6. RELEASED DATA SUMMARY

6.1 RELEASE OF CH 1 WB MEASUREMENTS(APRIL 1, 1994)

6.1.1 CALIBRATED RADIANCE DATA

The Ch 1 WB data being released for archive is listed in Appendix A This is the initial release; no inter-calibration has yet taken place. The summary for these files is:

S050_WB1	31 spectra	25 Nov	'91
S051_WB1	40 spectra	25 Nov	"
S052_WB1	22 spectra	26 Nov	"
S053_WB1	10 spectra	26 Nov	"
S054_WB1	32 spectra	26 Nov	"
S055_WB1	28 Spectra	27 Nov	"
S056_WB1	23 spectra	28 Nov	"
S057_WB1	4 spectra	29 Nov	"
S058_WB1	58 spectra	29, 30 Nov	"
S059_WB1	43 spectra	3 Dec	"
S062_WB1	22 spectra	4 Dec	"
S067_WB1	41 spectra	6 Dec	"
S068_WB1	92 spectra	6 Dec	"
S069_WB1	43 spectra	7 Dec	"

The file designations have been retained from the original data set, and for this reason, are now not contiguous.

6.1.2 DIAGNOSTIC SPECTRAL REGIONS IN CH 1 WB

Three spectral regions have been selected in the Ch 1 WB range for diagnostic purposes. They are:

1) 700 - 705 cm^{-1}	Ambient temperature near instrument,
2) 787 - 790 cm^{-1}	Window for H_2O amount, degree of cloudiness
3) 960 - 964 cm^{-1}	Window for H_2O amount, degree of cloudiness

Brightness temperature plots of the average temperature in each of these three regions are given in Appendix B for the above files.

The 1σ mean square deviation(MSD) has been computed, in terms of brightness temperature, for the two above "window" regions centered at 788 cm^{-1} and 962 cm^{-1} . They are given in Table 1 as a function of temperature.

Table 1. 1σ MSD's for two "window" regions.

Temperature	MSD - Temp @788 cm^{-1}	MSD - Temp @962 cm^{-1}
140K	2.0K	4.5K
150K	1.3K	2.7K
160K	0.8K	1.7K
170K	0.7K	1.1K
180K	0.6K	0.8K

6.2 RELEASE OF CH 1 NB MEASUREMENTS(OCT 20, 1995)

6.2.1 CALIBRATED RADIANCE DATA

The Ch 1 NB data being released for archive is listed in Appendix C This is the initial calibration; no inter-calibration has yet taken place. The summary for these files is:

S050_NB1	28 spectra	25 Nov	'91
S053_NB1	28 spectra	26 Nov	"
S054_NB1	18 spectra	26 Nov	"
S055_NB1	37 spectra	27 Nov	"
S056_NB1	23 spectra	28 Nov	"
S057_NB1	9 spectra	29 Nov	"
S058_NB1	66 spectra	29, 30 Nov	"
S062_NB1	2 spectra	4 Dec	"
S063_NB1	8 spectra	4 Dec	"
S064_NB1	91 spectra	5 Dec	"
S066_NB1	14 spectra	5 Dec	"
S067_NB1	39 spectra	6 Dec	"
S068_NB1	45 spectra	6 Dec	"

The file designations have been retained from the original data set, and for this reason, are now not contiguous.

6.2.2 DIAGNOSTIC SPECTRAL REGIONS IN CH 1 NB

Three spectral regions have been selected in the Ch 1 NB range for diagnostic purposes. They are:

1) 700 - 705 cm^{-1}	Ambient temperature near instrument,
2) 787 - 790 cm^{-1}	Window for H_2O amount, degree of cloudiness
3) 960 - 964 cm^{-1}	Window for H_2O amount, degree of cloudiness

Brightness temperature plots of the average temperature in each of these three regions are given in Appendix D for the above files.

6.3 RELEASE OF CH 2 NB MEASUREMENTS(OCT 20, 1995)

6.3.1 CALIBRATED RADIANCE DATA

The Ch 2 NB data being released for archive is listed in Appendix E This is the initial release; no inter-calibration has yet taken place. The summary for these files is:

S050_NB2	29 spectra	25 Nov	'91
S051_NB2	51 spectra	25 Nov	"
S053_NB2	22 spectra	26 Nov	"
S054_NB2	21 spectra	26 Nov	"
S055_NB2	40 spectra	27 Nov	"
S056_NB2	19 spectra	28 Nov	"
S057_NB2	9 spectra	29 Nov	"
S058_NB2	65 spectra	29, 30 Nov	"
S062_NB2	22 spectra	4 Dec	"
S063_NB2	32 spectra	4 Dec	"
S064_NB2	91 spectra	5 Dec	"
S066_NB2	26 spectra	5 Dec	"
S067_NB2	44 spectra	6 Dec	"
S068_NB2	48 spectra	6 Dec	"

The file designations have been retained from the original data set, and for this reason, are now not contiguous.

6.3.2 DIAGNOSTIC SPECTRAL REGIONS IN CH 2 NB

Three spectral regions have been selected in the Ch 2 NB range for diagnostic purposes. They are:

1) 1246 - 1253 cm^{-1} Maximum radiance indicator in Ch 2,
2) 1270 - 1273 cm^{-1} Mini-window in H_2O continuum,
3) 1337 - 1342 cm^{-1} Maximum radiance indicator in Ch 2.

