SUMMARY

Low-dispersion IUE spectra of photometric standards have been analyzed to look for sensitivity changes in the SWP, LWR, and LWP cameras. This report includes images through 1983.6. All three cameras show some sensitivity decrease, with the LWR having the most significant change. The LWR changes are now sufficiently large in some wavelength regions (~15% over 5.5 years at 2400 Angstroms) that non-negligible errors may be present in fluxes extracted from recent images. There is no evidence of a recent change in LWR sensitivity correlated with the LWR flare discovered in September 1983.

DISCUSSION

The sensitivity of the three active IUE cameras continues to be monitored by analyzing low-dispersion spectra of five standard stars (BD+28° 4211, BD+33° 2642, BD+75° 325, HD 60753, and HD 93521). The SWP and LWP sensitivity data bases have been extended to 1983.4. The LWR data base includes spectra through 1983.6.

The method of analysis (Holm and Schiffer, 1980) is the one used in previous reports (e.g. Schiffer, 1982; Sonneborn and Schiffer, 1982a). The spectra are ratioed to a reference spectrum for each star and placed in several wavelength bins. The flux ratios are fit with a multiple linear regression to find the rate of change in each bin and the temperature dependence for the camera. The temperature dependence of the sensitivity is assumed to be time-independent and is fit to the head amplifier temperature (THDA).

This analysis shows that the SWP and LWR sensitivity continues to exhibit the same general trends found in previous reports. On the other hand, a significantly larger set of LWP observations show the camera to be stable and more similar to the SWP and LWR than indicated by the first study of LWP sensitivity (Sonneborn and Schiffer, 1982b). The results for all three cameras are shown in Table 1 and Figures 1-3.

The SWP sensitivity continues to show little or no decrease in 150 Angstrom bins centered at 1300, 1550, 1850 Angstroms. The temperature dependence of the camera sensitivity is unchanged. Table 1 gives the rate of change in SWP sensitivity over two time periods. The second, 1979.5 - 1983.4, was chosen to exclude the period of rapid sensitivity decrease prior to 1979.5. Figure 1 shows the SWP regression lines for the 1979.5 - 1983.4 fit superposed on the complete set of SWP data. The temperature dependence has been removed from the data for plotting. The various symbols represent different stars: plus - BD+28° 4211; asterisk - HD 93521; diamond - HD 60753; square - BD+33° 2642; triangle - BD+75° 325. As found in earlier studies, the largest SWP sensitivity changes are taking place at the long wavelength end of the camera.

The LWR continues to show a significant sensitivity degredation (see Table 1). This is most pronounced in the 2400 Angstrom region where the camera sensitivity has decreased about 15% over the course of the IUE mission. The changes in the 2600 and 2900 Angstrom bins are about half as large as that at

shorter wavelengths. The LWR data are shown in Figure 2 with the 1978 - 1983.6 regression lines. These changes are now sufficiently large that there may be non-negligible errors in fluxes extracted from recent images. Cacciari and Wamsteker (1983) found that spectra of BD+75° 325 (in 100 Angstrom bins) show the LWR sensitivity changes to be a strong function of wavelength, with the largest decrease (15-20%) occurring near 2300 Angstroms. Work is now in progress at Goddard to determine the wavelength and time dependence of the LWR sensitivity changes at a resolution of 25 Angstroms using the data for all five standard stars.

There is concern that the recently discovered LWR flare may be affecting the camera sensitivity. LWR images from September and early October 1983 have recently been analyzed and compared with the LWR sensitivity data discussed above. These images are completely consistent with earlier data and trends shown in Figure 2, particularly in the 2400 Angstrom region.

A total of 24 suitable observations were available for the initial study of LWP sensitivity (Sonneborn and Schiffer, 1982b). In the past year the data for LWP sensitivity analysis has more than doubled and now includes 57 spectra. The additional data show some of the earlier conclusions to be incorrect. In particular, there are no wavelength regions with increasing sensitivity.

Table 1 shows that the LWP sensitivity is decreasing in the 2350 - 2650 Angstrom region at approximately 1.0 to 1.4 %/year. The sensitivity is unchanged in other wavelength regions. Representative graphs of the sensitivity data are shown in Figure 3. It is reassuring to note that the RMS error in an individual observation is about the same for all three cameras. The LWP sensitivity temperature dependence (-0.21±0.05 %/°C) is significantly lower than the SWP and LWR.

