

Weather Reporter Extension Pack

Curriculum Materials



The Advisory Unit
Computers in Education

The Innovation Centre
Hatfield, Herts AL10 9AB

Tel: 01707 281102 Fax: 01707 281103

sales@advisory-unit.org.uk

Using Weather Reporter data in your school

There are a number of questions about that arise when thinking about using the Weather Reporter data in school.

Who should be responsible for downloading the weather data?

The network manager should be responsible for setting up the system so that network stations can all access the Viewer module. Weather data can be saved manually or automatically into a shared area on the network for others to use. If the data is 'live' on the network, (i.e. the Weather Reporter is connected to the computer with the Reader module), then you can load the Viewer program on any station to look at the Weather Now screen and current graphs of hourly and daily weather from the Weather Reporter mast. Any user can then save data current Weather Reporter data.

How often should the data be downloaded?

Saving data for every hour of every day creates files which may not always be used in class. It is best to concentrate on saving hourly data for a purpose - perhaps as part of a weather week, or if typical, interesting or unusual weather has happened. Saving data every 48 hours will ensure that continuous hourly data is kept.

Daily data can be saved manually or automatically into a file. If saving manually, then fortnightly or monthly intervals are sufficient. It is best to keep a check on the system every so often to make sure that everything is set up correctly. For instance, the power may have been switched off inadvertently.

Saving weather data automatically ensures that a file of continuous data is kept and added to at intervals of your choosing.

In which format should the data be saved? Weather Reporter format or CSV format?

Both formats can be loaded into the Weather Reporter program and displayed again. It is not possible to convert saved data to a different format. This has to be done at the time the data is downloaded. Even if the data is not going to be used immediately in other programs such as spreadsheets or databases, it is best to save it in CSV format to get the maximum use from the data throughout the school.

Where should the weather data be saved?

Weather data files may be saved on a floppy disk, on the hard disk of your computer, or directly into a suitable shared area of the network. Datafiles may also be copied and used with the Weather Reporter program, spreadsheets or databases on any computer in the school. Geography, ICT, Maths and Science departments will all find a use for the data within the curriculum.

Weather Reporter in the Curriculum at Key Stage 2

Weather is an integral part of the Geography curriculum and has relevance to ICT, Science and Mathematics.

<p>Geography</p> <p>Geographical enquiry and skills</p> <ul style="list-style-type: none"> • use ICT to help in geographical investigations • identify and describe what places are like, for example, in terms of weather. <p>Knowledge and understanding of places</p> <p>explain why places are like they are, for example, in terms of weather conditions.</p>	<p>Examples</p> <p>Keep a weather diary, entering observations into a database then compare the data with the Weather Reporter.</p> <p>See how the weather changes on the hourly graphs throughout a rainy day and a sunny day.</p> <p>Understanding temperature. What is the temperature now? Do I need to wear a coat, hat, scarf and gloves to go out to play today or only a T-shirt?</p> <p>Make a weather tree to show the differences between the seasons. Draw a large tree with 12 branches, one for each month, and pin it on the classroom wall. Stick a coloured leaf onto the branch to represent each day's weather. Use 'cold' colours for low temperatures and 'hot' colours for higher temperatures. If it has rained put a black dot on the leaf.</p>
<p>Science</p> <p>Scientific enquiry</p> <p>Obtaining and presenting evidence</p> <ul style="list-style-type: none"> • Use simple equipment and materials appropriately and take action to control risks make systematic observations and measurements, including the use of ICT for datalogging • Check observations and measurements by repeating them where appropriate use a wide range of methods, including diagrams, drawings, tables, bar charts, line graphs and ICT, to communicate data in an appropriate and systematic manner <p>Considering evidence and evaluating</p> <ul style="list-style-type: none"> • Make comparisons and identify simple patterns or associations in their own observations and measurements or other data <p>Use observations, measurements or other data to draw conclusions.</p>	<p>Examples</p> <p>Compare readings from hand-held thermometers, anemometers and rain gauges in different places in the school grounds with weather data from the Weather Reporter automatic datalogging system.</p>

<p>Mathematics</p> <p><i>Processing, representing and interpreting data</i></p> <ul style="list-style-type: none">• solve problems involving data.• interpret tables, lists and charts used in everyday life; construct and interpret frequency tables, including tables for grouped discrete data.• represent and interpret discrete data using graphs and diagrams, including pictograms, bar charts and line graphs, then interpret a wider range of graphs and diagrams, using ICT where appropriate.• know that mode is a measure of average and that range is a measure of spread, and to use both ideas to describe data sets.• recognise the difference between discrete and continuous data.	<p><i>Using weather data in Mathematics</i></p> <p>Find out about maximum, minimum temperature and range of temperature by interpreting the graphs and using weather data in a spreadsheet.</p> <p>Decide whether a line or a bar graph is suitable for representing different types weather data.</p> <p>Identify which weather data is discrete and which is continuous.</p>
<p>ICT</p> <p><i>Developing ideas and making things happen</i></p> <ul style="list-style-type: none">• create, test, improve and refine sequences of instructions to make things happen and to monitor events and respond to them, for example, monitoring changes in temperature, detecting light levels. <p><i>Finding things out</i></p> <ul style="list-style-type: none">• interpret information, check it is relevant and reasonable and think about what might happen if there were any errors or omissions.	<p><i>Examples</i></p> <p>Understand the processes in monitoring weather data by trying out some datalogging experiments with temperature or light sensors. Compare the results with the Weather Reporter data.</p> <p>Understand why Weather Reporter data may be incomplete or incorrect.</p>

Weather Reporter in the curriculum at Key Stage 3

Weather studies, enquiries and skills in Geography, scientific investigations, datalogging and data interpretation in ICT and the use of data in Mathematics are all relevant activities with the Weather Reporter for this age range.

