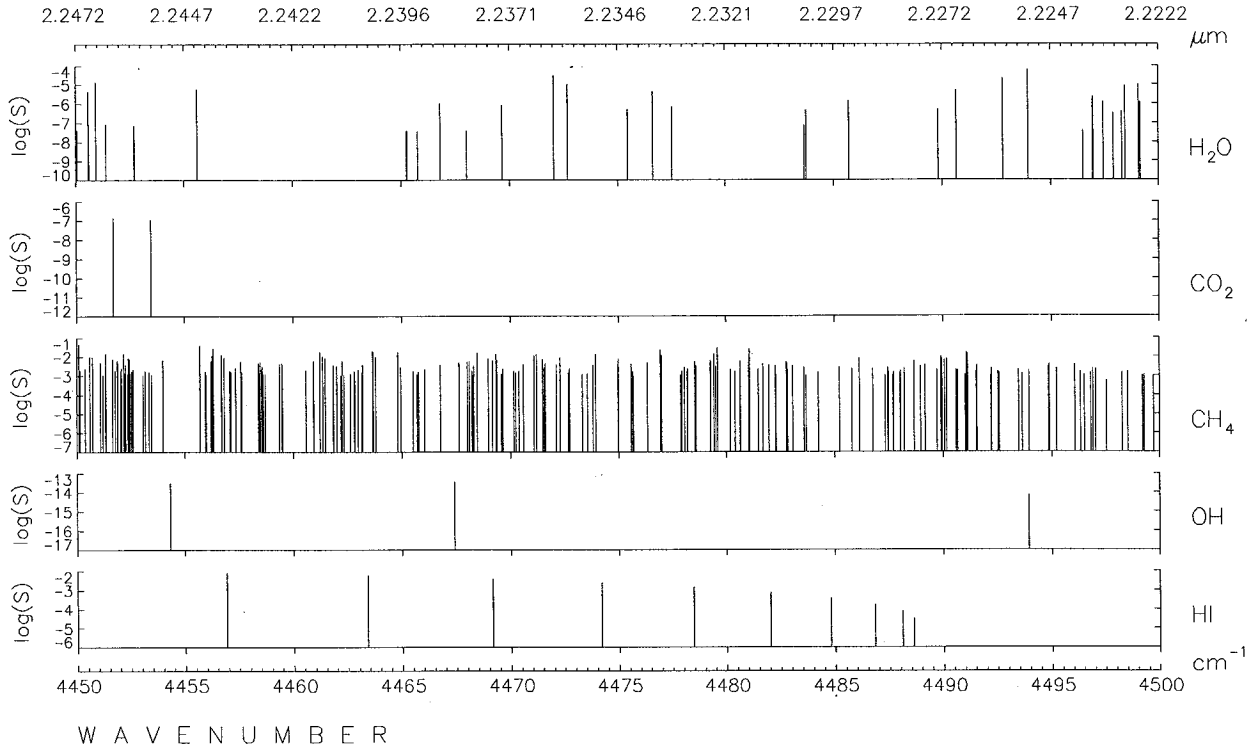

2.3256
2.3229
2.3202
2.3175
2.3148
2.3121
2.3095
2.3068
2.3041
2.3015
2.2989
μm
log(S)
H2O
N2O
CO
CH4
OH
HF
HI
CO SUN
cm-1
4300
4305
4310
4315
4320
4325
4330
4335
4340
4345
4350
WAVENUMBER

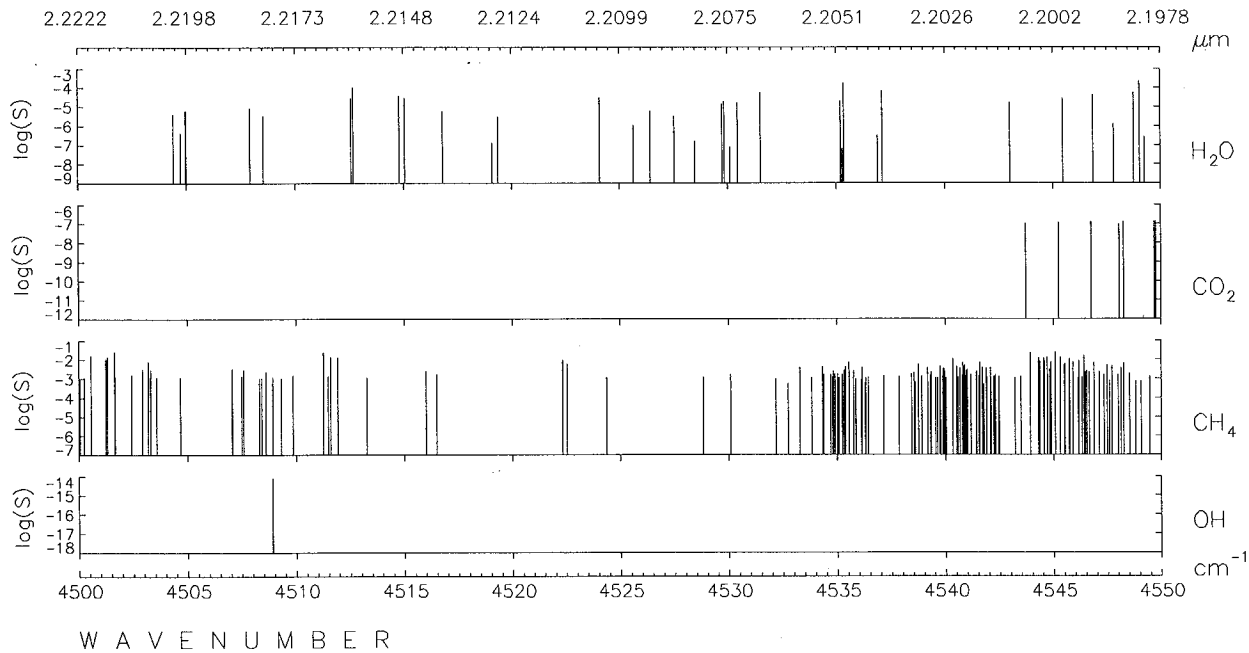
ORIGINAL PAGE IS
OF POOR QUALITY

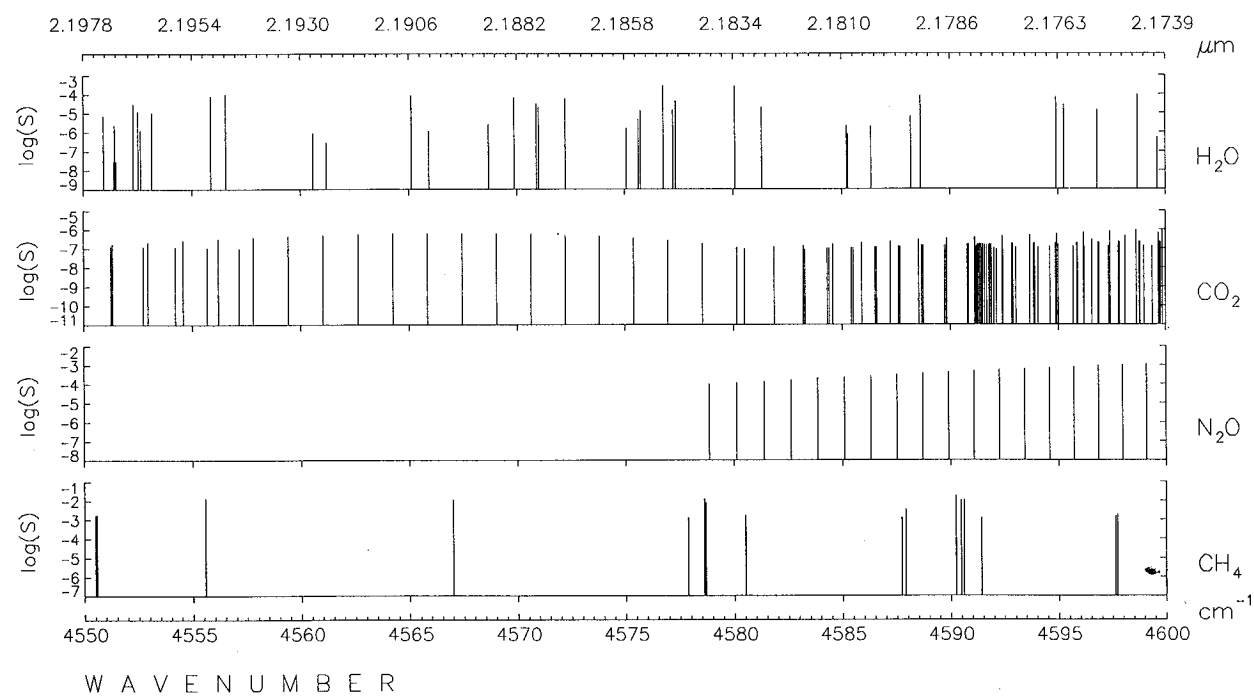



2.2727
2.2701
2.2676
2.2650
2.2624
2.2599
2.2573
2.2548
2.2523
2.2497
2.2472
μm
log(S)
H2O
CO2
N2O
CH4
OH
HI
cm-1
4400
4405
4410
4415
4420
4425
4430
4435
4440
4445
4450
WAVENUMBER

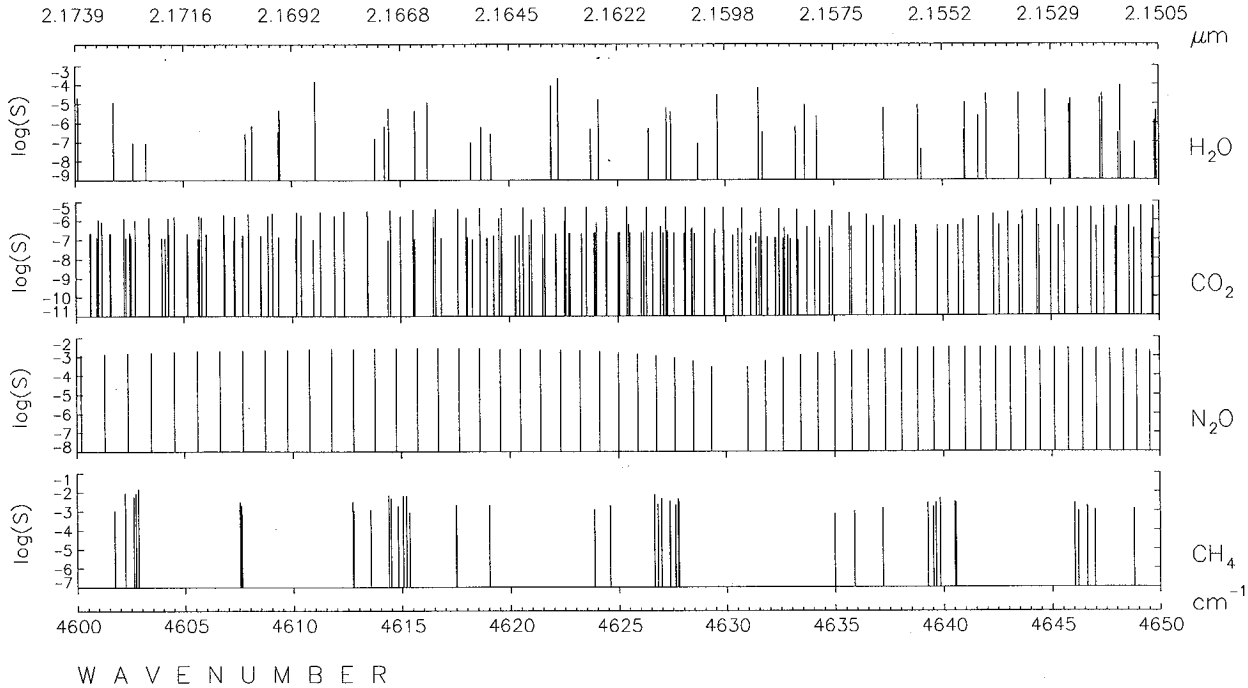
ORIGINAL PAGE IS
OF POOR QUALITY

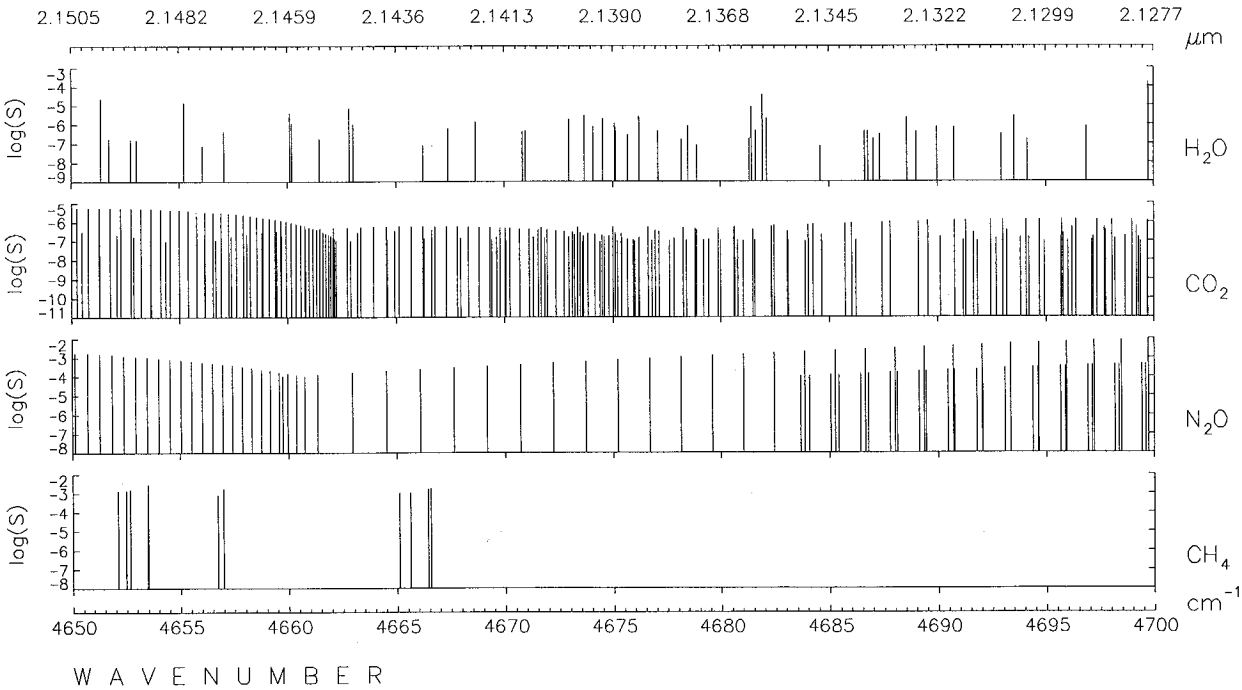


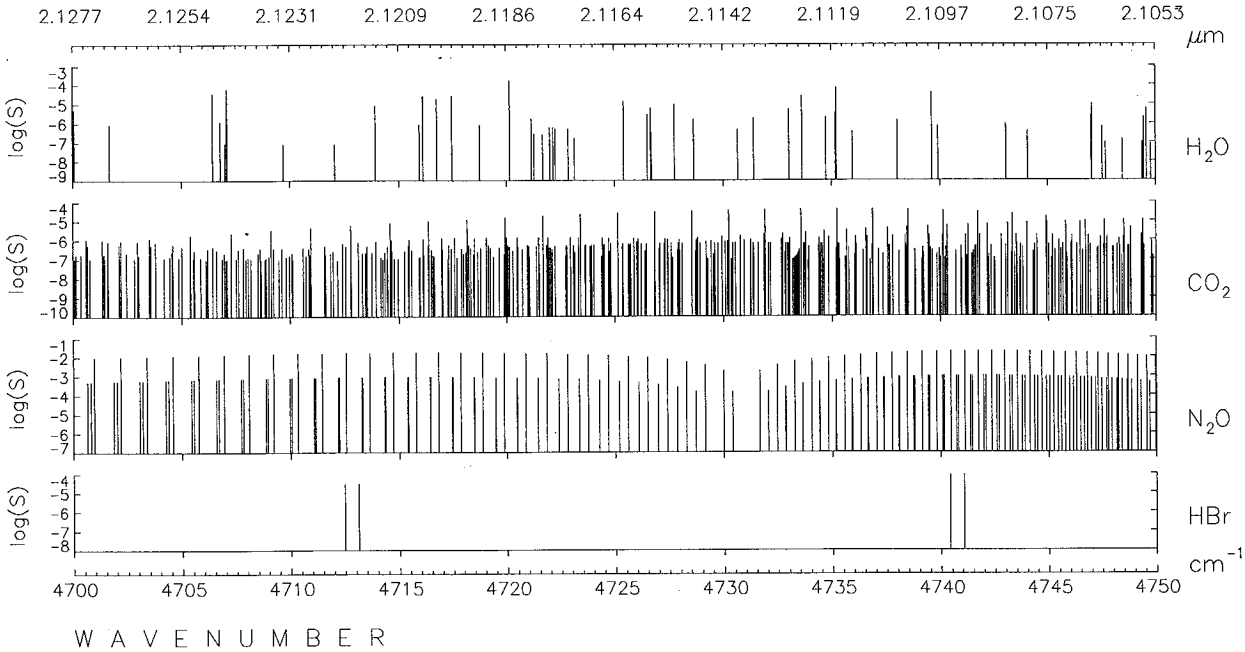

2.2222 2.2198 2.2173 2.2148 2.2124 2.2099 2.2075 2.2051 2.2026 2.2002 2.1978
μm
log(S)
H2O
CO2
CH4
OH
cm-1
4500 4505 4510 4515 4520 4525 4530 4535 4540 4545 4550
WAVENUMBER

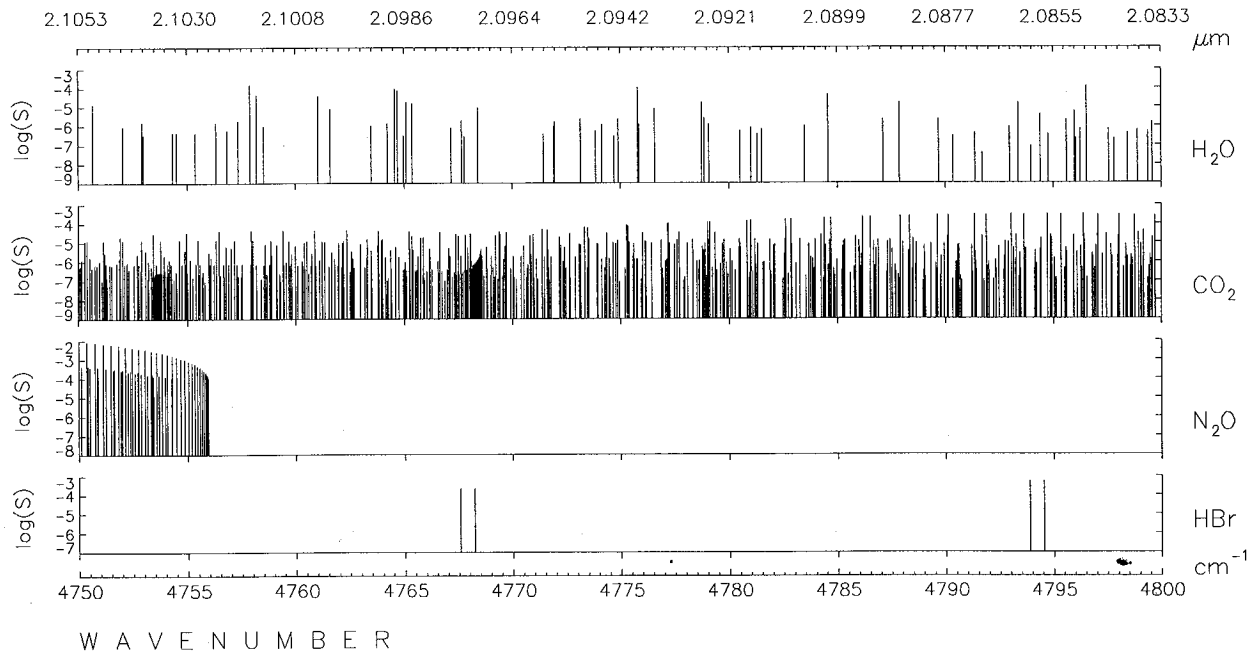

2.1978 2.1954 2.1930 2.1906 2.1882 2.1858 2.1834 2.1810 2.1786 2.1763 2.1739
μm
log(S)
H2O
CO2
N2O
CH4
cm-1
4550 4555 4560 4565 4570 4575 4580 4585 4590 4595 4600
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

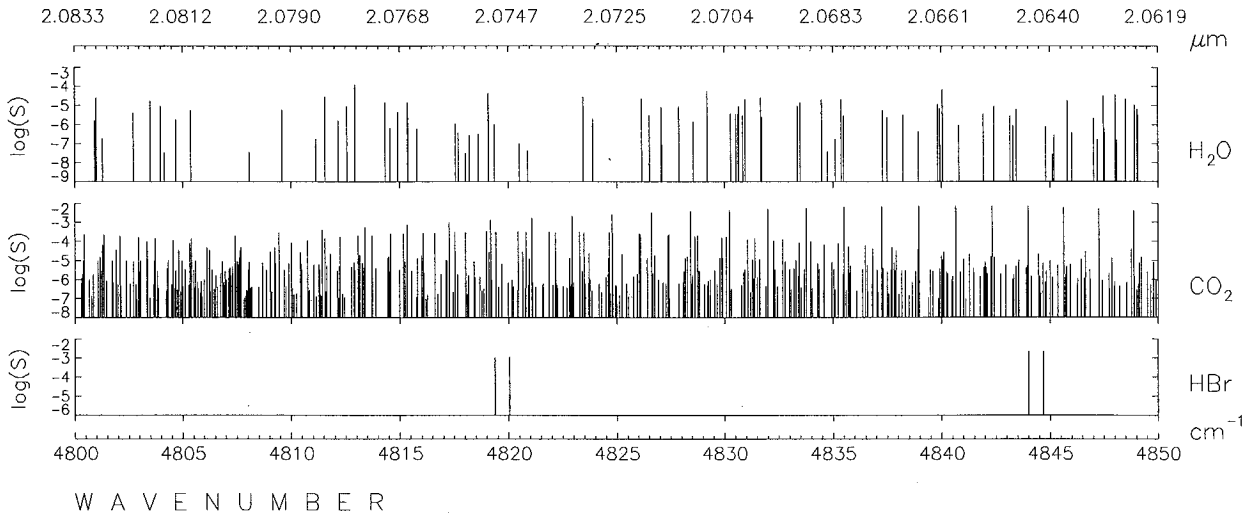


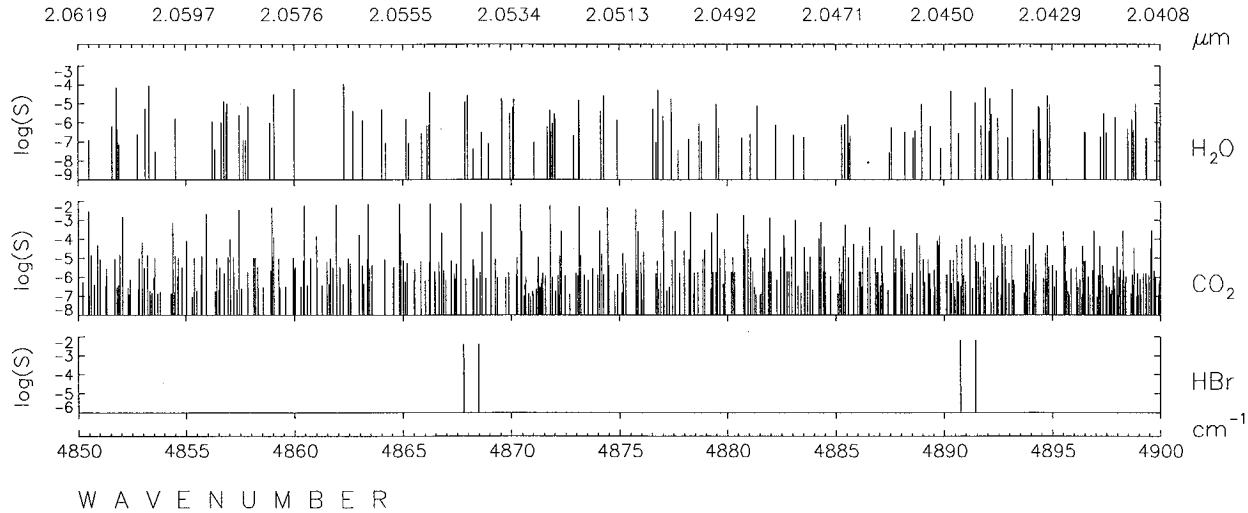


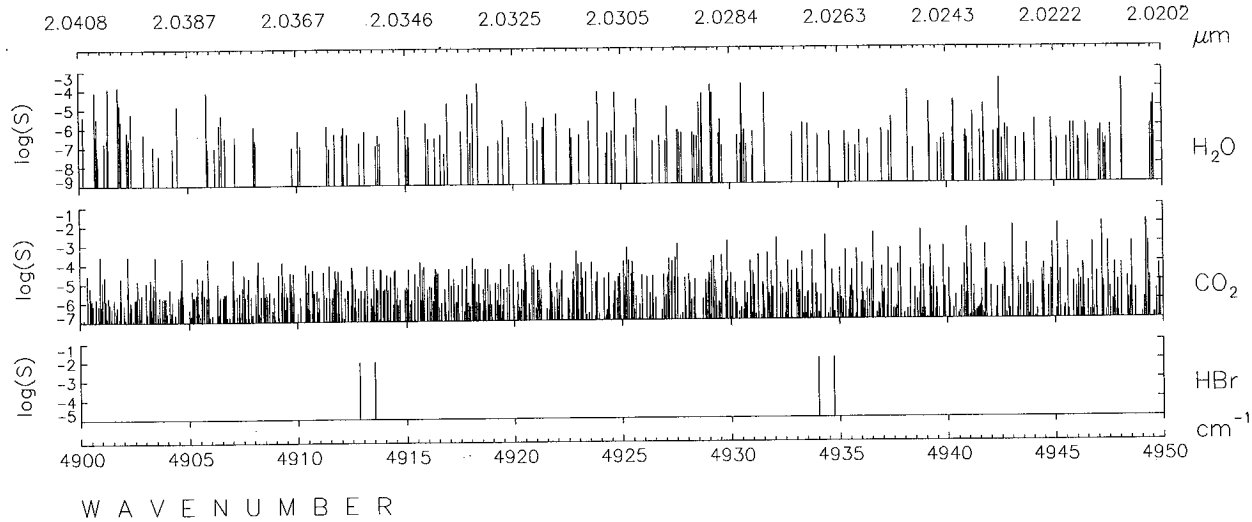

2.1277 2.1254 2.1231 2.1209 2.1186 2.1164 2.1142 2.1119 2.1097 2.1075 2.1053
μm
log(S)
H2O
CO2
N2O
HBr
cm-1
4700 4705 4710 4715 4720 4725 4730 4735 4740 4745 4750
WAVENUMBER

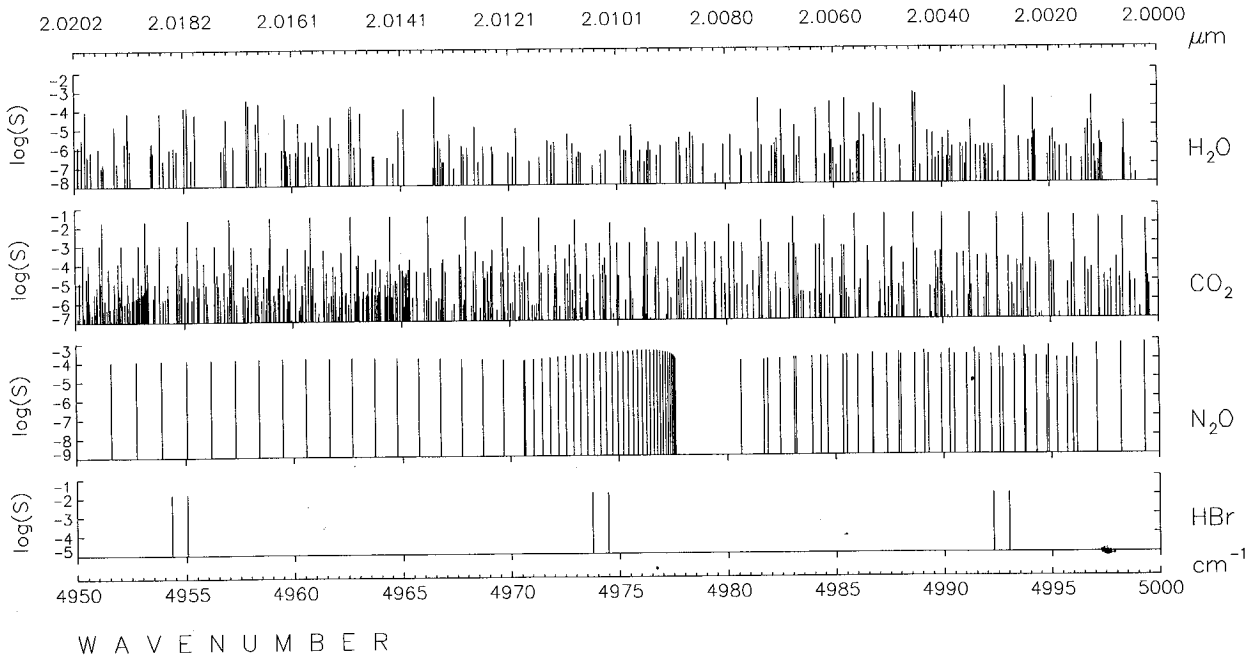

2.1053 2.1030 2.1008 2.0986 2.0964 2.0942 2.0921 2.0899 2.0877 2.0855 2.0833
μm
log(S)
H2O
CO2
N2O
HBr
cm-1
4750 4755 4760 4765 4770 4775 4780 4785 4790 4795 4800
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

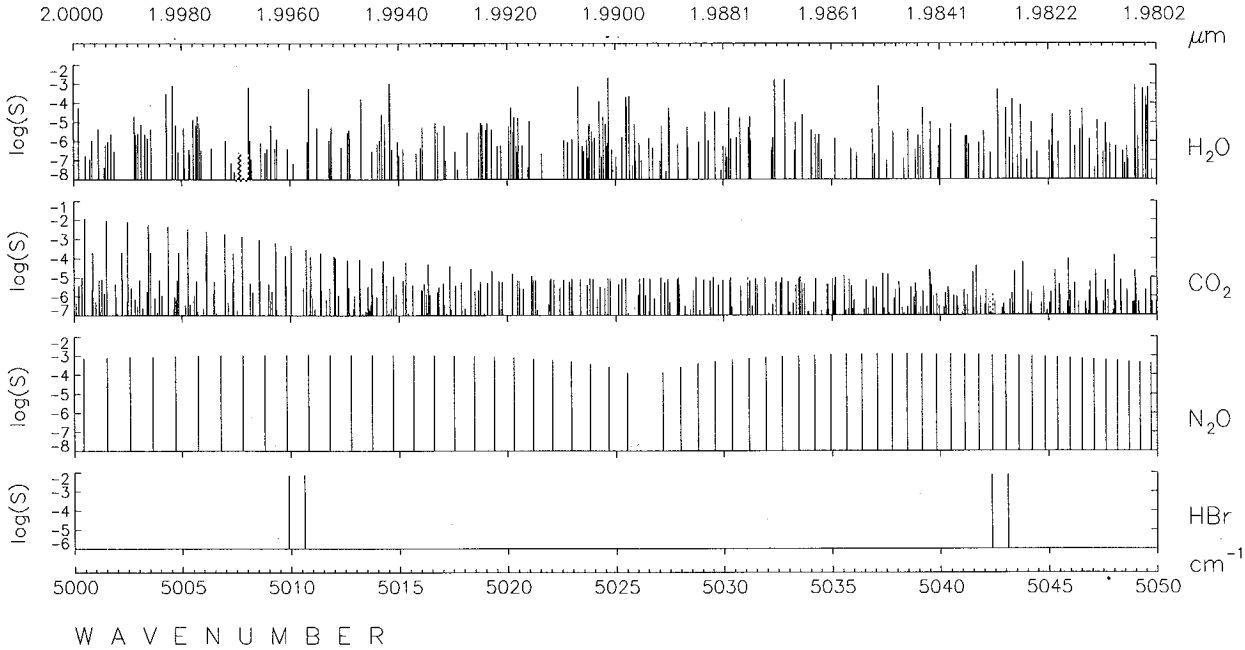


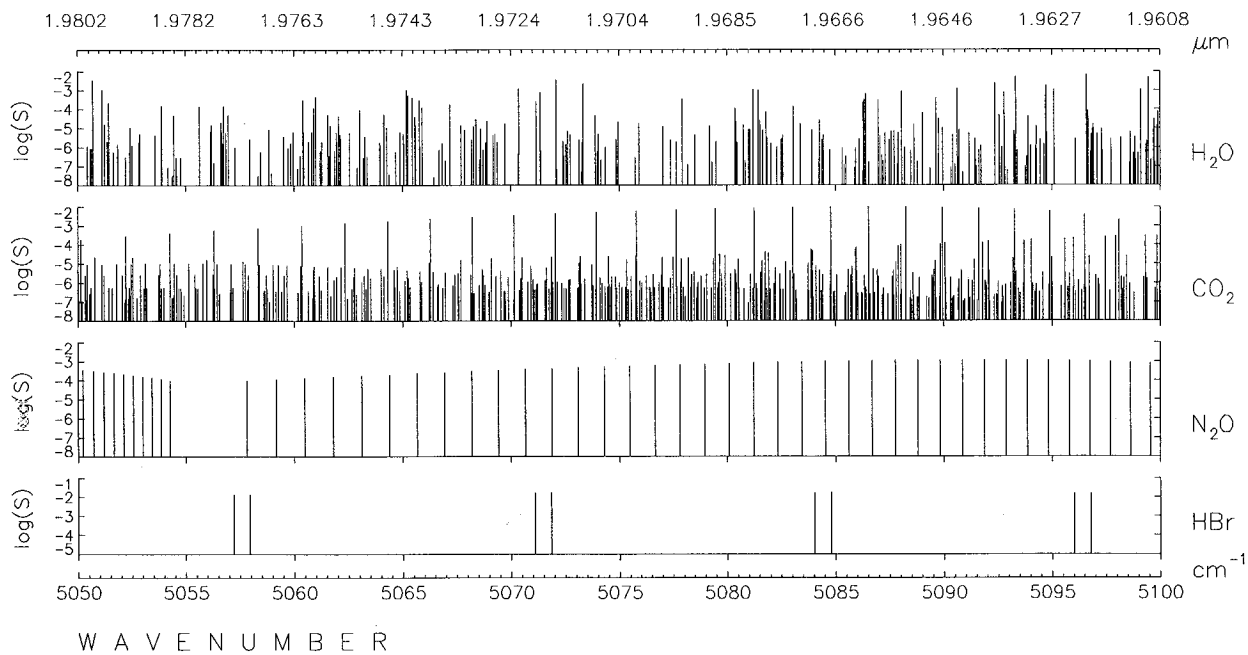


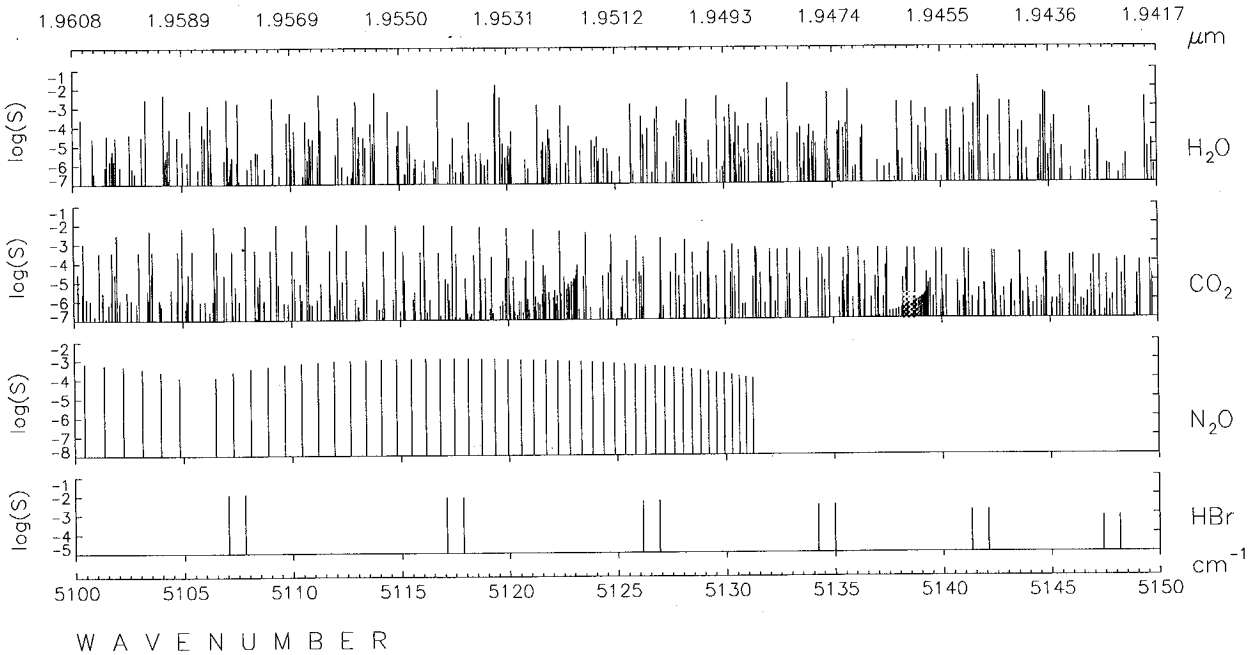

2.0408 2.0387 2.0367 2.0346 2.0325 2.0305 2.0284 2.0263 2.0243 2.0222 2.0202
μm
log(S)
H2O
CO2
HBr
cm-1
4900 4905 4910 4915 4920 4925 4930 4935 4940 4945 4950
WAVENUMBER

