IUE Low Dispersion Sensitivity Monitoring XVI.

Introduction

The low dispersion sensitivity monitoring analysis for the LWP, LWR, and SWP cameras has been updated to March 1989. An error in the method of analysis for the LWP camera was recently discovered. Previously (e.g. Garhart, et. al., 1989), the data was normalized to the maximum flux of all the bins rather than to the maximum flux in each bin. This resulted in grossly erroneous degradation readings at all wavelengths (e.g. too low a rate). The new rates, along with the corrected rates for previous years, have been included in this report. In addition, the flux is now ratioed to a reference spectrum before being fit with the regression, and the LWP database includes only those images processed with the new ITF. The analysis for the LWR and SWP cameras was not affected by this error. The following stars are used to monitor changes in camera sensitivity:

BD+28° 4211, HD 93521, HD60753, BD+33° 2642, BD+75° 325.

The symbols for each star are, respectively:

$+ , * , \diamond , \square , \Delta .$

Analysis

The sensitivity data are analyzed using the standard methods as described by Holm and Schiffer (1980). The data are ratioed to a reference spectrum for each star (listed in Table 3) and placed into three wavelength bins, each 150Å wide (300Å for the LWR). The binned flux ratios are then fit with a multiple linear regression to find the rate of change (%/yr.) in each wavelength region and the overall temperature dependence (%/°C) of the camera. The temperature dependence is assumed to be time independent and is fit to the head amplifier temperature (THDA). The fifth standard, BD+75° 325, is not included in the SWP sensitivity monitoring analysis. The temperature and time dependent coefficients for the three cameras are listed in Table 1. The data are normalized to 1978 and corrected for camera temperature (THDA) dependence before being plotted in Figures 1-4.

Results

The sensitivity results, as shown in Table 2, are derived if one assumes a starting date of 1984.5 for the regression, as it was about this time that the LWP became the primary long wavelength camera. These values show an increased downward trend in camera sensitivity for the LWP over all bandpasses as compared to previous results. In the case of the LWR, the new rates are appproximately half their original values. The plots in Figures 1, 2, and 3 confirm these numbers by comparing the linear fit to all the data (line #2) to the new

sensitivity figures (line #1). These new values probably represent the actual degradation of the cameras since the time of the switchover.

The rate of the LWR sensitivity degradation appears to be slowing over the years, as evidenced by the data in Table 1. This decrease may be tied to the fact that the camera is shut off for long periods of time. Figure 6 is included as a comparison between the -4.5 kV UVC and the -5.0 kV UVC data.

The SWP degradation rates exhibit little or no change over previous values, which is most pronounced in the long wavelength region of the camera when one examines the data as shown in Table 1. The degradation values in this region have remained steady for the past two years.

The camera head amplifier temperatures (THDA) are also monitored for temporal variations and are plotted in Figure 5. When the least-squares analysis is restricted to dates after 1981 (1983 for the LWP), the statistical increase in camera temperatures is less than 1%/yr.

Matthew P. Garhart

Terry J. Teays

11 April 1989

Holm, A.V., and Schiffer, F.H., 1980, "IUE Camera Sensitivity Variations", NASA IUE Newsletter No. 9, p. 8

Garhart, M.P., Oliversen, N.A., and Teays, T.J., 1989, "IUE Low Dispersion Sensitivity Monitoring XV.", NASA IUE Newsletter No. 37, p. 71

Table 1.

Results of low dispersion camera sensitivity analysis - Mar. 1989

LWP Camera

Temperature dependence = -0.18 ± 0.03 %/°C
RMS error for a single observation = 5.5 %
375 data points used in regression

Wavelength Region (Å)	Time Dependence (%/yr.) 1980.4 through 1989.2	1988.4	1987.7	1986.4	1985.3	1984.2
2075 - 2225	-0.33±0.05	+0.01±0.07	+0.16±0.08	+0.56±0.12	+0.90±0.16	+0.19±0.20
2225 - 2375	-1.07±0.05	-0.87±0.07	-0.73±0.08	-0.52±0.12	-0.31±0.16	-1.25±0.20
2375 - 2525	-0.97±0.05	-0.74±0.07	-0.61±0.08	-0.43±0.12	-0.22±0.16	-0.75±0.20
2525 - 2675	-1.04±0.05	-0.87±0.07	-0.74±0.08	-0.45±0.12	-0.06±0.16	-0.44±0.20
2675 - 2825	-0.96±0.05	-0.83±0.07	-0.72±0.08	-0.50±0.12	-0.18±0.16	-0.40±0.20
2825 - 2975	-0.75±0.05	-0.57±0.07	-0.47±0.08	-0.27±0.12	+0.07±0.16	-0.03±0.20

LWR Camera

Temperature dependence = -0.85 ± 0.04 %/°C
RMS error for a single observation = 3.5 %
376 data points used in regression
-5.0 kV UVC = 309 data pts.
-4.5 kV UVC = 67 data pts.

Wavelength Region (Å)	Time dependence (%/yr.) 1978.4 through 1989.2	1988.1	1987.7	1986.4	1985.3	1984.2
2250 - 2550	-1.99±0.04	-2.06±0.04	-2.34±0.05	-2.49±0.08	-2.23±0.10	-2.45±0.09
2550 - 2650	-1.50±0.04	-1.51±0.04	-1.65±0.05	-1.73±0.08	-1.69±0.10	-1.36±0.09
2750 - 3050	-1.35±0.04	-1.34±0.04	-1.55±0.05	-1.73±0.08	-1.84±0.10	-1.35±0.09

SWP Camera

Temperature dependence = -0.44 ± 0.03 %/°C
RMS error for a single observation = 3.2 %
383 data points used in regression

Wavelength Region (Å)	Time dependence (%/yr.) 1979.5 through 1989.2	1988.7	1987.7	1986.3	1985.3	1984.2
1225 - 1375	-0.79±0.03	-0.75±0.04	-0.69±0.04	-0.66±0.06	-0.69±0.08	-0.72±0.13
1475 - 1625	-0.50±0.03	-0.47±0.04	-0.38±0.04	-0.22±0.06	-0.17±0.08	-0.16±0.13
1775 - 1925	-0.79±0.03	-0.79±0.04	-0.78±0.04	-0.69±0.06	-0.63±0.08	-0.86±0.13

Table 2.

Comparison of camera degradation rates

LWP Camera
Time Dependence (%/yr.)

Wavelength Region (Å)	1980.4 1989.2	1984.5 1989.2
2075 - 2225	-0.33±0.05	-1.26±0.08
2225 - 2375	-1.07±0.05	-1.81±0.08
2375 - 2525	-0.97±0.05	-1.68±0.08
2525 - 2675	-1.04±0.05	-1.72±0.08
2675 - 2825	-0.96±0.05	-1.49±0.08
2825 - 2975	-0.75±0.05	-1.26±0.08

LWR Camera
Time dependence (%/yr.)