Geography	Examples
<p>Geographical enquiry</p> <ul style="list-style-type: none"> • Ask geographical questions • Suggest appropriate sequences of investigations • Collect, record and present evidence • Analyse and evaluate evidence and draw and justify conclusions • Communicate in ways appropriate to the task and audience. <p>Geographical Skills</p> <ul style="list-style-type: none"> • Select and use appropriate fieldwork techniques and instruments • Select and use appropriate graphical techniques to present evidence on maps and diagrams including ICT. <p>Themes</p> <ul style="list-style-type: none"> • How and why weather and climate vary from place to place. • Differences between 'weather' and 'climate'. 	<p>Local weather</p> <p>Keep a weather diary for a week. Listen to weather forecasts, keep weather maps from the newspapers and download hourly Weather Reporter data. How accurate are the predictions of the weather? What methods are used to present weather information? Try out different methods of presenting weather data for particular audiences, to describe what the weather has been like.</p> <p>Regional weather</p> <p>How does local weather compare with other parts of the country? Use Met Office statistics or exchange data with another school. See The Advisory Unit's web site for links to other schools with weather data.</p> <p>www.advisory-unit.org.uk</p> <p>Weather and climate</p> <p>Compare your monthly averages with other parts of the world. Use data from atlases or digests for these comparisons. Enter data and draw graphs in a spreadsheet and compare the results with the Weather Reporter data for your area.</p> <p>Compare the same month's daily data for a few years. What are the similarities and differences? Are there any patterns?</p> <p>Seasonality</p> <p>Compare daily data for a winter month and a summer month. Draw and interpret graphs in a spreadsheet to do this.</p> <p>Save hourly and daily weather data to show stable conditions (high pressure areas) and unsettled weather (low pressure areas). Describe the data and indicate the differences on graphs.</p> <p>Relationships</p> <p>Save daily weather data in CSV format and display it on graphs in a spreadsheet or search the weather data in a database program.</p> <p>Is there evidence of any relationships. Is it always windy when it rains? Are sunny days hot? This may be an opportunity to try some hypothesis testing.</p>

<p>ICT</p> <p><i>Developing ideas and making things happen</i></p> <ul style="list-style-type: none"> • how to use ICT to measure, record, respond to and control events by planning, testing and modifying sequences of instructions, for example, using automatic weather stations. <p><i>QCA KS3 Schemes of Work - Unit 8</i></p> <p>The Weather Reporter is a key resource for this unit of work which includes:</p> <ul style="list-style-type: none"> • How an automatic weather station senses and saves data; • How to download weather data; • How to process and analyse data in graphs; • How to share weather data and weather images within a presentation package or web pages. 	<p><i>Examples</i></p> <p>The resources in this pack are ideal for supporting work with the Weather Reporter to cover the requirements of the ICT curriculum and Unit 8 in the QCA Scheme of Work for Key Stage 3.</p> <p>The resources may also be used in the Geography classroom, especially if Unit 8 is taught by the Geography Department.</p> <p>See Page 7 for a list of resources, activities and learning outcomes</p>
<p>Mathematics</p> <p><i>Handling data</i></p> <ul style="list-style-type: none"> • collect data from a variety of suitable sources, including experiments and surveys, and primary and secondary sources • process and represent the data: turn the raw data into usable information that gives insight into the problem • interpret and discuss the data: answer the initial question by drawing conclusions from the data. 	<p><i>Examples</i></p> <p>Devise a problem, such as <i>'How can complex daily weather data be simplified and presented to a wide audience?'</i></p> <p>Download daily data for a month's weather in CSV format and make it available for pupils to use in spreadsheets.</p> <p>Consider ways of summarising the data: e.g. finding the maximum, minimum, range, mean, mode of different weather elements;</p> <p>Consider whether continuous and discrete data needs to be treated differently;</p> <p>Display the weather data on graphs, add trend lines and annotate the graphs to point out the key features, e.g. 7 continuous nights with frost; gradual rise in temperature during the month.</p>

Weather Reporter in the curriculum at Key Stage 4 and beyond.

The ideas and resources for Key Stage 3 can also be adapted for use higher up the school.

Geography

Investigate weather systems.

Draw graphs of hourly data and describe changes in the weather in conjunction with synoptic charts, satellite images, and reports in daily newspapers.

Explain how and why these changes have occurred.

Use this information to predict the weather. Make a weather forecast for the next day, based on current information.

Investigate local changes in weather

Hourly data may also be used to make comparisons of data from schools in the local area to investigate the influence of local features. For instance, do changes in relief or distance from the sea have any effect?

Individual studies

The examples for KS3 and KS4 may also be the basis for project work.

Further ideas at 16+

Analyse weather systems in detail in conjunction with Weather Reporter data, charts and satellite images.

Investigate the relationship between river flow and hourly rainfall in the local area.

Identify local weather conditions such as heat islands or frost hollows and explain how and why they occur.

Look at the effects of the weather on people's behaviour. Do more traffic accidents happen when the weather is bad? Compare local accident data with hourly weather data for a given period to find out.

ICT / Design and Technology

Investigating energy saving

Use the weather data to help model how thermostats operate. Design a system that measures and controls data from temperature sensors, and obtain feedback from using real weather data with the system.