The mean camera temperatures (THDA) continue to rise at nearly a constant rate (about 0.4°C/year), as have spacecraft temperatures in general. (The cause of the increases and their stabilization points are still unknown.) The THDA data as a function of time is shown in Figure 4 (SWP and LWR) and Figure 5 (LWP). The mean THDA at 1983.4 is 9.5°C (SWP), 14.4°C (LWR), and 9.1°C (LWP).

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References

Cacciari, C. and Wamsteker, W. 1983. "LWR sensitivity variation"
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Holm, A.V., and Schiffer, F.H. 1980. NASA IUE Newsletter No. 9, p. 8.

Schiffer, F.H. 1982. NASA IUE Newsletter No. 19, pg.33.

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Table 1

Results of SWP, LWR, and LWP sensitivity analysis

SWP camera

Temperature dependence: -0.54±0.05 %/°C
RMS error in an individual observation: 3.3%
171 observations of 4 stars

Time dependence

wavelength	1978 - 1983.4	1979.5 - 1983.4
1300±75A	-0.37±0.13 %/year	-0.46±0.16 %/year
1550 "	-0.40 "	+0.16 "
1850 "	-1.25 "	-0.63 "

LWR camera

Temperature dependence: -0.78±0.05 %/°C
RMS error in an individual observation: 3.4%
201 observations of 5 stars

Time dependence

wavelength	1978 - 1983.6	1979.5 - 1983.6
2400±150A	-2.30±0.11 %/year	-2.56±0.14 %/year
2600± 50A	-1.19 "	-1.43 "
2900±150A	-1.13 "	-1.50 "

LWP camera

Temparature dependence: -0.21±0.05 %/°C
RMS error in an individual observation: 3.5%
57 observations of 5 stars

Time dependence

wavelength	1980 - 1983.4
2150±75A	-0.14±0.21 %/year
2300 "	-0.91 "
2450 "	-1.42 "
2600 "	-1.12 "
2750 "	-0.13 "
2900 "	+0.07 "