Wavelength Region (Å)	1978.4 1989.2	1984.5 1989.2
2250 - 2550	-1.99±0.04	-0.98±0.12
2550 - 2650	-1.50±0.04	-0.82±0.12
2750 - 3050	-1.35±0.04	-0.65±0.12

Table 3.

Reference Stars used for normalization

STAR	**LWP**	date	**LWR**	date	**SWP**	date
BD+28° 4211	3688	1984.5	1712	1978.5	2139	1978.6
HD 93521	3535	1984.4	1589	1978.4	1955	1978.5
HD 60753	3689	1984.5	1642	1978.4	1752	1978.3
BD+33° 2642	3610	1984.5	2137	1978.6	4003	1979.1
BD+75° 325	3537	1984.4	2748	1978.8		

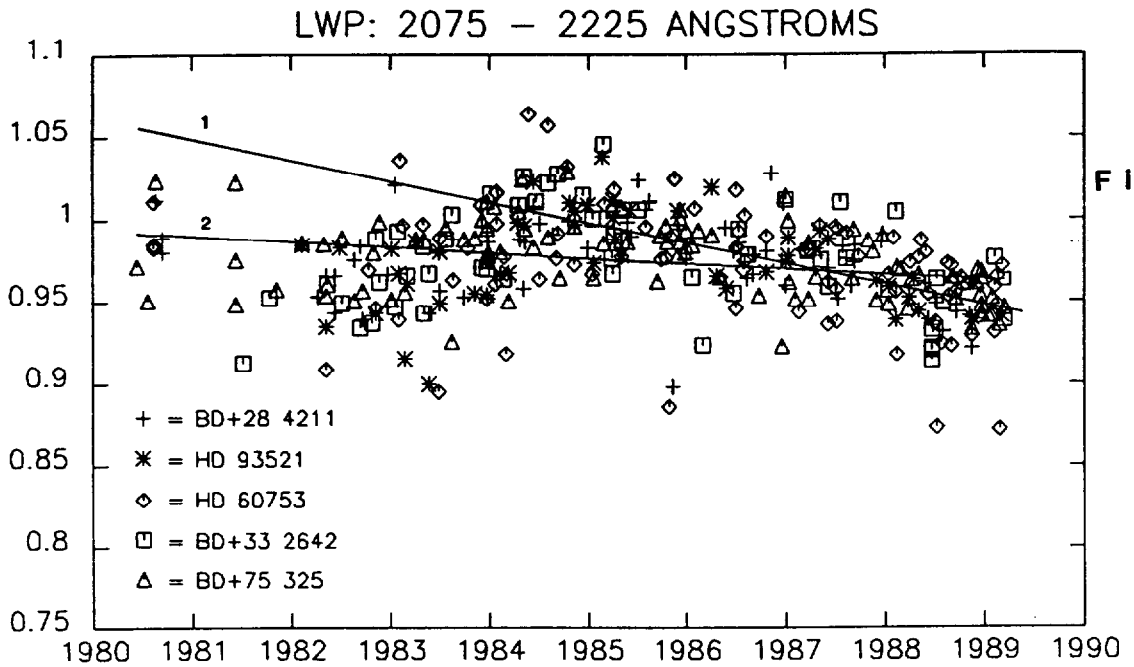
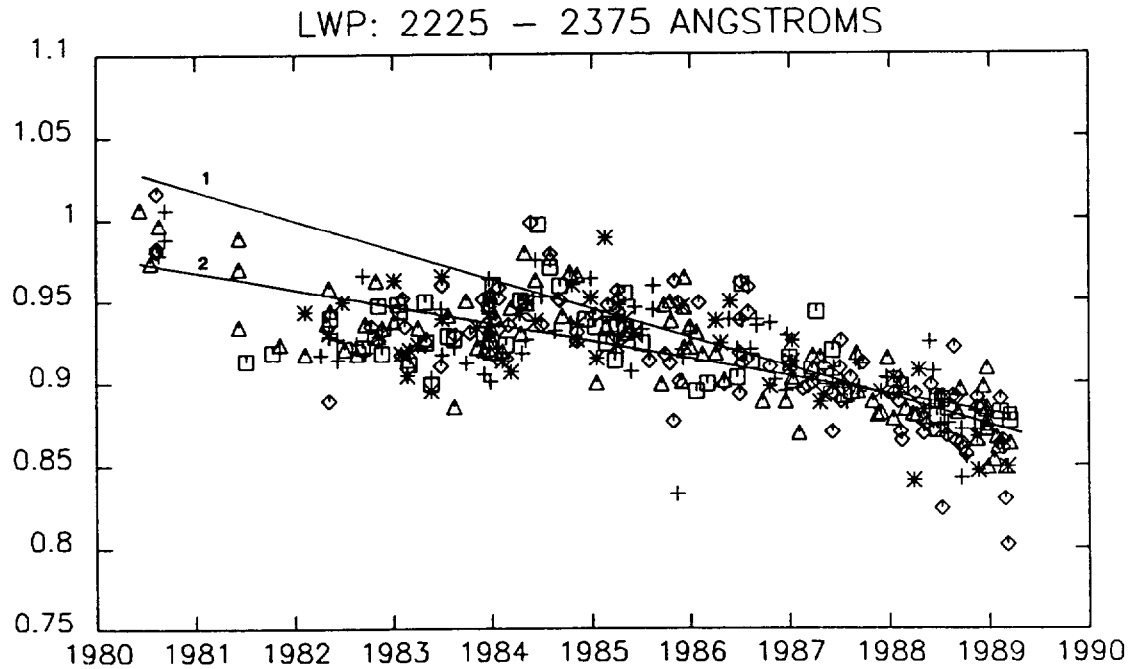

LWP: 2075 – 2225 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2
+ = BD+28 4211
* = HD 93521
◇ = HD 60753
□ = BD+33 2642
△ = BD+75 325