Brightness temperature plots of these three regions for the above files are given in Appendix F.

7. DATA USEAGE GUIDE

7.1. DATA FORMAT

The files from the Coffeyville experiment are in the format:

KEYWORD = VALUE.

```
FILENAME = S050_WB1.V1b
CREATION_DATE = 11-Dec-1995 14:51:23 EST
RELEASE_VERSION = 1b
BEGIN_SCAN_NUMBER = 371
        MEASUREMENT_TIME_GMT = 25-Nov-1991 01:45:51 GMT
        MEASUREMENT_TIME_CST = 24-Nov-1991 19:45:51 CST
        TARGET_ID = SKY
        CHANNEL_NUMBER = CHANNEL 1 WIDEBAND
        INPUT_FILENAME = SIRIS050.SA5
        WINDOW_TEMPERATURE = 282.74
        INPUT_MIRROR_TEMPERATURE = 282.93
        FIXED_MIRROR_TEMPERATURE = 282.92
        COLLIMATOR_TEMPERATURE = 281.47
        START_TIME_WARM_TARGET_AVG = 25-Nov-1991 03:19:45 GMT
        END_TIME_WARM_TARGET_AVG = 25-Nov-1991 03:35:28 GMT
        NUMBER_IN_WARM_TARGET_AVG = 10
        WARM_TARGET_TEMPERATURE = 286.18
        START_TIME_COLD_TARGET_AVG = 25-Nov-1991 04:33:09 GMT
        END_TIME_COLD_TARGET_AVG = 25-Nov-1991 04:47:14 GMT
        NUMBER_IN_COLD_TARGET_AVG =  9
        COLD_TARGET_TEMPERATURE = 202.92
        START_TIME_UPDATE_WARM_TARGET_AVG = 25-Nov-1991 02:07:04 GMT
        END_TIME_UPDATE_WARM_TARGET_AVG = 25-Nov-1991 02:23:52 GMT
        NUMBER_IN_UPDATE_WARM_TARGET_AVG = 11
        UPDATE_WARM_TARGET_TEMPERATURE = 286.20
        DATA_RESOLUTION = 0.122
        FIRST_WAVENUMBER = 699.9697
        WAVENUMBER_INTERVAL =  6.0269479e-02
        NUMBER_OF_RADIANCE_VALUES =  6638
        RADIANCE_UNITS = ERG SEC-1 CM-2 SR-1 / CM-1
        RADIANCE_VALUES =
        107.930
        109.758
        110.375
        .
        31.203
        23.953
        23.305
        END_SCAN_NUMBER = 371
```

7.2 WAVENUMBER SCALE RECONSTRUCTION

The wavenumber scale may be constructed from

$$\text{Wavenumber(n)} = \text{FIRST_WAVENUMBER(699.9697)} + (n-1)\ \text{WAVENUMBER-INTERVAL(6.0269947e-02).} \quad (9)$$

The two quantities on the right hand side of the expression are located in the data record.

7.3 APODIZATION FUNCTION AND INSTRUMENT FUNCTION

As given by eqn(8), the apodization function is

$$ap = .54 + .46 \cdot \cos(\pi \cdot x / L) \quad (10)$$

where

x = optical path difference

L = maximum optical path difference(For a resolution of .122 cm^{-1}, L = 8.2 cm).

The corresponding instrument function to be applied to synthetic spectra in the wavenumber domain, is

$$\text{I.F.} = \frac{\sin(\pi X)}{(\pi X)} + \frac{.46\ X \sin(\pi X)}{54\ \pi\ (1-X^2)} \quad (11)$$

where X is the relative displacement from the center wave number of interest

$$X = \Delta\nu / (1/2L), \quad (12)$$

with $1/L = .122\ cm^{-1}$.

8. AVERAGING OF DATA TO IMPROVE S/N

Due to the high spectral resolution and short integration time(82 sec for wb mode, 68 sec for nb mode), the radiance's of an individual spectrum are noisy in the 800 - 1000 cm^{-1} region. The short integration time was deliberately used to assist in identifying time varying events in the spectum; with spectral averaging to be used in the post processing phase to yield spectra with adequate S/N. In looking through the individual spectrum data base, it is evident that atmospheric conditions were relatively stable for most time periods of 10 minutes or longer. Thus, we may average individual spectra for this time period, improving the S/N by sqrt(number of observations). These spectral subsets to be

averaged may be initially selected from diagnostic spectral "windows", such as discussed in Sections. 6.1.2, 6.2.2, and 6.3.2, and listed in the Tables in Appendices A, C, and E, and presented in the figures in Appendices B, D, and F. The degree of atmospheric constancy should be checked via the mean square deviation(MSD) of the individual spectra in the average.

Sixteen average spectra have been constructed, to assist in the data validation process. Several average spectra have been chosen for each key day, including at least one average for each channel(see Table 2). In addition, the

Table 2. Base set of SIRIS average spectra.

