



# Analysing weather data

WOW resource

Science/Maths/ICT

## Overview

This mini project aims to develop students' scientific skills in collecting, displaying and analysing data. It is designed for students who have access to the internet and those who have some previous experience using spreadsheet software like Excel. It can be adapted for students without computer access but teachers will need to supply their students with the data required.

It is more suited for KS4 pupils but a high ability KS3 class could probably cope with its content.

It focuses on using the Weather Observations Website (WOW) website to gather information on past weather measurements taken from various observation sites. This data is then analysed to look for outliers, produce averages and graphs for interpretation.

This resource also aims to teach pupils knowledge on how aspects of the weather can change over time (over 24 hours, or over a year) and some simple reasons for this.

Cross curricula links can be made with maths for the data analysis and IT for using spreadsheets and producing graphs on computers.

## Objectives

- To develop essential scientific skills such as researching meteorological websites, recording data clearly, simple analysis and processing of data.
- To gain experience of handling large amounts of data and presenting it clearly and appropriately.
- To think about and be able to identify outliers in data, how to deal with outliers so they do not skew average results and to think of possible explanations for them.
- To build on the use of graphs to display information, focussing on how to use range bars on scatter graphs and assessing the reliability of the data based on the size of the range bars.

## Introduction

**Note:** it is advised that teachers spend some time familiarising themselves with the WOW website before starting this project with pupils. (<http://wow.metoffice.gov.uk/>)

Explain to students that they are going to collect and record data on the weather from a location in the UK using the WOW website; they will do this for a period of time that they (or you as the teacher) can decide upon. Once they have collected the data they will then analyse it using statistical techniques (such as calculating averages and ranges), and produce graphs to display their data.

It is advised that pupils focus on temperature changes in their study but other aspects of the weather, such as wind speed or air pressure, can be used if preferred.

Ask students to choose a location in the UK to work on, some students will want to choose particular cities/areas because of their favourite football teams or TV programme. Your students will need to decide the time period over which they will collect their data, here are some suggestions:

- Every hour over a 24 hour period
- Every day for a month\*
- Every month for a year\*

\*If students decide on one of the last two options, it is important that they always collect the data at the same time of day e.g. at 12pm every day. To make things easier, ask students to collect data at 12pm on the first day of each month.

Discuss with your class why this is important, emphasising that this makes it a fair test.

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Highlight that **in an investigation only one variable should be changed to ensure valid results, and other variables must be controlled.**

In this case the only variable changed should be the date. Changing the date and the time of day would be changing two variables, making the results less valid and harder to compare.

Students will need to be able to record their data in their exercise books or directly into a spreadsheet. Make sure that pupils get this information recorded clearly in tables as this will help them later on.

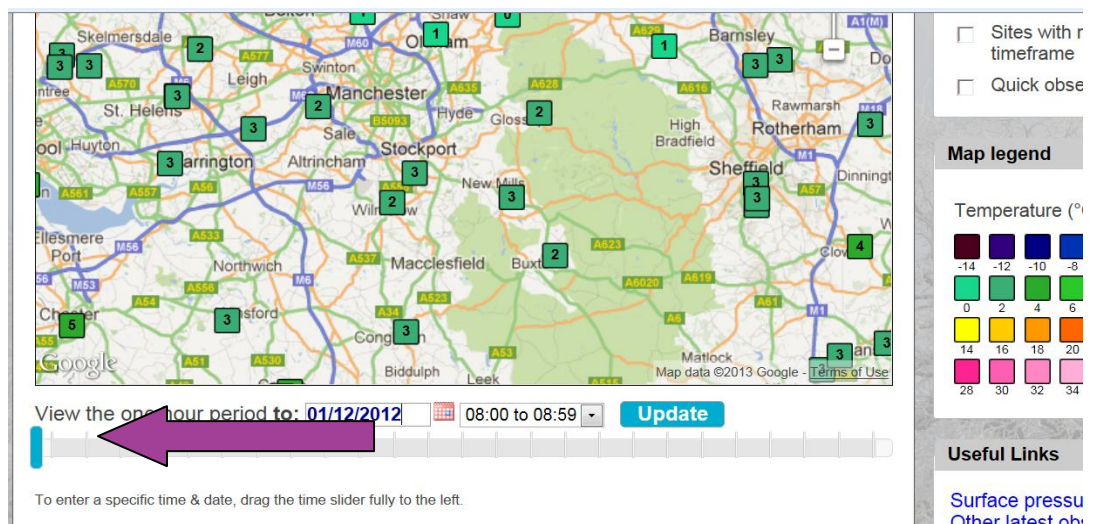
Using the WOW website, ask students to record data from at least six different observation sites all close to the location they have chosen. See below for more detail on how to do this.