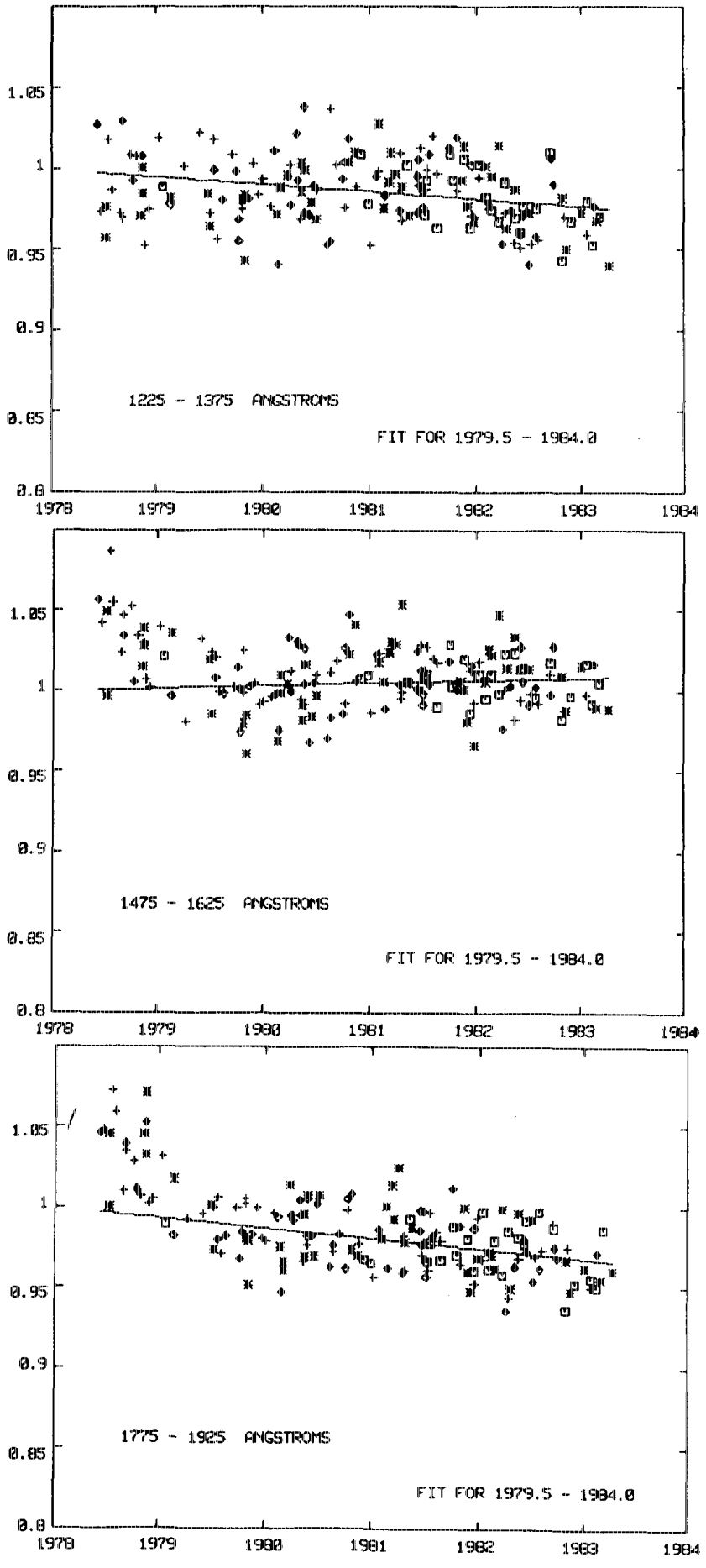

Figure 1.
SWP sensitivity
changes

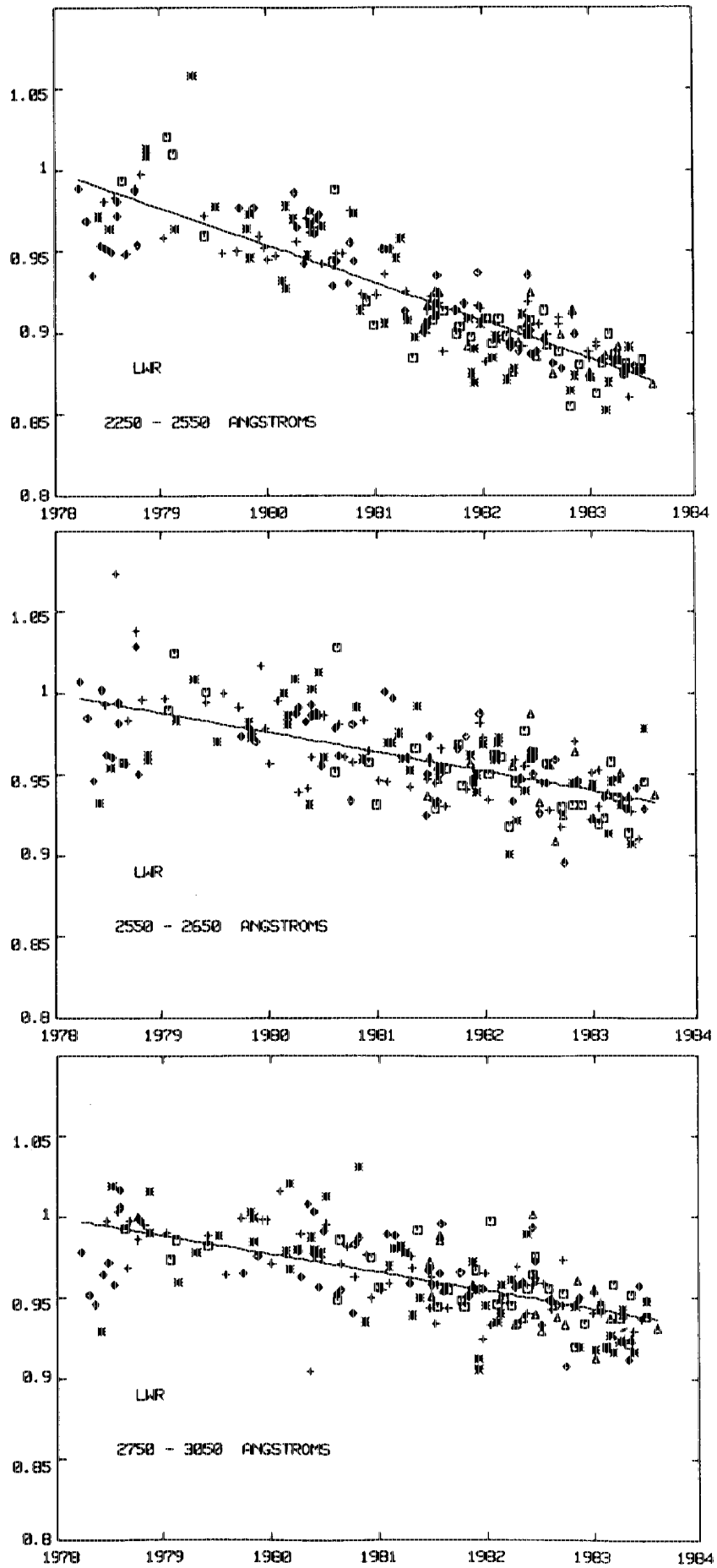

Figure 2.