					Time	Num
			Scan		First Scan	Scans
Case	File	Channel	Number	Date	GMT	in Avg
			Mid-Lat Key Day			
#1	S052	1 WB	355	Nov 26	01:03:28	7
#2	S054	1 WB	21	Nov 26	16:48:27	7
#3	S053	1 NB	134	Nov 26	14:12:05	8
#4	S053	2 NB	134	Nov 26	14:12:05	8
			Warm Dry Key Day			
#5	S058	1 WB	144	Nov 30	00:49:37	7
#6	S058	1 WB	368	Nov 30	04:04:20	7
#7	S058	1 NB	405	Nov 30	04:38:16	8
#8	S058	2 NB	405	Nov 30	04:38:16	8
			Cold Dry Key Day			
#9	S062	1 WB	72	Dec 4	04:31:45	7
			Cold Wet Key Day			
#10	S064	1 NB	302	Dec 5	02:24:03	7
#11	S066	1 NB	112	Dec 5	22:01:36	8
#12	S066	2 NB	112	Dec 5	22:01:36	8
			Cirrus/Sub-Trop Key Day			
#13	S067	1 WB	452	Dec 6	04:54:57	7
#14	S068	1 WB	19	Dec 6	19:49:32	7
#15	S068	1 NB	30	Dec 6	20:00:32	8
#16	S068	2 NB	30	Dec 6	20:03:32	8

average spectra were selected so that they overlap in time with the Uni. of Wisconsin AERI measurements. The averages were constructed in accordance with the following:

Ch 1 WB	7 spectra in average Total integration time = 9.6 min Improvement in S/N over indiv spectrum = 2.6
Ch 1 NB, Ch 2 NB	8 spectra in average Total integration time = 9.1 min Improvement in S/ over indiv spectrum = 2.8.

These average spectra, along with their MSD, are shown in Fig's 7-22.

The MSD are plotted on the same scale as the downwelling radiances. The MSD curves shown in the Fig's includes noise contributions from the instrument(NESR), atmospheric variability, and other interference effects. The MSD noise level is approximately 1% of the maximum emission level at 700 to 750 cm^{-1}. The NESR levels, as determined from the calibrations targets(see Fig's 4-6), are approximately 1-2 radiance units for Ch 1, and approximately 0.2 radiance units for Ch 2. The MSD levels shown in Fig's 7-22 are close to the NESR levels, in general, indicating atmospheric conditions for the selected spectra in each average were fairly constant.

The explicit MSD noise features can be seen to trigger negative radiances, at their spectral locations, in some of the cold case radiances. The average radiances, the MSD noise level and, the MSD distinctive peaks, exhibit minor variability between the different cases in the enhanced noise spectral region. This noise behavior should be taken into account for data interpretation.

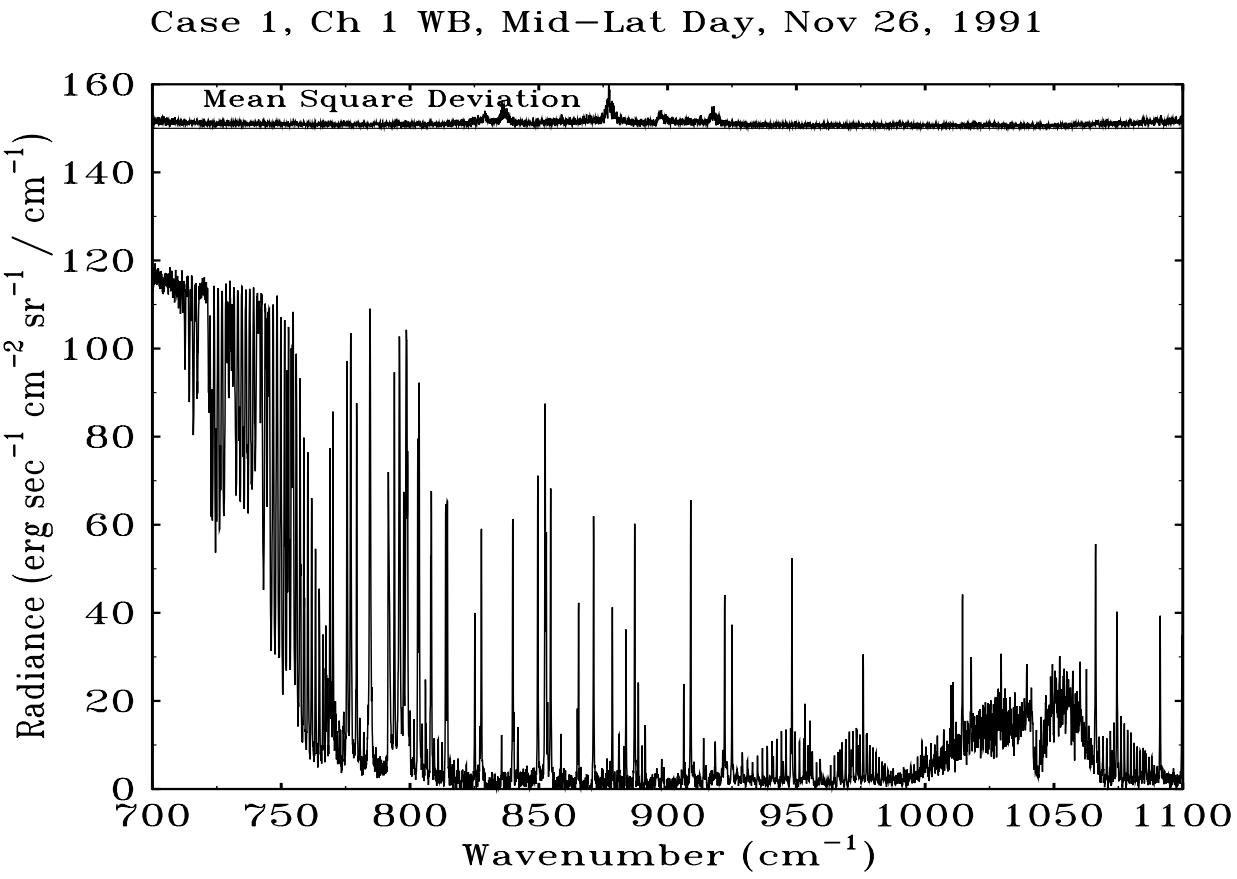

Fig. 7. Downwelling radiance and standard deviation. File = S052. 7 spectr in avg. Beginning scan = 355. Beg time = 01:03:28.