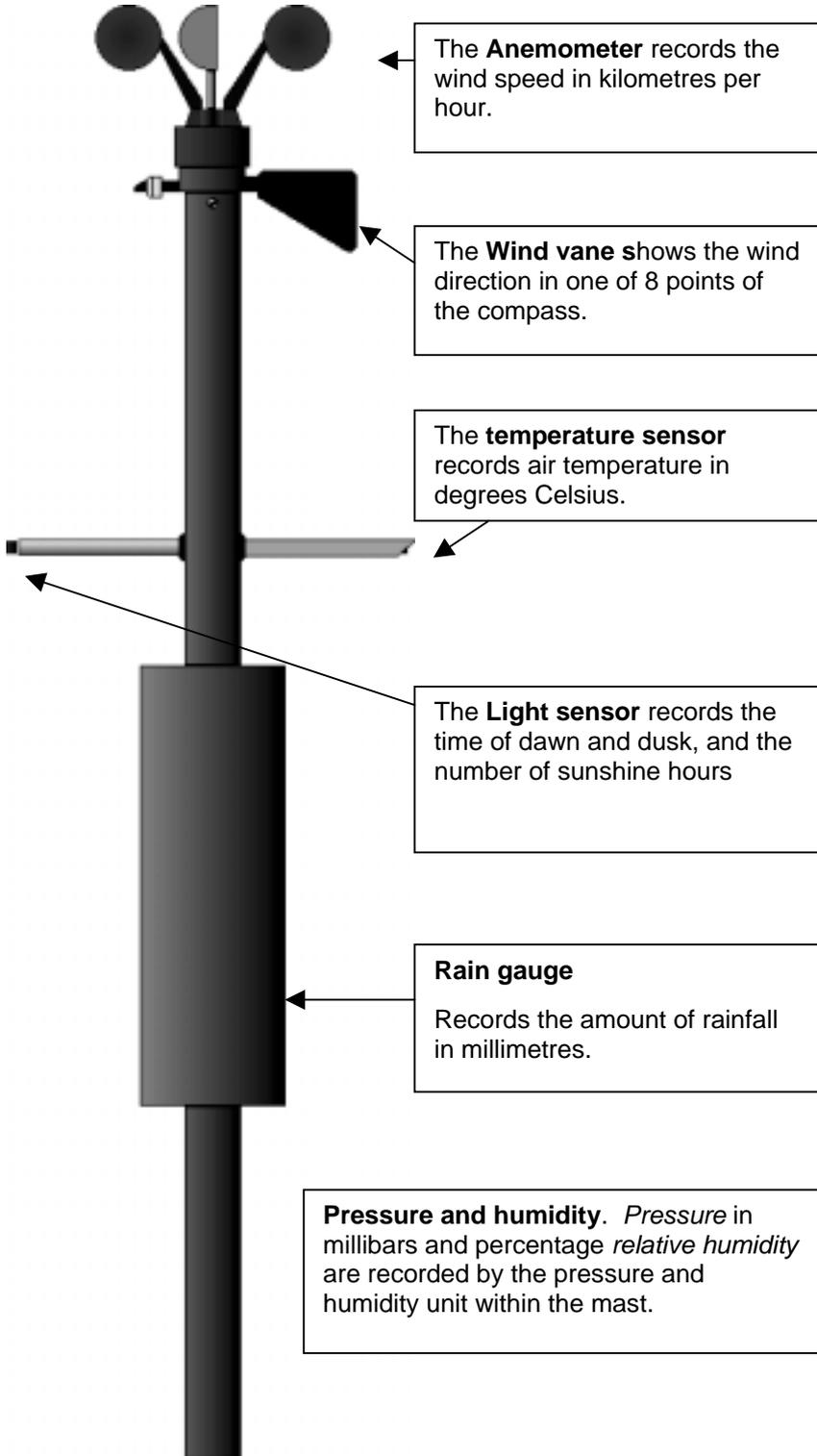
Weather Reporter activities

A summary of the Weather Reporter activities. The resource sheets are on the following pages.

	Objective	Activity	Resource sheet	Learning outcome
1	To find out why we use automatic weather stations.	Comparison between manual and automatic methods	WR 1a and b - Comparing automatic and manual data recording.	An understanding of the differences between these two methods.
2	To find out about automatic data collection.	Finding out about sensors and data storage.	WR 2a - How the Weather Reporter records data. WR 2b Glossary of terms.	Understanding the functions of different types of sensors that collect weather data.
3	Obtaining weather data from the Weather Reporter	Linking up Weather Reporter and computer; downloading data using the Weather Reporter software	WR 3 - Collecting and storing Weather Reporter data. Weather Reporter system.	Understanding that data may be stored and retrieved from remote sources.
4	Collecting Weather Reporter data from the Internet.	Use the Advisory Unit's links to find a school site with weather data and transfer this data to a datahandling package.	WR 4 - Finding and using Weather Reporter data on the Internet.	Understanding that weather data may be obtained from other schools' websites.
5	Make and interpret weather graphs in Excel.	Using Excel to draw composite graphs.	WR 5 - drawing composite graphs adding annotations in Excel 97.	Understanding how weather data may be transformed and analysed by means of graphs.
6	Create a presentation that includes an Excel chart of the weather.	Importing a graph into another Windows application.	WR 6 - Importing an Excel chart into other Windows packages.	Understanding that graphic information may be used in different ways for different audiences.
7	Making and automatically updating a weather presentation on a web page	Using the automatic save facility to update a web page	WR7 - inserting data and graphs in to web pages	Understanding that weather data may be automatically updating on web sites.

WR1A - comparing automatic and manual data recording

Automatic data recording



Manual data recording

How would you record this data manually?

Wind speed

.....

Wind direction

.....

Temperature

.....
.....

Sunshine

.....
.....

Rainfall

.....
.....

Pressure

.....
.....
.....
.....

Relative Humidity

.....
.....