Figure 1


LWP: 2225 – 2375 ANGSTROMS
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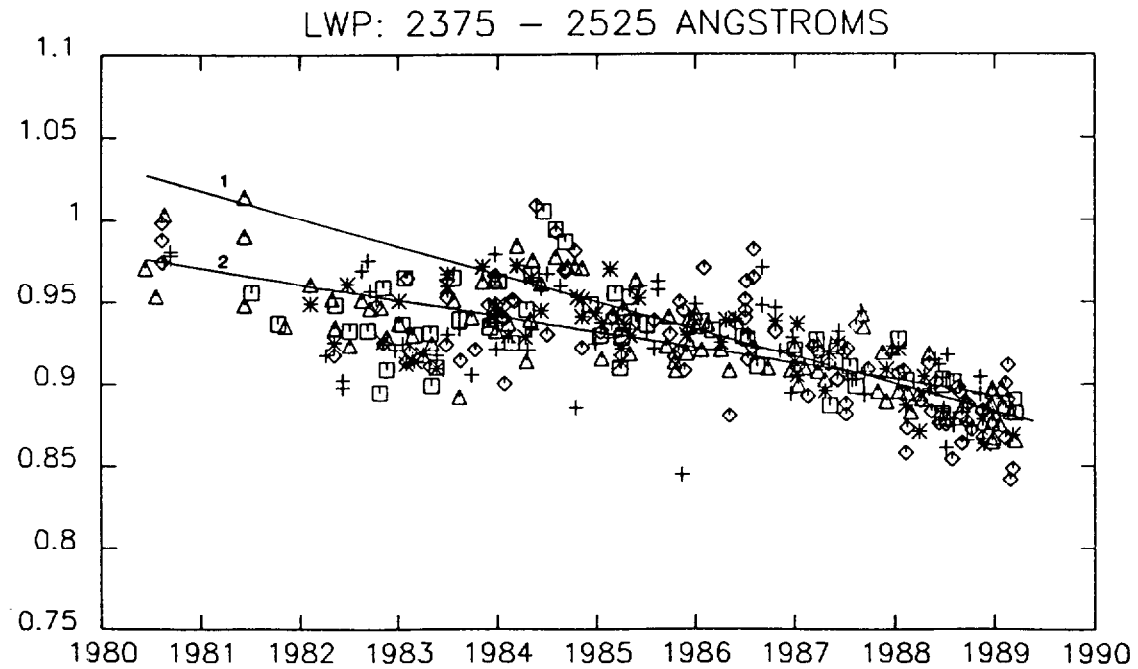
0.9
0.85
0.8
0.75
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2


LWP: 2375 – 2525 ANGSTROMS
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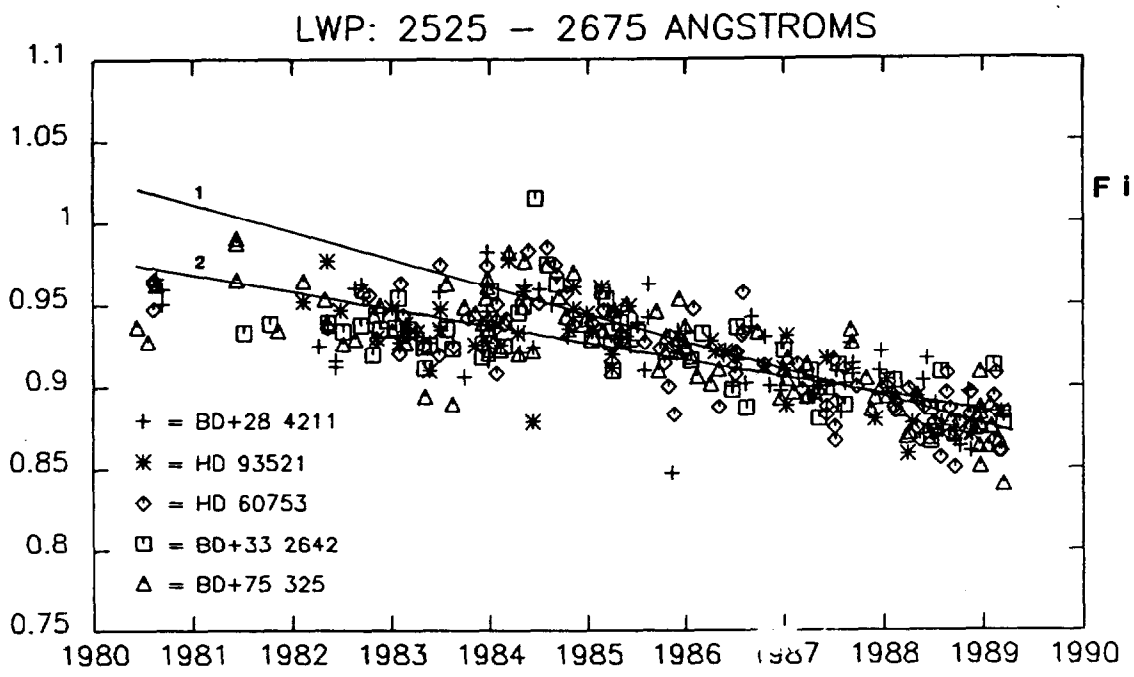
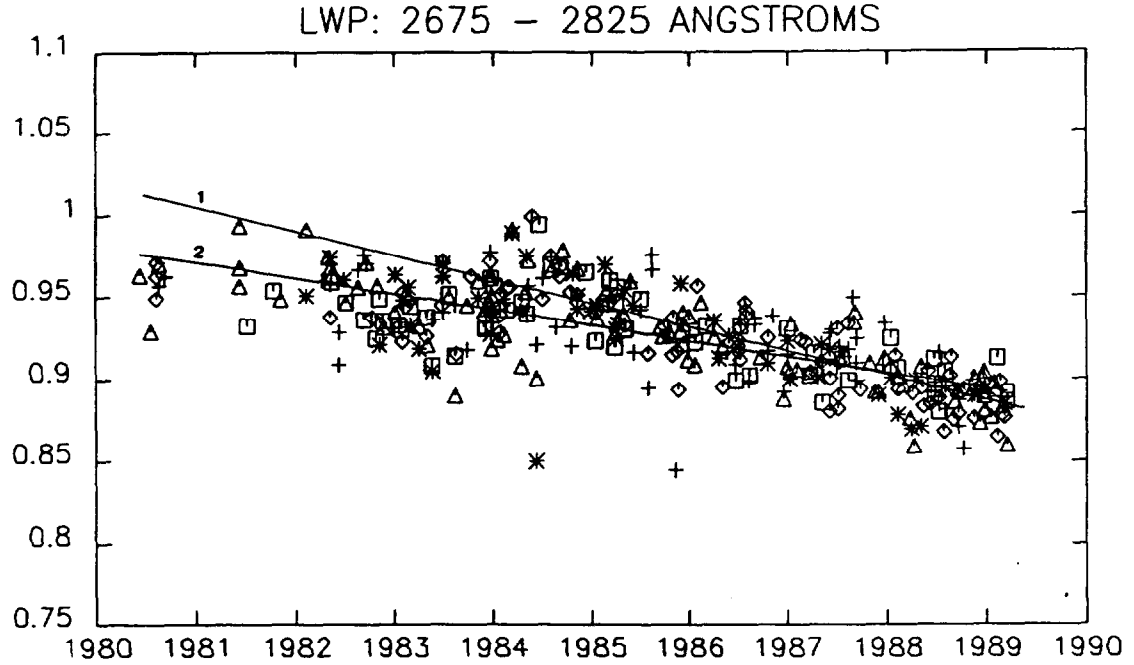
0.95
0.9
0.85
0.8
0.75
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2


LWP: 2525 – 2675 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2
+ = BD+28 4211
* = HD 93521
◇ = HD 60753
□ = BD+33 2642
△ = BD+75 325


