CHAPTER 4

STATISTICAL MODELLING

As indicated in Chapter 2, the graphical method illustrated in Chapter 3 provides a basis for statistical modelling using time series analysis. Since the sequence of height observations for a tide of a given type is relatively smooth (at least compared to the sequence of heights of successive tides of different types) and there is no trend. It is reasonable to use a stationary time series model for these data. And since the trend has been removed from the time of occurrence by using the hour of occurrence during a lunar day rather than during a solar day, these data may be modeled similarly.

Data analysis and model fitting.

The data at the two semidiurnal locations, Laem Ta Chi and Ko Nu, are fitted by using the function *tsplot* of *Asp*. However, the data at Bang Nara and Pak Phun have some missing data (gaps), so the function *tsplot1* of *Asp*, is used. This function incorporates the E-M algorithm to handle the missing data.

4.1 Analysis of tide heights

Figures 4.1 – 4.4 show the results of applying the time series model containing a small number of harmonic components to the tide heights at Laem Ta Chi.

Figures 4.5 – 4.8 show the corresponding results for the heights at Ko Nu.

Figures 4.8 – 4.16 show the corresponding results for Bang Nara and Pak Phun.

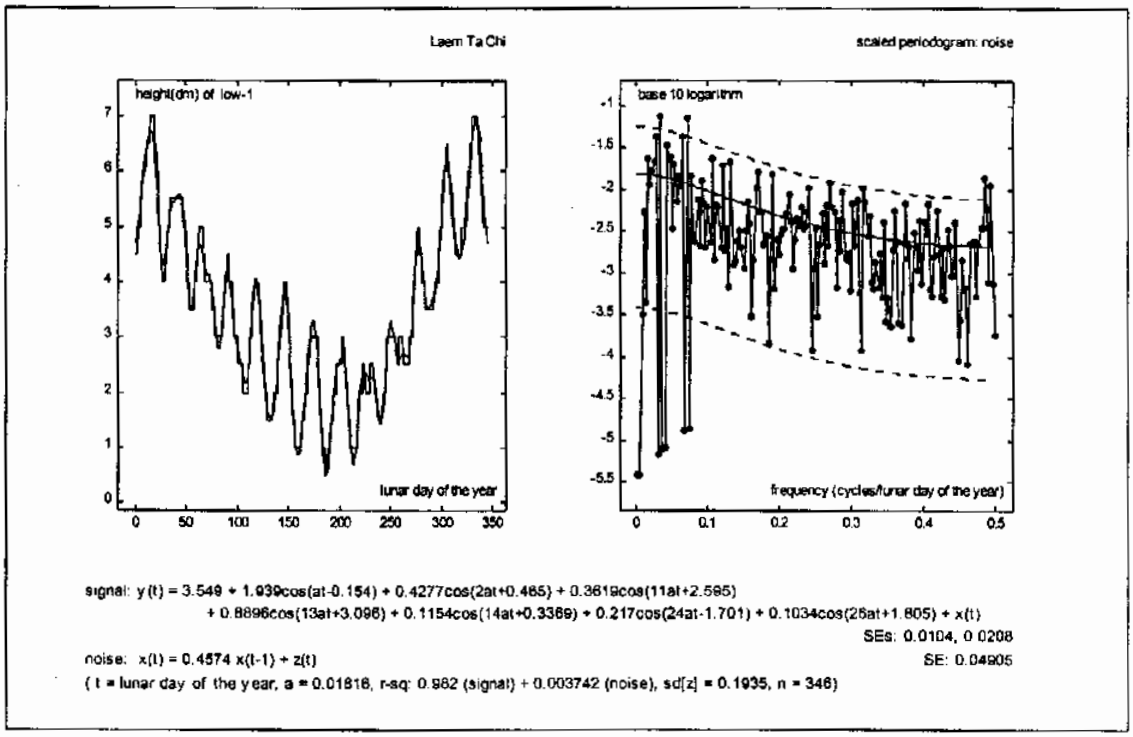

Figure 4.1 Analysis of heights(dm) of low-1 for Laem Ta Chi in 1994