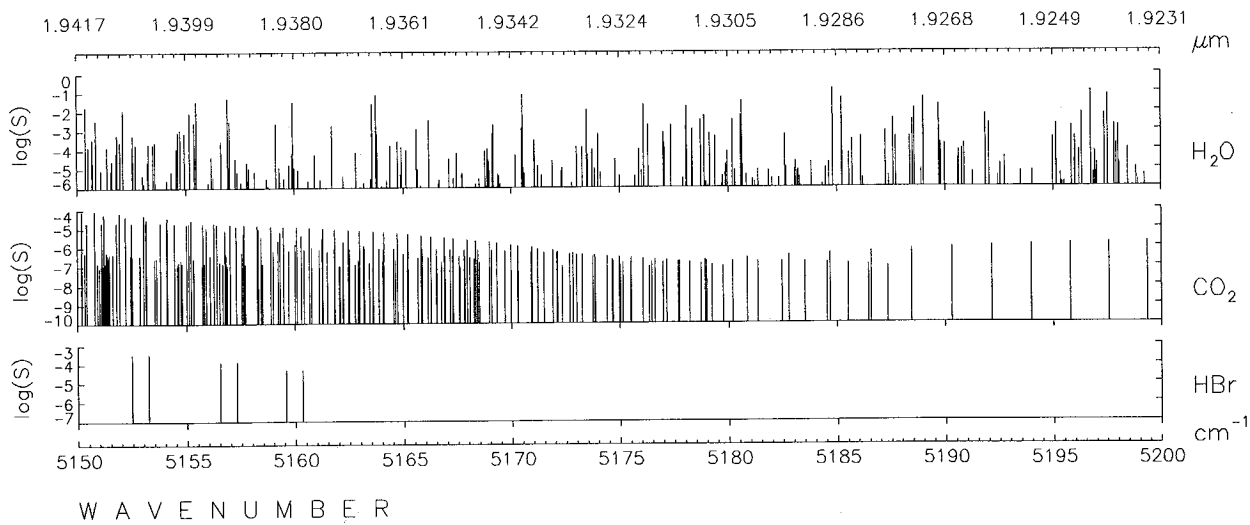

2.0202 2.0182 2.0161 2.0141 2.0121 2.0101 2.0080 2.0060 2.0040 2.0020 2.0000
μm
log(S)
H2O
CO2
N2O
HBr
cm-1
4950 4955 4960 4965 4970 4975 4980 4985 4990 4995 5000
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

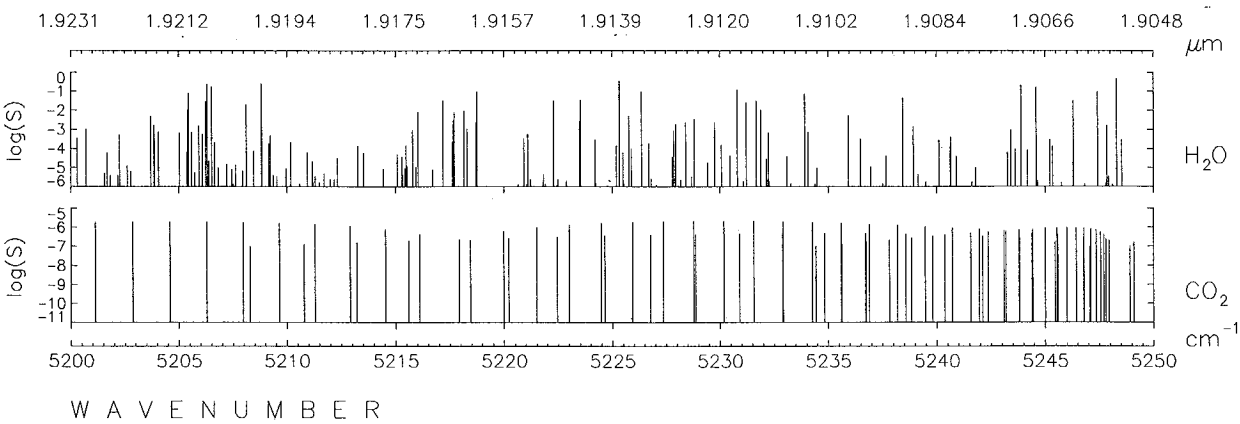


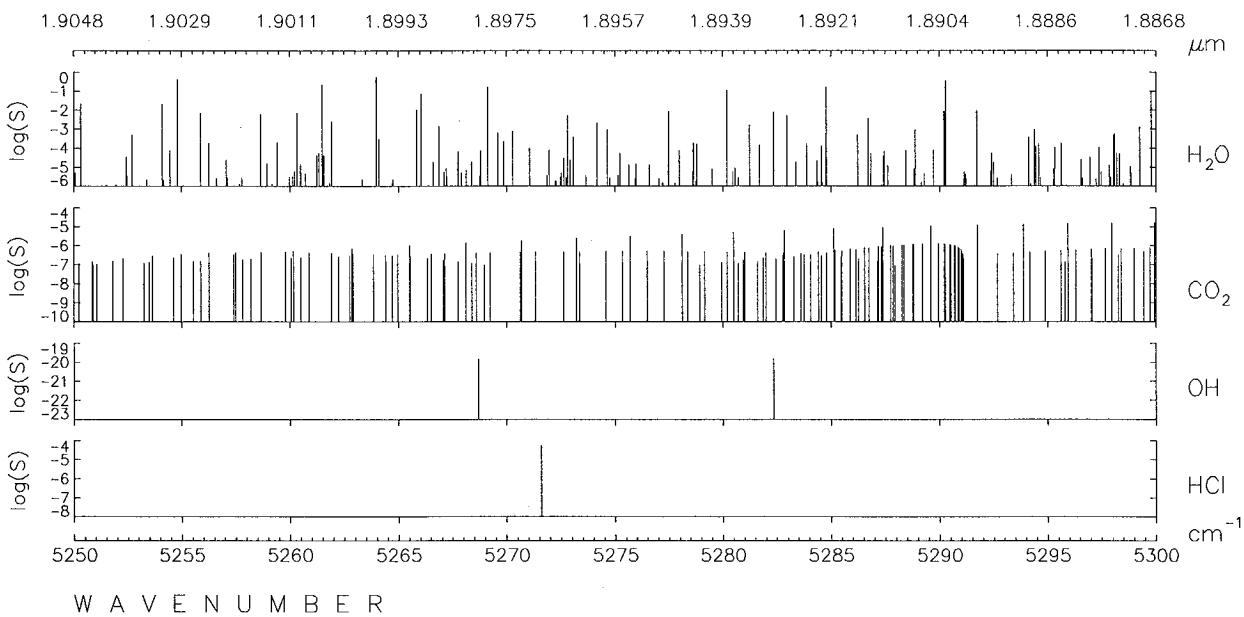


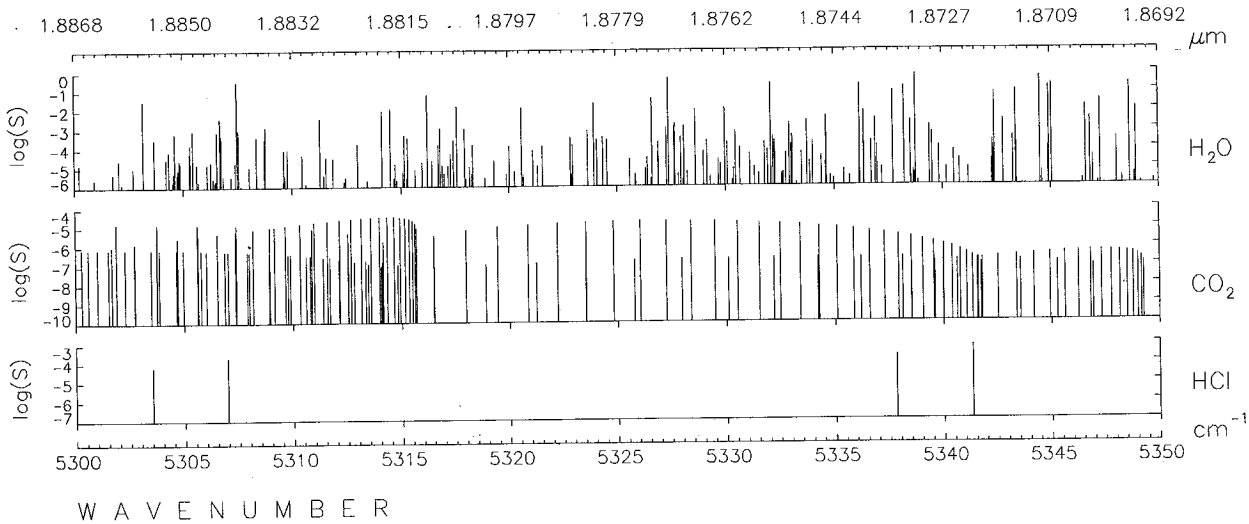

1.9608 1.9589 1.9569 1.9550 1.9531 1.9512 1.9493 1.9474 1.9455 1.9436 1.9417
μm
log(S)
H2O
CO2
N2O
HBr
cm-1
5100 5105 5110 5115 5120 5125 5130 5135 5140 5145 5150
WAVENUMBER

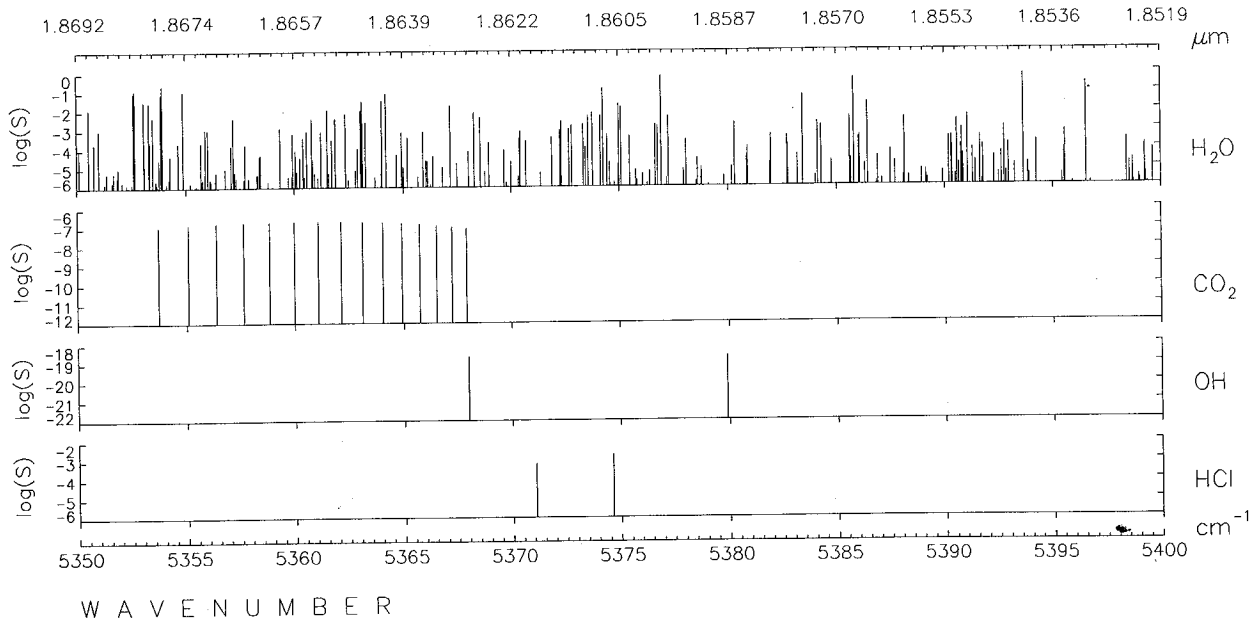

1.9417 1.9399 1.9380 1.9361 1.9342 1.9324 1.9305 1.9286 1.9268 1.9249 1.9231
μm
log(S)
H2O
CO2
HBr
cm-1
5150 5155 5160 5165 5170 5175 5180 5185 5190 5195 5200
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

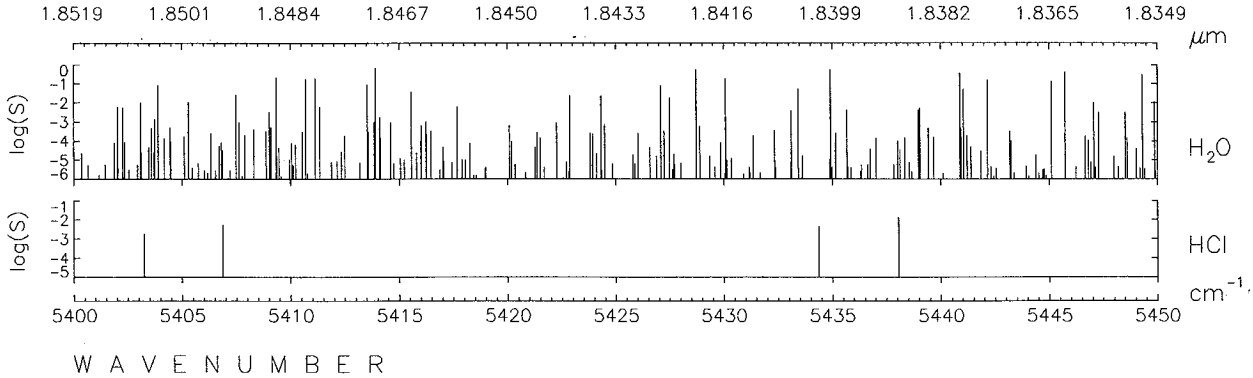


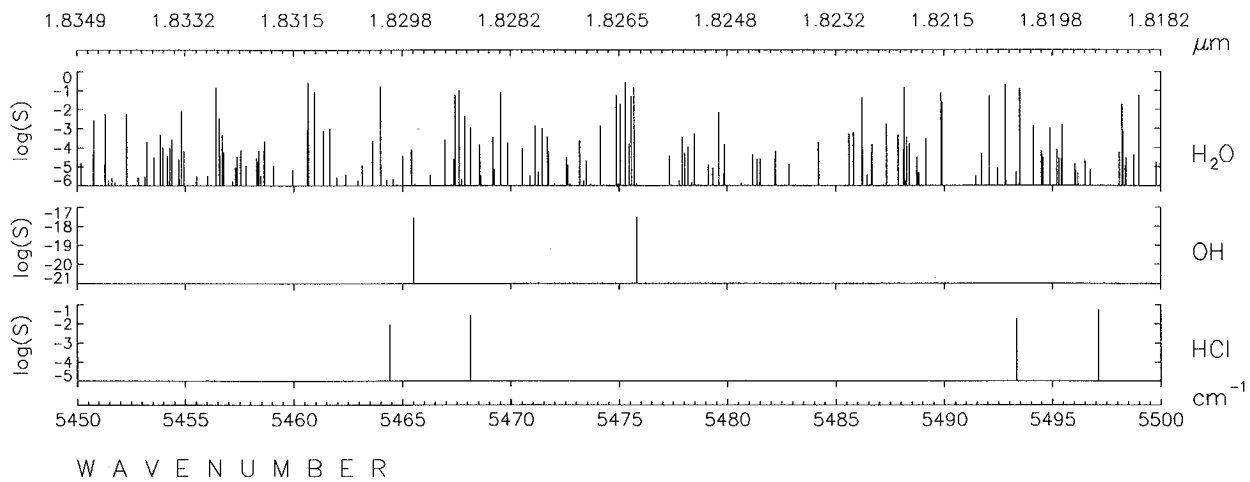


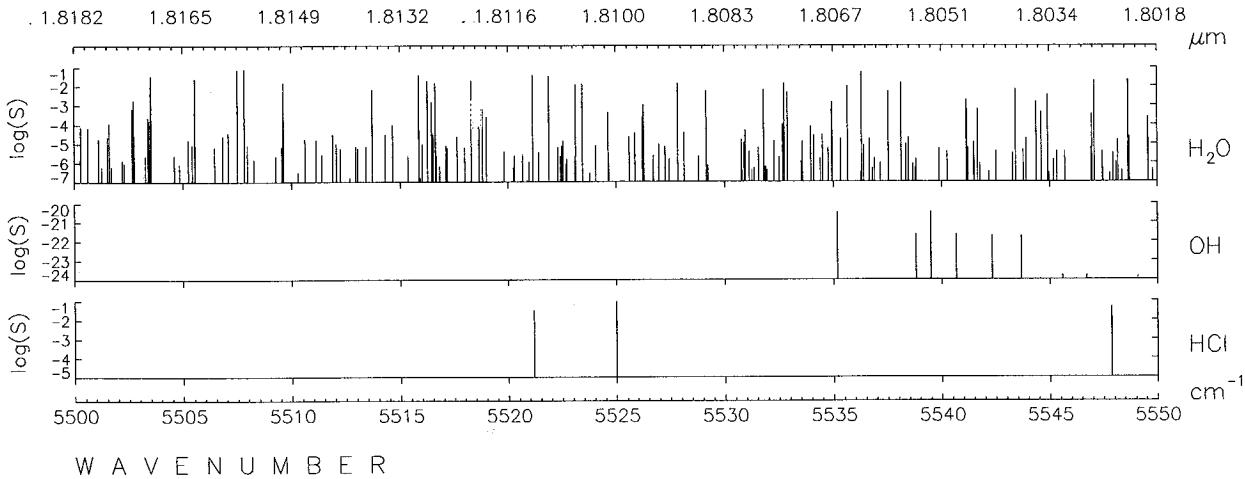

1.8868 1.8850 1.8832 1.8815 1.8797 1.8779 1.8762 1.8744 1.8727 1.8709 1.8692
μm
log(S)
H2O
CO2
HCl
cm-1
5300 5305 5310 5315 5320 5325 5330 5335 5340 5345 5350
WAVENUMBER

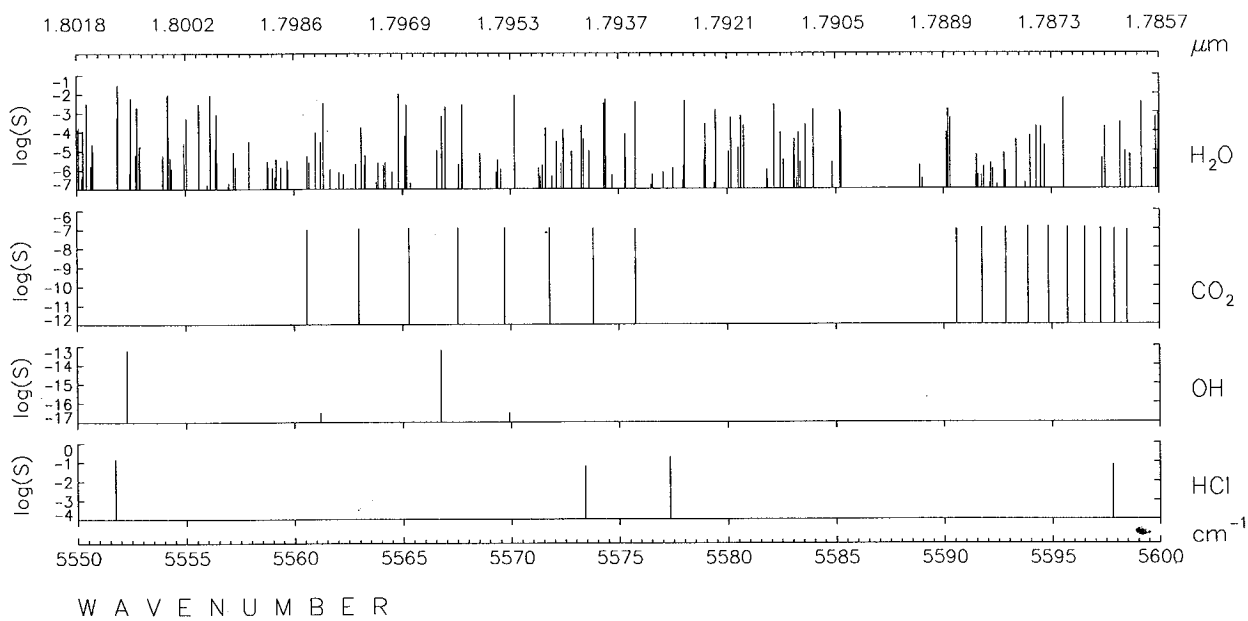

1.8692 1.8674 1.8657 1.8639 1.8622 1.8605 1.8587 1.8570 1.8553 1.8536 1.8519
μm
log(S)
H2O
CO2
OH
HCl
cm-1
5350 5355 5360 5365 5370 5375 5380 5385 5390 5395 5400
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

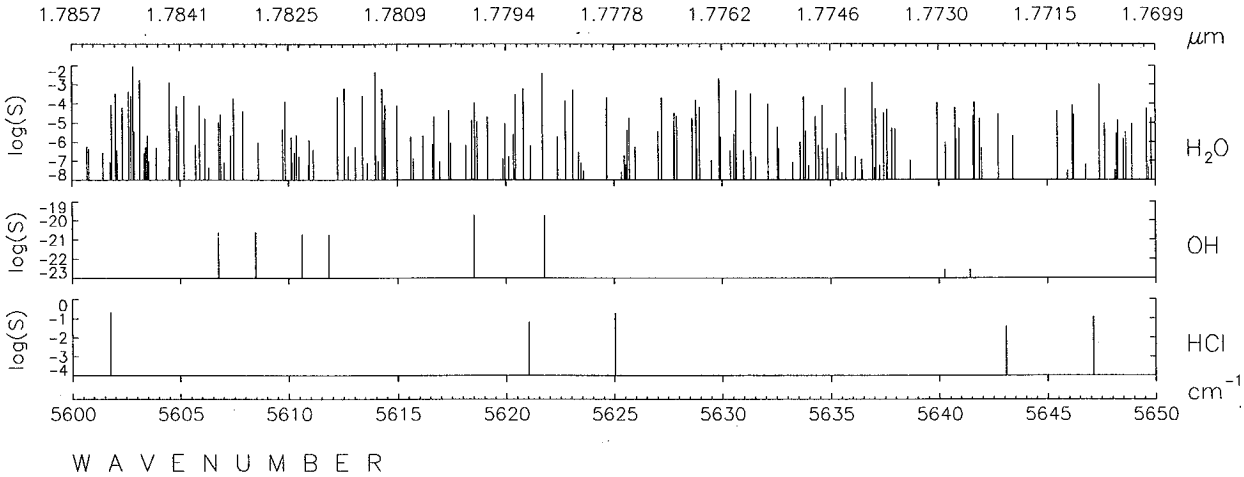


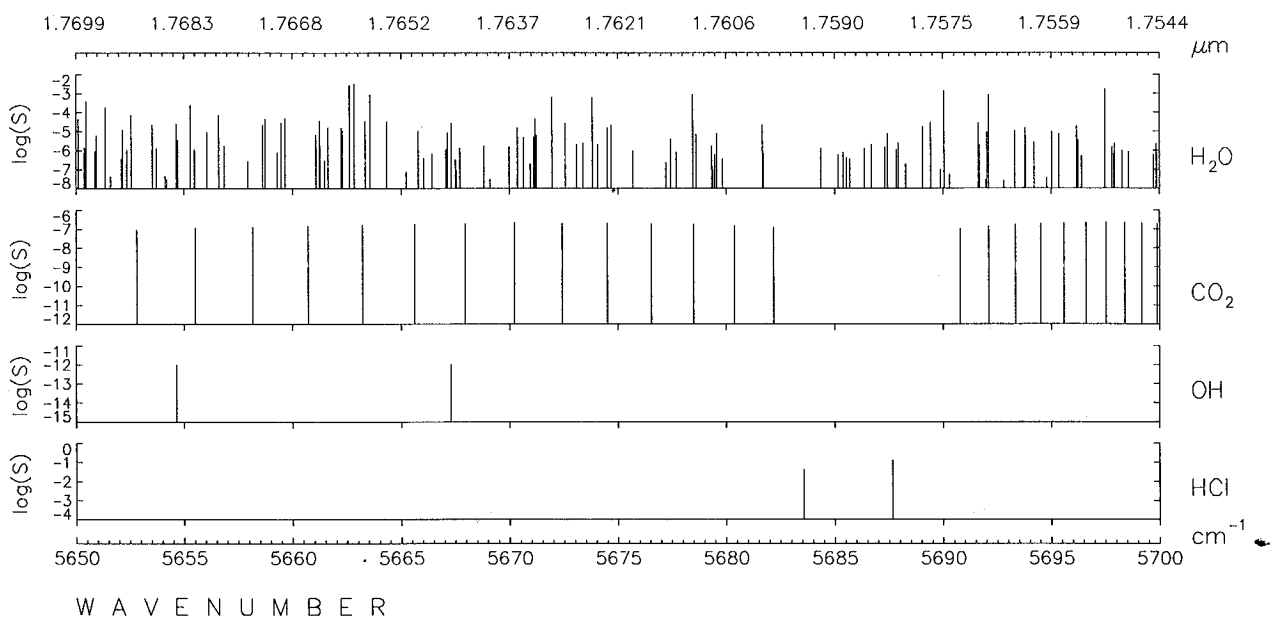


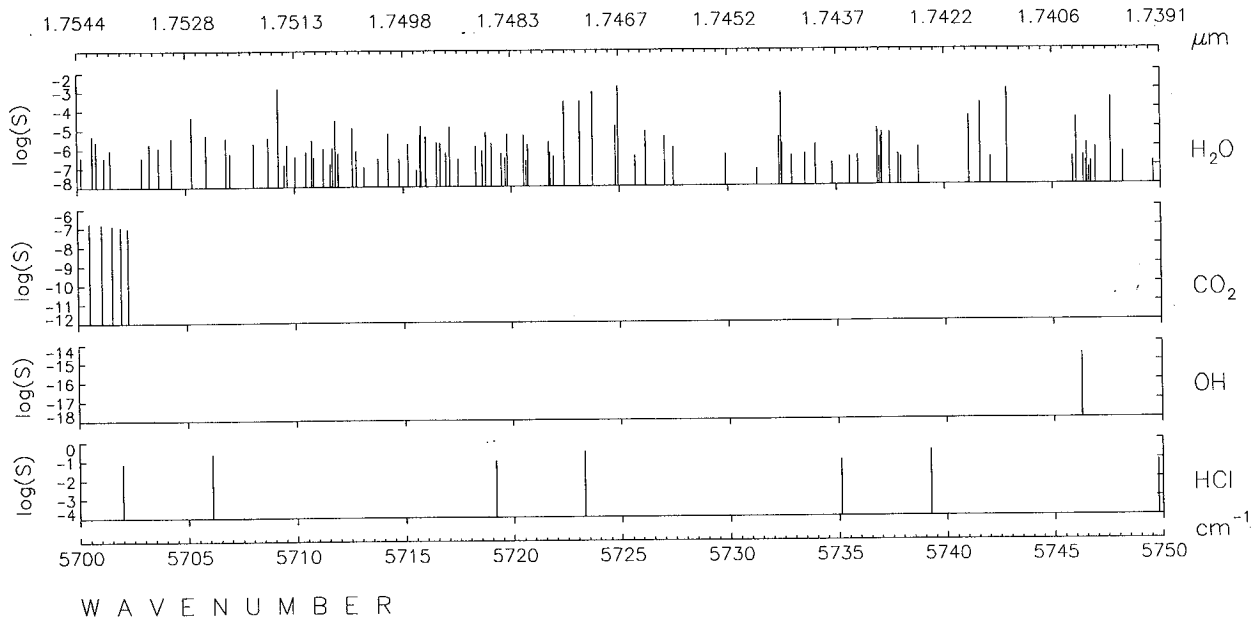

1.8182 1.8165 1.8149 1.8132 1.8116 1.8100 1.8083 1.8067 1.8051 1.8034 1.8018
μm
log(S)
H2O
OH
HCl
cm-1
5500 5505 5510 5515 5520 5525 5530 5535 5540 5545 5550
WAVENUMBER

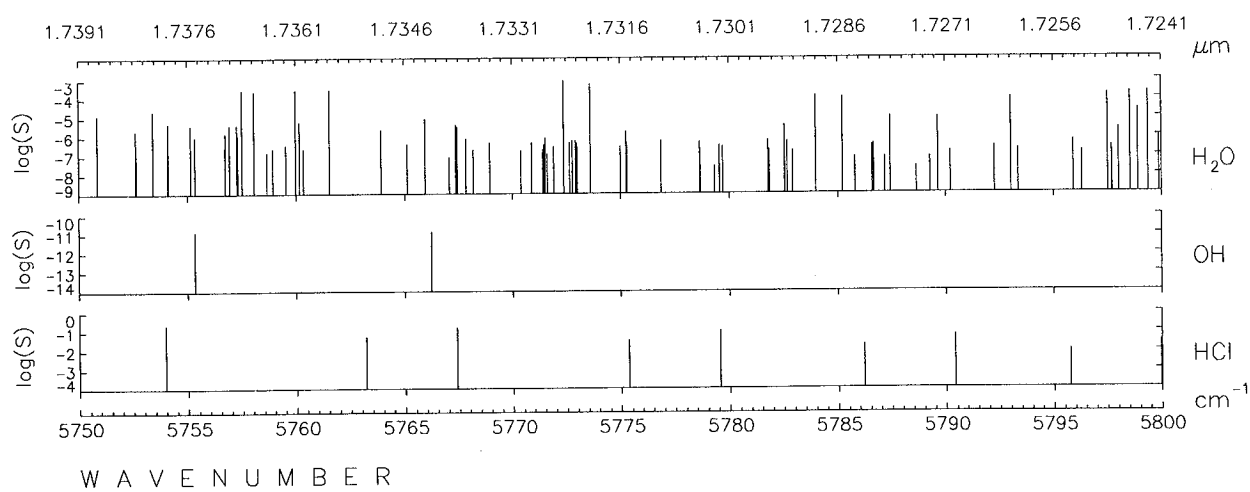

1.8018 1.8002 1.7986 1.7969 1.7953 1.7937 1.7921 1.7905 1.7889 1.7873 1.7857
μm
log(S)
H2O
CO2
OH
HCl
cm-1
5550 5555 5560 5565 5570 5575 5580 5585 5590 5595 5600
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

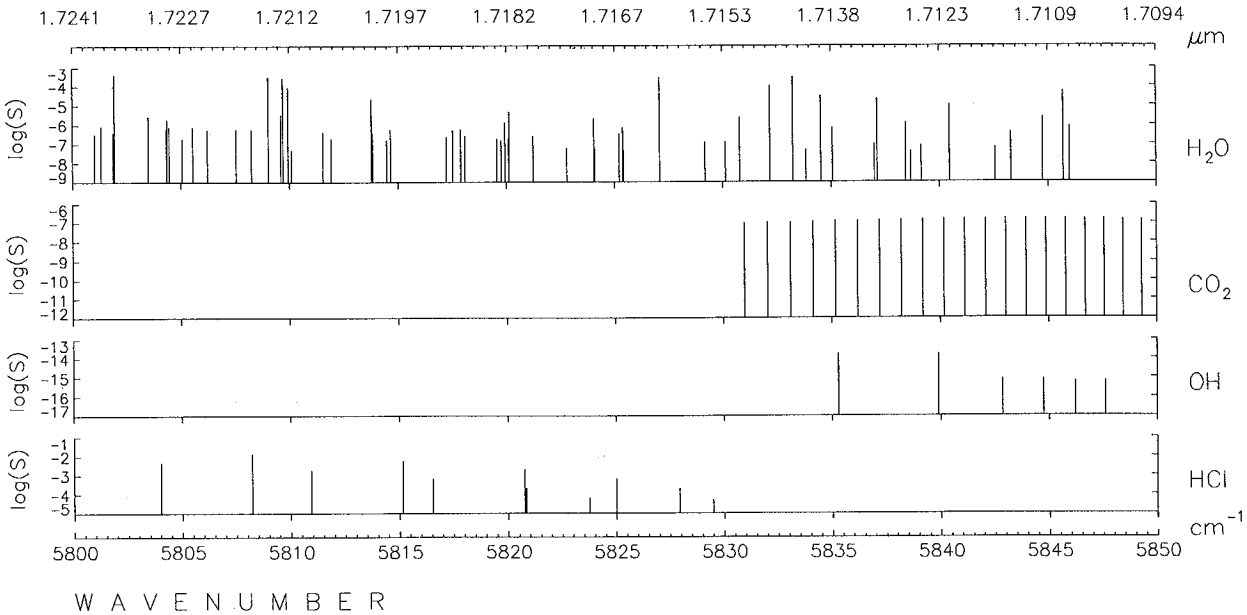


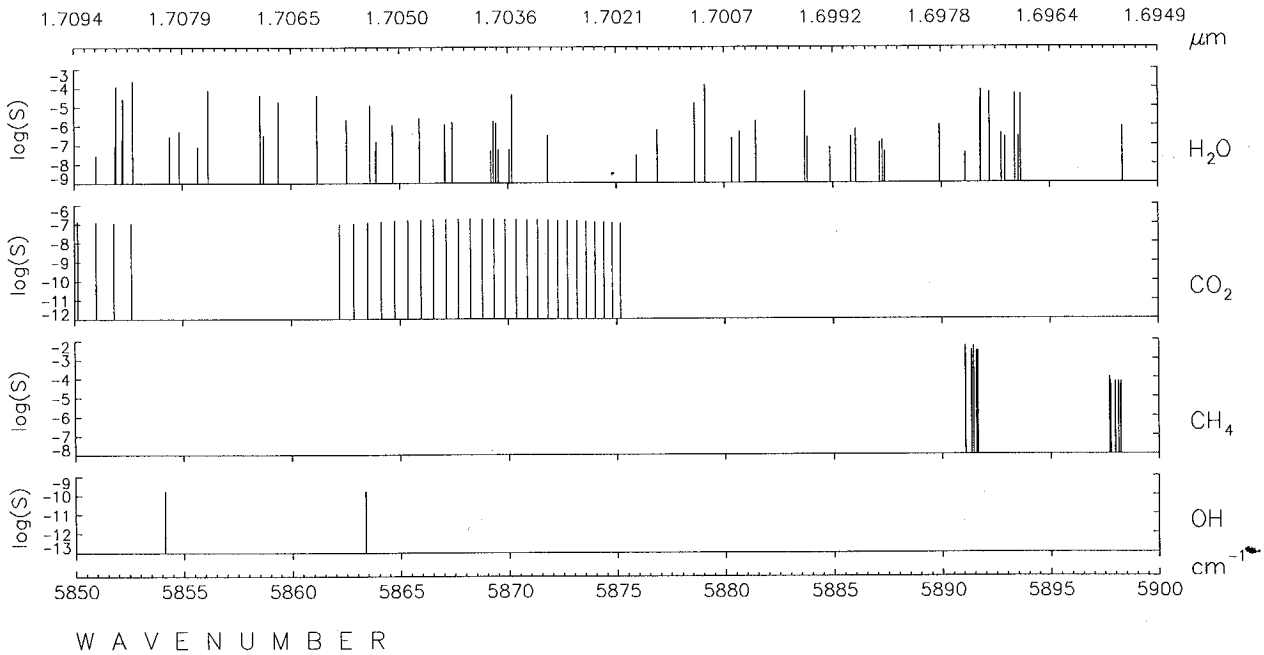


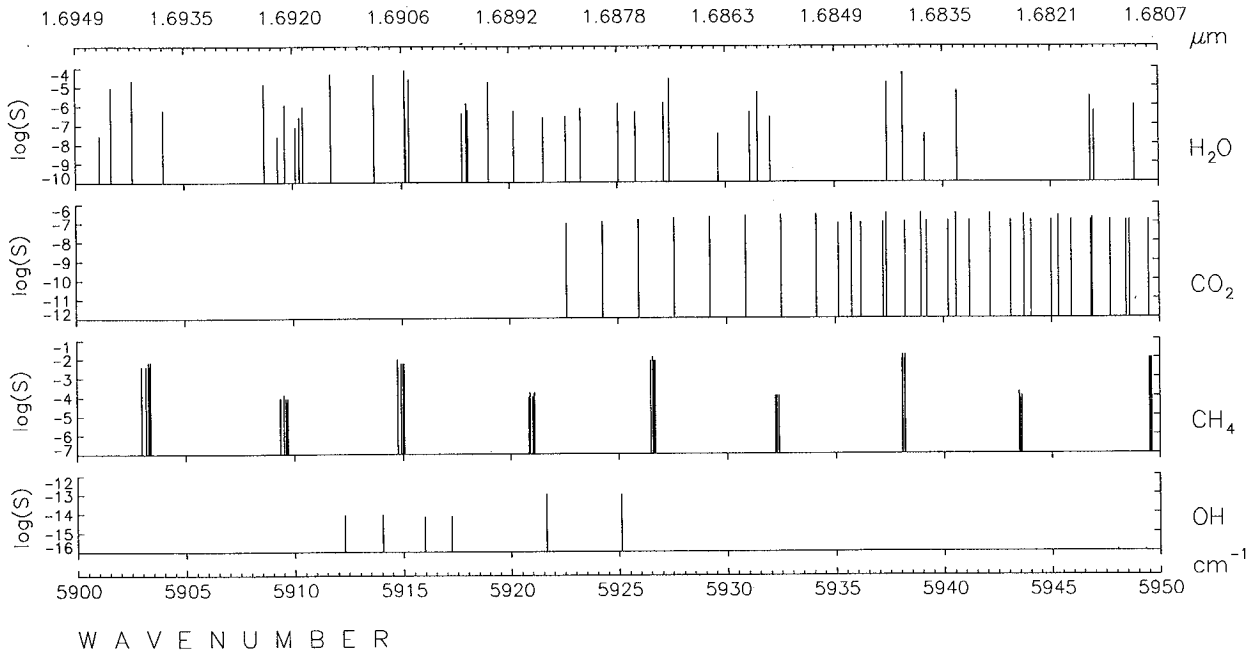

1.7544 1.7528 1.7513 1.7498 1.7483 1.7467 1.7452 1.7437 1.7422 1.7406 1.7391
μm
log(S)
H2O
CO2
OH
HCl
cm-1
5700 5705 5710 5715 5720 5725 5730 5735 5740 5745 5750
WAVENUMBER

