NOAA Technical Memorandum ERL WPL-132

DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA

DOCUMENTATION OF PROGRAMS TO COMPUTE SPECTRA FROM PROFILER RADIOMETRIC OBSERVATIONS

Piero Ciotti

Wave Propagation Laboratory
Boulder, Colorado
April 1986

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / Environmental Research Laboratories

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DOCUMENTATION OF PROGRAMS TO COMPUTE SPECTRA FROM PROFILER RADIOMETRIC OBSERVATIONS

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ABSTRACT

This report describes the use of FORTRAN programs that derive spectra from Profiler and dual-channel radiometric data. For example, time series and spectra of geopotential heights, geopotential thicknesses, surface pressure, precipitable water vapor, and brightness temperatures themselves, can be derived using these programs.

I. INTRODUCTION

Computer programs have been written to derive spectra of various quantities from Profiler radiometric data. For example, time series and spectra of geopotential heights, geopotential thicknesses, surface pressure, and brightness temperatures themselves have been derived. In addition, two programs have been written to process the dual-channel radiometer 5-second data. This memorandum is a user's guide to this software.

The following list includes a brief description of the purpose of the programs.

a) SPCANL5 plots time series and computes and plots Fourier and Autoregressive spectra of 2-minute data samples that are stored in a file with a standard format.

b) SPCANS2 plots time series and computes and plots Fourier and Autoregressive spectra of 5-second data samples that are stored in a file with a standard format.

c) FLPROF reads a Profiler data file and produces a new data file compatible with SPCANL5 and suitable for processing brightnesses and surface variables.

d) FLPROF1 has the same purpose as FLPROF, but reads Profiler data files having the new format.

e) FLPROF2 reads a dual-channel radiometer 5-second data file and produces a new data file compatible with SPCANS2.

f) FLISOB reads a Profiler data file and, using suitable coefficients, produces a pressure height data file, compatible with SPCANL5.

g) FLISOB1 has the same purpose as FLISOB, but reads Profiler data files having the new format.

Dr. E. R. Westwater, NOAA/ERL, Wave Propagation Laboratory, was Research Adviser for this paper.

h) EXCHANG reads a file containing retrieval coefficients and produces a new coefficient file, compatible with FLISOB.

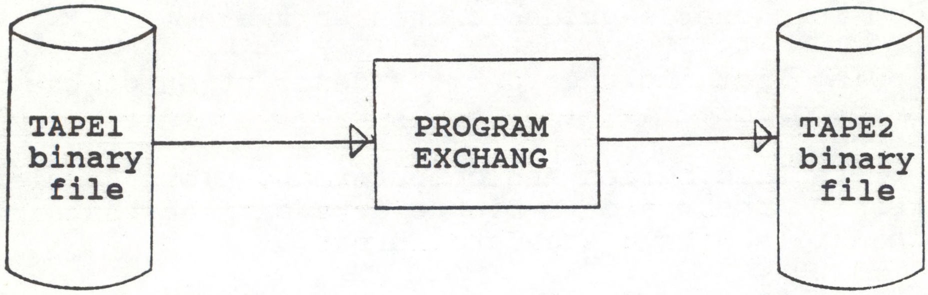
II. Program EXCHANG

The retrieval coefficients for Profiler derived quantities are derived assuming the following order for the data vector:

d1 = TS (C) = surface temperature
d2 = PS (mb) = surface pressure
d3 = (RH)S (fraction) = surface relative humidity
d4 = Tb (53.85) (K) = brightness temperature at 53.85 GHz
d5 = Tb (55.45) (K) = brightness temperature at 55.45 GHz
d6 = Tb (58.80) (K) = brightness temperature at 58.80 GHz
d7 = tau (20.6) nepers = optical depth at 20.60 GHz
d8 = tau (31.65) nepers = optical depth at 31.65 GHz
d9 = Tb (52.85) (K) = brightness temperature at 52.85 GHz

Program EXCHANG rearranges coefficients to an order compatible with the Profiler data format.

FOR REARRANGING THE ORDER OF THE COEFFICIENTS



<u>Inputs</u>

TAPE1: original coefficient file (output of REWRITE)

<u>Outputs</u>

TAPE2: rearranged coefficient file: NVCOEF2
JLCOEF2
etc.

No procedure file: interactive use.

EX:

```
GET, TAPE1 = JJATHK.
GET, EXBIN.          (binary executable version of EXCHANG)
EXBIN.
SAVE, TAPE2 = JLCOEF2.
```

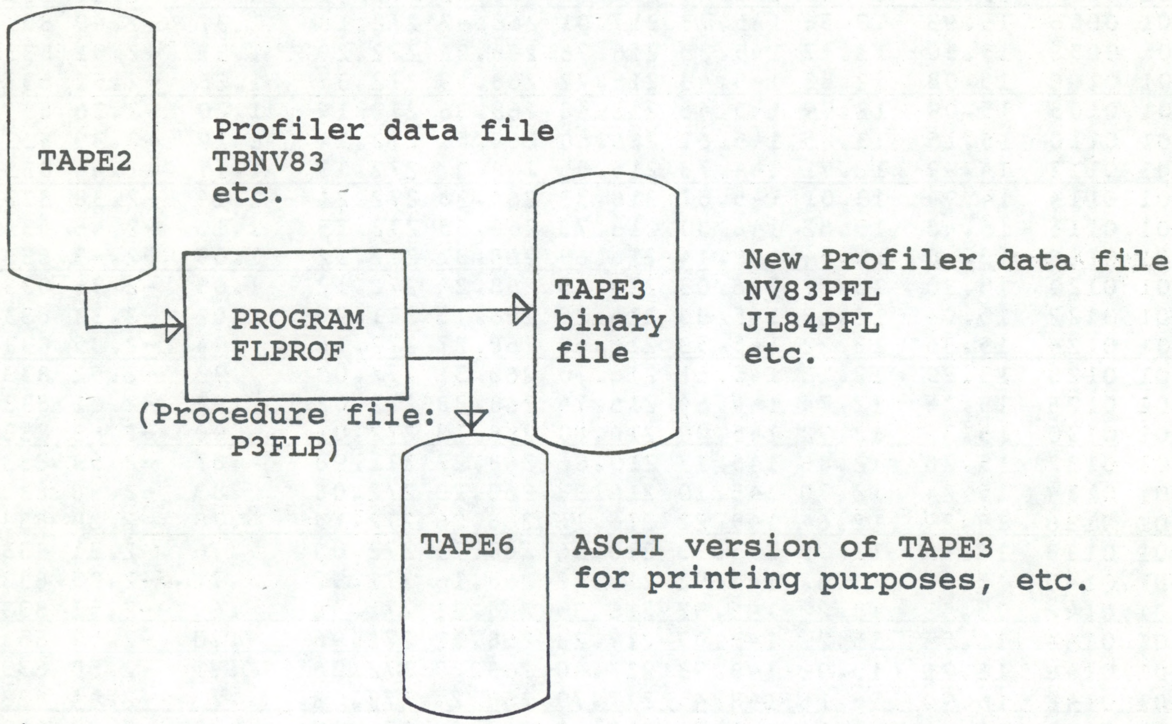
See Appendix A for the listing of EXCHANG

III. Program FLPROF

The original Profiler data file contains gaps due to calibration. The following program interpolates the original data and writes the results on an output file.

PROFILER DATA FILE ⟹ NEW PROFILER DATA FILE

The new Profiler data file contains bogused data for the calibration periods and can be used as input file for the SPCANL5 program in order to compute spectra of brightnesses or surface variables.



Inputs

Keyboard: the program asks for the beginning date and time, and for the ending date and time of the period to be processed. The format for the inputs is YRMODA,HRMI.

TAPE2: Profiler ASCII data file (see Fig. 1). The standard name for a Profiler data file is TBMOYR where MO = month and YR = year.
Ex.: TBNV83, TBJL84, etc.

Figure 1. Profiler data file representing format used before August 1, 1984. No data are recorded 02, 04, and 06 minutes after the hour because of internal calibration.