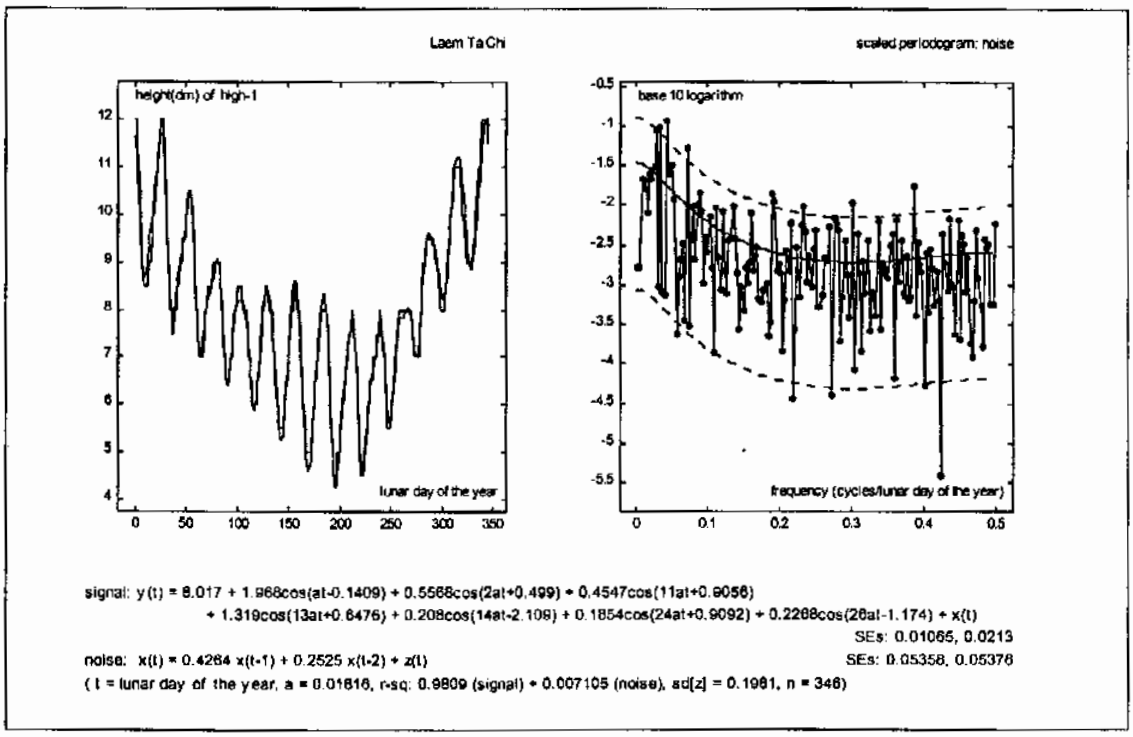

Figure 4.2 Analysis of heights(dm) of high-1 for Laem Ta Chi in 1994

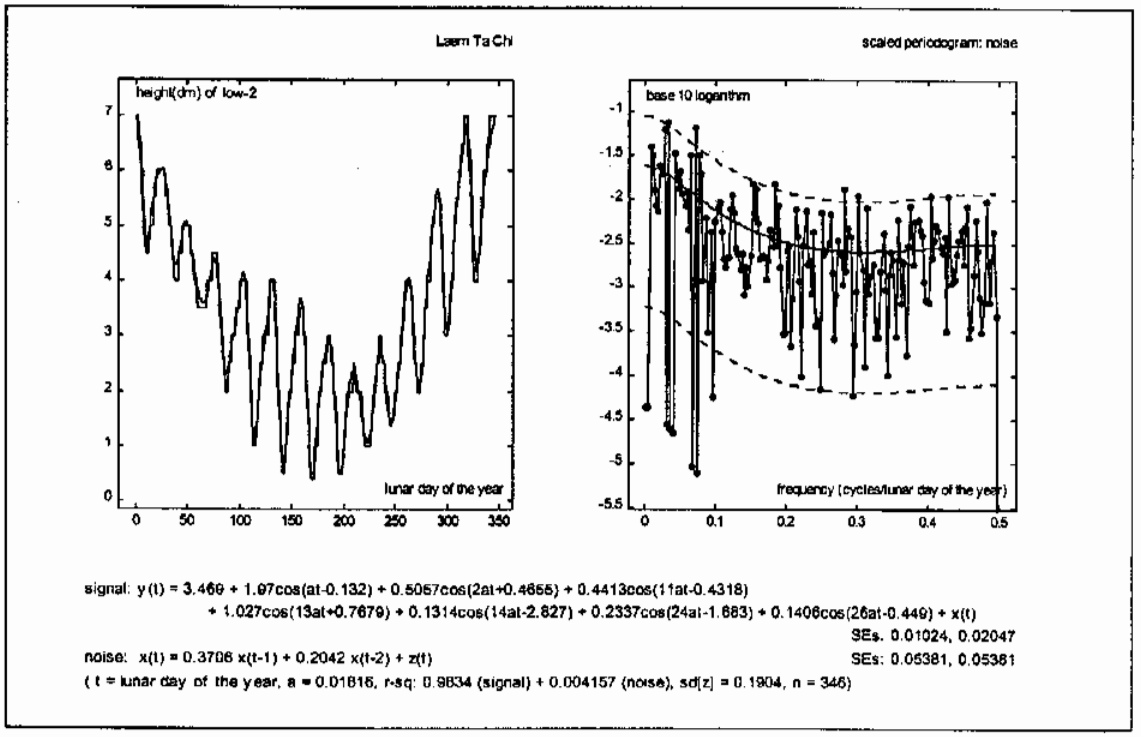

Figure 4.3 Analysis of heights(dm) of low-2 for Laem Ta Chi in 1994

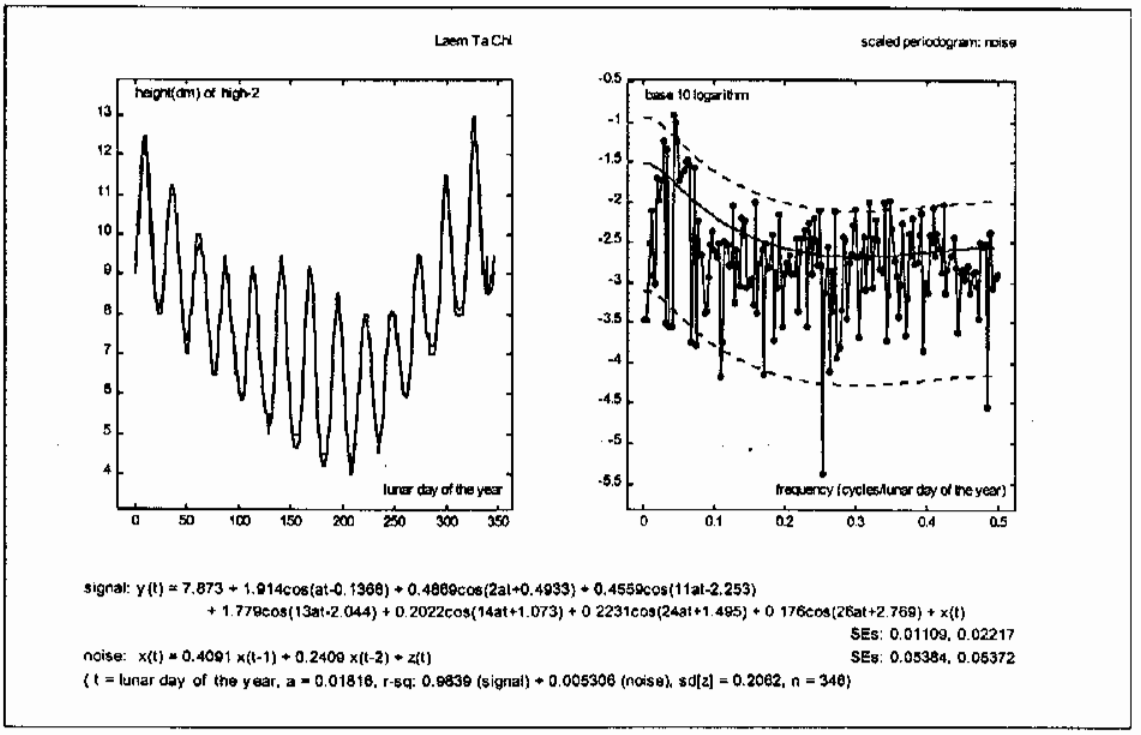

Figure 4.4 Analysis of heights(dm) of high-2 for Laem Ta Chi in 1994

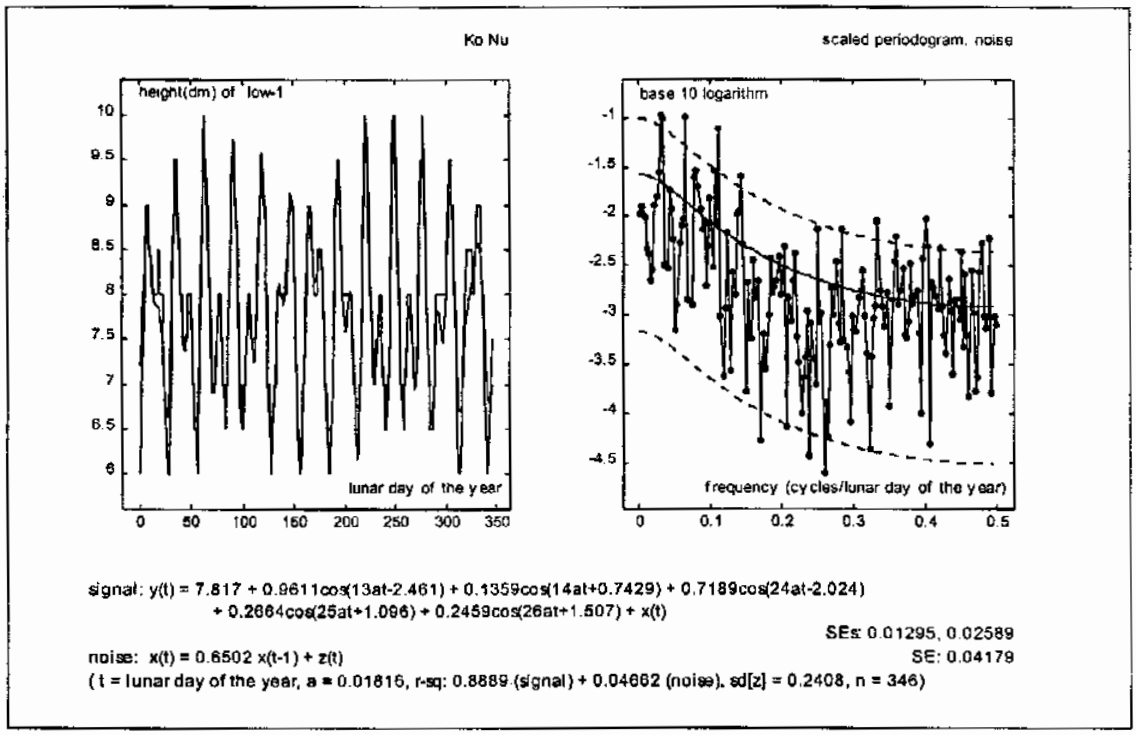

Figure 4.5 Analysis of heights(dm) of low-1 for Ko Nu in 1994

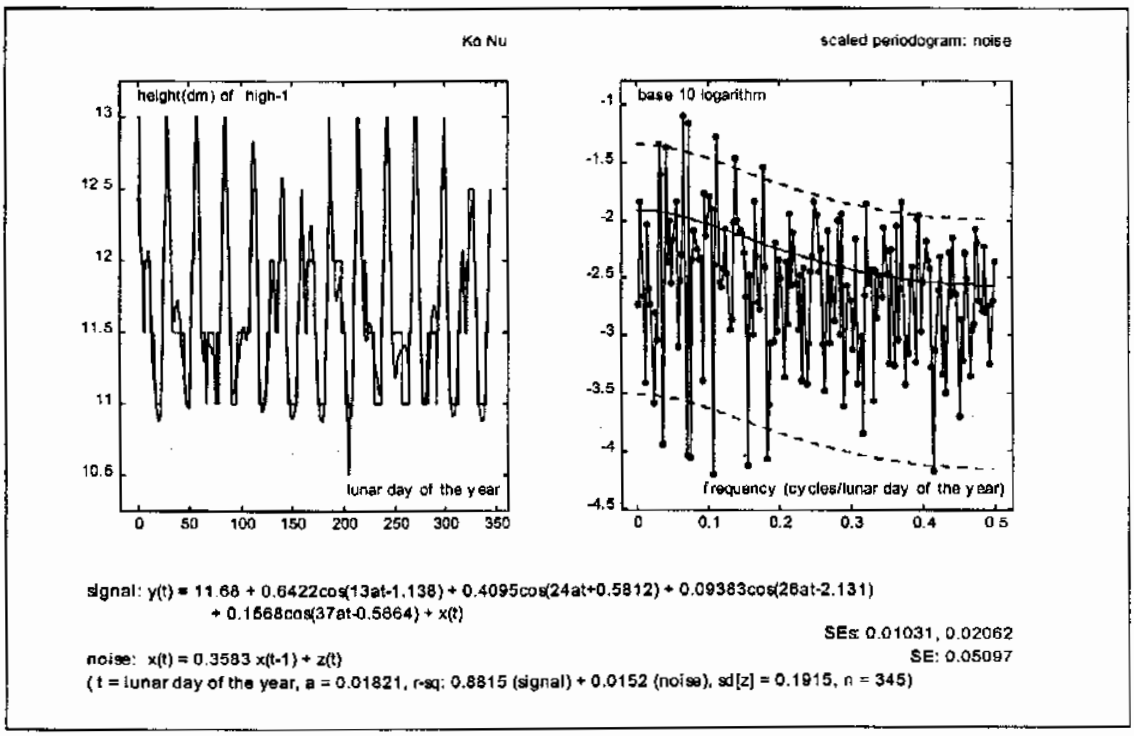

Figure 4.6 Analysis of heights(dm) of high-1 for Ko Nu in 1994

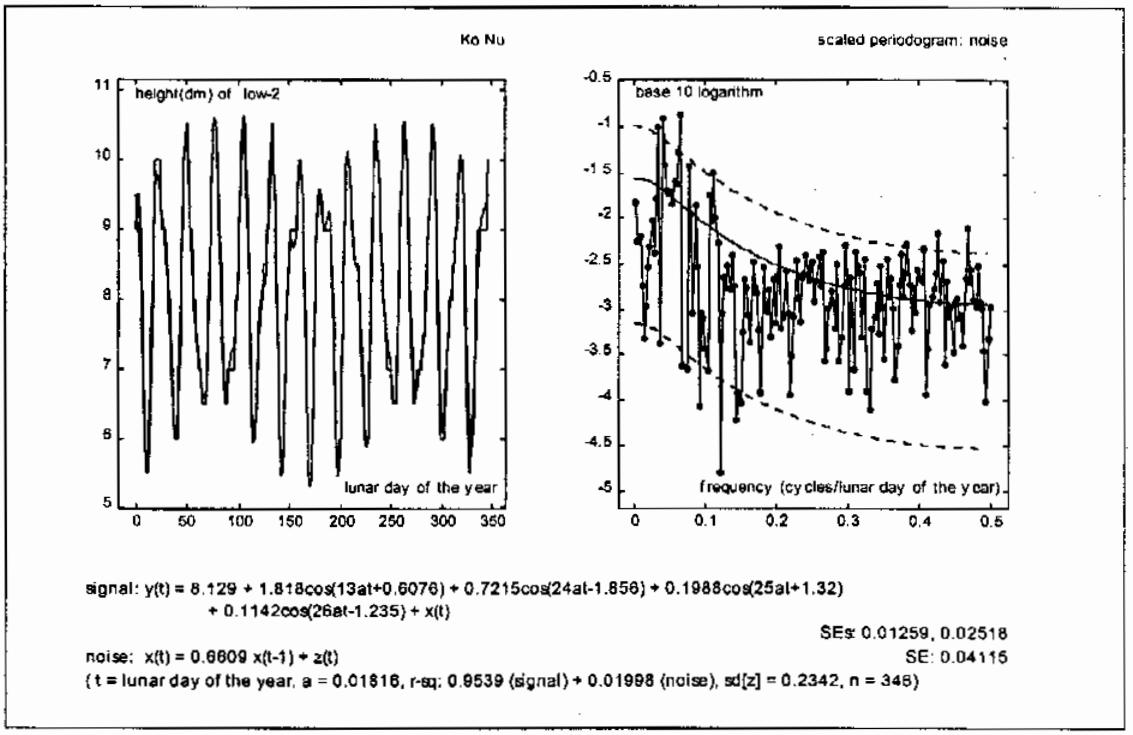

Figure 4.7 Analysis of heights(dm) of low-2 for Ko Nu in 1994

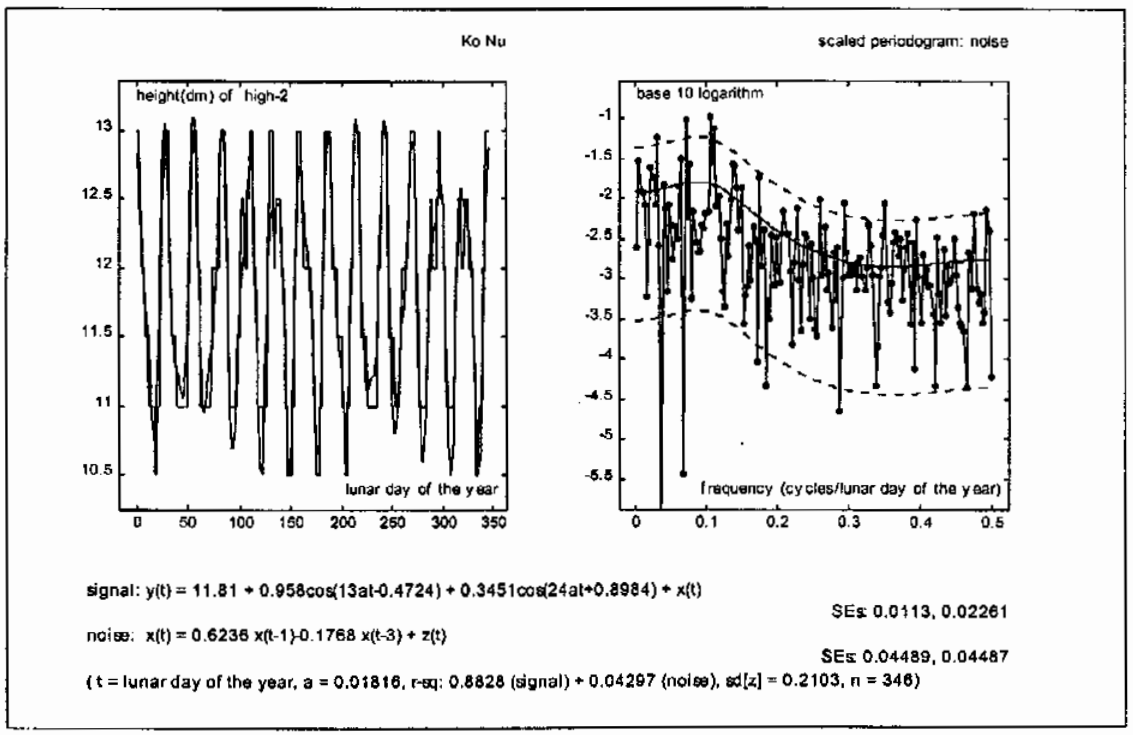

Figure 4.8 Analysis of heights(dm) of high-2 for Ko Nu in 1994

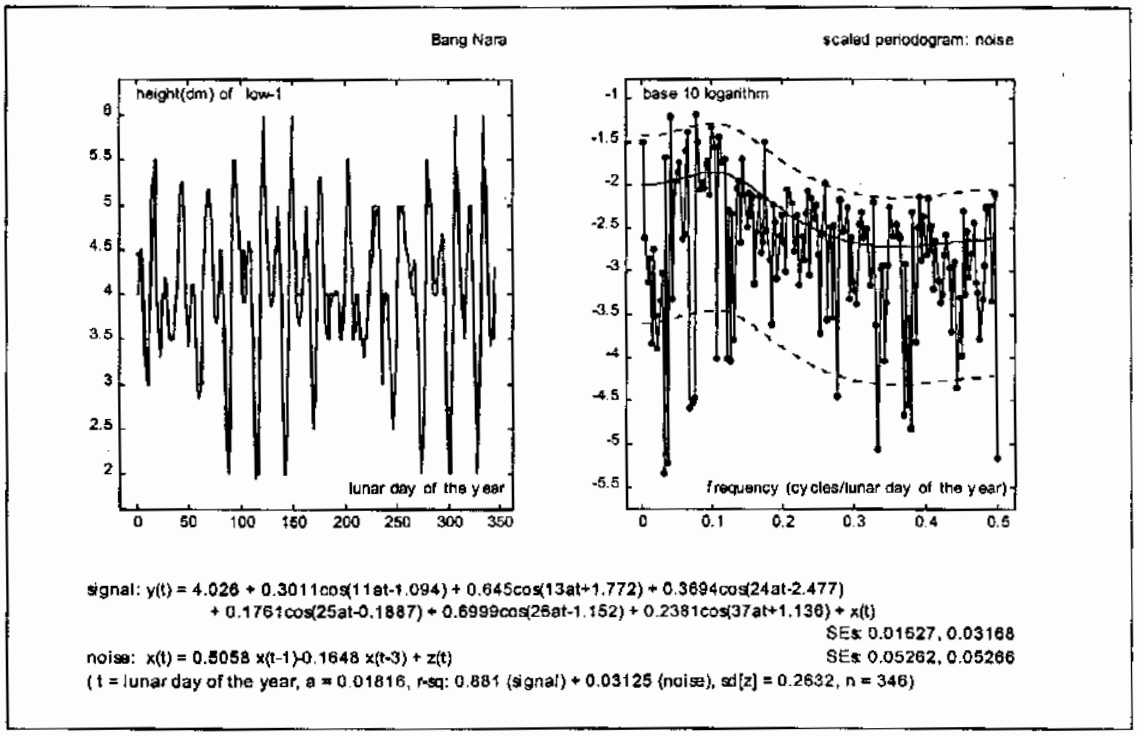

Figure 4.9 Analysis of heights(dm) of low-1 for Bang Nara in 1994

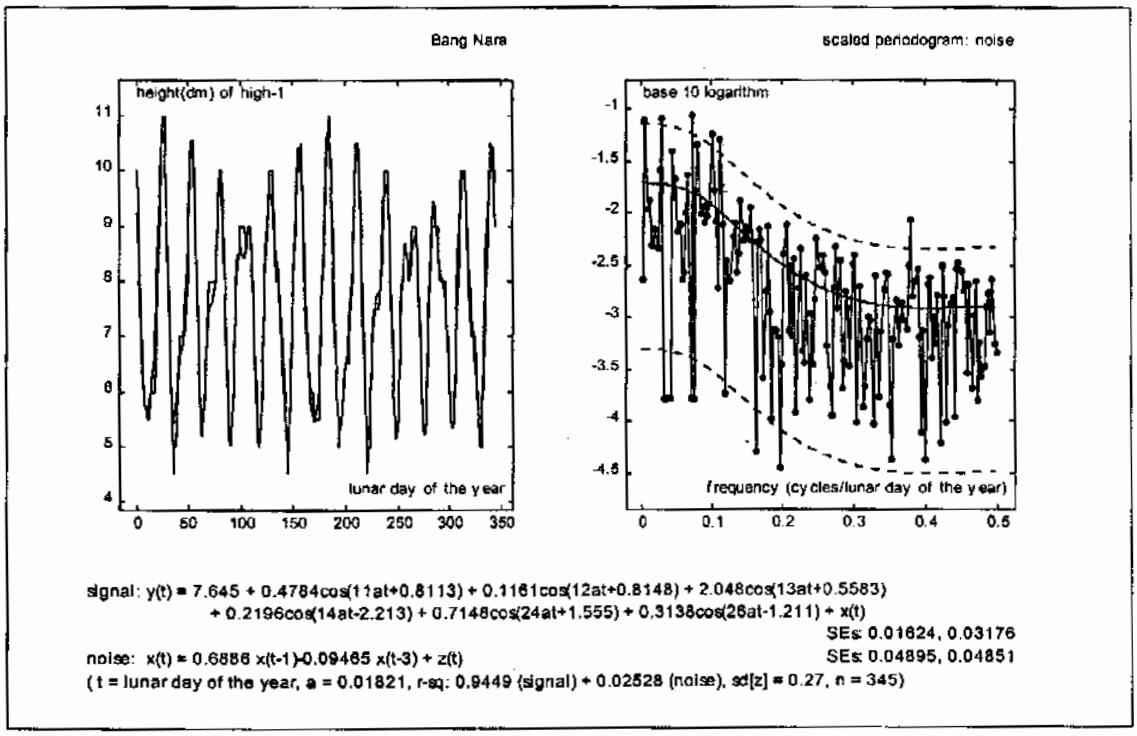

Figure 4.10 Analysis of heights(dm) of high-1 for Bang Nara in 1994

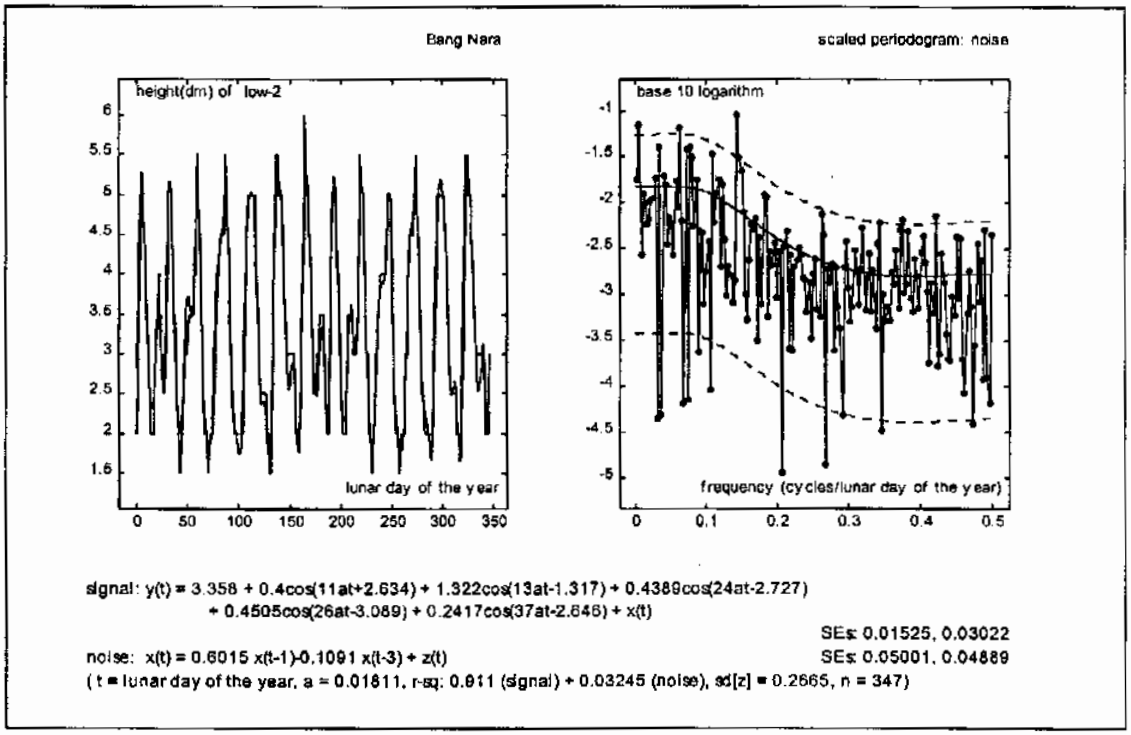

Figure 4.11 Analysis of heights(dm) of low-2 for Bang Nara in 1994

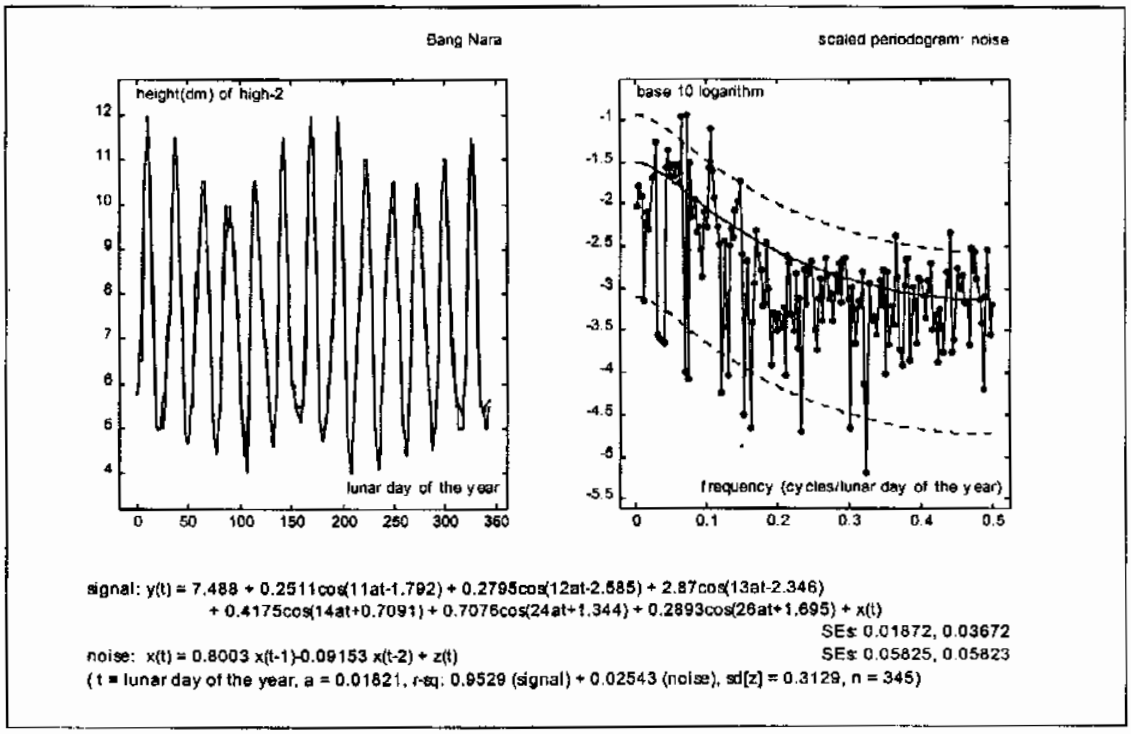

Figure 4.12 Analysis of heights(dm) of high-2 for Bang Nara in 1994

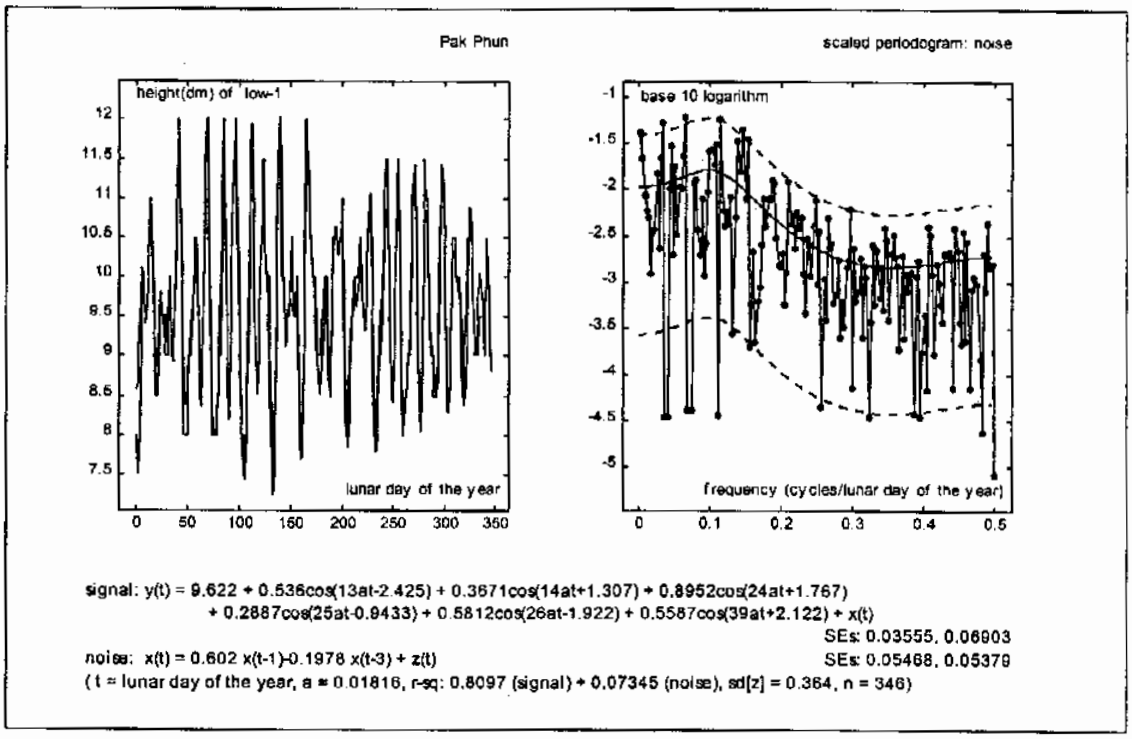

Figure 4.13 Analysis of heights(dm) of low-1 for Pak Phun in 1994

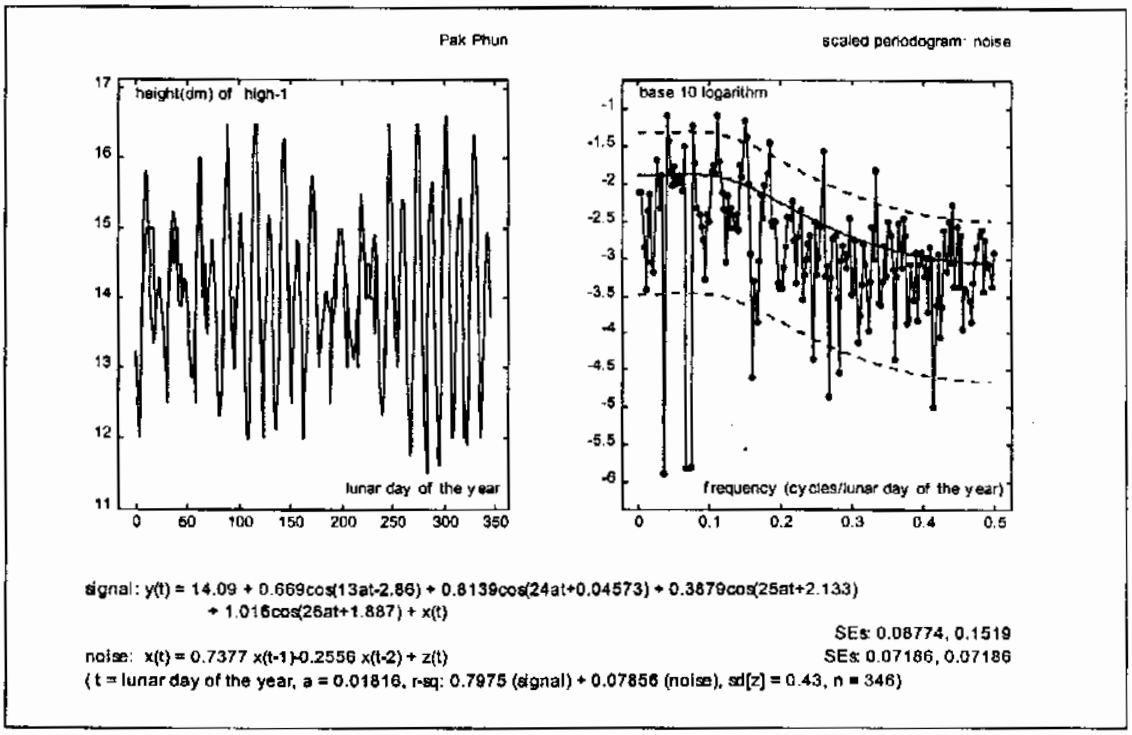