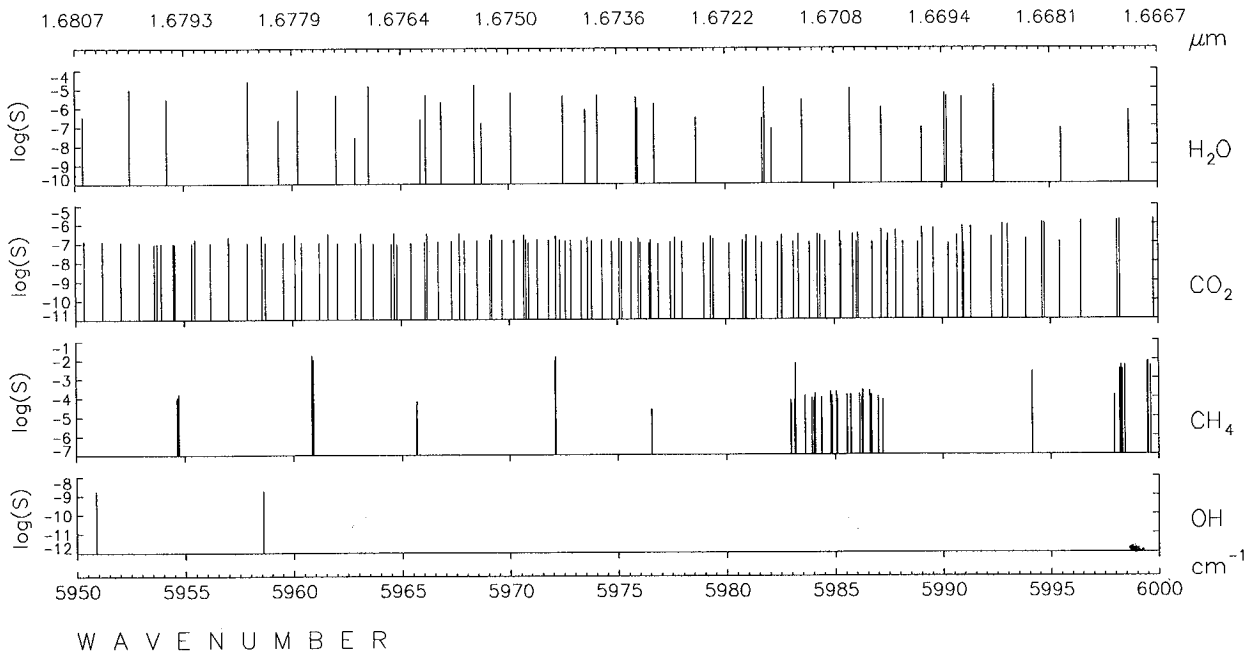

1.7391 1.7376 1.7361 1.7346 1.7331 1.7316 1.7301 1.7286 1.7271 1.7256 1.7241
μm
log(S)
H2O
OH
HCl
cm-1
5750 5755 5760 5765 5770 5775 5780 5785 5790 5795 5800
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

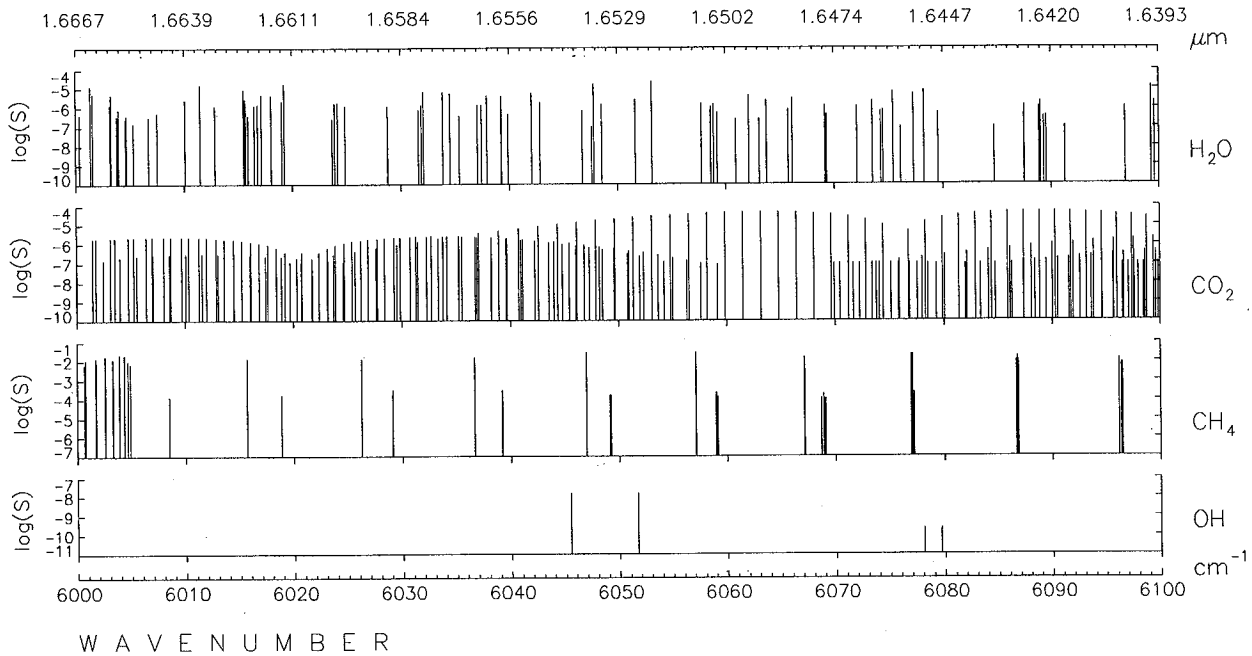


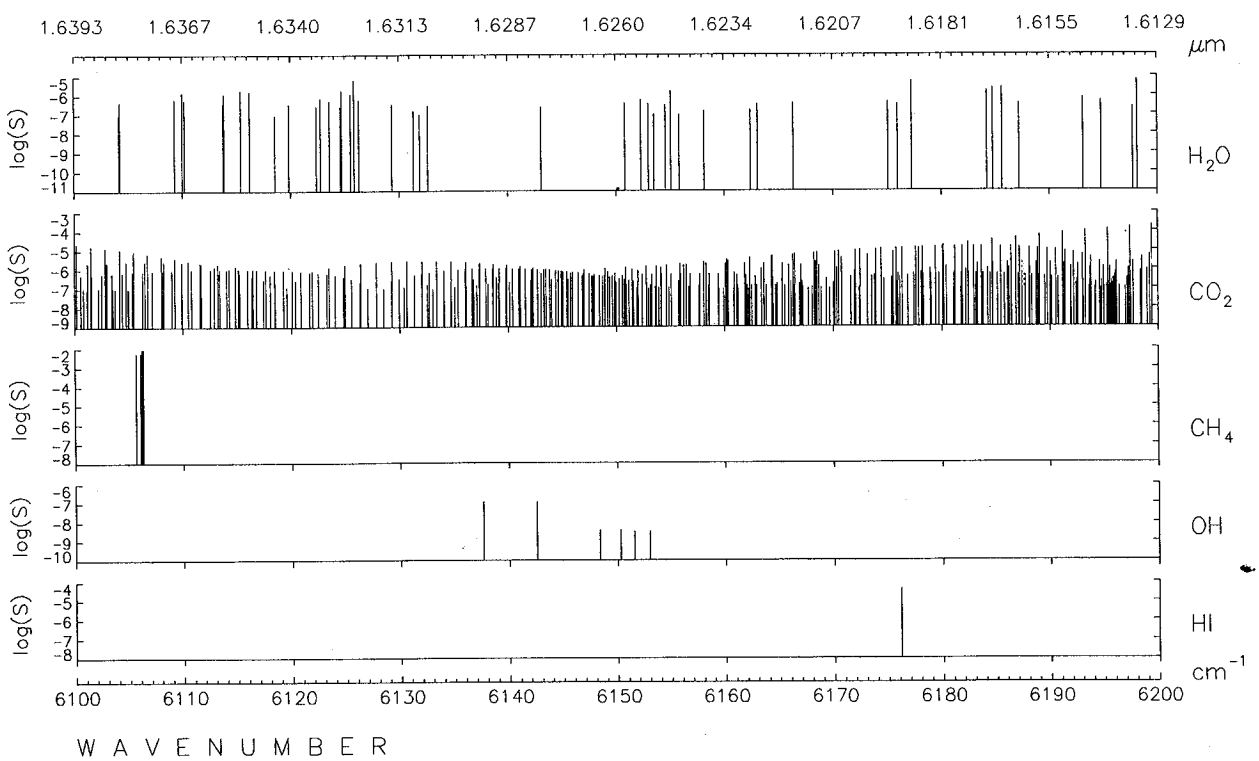


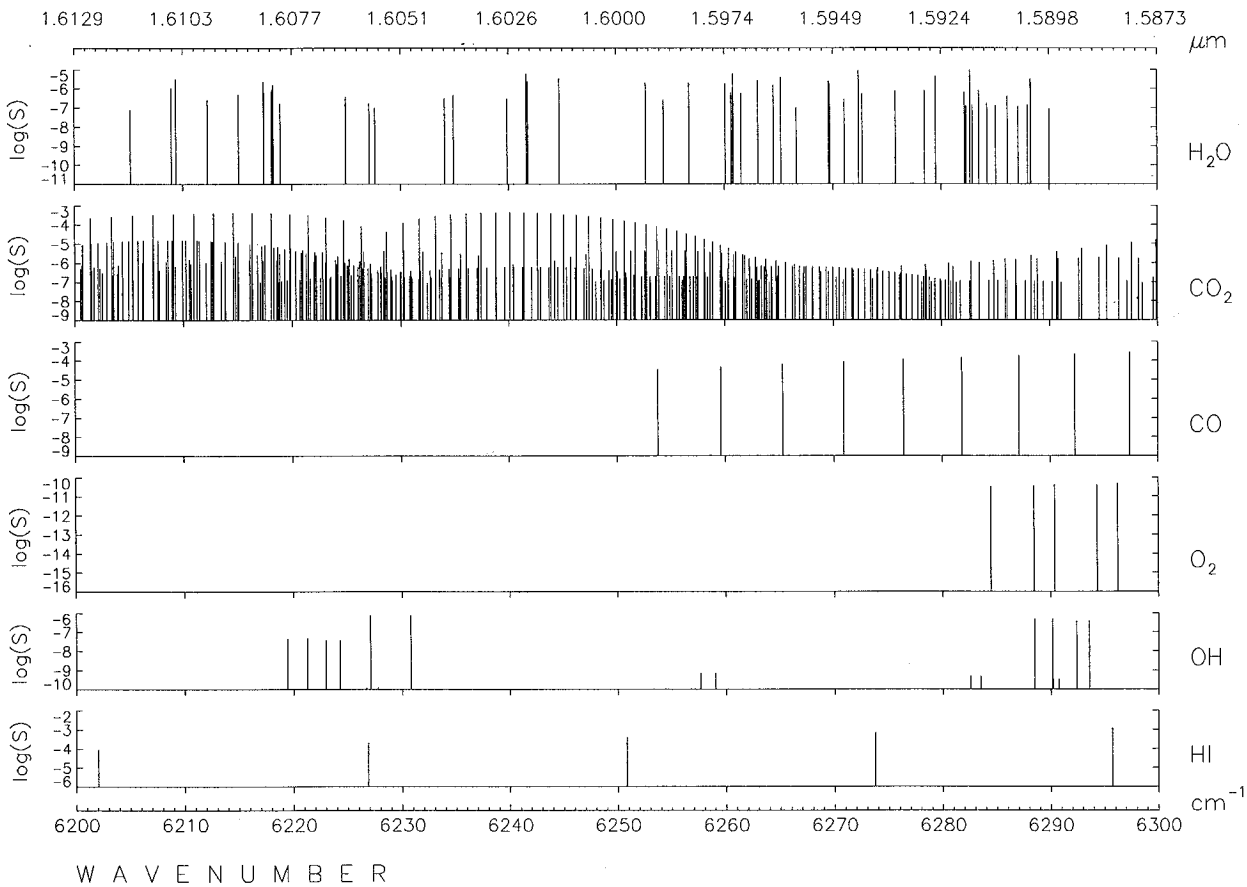

1.6949 1.6935 1.6920 1.6906 1.6892 1.6878 1.6863 1.6849 1.6835 1.6821 1.6807
μm
log(S)
H2O
CO2
CH4
OH
cm-1
5900 5905 5910 5915 5920 5925 5930 5935 5940 5945 5950
WAVENUMBER


1.6807 1.6793 1.6779 1.6764 1.6750 1.6736 1.6722 1.6708 1.6694 1.6681 1.6667
μm
log(S)
H2O
CO2
CH4
OH
cm-1
5950 5955 5960 5965 5970 5975 5980 5985 5990 5995 6000
WAVENUMBER

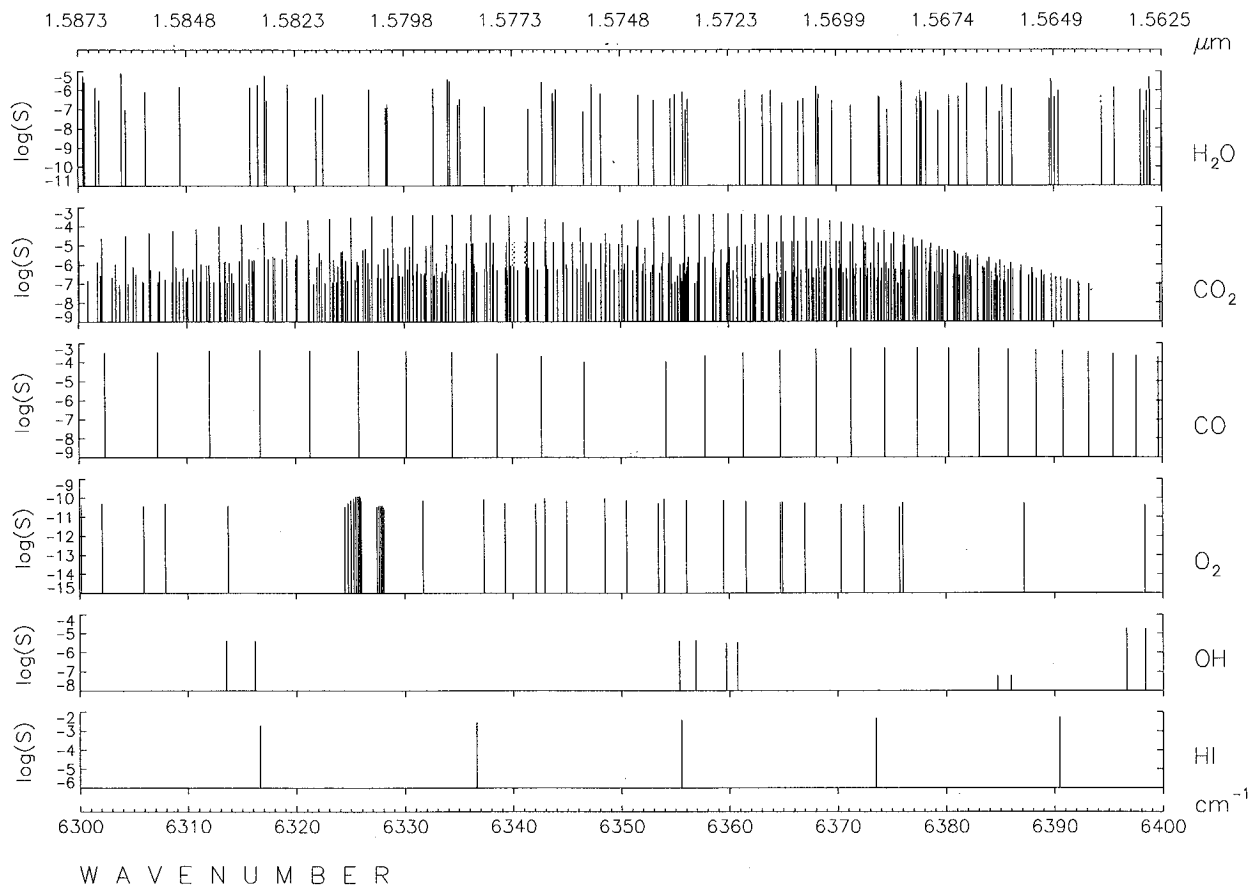
ORIGINAL PAGE IS
OF POOR QUALITY

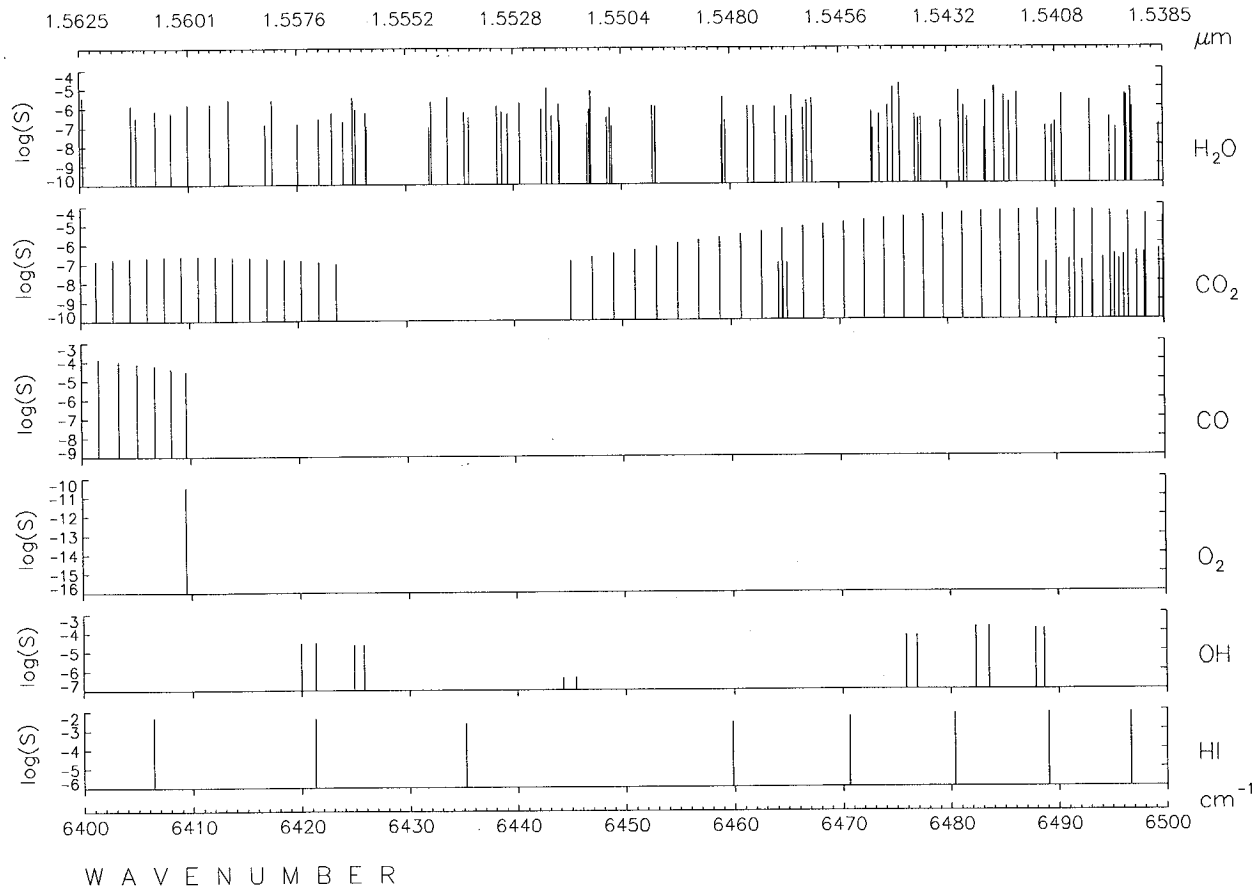




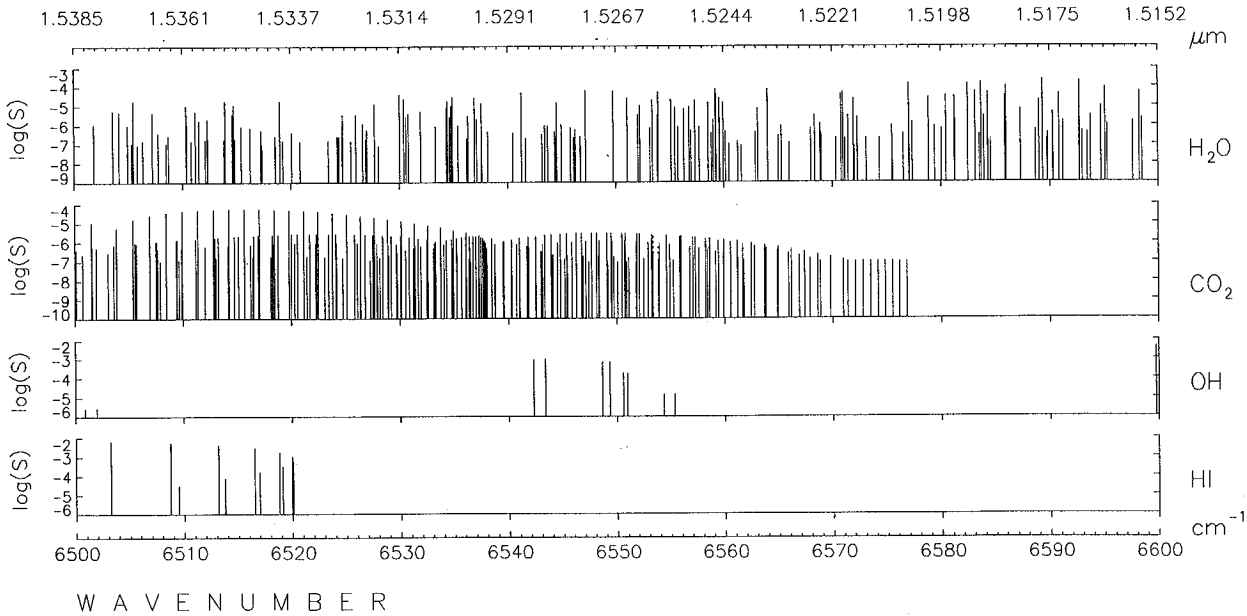

1.6129
1.6103
1.6077
1.6051
1.6026
1.6000
1.5974
1.5949
1.5924
1.5898
1.5873
μm
log(S)
H2O
CO2
CO
O2
OH
HI
cm-1
6200
6210
6220
6230
6240
6250
6260
6270
6280
6290
6300
WAVENUMBER

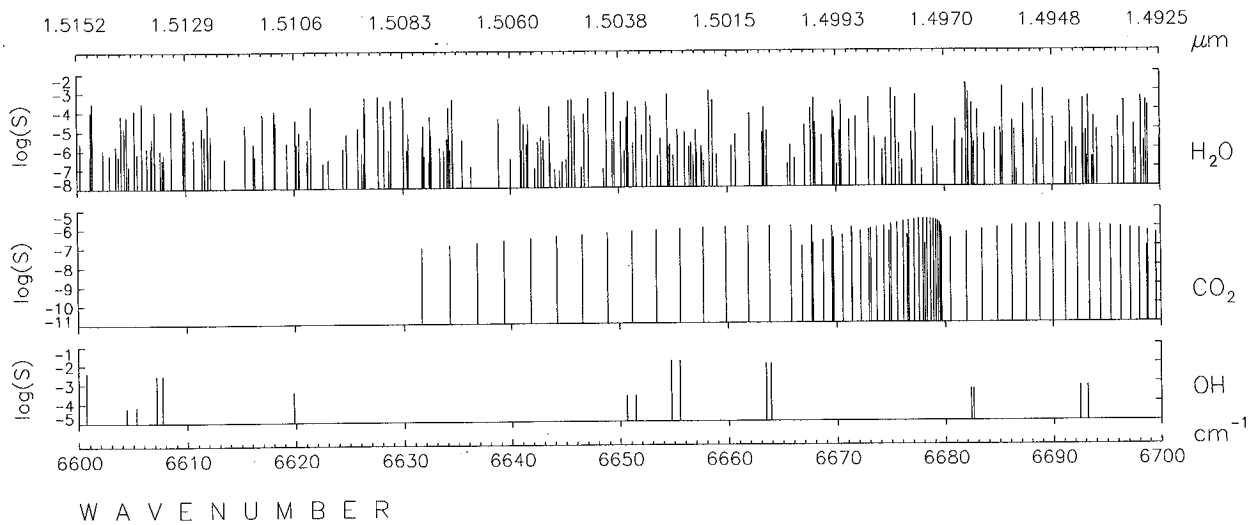
ORIGINAL PAGE IS
OF POOR QUALITY

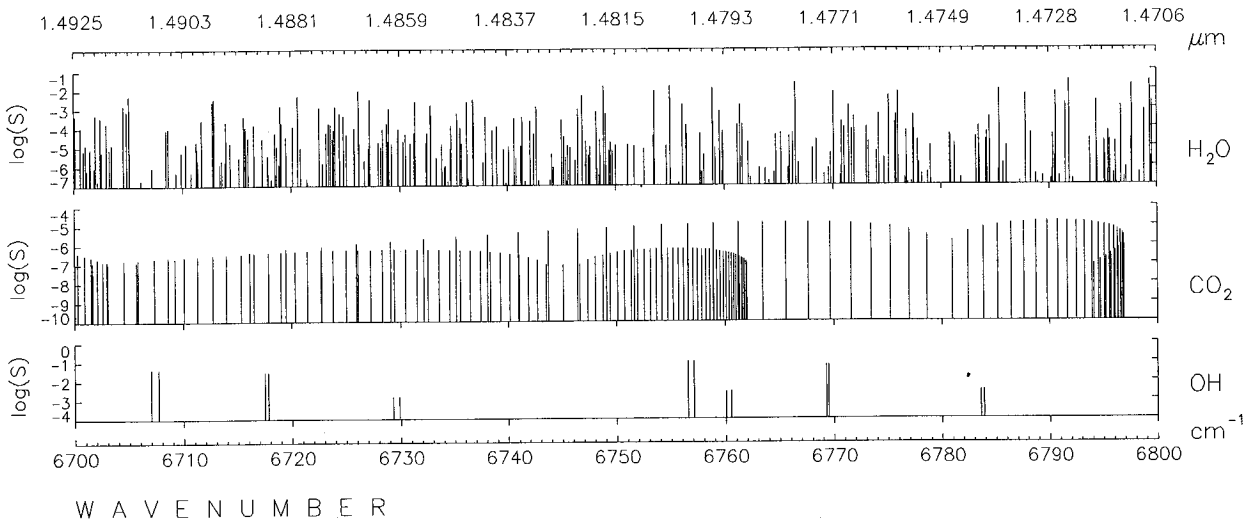



1.5625
1.5601
1.5576
1.5552
1.5528
1.5504
1.5480
1.5456
1.5432
1.5408
1.5385
μm
log(S)
H2O
CO2
CO
O2
OH
HI
cm-1
6400
6410
6420
6430
6440
6450
6460
6470
6480
6490
6500
WAVENUMBER

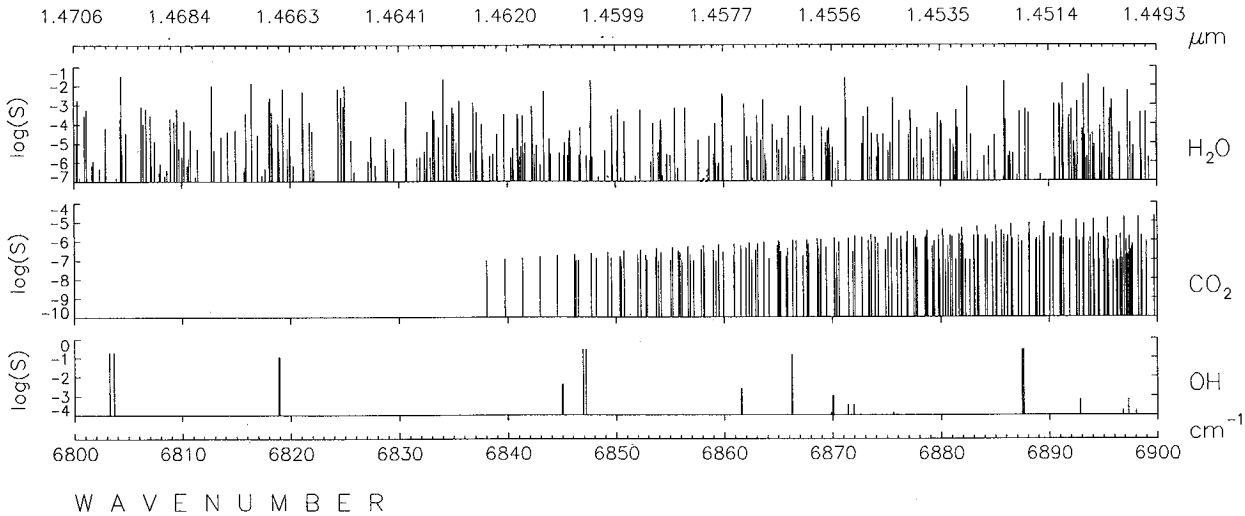
ORIGINAL PAGE IS
OF POOR QUALITY

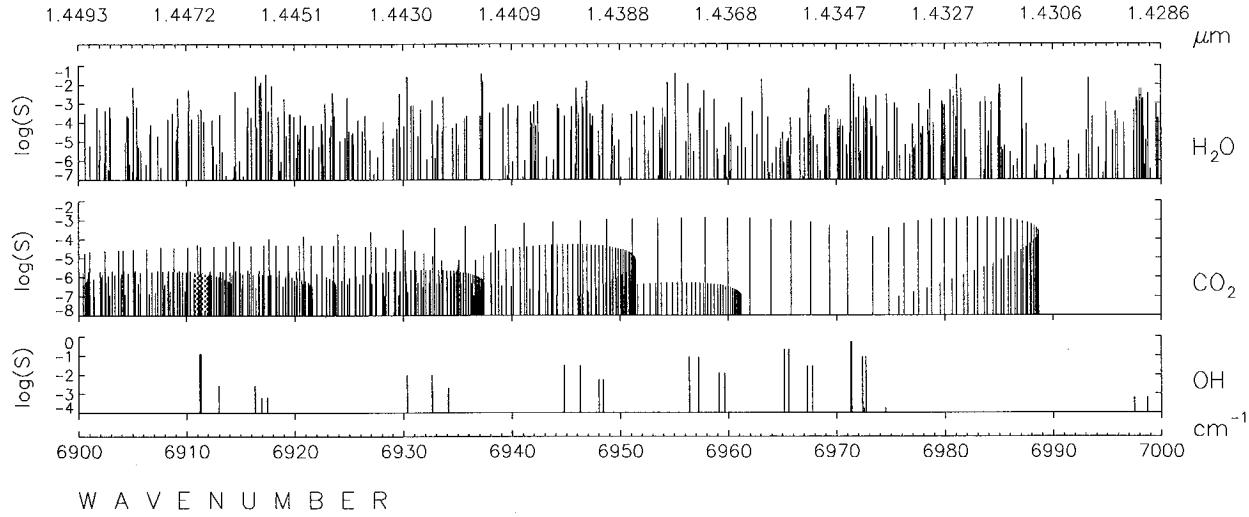


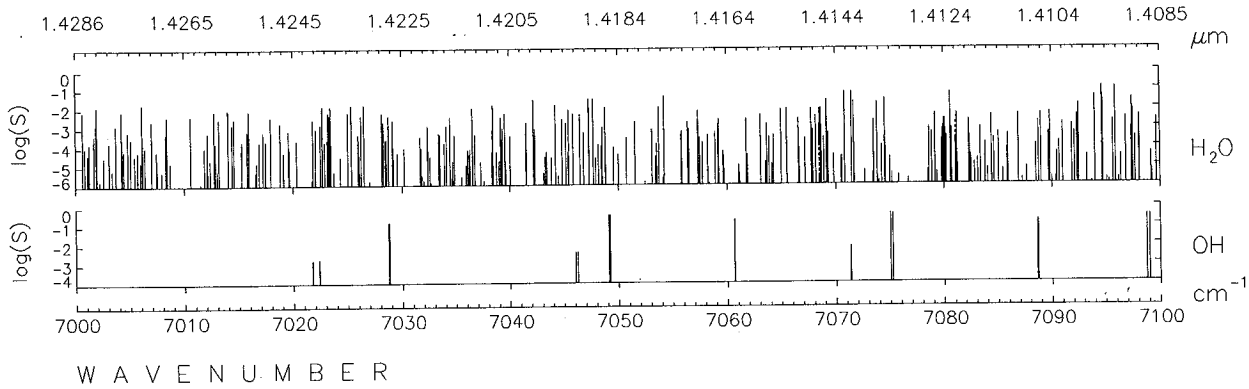

1.5152 1.5129 1.5106 1.5083 1.5060 1.5038 1.5015 1.4993 1.4970 1.4948 1.4925
μm
log(S)
H2O
CO2
OH
cm-1
6600 6610 6620 6630 6640 6650 6660 6670 6680 6690 6700
WAVENUMBER