YRMODA	MISS	TB (20.6)	TB (31.65)	TB (52.85)	TB (53.85)	TB (55.45)	TB (58.80)	TS	TD	P	IGNORE
840401	0038	15.57	13.84	146.19	217.09	268.50	272.39	1.84	-1.89	833.80	3.45
840401	0040	15.50	13.65	145.76	217.32	268.45	272.40	1.76	-2.05	833.82	3.39
840401	0042	15.04	12.81	144.88	216.77	268.54	272.37	1.71	-1.85	833.83	3.28
840401	0044	15.01	12.66	144.65	216.72	268.52	272.30	1.66	-1.79	833.83	3.22
840401	0046	15.28	13.06	145.52	216.76	268.45	272.30	1.62	-2.09	833.83	3.20
840401	0048	15.32	13.38	145.32	217.08	268.49	272.28	1.53	-2.22	833.85	3.14
840401	0050	15.20	13.20	145.42	216.86	268.53	272.36	1.49	-2.22	833.88	3.05
840401	0052	15.26	13.10	145.35	216.92	268.46	272.30	1.46	-2.37	833.92	2.97
840401	0054	15.32	13.28	145.64	216.90	268.42	272.22	1.44	-2.19	833.93	2.90
840401	0056	15.43	13.56	145.73	217.01	268.43	272.16	1.37	-2.49	833.91	2.87
840401	0058	15.30	13.17	145.38	216.98	268.34	272.29	1.31	-2.91	833.90	2.79
840401	0100	15.08	12.88	145.48	216.72	268.49	272.37	1.28	-2.51	833.88	2.73
840401	0108	15.09	12.99	145.46	216.48	268.36	272.19	1.20	-2.36	833.84	2.55
840401	0110	15.15	13.05	145.61	216.60	268.51	272.14	1.19	-2.39	833.83	2.52
840401	0112	14.99	12.71	144.78	216.55	268.37	272.13	1.17	-2.44	833.84	2.42
840401	0114	14.94	13.01	145.57	216.33	268.38	272.21	1.14	-2.38	833.84	2.38
840401	0116	15.48	13.82	146.30	216.73	268.35	272.15	1.10	-2.46	833.84	2.37
840401	0118	15.40	13.54	146.14	216.69	268.31	272.12	1.09	-2.43	833.84	2.30
840401	0120	15.30	13.27	146.03	216.45	268.24	272.12	1.08	-2.36	833.83	2.25
840401	0122	15.04	12.62	145.38	216.25	268.13	271.99	1.02	-2.32	833.83	2.23
840401	0124	15.35	13.22	145.58	216.63	268.27	272.14	.94	-2.35	833.81	2.18
840401	0126	15.39	13.13	145.61	216.70	268.31	272.03	.93	-2.52	833.83	2.25
840401	0128	15.14	12.74	144.64	216.74	268.28	272.02	.92	-2.61	833.84	2.18
840401	0130	15.35	12.92	145.00	216.80	268.23	272.01	.90	-2.63	833.81	2.14
840401	0132	15.28	12.86	145.17	216.66	268.27	271.98	.87	-2.53	833.79	2.07
840401	0134	15.24	12.70	145.10	216.38	268.20	272.08	.83	-2.48	833.81	2.02
840401	0136	15.29	12.64	145.22	216.16	268.26	272.15	.78	-2.34	833.85	1.97
840401	0138	15.45	12.95	145.33	216.36	268.15	272.08	.76	-2.31	833.88	1.88
840401	0140	15.49	13.32	145.92	216.42	268.16	271.92	.71	-2.35	833.89	1.91
840401	0142	15.53	13.20	145.92	216.35	268.31	271.98	.69	-2.51	833.89	1.86
840401	0144	16.54	15.27	148.07	217.28	268.12	271.96	.70	-2.59	833.90	1.81
840401	0146	16.71	15.91	148.93	217.40	268.29	272.06	.71	-2.55	833.92	1.77
840401	0148	16.90	16.16	148.45	217.79	268.27	272.03	.73	-2.44	833.96	1.72
840401	0150	16.20	14.69	146.76	217.18	268.29	271.99	.75	-2.37	833.99	1.71
840401	0152	16.25	14.95	146.92	217.34	268.12	271.96	.72	-2.34	834.00	1.67
840401	0154	16.66	15.65	147.72	217.55	268.12	271.97	.73	-2.39	834.03	1.64
840401	0156	16.90	16.19	147.99	217.87	268.17	272.02	.73	-2.43	834.03	1.55
840401	0158	17.00	16.54	149.00	217.78	268.22	272.12	.76	-2.41	834.04	1.43
840401	0200	17.04	16.63	148.34	218.15	268.09	271.87	.77	-2.33	834.04	1.43
840401	0208	16.60	15.56	147.23	217.90	268.23	271.97	.86	-2.52	834.03	1.44
840401	0210	15.81	13.95	146.01	216.77	268.25	271.96	.83	-2.48	834.02	1.48
840401	0212	16.08	14.56	146.15	217.20	268.22	272.08	.82	-2.42	834.03	1.47

Outputs

CRT screen: prompt for inputs from keyboard, error messages, processing information.

TAPE3: binary data file containing Profiler and surface data relative to the selected period, in a format compatible with SPCANL5.
The standard name for this file is MOYRPFL where MO = month and YR = year.
EX.: NV83PFL, JL84PFL, etc.

TAPE6: ASCII version of TAPE3 (see Fig. 2). It can be printed and then deleted. It is not utilized by other programs.

Program FLPROF can be executed using the BEGIN type procedure file P3FLP (see Appendix A). P3FLP needs to be edited in order to use the correct names for the input and output files.
EX.:

```
GET,P3FLP.
(optional edit of P3FLP)
P3FLP.


> Input beginning date, time; ending date, time.

? 850703,0030,850730,2330
```

Note: for the beginning and ending time, times relative to the minutes 58,00,02,04,06,08,10,12 of each hour should not be used.

IV. Program FLISOB

This program computes, using the suitable coefficients of the month, pressure heights from the Profiler data and writes the ouput to tape. The program calculates the optical depths at 20.6 GHz and 31.65 GHz from the corresponding brightnesses; therefore it needs to be edited in order to use the correct mean radiating temperatures of the month. The mean radiating temperatures are stored in the variables TMR20 and TMR31 which are defined in a DATA statement in the SUBROUTINE TRASF. Program FLISOB does also the data bogusing for the calibration periods.

Figure 2. Profiler data after bogusing. Data are inserted during calibration times by interpolation from adjacent points.