Figure 4.14 Analysis of heights(dm) of high-1 for Pak Phun in 1994

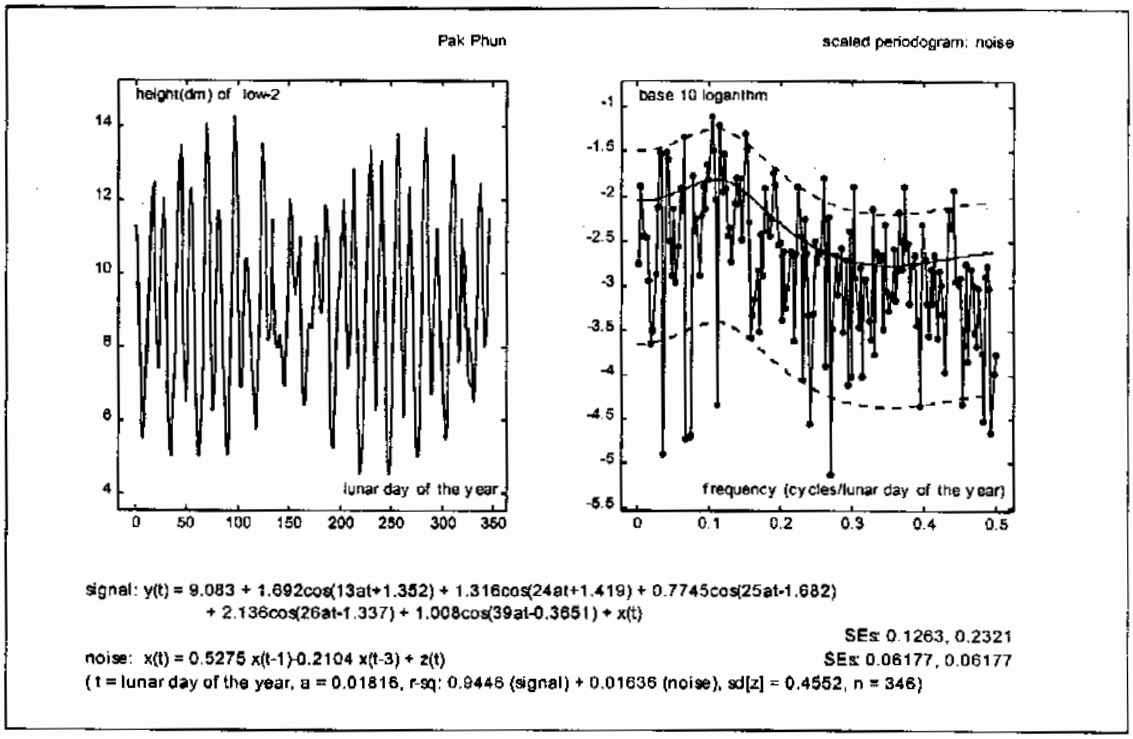

Figure 4.15 Analysis of heights(dm) of low-2 for Pak Phun in 1994

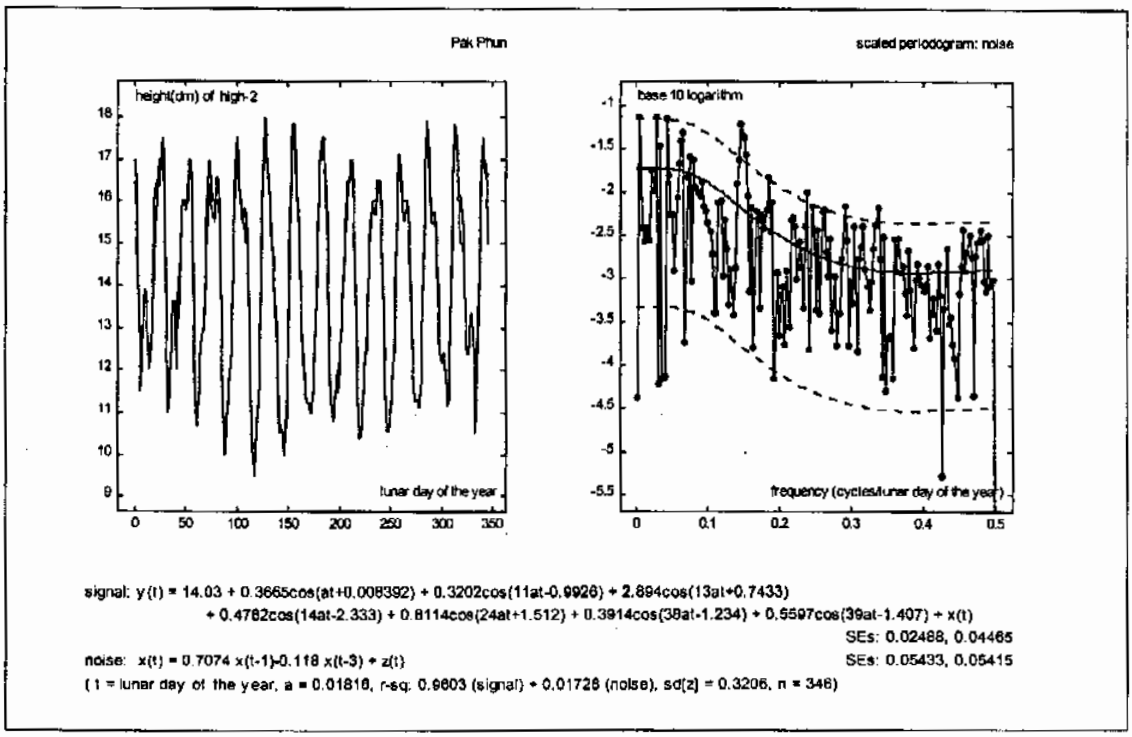

Figure 4.16 Analysis of heights(dm) of high-2 for Pak Phun in 1994

It is interesting to note that the tide heights at Laem Ta Chi show a seasonal pattern, with low water heights in July and relatively high tide heights in January and December. This effect is due to the annual monsoon. This pattern does not occur at the other locations, which raises the question as to whether the tide tables at these locations are correct.

4.2 Analysis of time of occurrence

Figures 4.17 – 4.32 give the results of fitting simple harmonic models to the observed times of occurrence for each of the four tides at Laem Ta Chi, Ko Nu, Bang Nara and Pak Phun. The results from all four locations are summarised and discussed in Chapter 5.

4.3 Tidal reconstruction

Figures 4.33 – 4.40 give the results of using the simple harmonic model for the heights and times of occurrence to reconstruct the tides at Ko Nu and Pak Phun over 120 days. At Ko Nu the data show a pure semidiurnal tide, and at Pak Phun the data show a mixed tide (diurnal and semidiurnal). For conciseness, results of the reconstruction for the other two locations are not shown. However, these can be produced by the same methods at any location.