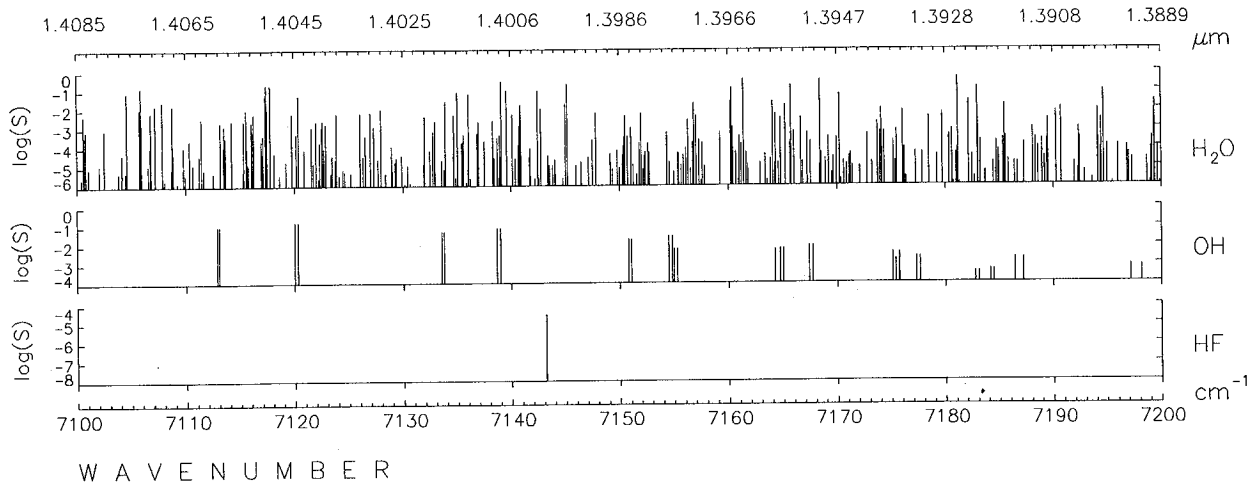

1.4925 1.4903 1.4881 1.4859 1.4837 1.4815 1.4793 1.4771 1.4749 1.4728 1.4706
μm
log(S)
H2O
CO2
OH
cm-1
6700 6710 6720 6730 6740 6750 6760 6770 6780 6790 6800
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

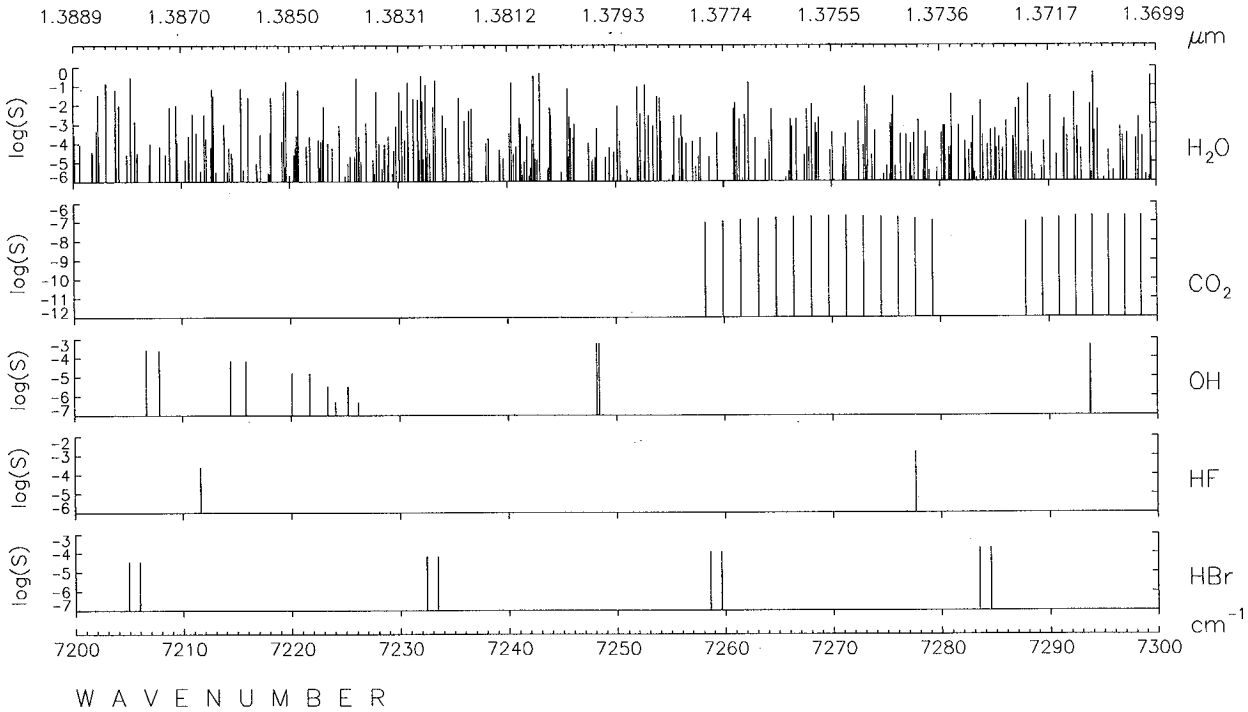


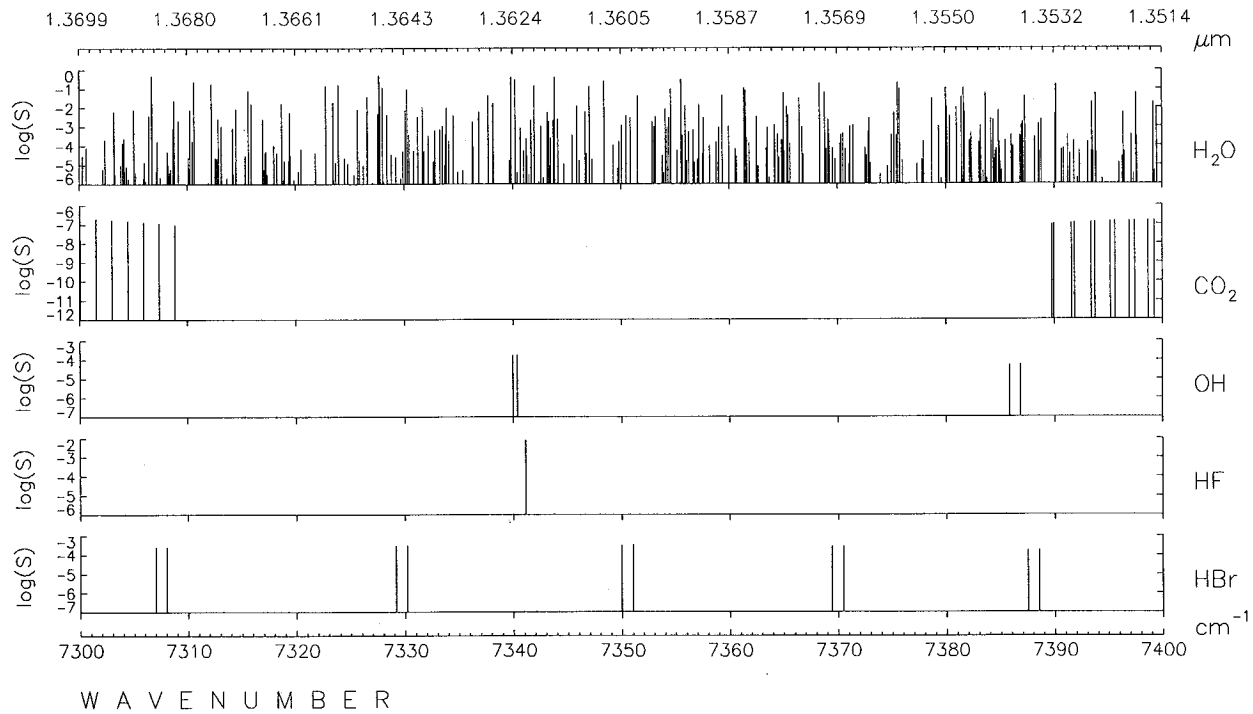


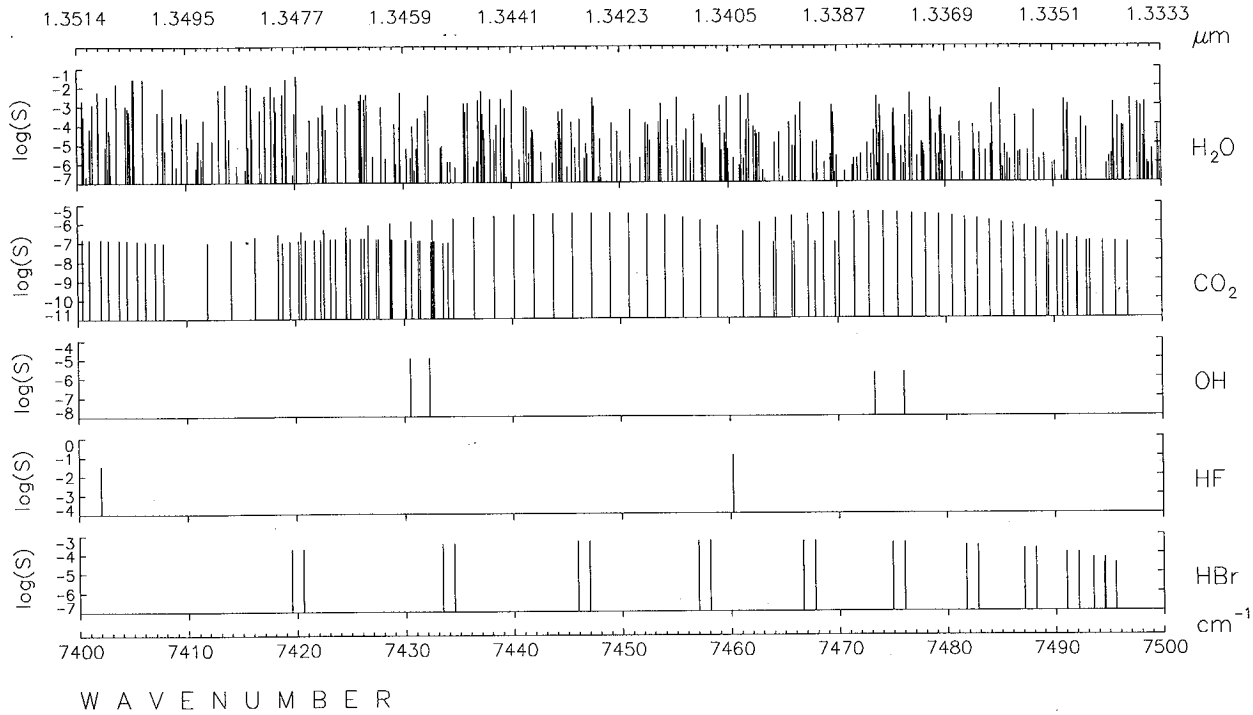

1.4286 1.4265 1.4245 1.4225 1.4205 1.4184 1.4164 1.4144 1.4124 1.4104 1.4085
μm
log(S)
H2O
OH
cm-1
7000 7010 7020 7030 7040 7050 7060 7070 7080 7090 7100
WAVENUMBER

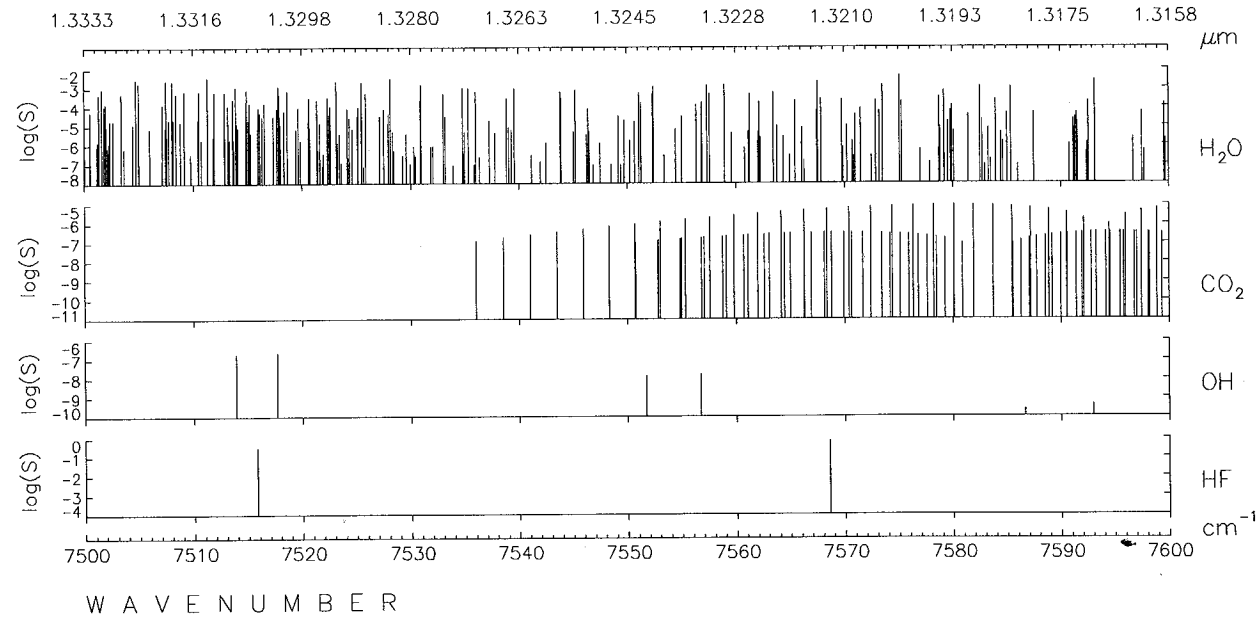

1.4085 1.4065 1.4045 1.4025 1.4006 1.3986 1.3966 1.3947 1.3928 1.3908 1.3889
μm
log(S)
H2O
OH
HF
cm-1
7100 7110 7120 7130 7140 7150 7160 7170 7180 7190 7200
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

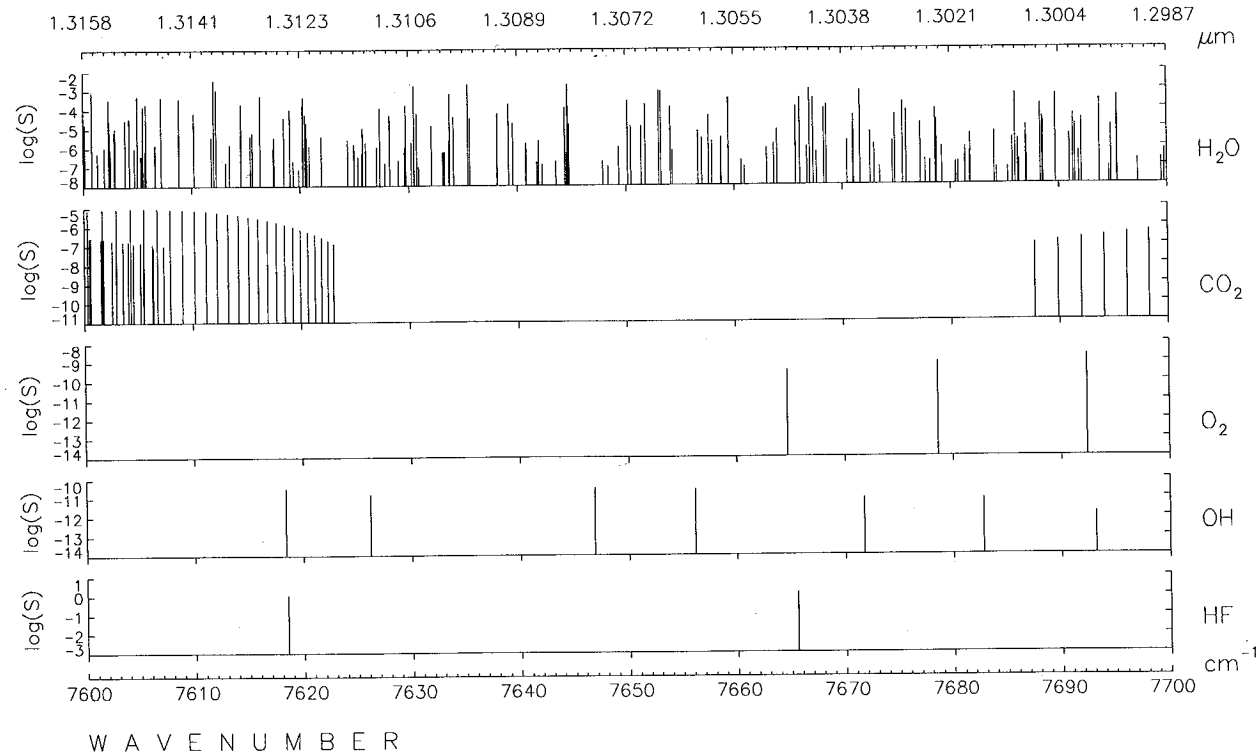


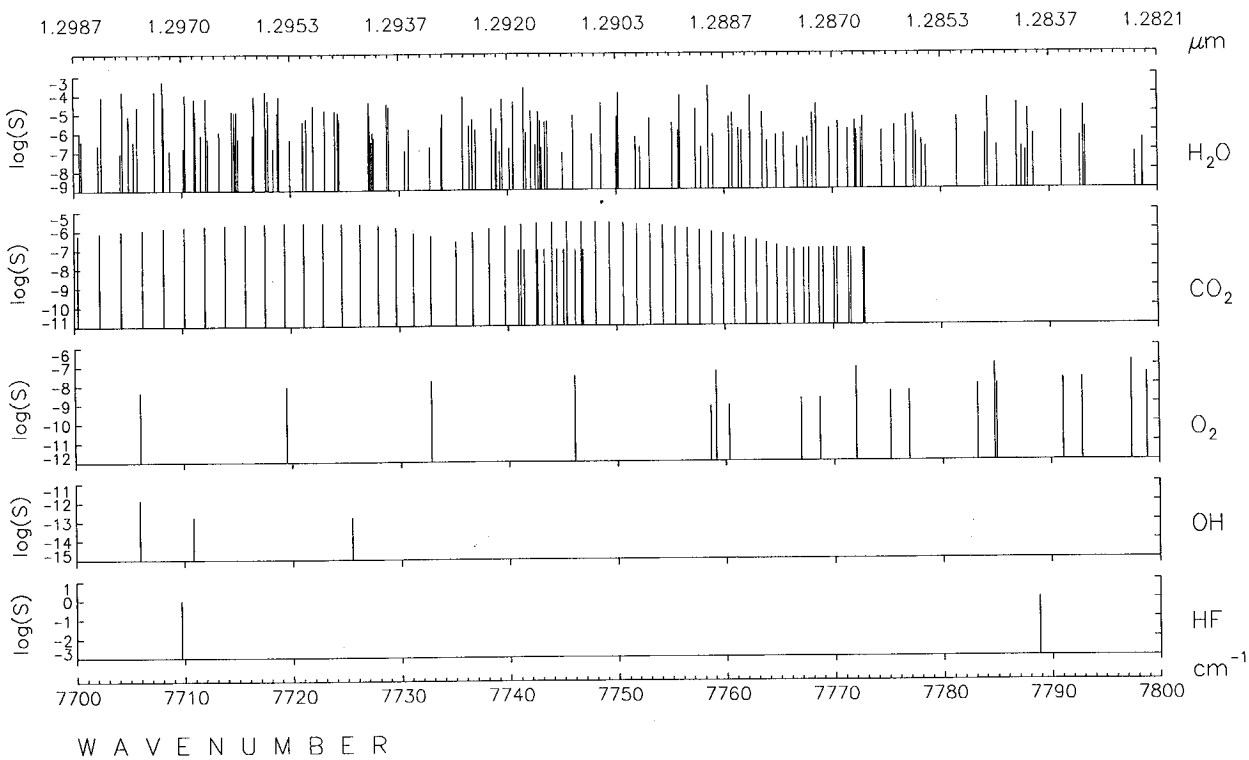


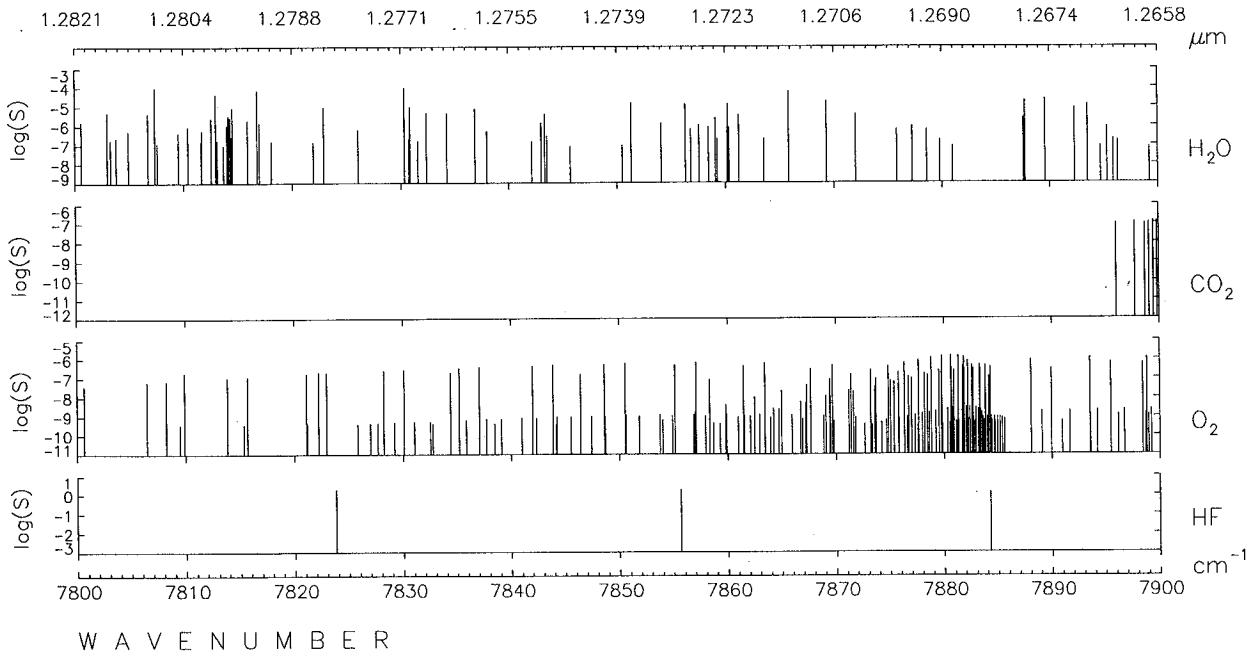

1.3514 1.3495 1.3477 1.3459 1.3441 1.3423 1.3405 1.3387 1.3369 1.3351 1.3333
μm
log(S)
H2O
CO2
OH
HF
HBr
cm-1
7400 7410 7420 7430 7440 7450 7460 7470 7480 7490 7500
WAVENUMBER

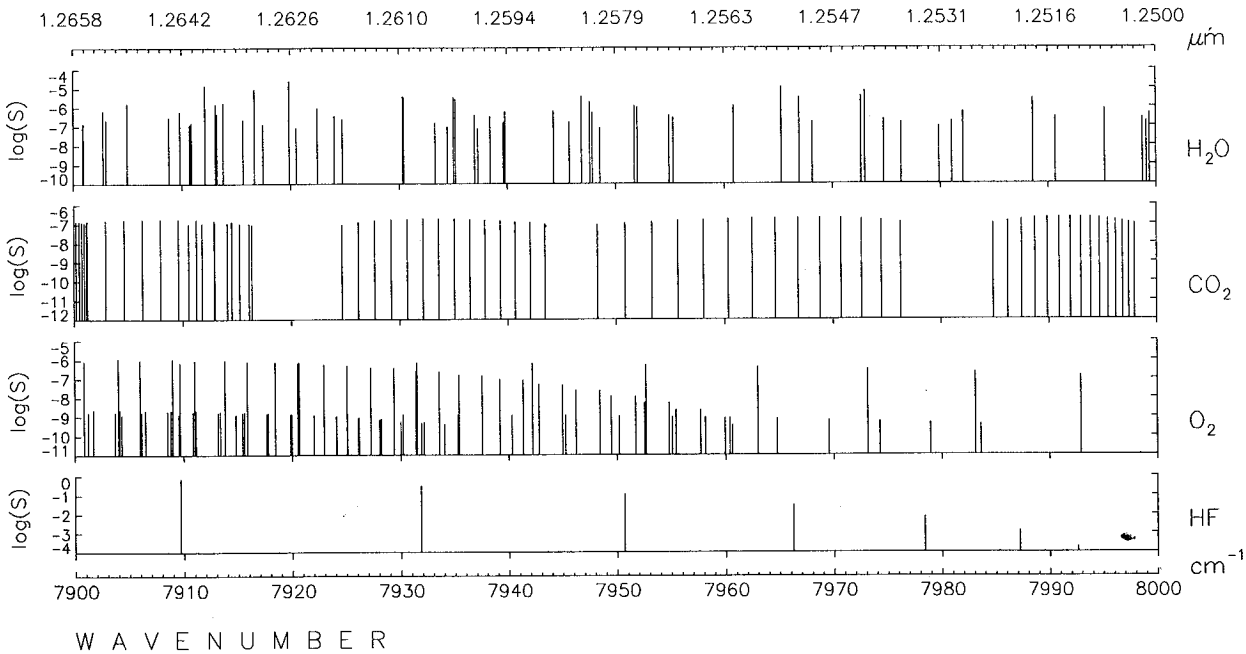

1.3333 1.3316 1.3298 1.3280 1.3263 1.3245 1.3228 1.3210 1.3193 1.3175 1.3158
μm
log(S)
H2O
CO2
OH
HF
cm-1
7500 7510 7520 7530 7540 7550 7560 7570 7580 7590 7600
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

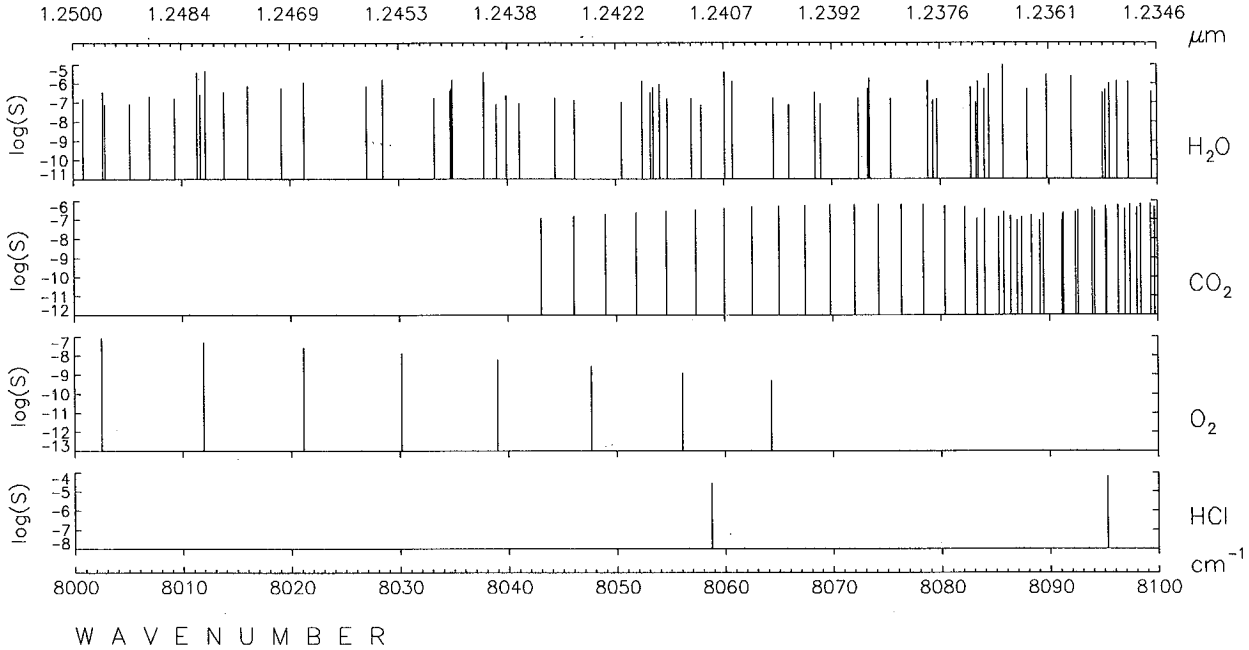


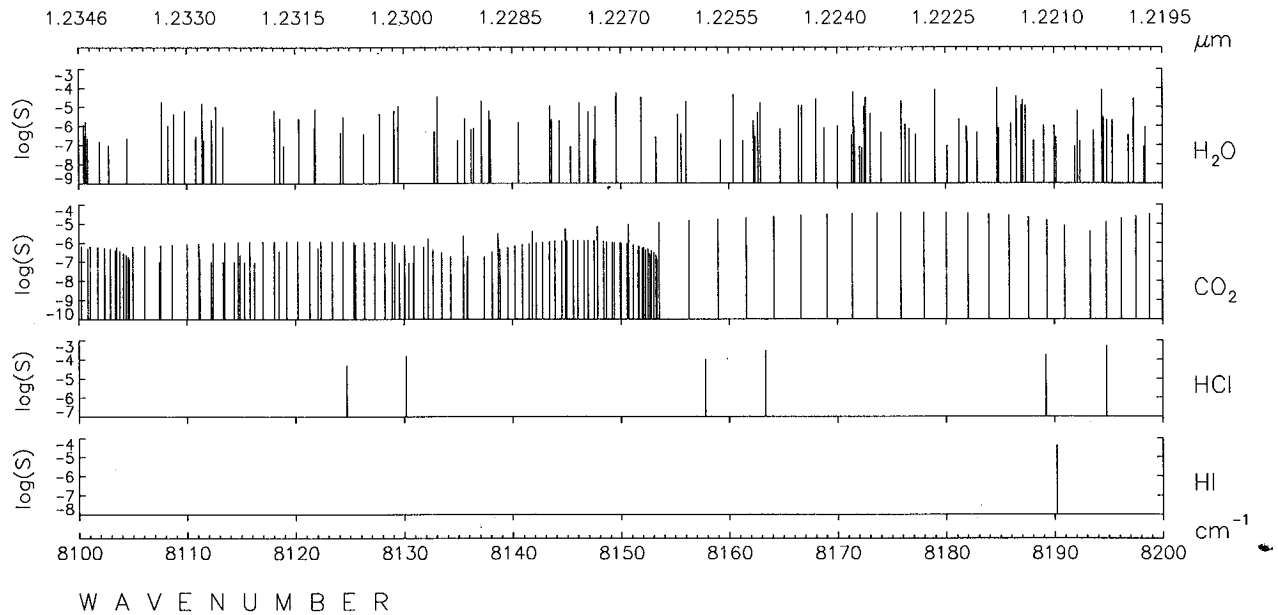


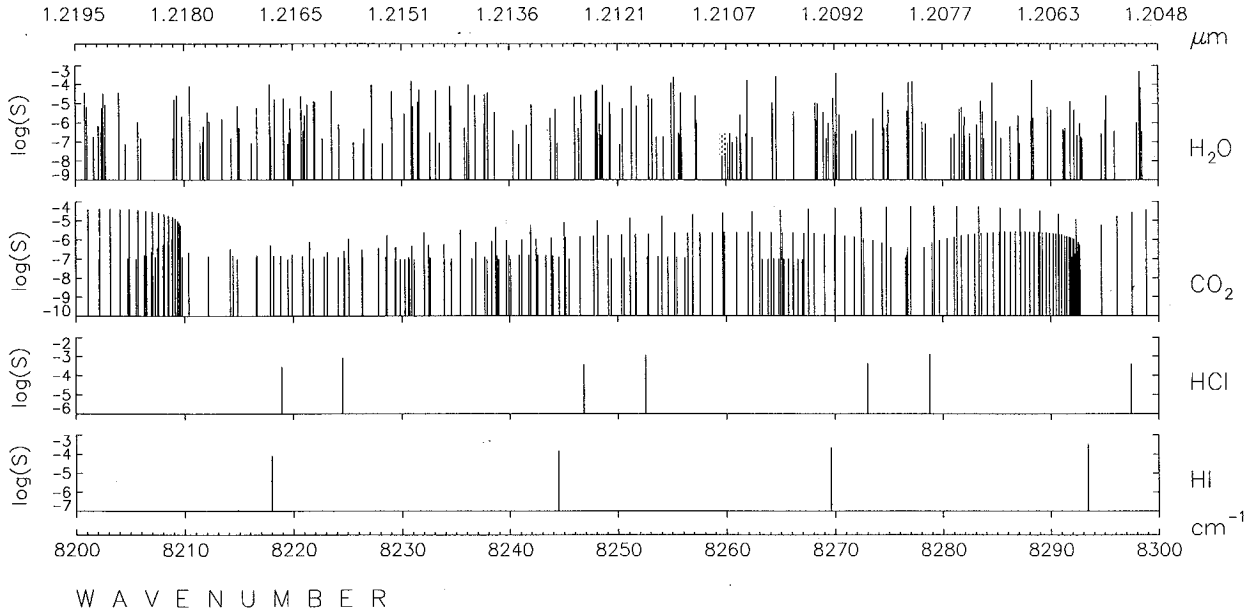

1.2821 1.2804 1.2788 1.2771 1.2755 1.2739 1.2723 1.2706 1.2690 1.2674 1.2658
μm
log(S)
H2O
CO2
O2
HF
cm-1
7800 7810 7820 7830 7840 7850 7860 7870 7880 7890 7900
WAVENUMBER

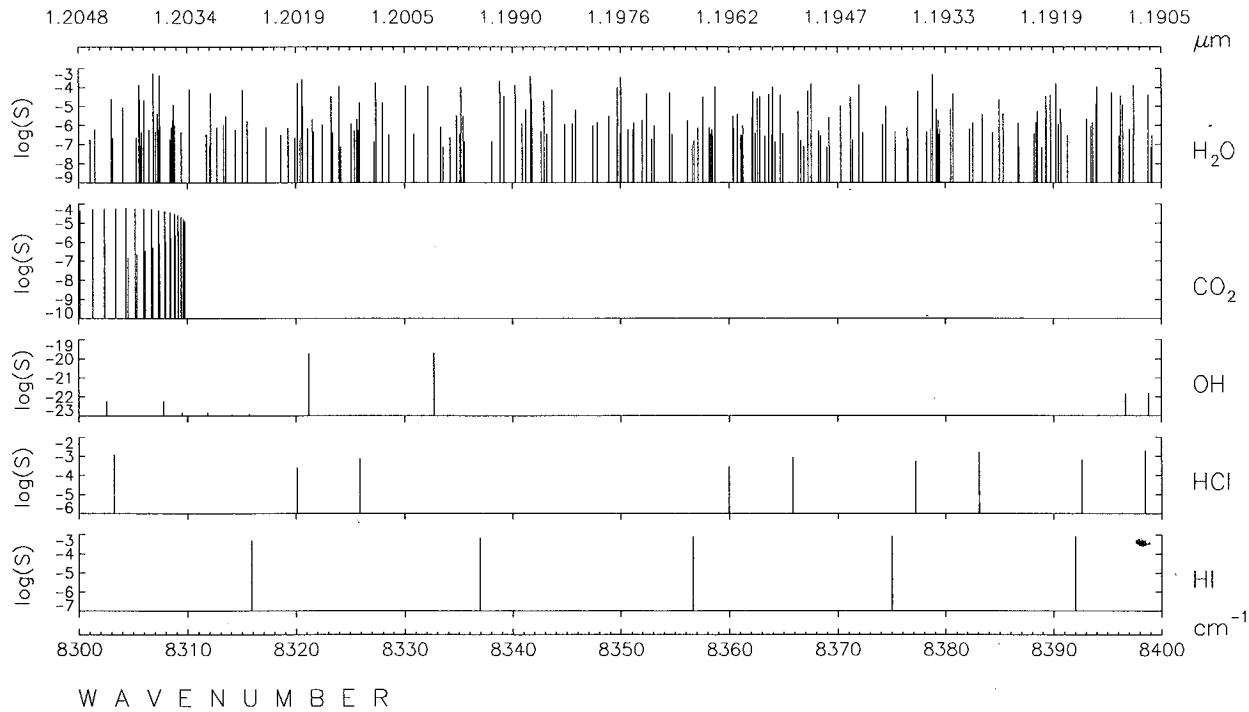

1.2658 1.2642 1.2626 1.2610 1.2594 1.2579 1.2563 1.2547 1.2531 1.2516 1.2500
μm
log(S)
H2O
CO2
O2
HF
cm-1
7900 7910 7920 7930 7940 7950 7960 7970 7980 7990 8000
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