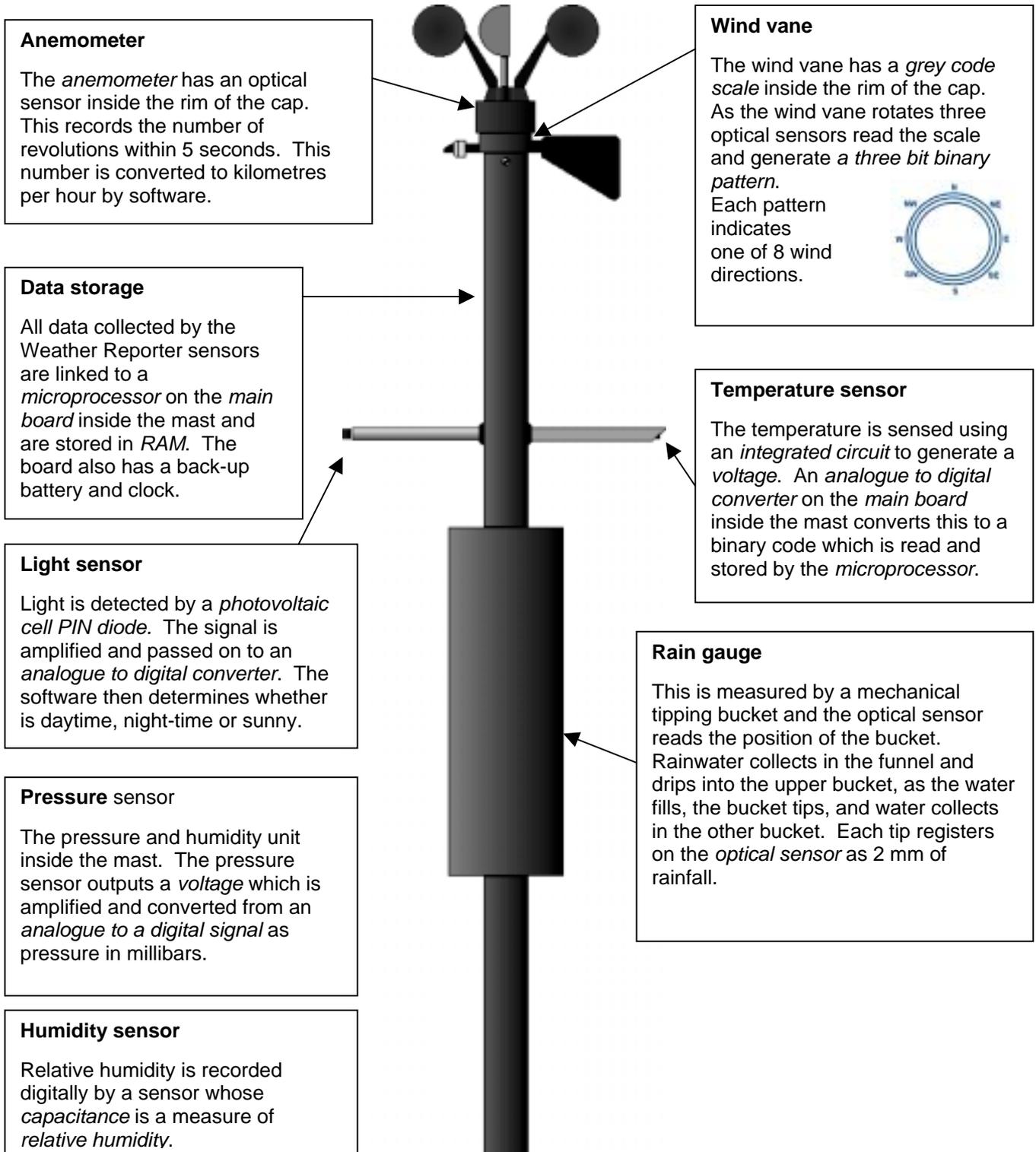
WR1B - Comparing manual and automatic weather recording

Fill in the missing spaces on Weather Reporter 1a to show how you would record the weather manually.

Think about the different methods of collecting data from the Weather Reporter and the manual instruments, then fill in the table below.

	Automatic weather recording	Manual weather recording
Is weather data recorded regularly every day and every hour?		
Is weather data recorded accurately? Are there any reasons why it might not be accurate?		
How would you transfer the weather records into a chart or table?		
Is there some weather data that is difficult to collect by manual methods?		
Is there some weather data that is difficult to collect automatically ?		

WR2A - How the Weather Reporter records data



WR 2B - Weather Reporter glossary

Analogue signal

This is the result of measuring continuously variable data, such as temperature or light.

Analogue to digital converter

A device that changes continuously variable (analogue) data into a digital signal.

Anemometer

A device that measures wind speed. It may be hand held or part of an automatic weather station.

CSV

This stands for Comma Separated Values and is a simple way of storing information in a text file that can be used by many different programs, such as databases and spreadsheets.

Digital signal

A digital signal only has two states, ON and OFF. Often represented by 0 and 1, or zero and 5 volts in an electronic circuit.

Integrated circuit

A miniature electric circuit containing large numbers of devices packaged as a single unit with inputs, outputs and power-supply connections. All this can be put onto a single chip.

Main board

An electrical circuit board that contains all the important microprocessors and connections.

Microprocessor

One or more integrated circuits on a chip that carry out instructions from a computer program.

Optical sensor

Any method of detecting light and translating it into electric signals by means of a photoelectric cell. Optical sensors record variations in light intensity as light is transmitted or reflected. Optical sensing is used in pattern-recognition systems, such as the grey code scale, which measures wind direction.

Pressure

Air pressure is the weight of air on the earth's surface. Normally this is about 1000 millibars.

Photovoltaic cell

A device that converts light to electric current.

RAM

Random Access Memory. This is where data is stored in the weather station mast.

Relative humidity

This is a ratio between the actual amount of water vapour in a given volume of air and the amount which would be present if the air were totally saturated with water at the same temperature. Relative humidity is usually shown as a percentage.

Rolling buffer

The data is stored on a fixed size storage space that can only hold a certain amount of data. When more data is collected, the first set of data is discarded, the remaining data moves along and new data is added on.