LWP: 2675 – 2825 ANGSTROMS
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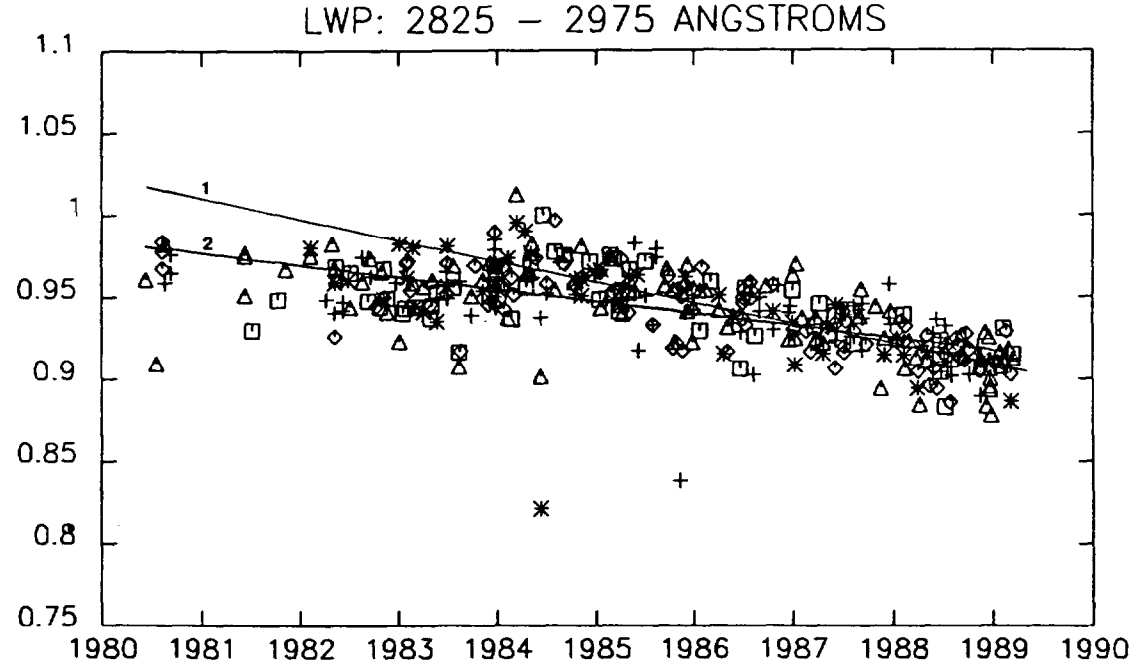
1.05
1
0.95
0.9
0.85
0.8
0.75
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2


LWP: 2825 – 2975 ANGSTROMS
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1.05
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0.95
0.9
0.85
0.8
0.75
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2

Figure 2

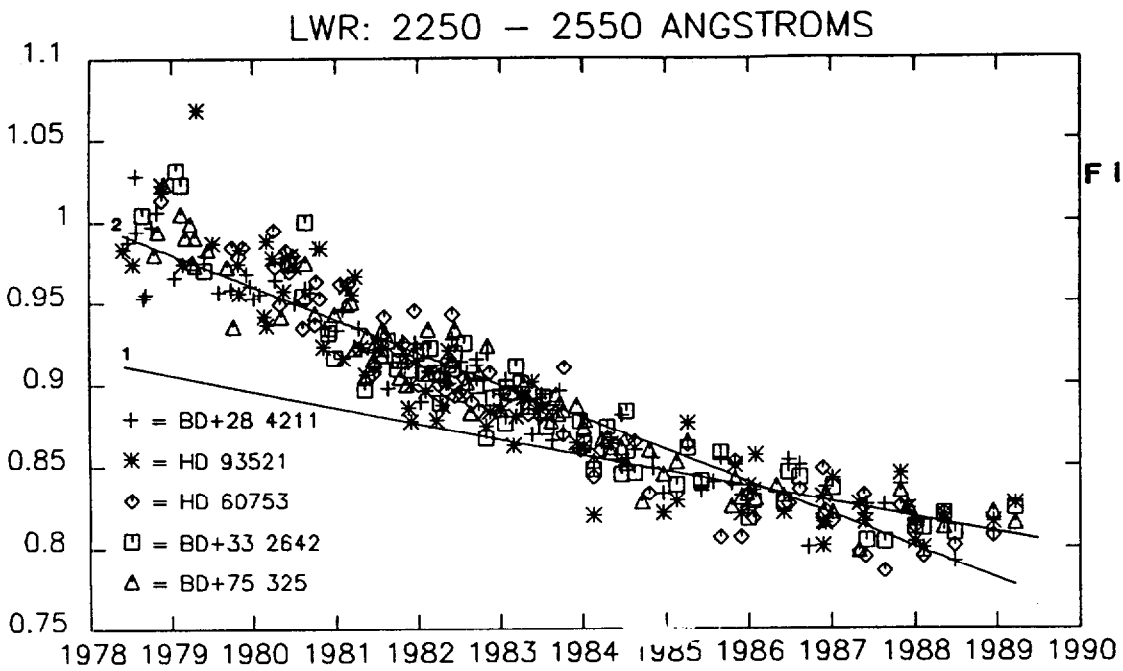
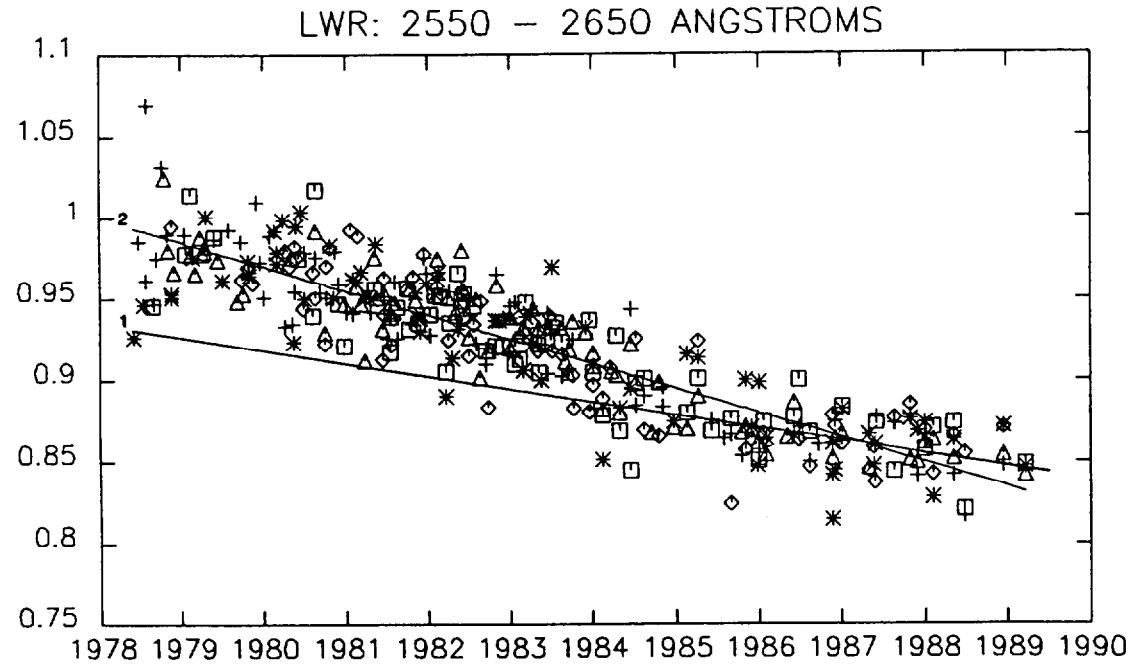