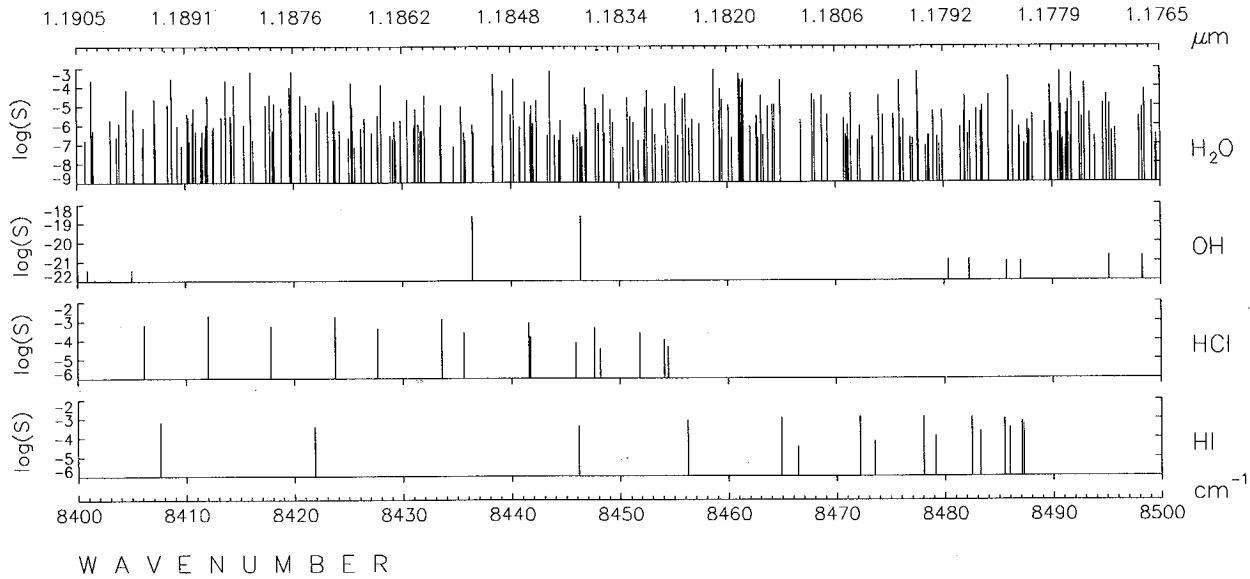


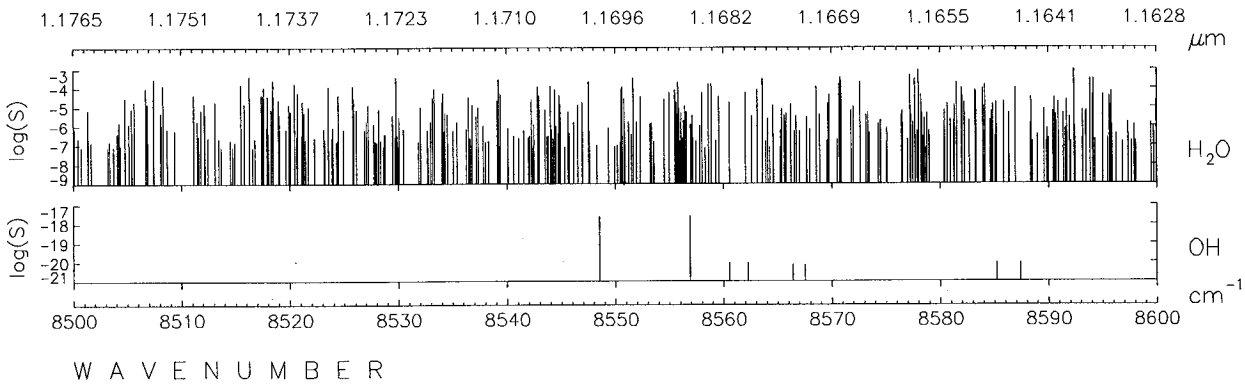


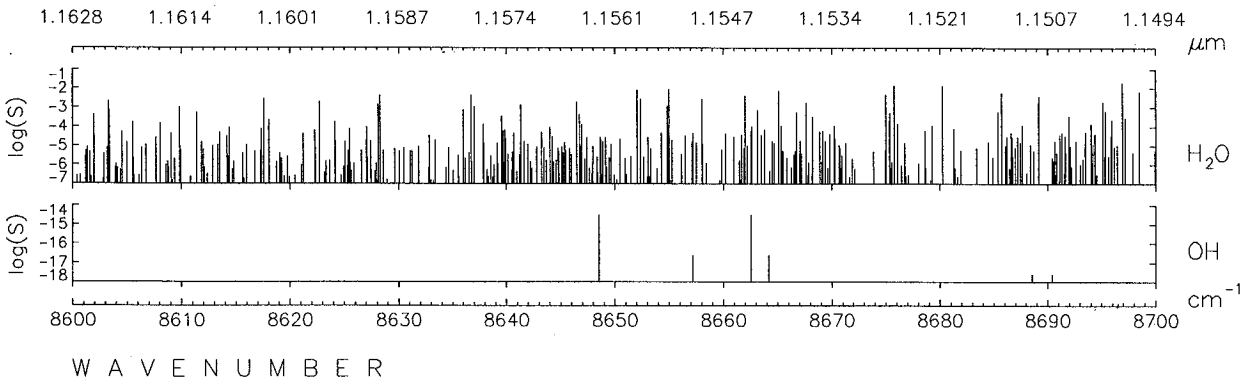

1.2195 1.2180 1.2165 1.2151 1.2136 1.2121 1.2107 1.2092 1.2077 1.2063 1.2048
μm
log(S)
H2O
CO2
HCl
HI
cm-1
8200 8210 8220 8230 8240 8250 8260 8270 8280 8290 8300
WAVENUMBER

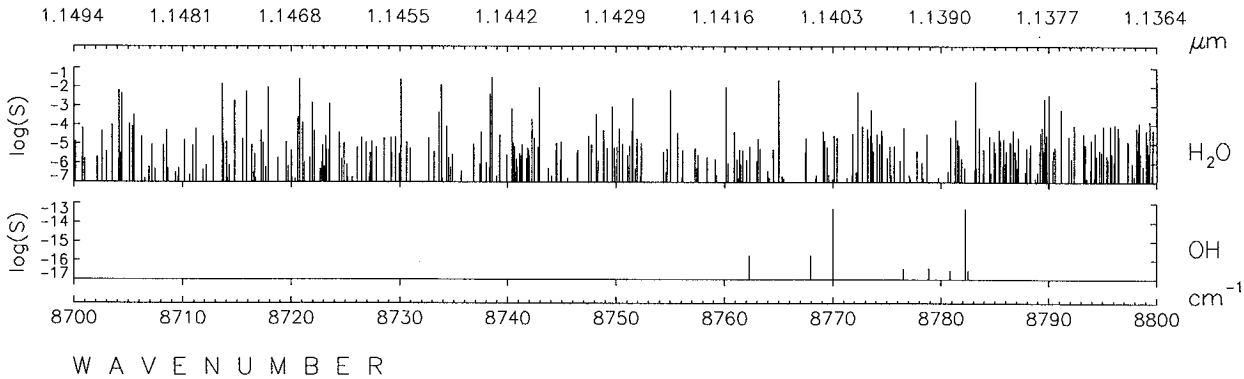

1.2048 1.2034 1.2019 1.2005 1.1990 1.1976 1.1962 1.1947 1.1933 1.1919 1.1905
μm
log(S)
H2O
CO2
OH
HCl
HI
cm-1
8300 8310 8320 8330 8340 8350 8360 8370 8380 8390 8400
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

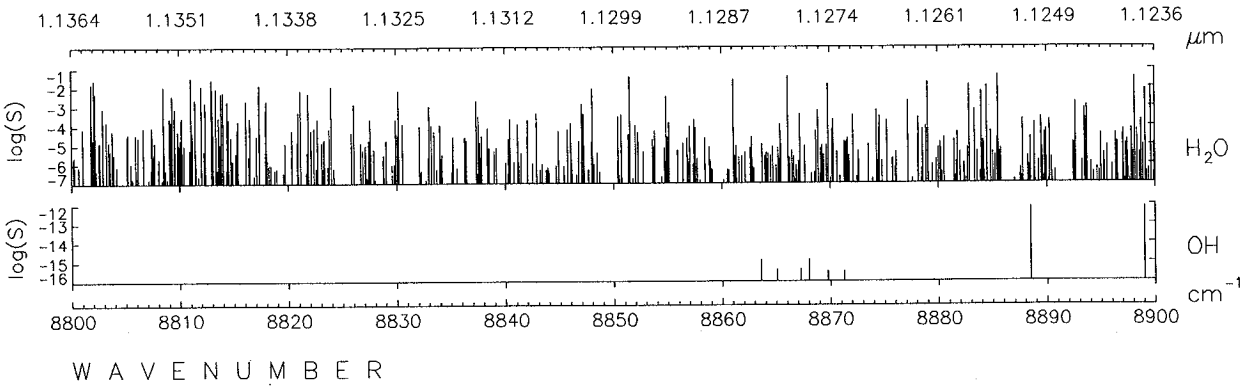


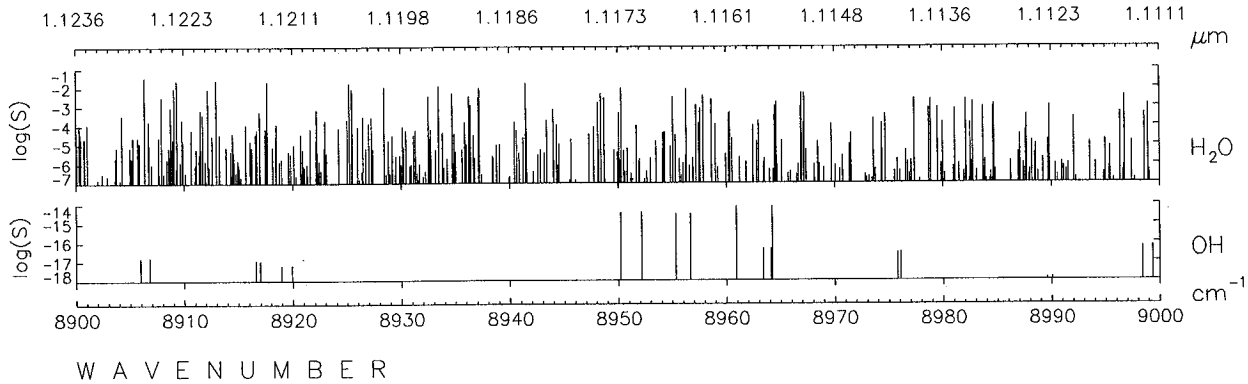


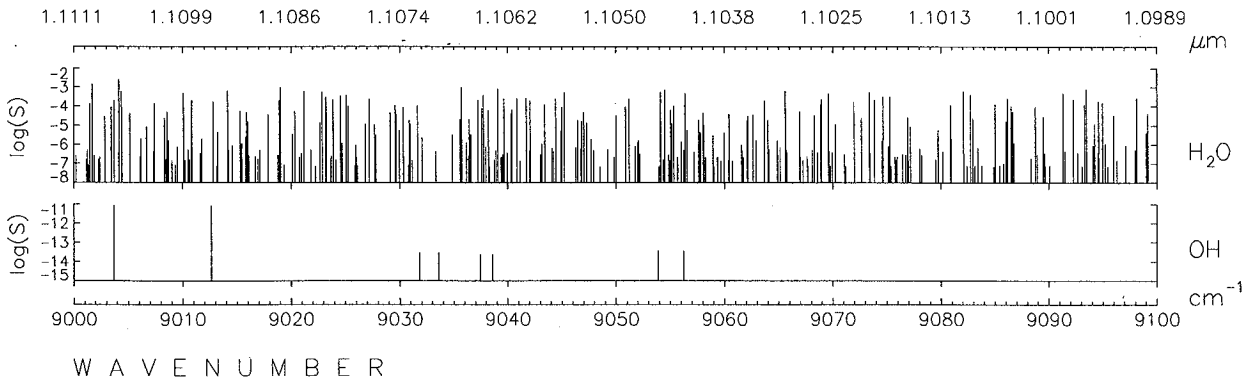

1.1628
1.1614
1.1601
1.1587
1.1574
1.1561
1.1547
1.1534
1.1521
1.1507
1.1494
μm
log(S)
H2O
OH
cm-1
8600
8610
8620
8630
8640
8650
8660
8670
8680
8690
8700
WAVENUMBER

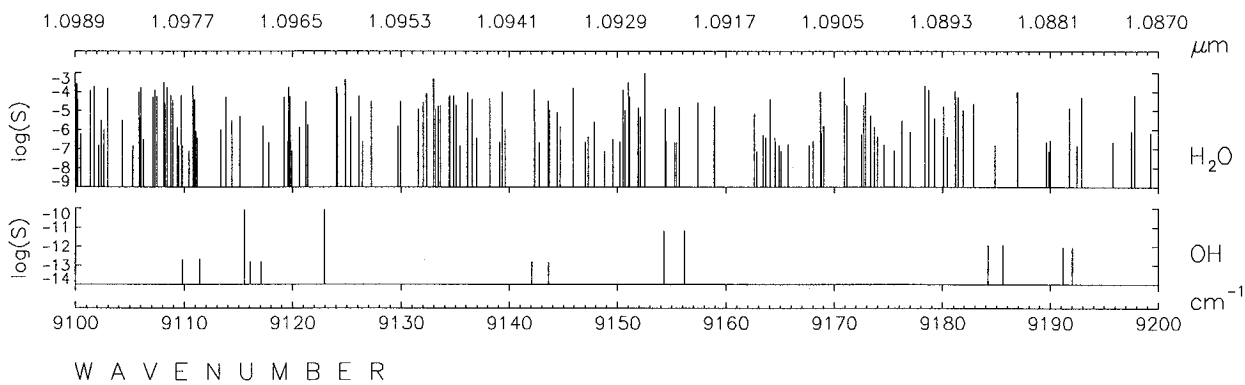

1.1494
1.1481
1.1468
1.1455
1.1442
1.1429
1.1416
1.1403
1.1390
1.1377
1.1364
μm
log(S)
H2O
OH
cm-1
8700
8710
8720
8730
8740
8750
8760
8770
8780
8790
8800
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

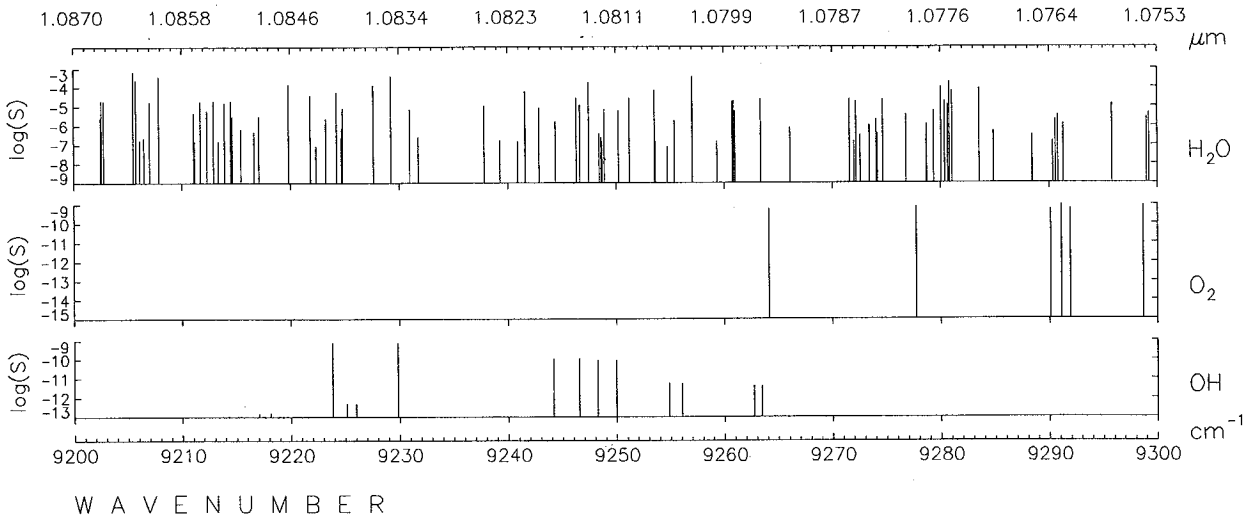


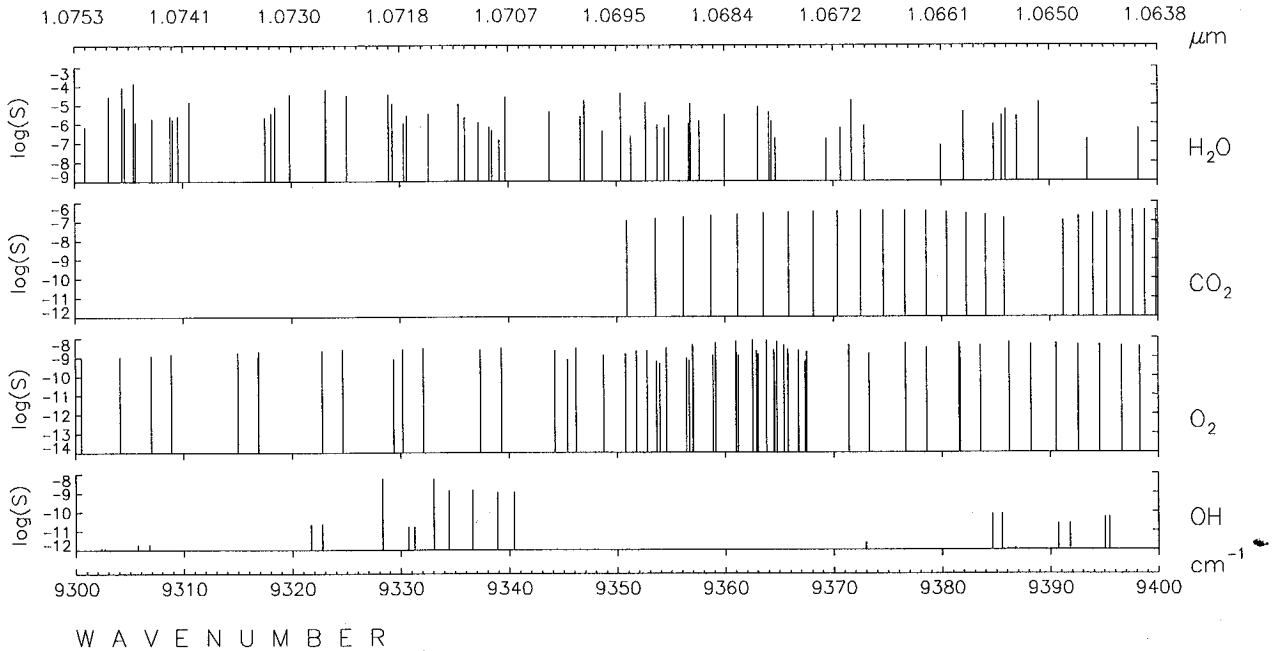


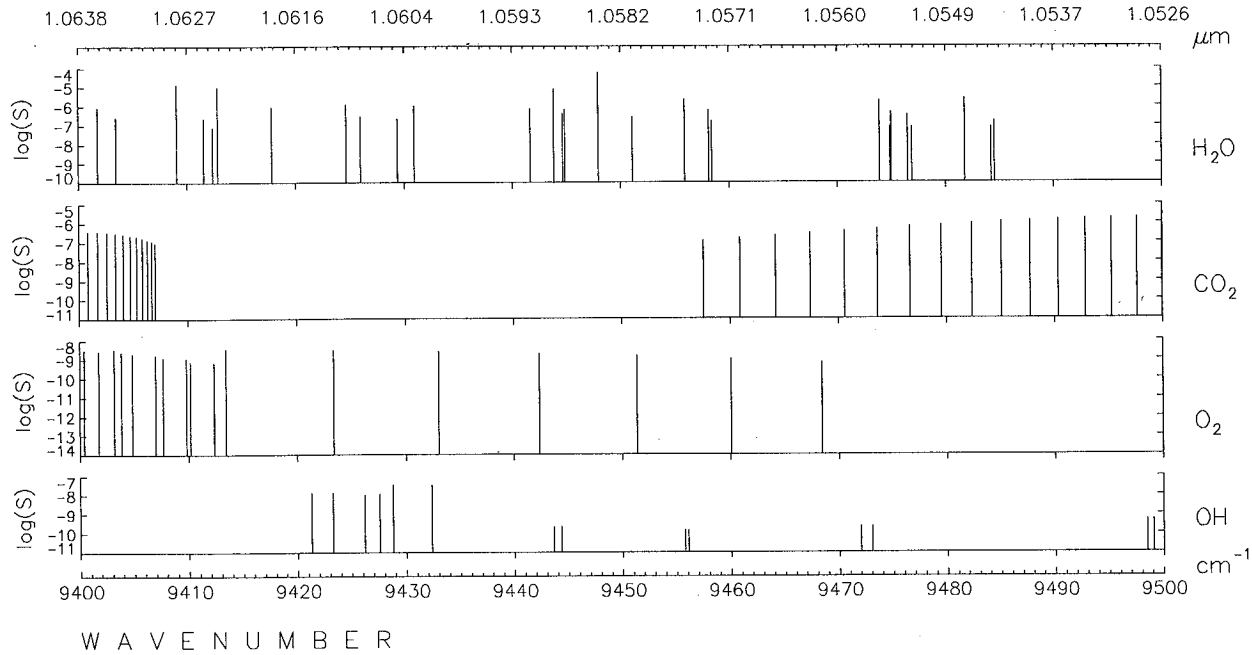

1.1111 1.1099 1.1086 1.1074 1.1062 1.1050 1.1038 1.1025 1.1013 1.1001 1.0989
μm
log(S)
H2O
OH
cm-1
9000 9010 9020 9030 9040 9050 9060 9070 9080 9090 9100
WAVENUMBER

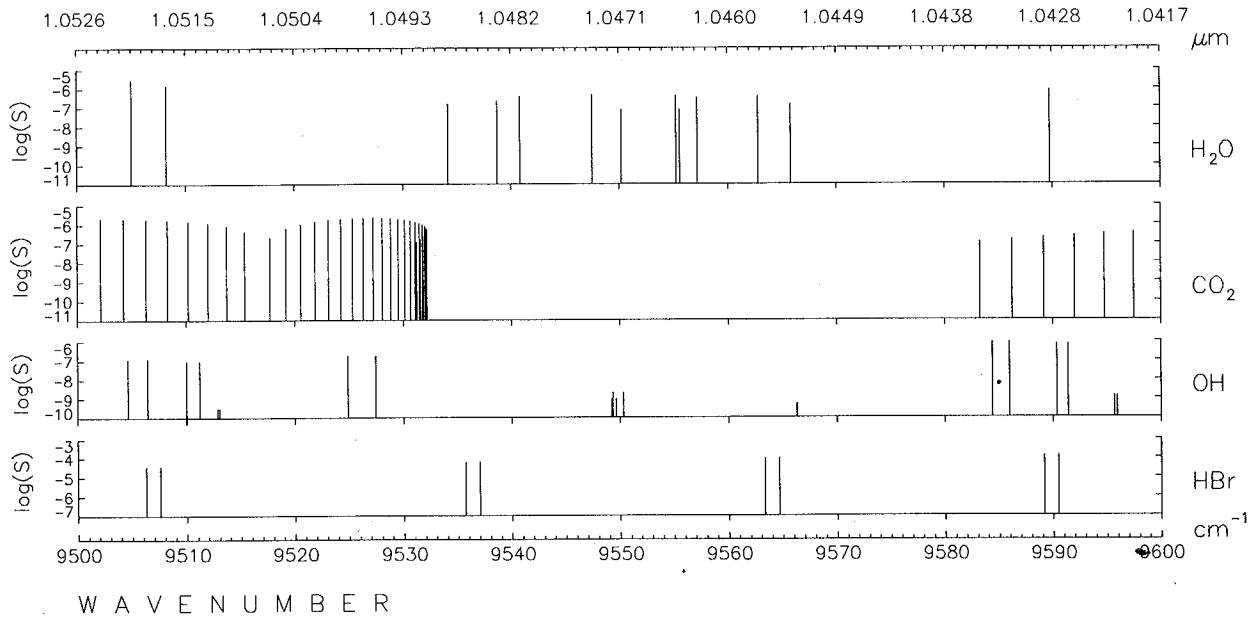

1.0989 1.0977 1.0965 1.0953 1.0941 1.0929 1.0917 1.0905 1.0893 1.0881 1.0870
μm
log(S)
H2O
OH
cm-1
9100 9110 9120 9130 9140 9150 9160 9170 9180 9190 9200
WAVENUMBER

ORIGINAL PAGE IS
OF POOR QUALITY

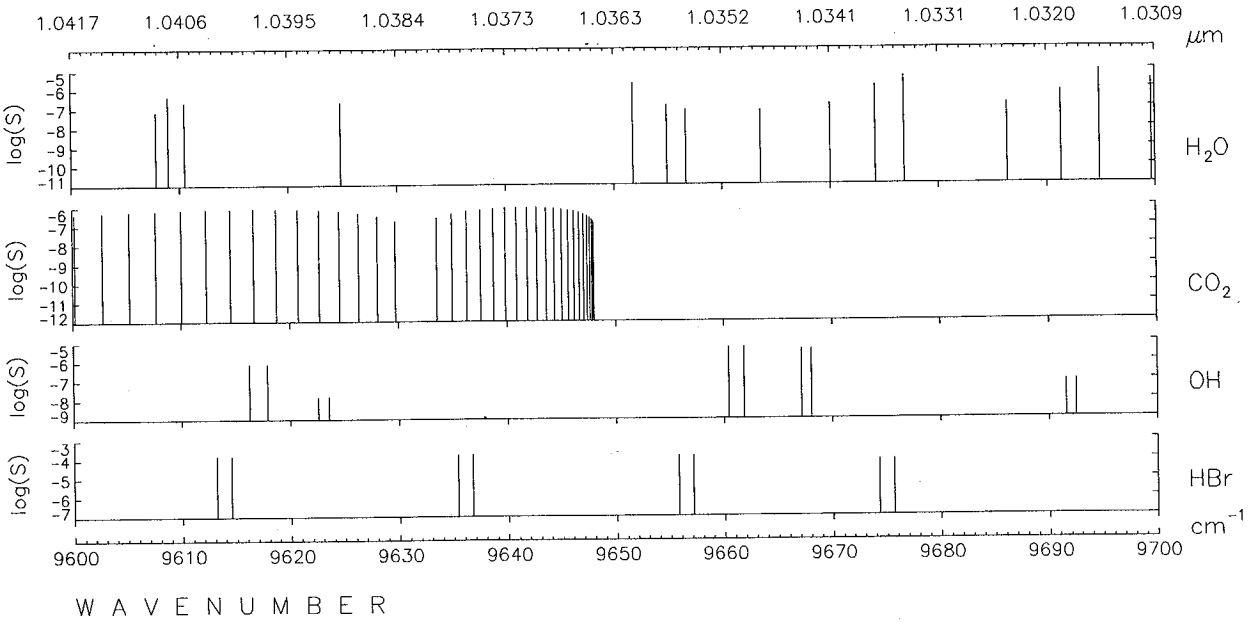


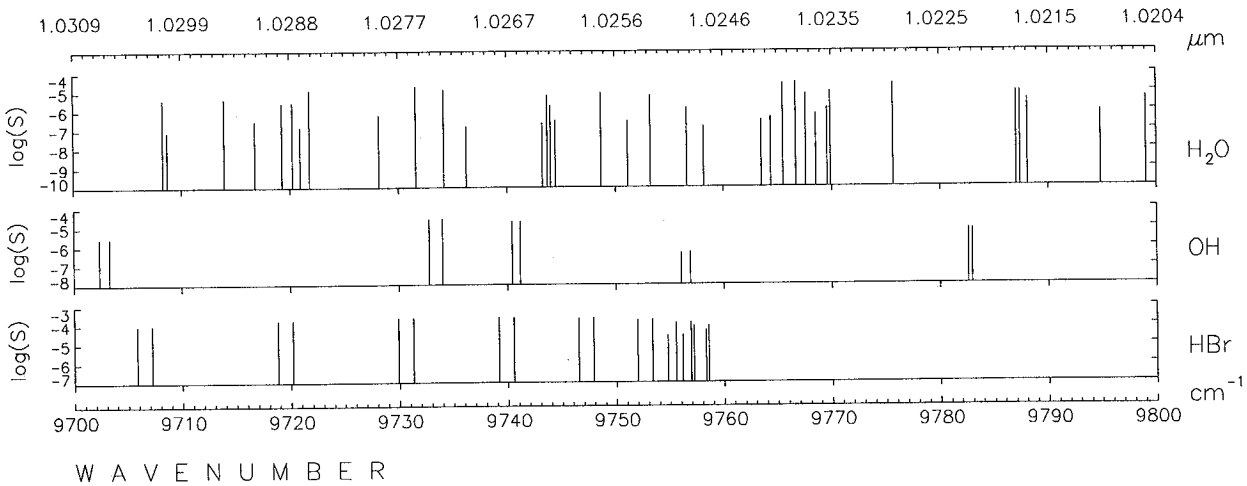


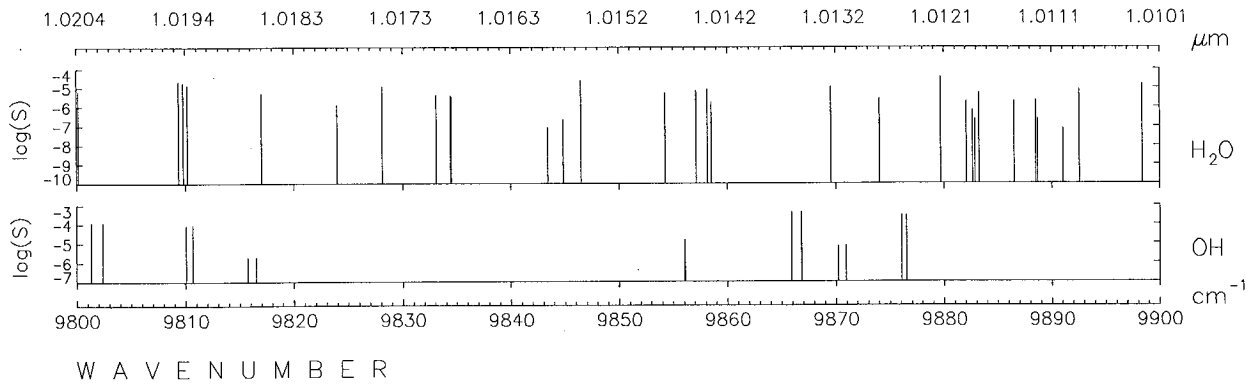

1.0638 1.0627 1.0616 1.0604 1.0593 1.0582 1.0571 1.0560 1.0549 1.0537 1.0526
μm
log(S)
H2O
CO2
O2
OH
cm-1
9400 9410 9420 9430 9440 9450 9460 9470 9480 9490 9500
WAVENUMBER

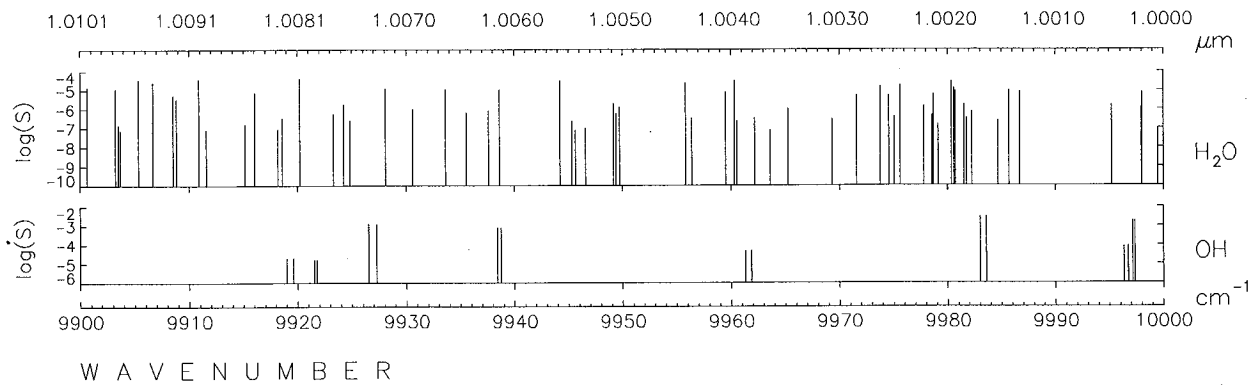

1.0526 1.0515 1.0504 1.0493 1.0482 1.0471 1.0460 1.0449 1.0438 1.0428 1.0417
μm
log(S)
H2O
CO2
OH
HBr
cm-1
9500 9510 9520 9530 9540 9550 9560 9570 9580 9590 9600
WAVENUMBER

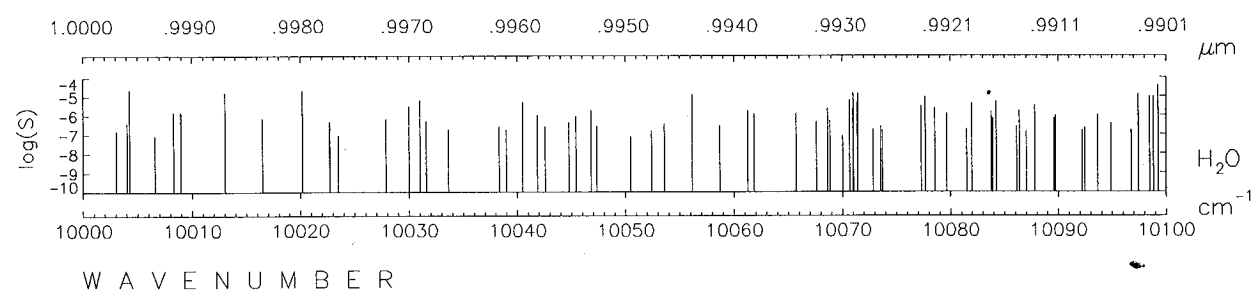
ORIGINAL PAGE IS
OF POOR QUALITY



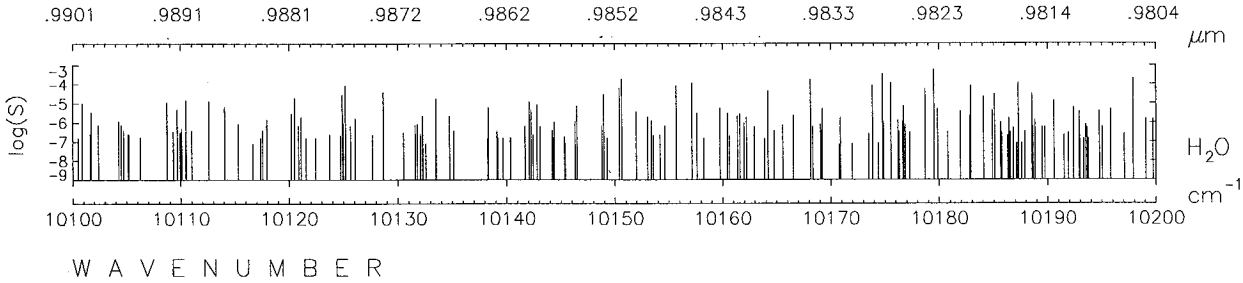


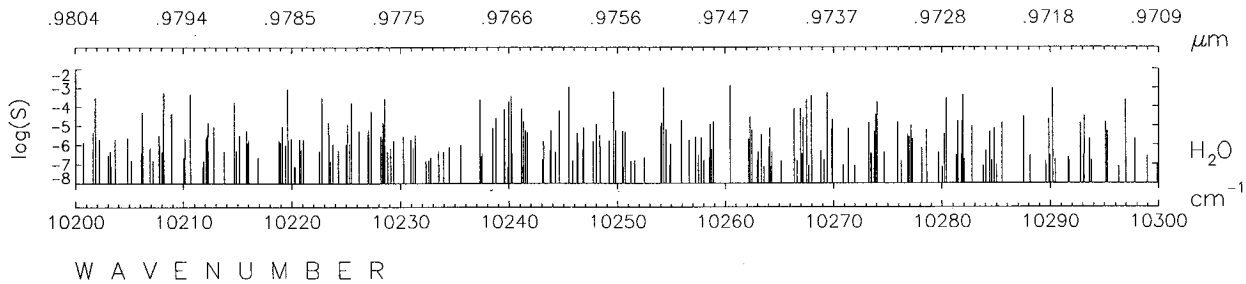

1.0204 1.0194 1.0183 1.0173 1.0163 1.0152 1.0142 1.0132 1.0121 1.0111 1.0101
μm
log(S)
H2O
OH
cm-1
9800 9810 9820 9830 9840 9850 9860 9870 9880 9890 9900
WAVENUMBER