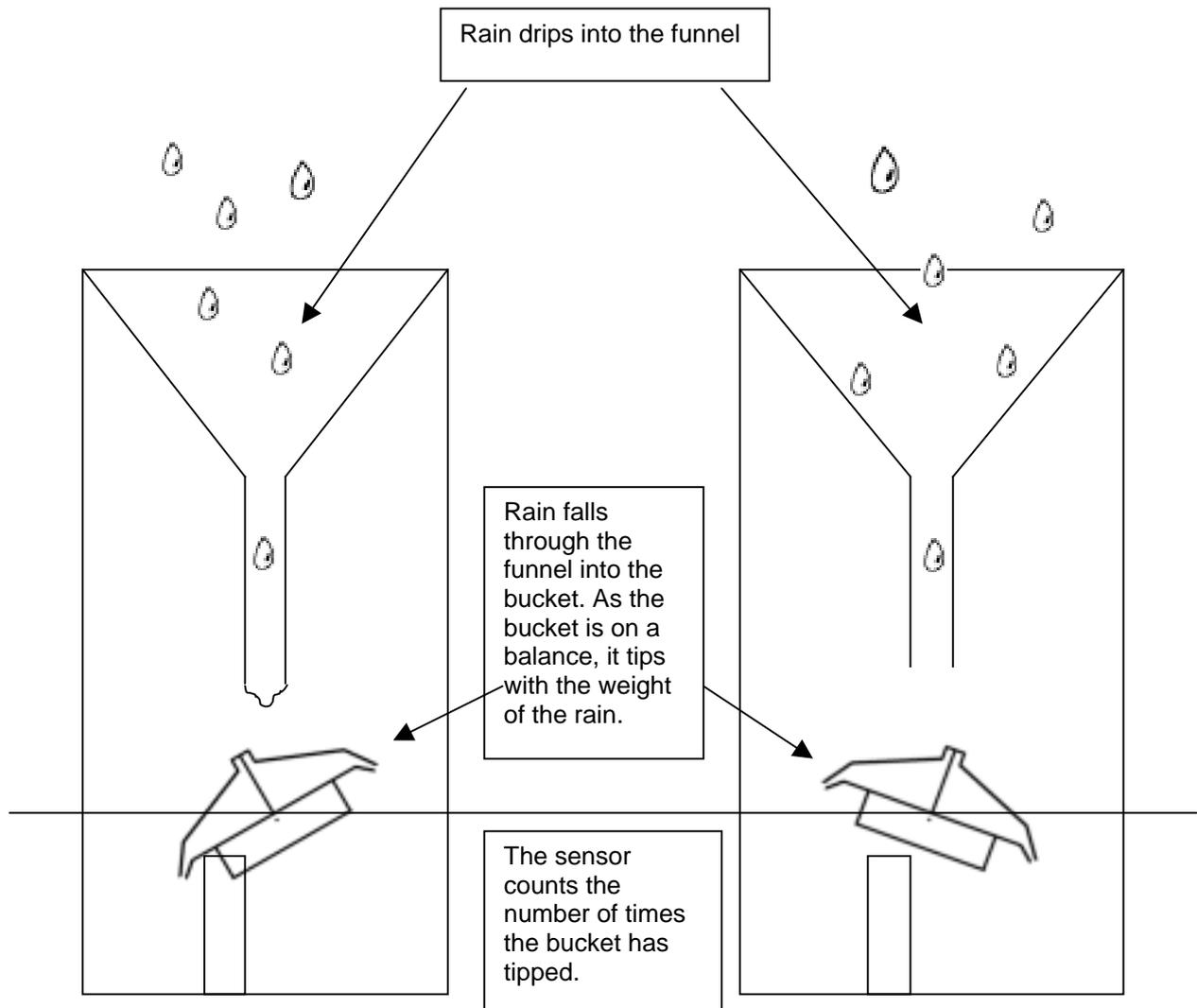
Serial port

A computer interface that sends and receives one bit of data at a time.

WR2c -How the Weather Reporter measures rainfall

The tipping bucket rain gauge measures rainfall.

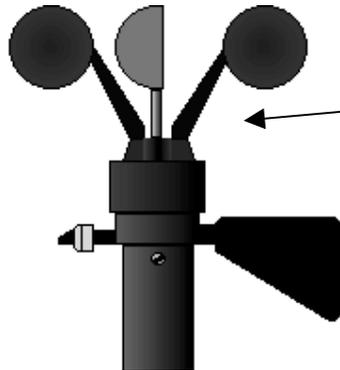
This is a mechanical device that has an optical sensor which reads the number of times a bucket on a balance has tipped.



The software converts the number of tips into millimetres of rainfall.

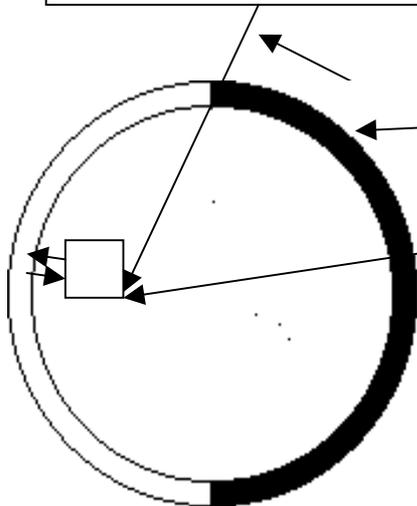
WR2c - How the Weather Reporter measures wind speed

The **anemometer** measures the wind speed.



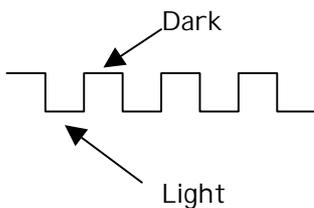
The wind turns the anemometer round.

If you take the anemometer off and look down inside it you can see the wind speed sensor.



Part of the inside of the anemometer is white (light) and part is black (dark).

The sensor reads the changes in light and dark as the anemometer moves round and converts the output to a stream of digits.



This is the output from a high wind speed - a rapid stream of digits.



This is the output from a low wind speed - a slow stream of digits.

The output is passed to a processor. Software converts the output into wind speed in kilometres per hour and Beaufort Scale.

WR 2c - Recording wind direction

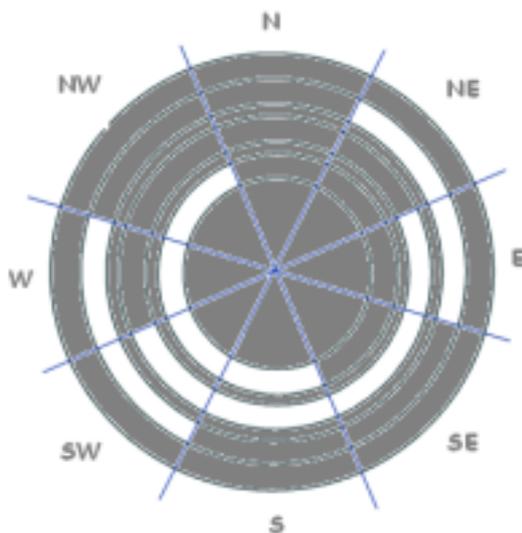
The wind vane has a *grey code scale* inside the rim of the cap. This is shown on the diagram below.

As the wind vane rotates three optical sensors read the scale and generate a *three bit binary pattern*. Each pattern indicates one of 8 wind directions.

Fill in the table below to complete the three bit binary pattern code. A white bar is shown as '1', a black bar is '0'. The South wind direction has been done for you.

Add the other directions to the grey code scale diagram.