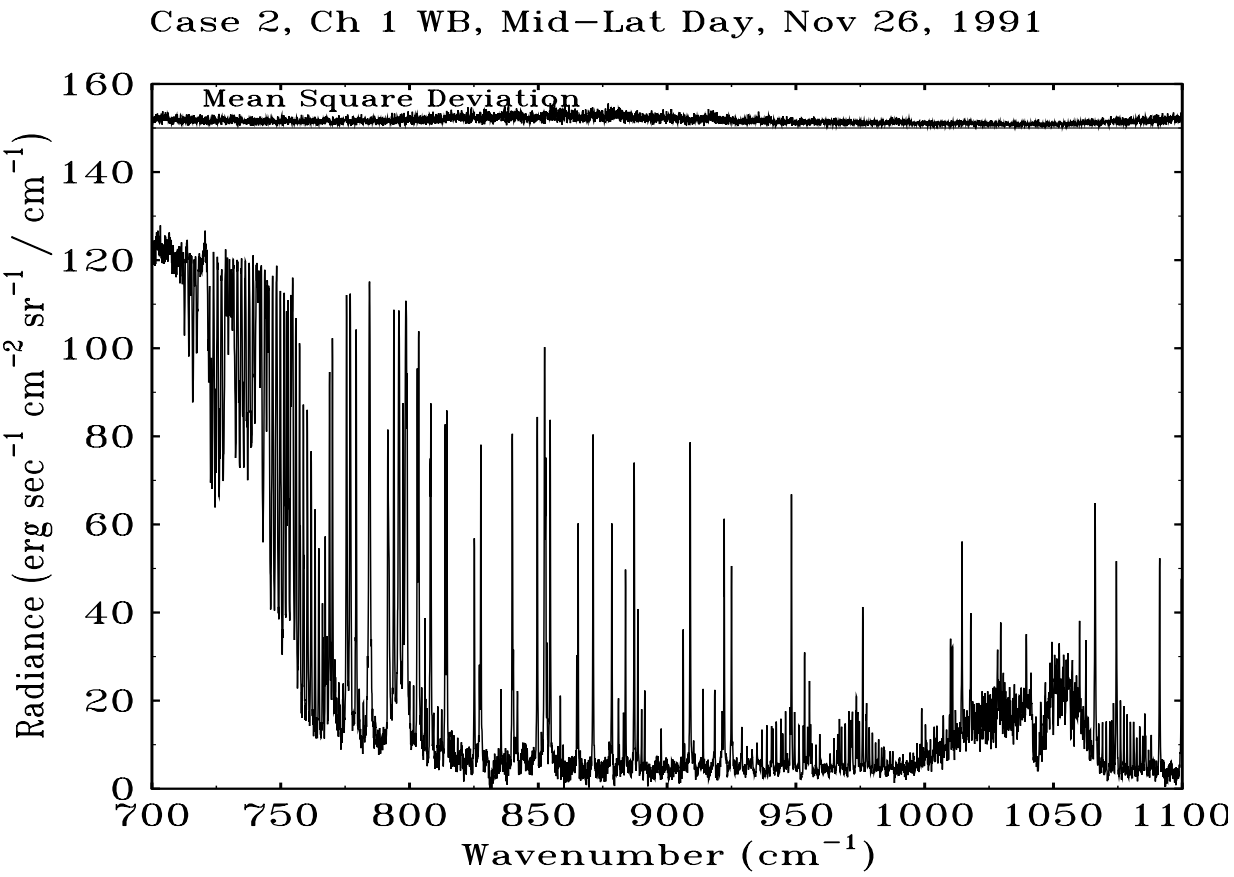

Fig. 8. Downwelling radiance and standard deviation. File = S054. 7 spectr in avg. Beginning scan = 21. Beg time = 16:48:27.