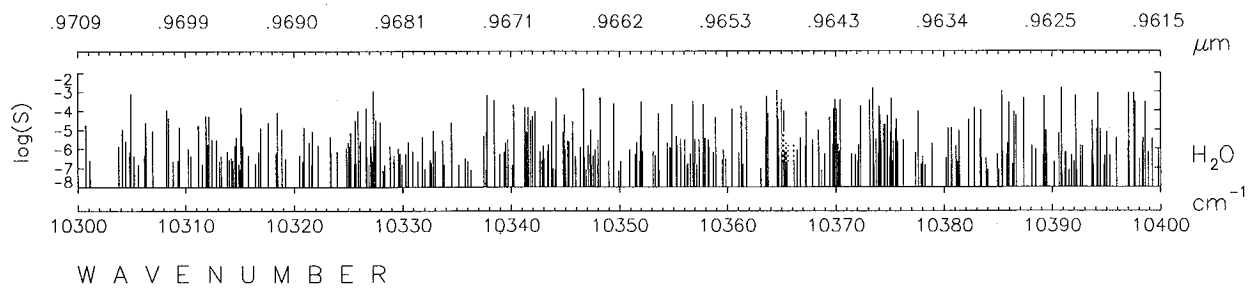

1.0101 1.0091 1.0081 1.0070 1.0060 1.0050 1.0040 1.0030 1.0020 1.0010 1.0000
μm
log(S)
H2O
OH
cm-1
9900 9910 9920 9930 9940 9950 9960 9970 9980 9990 10000
WAVENUMBER

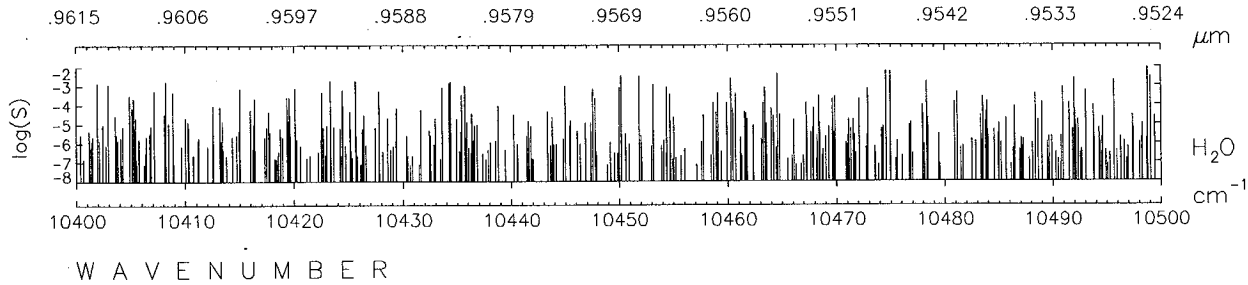

1.0000 .9990 .9980 .9970 .9960 .9950 .9940 .9930 .9921 .9911 .9901
μm
log(S)
H2O
cm-1
10000 10010 10020 10030 10040 10050 10060 10070 10080 10090 10100
WAVENUMBER

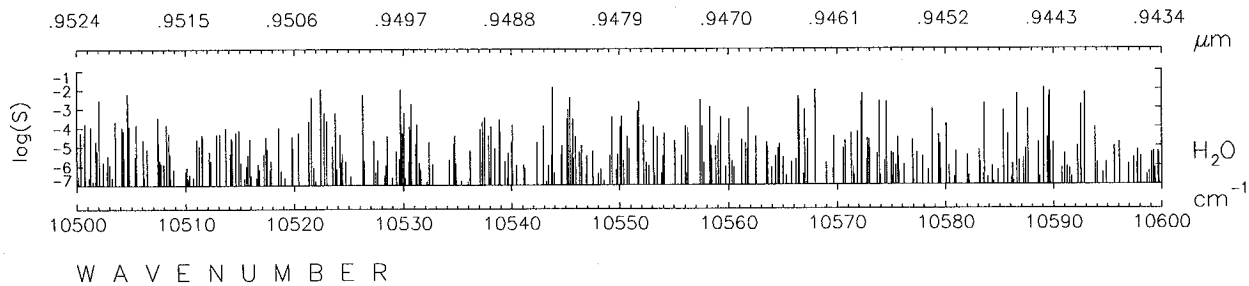
ORIGINAL PAGE IS
OF POOR QUALITY

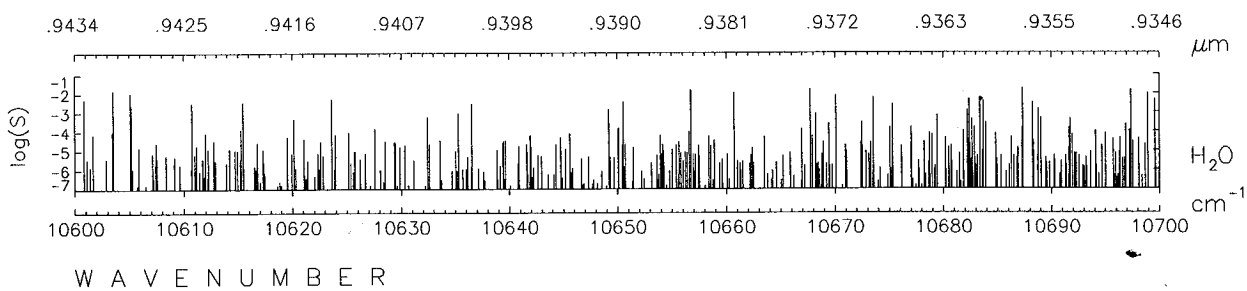




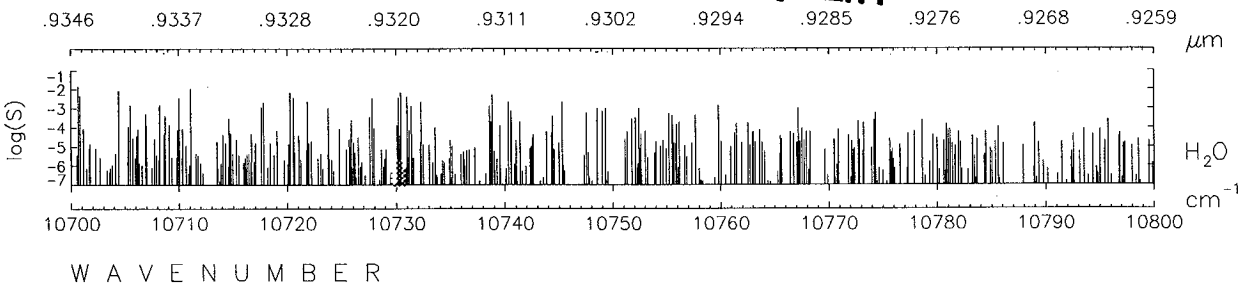


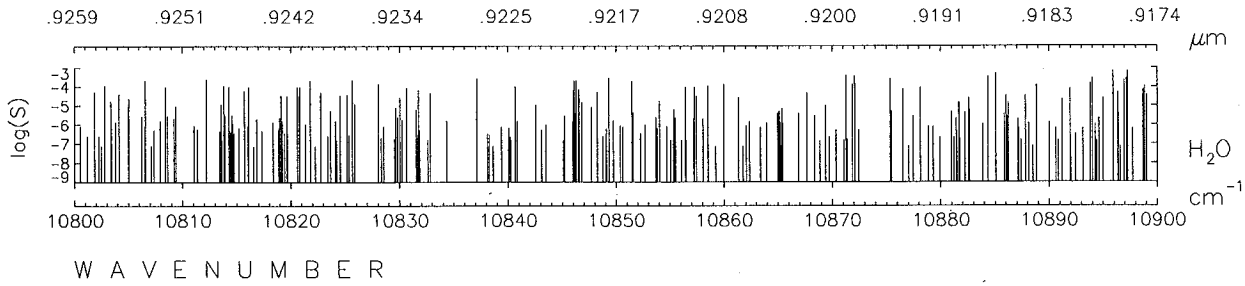

.9615 .9606 .9597 .9588 .9579 .9569 .9560 .9551 .9542 .9533 .9524
μm
log(S)
-2 -3 -4 -5 -6 -7 -8
H2O
cm-1
10400 10410 10420 10430 10440 10450 10460 10470 10480 10490 10500
WAVENUMBER

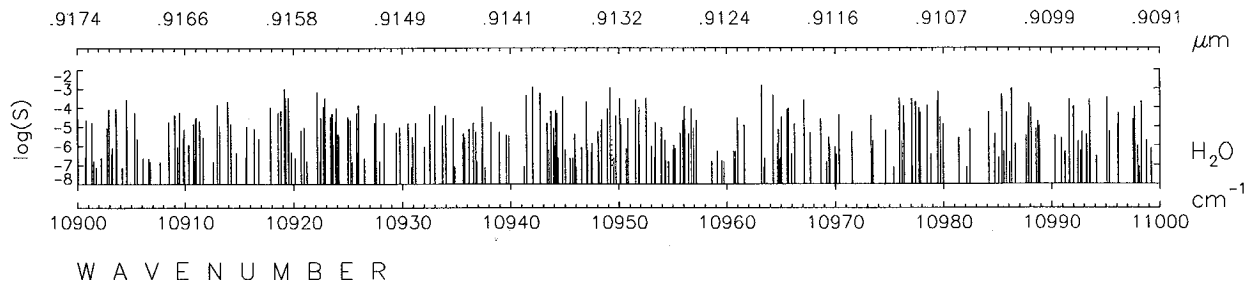

.9524 .9515 .9506 .9497 .9488 .9479 .9470 .9461 .9452 .9443 .9434
μm
log(S)
-1 -2 -3 -4 -5 -6 -7
H2O
cm-1
10500 10510 10520 10530 10540 10550 10560 10570 10580 10590 10600
WAVENUMBER

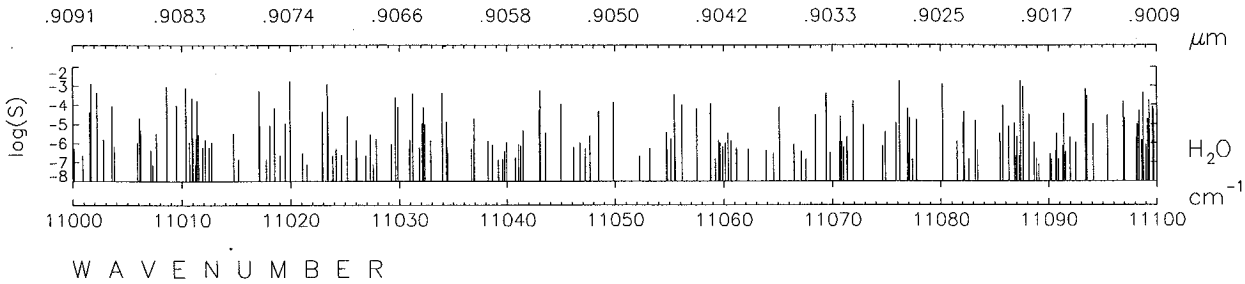

.9434 .9425 .9416 .9407 .9398 .9390 .9381 .9372 .9363 .9355 .9346
μm
log(S)
-1 -2 -3 -4 -5 -6 -7
H2O
cm-1
10600 10610 10620 10630 10640 10650 10660 10670 10680 10690 10700
WAVENUMBER

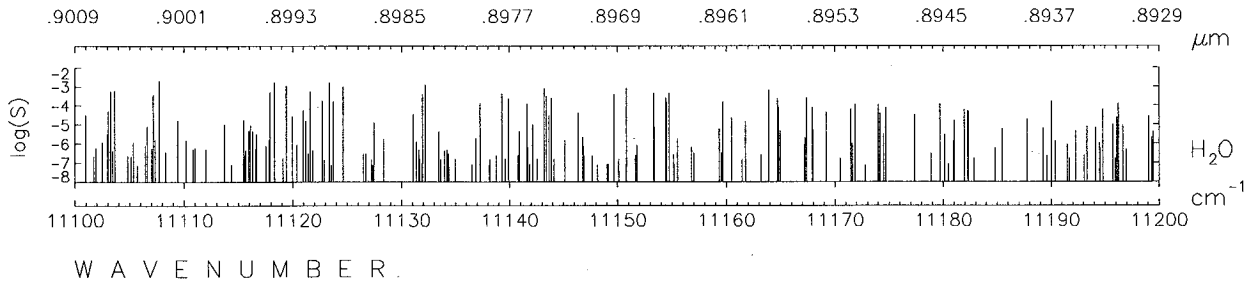
ORIGINAL PAGE IS
OF POOR QUALITY

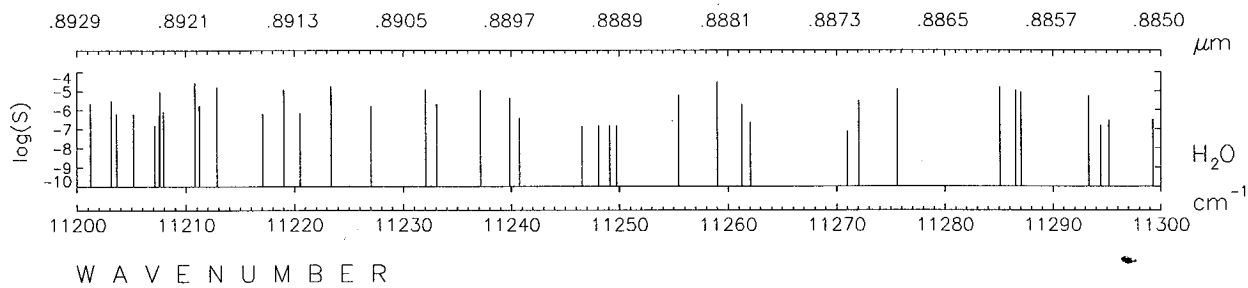




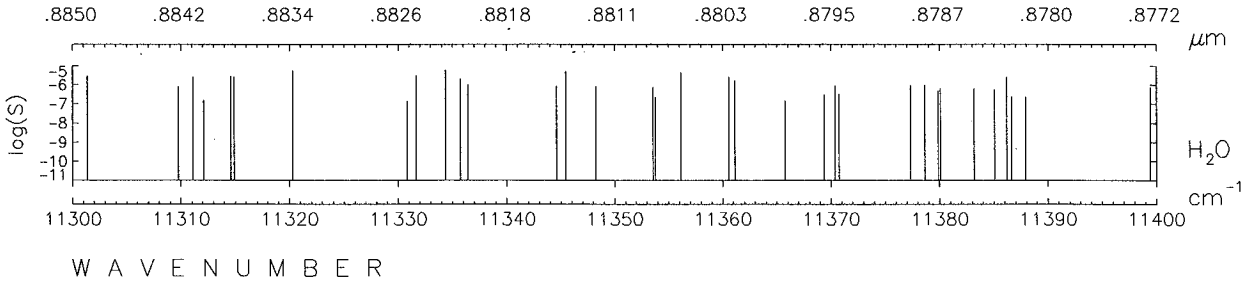


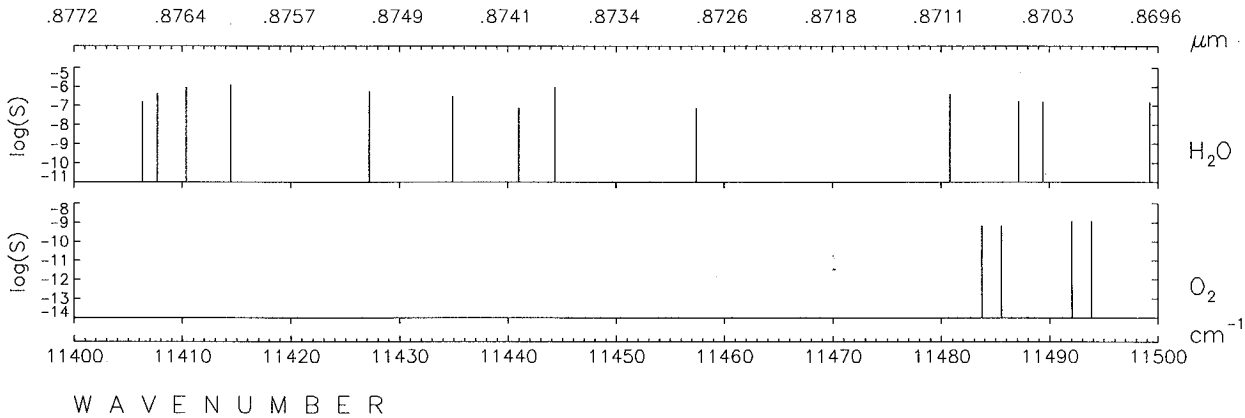

.9091 .9083 .9074 .9066 .9058 .9050 .9042 .9033 .9025 .9017 .9009
μm
log(S)
-2 -3 -4 -5 -6 -7 -8
H2O
cm-1
11000 11010 11020 11030 11040 11050 11060 11070 11080 11090 11100
WAVENUMBER

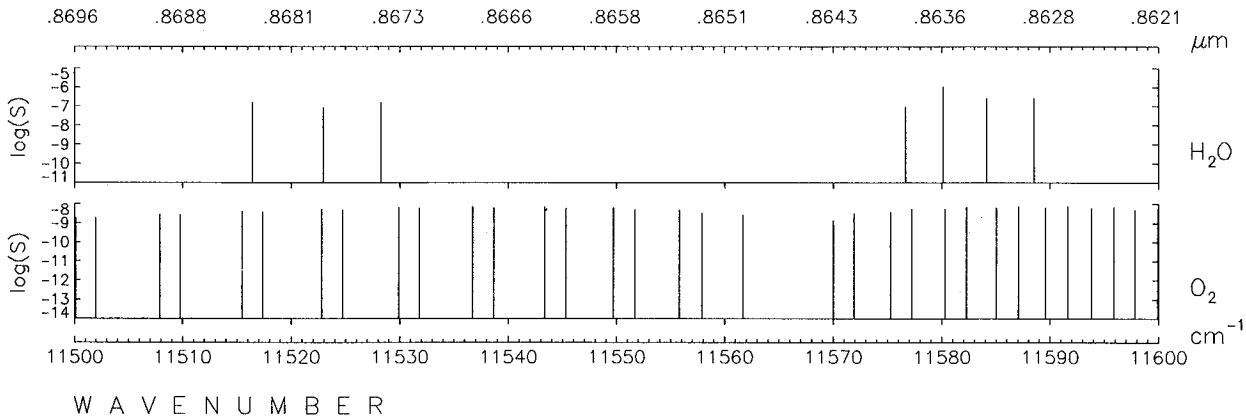

.9009 .9001 .8993 .8985 .8977 .8969 .8961 .8953 .8945 .8937 .8929
μm
log(S)
-2 -3 -4 -5 -6 -7 -8
H2O
cm-1
11100 11110 11120 11130 11140 11150 11160 11170 11180 11190 11200
WAVENUMBER

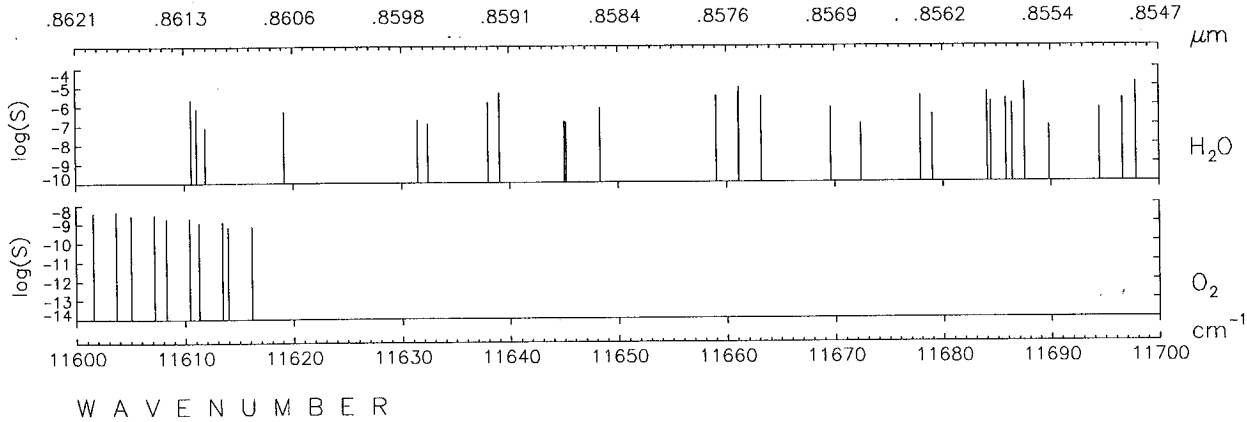

.8929 .8921 .8913 .8905 .8897 .8889 .8881 .8873 .8865 .8857 .8850
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
11200 11210 11220 11230 11240 11250 11260 11270 11280 11290 11300
WAVENUMBER

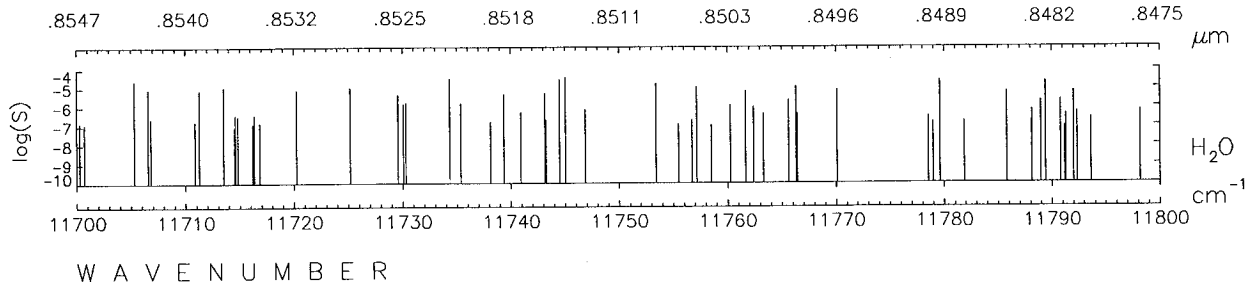
ORIGINAL PAGE IS
OF POOR QUALITY

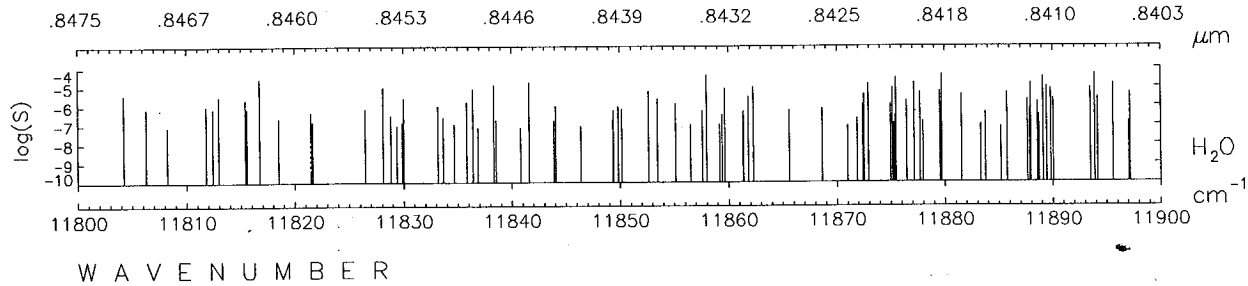




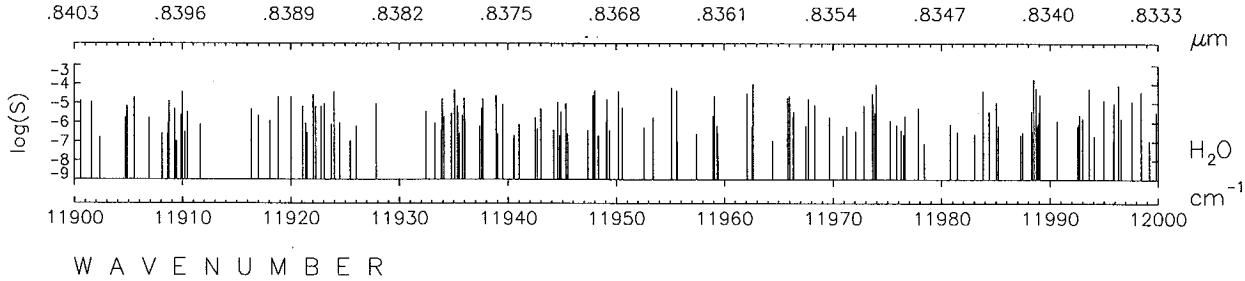


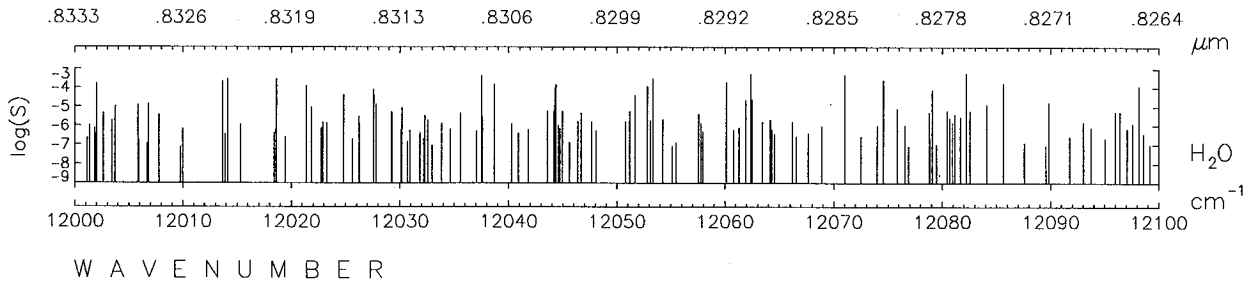

.8621 .8613 .8606 .8598 .8591 .8584 .8576 .8569 .8562 .8554 .8547
μm
log(S)
H2O
log(S)
O2
cm-1
11600 11610 11620 11630 11640 11650 11660 11670 11680 11690 11700
WAVENUMBER

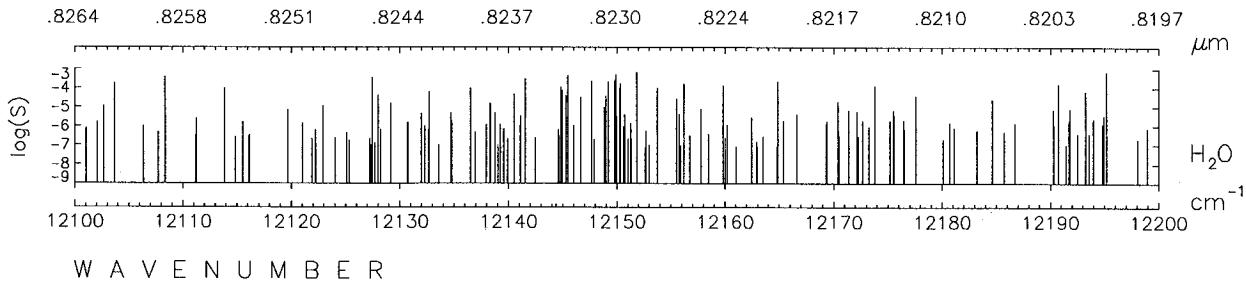

.8547 .8540 .8532 .8525 .8518 .8511 .8503 .8496 .8489 .8482 .8475
μm
log(S)
H2O
cm-1
11700 11710 11720 11730 11740 11750 11760 11770 11780 11790 11800
WAVENUMBER

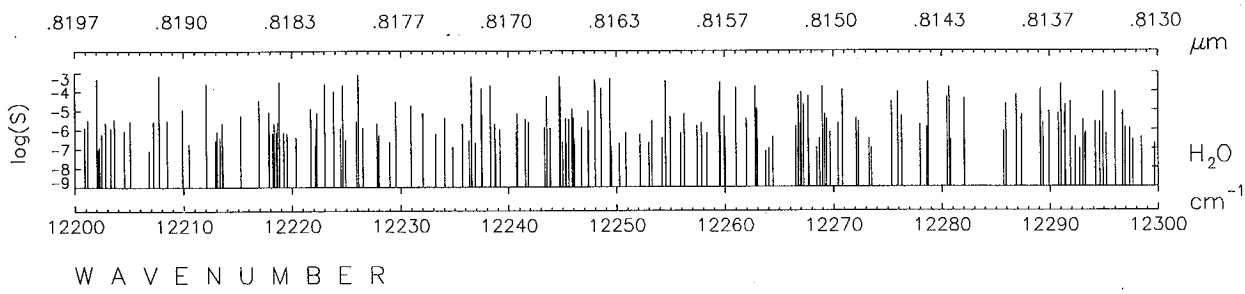

.8475 .8467 .8460 .8453 .8446 .8439 .8432 .8425 .8418 .8410 .8403
μm
log(S)
H2O
cm-1
11800 11810 11820 11830 11840 11850 11860 11870 11880 11890 11900
WAVENUMBER

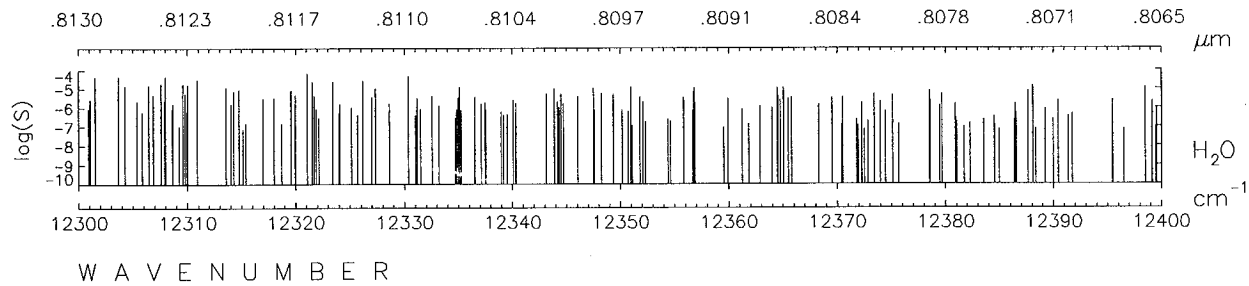
ORIGINAL PAGE IS
OF POOR QUALITY

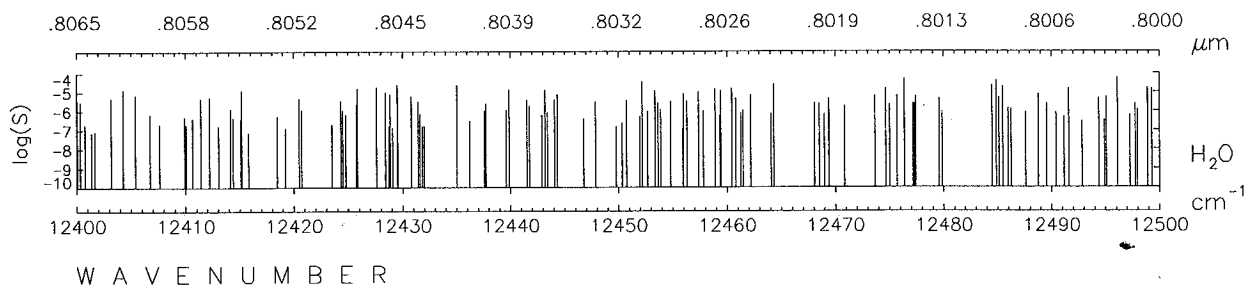




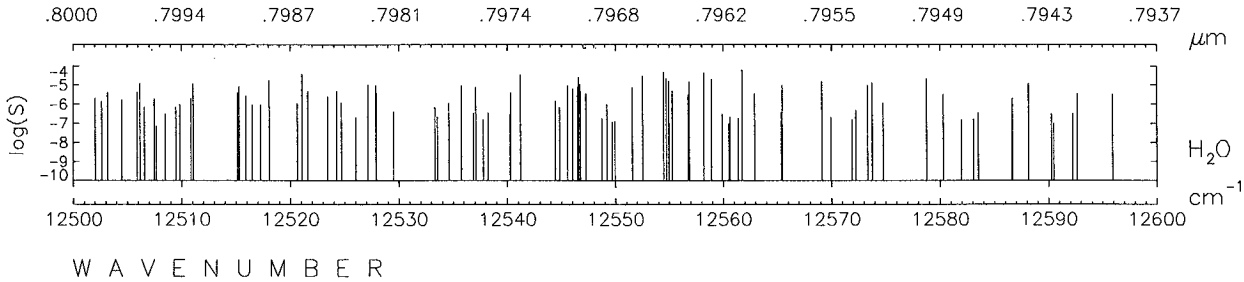


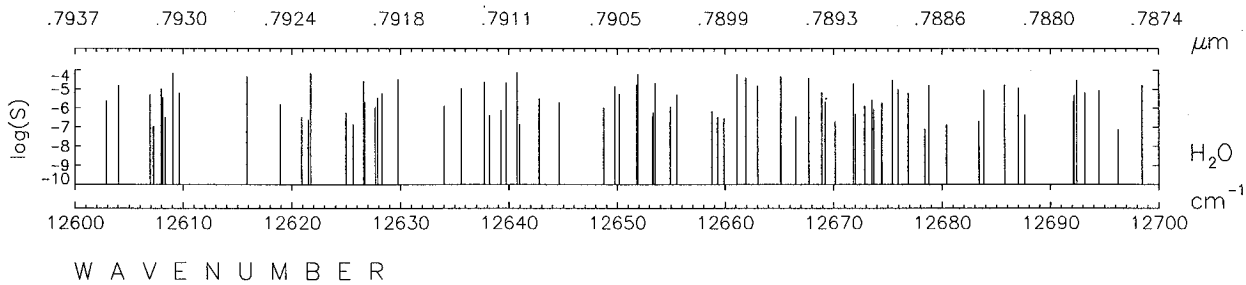

.8197 .8190 .8183 .8177 .8170 .8163 .8157 .8150 .8143 .8137 .8130
μm
log(S)
-3 -4 -5 -6 -7 -8 -9
H2O
cm-1
12200 12210 12220 12230 12240 12250 12260 12270 12280 12290 12300
WAVENUMBER

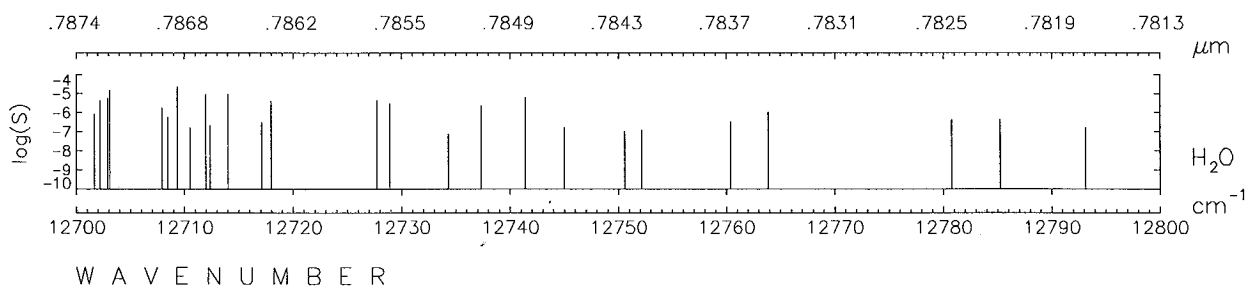

.8130 .8123 .8117 .8110 .8104 .8097 .8091 .8084 .8078 .8071 .8065
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
12300 12310 12320 12330 12340 12350 12360 12370 12380 12390 12400
WAVENUMBER