Direction	Inner	Middle	Outer
N			
NE			
E			
SE			
S	1	1	0
SW			
W			
NW			



WR 3 - Collecting and saving Weather Reporter data

1. Where is the weather data stored?

Weather data is stored in a *microprocessor* in the mast of the Weather Reporter. Hourly data is stored in a *rolling buffer* for 58 hours and daily data is stored for 58 days from the current time. Weather Reporter Resource 2 shows how the data is collected by the sensors.

2. How do I collect weather data?

The Reader module

The Reader module should be running on the network, (or on your stand alone computer) and the Weather Reporter plugged into the computer with the Reader module in order to collect the data

Downloading current data with the Viewer module

Run the Viewer module on your computer. When the main toolbar appears, choose 'Weather Now', hourly or daily weather data.



The screen will be updated with the current weather data from the Weather Reporter mast.

3. How do I save weather data?

The weather is shown as a graph on the screen, you can save the graph, (hourly, daily and 'Weather Now') or the actual values for hourly weather and daily summaries.

Save the data in *CSV* (comma separated values) format in your network area, or in a prepared shared folder, so that it can be used in other programs, such as spreadsheets.

4. Weather Reporter filenames

When saving data it is useful to keep to these rules, so that you know when the data has been saved, and whether it is hourly or daily data.

The first two digits are the date, the next three letters are the month, followed by the year and whether it's daily or hourly data:

e.g. 02FEB01d.csv - daily data saved on the 2nd February 2001.

e.g. 23APR00h.csv - hourly data saved on the 23rd April 2000.

WR 4 Hourly Weather Reporter data

When the Weather Reporter hourly data is loaded into a spreadsheet it is formatted with these headings and explanations.

TIME	DATE	TEMP	WINDMAX	WINDAVE	BEAUFMAX	BEAUFVE	DIRECT	RAINFALL	PRESSURE	HUMIDITY
Time data was collected	Date data was collected	Temperature in degrees Celsius	Maximum 5 second gust (kph)	Maximum 10 minute average (kph)	Maximum 5 second gust (Beaufort)	Maximum 10 minute average (Beaufort)	Wind direction	Rainfall in mm	Pressure in mBars	Relative Humidity
16	20/05/00	17.22	19.89	8.52	3	2	SW	0	979	47
17	20/05/00	19.52	24.62	8.52	4	2	S	0	978	44
18	20/05/00	15.21	19.89	10.42	3	2	SW	0	979	49
19	20/05/00	13.2	17.99	7.58	3	2	S	0	981	59
20	20/05/00	10.33	14.20	4.73	3	1	W	0	982	73
21	20/05/00	8.90	15.15	5.68	3	1	W	0.25	983	79
22	20/05/00	7.75	17.05	3.79	3	1	SW	1	984	81
23	20/05/00	7.75	14.20	3.79	3	1	SW	2	984	82
0	21/05/00	7.46	17.99	4.73	3	1	SW	2.75	983	81
1	21/05/00	7.46	4.73	0.95	1	0	SW	3.75	983	85
2	21/05/00	6.89	8.52	2.84	2	1	SW	4.75	982	83
3	21/05/00	6.89	8.52	1.89	2	1	SW	6.5	981	86
4	21/05/00	6.89	2.84	0	1	0	SW	8.25	980	86

Hourly data is stored for 58 hours at a time. All the readings are shown on the hour except for the wind records.

The rainfall is shown as a total since 9am.

WR5 Daily Weather Reporter data

TIME	DATE	TEMPMAX	TEMPMIN	WIND	WINDMAX	BEAUWIND	BEAUMAX	DIRECT	RAINFALL	SUNSHINE	SUNRISE	SUNSET	PRESSURE	HUMIDITY
Time data was collected	Date data was collected	Maximum temperature in degrees Celsius	Minimum temperature in degrees Celsius	Maximum 10 minute average between 0800 and 0900 GMT (kph)	Maximum 10 minute average before 0900 GMT (kph)	Maximum 10 minute average between 0800 and 0900 GMT (Beaufort)	Maximum 10 minute average before 0900 GMT (Beaufort)	Wind direction	Rainfall in mm	Sunshine hours	Sunrise (hours)	Sunset (hours)	Pressure in mBars	Relative Humidity (percent)
9	06/01/00	10.6	5.5	15.2	23.7	3	4	N	0.3	2	8.3	15.9	990	83
9	07/01/00	11.5	2.6	12.3	14.2	3	3	NW	0	1.2	7.8	16.1	1000	84
9	08/01/00	11.2	4.6	3.8	20.8	1	4	N	2.3	3.3	8.2	15.9	998	82
9	09/01/00	10	-2.0	2.8	13.3	1	3	N	0	6.4	8.1	16.1	1009	83
9	10/01/00	7.5	-3.7	0.0	7.6	0	2	NW	0	7.5	8.0	16.3	1019	81
9	11/01/00	7.2	-1.1	10.4	12.3	2	3	NW	0.3	5.6	8.2	16.1	1015	83
9	12/01/00	10.3	6.3	17	18	3	3	NW	0	2	8.7	16.0	1005	76

Daily weather data is stored for 58 days at a time

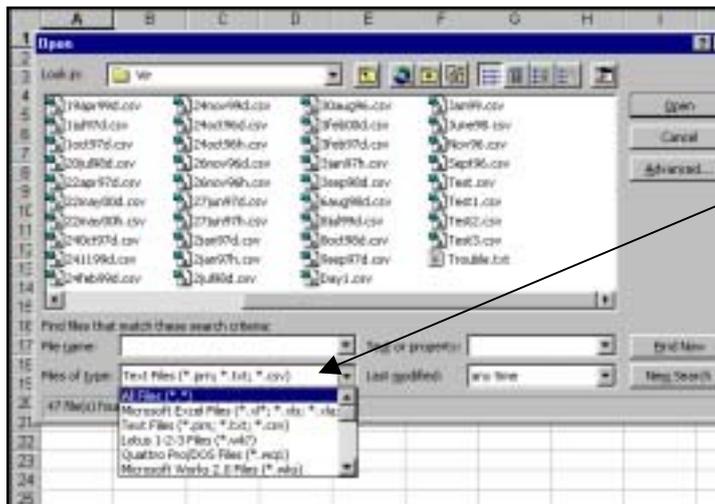
The wind direction, pressure and humidity readings for 9am are shown here.