LWR sensitivity
changes

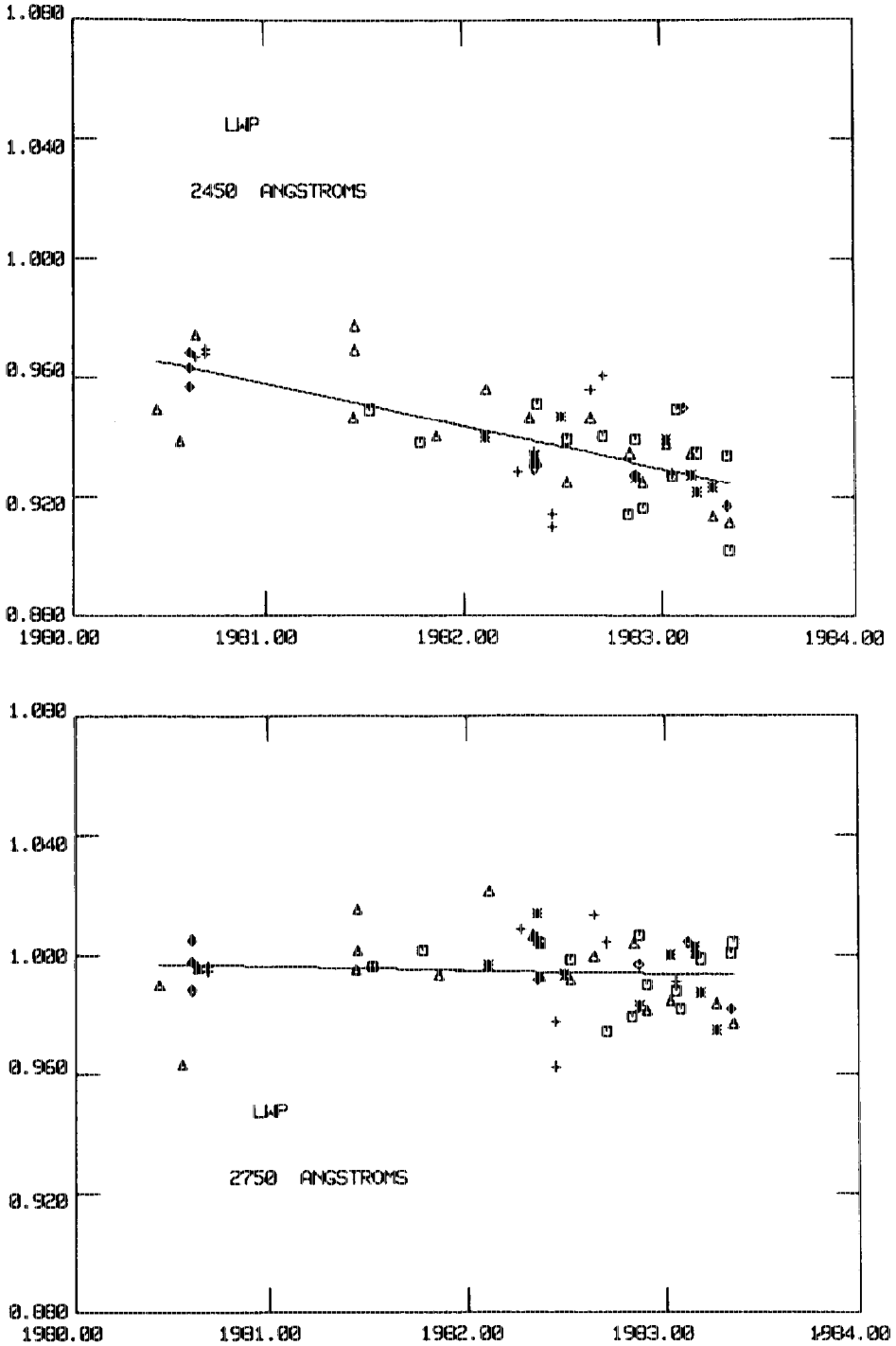

Figure 3. Representative LWP sensitivity changes