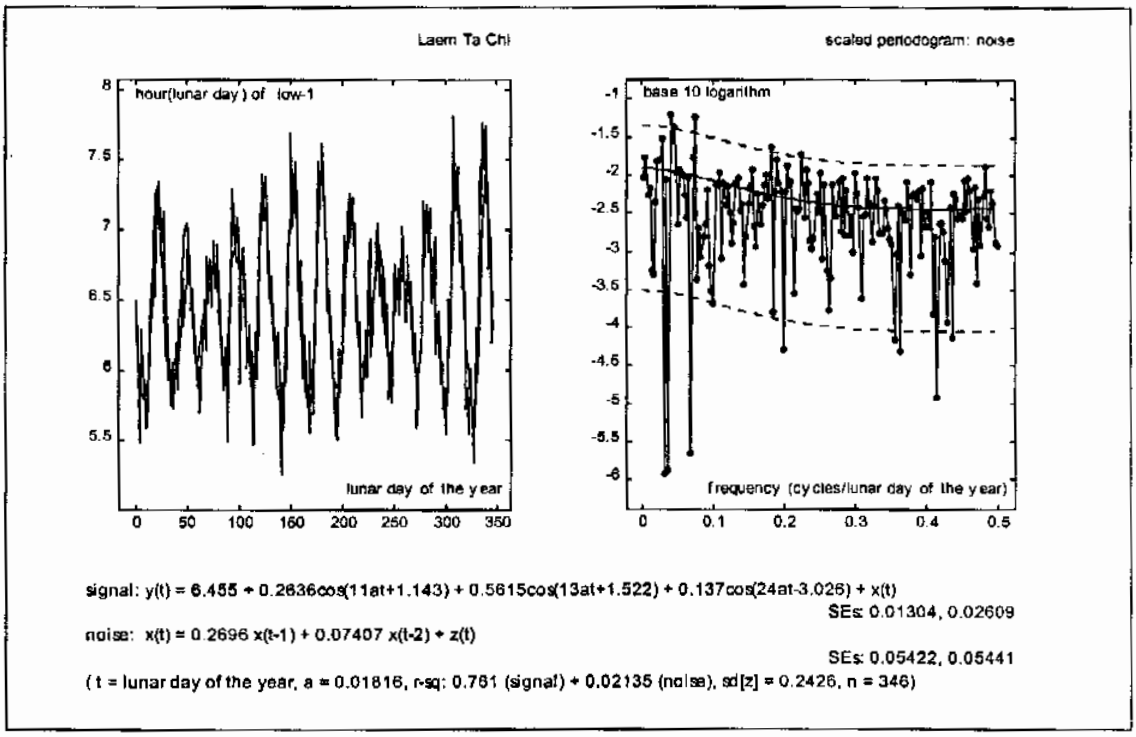

Figure 4.17 Analysis of time of occurrence of low-1 for Laem Ta Chi in 1994

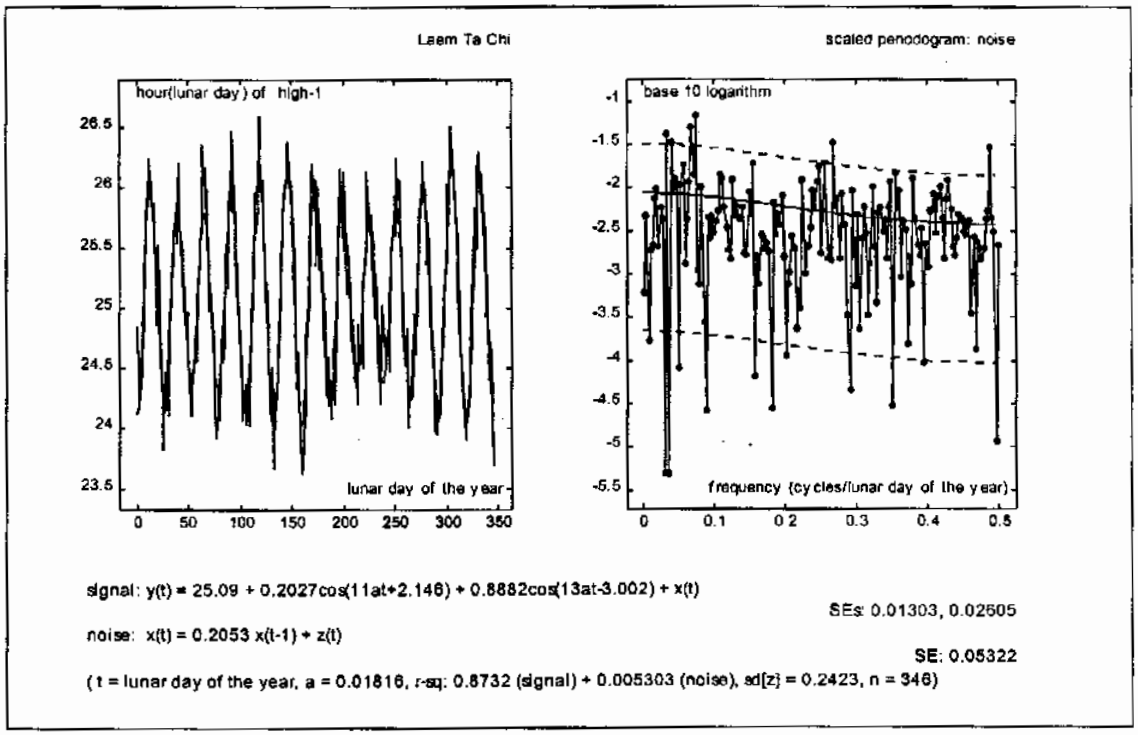

Figure 4.18 Analysis of time of occurrence of high-1 for Laem Ta Chi in 1994

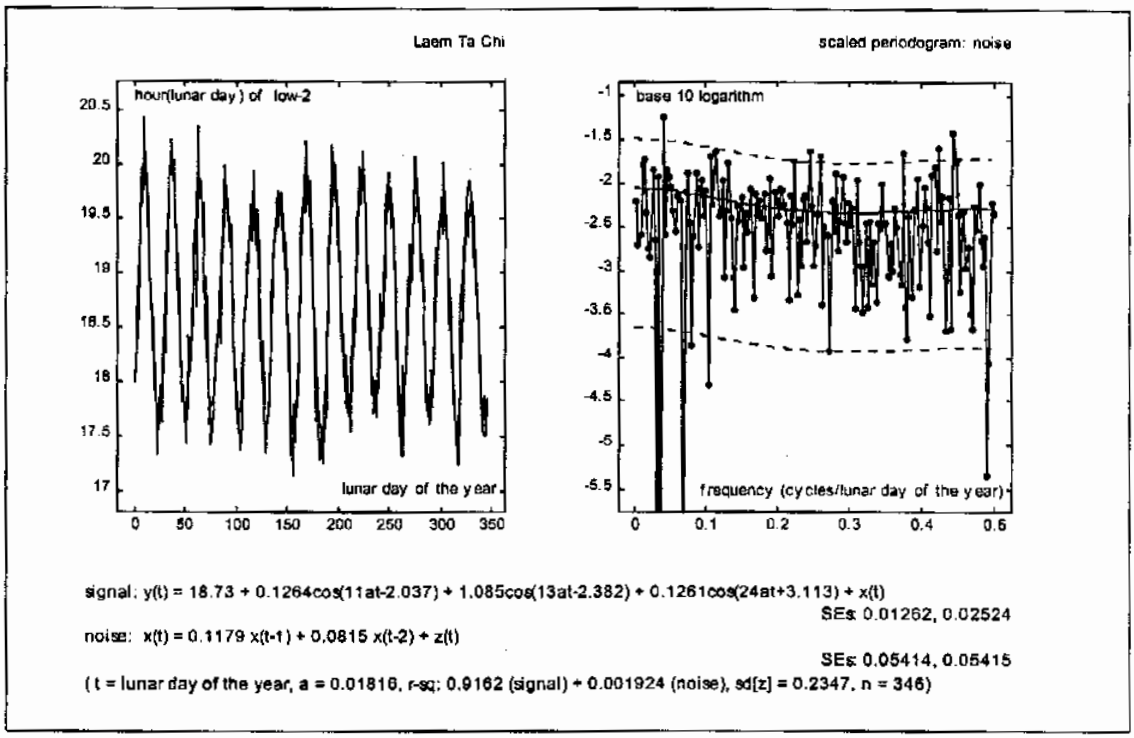

Figure 4.19 Analysis of time of occurrence of low-2 for Laem Ta Chi in 1994

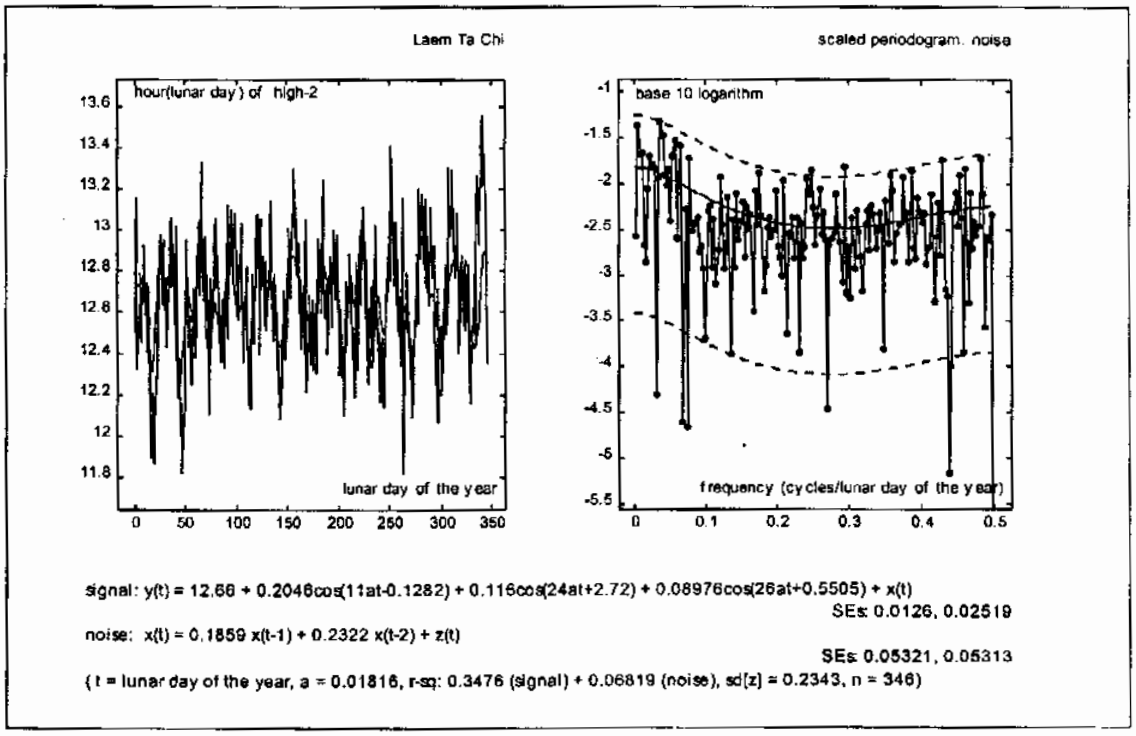

Figure 4.20 Analysis of time of occurrence of high-2 for Laem Ta Chi in 1994

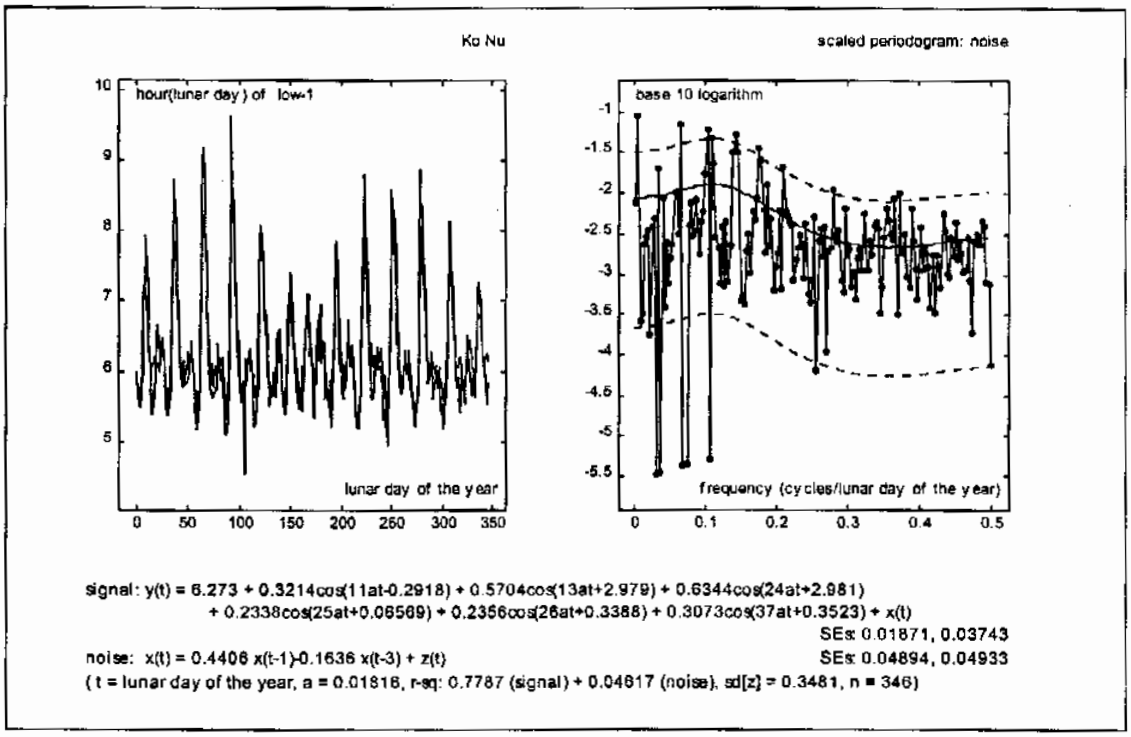

Figure 4.21 Analysis of time of occurrence of low-1 for Ko Nu in 1994