LWR: 2250 – 2550 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
+ = BD+28 4211
* = HD 93521
◇ = HD 60753
□ = BD+33 2642
△ = BD+75 325
1
2

Figure 3


LWR: 2550 – 2650 ANGSTROMS
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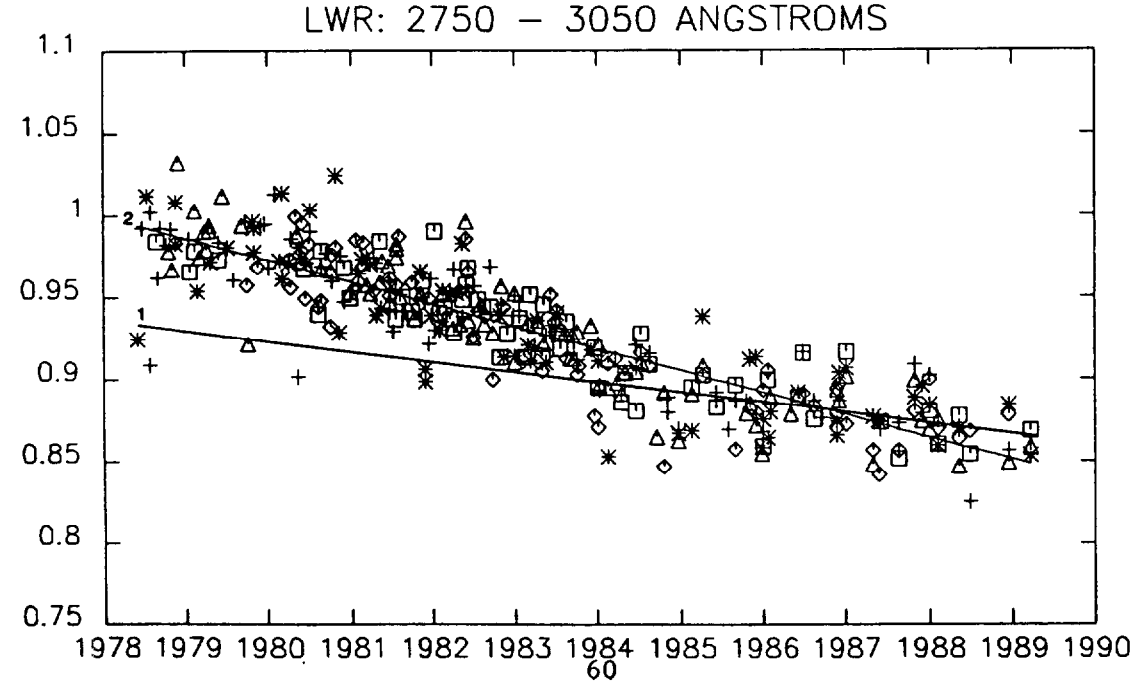
1
0.95
0.9
0.85
0.8
0.75
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2