## Extracting weather data

1. Open the WOW website and zoom in on the chosen location e.g. Manchester.
2. Pick at least six different observation sites close to the location chosen.

## Changing the date

3. Slide the time slider to the left to enter a specific date.



View the one hour period to: 01/12/2012 08:00 to 08:59 **Update**

To enter a specific time & date, drag the time slider fully to the left.

**Map legend**

Temperature (°C)

|     |     |     |    |
|-----|-----|-----|----|
| -14 | -12 | -10 | -8 |
| 0   | 2   | 4   | 6  |
| 14  | 16  | 18  | 20 |
| 26  | 30  | 32  | 34 |

**Useful Links**

[Surface pressure](#)  
[Other latest observations](#)

4. Select the required date or month.
5. Enter the desired time of day and press update.
6. Record the updated observations.
7. Repeat the process from step 3 until all the data has been collected.



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## Analysing data

Once students have collected their data, they can calculate an average value using the measurements from the different observation sites for each date.

| Date and Time               | Site 1<br>Temp (°C) | Site 2<br>Temp (°C) | Site 3<br>Temp (°C) | Site 4<br>Temp (°C) | Site 5<br>Temp (°C) | Site 6<br>Temp (°C) | Av.<br>Temp (°C) |
|-----------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------------------|
| Jan 1 <sup>st</sup><br>12pm | 3                   | 3                   | 2                   | 1                   | 3                   | 3                   | 2.5              |
| Feb 1 <sup>st</sup><br>12pm | 2                   | 2                   | 2                   | 0                   | 2                   | 2                   |                  |
| Mar 1 <sup>st</sup><br>12pm | 5                   | 5                   | 5                   | 0                   | 5                   | 4                   |                  |

## Graph skills

Students can plot their data to produce scatter graphs, **plotting average temperature on the y-axis and date on the x-axis**. This is a great opportunity for students to draw their graphs on graph paper. Teachers will need to assess the ability of their students as this might be tricky for some students. It is also an excellent opportunity for students to use **IT** to draw graphs using computer software like Excel.

## Extension tasks

### Plotting other people's data

Students can share their data with each other and plot their friend's data (taken from a different location) on their own graph. This enables them to compare two different locations in the UK and works particularly well if the two locations are quite a distance apart.

**Note:** when sharing data make sure observations are from the same date and time to make sure it is a fair test.

### Outliers

Outliers are results which do not fit in with the trend of a set of measurements. Outliers can skew average calculations making them inaccurate.

Ask students to check their data and highlight any outliers. Explain why any outlier identified should not be used in the average calculation as it makes their results inaccurate. Below are some examples of how outliers can change results.



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An average of **10** is calculated when the outlier is included.

| Date and Time | Site 1 Temp (°C) | Site 2 Temp (°C) | Site 3 Temp (°C) | Site 4 Temp (°C) | Site 5 Temp (°C) | Site 6 Temp (°C) | Site 7 Temp (°C) | Av. Temp (°C) |
|---------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---------------|
| 1 Mar 12pm    | 8                | 8                | 8                | 9                | <b>16</b>        | 8                | 8                | 10            |

An average of **8** is calculated when the **outlier** is removed.

| Date and Time | Site 1 Temp (°C) | Site 2 Temp (°C) | Site 3 Temp (°C) | Site 4 Temp (°C) | Site 5 Temp (°C) | Site 6 Temp (°C) | Site 7 Temp (°C) | Av. Temp (°C) |
|---------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---------------|
| 1 Mar 12pm    | 8                | 8                | 8                | 9                | <b>16</b>        | 8                | 8                | 8             |