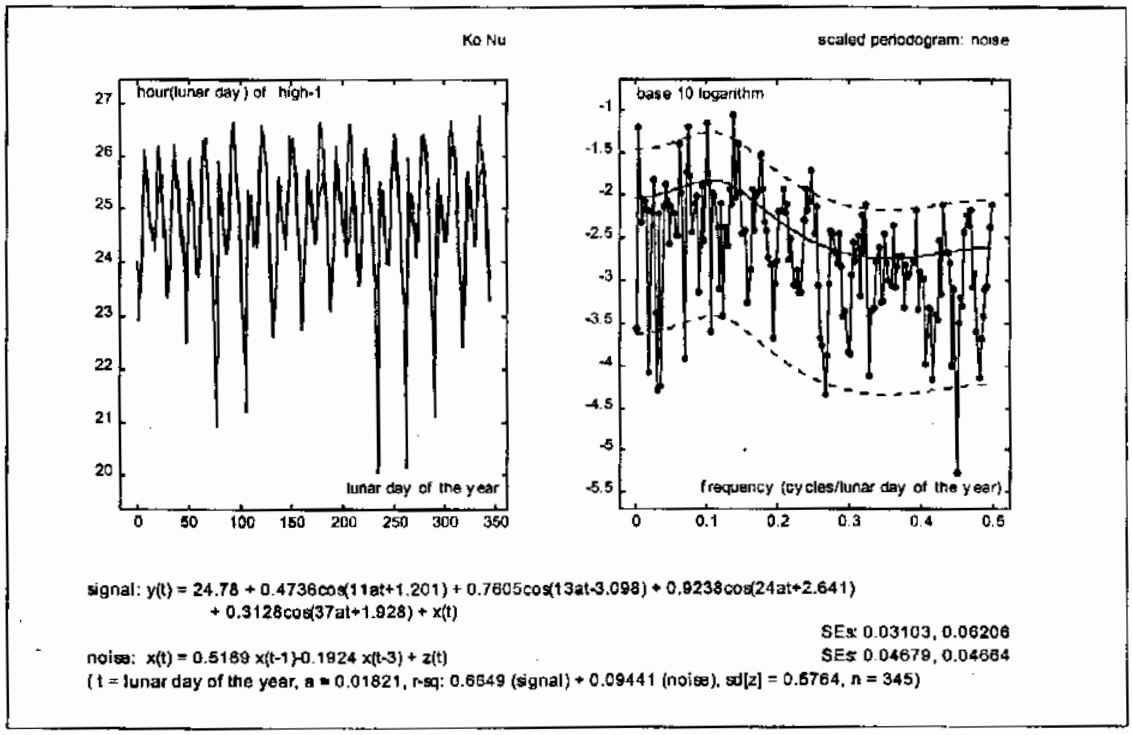

Figure 4.22 Analysis of time of occurrence of high-1 for Ko Nu in 1994

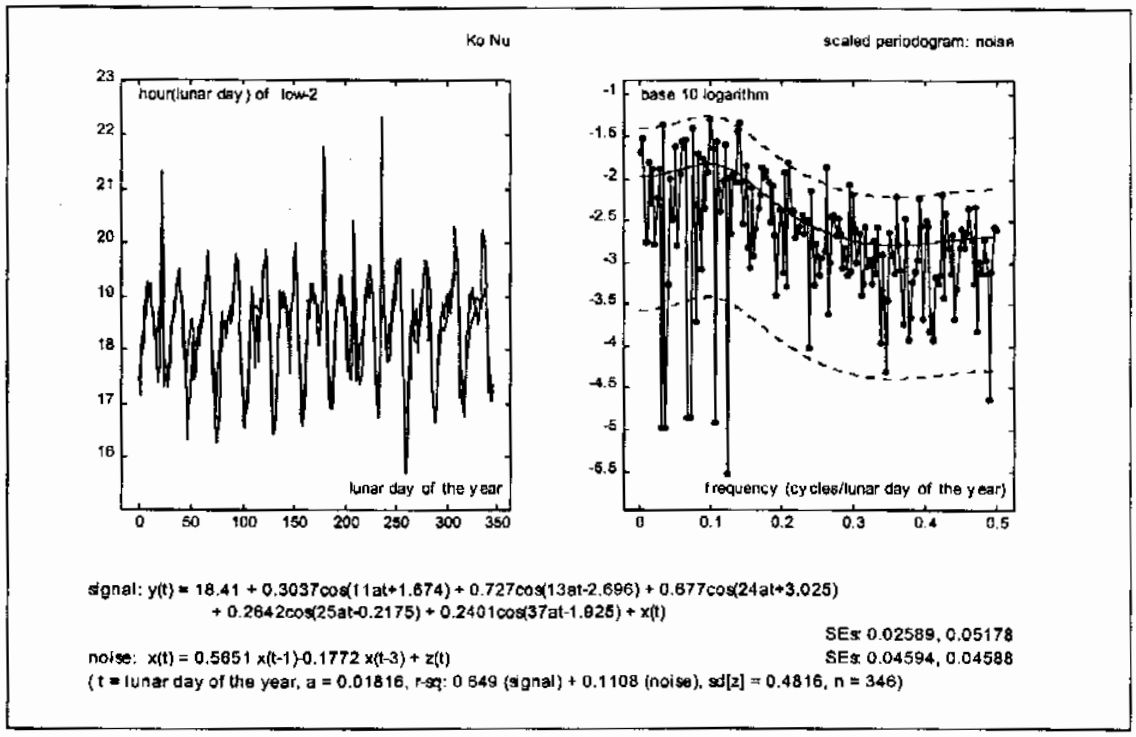

Figure 4.23 Analysis of time of occurrence of low-2 for Ko Nu in 1994

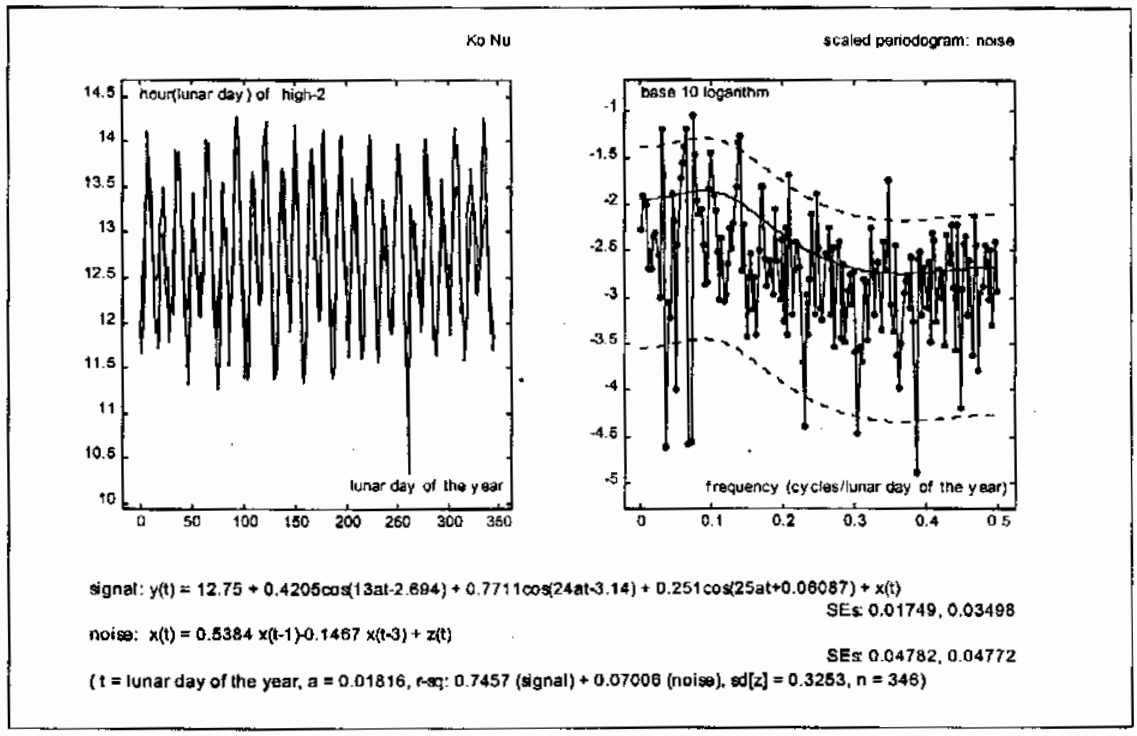

Figure 4.24 Analysis of time of occurrence of high-2 for Ko Nu in 1994

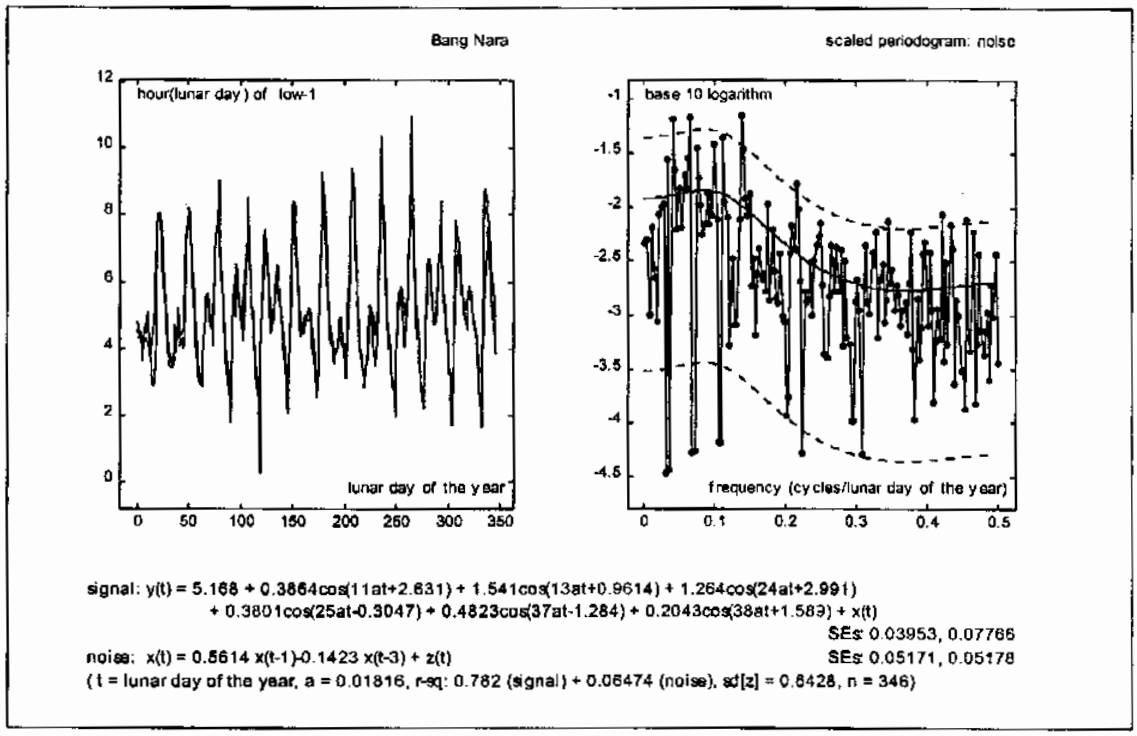

Figure 4.25 Analysis of time of occurrence of low-1 for Bang Nara in 1994

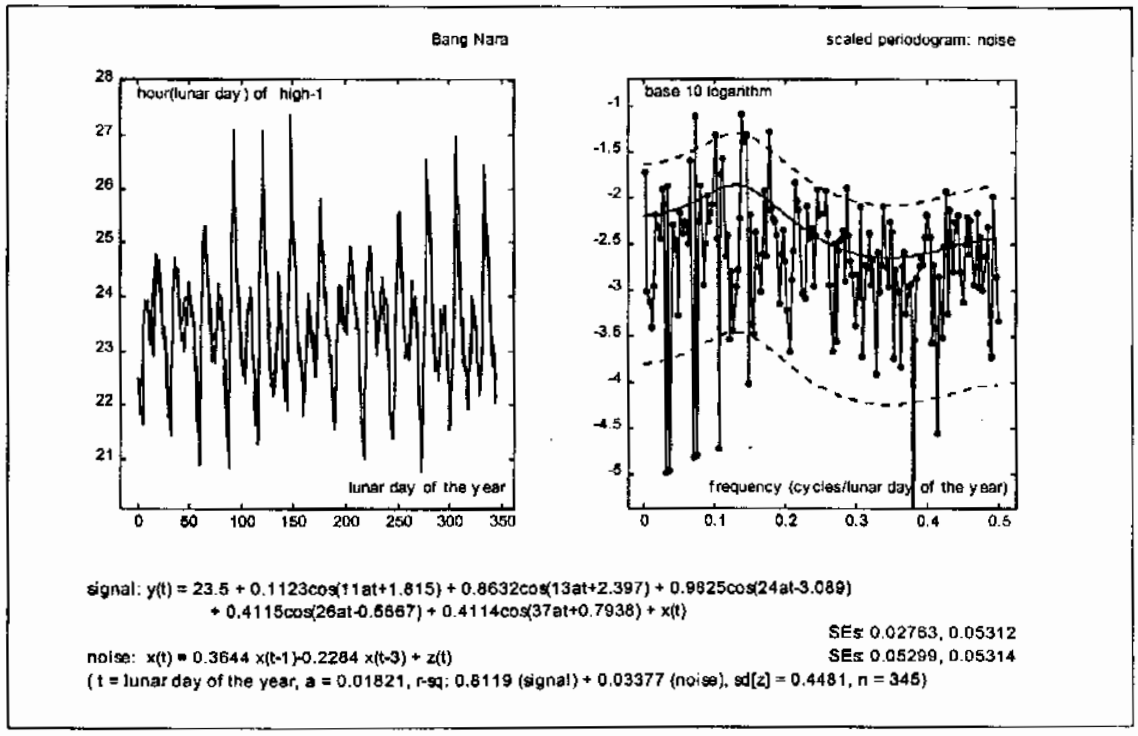