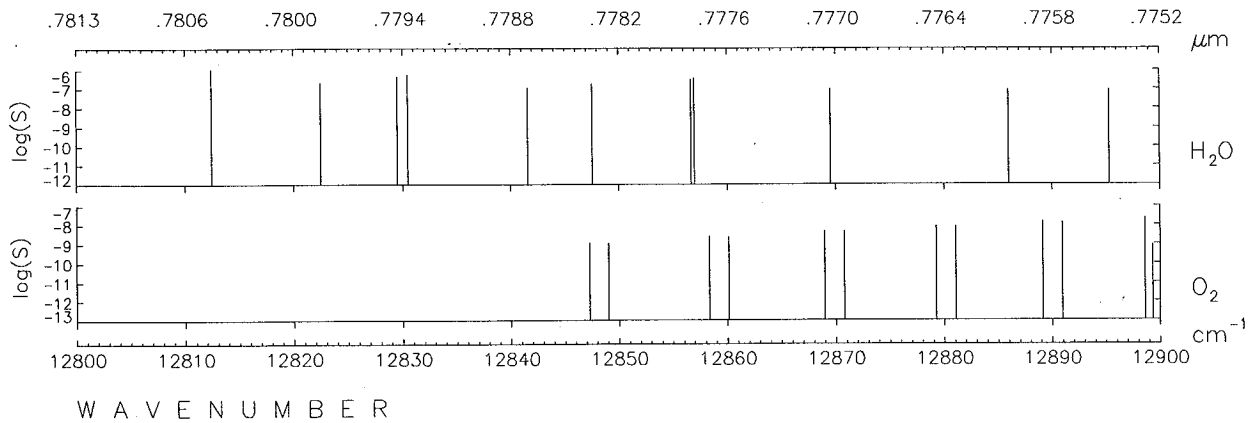

.8065 .8058 .8052 .8045 .8039 .8032 .8026 .8019 .8013 .8006 .8000
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
12400 12410 12420 12430 12440 12450 12460 12470 12480 12490 12500
WAVENUMBER

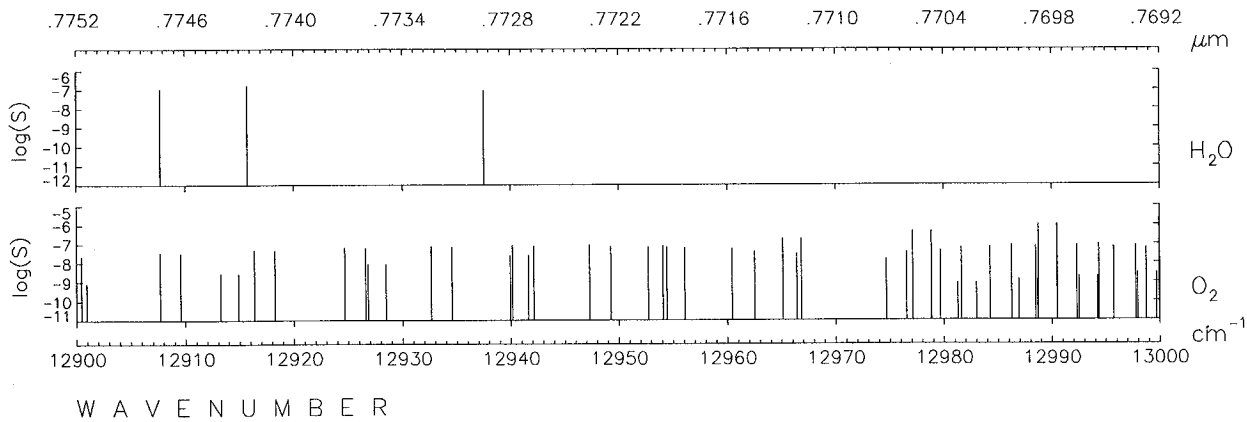
ORIGINAL PAGE IS
OF POOR QUALITY

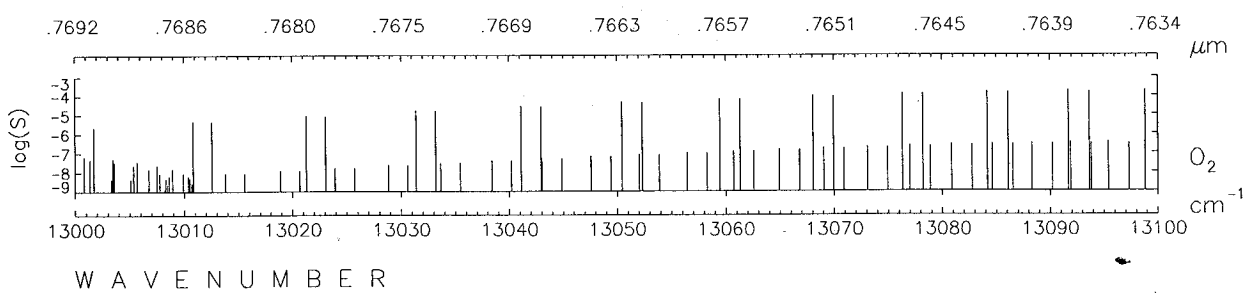




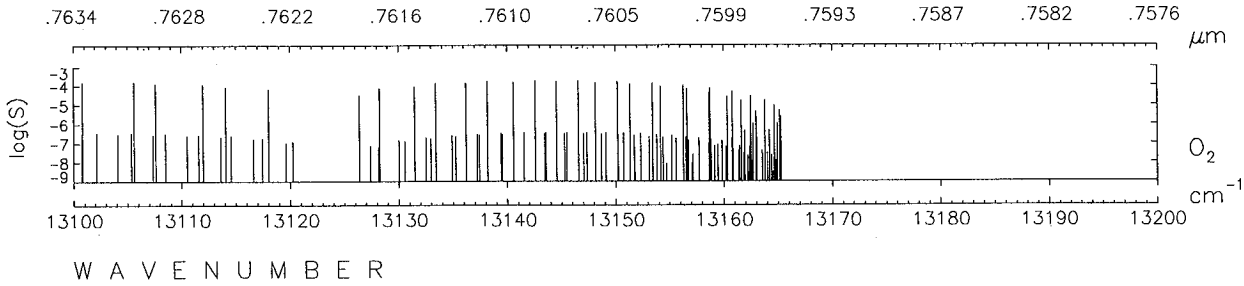


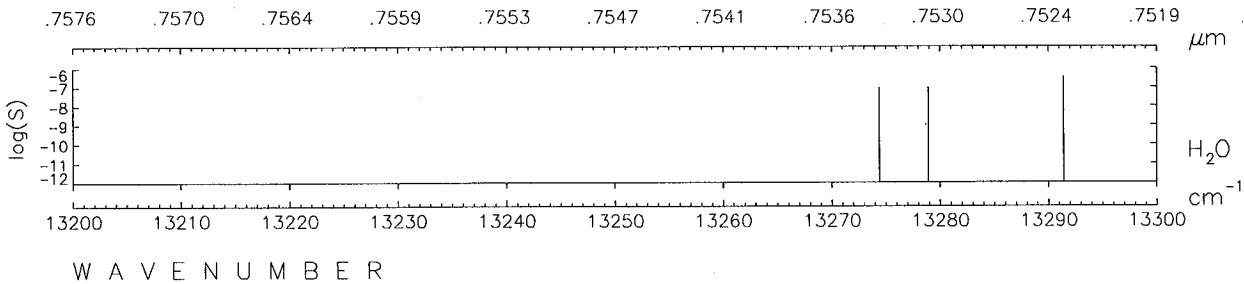

.7813 .7806 .7800 .7794 .7788 .7782 .7776 .7770 .7764 .7758 .7752
μm
log(S)
H2O
O2
cm-1
12800 12810 12820 12830 12840 12850 12860 12870 12880 12890 12900
WAVENUMBER

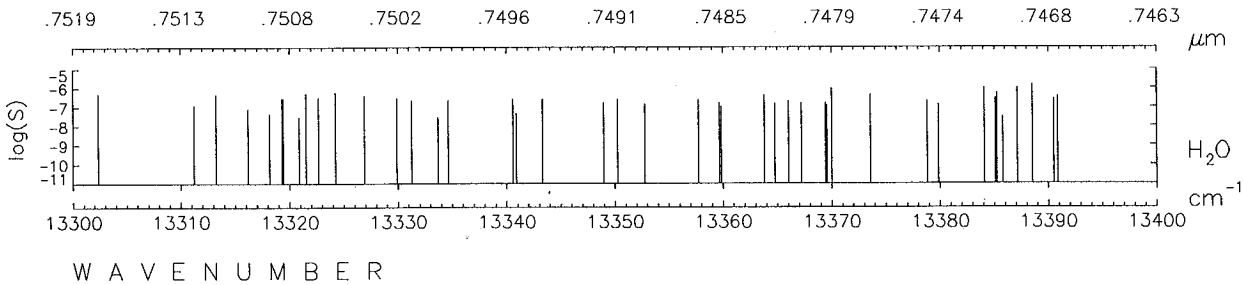

.7752 .7746 .7740 .7734 .7728 .7722 .7716 .7710 .7704 .7698 .7692
μm
log(S)
H2O
O2
cm-1
12900 12910 12920 12930 12940 12950 12960 12970 12980 12990 13000
WAVENUMBER

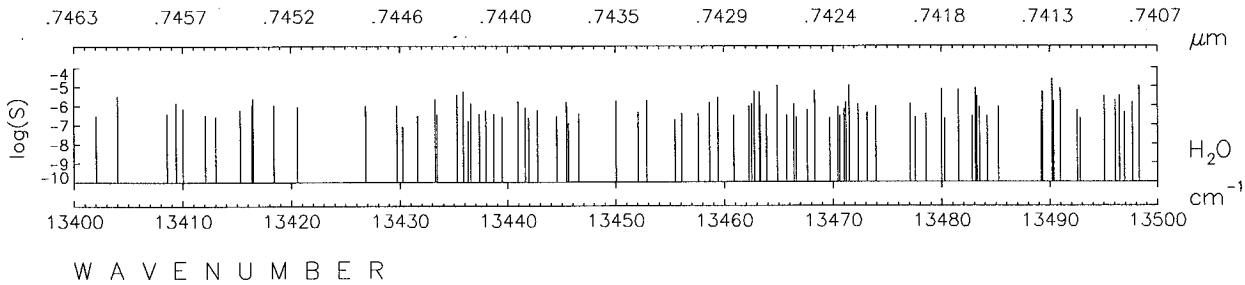

.7692 .7686 .7680 .7675 .7669 .7663 .7657 .7651 .7645 .7639 .7634
μm
log(S)
O2
cm-1
13000 13010 13020 13030 13040 13050 13060 13070 13080 13090 13100
WAVENUMBER

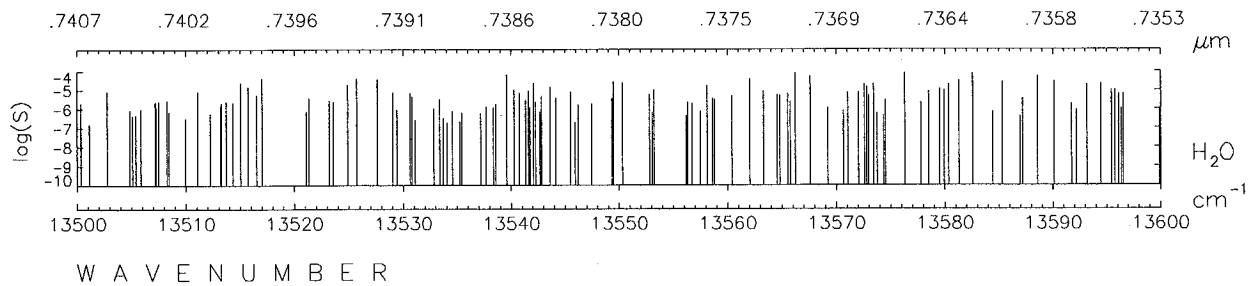
ORIGINAL PAGE IS
OF POOR QUALITY

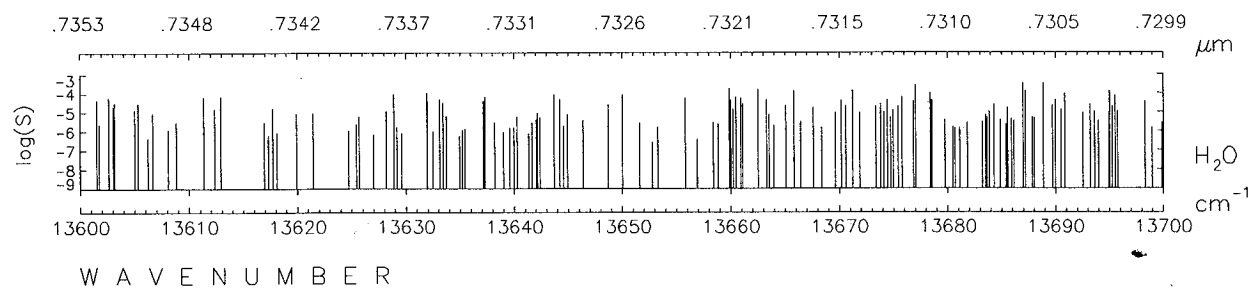




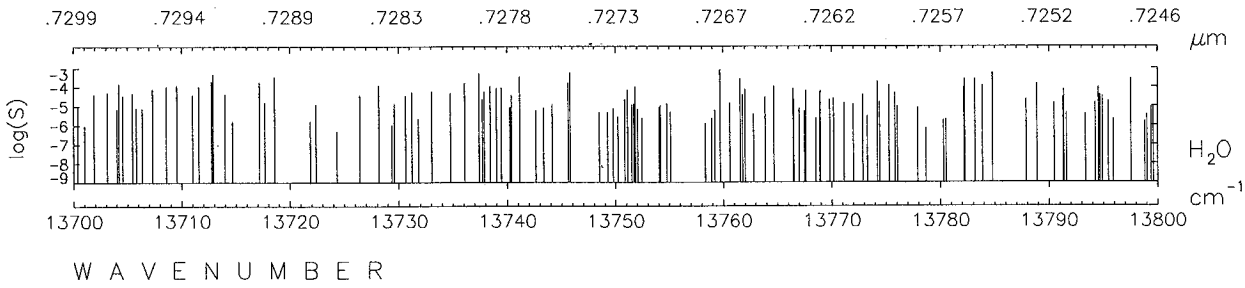


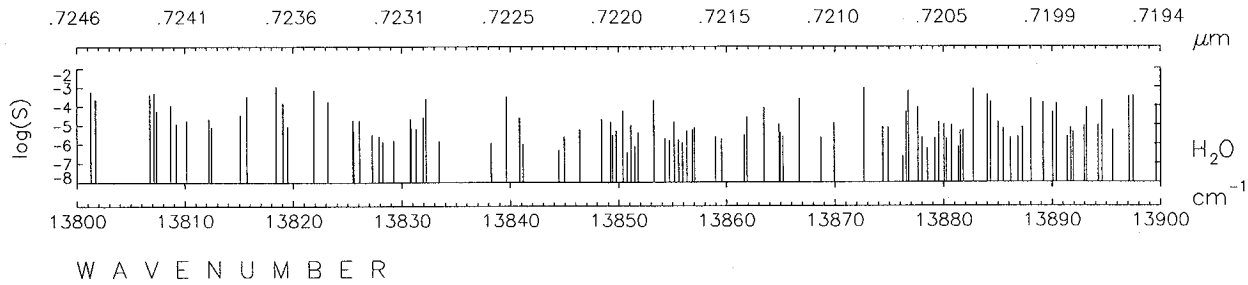

.7463 .7457 .7452 .7446 .7440 .7435 .7429 .7424 .7418 .7413 .7407
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
13400 13410 13420 13430 13440 13450 13460 13470 13480 13490 13500
WAVENUMBER

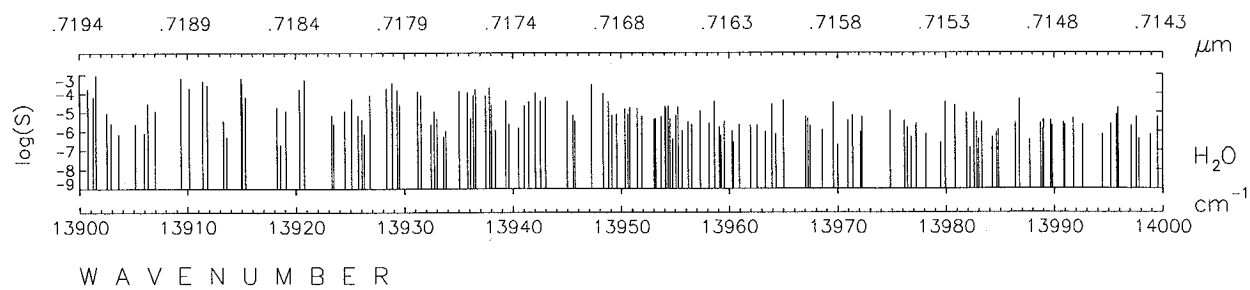

.7407 .7402 .7396 .7391 .7386 .7380 .7375 .7369 .7364 .7358 .7353
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
13500 13510 13520 13530 13540 13550 13560 13570 13580 13590 13600
WAVENUMBER

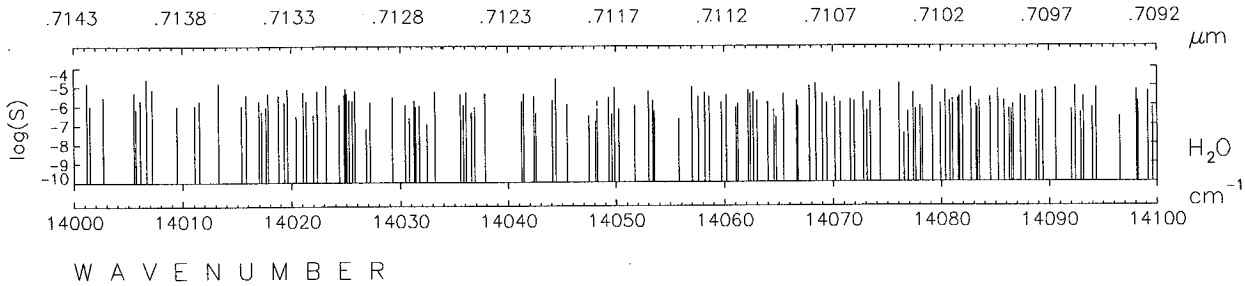

.7353 .7348 .7342 .7337 .7331 .7326 .7321 .7315 .7310 .7305 .7299
μm
log(S)
-3 -4 -5 -6 -7 -8 -9
H2O
cm-1
13600 13610 13620 13630 13640 13650 13660 13670 13680 13690 13700
WAVENUMBER

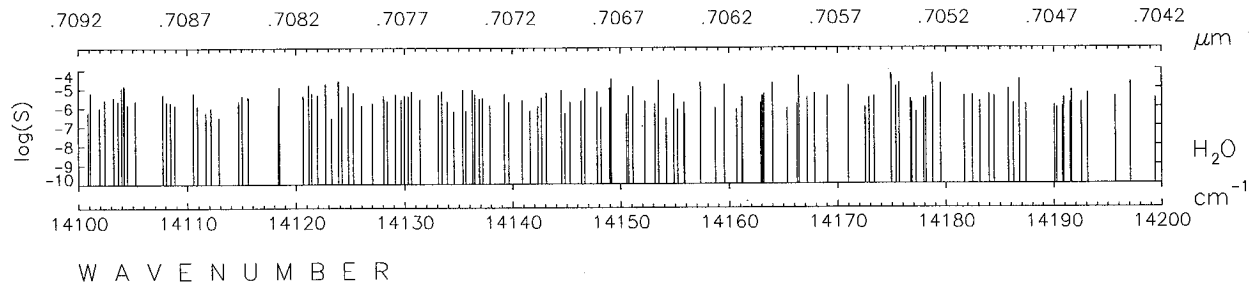
ORIGINAL PAGE IS
OF POOR QUALITY

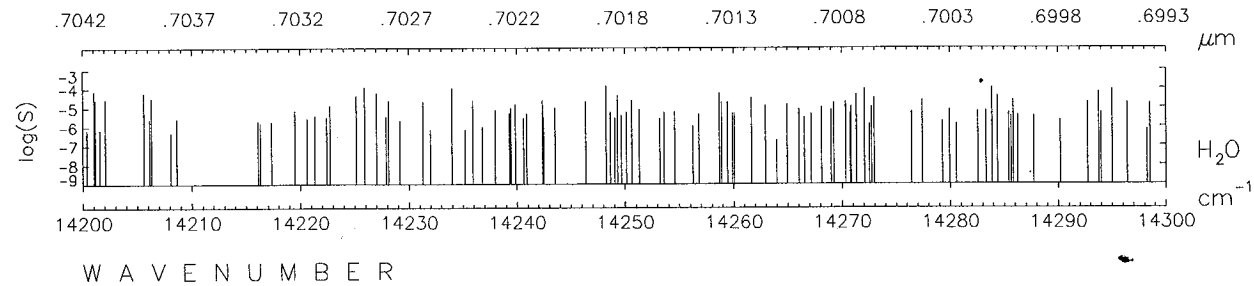




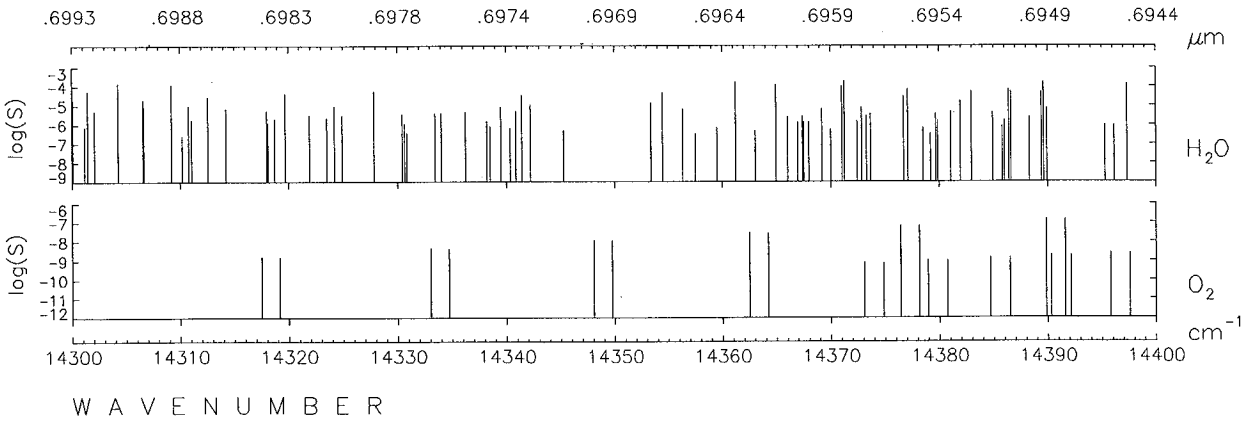


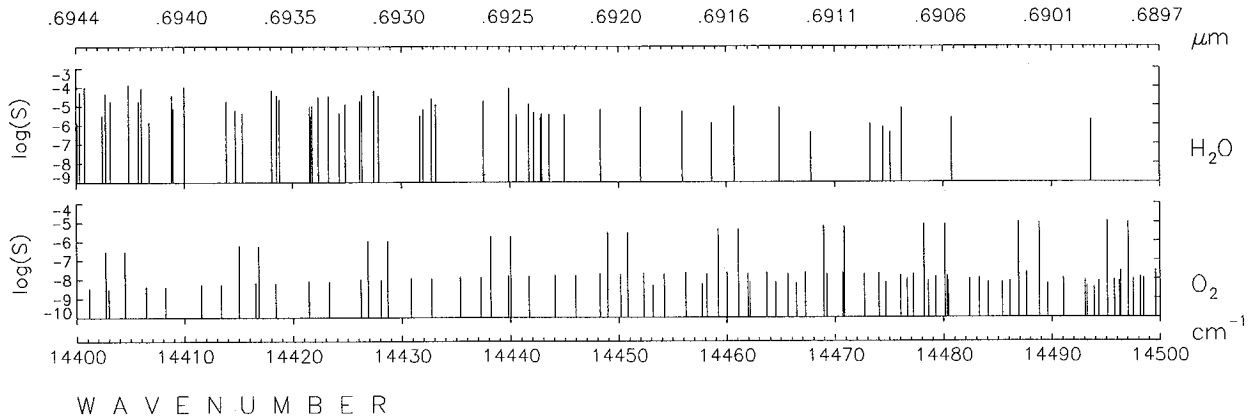

.7143 .7138 .7133 .7128 .7123 .7117 .7112 .7107 .7102 .7097 .7092
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
14000 14010 14020 14030 14040 14050 14060 14070 14080 14090 14100
WAVENUMBER

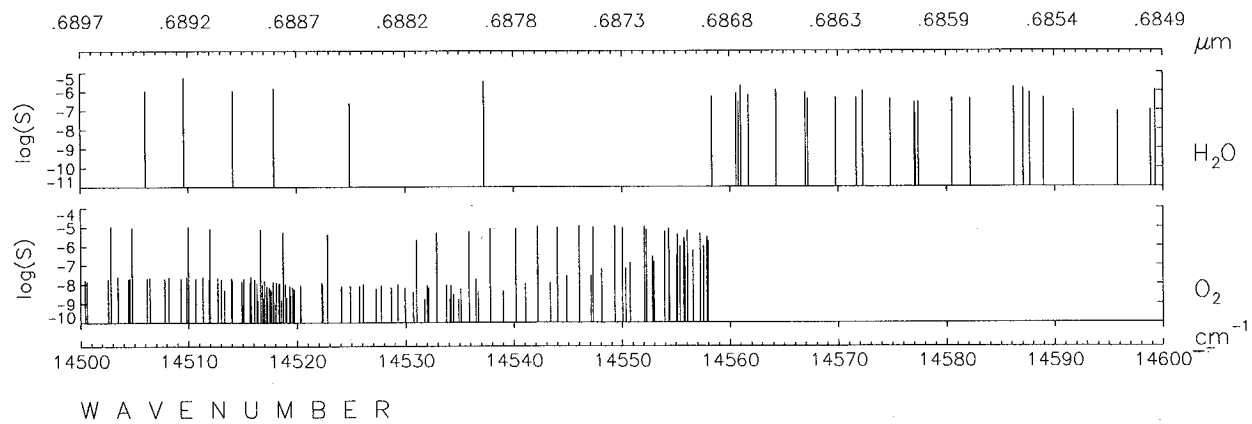

.7092 .7087 .7082 .7077 .7072 .7067 .7062 .7057 .7052 .7047 .7042
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
14100 14110 14120 14130 14140 14150 14160 14170 14180 14190 14200
WAVENUMBER

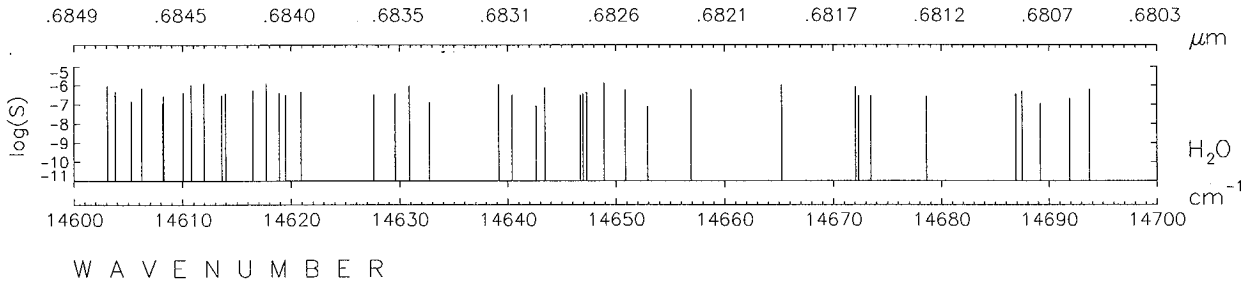

.7042 .7037 .7032 .7027 .7022 .7018 .7013 .7008 .7003 .6998 .6993
μm
log(S)
-3 -4 -5 -6 -7 -8 -9
H2O
cm-1
14200 14210 14220 14230 14240 14250 14260 14270 14280 14290 14300
WAVENUMBER

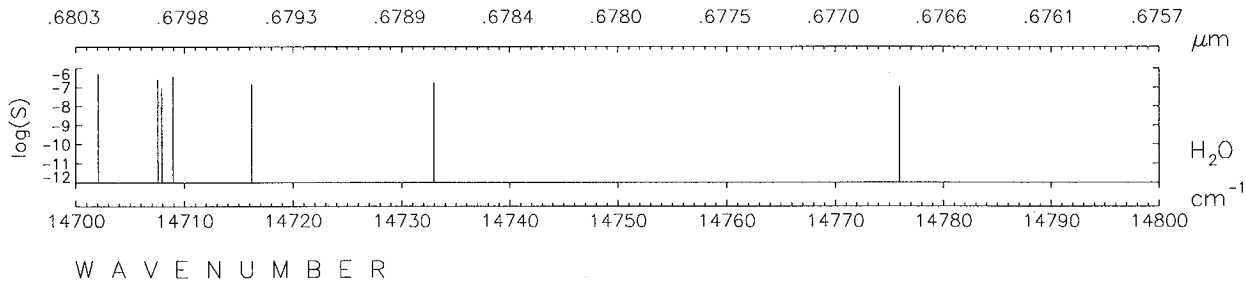
ORIGINAL PAGE IS
OF POOR QUALITY

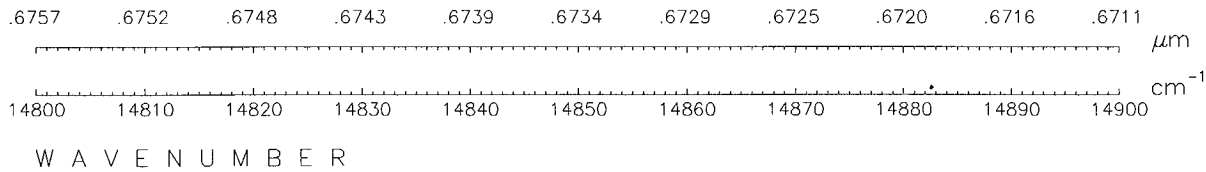




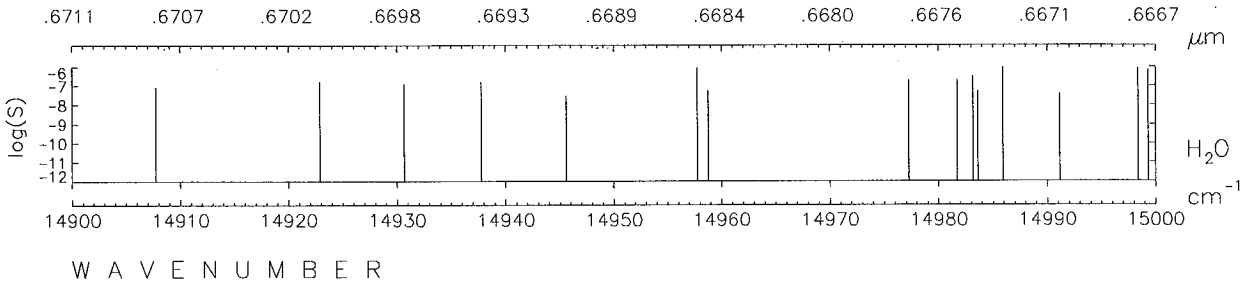


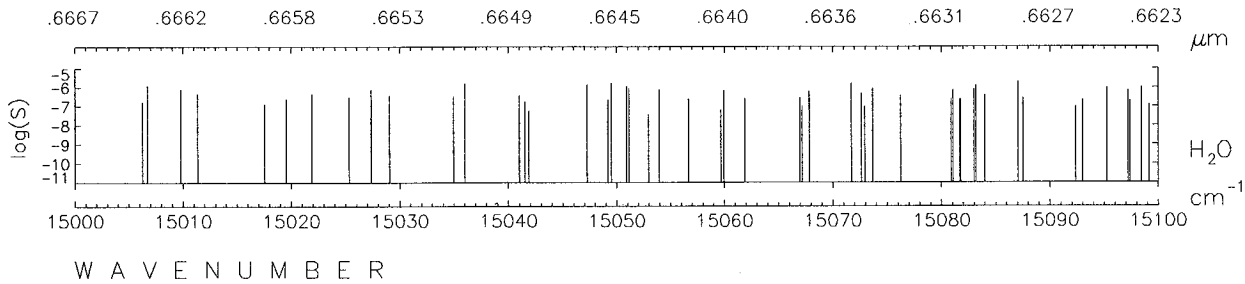

.6849 .6845 .6840 .6835 .6831 .6826 .6821 .6817 .6812 .6807 .6803
μm
log(S)
-5 -6 -7 -8 -9 -10 -11
H2O
cm-1
14600 14610 14620 14630 14640 14650 14660 14670 14680 14690 14700
WAVENUMBER

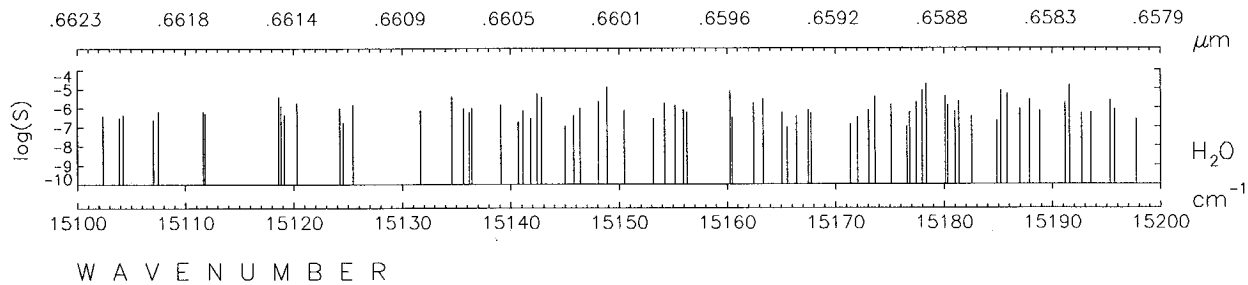

.6803 .6798 .6793 .6789 .6784 .6780 .6775 .6770 .6766 .6761 .6757
μm
log(S)
-6 -7 -8 -9 -10 -11 -12
H2O
cm-1
14700 14710 14720 14730 14740 14750 14760 14770 14780 14790 14800
WAVENUMBER

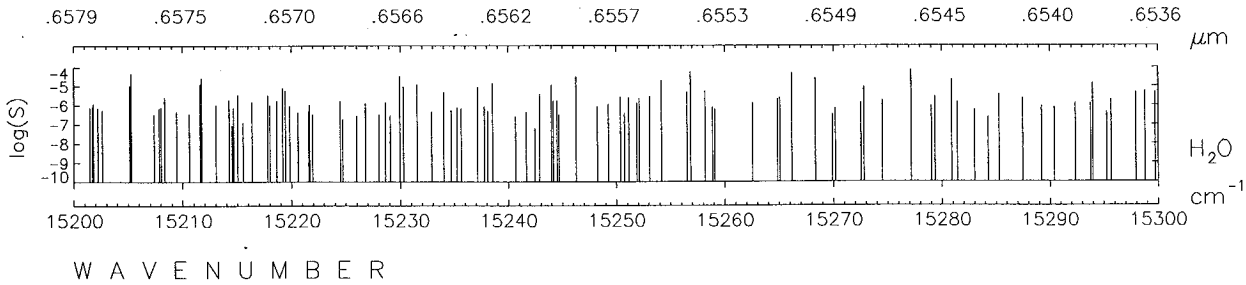

.6757 .6752 .6748 .6743 .6739 .6734 .6729 .6725 .6720 .6716 .6711
μm
cm-1
14800 14810 14820 14830 14840 14850 14860 14870 14880 14890 14900
WAVENUMBER