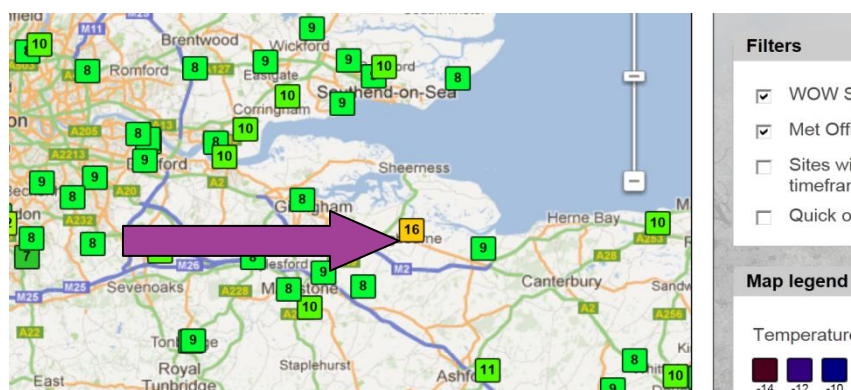
## Explaining outliers

Usually it is difficult to find an explanation for outliers; it can be down to many factors such as human error, faulty equipment or poor quality/inaccurate equipment. Outliers with weather observations can sometimes be explained by the equipment being placed in locations which are not ideal, for example sheltered or shaded spots.

Explaining outliers can make a good starting point for a discussion with students.

The WOW website enables pupils to find out information on individual observation sites. This can sometimes explain any outliers. This information can be included in pupils' work to justify/explain outliers. See below to see how this can be done.

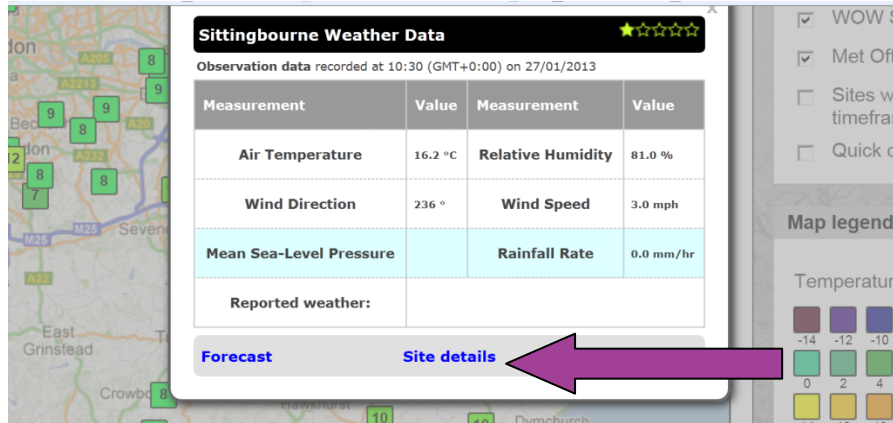
1. Click on the square to get the observation site data.



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2. Click on site details.



**Sittingbourne Weather Data** ★★★★★

Observation data recorded at 10:30 (GMT+0:00) on 27/01/2013

| Measurement             | Value   | Measurement       | Value     |
|-------------------------|---------|-------------------|-----------|
| Air Temperature         | 16.2 °C | Relative Humidity | 81.0 %    |
| Wind Direction          | 236 °   | Wind Speed        | 3.0 mph   |
| Mean Sea-Level Pressure |         | Rainfall Rate     | 0.0 mm/hr |
| Reported weather:       |         |                   |           |

Forecast      Site details

3. Explanation for outliers can sometimes be found.

**Additional Information**

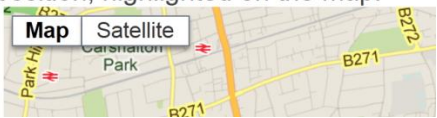
Fine Offset 1080 currently mounted on 1.7m pole in the  
Temperature gauge exposed to sunlight

**Site Location**

This site location at the following position, highlighted on the map.

Latitude  
51.350238

Longitude



## Range bars

Range bars are a way to graphically represent the range of measurements at each data point.

Having already plotted the averages on their graphs students can plot the highest and lowest value they recorded for each date. A line can then be drawn connecting the highest and lowest values for each date, running through the average.

Students can add range bars to their graphs and discuss their implications as an extension task. Large range bars decrease confidence in the reliability of data and small range bars increase confidence.