YRMODA	HRMI	TB (20.6)	TB (31.65)	TB (52.8)	TB (53.85)	TB (55.45)	TB (58.8)	TS	RH	P	IGNORE
830107	1714	30.07	23.94	165.34	236.56	287.26	292.47	20.72	.50	838.76	5.80
~~830107~~	~~1716~~	~~30.10~~	~~23.98~~	~~165.24~~	~~236.67~~	~~287.42~~	~~292.52~~	~~21.41~~	~~.50~~	~~838.62~~	~~5.75~~
830107	1718	30.20	24.03	165.46	236.48	287.25	292.57	20.93	.48	838.82	5.72
830107	1720	30.11	23.95	165.51	236.37	287.10	292.44	20.85	.53	838.92	5.79
~~830107~~	~~1722~~	~~30.12~~	~~24.04~~	~~165.57~~	~~236.33~~	~~287.32~~	~~292.71~~	~~20.44~~	~~.50~~	~~838.64~~	~~5.84~~
830107	1724	30.26	24.14	165.46	236.50	287.47	292.68	20.37	.36	838.67	5.76
830107	1726	30.27	24.15	165.97	236.21	287.29	292.76	20.87	.40	838.43	5.82
~~830107~~	~~1728~~	~~30.22~~	~~24.06~~	~~165.54~~	~~236.53~~	~~287.41~~	~~292.63~~	~~20.83~~	~~.57~~	~~838.64~~	~~5.90~~
830107	1730	30.29	24.27	166.15	236.47	287.47	292.94	20.41	.42	838.63	5.82
830107	1732	30.29	24.17	166.01	236.25	287.47	292.83	21.34	.50	838.70	5.91
~~830107~~	~~1734~~	~~30.34~~	~~24.19~~	~~165.95~~	~~236.64~~	~~287.51~~	~~292.80~~	~~20.58~~	~~.54~~	~~838.69~~	~~5.91~~
830107	1736	30.43	24.21	166.07	236.68	287.57	292.92	20.47	.44	838.65	5.89
830107	1738	30.48	24.28	166.16	236.69	287.56	292.88	21.64	.46	838.68	5.90
~~830107~~	~~1740~~	~~30.47~~	~~24.37~~	~~166.30~~	~~236.77~~	~~287.69~~	~~293.04~~	~~19.85~~	~~.43~~	~~838.64~~	~~5.99~~
830107	1742	30.41	24.28	166.43	236.50	287.53	292.90	21.12	.42	838.69	6.10
830107	1744	30.40	24.25	166.30	236.71	287.41	292.89	20.61	.51	838.71	6.20
~~830107~~	~~1746~~	~~30.37~~	~~24.16~~	~~166.10~~	~~236.75~~	~~287.60~~	~~292.72~~	~~20.61~~	~~.45~~	~~838.68~~	~~6.28~~
830107	1748	30.38	24.24	165.84	236.75	287.56	292.65	21.47	.55	838.76	6.34
830107	1750	30.37	24.24	166.00	236.62	287.56	292.68	20.77	.45	838.75	6.38
~~830107~~	~~1752~~	~~30.35~~	~~24.18~~	~~165.77~~	~~236.90~~	~~287.56~~	~~292.78~~	~~20.61~~	~~.50~~	~~838.61~~	~~6.41~~
830107	1754	30.37	24.19	165.59	236.91	287.71	292.76	21.76	.43	838.77	6.45
830107	1756	30.46	24.27	165.82	236.80	287.61	292.96	20.80	.44	838.84	6.38
~~830107~~	~~1758~~	~~30.46~~	~~24.26~~	~~165.96~~	~~236.78~~	~~287.59~~	~~293.11~~	~~21.37~~	~~.53~~	~~838.75~~	~~6.40~~
830107	1800	30.41	24.23	165.67	236.74	287.53	292.83	21.10	.51	838.56	6.47
830107	1802	30.39	24.22	165.53	236.72	287.50	292.69	20.97	.50	838.47	6.51
~~830107~~	~~1804~~	~~30.41~~	~~24.21~~	~~165.68~~	~~236.63~~	~~287.54~~	~~292.91~~	~~20.99~~	~~.48~~	~~838.50~~	~~6.57~~
830107	1806	30.44	24.23	165.72	236.66	287.41	292.95	21.12	.57	838.70	6.65
830107	1808	30.39	24.18	165.78	236.54	287.55	292.97	20.91	.43	838.56	6.70
~~830107~~	~~1810~~	~~30.31~~	~~24.17~~	~~165.93~~	~~236.57~~	~~287.50~~	~~292.88~~	~~20.92~~	~~.51~~	~~838.59~~	~~6.79~~
830107	1812	30.26	24.10	165.95	236.57	287.46	292.75	21.28	.44	838.68	6.86
830107	1814	30.36	24.14	165.64	236.65	287.43	292.79	20.66	.44	838.76	6.77
~~830107~~	~~1816~~	~~30.40~~	~~24.16~~	~~165.66~~	~~236.90~~	~~287.49~~	~~292.87~~	~~20.52~~	~~.49~~	~~838.58~~	~~6.73~~
830107	1818	30.35	24.24	165.99	236.75	287.41	292.79	20.22	.45	838.73	6.76
830107	1820	30.42	24.26	165.93	236.85	287.64	293.04	21.24	.42	838.54	6.75
~~830107~~	~~1822~~	~~30.42~~	~~24.31~~	~~166.25~~	~~236.78~~	~~287.58~~	~~292.92~~	~~21.67~~	~~.54~~	~~838.61~~	~~6.75~~
830107	1824	30.44	24.26	166.29	236.59	287.47	292.84	20.50	.50	838.59	6.79
830107	1826	30.38	24.22	165.69	236.86	287.59	292.82	21.67	.51	838.57	6.87
~~830107~~	~~1828~~	~~30.32~~	~~24.26~~	~~166.00~~	~~236.56~~	~~287.55~~	~~292.81~~	~~20.40~~	~~.42~~	~~838.54~~	~~6.91~~
830107	1830	30.29	24.23	166.02	236.45	287.44	292.86	21.27	.44	838.54	6.98
830107	1832	30.40	24.29	165.63	236.80	287.70	292.75	20.63	.58	838.63	6.93
~~830107~~	~~1834~~	~~30.51~~	~~24.37~~	~~165.80~~	~~236.97~~	~~287.74~~	~~293.17~~	~~20.08~~	~~.48~~	~~838.85~~	~~6.88~~
830107	1836	30.45	24.31	165.68	236.83	287.64	293.04	21.34	.42	838.75	6.96
830107	1838	30.46	24.35	166.21	236.51	287.67	293.26	20.94	.45	838.82	7.03
~~830107~~	~~1840~~	~~30.39~~	~~24.32~~	~~165.90~~	~~236.40~~	~~287.62~~	~~292.88~~	~~20.10~~	~~.49~~	~~838.65~~	~~7.14~~
830107	1842	30.34	24.32	165.93	236.45	287.56	292.97	21.55	.46	838.59	7.24
830107	1844	30.36	24.30	166.15	236.40	287.62	292.98	21.15	.53	838.62	7.30
~~830107~~	~~1846~~	~~30.33~~	~~24.29~~	~~166.32~~	~~236.45~~	~~287.62~~	~~293.07~~	~~20.60~~	~~.47~~	~~838.67~~	~~7.36~~
830107	1848	30.34	24.33	166.39	236.48	287.62	293.01	21.19	.50	838.57	7.46
830107	1850	30.32	24.34	166.38	236.49	287.63	293.05	20.86	.52	838.53	7.56

```
PROFILER DATA FILE          PRESSURE HEIGHTS DATA FILE

                  Profiler data file
         TAPE2    TBNV83
                  TBJL84
                  etc.

TAPE1                        TAPE3    Pressure heights data file
binary       PROGRAM         binary   NV83ISF
 file        FLISOB           file    JL84ISF, etc.

Height   (Procedure file:
Coeff.      P3FLI)
NVCOEF2
JLCOEF2
etc.                         TAPE6   ASCII version of TAPE3
                                     for printing purposes, etc.
```

<u>Inputs</u>

Keyboard: the program asks for the beginning date and time, and for the ending date and time of the period to be processed. The format for the inputs is YRMODA,HRMI.

TAPE1: retrieval coefficient binary data file. The standard name for the file is MOCOEFX where MO = month and X = number that identifies different sets of coefficients. EX.: NVCOEF2, JLCOEF2, NVCOEF5, etc.

TAPE2: Profiler ASCII data file (see Fig.1). The standard name for a Profiler data file is TBMOYR where MO = month and YR = year. EX.: TBNV83, TBJL84, etc.

<u>Outputs</u>

CRT screen: prompt for inputs from keyboard, error messages, processing information.

TAPE3: binary data file containing pressure height and thickness data relative to the selected period, in a format compatible with SPCANL5. The standard name for this file is MOYRISX where MO = month , YR = year and X = number that identifies the coefficient set that produced the data. EX.: NV83IS2, JL84IS2, etc.

TAPE6: ASCII version of TAPE3 (see Fig. 3). It can be printed and then deleted. It is not utilized by other programs.

Program FLISOB can be executed using the BEGIN type procedure file P3FLI (see Appendix A). P3FLI needs to be edited in order to use the correct names for the input and output files.
EX.:

```
GET, P3FLI.
(optional edit of P3FLI)
P3FLI

> Input beginning date, time; ending date, time

? 850703,0030,850730,2330
```

Note: for the beginning and ending time, times relative to the minutes 58,00,02,04,06,08,10,12 of each hour should not be used.

V. Program SPCANL5

Once either the new Profiler file has been created or the pressure heights have been computed and written to a file, the resulting output can be plotted and spectra computed.

SPCANL5 plots time series and computes and plots Fourier and Autoregressive spectra of 2-minute data samples that are stored in a file with a standard format. Examples of the microfilm output of this program are shown in Figs. 4 and 5.

SPCANL5 computes Fourier spectra using the FSPMS subroutine. It also computes Autoregressive and Fourier spectra using the ASPS subroutine. Both subroutines are standard STAR5 library subroutines (ATTACH,STAR5/UN=CAMLIB.).

In addition, the program provides an optional detrending scheme based on the subroutine MAFLT of the STAR5 library and a spike filtering routine.