LWR: 2750 – 3050 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990
1
2

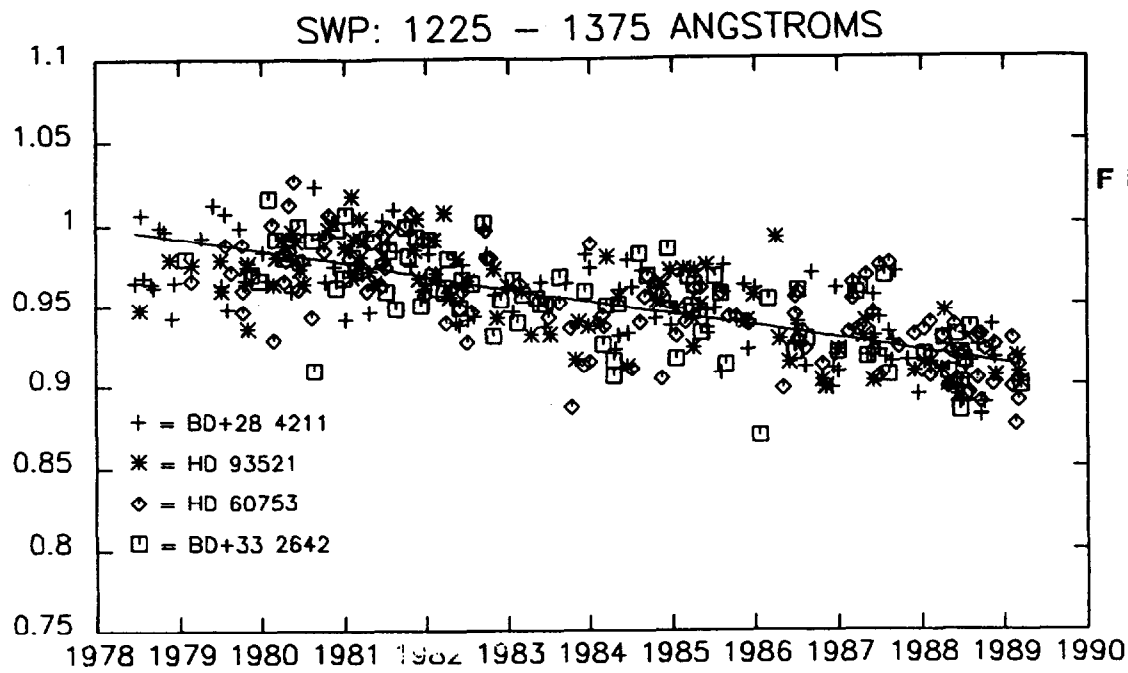
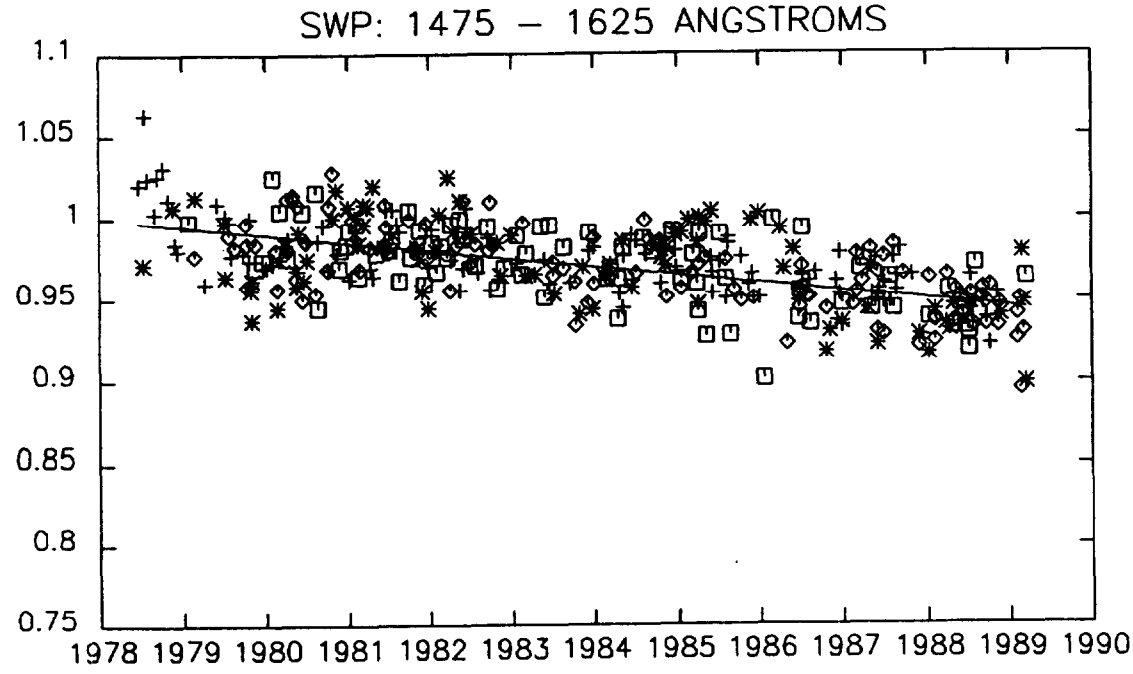
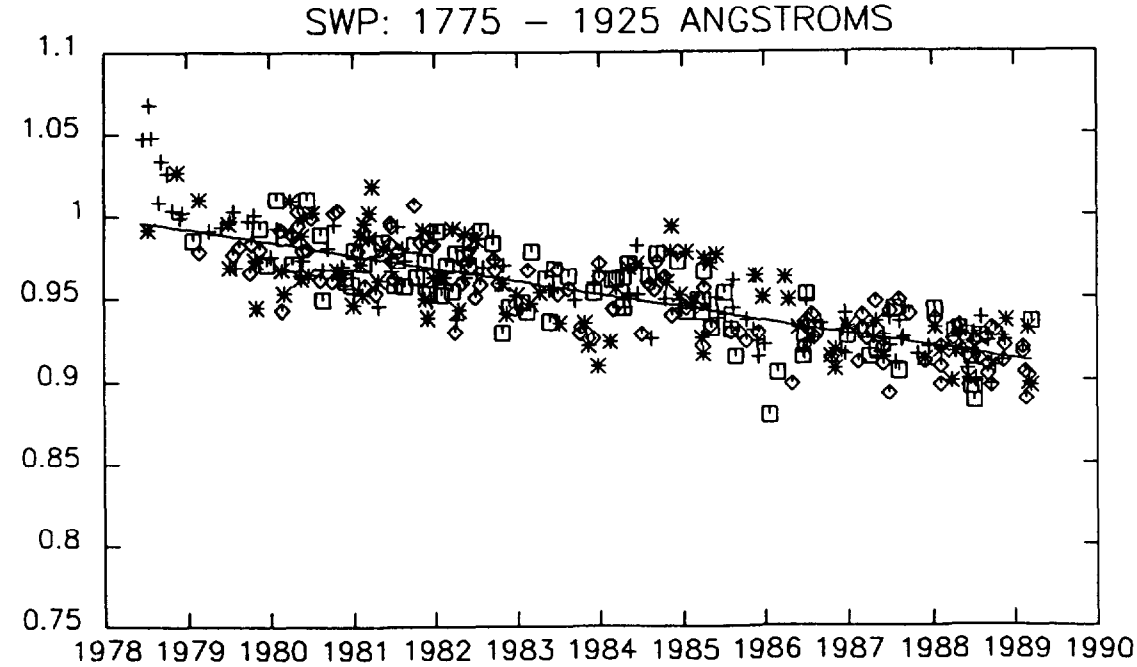

SWP: 1225 – 1375 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
+ = BD+28 4211
* = HD 93521
◇ = HD 60753
□ = BD+33 2642
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990