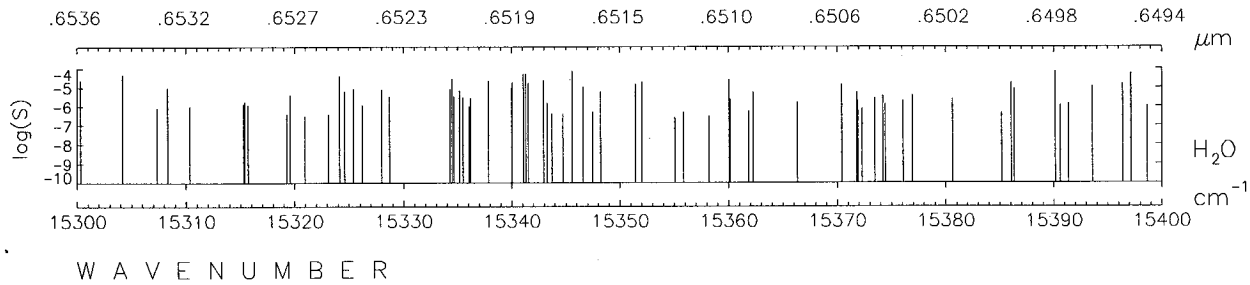
ORIGINAL PAGE IS
OF POOR QUALITY

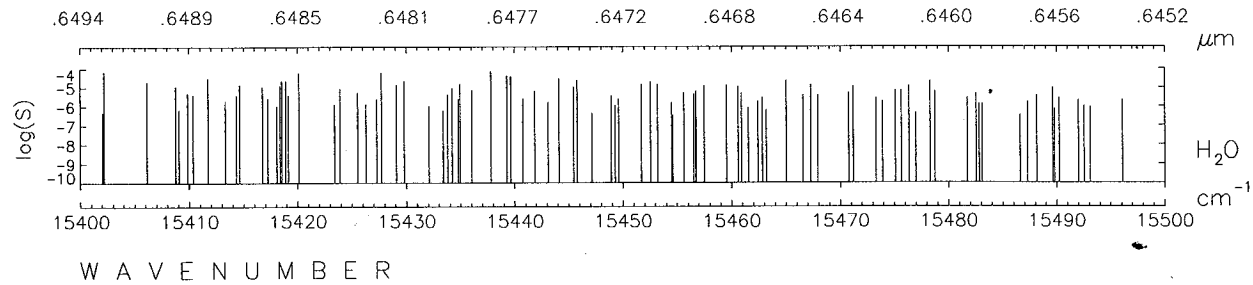




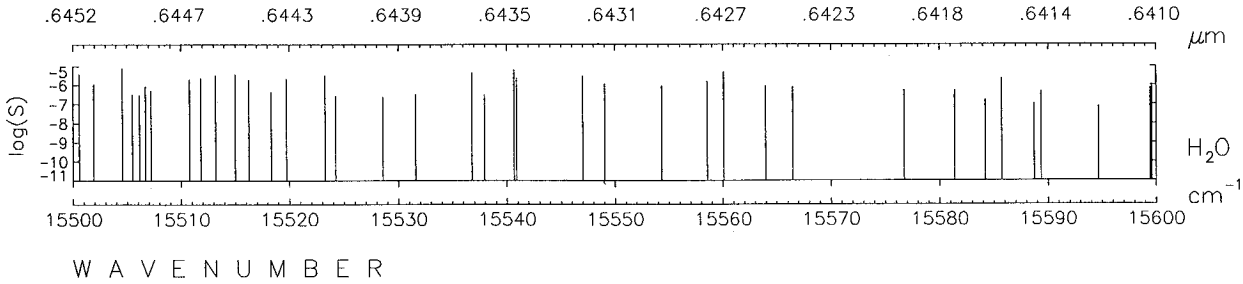


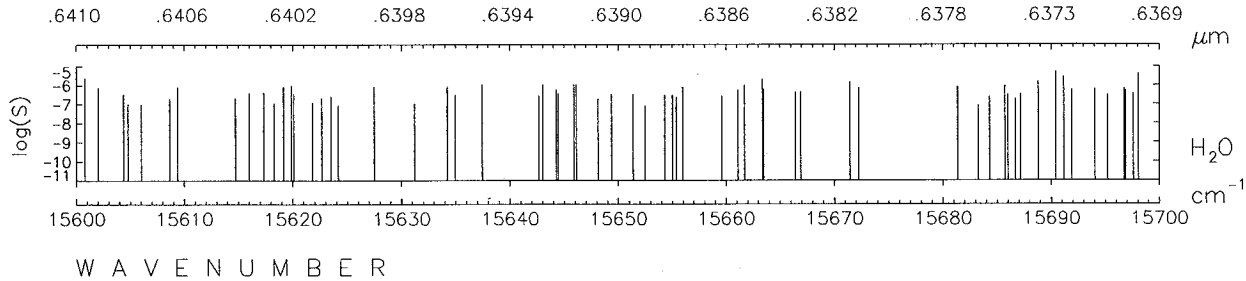

.6579 .6575 .6570 .6566 .6562 .6557 .6553 .6549 .6545 .6540 .6536
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
15200 15210 15220 15230 15240 15250 15260 15270 15280 15290 15300
WAVENUMBER

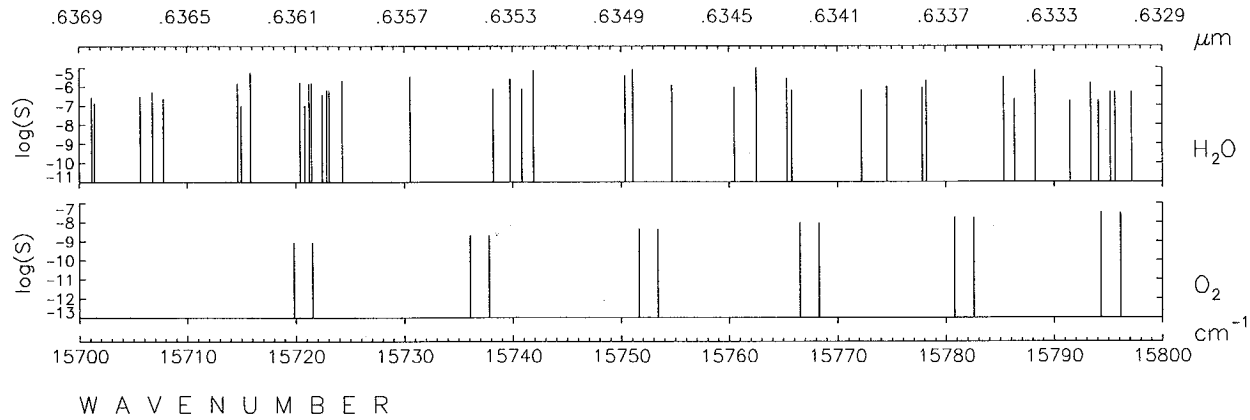

.6536 .6532 .6527 .6523 .6519 .6515 .6510 .6506 .6502 .6498 .6494
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
15300 15310 15320 15330 15340 15350 15360 15370 15380 15390 15400
WAVENUMBER

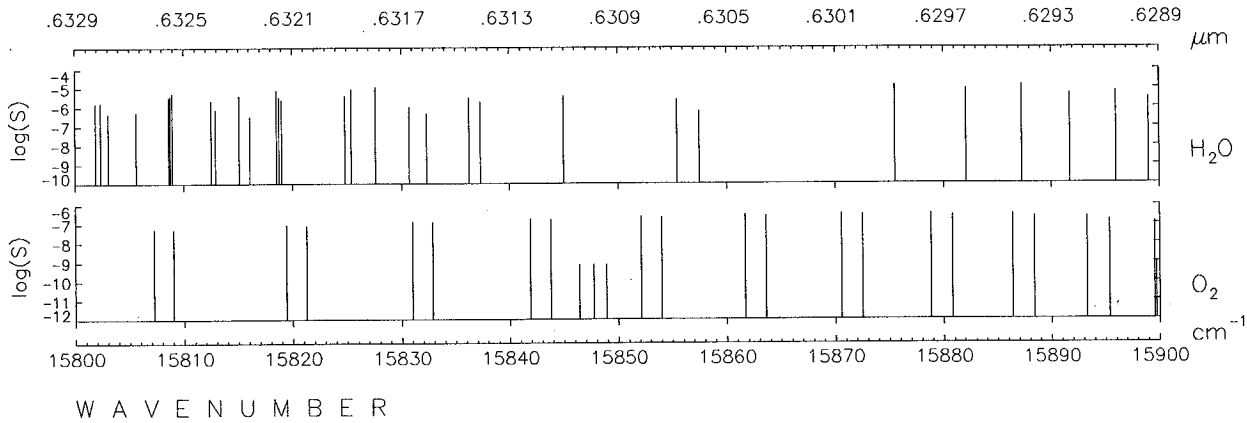

.6494 .6489 .6485 .6481 .6477 .6472 .6468 .6464 .6460 .6456 .6452
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
15400 15410 15420 15430 15440 15450 15460 15470 15480 15490 15500
WAVENUMBER

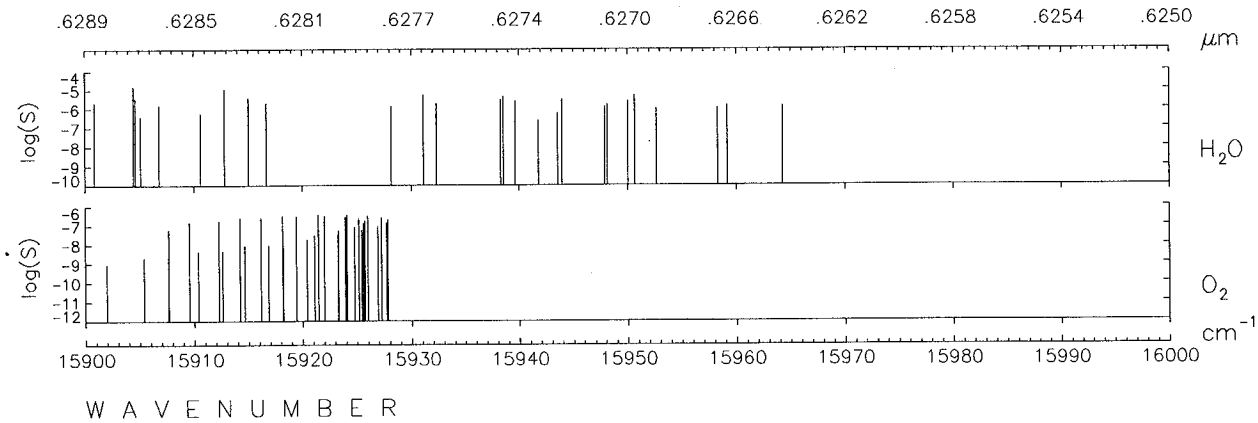
ORIGINAL PAGE IS
OF POOR QUALITY

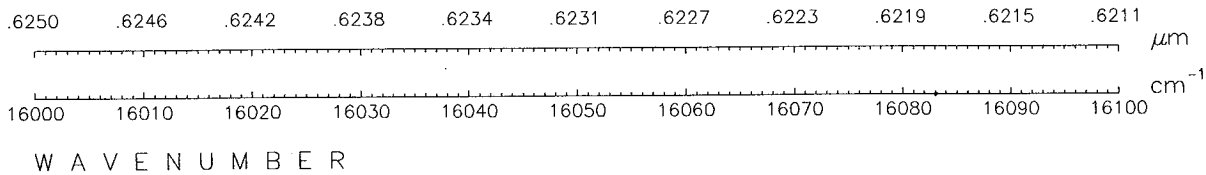


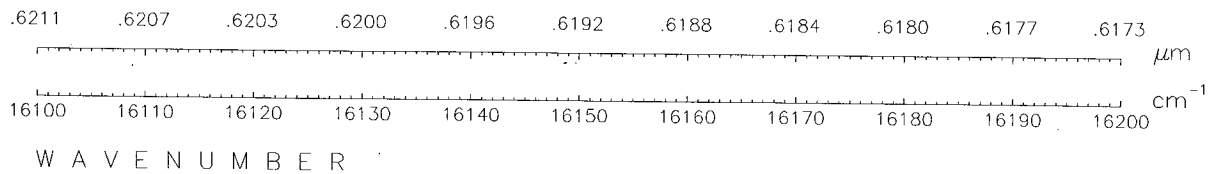




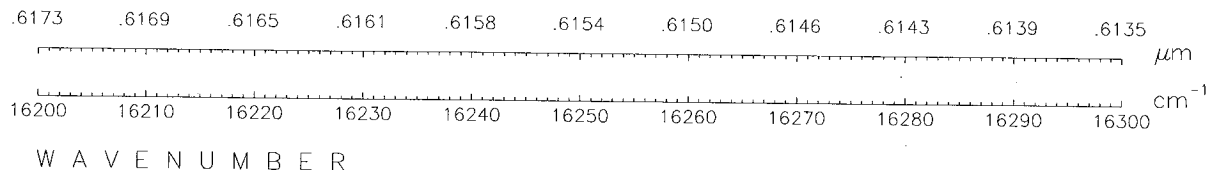

.6329 .6325 .6321 .6317 .6313 .6309 .6305 .6301 .6297 .6293 .6289
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
log(S)
-6 -7 -8 -9 -10 -11 -12
O2
cm-1
15800 15810 15820 15830 15840 15850 15860 15870 15880 15890 15900
WAVENUMBER

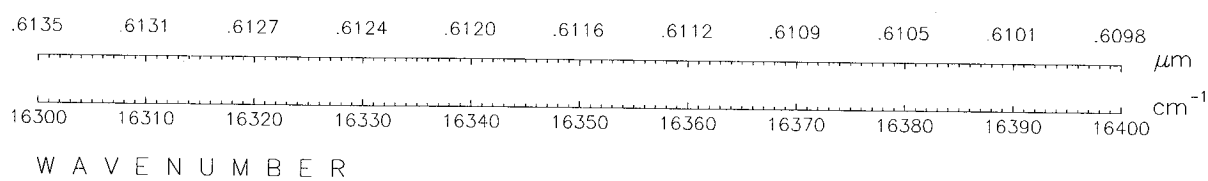

.6289 .6285 .6281 .6277 .6274 .6270 .6266 .6262 .6258 .6254 .6250
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
log(S)
-6 -7 -8 -9 -10 -11 -12
O2
cm-1
15900 15910 15920 15930 15940 15950 15960 15970 15980 15990 16000
WAVENUMBER

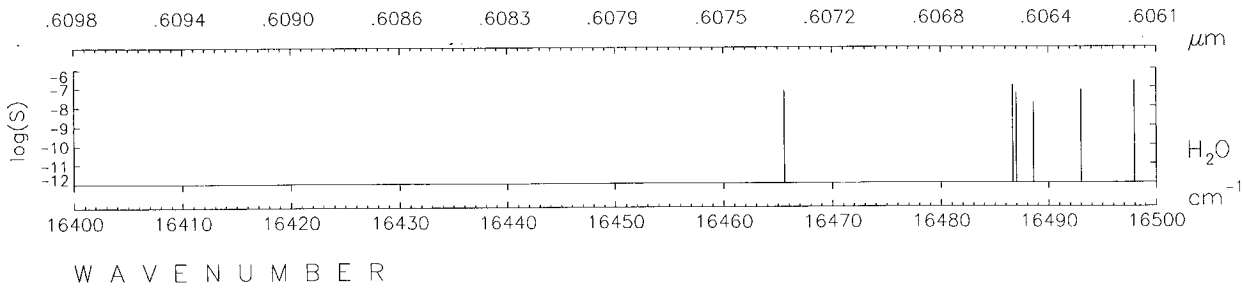

.6250 .6246 .6242 .6238 .6234 .6231 .6227 .6223 .6219 .6215 .6211
μm
cm-1
16000 16010 16020 16030 16040 16050 16060 16070 16080 16090 16100
WAVENUMBER

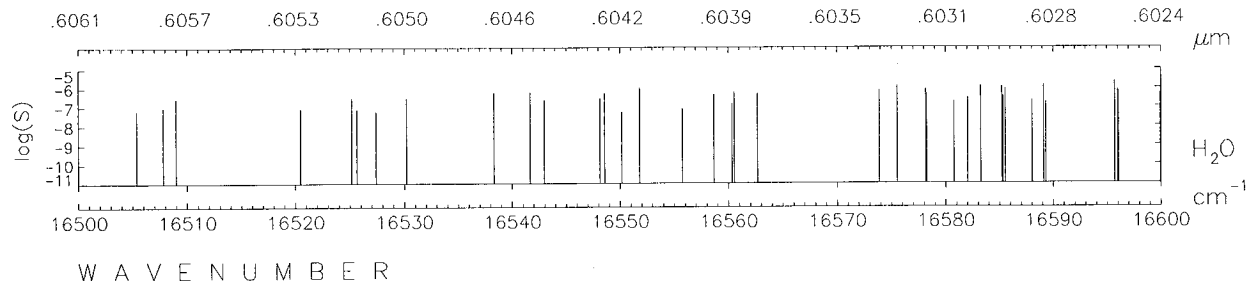


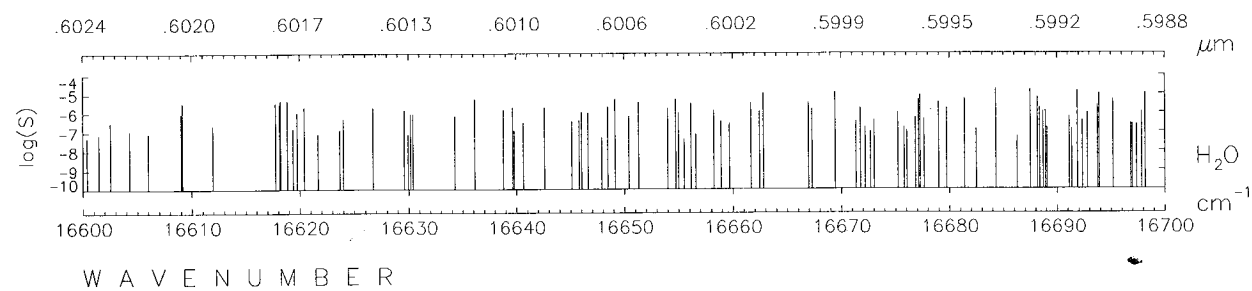
ORIGINAL PAGE IS
OF POOR QUALITY



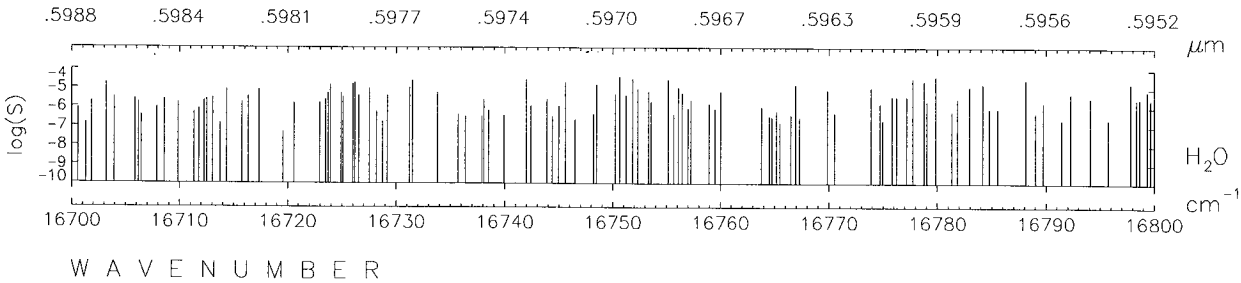


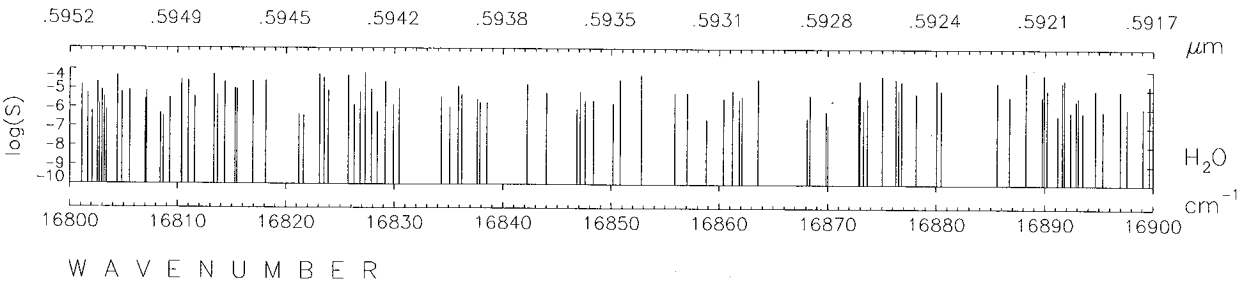

.6098 .6094 .6090 .6086 .6083 .6079 .6075 .6072 .6068 .6064 .6061
μm
log(S)
-6 -7 -8 -9 -10 -11 -12
H2O
cm-1
16400 16410 16420 16430 16440 16450 16460 16470 16480 16490 16500
WAVENUMBER

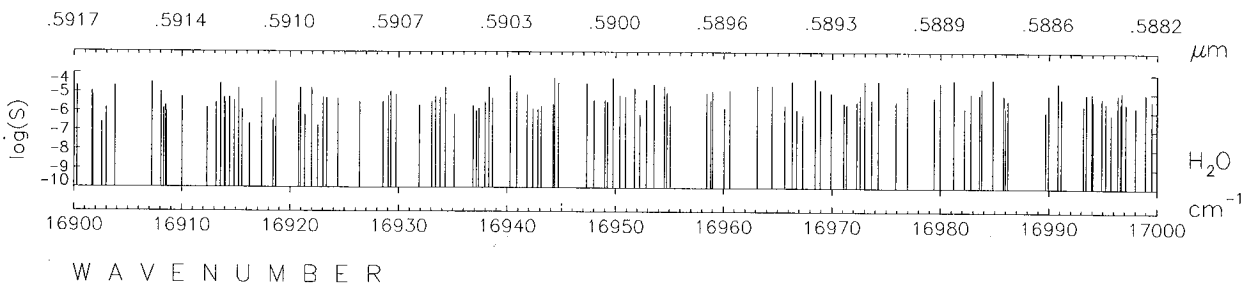

.6061 .6057 .6053 .6050 .6046 .6042 .6039 .6035 .6031 .6028 .6024
μm
log(S)
-5 -6 -7 -8 -9 -10 -11
H2O
cm-1
16500 16510 16520 16530 16540 16550 16560 16570 16580 16590 16600
WAVENUMBER

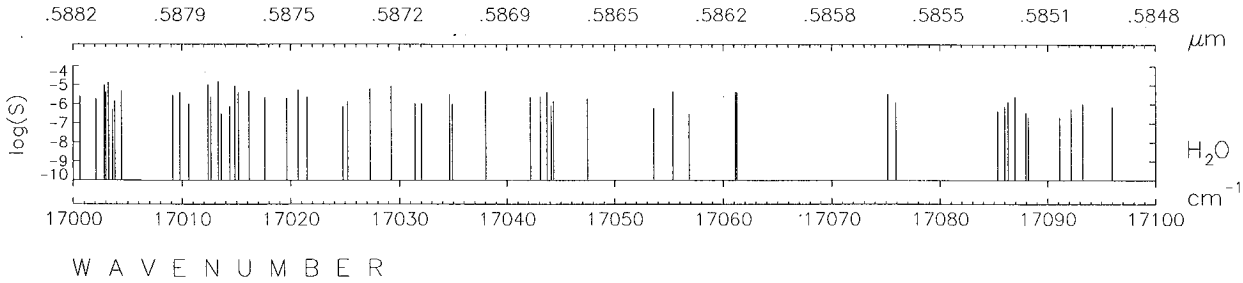

.6024 .6020 .6017 .6013 .6010 .6006 .6002 .5999 .5995 .5992 .5988
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
16600 16610 16620 16630 16640 16650 16660 16670 16680 16690 16700
WAVENUMBER

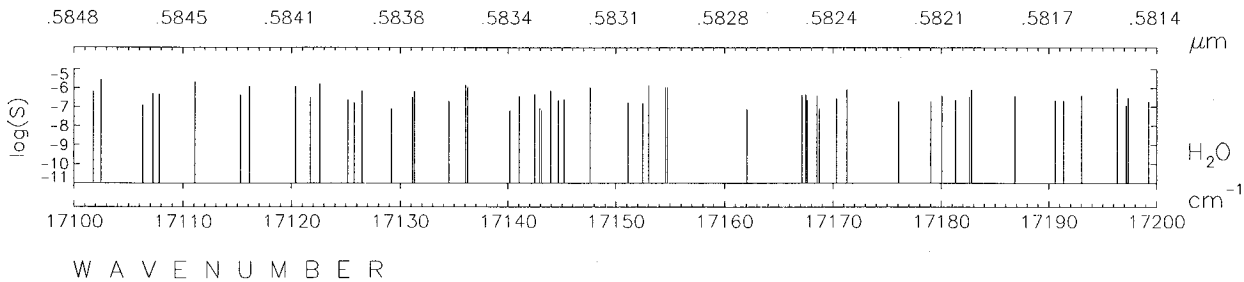
ORIGINAL PAGE IS
OF POOR QUALITY

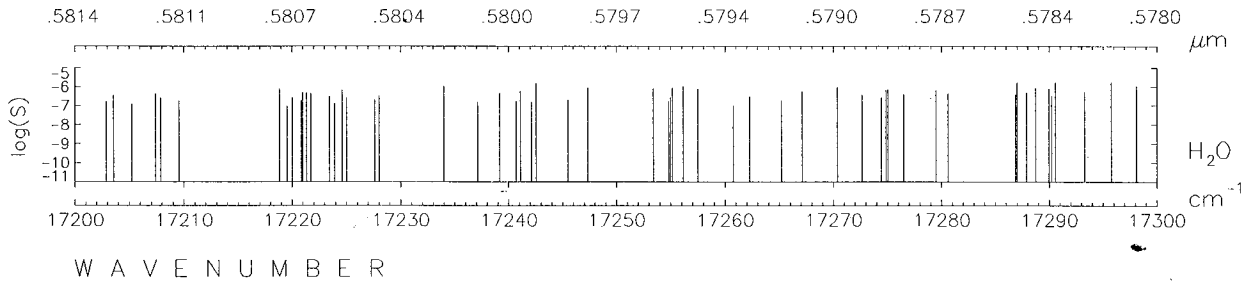






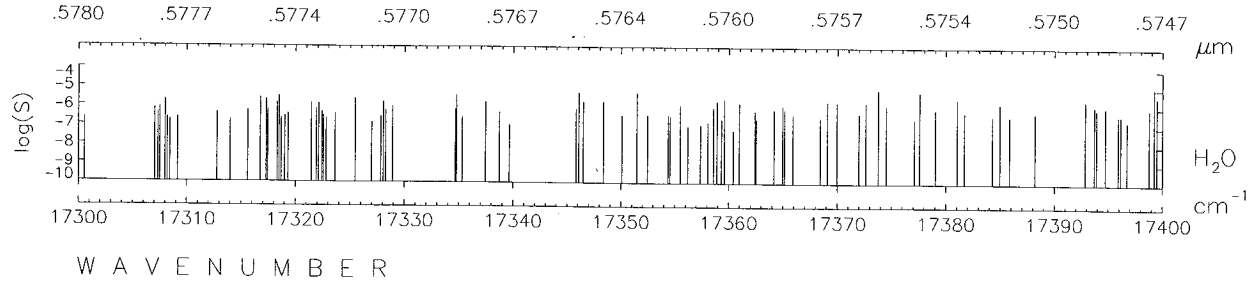

.5882 .5879 .5875 .5872 .5869 .5865 .5862 .5858 .5855 .5851 .5848
μm
log(S)
-4 -5 -6 -7 -8 -9 -10
H2O
cm-1
17000 17010 17020 17030 17040 17050 17060 17070 17080 17090 17100
WAVENUMBER

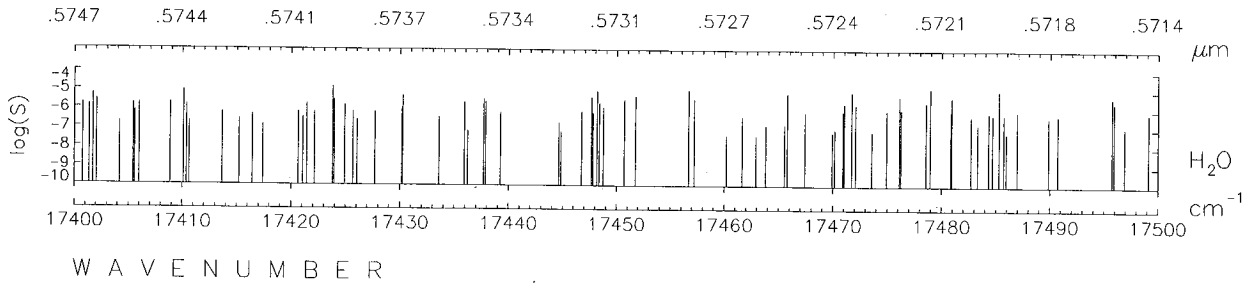

.5848 .5845 .5841 .5838 .5834 .5831 .5828 .5824 .5821 .5817 .5814
μm
log(S)
-5 -6 -7 -8 -9 -10 -11
H2O
cm-1
17100 17110 17120 17130 17140 17150 17160 17170 17180 17190 17200
WAVENUMBER

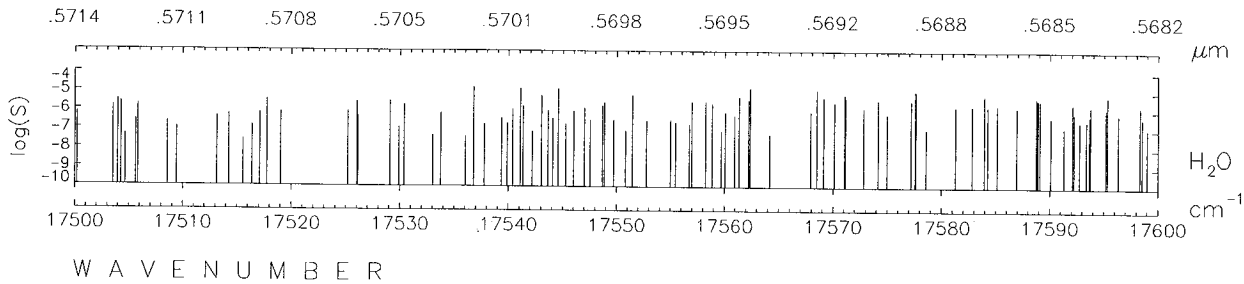

.5814 .5811 .5807 .5804 .5800 .5797 .5794 .5790 .5787 .5784 .5780
μm
log(S)
-5 -6 -7 -8 -9 -10 -11
H2O
cm-1
17200 17210 17220 17230 17240 17250 17260 17270 17280 17290 17300
WAVENUMBER

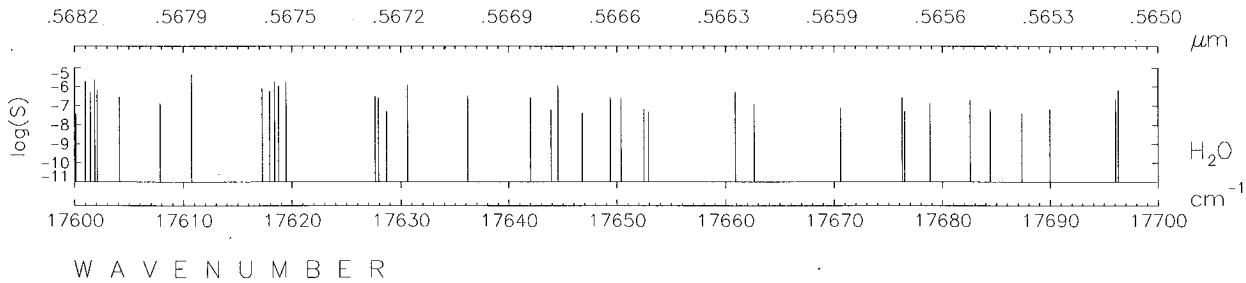
C-3

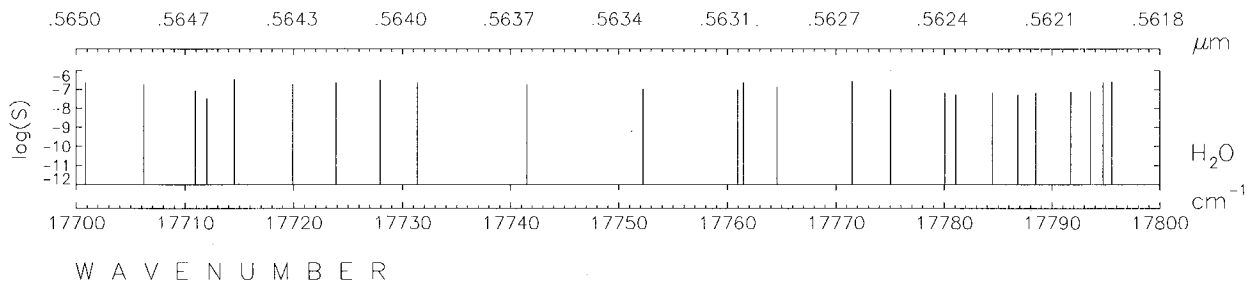
ORIGINAL PAGE IS
OF POOR QUALITY

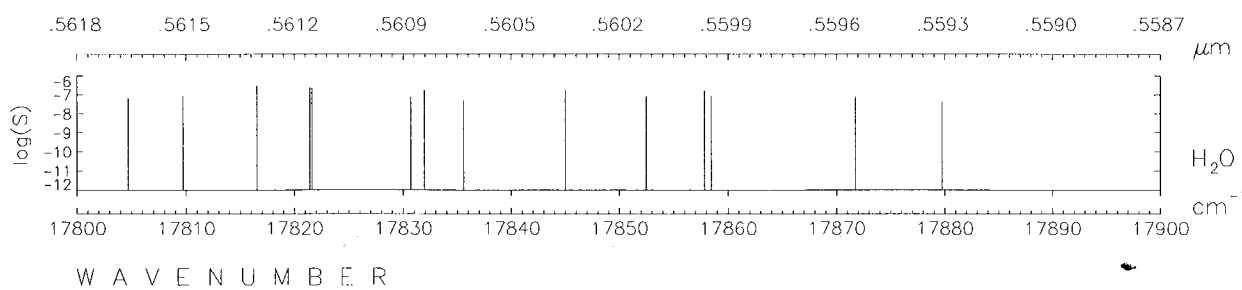












ORIGINAL PAGE IS
OF POOR QUALITY

NASA
National Aeronautics and Space Administration

Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA RP-1188		

4. Title and Subtitle	5. Report Date
Atlas of Absorption Lines From 0 to 17 900 cm^{-1}	September 1987
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
J. H. Park, L. S. Rothman, C. P. Rinsland, H. M. Pickett, D. J. Richardson, and J. S. Namkung	L-16330
9. Performing Organization Name and Address	10. Work Unit No.
NASA Langley Research Center Hampton, VA 23665-5225	618-21-00-01
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Aeronautics and Space Administration Washington, DC 20546-0001	Reference Publication
	14. Sponsoring Agency Code

15. Supplementary Notes

J. H. Park and C. P. Rinsland: Langley Research Center, Hampton, Virginia.
L. S. Rothman: Air Force Geophysics Lab., Hanscom AFB, Massachusetts.
H. M. Pickett: Jet Propulsion Laboratory, Pasadena, California.
D. J. Richardson and J. S. Namkung: ST Systems Corporation (STX), Hampton, Virginia.
This report is a revised edition of NASA RP-1084.

16. Abstract

Plots of logarithm (base 10) of absorption line strength versus wavenumber from 0 to 17 900 cm^{-1} are shown for the 28 atmospheric gases (H_2O, CO_2, O_3, N_2O, CO, CH_4, O_2, NO, SO_2, NO_2, NH_3, HNO_3, OH, HF, $HC\ell$, HBr, HI, $C\ell O$, OCS, H_2CO, $HOC\ell$, N_2, HCN, $CH_3C\ell$, H_2O_2, C_2H_2, C_2H_6, PH_3), which appear in the 1986 Air Force Geophysics Laboratory high-resolution transmission molecular absorption data base (HITRAN) compilation, and for $O(^3P)$, 18-0 isotopic ozone, and HO_2 from the 1984 JPL compilation in the 0- to 200-cm^{-1} region, and infrared solar CO lines at 4500 K. Also shown are plots of logarithm (base 10) of approximate infrared absorption cross sections of 11 heavy molecules versus wavenumber. The cross-section data cover 700 to 1800 cm^{-1} and are included as a separate data file in the 1986 HITRAN database.

17. Key Words (Suggested by Authors(s))		18. Distribution Statement
Spectroscopy	Remote sensing	Unclassified—Unlimited
Infrared	Pollution	
Microwave		
Absorption		
Emission		Subject Category 43

19. Security Classif.(of this report)	20. Security Classif.(of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	197	A09

For sale by the National Technical Information Service, Springfield, Virginia 22161-2171

National Aeronautics and
Space Administration
Code NTT-4

Washington, D.C.
20546-0001

Official Business
Penalty for Private Use, $300

SPECIAL FOURTH-CLASS RATE
POSTAGE & FEES PAID
NASA
Permit No. G-27

NASA

POSTMASTER: If Undeliverable (Section 158 Postal Manual) Do Not Return