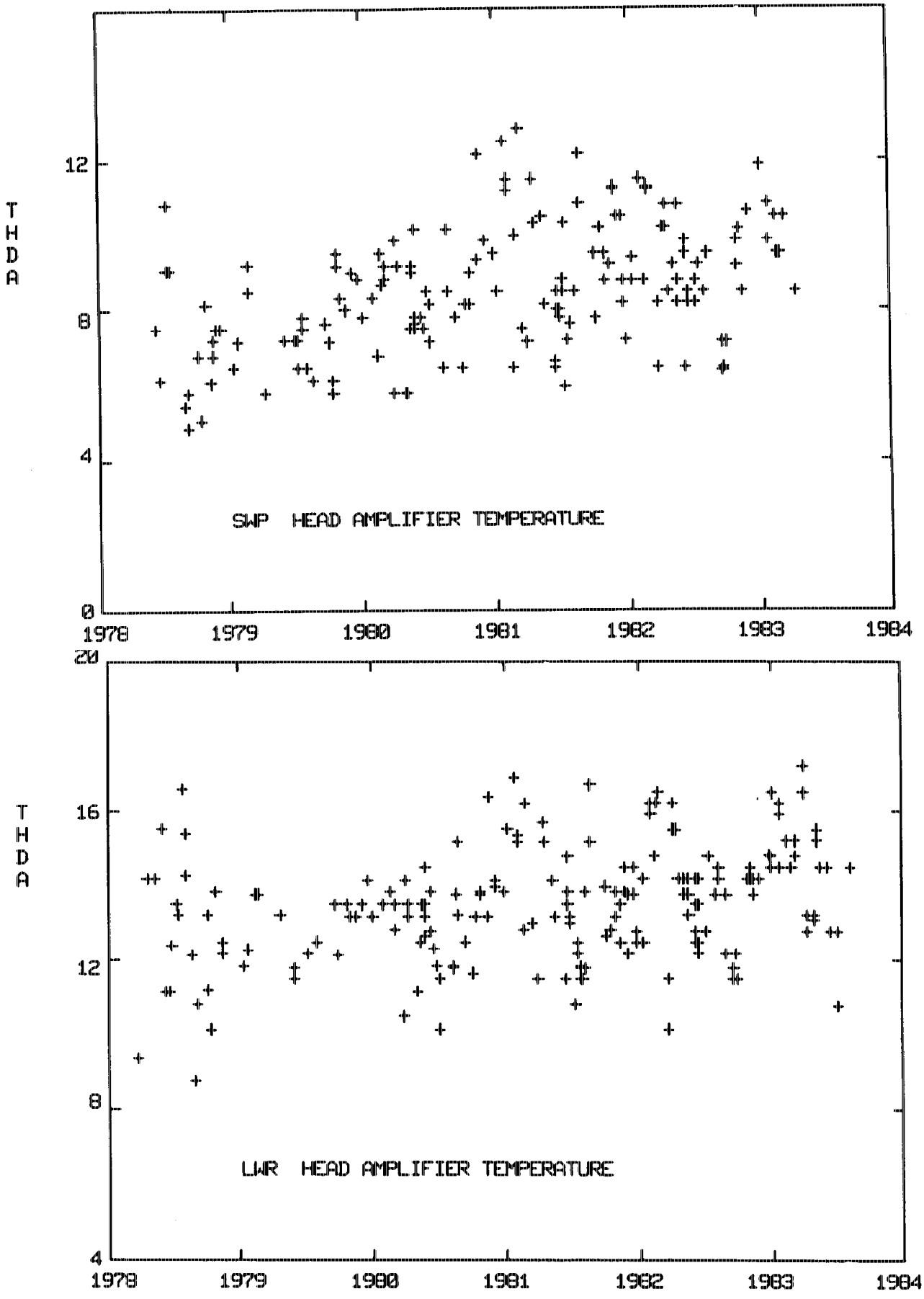

Figure 4. SWP and LWR THDA for sensitivity monitoring images as a function of time.