The data segments to be processed are selected by means of the beginning date and time and the ending date and time. For each selected time period a plot of the time series is produced. Then either FSPMS or the ASPS or both subroutines can be utilized in order to produce spectra.

Once a data segment has been selected, it is possible to compute and plot spectra by averaging N $\geq$ 1 spectra of successive contiguous data segments. These segments have the same number of samples as the original. The average spectrum is plotted, while time series relative to all the data segments are also plotted.

Figure 3. Pressure heights and pressure thickness data file.

YRMODA	HRMI	800	700	600	500	400	300	200	100	500-800	300-500
831105	918	.3639	1.483	2.723	4.128	5.756	7.714	10.30	14.62	3.764	3.587
831105	920	.3638	1.482	2.723	4.132	5.766	7.734	10.33	14.65	3.768	3.602
831105	922	.3641	1.479	2.721	4.137	5.785	7.773	10.40	14.72	3.773	3.636
831105	924	.3647	1.476	2.720	4.147	5.813	7.827	10.48	14.80	3.782	3.680
831105	926	.3646	1.478	2.723	4.157	5.832	7.858	10.52	14.84	3.792	3.702
831105	928	.3653	1.473	2.720	4.157	5.840	7.881	10.57	14.88	3.791	3.724
831105	930	.3653	1.475	2.721	4.154	5.832	7.864	10.54	14.85	3.789	3.709
831105	932	.3659	1.475	2.722	4.159	5.844	7.889	10.58	14.89	3.793	3.729
831105	934	.3651	1.480	2.723	4.143	5.801	7.804	10.44	14.76	3.778	3.661
831105	936	.3652	1.477	2.722	4.149	5.816	7.834	10.49	14.80	3.783	3.685
831105	938	.3653	1.478	2.721	4.149	5.819	7.842	10.50	14.82	3.784	3.693
831105	940	.3645	1.482	2.721	4.129	5.765	7.736	10.34	14.66	3.765	3.607
831105	942	.3646	1.482	2.720	4.123	5.752	7.713	10.30	14.62	3.759	3.590
831105	944	.3647	1.482	2.721	4.125	5.757	7.723	10.32	14.64	3.761	3.598
831105	946	.3648	1.482	2.720	4.125	5.758	7.725	10.32	14.64	3.760	3.599
831105	948	.3649	1.480	2.718	4.126	5.764	7.739	10.35	14.67	3.761	3.613
831105	950	.3645	1.481	2.719	4.127	5.764	7.740	10.35	14.67	3.762	3.613
831105	952	.3647	1.480	2.718	4.128	5.769	7.749	10.36	14.69	3.763	3.621
831105	954	.3646	1.479	2.720	4.134	5.781	7.769	10.39	14.72	3.769	3.636
831105	956	.3647	1.478	2.718	4.141	5.802	7.812	10.46	14.79	3.776	3.671
831105	958	.3647	1.475	2.721	4.153	5.828	7.855	10.53	14.85	3.788	3.702
831105	1000	.3643	1.477	2.720	4.143	5.802	7.807	10.45	14.78	3.779	3.664
831105	1002	.3641	1.478	2.720	4.138	5.789	7.782	10.41	14.74	3.774	3.644
831105	1004	.3640	1.477	2.720	4.139	5.791	7.785	10.42	14.75	3.775	3.646
831105	1006	.3638	1.477	2.719	4.138	5.789	7.780	10.41	14.74	3.774	3.642
831105	1008	.3639	1.477	2.719	4.137	5.787	7.776	10.40	14.74	3.773	3.639
831105	1010	.3641	1.477	2.718	4.135	5.782	7.769	10.40	14.73	3.770	3.634
831105	1012	.3642	1.475	2.719	4.145	5.808	7.816	10.47	14.80	3.781	3.671
831105	1014	.3642	1.475	2.719	4.144	5.806	7.812	10.46	14.79	3.780	3.668
831105	1016	.3647	1.473	2.718	4.148	5.818	7.837	10.50	14.84	3.784	3.689
831105	1018	.3643	1.474	2.719	4.146	5.812	7.824	10.48	14.81	3.782	3.677
831105	1020	.3640	1.475	2.717	4.137	5.792	7.788	10.43	14.77	3.773	3.651
831105	1022	.3637	1.476	2.720	4.141	5.796	7.792	10.43	14.76	3.778	3.650
831105	1024	.3635	1.477	2.720	4.139	5.789	7.777	10.41	14.74	3.775	3.638
831105	1026	.3634	1.476	2.718	4.140	5.794	7.789	10.43	14.77	3.776	3.649
831105	1028	.3634	1.475	2.719	4.144	5.803	7.805	10.45	14.79	3.780	3.661
831105	1030	.3631	1.476	2.719	4.141	5.796	7.791	10.43	14.77	3.778	3.651
831105	1032	.3626	1.479	2.723	4.141	5.789	7.772	10.39	14.72	3.779	3.630
831105	1034	.3633	1.476	2.718	4.141	5.797	7.794	10.44	14.78	3.777	3.653
831105	1036	.3632	1.477	2.719	4.140	5.793	7.786	10.42	14.76	3.777	3.646
831105	1038	.3629	1.477	2.720	4.141	5.794	7.785	10.42	14.76	3.778	3.644
831105	1040	.3630	1.474	2.717	4.143	5.804	7.810	10.47	14.81	3.780	3.667
831105	1042	.3624	1.475	2.718	4.143	5.802	7.803	10.45	14.79	3.780	3.660
831105	1044	.3612	1.476	2.721	4.144	5.799	7.791	10.42	14.76	3.783	3.647
831105	1046	.3608	1.476	2.717	4.134	5.779	7.760	10.38	14.73	3.773	3.626
831105	1048	.3609	1.474	2.719	4.143	5.801	7.779	10.44	14.78	3.782	3.656
831105	1050	.3606	1.476	2.718	4.136	5.781	7.762	10.38	14.73	3.775	3.626
831105	1052	.3609	1.474	2.718	4.140	5.794	7.786	10.42	14.77	3.779	3.646
831105	1054	.3606	1.475	2.718	4.136	5.783	7.765	10.39	14.73	3.775	3.629
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Figure 4. Example of time series plot produced by SPCANL5.