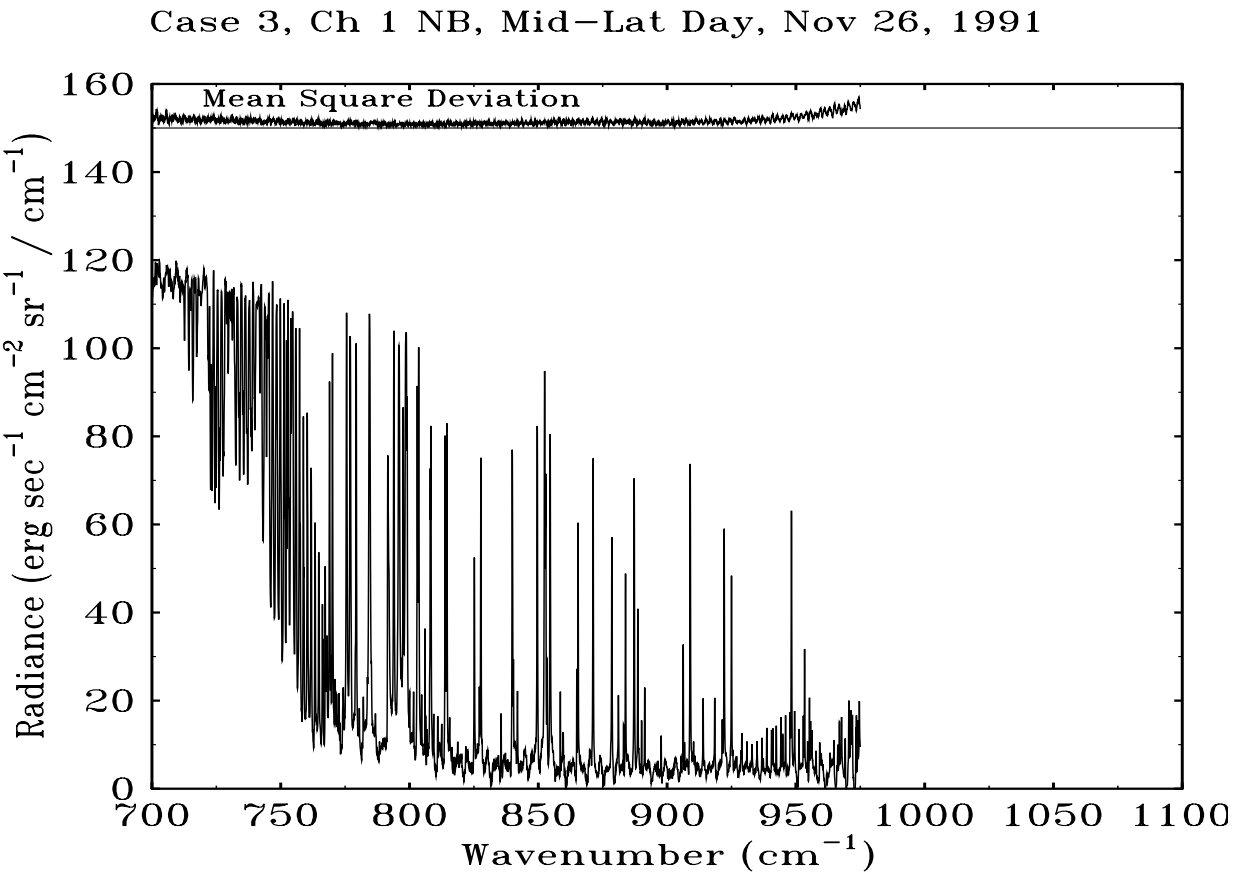

Fig. 9. Downwelling radiance and standard deviation. File = S053. 8 spectr in avg. Beginning scan = 134. Beg time = 14:12:05.

