

# Time Series

## Practical 1

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### **Abstract**

You should start your report with a short (1 paragraph) summary of your findings, written in a style suitable for a non-statistician.

### **Question 1**

The pond data, which contains the monthly water levels in a small pond in rural Hampshire, is loaded into R. Recordings are taken at the start of every month, from January 1966 to December 2015. Without performing any processing of raw data, the following are noted

- The measuring appears to have a maximum cutoff at 6 m. Anything above this gets set to 6 m.
- There are seasonality effects with a period of 12 months.
- A seasonal effect with a period greater than 12 months is present. This is approximated at 8.5 years.
- One large dip in the data, where the pond level reaches a record low, is seen around 2005. This

The data is plotted (Figure 1) and summary statistics are computed (Table 1).

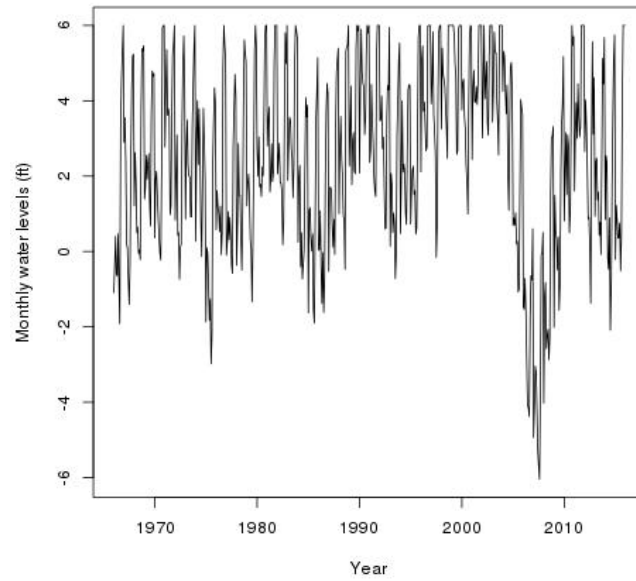


Figure 1: Monthly water levels in a pond.

By plotting the ACF of the pond data time series, we see a periodic seasonality is present in the data (Figure 2).

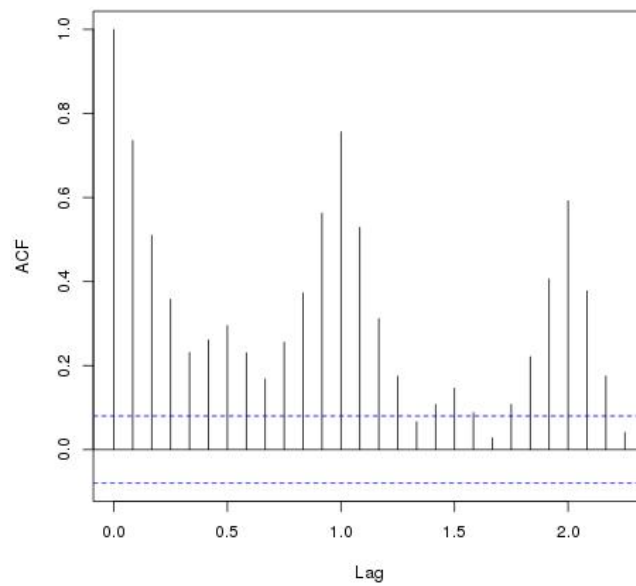


Figure 2: ACF of data.

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
-6.0460	0.7135	2.6400	2.5180	4.4540	6.0000

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Table 1: Summary statistics for monthly water levels in a pond.

Seasonality (annual) was removed and residuals were denoted by  $Y$  (see Figure 3). It can be seen from the plot that there exists a seasonality trend of approximately 8.5 years.

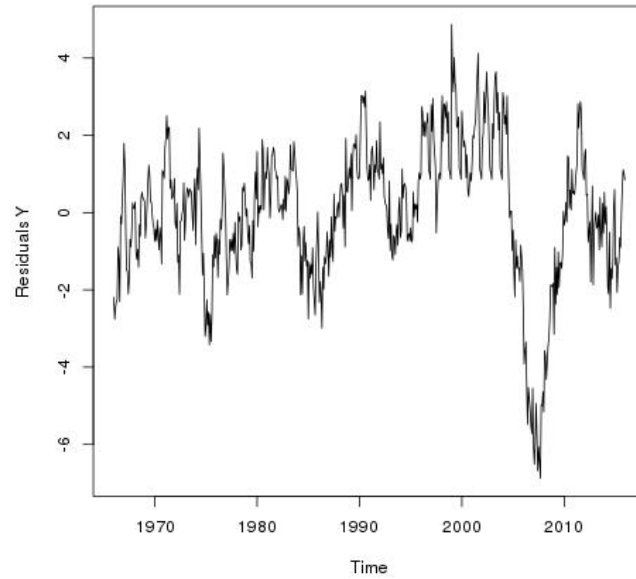


Figure 3: Residuals  $Y$ .

The ACF of the residuals  $Y$  is plotted, it is evident that there exists a trend in the data (Figure 4).

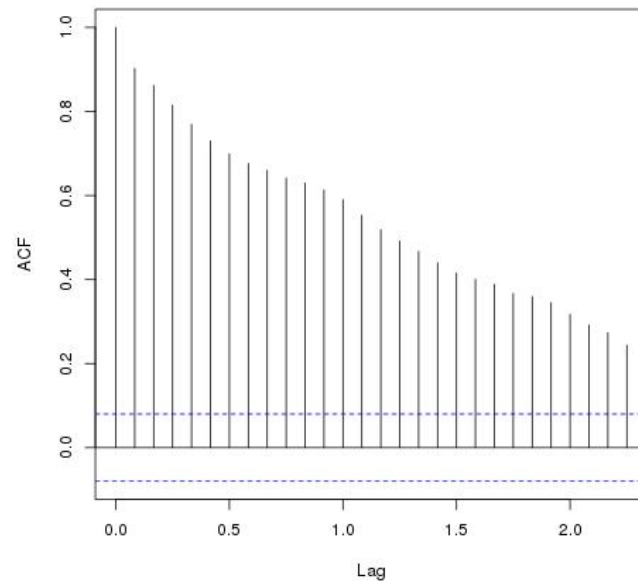


Figure 4: ACF of residuals  $Y$ .