Figure 4.26 Analysis of time of occurrence of high-1 for Bang Nara in 1994

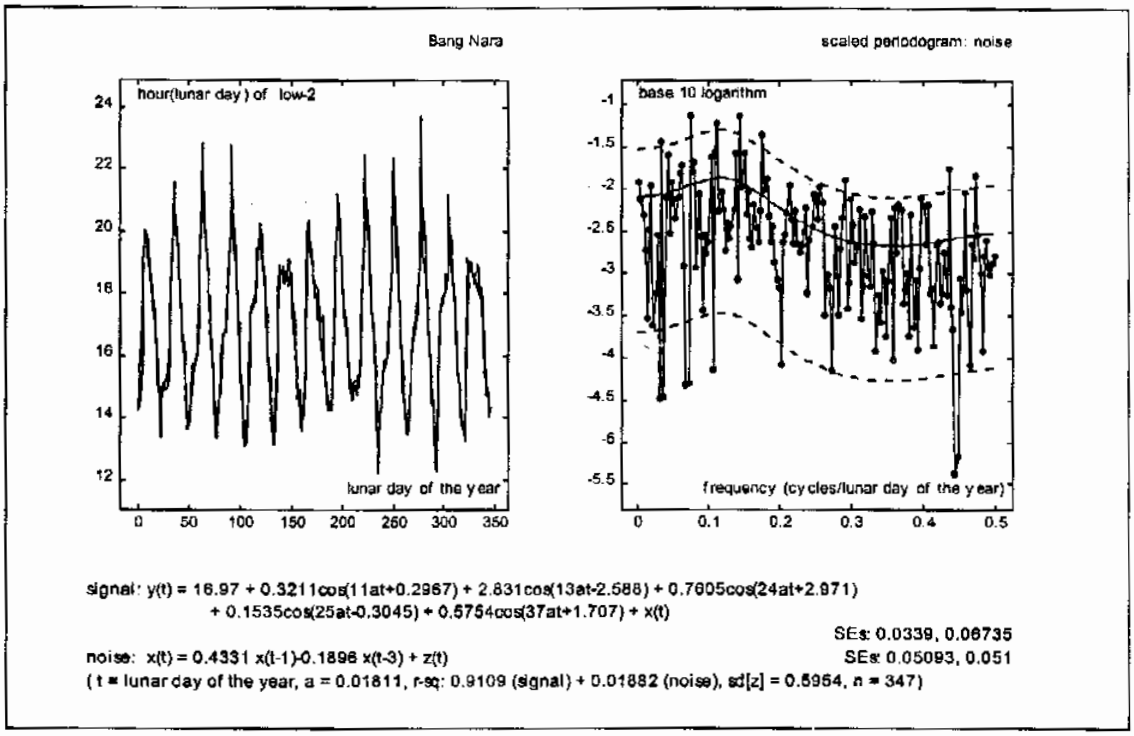

Figure 4.27 Analysis of time of occurrence of low-2 for Bang Nara in 1994

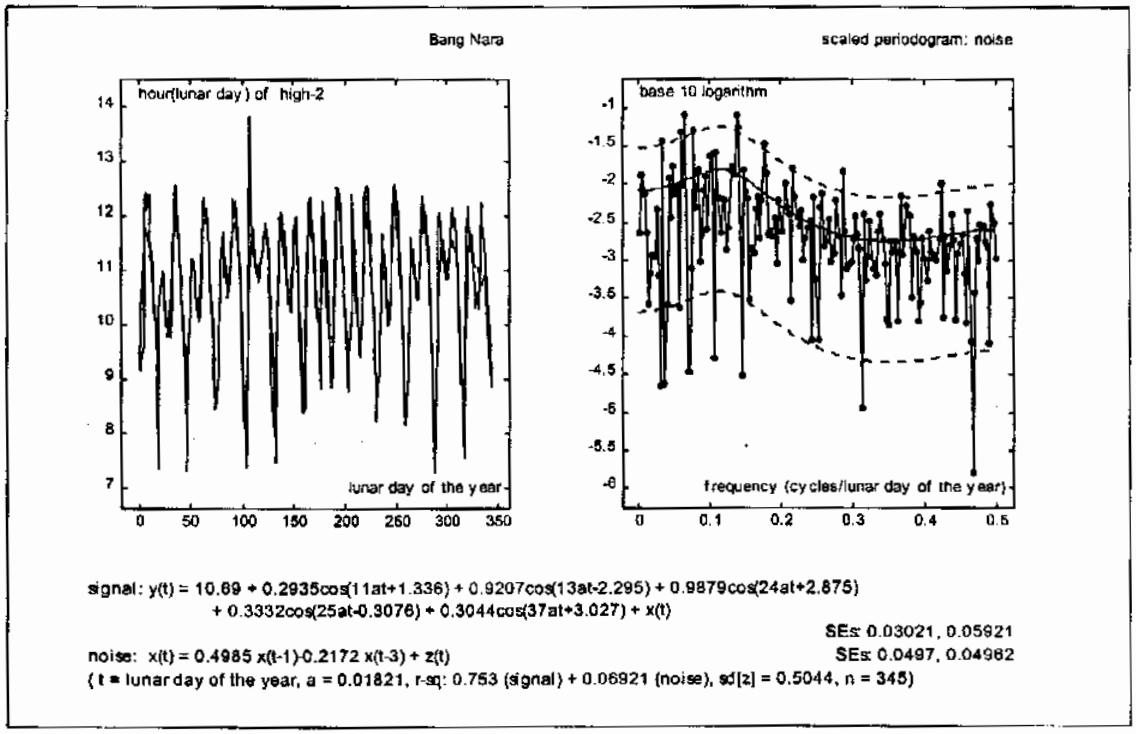

Figure 4.28 Analysis of time of occurrence of high-2 for Bang Nara in 1994

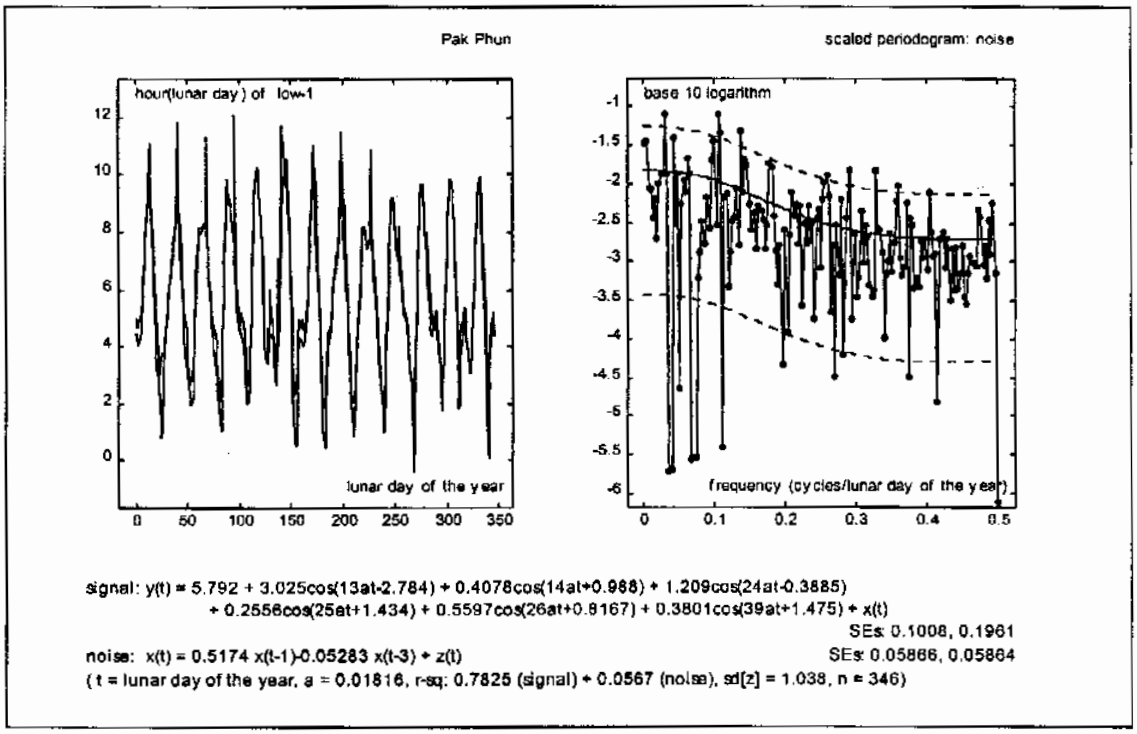

Figure 4.29 Analysis of time of occurrence of low-1 for Pak Phun in 1994

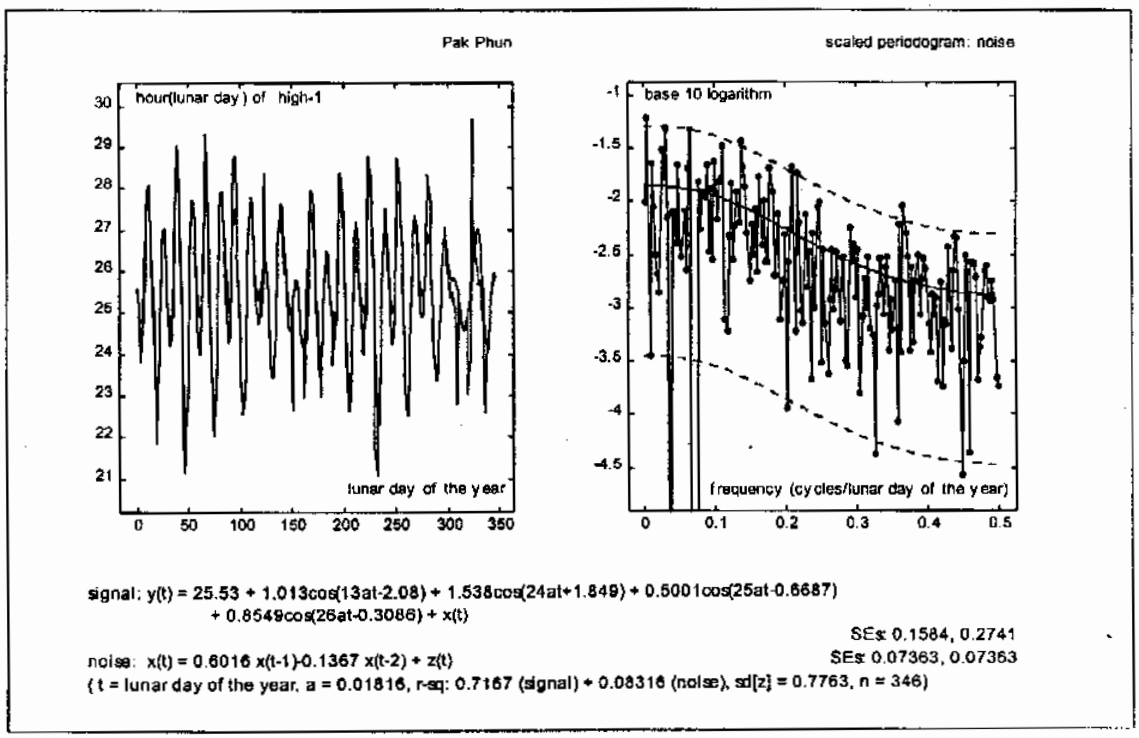

Figure 4.30 Analysis of time of occurrence of high-1 for Pak Phun in 1994

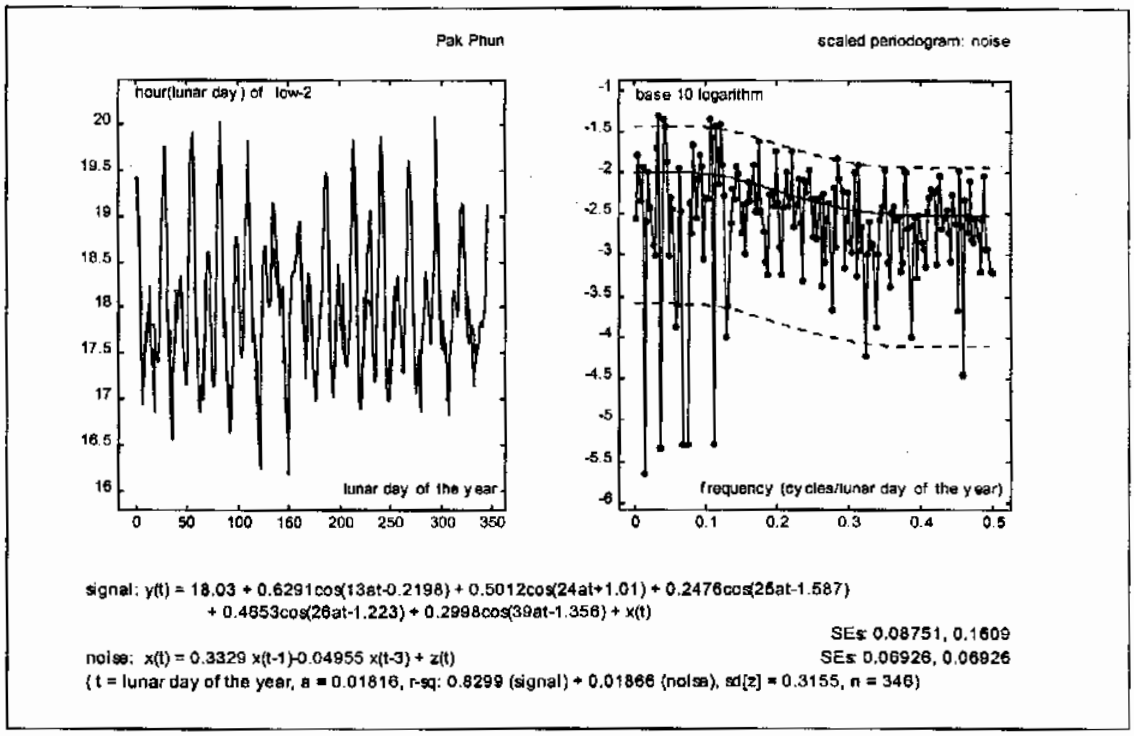