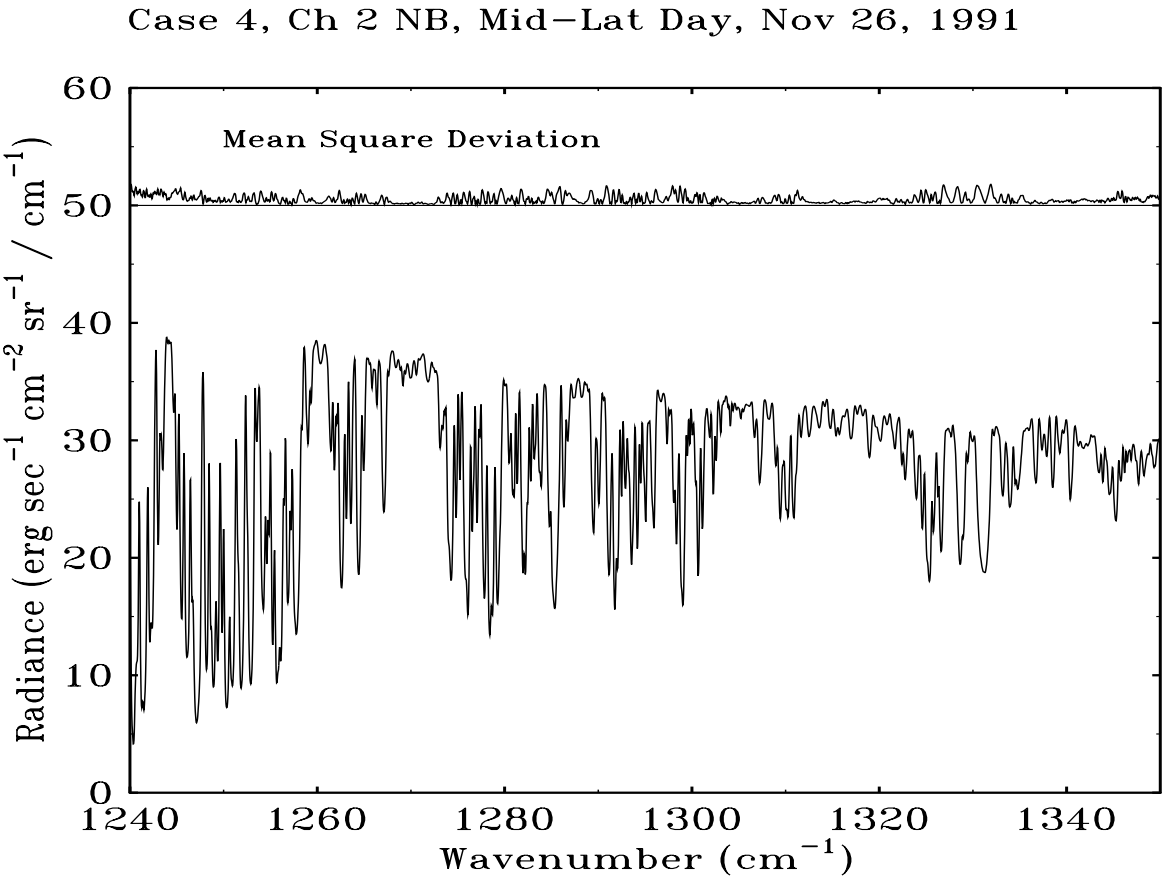

Fig. 10. Downwelling radiance and standard deviation. File = S053. 8 spectr in avg. Beginning scan = 134. Beg time = 14:12:05.

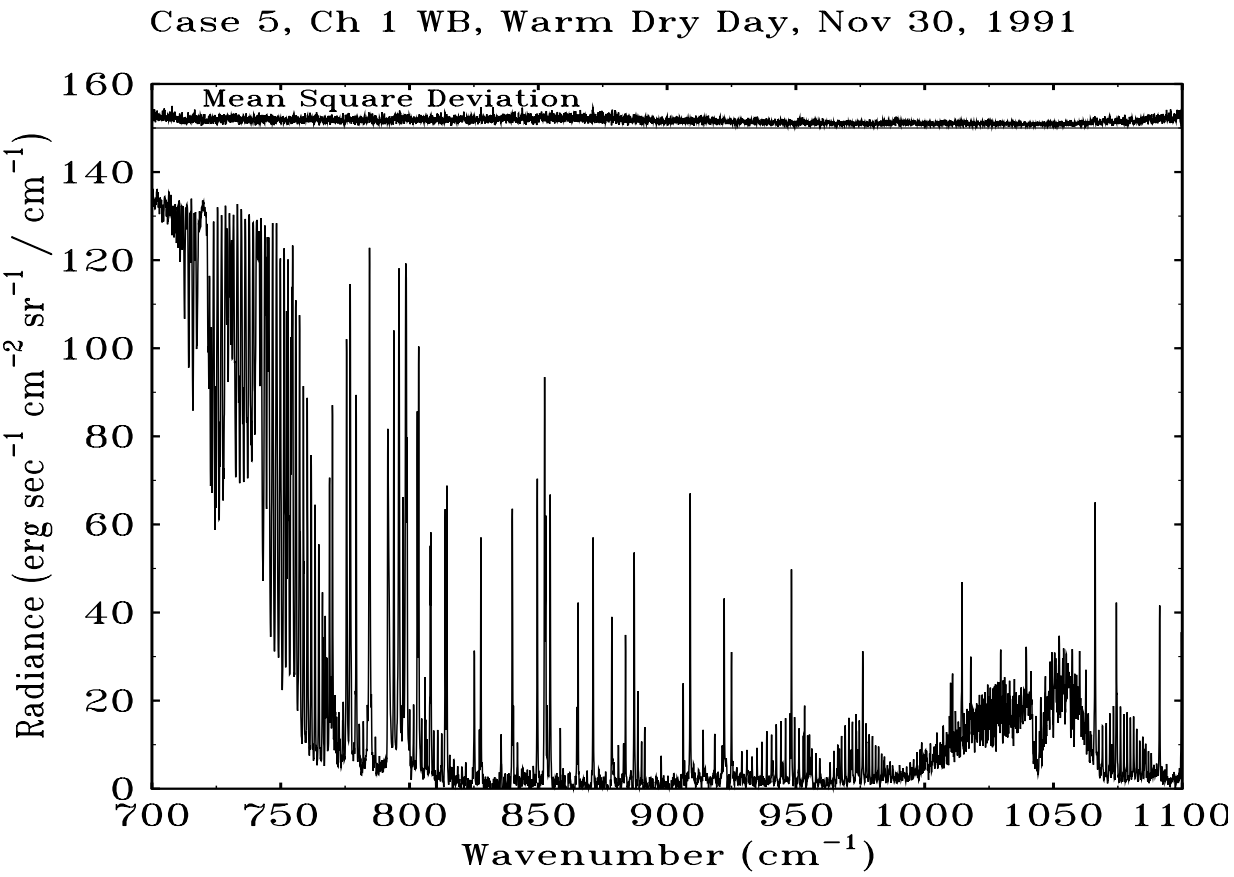

Fig. 11. Downwelling radiance and standard deviation. File = S058. 7 spectr in avg. Beginning scan = 144. Beg time = 00:49:37.