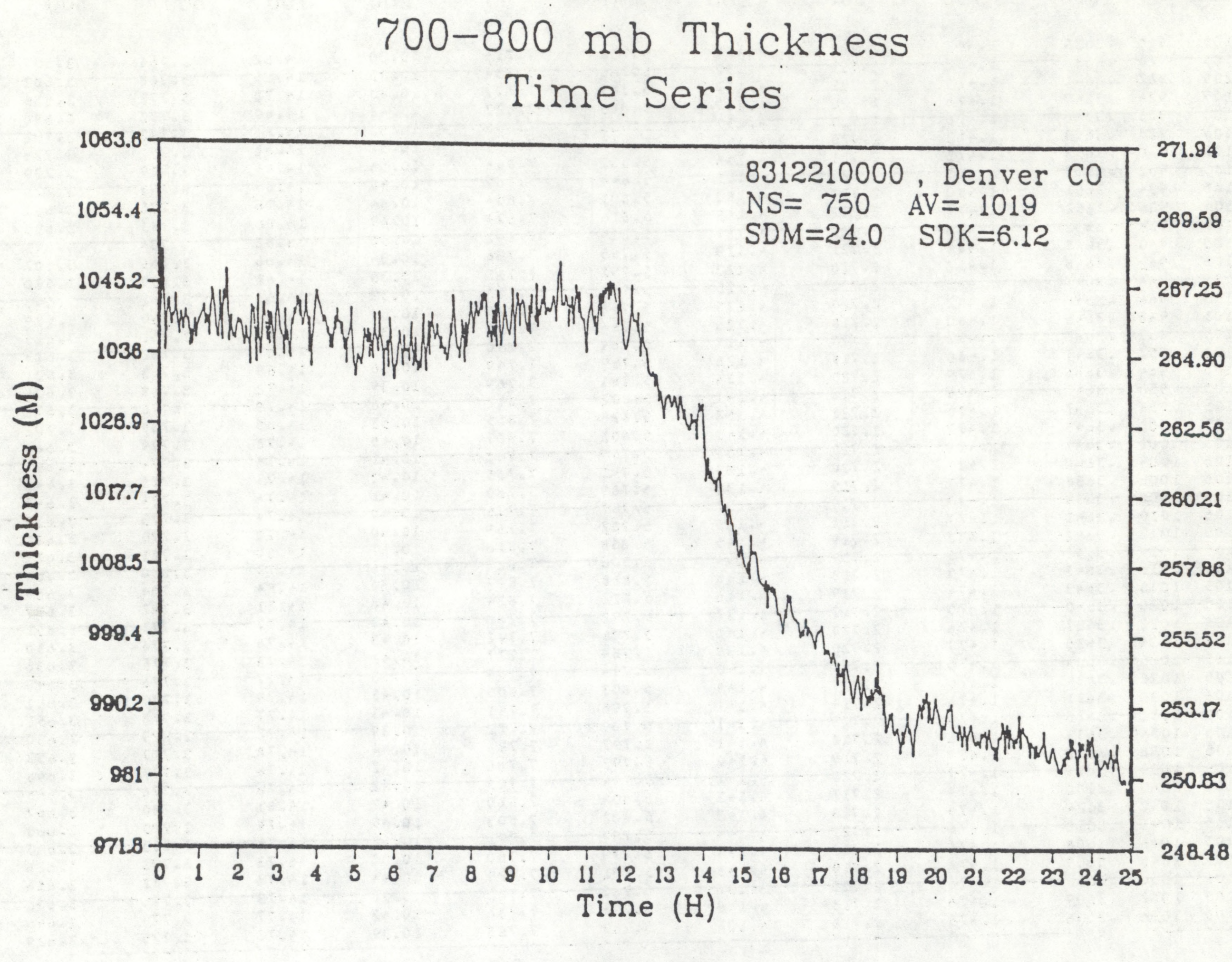
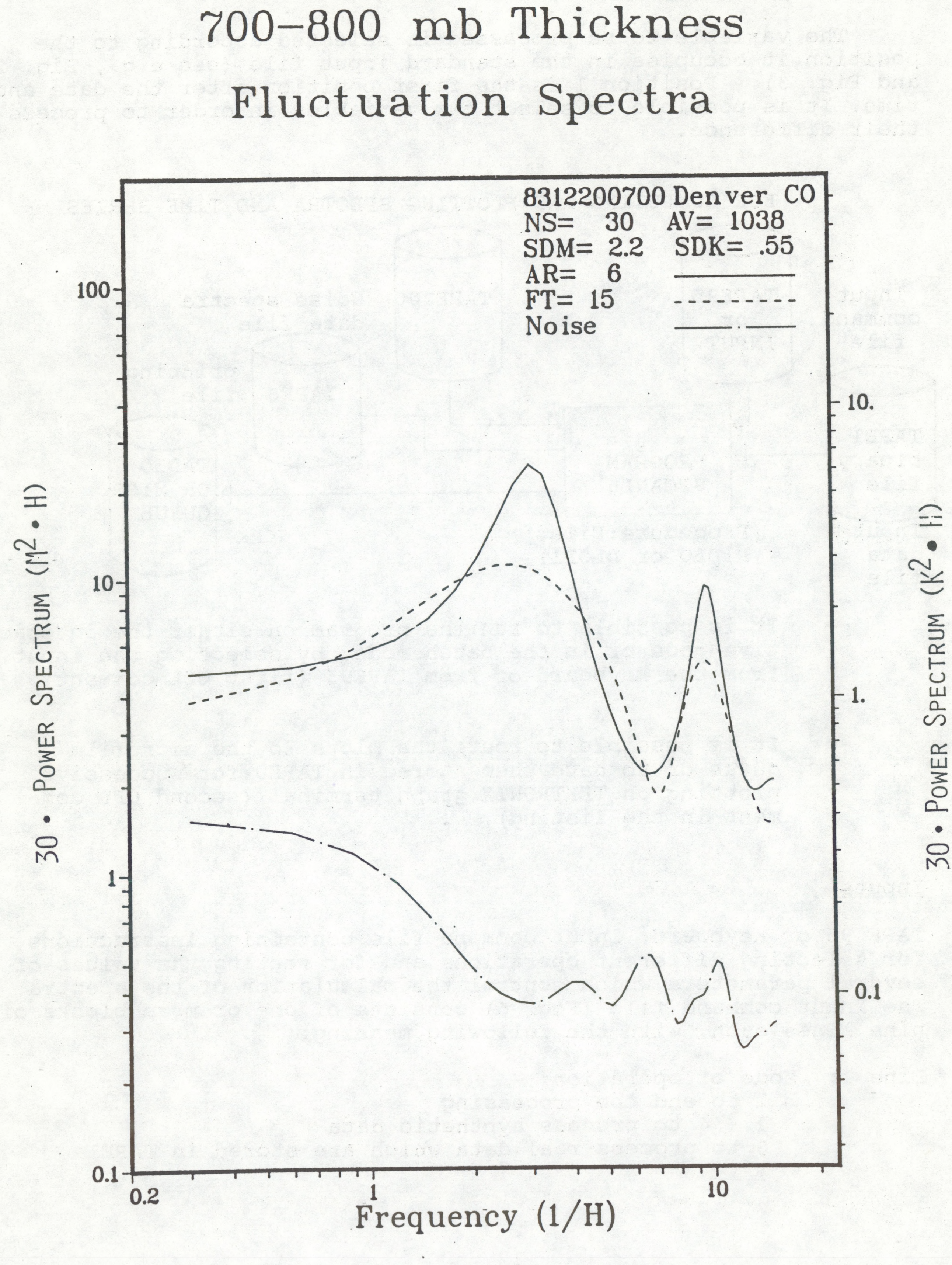


Figure 5. Example of spectral plot produced by SPCANL5.

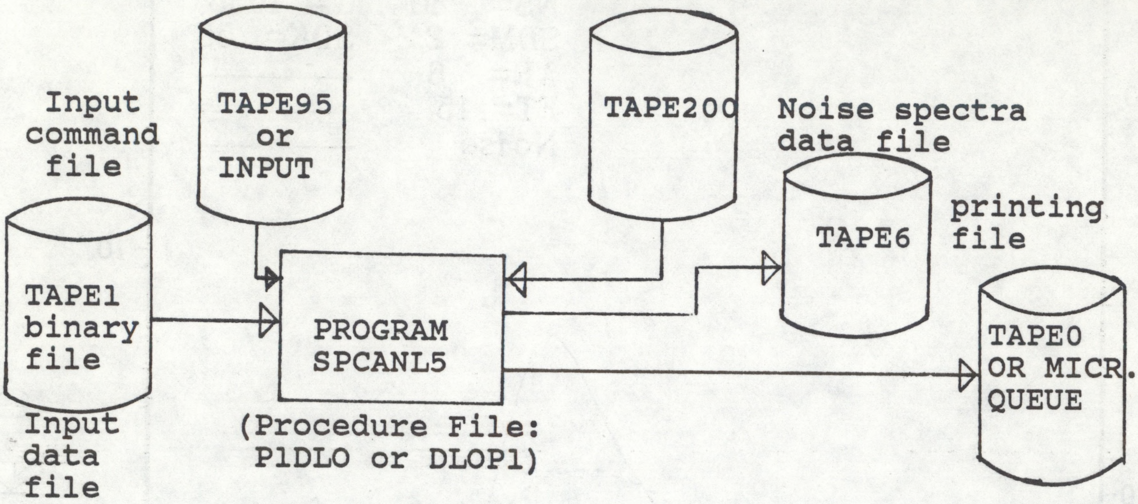


It is also possible to compute and plot $M \geq 1$ successive spectra, each of which is the average of $N \geq 1$ spectra.

A noise reference spectrum, read in from tape, can be drawn in each spectral plot.

The variable to be processed is selected according to the position it occupies in the standard input file (see e.g., Fig. 2 and Fig. 3). Position 1 is the first position after the date and time. It is possible to select two variables in order to process their difference.

FOR COMPUTING AND PLOTTING SPECTRA AND TIME SERIES



-- It is possible to run the program on either the interactive mode or in the batch mode, by selecting the input from the keyboard or from TAPE95 (first CFL comment).

-- It is possible to route the plots to the microfilm queue or to have them stored in TAPE0 for successive plotting on TEKTRONIX graph terminal (second CFL comment in the listing).