Figure 4.31 Analysis of time of occurrence of low-2 for Pak Phun in 1994

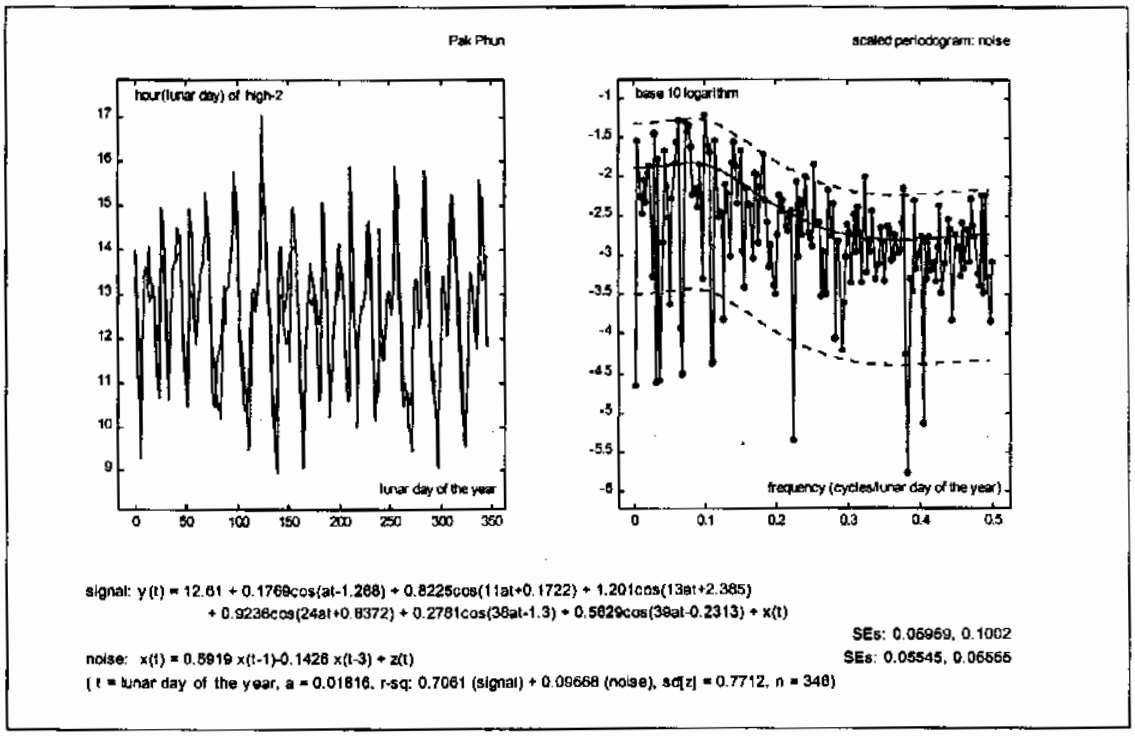

Figure 4.32 Analysis of time of occurrence of high-2 for Pak Phun in 1994

Reconstruction of water heights at Ko Nu

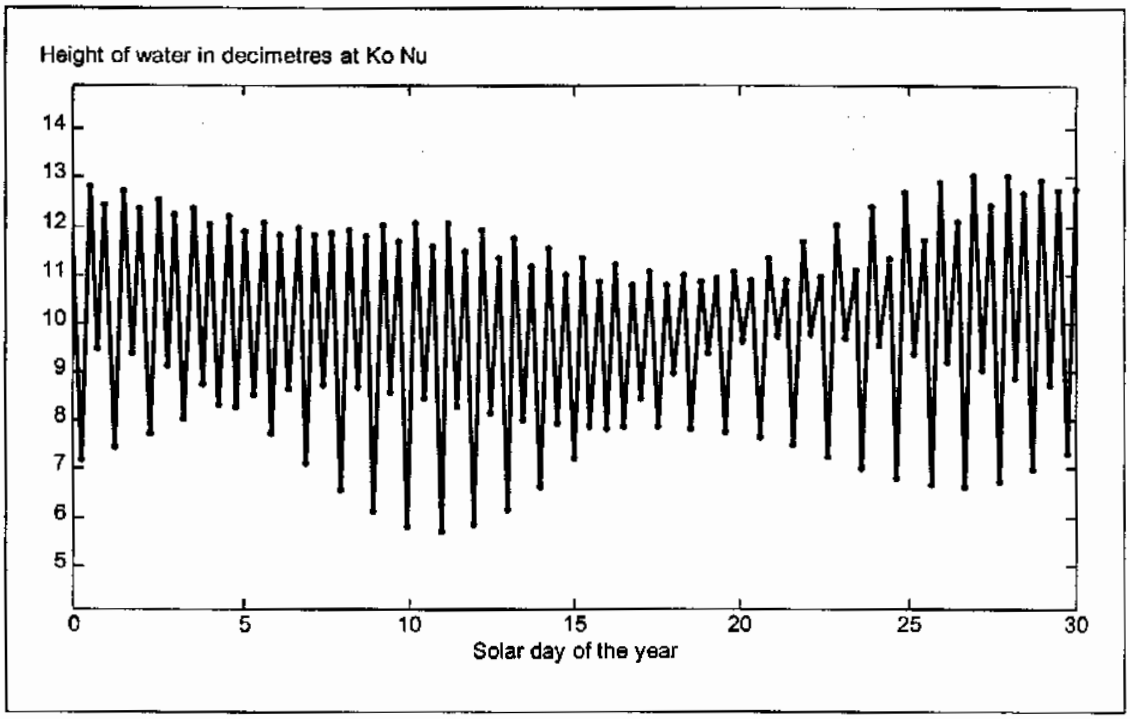

Figure 4.33 Tidal reconstruction for Ko Nu in the first 30 days

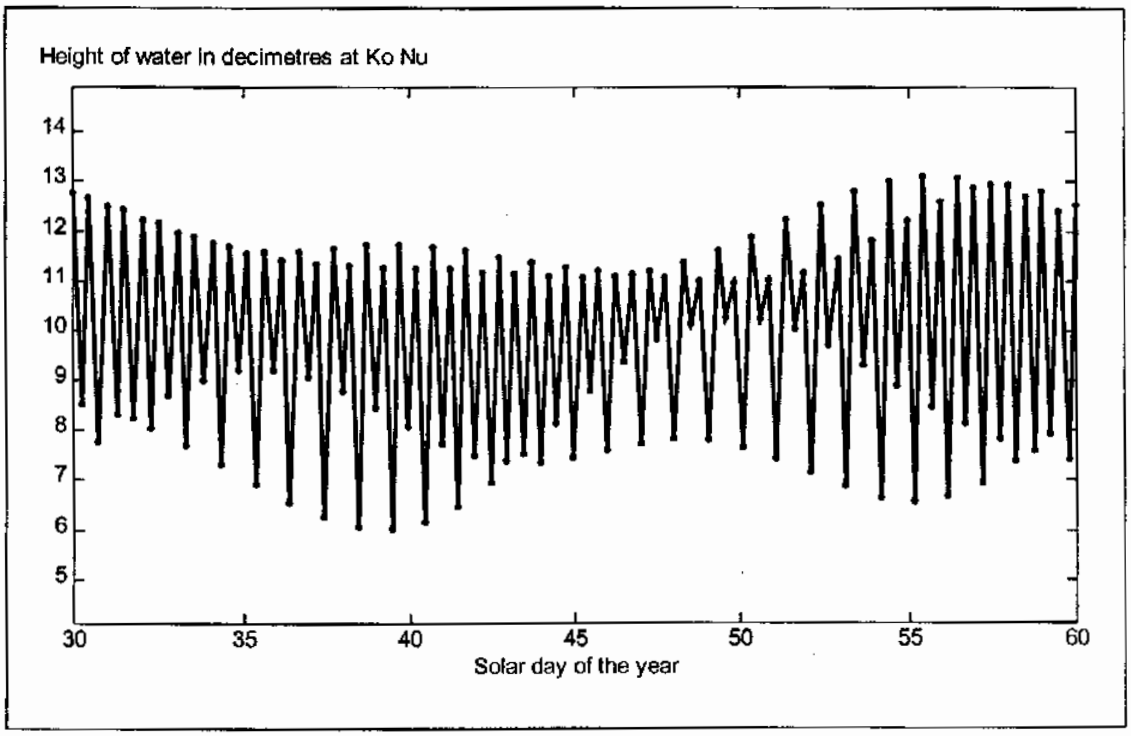

Figure 4.34 Tidal reconstruction for Ko Nu during 30 – 60 days

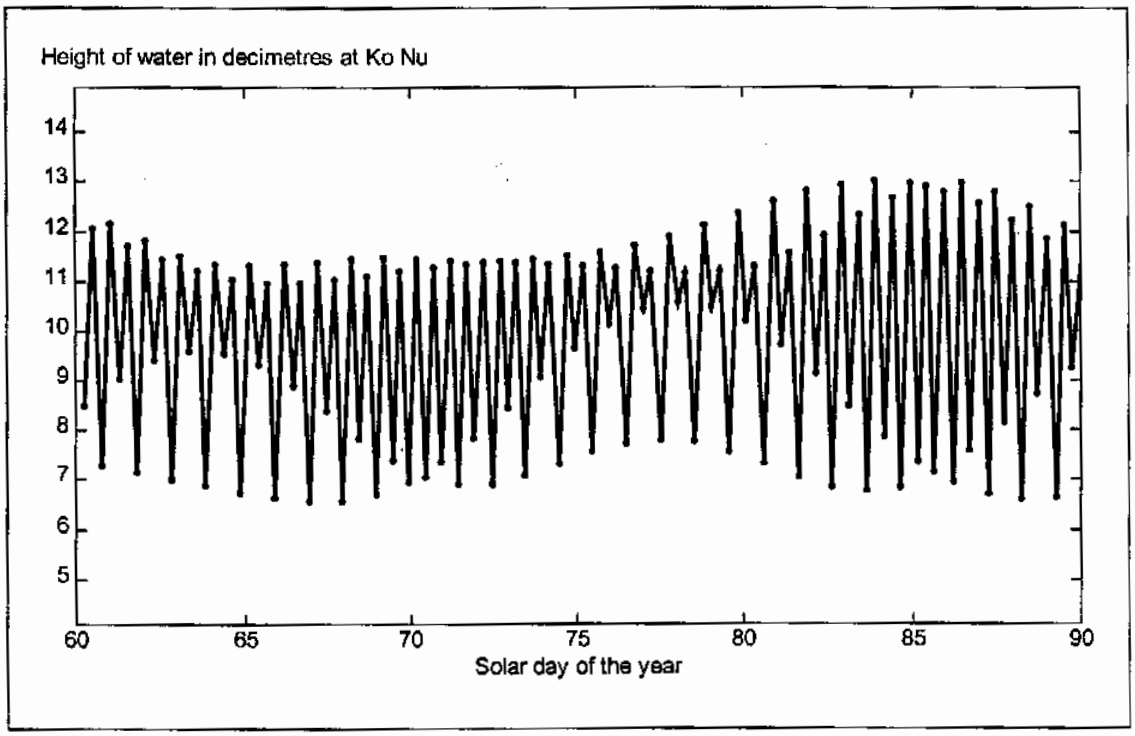

Figure 4.35 Tidal reconstruction for Ko Nu during 60 – 90 days

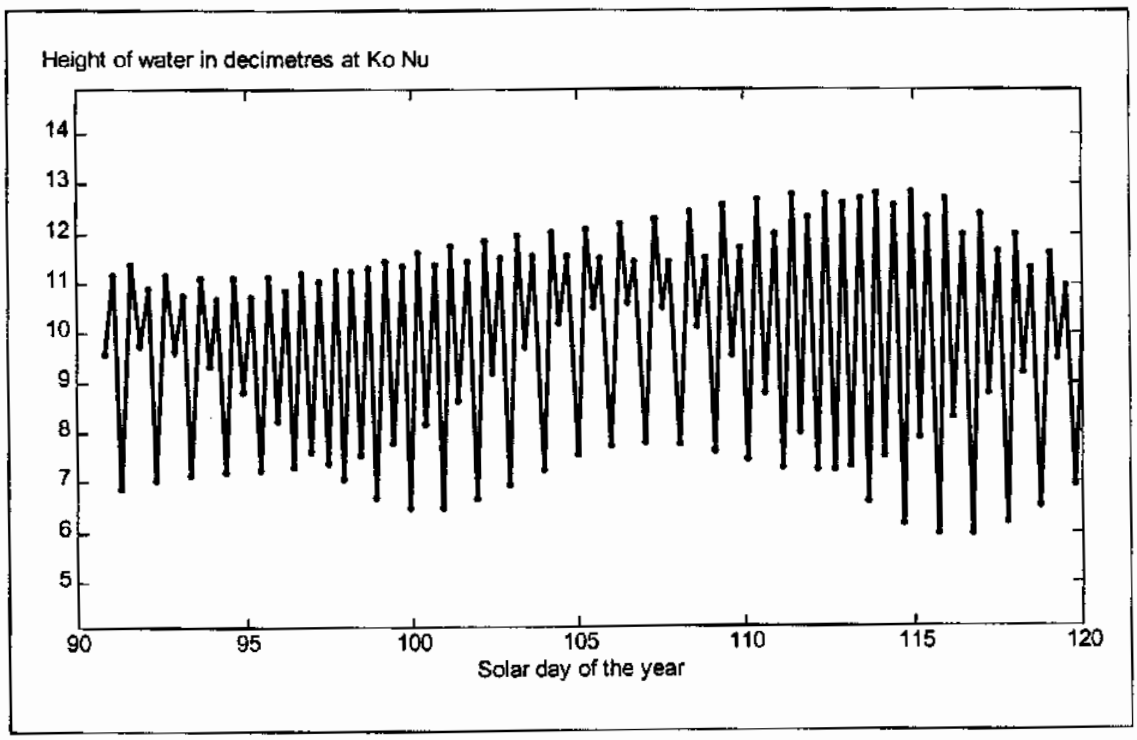