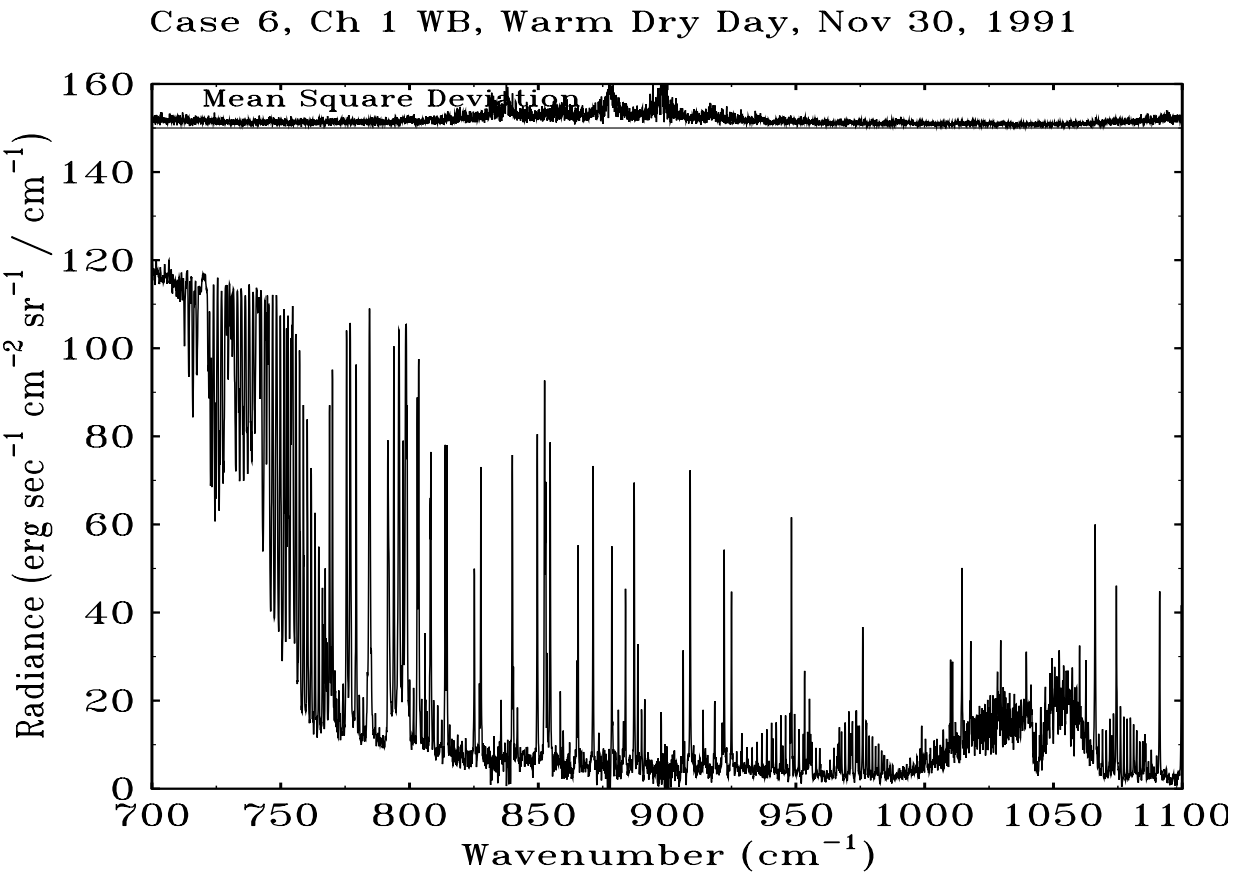

Fig. 12. Downwelling radiance and standard deviation. File = S058. 7 spectr in avg. Beginning scan = 368. Beg time = 04:04:20.