<u>Inputs</u>

TAPE 95 or Keyboard: Input command file containing instructions for selecting different operations and for setting the values of several parameters which control the calculation of the spectra. The input command file (Fig. 6) consists of one or more blocks of nine lines each, with the following meaning:

Line 1: Mode of operation:
- 1 to end the processing
- 2 - 4 to process synthetic data
- 5 to process real data which are stored in TAPE1

Figure 6. Example of input command file (TAPE95) for SPCANL5.

```
5
850704,0502,850704,0700
1
4,4
53.85 (B)RIGHTNESS (T)EMPERATURES$
100,0,50
3,1,0,0,0
0,0
12,0
5
850704,0502,850704,0700
1
5,5
55.45 (B)RIGHTNESS (T)EMPERATURES$
100,0,50
3,1,0,0,0
0,0
12,0
5
850704,0502,850704,0700
1
6,6
58.80 (B)RIGHTNESS (T)EMPERATURES$
100,0,50
3,1,0,0,0
0,0
12,0
1
831220,0432,831220,0630
1
9,9
(S)URFACE (P)RESSURES$
```

Note: the program keeps reading blocks of the input command file and processing data until it finds a "1" on Line 1 of a block of the input command file.

Line 2: Beginning date, time; ending date, time of the first data period to be processed.

Line 3: Enter "1" if the input data file (TAPE1) needs to be rewound in order to find the period of interest in a sequential scanning, otherwise enter "0".

Line 4: First parameter: position p_1 in the input data file (TAPE1) of the first variable to be processed.

Second parameter: position p_2 in the input data file of the second variable to be processed.

Note: if $p_1 = p_2$ only one variable is processed. If $p_1 \neq p_2$ the difference variable (p_2) - variable (p_1) is utilized in the processing. See example of input files for the meaning of the variables.

Line 5: Enter the name of the variable to be used as a title for the plot

Note 1: Capital letters have to be parenthesized
Note 2: The title must end with a "$"
Note 3: According to the content of Line 5, several options are selected:

IF the sequence of letters "MB" is present in Line 5 THEN

-- a secondary temperature Y-axis is traced
-- the title "POWER SPECTRUM (M**2*H)" is used for the spectrum plot.

IF the sequence of letters "EIGHT" is present in Line 5 THEN

-- the Y-title "HEIGHT (M)" is used for the time series plot

ELSE - the Y-title "THICKNESS (M)" is used for the time series plot

END IF

ELSE - the secondary temperature Y-axis is not traced the Y-title "POWER SPECTRUM" (without units) is used for the spectrum plot

IF the sequence of letters "RIGHTNES" is present in Line 5 THEN

-- the Y-title "BRIGHTNESS (K)" is used for the time series plot

ELSE IF the sequence of letters "EMPERATU" is present in Line 5 THEN

-- the Y-title "TEMPERATURE (C)" is used for the time series plot

ELSE - the Y-title "PRESSURE (MB)" is used for the time series plot

END IF

END IF

Line 6: First parameter: sets the threshold of the maximum acceptable difference between the values of two consecutive input data points. Any time a difference bigger than the threshold is found, the subroutine FILTER is called and the second data point is modified so that the new difference is equal to the selected threshold.

Second parameter: sets the length of the moving average filter applied to the data for detrending purposes

= 0: no moving average
= N: length of the filter equal to N - 1

Notes: N must be an odd number. N/2 data points are lost at the beginning of the period and N/2 points are lost at the end of the period. It is necessary to take this in account, modifying suitably the beginning and the ending time of the period in Line 2.

Third parameter: number of frequency points in the output spectra.

Fourth parameter: minimum value of the time series for plotting in absolute scale.

Fifth parameter: maximum value of the time series for plotting in absolute scale. If = 0, the program looks for the actual minimum and maximum.

Line 7: First parameter: number of consecutive data segments to be used for producing an average spectrum. The length of each segment is the same and is fixed in Line 2.

Second parameter: number of consecutive spectra to be computed. Each spectrum can be obtained by averaging over more than one data segment (according to the first parameter). See also Fig. 7.

Figure 7. Example of procedures to be used when adjacent segments of data are processed to obtain spectra.

```
>INPUT START DAY,TIME, END DAY,TIME 2(YRMODA,HRMI)
? 850704,0802,850704,1000

---+----+------------------------------------------  TAPE1

>INPUT # OF SPECTRA TO BE AVERAGED, ELABORATED (NAVE,NSPE);
 MIN,MAX,NOISE (YMI,YMA,INPS)
? 1,1,X,X,X

850704,0802  850704,1000

   1sp.
---+----+------------------------------------------  TAPE1
```

1 Spectrum is computed and plotted for the selected period.

```
? 3,1,X,X,X

850704,0802            850704,1400

   1sp. 2sp. 3sp.
---+----+----+----+--------------------------------  TAPE1

  average spect.
```

3 Spectra are computed: the first spectrum is computed for the selected period, the second and the third spectra are computed for the succeeding periods. Then the average spectrum is plotted.

```
? 1,2,X,X,X

850704,0802            850704,1200

   1sp. 2sp.
---+----+----+-------------------------------------  TAPE1
```

2 Spectra, for the selected time period and for the succeeding period, are computed and plotted.

```
? 2,3,X,X,X

850704,0802                      850704,2000

   1sp. 2sp. 3sp. 4sp. 5sp. 6sp.
---+----+----+----+----+----+----+-----------------  TAPE1

   1 av.sp.  2 av.sp.  3 av.sp.
```

3 Average spectra are computed and plotted, each of which is obtained averaging 2 successive spectra.

Third parameter: minimum value of the spectrum for plotting in absolute scale.

Fourth parameter: maximum value of the spectrum for plotting in absolute scale. If = 0, the program looks for the actual minimum and maximum.

Fifth parameter: 1 if the noise spectra, read in from TAPE200, are to be plotted, = 0 otherwise.

Line 8: First parameter: 1 if the four Fourier spectra produced by FSPMS are to be computed and plotted, = 0 otherwise.

Second parameter: IF first parameter = 1 THEN: = 1 if the printer graphic produced by FSPMS is required, = 0 otherwise.

ELSE = 0 always.

Note: the four Fourier spectra are computed using an autocovariance function of length m = N/16, N/8, N/4 and N/2, where N = number of input data points.

Line 9: First parameter: order of the autoregressive model for the subroutine ASPS.

Note: if = 0 the order is selected automatically, if <0 no autoregressive spectrum is computed. The criterion for an automatically selected order is discussed in the STAR5 users guide.

Second parameter: IF first parameter > 0 THEN: = 1 if the printer graphic produced by ASPS is required, = 0 otherwise.

ELSE = 0 always.

Note: ASPS produces an AR spectrum and a Fourier spectrum which is computed from an autocovariance function of length m = N/2.

TAPE1: binary input data file containing the pressure height or Profiler time series. It is the file produced by FLISOB or FLPROF.

EX: NV83IS2 or NV83PFL

JL84IS2 or JL84PFL

TAPE200: input data file containing the Fourier noise spectra.

Note: TAPE201 contains 7 50-point noise spectra, for the standard thicknesses, computed using a 9-point Profiler data vector. This tape can be read in by setting NT=7 in the PARAMETER statement of SPCANL5.

TAPE202 contains 7 50-point noise spectra, for the standard thicknesses, computed using a 8-point Profiler data vector. This tape can be read in by setting NT=7 in the PARAMETER statement of SPCANL5.

TAPE205 contains 2 50-point noise spectra, for the 500-800 mb thicknesses and the 500 mb height, computed using a 9-point Profiler data vector. This tape can be read in by setting NT=2 in the PARAMETER statement of SPCANL5.

Outputs

OUTPUT or CRT screen: prompts from inputs, error messages.

TAPE6: output print file containing departures from the mean value of the input data, standard deviations and spectra.

TAPE0: output plot file created when the TEKTRONIX output option is selected.

Microfilm queue: output plot file when the MCRFLM output option is selected.