Figure 4


SWP: 1475 – 1625 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990


SWP: 1775 – 1925 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990

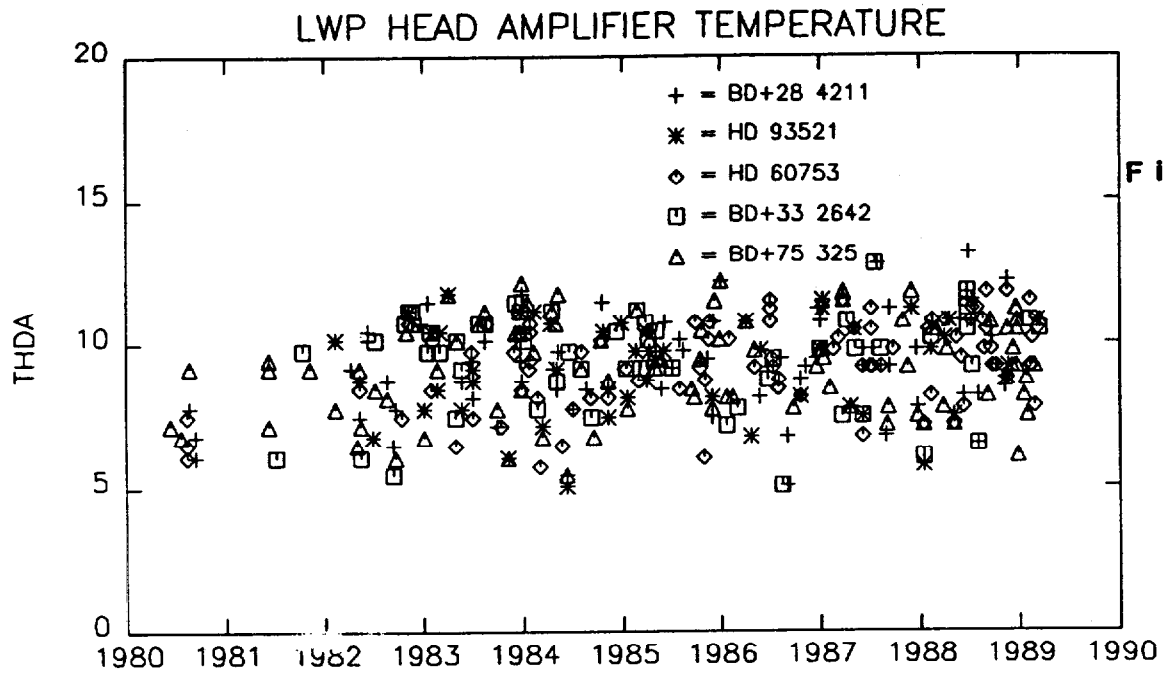
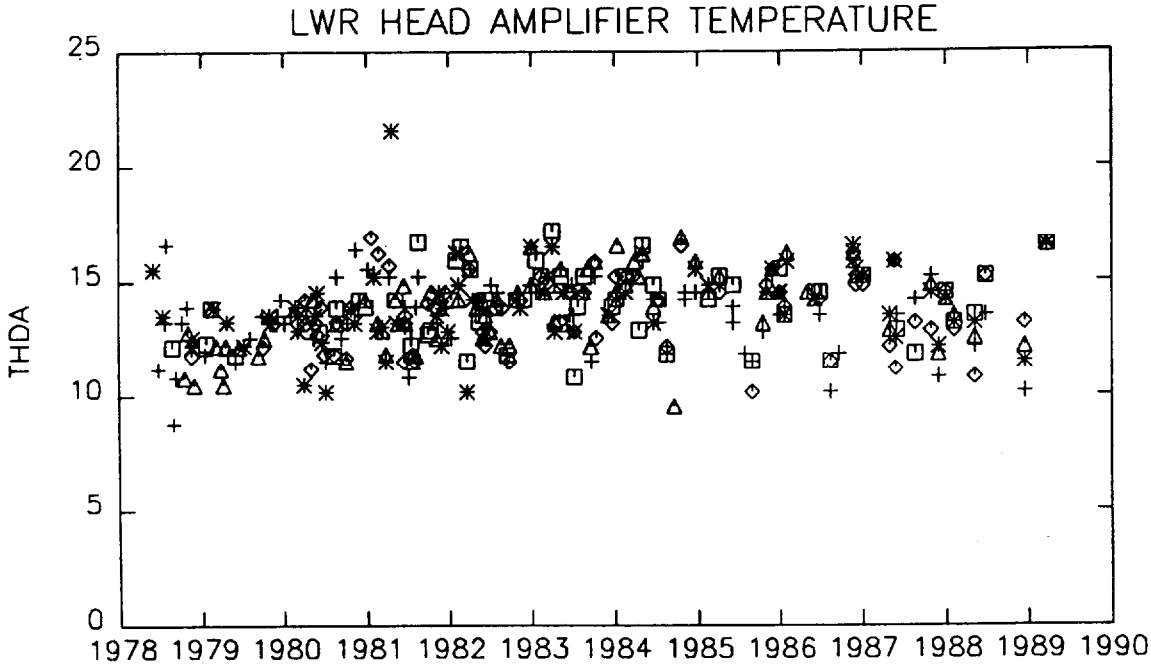

LWP HEAD AMPLIFIER TEMPERATURE
+ = BD+28 4211
* = HD 93521
◇ = HD 60753
□ = BD+33 2642
△ = BD+75 325
THDA
0
5
10
15
20
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990

Figure 5


LWR HEAD AMPLIFIER TEMPERATURE
THDA
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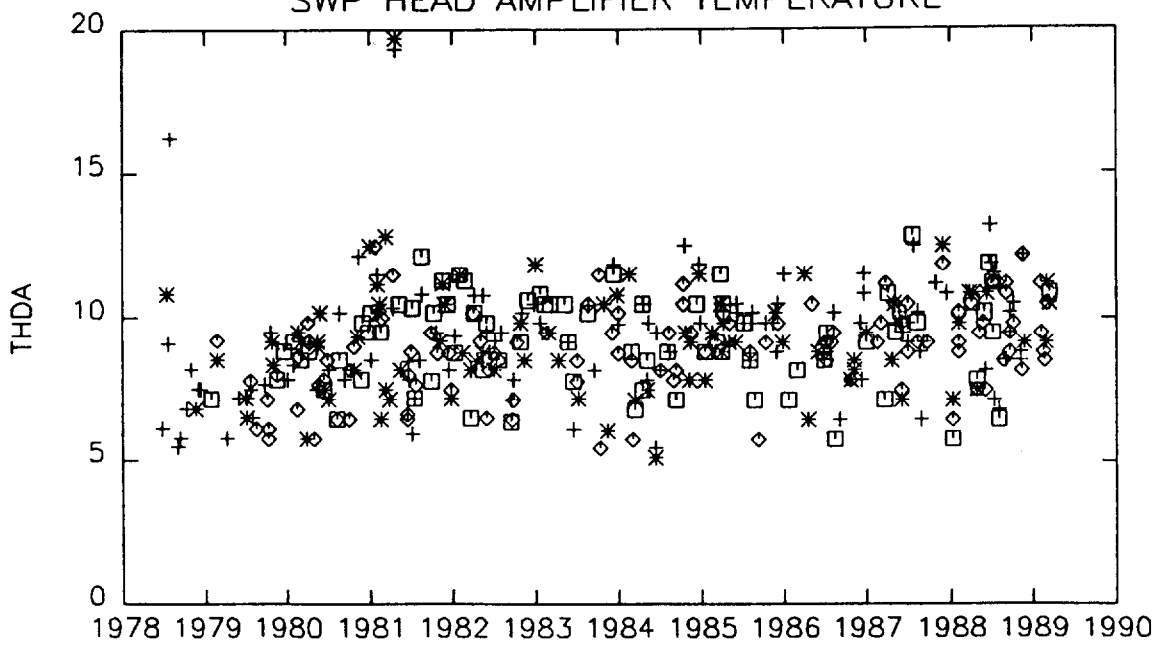
5
10
15
20
25
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990


SWP HEAD AMPLIFIER TEMPERATURE
THDA
0
5
10
15
20
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990