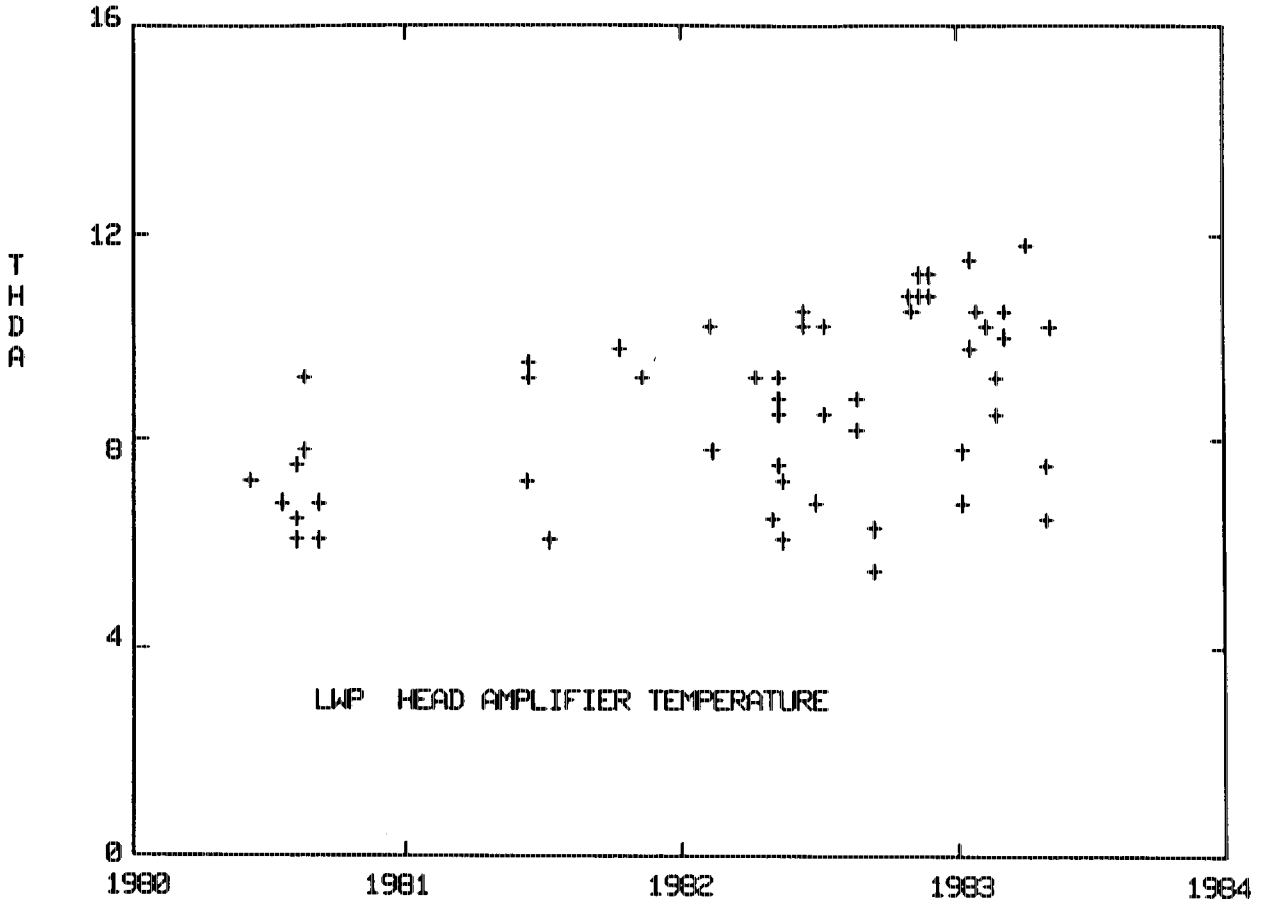

Figure 5. LWP THDA as a function of time