SPCANL5 can be executed either in batch mode, using the procedure file P1DLO (see Appendix B), or in interactive mode, using the procedure file DLOP1 (see Appendix B). Both procedure files need to be edited in order to use the correct names for the input and output files.
EX.:

```
GET,P1DLO
(optional edit of P1DLO)
SUBMIT,P1DLO
```

or

```
GET,DLOP1
(optional edit of DLOP1)
DLOP1
```

VI. Program FLPROF1

In the new format (in use after August 1, 1984) of the Profiler data file (Fig. 8) the time is expressed in hours,

Figure 8. New Profiler data file representing data taken after August 1, 1984. Note that only two calibration times are missing per hour and that calibration can occur at any time within an hour. Also note that data are sampled quasi-periodically, with a 6-sec shift occurring between adjacent calibration periods.

YRMODA	HRMISS	TB (20.6)	TB (31.65)	TB (52.80)	TB (53.85)	TB (55.45)	TB (58.80)	TS	DD	P
850703	003731	26.23	14.62	157.63	234.96	290.28	296.50	27.68	3.03	843.10
850703	003931	26.29	14.75	157.51	234.98	290.27	296.88	27.68	3.34	843.11
850703	004131	26.42	14.83	157.83	235.23	289.43	296.94	27.65	3.70	843.13
850703	004331	26.62	14.94	157.78	235.62	289.98	296.69	27.64	3.70	843.15
850703	004531	26.95	14.95	157.47	235.28	289.74	296.59	27.65	3.57	843.14
850703	004731	27.12	14.97	156.97	234.58	289.88	296.64	27.80	3.73	843.15
850703	004931	27.06	15.18	156.60	235.58	289.95	296.69	28.08	4.11	843.17
850703	005131	27.41	15.10	156.48	235.27	290.11	296.68	27.99	4.26	843.21
850703	005331	27.67	15.13	156.35	235.59	289.70	296.72	27.78	4.13	843.22
850703	005531	27.36	15.10	156.44	235.12	289.94	296.77	27.60	3.79	843.18
850703	005731	26.81	15.10	156.53	235.49	289.95	296.63	27.44	3.68	843.16
850703	005931	26.89	15.04	157.16	235.03	289.72	296.67	27.33	3.74	843.17
850703	010131	26.62	14.94	157.76	235.18	290.04	296.58	27.26	3.75	843.21
850703	010331	26.78	14.87	157.06	235.03	290.22	296.46	27.18	3.58	843.21
850703	010531	26.80	15.25	158.55	235.25	289.55	296.57	27.05	3.49	843.21
850703	010731	26.64	15.03	158.34	235.37	290.26	296.50	26.96	3.51	843.21
850703	010931	26.61	14.97	158.56	235.28	289.98	296.39	26.89	3.34	843.21
850703	011131	26.80	15.41	158.84	235.57	290.37	296.62	26.77	3.20	843.21
850703	011331	26.96	15.40	158.02	235.44	289.77	296.32	26.55	3.43	843.21
850703	011937	26.69	15.13	158.83	235.54	289.36	296.56	26.08	3.93	843.21
850703	012137	26.96	14.94	158.94	235.65	289.79	296.49	25.97	4.05	843.21
850703	012337	27.13	15.18	158.82	235.21	289.80	296.36	25.66	4.42	843.20
850703	012537	27.11	15.17	158.67	234.84	290.07	296.36	25.57	4.69	843.19
850703	012737	26.90	15.39	159.78	234.92	289.81	296.50	25.45	4.71	843.17
850703	012937	26.94	15.42	160.67	235.50	289.95	296.53	25.38	4.62	843.16
850703	013137	26.90	15.53	160.87	235.41	289.40	296.25	25.24	4.61	843.16
850703	013337	27.15	15.52	161.11	235.56	290.05	296.41	25.03	4.64	843.16
850703	013537	27.40	15.45	160.12	235.61	289.92	296.37	24.91	4.72	843.17
850703	013737	27.57	15.34	159.58	234.70	289.87	296.43	24.75	4.90	843.21
850703	013937	27.53	15.51	158.74	234.85	289.50	296.31	24.63	4.92	843.22
850703	014137	27.35	15.63	159.67	235.47	289.36	296.24	24.64	4.87	843.25
850703	014337	27.19	15.56	158.65	235.41	289.43	296.20	24.88	4.68	843.27
850703	014537	27.33	15.42	157.65	234.99	289.60	296.18	25.03	4.23	843.28
850703	014737	27.06	15.23	157.32	234.81	289.46	296.38	25.10	4.19	843.28
850703	014937	26.90	14.97	158.47	235.80	289.58	296.29	24.97	4.58	843.28
850703	015137	27.12	15.02	157.55	235.52	289.83	296.20	24.66	5.55	843.26
850703	015337	27.12	15.19	157.44	234.39	289.44	296.32	24.44	6.06	843.25
850703	015537	26.78	15.16	158.23	234.98	289.46	296.26	24.32	5.97	843.24
850703	015737	26.60	15.28	159.33	235.23	289.57	296.43	24.22	5.52	843.21
850703	015937	26.47	15.24	159.54	235.05	289.46	296.29	24.22	5.24	843.21
850703	020137	26.62	15.81	160.28	235.47	289.82	296.01	24.16	5.12	843.21
850703	020337	27.23	16.76	160.76	235.81	289.73	296.20	24.19	5.36	843.24

minutes and seconds. In addition, the calibration cycle can take place any time during the hour.

FLPROF1 has the same mode of operation as FLPROF. The relevant differences are the following:

- The procedure file is P3FLP1 (see Appendix C for the listing).

- Beginning and ending times have to be input using the format (YRMODA,HRMISS).

- There are no restrictions for the beginning and ending times. If a calibration cycle is found at the beginning of the selected period, the program aborts after outputting a message to the screen.

- The program identifies gaps in the data file and outputs a message to the screen.

VII. Program FLISOB1

In the new format of the Profiler data file (Fig. 8) the time is expressed in hours, minutes and seconds. In addition, the calibration cycle can take place any time during the hour.

FLISOB1 has the same mode of operation as FLISOB. The relevant differences are the following:

- The procedure file is P3FLI1 (see Appendix C for the listing).

- Beginning and ending times have to be input using the format (YRMODA,HRMISS).

- There are no restrictions for the beginning and ending times. If a calibration cycle is found at the beginning of the selected period, the program aborts after outputting a message to the screen.

- The program identifies gaps in the data file and outputs a message to the screen.

VIII. Program FLPROF2

The dual channel radiometer data file has the format shown in Fig. 9.

FLPROF2 has the same mode of operation as FLPROF1. The relevant differences are the following:

Figure 9. Dual-channel radiometer data file.

MODE	DAY	HRMISS	EL	AZ	TB (20.6)	TAU (20.6)	TB (31.65)	TAU (31.65)	V	L
0	133	35225	898	3498	1617	4933	1275	3672	97	0
0	133	35230	898	3498	1601	4873	1344	3934	91	0
0	133	35235	900	3498	1575	4774	1293	3740	91	0
0	133	35240	900	3498	1591	4832	1359	3990	89	0
0	133	35245	900	3498	1577	4782	1359	3992	88	0
0	133	35250	900	3498	1619	4942	1272	3659	97	0
0	133	35255	900	3500	1612	4913	1414	4202	89	0
0	133	353 0	900	3500	1622	4951	1369	4029	92	0
0	133	353 5	900	3500	1556	4700	1232	3509	92	0
0	133	35310	900	3500	1598	4862	1270	3654	95	0
0	133	35315	898	3498	1635	5002	1314	3819	97	0
0	133	35320	898	3498	1566	4741	1224	3480	93	0
0	133	35325	898	3498	1659	5093	1265	3533	102	0
0	133	35330	898	3498	1588	4821	1408	4178	86	0
0	133	35335	898	3498	1651	5063	1225	3482	103	0
0	133	35340	900	3500	1630	4983	1293	3742	97	0
0	133	35345	900	3498	1609	4902	1297	3755	95	0
0	133	35350	900	3498	1585	4813	1328	3872	90	0
0	133	35355	900	3500	1588	4822	1240	3541	95	0
0	133	354 0	900	3500	1551	4681	1234	3516	91	0
0	133	354 5	900	3500	1614	4922	1311	3808	95	0
0	133	35410	900	3500	1583	4803	1285	3710	92	0
0	133	35415	900	3500	1559	4713	1325	3862	87	0
0	133	35420	898	3498	1596	4853	1269	3648	95	0
0	133	35425	898	3498	1583	4802	1197	3377	97	0
0	133	35430	898	3498	1559	4712	1316	3827	88	0
0	133	35435	898	3498	1575	4773	1245	3558	93	0
0	133	35440	898	3498	1580	4794	1304	3783	91	0
0	133	35445	900	3498	1565	4733	1254	3592	92	0
0	133	35450	900	3498	1564	4733	1287	3719	90	0
0	133	35455	900	3500	1591	4832	1389	4104	88	0
0	133	355 0	900	3500	1633	4993	1360	3995	94	0
0	133	355 5	900	3500	1588	4823	1295	3748	92	0
0	133	35510	900	3500	1581	4795	1263	3627	93	0
0	133	35515	900	3500	1578	4784	1307	3795	90	0
0	133	35520	900	3500	1536	4623	1317	3830	85	0
0	133	35525	898	3498	1586	4814	1209	3422	96	0
0	133	35530	898	3498	1583	4803	1385	4089	87	0
0	133	35535	898	3498	1604	4882	1304	3783	94	0
0	133	35540	898	3498	1617	4932	1399	4146	90	0
0	133	35545	898	3498	1559	4711	1273	3663	90	0
0	133	35550	900	3500	1606	4891	1263	3627	96	0
0	133	35555	900	3498	1645	5040	1331	3885	97	0
0	133	356 0	900	3500	1599	4863	1287	3718	94	0
0	133	356 5	900	3500	1617	4932	1353	3967	93	0
0	133	35610	900	3500	1588	4821	1272	3659	93	0
0	133	35615	900	3500	1553	4691	1228	3496	92	0
0	133	35620	900	3500	1585	4812	1288	3723	92	0