There is a daily total for sunshine hours and rainfall.

WR6 - Drawing weather graphs in Excel

1. Finding and organising Weather Reporter data files

When in Excel, choose **File Open** and display the Drive and Directory in which Weather Reporter data has been saved.

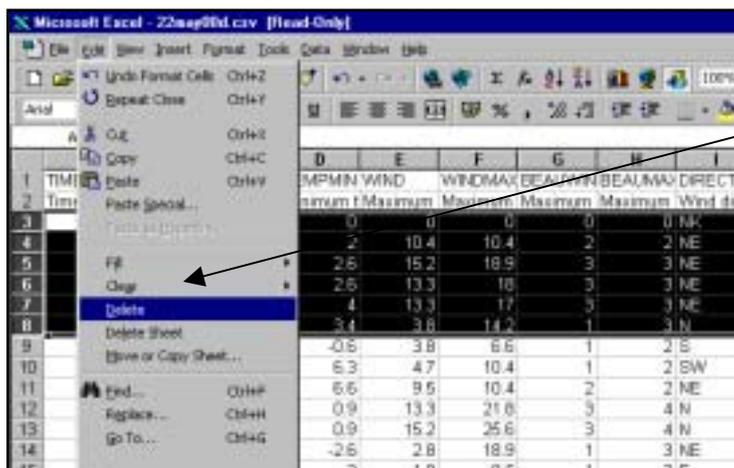


Click in the '**Files of type**' box to choose the **CSV Weather Reporter** files.

Click on a **filename** in the list and then **OK** to load the file into Excel.

2. Tidying up

When the file has loaded you may want to tidy it up, for instance by just working with data for one whole month, and removing other days' data



Highlight the numbers in the left margin of the rows you want to remove. The whole row will then be highlighted.

Click on **Edit, Delete**.

You can save the file as a Excel (xls) file with a new name.

Go to **File, Save As**, then choose a new name, e.g. May2000.xls

2. Draw a composite graph of daily weather data in Excel

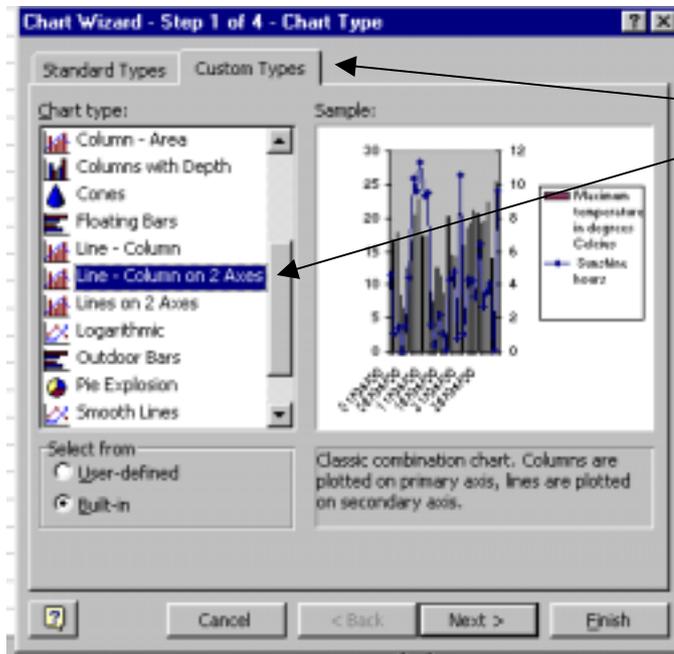
You may want to draw a graph to show two different types of data, for instance, temperature and sunshine hours.

First think carefully how you wish to display each type of data. Is the data non-contiguous (e.g. rainfall) or contiguous, such as pressure?

a) choose the data to plot on the graph.

Highlight the columns you need including the date column. (**Hint:** hold the CTRL key down before choosing the second column.) Make sure you include the cell with the description of the data at the top of each column.

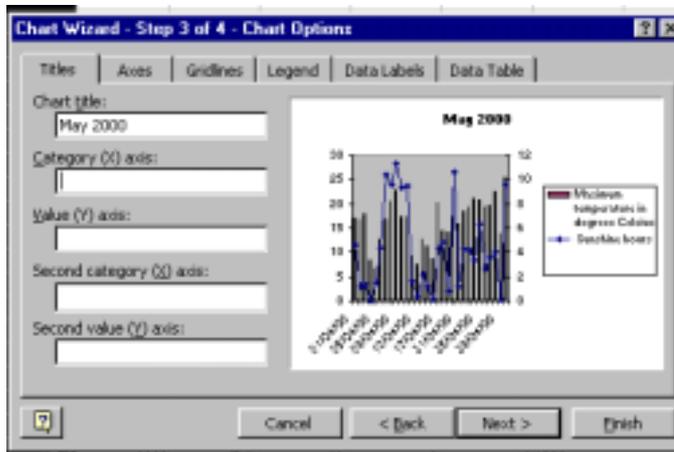
b) click on the Chart Wizard.



Choose **Custom Types**, then Chart type **Line - Column on 2 axes**.

Click the **Next** button to move on.

c) Enter information when prompted in the Chart Wizard.

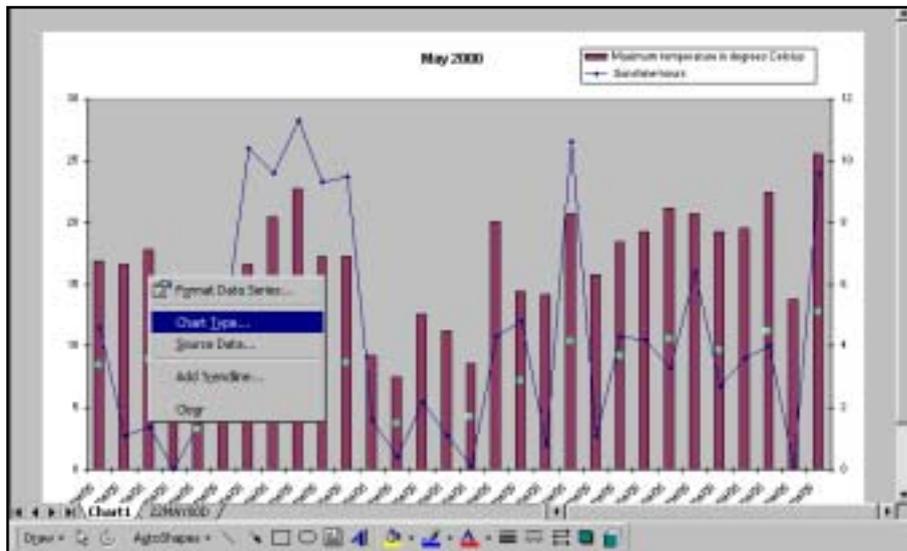


Step 2: Click on **Next**.