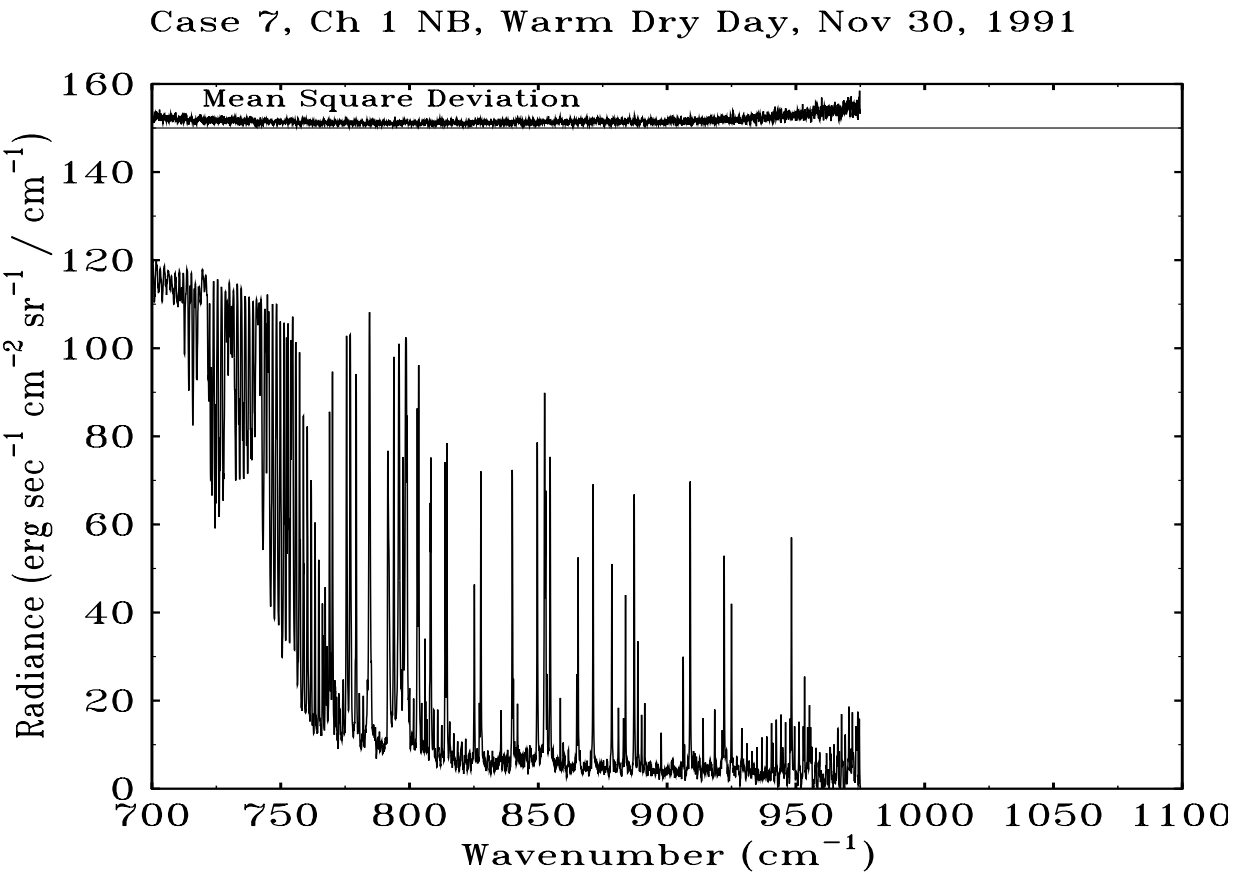

Fig. 13. Downwelling radiance and standard deviation. File = S058. 8 spectr in avg. Beginning scan = 405. Beg time = 04:38:16.

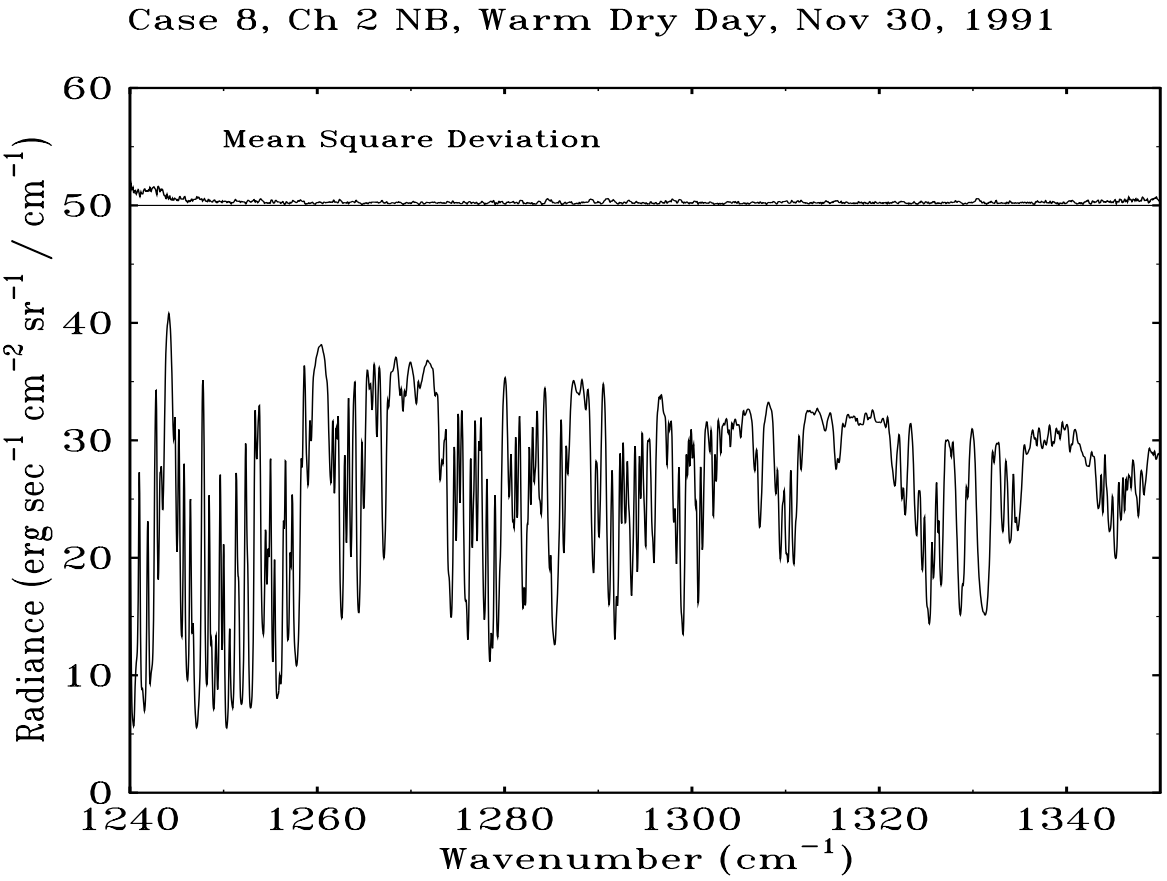

Fig. 14 Downwelling radiance and standard deviation. File = S058. 8 spectr in avg. Beginning scan = 405. Beg time = 04:38:16.