- The procedure file is P3FLP2 (see Appendix C for the listing).

- Beginning and ending times have to be input using the format (DDD,HRMOSS), where DDD is the Julian day.

- The program does not bogus data.

IX. Program SPCANS2

SPCANS2 plots time series and computes and plots Fourier and Autoregressive spectra of 5-second data samples that are stored in a file with a standard format.

SPCANS2 has the same mode of operation as SPCANL5. The relevant differences are the following:

- The input command file TAPE95 (see Fig. 10) has blocks of 10 lines, since an extra line has to be used, after line 5, for inputting the location of the experiment.

- Beginning and ending times, in line 2, have to be input using the format (DDD,HHMMSS), where DDD is the Julian day.

- Several additional patterns are identified in line 5.

  IF the sequence of letters "APOR" is present in Line 5 THEN

    -- the Y-title "Water Vapor (cm)" is used for the time series plot

  ELSE IF the sequence of letters "IQUI" is present in Line 5 THEN

    -- the Y-title "Liquid Water (mm)" is used for the time series plot

  ELSE IF the sequence of letters "BSOR" is present in Line 5 THEN

    -- the Y-title "Absorption (nepers)" is used for the time series plot

Figure 10. Example of input command file (TAPE95) for SPCANS2.

```
5
133,035145,133,051030
0
7,7
(W)ATER (V)APORS
(M)IDLANDS
0,0,300,0,0
1,1,0,0,0
0,0
70,0
5
133,035145,133,051030
1
3,3
20.6 (B)RIGHTNESS (T)EMPERATURES
(M)IDLANDS
0,0,300,0,0
1,1,0,0,0
0,0
70,0
1
```

Appendix A. Listing of EXCHANG, P3FLI, P3FLP

```
************************************************************
      PROGRAM EXCHANG(INPUT,OUTPUT,TAPE1,TAPE2)
      DIMENSION X(10),Y(10)
      DO 1 I=1,10
      READ(1) X
      Y(1)=X(1)
      Y(2)=X(8)
      Y(3)=X(9)
      Y(4)=X(10)
      DO 2 J=5,7
    2 Y(J)=X(J)
      Y(8)=X(2)
      Y(9)=X(4)
      Y(10)=X(3)
    1 WRITE(2) Y
      STOP
      END
************************************************************
************************************************************
************************************************************
************************************************************
************************************************************
************************************************************
.PROC,P3FLI.
RETURN,*.
UNLOAD,*.
GET,FLISOB.
FTN5,I=FLISUB,L=0.
GET,TAPE1=DCCOEF2.
ATTACH,TAPE2=TBDC83.
LGO.
REPLACE,TAPE6=PIPPO.
REVERT.
EXIT.
REVERT,ABORT.
************************************************************
************************************************************
************************************************************
************************************************************
************************************************************
************************************************************
.PROC,P3FLP.
RETURN,*.
UNLOAD,*.
GET,FLPRBIN.
ATTACH,TAPE2=TBJL84.
FLPRBIN.
REPLACE,TAPE6=PIPPO.
REVERT.
EXIT.
REVERT,ABORT.
************************************************************
************************************************************
```

Appendix B. Listing of P1DLO and DLOP1

```
/JOB
P1DLO(T1000)
ACCOUNT(CIOTTI,R454,WPL)
CHARGE(ZRM2A8243,Z)
HEADING.    RB3 X6866
HEADING.    P.CIOTTI
HEADING.   MID133.
ROUTE(OUTPUT,DC=PR,UN=RB3TRM,FM=NOAA,DEF)
GET,LGO=SPCBIN2.
GET(TAPE95=TAPE104)
GET,TAPE20C=TAPE201.
IF,FILE(STAR5,.NOT.AS).ATTACH,STAR5/UN=CAMLIB.
IF,FILE(IMSL,.NOT.AS).ATTACH,IMSL/UN=LIB.
IF,FILE(GRAFING,.NOT.AS).GET(GRAFING/UN=GRAF)
IF,FILE(TAPE1,.NOT.AS).GET,TAPE1=SNI133.
BEGIN,DISSPLA,GRAFING,PLOTTER=MCRFLM,LOADMAP=MAP,
         LS1=$LDSET,LIB=STAR5/IMSL.$.
REWIND,TAPE6,TAPE95.
COPYSBF,TAPE95.
COPYSBF,TAPE6.
DAYFILE=DAY.
REPLACE,DAY.
EXIT.
REWIND,TAPE6,TAPE95.
COPYSBF,TAPE95.
COPYSBF,TAPE6.
DAYFILE=DAY.
REPLACE,DAY.
```

```
.PROC,DLO.
RETURN,*.
GET,LGO=SPCBINT.
.*FTN5,I=SPCANL5,L=PIPPO.
IF,FILE(STAR5,.NOT.AS).ATTACH,STAR5/UN=CAMLIB.
IF,FILE(IMSL,.NOT.AS).ATTACH,IMSL/UN=LIB.
.* LIBRARY(STAR5,IMSL)
IF,FILE(GRAFING,.NOT.AS).GET(GRAFING/UN=GRAF)
GET,TAPE20C=TAPE205.
GET,TAPE95=TAPE104.
IF,FILE(TAPE1,.NOT.AS).GET,TAPE1=SNI133.
BEGIN,DISSPLA,GRAFING,PLOTTER=TEKTRN,LOADMAP=MAP,
         LS1=$LDSET,LIB=STAR5/IMSL.$.
REWIND,TAPE0.
COPY,TAPE0.
REVERT.
EXIT.
REVERT,ABORT.
```

Appendix C. Listing of P3FLP1, P3FLI1, P3FLP2

```
.PROC,P3FLP1.
RETURN,*.
UNLOAD,*.
GET,FLPRBIN=FLPRB1.
GET,TAPE2=TBJL85.
FLPRBIN.
REPLACE,TAPE6=PIPPO.
REVERT.
EXIT.
REVERT,ABORT.
**************************************************************
**************************************************************
**************************************************************
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**************************************************************
**************************************************************
**************************************************************
**************************************************************
.PROC,P3FLI1.
RETURN,*.
UNLOAD,*.
GET,FLISOB1.
FTN5,I=FLISOB1,L=0.
GET,TAPE1=JLCOEF2.
GET,TAPE2=TBJU85.
LGO.
REPLACE,TAPE6=PIPPO.
REVERT.
EXIT.
REVERT,ABORT.
**************************************************************
**************************************************************
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**************************************************************
**************************************************************
.PROC,P3FLP2.
RETURN,*.
UNLOAD,*.
GET,FLPRBIN=FLPRB2.
GET,TAPE2=MID133.
FLPRBIN.
REPLACE,TAPE6=PIPPO.
REVERT.
EXIT.
REVERT,ABORT.
**************************************************************
**************************************************************
**************************************************************
```