Step 3: Enter your details in, then **Next**.

Step 4: Choose **As new sheet**.

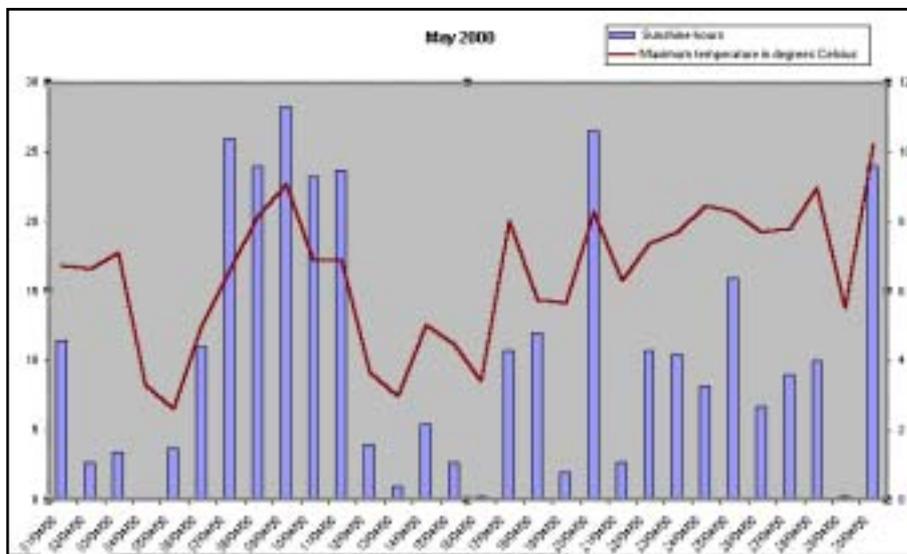
3. Annotating a graph



In this example, the sunshine hours and temperature have been displayed in the wrong styles.

To correct this, click with the **right mouse button** on a line or column, the **choose Chart Type** from the menu that appears.

Click on the correct chart type from the list, then **OK**.



Annotating a chart

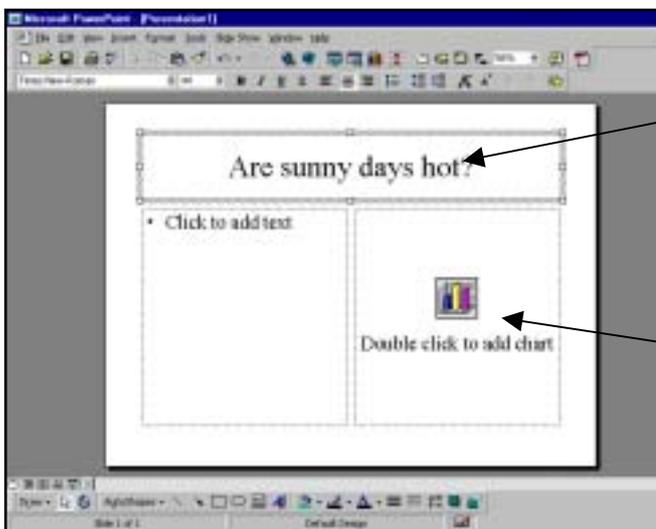
Use the **Draw Toolbar** (find this in **View, Toolbars**) to annotate the chart.

The **Text Box** and the **arrow** will help you to label important features, such as: The hottest day; the day with the most sunshine; days when it was hot and sunny, days when it was cool and dull.

WR6 - Importing an Excel chart into PowerPoint

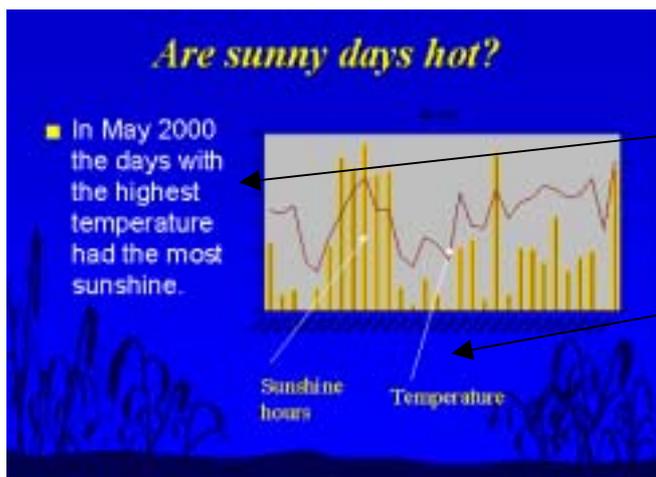
When you have created a chart in Excel you can show it to an audience with a presentation package such as PowerPoint. It is helpful to pick out the most important message that you want to illustrate with the chart and think about the text to go on the slide.

1. Make sure you have saved your chart in an Excel workbook and know where to find it.
2. Load PowerPoint and choose a blank presentation. Choose a slide with text and a chart.



3. When the slide appears on the screen, add a heading that explains what you want to show.

4. Click **once** on the chart area, then choose **Insert Object**. Click on **Insert from File**, then browse to find your saved workbook. It will then automatically load onto the slide.



5. Add a simple text message.

6. Add annotations to the chart using the **arrow** and **text box** from the **Drawing Toolbar**.

7. Create a colour scheme and design for your slide that helps to get your message across effectively to the chosen audience.
8. Click on View, Slide to display it on a full screen.