Figure 4.36 Tidal reconstruction for Ko Nu during 90 – 120 days

Reconstruction of water heights at Pak Phun

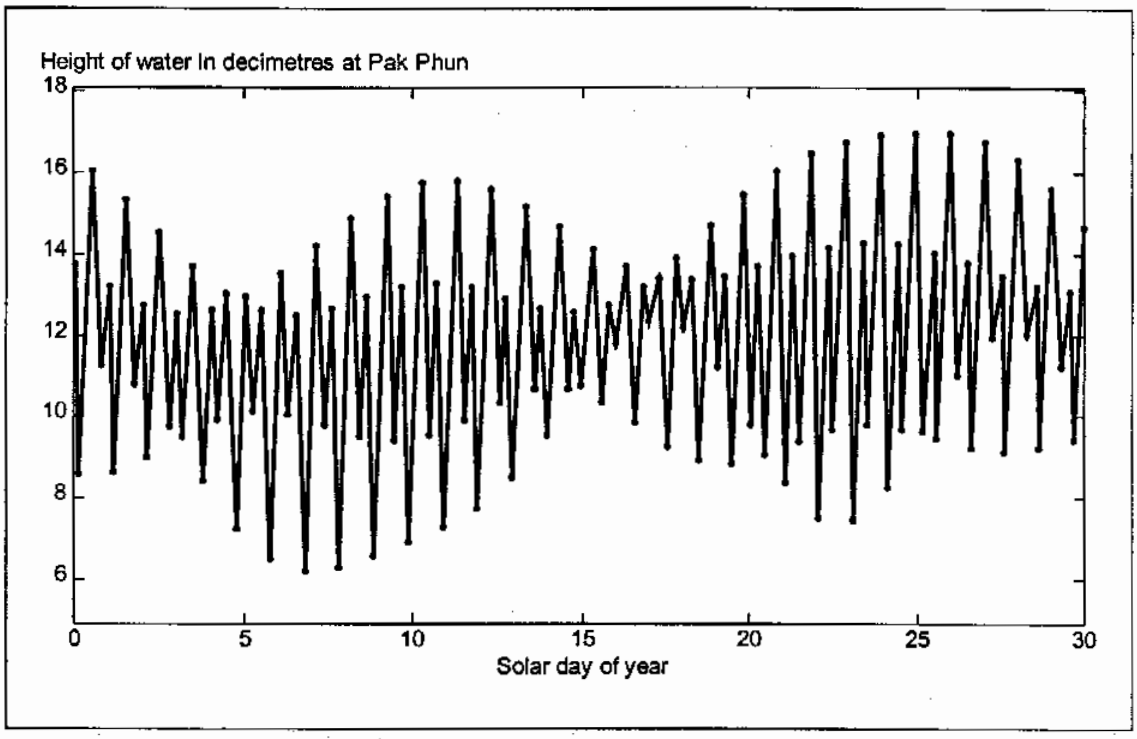

Figure 4.37 Tidal reconstruction for Pak Phun in the first 30 days

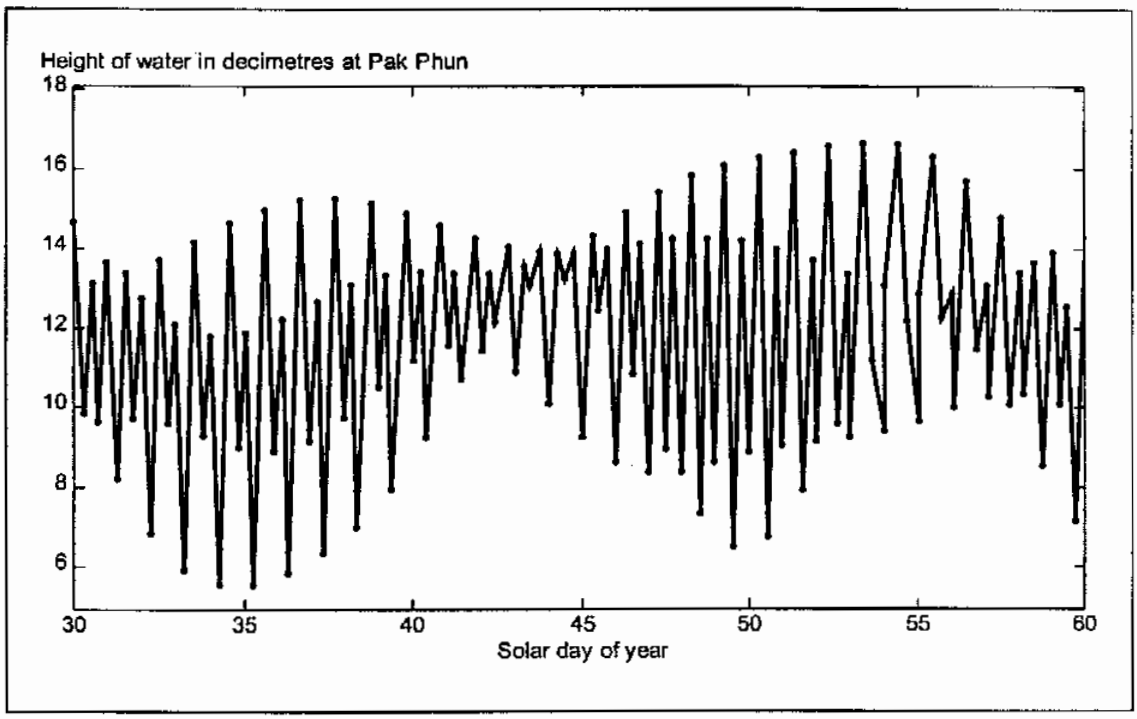

Figure 4.38 Tidal reconstruction for Pak Phun during 30 – 60 days

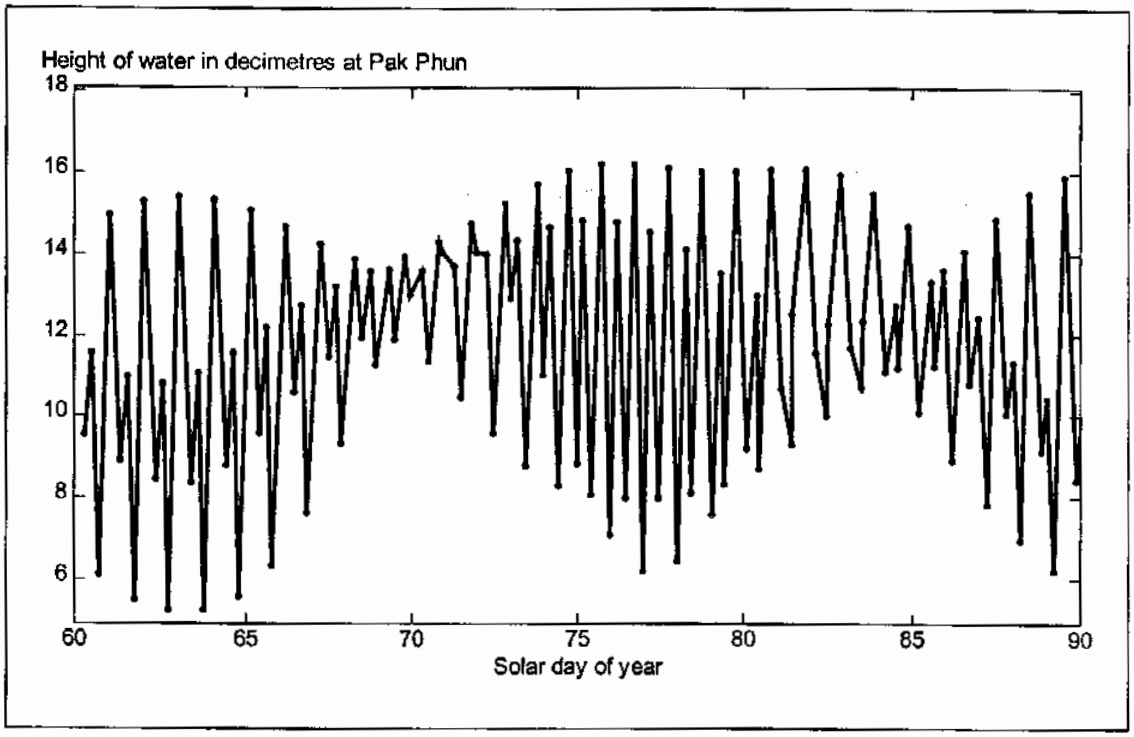

Figure 4.39 Tidal reconstruction for Pak Phun during 60 – 90 days

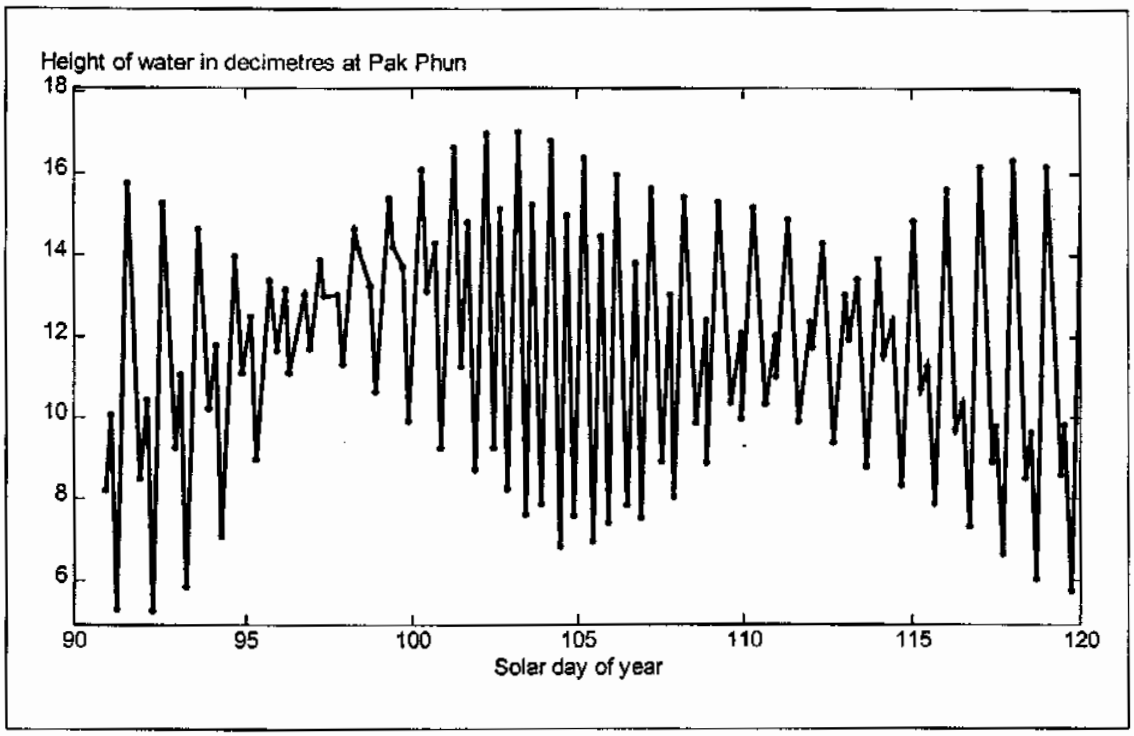

Figure 4.40 Tidal reconstruction for Pak Phun during 90 – 120 days