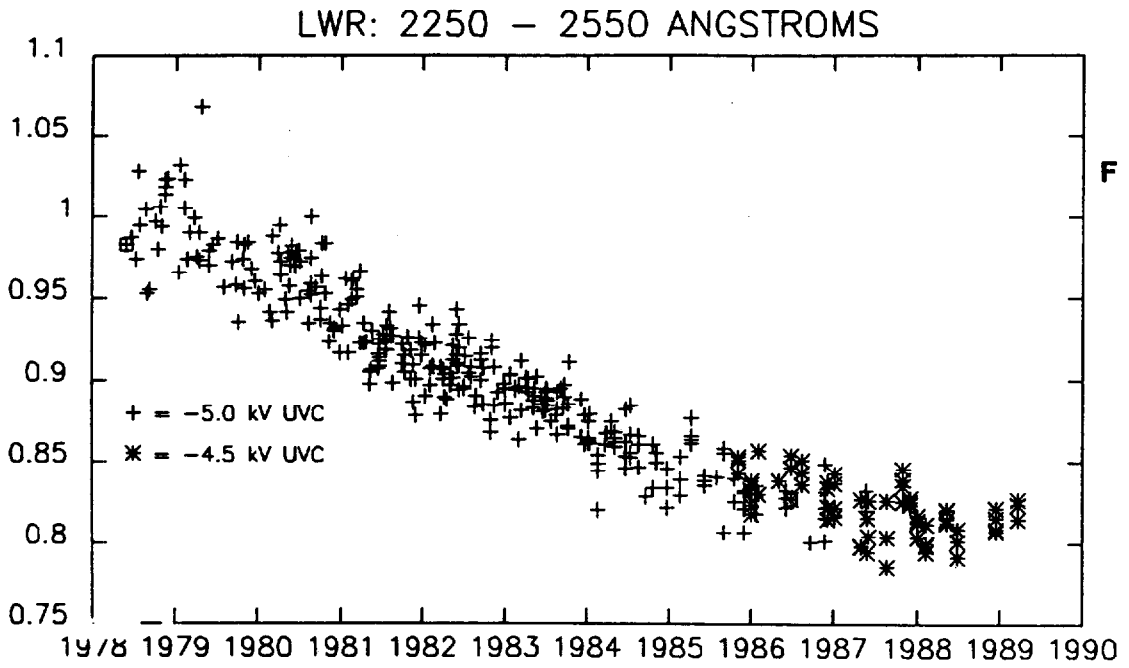
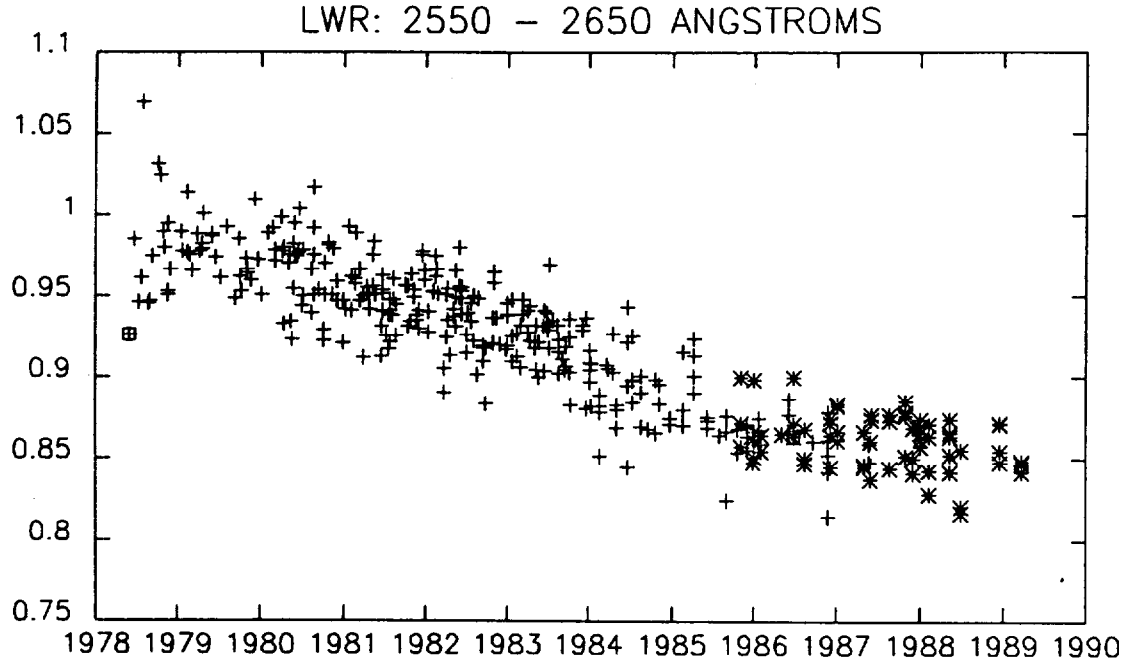

LWR: 2250 – 2550 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
+ = −5.0 kV UVC
* = −4.5 kV UVC
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990

Figure 6


LWR: 2550 – 2650 ANGSTROMS
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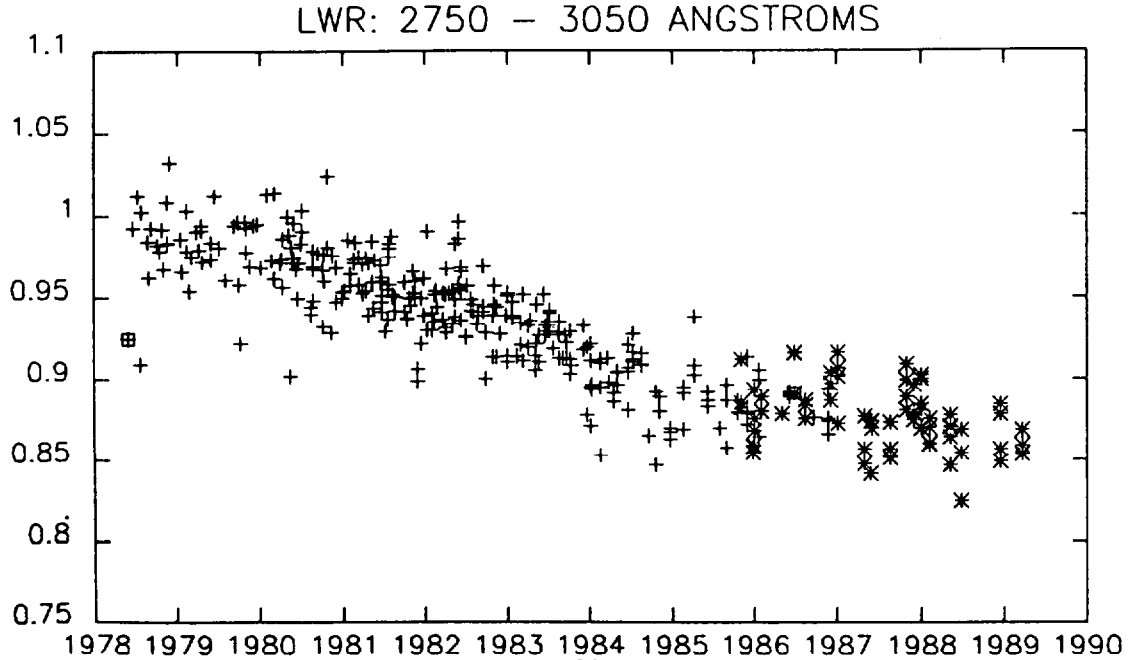
1.05
1
0.95
0.9
0.85
0.8
0.75
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990


LWR: 2750 – 3050 ANGSTROMS
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990