Contents

1.1 Browse and bookmark the web sites referred to in the previous section.

1.2 Become familiar with the MINITAB package by starting it up on the PCs (see notes). Get used to the options and the on-line help.

1.3 Type in a column of 10 numbers guessed at random and then try to analyse them using the "Stats" options. (this will be covered in detail in the next lecture).

2.1 Try to reproduce the analyses presented in this lecture by using MINITAB on the data set **rdgmorph.txt**.

2.2 Prepare a new data set based on a sample of your colleagues and repeat the analyses. Comment on any notable differences from the sample of Reading meteorologists.

2.3 Add a "troll" with height 0.5 metres and weight of 150kg to your data set and repeat the descriptive statistics. Note which statistics are most sensitive to having a troll (i.e. outlier) in the data.

1. Is there a linear time trend in the wintertime means of Central England Temperature ? Read the **atldjf.txt** data into MINITAB and then perform a regression analysis of CET (column 6) on year (column 1) in order to test this hypothesis. Find the estimated rate of change per year, the coefficient of determination, and the confidence.

2. Carefully examine your linear fit to the Central England Temperature series by making diagnostics of the residuals. Do you think that the CET trend is well described by the linear fit ?

3. Based on your best estimates of the linear fit, what is the predicted linear warming in CET in 100 years time ? Give uncertainity estimates on this climate prediction.

1 Exercises

1. Extend your linear modelling of CET in data set **atldjf.txt** by performing a multiple regression that includes the mean wintertime sea-level pressure at Iceland. Comment on whether this improves the fit ?

2. Use the sea-level pressures in data set **atldjf.txt** to explain the CET response by performing a multivariate regression excluding time. Which pressure observations are most important in explaining the CET ?

3. Test the sensitivity of the above multivariate regression to the inclusion of time as an explanatory factor. Are pressures alone sufficient for explaining the long-term trend in CET since 1950 ?

2 Exercises

1. Read into MINITAB the montly mean time series of Darwin sea-level pressures in file **darwinraw.txt** and reproduce the analyses presented in this chapter of the notes.

2. Using the ARIMA option in MINITAB, fit both an AR(1) and AR(2) time series model to the series and compare the fits.

3. Gaussian white noise is unpredictable. However, backward differences of Gaussian white noise are well correlated with preceeding values. Calculate both theoretically and with some randomly generated numbers the lag-1 autocorrelation for such a series. Explain why an AR(1) fit to such a series could not be used as a forecasting scheme to predict white noise.

3 Getting started with MINITAB

Click on the MINITAB icon and the MINITAB package will open up. Read carefully the introduction to the on-line help. Then try and read in some data by clicking on the data ? window and then "Open descriptor ?" in the "File" icon. Don't forget to be clicked on the appropriate data or command window when performing operations.

4 MINITAB datasets used in the notes and exercises

4.1 Dataset 1: rdgmorph.txt

Small biometric survey of nearby colleagues in the meteorology department at the University of Reading taken on 10 Aug 2000.

PERSON AGE in years WEIGHT (cm) HEIGHT (kg)

4.2 Dataset 2: darwin.txt and darwinraw.txt

Monthly mean Sea-level pressure measured at Darwin in northern Australia from Jan 1951 to Jul 2000 freely obtained from http://www.cpc.noaa.gov/data/indices/

Note that 1000mb has been subtracted from all values.

YEAR JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Darwinraw.txt consists of the 600 consecutive monthly mean values of the pressure at Darwin starting in January 1951. Note that the annual cycle is present.

4.3 Dataset 3: atldjf.dat

Some wintertime means of historical time series from around the North Atlantic for the period from 1866 to 1997. (Note: 1866 refers to mean of Dec 1865 to Feb 1866).

Columns 2-6 are the mean sea-level pressures observed at certain stations frequently used to construct the North Atlantic Oscillation index. CET is the Central England Temperature observed at several central stations in England. The pressures can be used to explain the variations in the temperatures. In other words, the central england temperature is a response to changes in explanatory factors related to the atmospheric circulation.

Original time series data can be found on http://www.met.rdg.ac.uk/cag/NAO/ under Indices.

YEAR ICELAND AZORES GIBRALTAR LISBON CET 1866 995.1 1021.57 1022.63 1022.37 5.33