Weather is the detailed conditions on a daily or perhaps weekly basis: it refers to many elements of the weather, all of which can be measured and forecasts made, such as wind direction and speed and the amount of moisture in the air (called humidity)

Reading University's Weather Station

Figure 4: Elements of weather, traditional instruments used to measure them and the measurement units

Weather element	*Instrument*	*Units*
Air pressure	Barometer	mb (millibars)
Cloud cover	Human sight	oktas (how many eighths of the sky is covered by cloud)
Cloud type	Human sight and chart	Names of cloud types (e.g. cumulus)
Precipitation	Rain gauge	mm (millimetres)
Relative humidity	Hygrometer	% (percentage of the moisture in the air compared to what the air could hold at its present temperature)
Sunshine	Sunshine recorder	Hours per day
Temperature	Maximum and minimum thermometer	˚C (degrees centigrade)
Wind direction	Wind vane	Compass point that the wind is coming from (e.g. north)
Wind speed	Anemometer	m/s or km/h (metres per second or kilometres per hour) or sometimes the Beaufort scale

Figure 5: Images of selected weather instruments (thermometers in screen, rain gauge, barometer, wind vane and anemometer)



Measuring the weather

Weather data is collected daily at weather stations at the ground level by professionals and amateurs, and by professionals using weather balloons in the troposphere and even in the stratosphere. The standard weather station consists of a Stevenson Screen which houses most of the weather instruments in a louvered box a set height above the ground. This box is painted white to stop it absorbing heat energy from the Sun, while at the same time providing shade inside with an airflow so that instruments can accurately measure aspects of weather. A weather station needs to be in a large open space away from any interference that may alter the readings and make them inaccurate.

Weather stations in contrasting sites can reveal interesting local patterns, such as differences between a slope facing north compared to one facing south, or between the bottom of valley compared to the top of a hill, or differences between a rural and an urban area, or between the coast and inland.

Most weather stations – on the ground or at sea - are now automated and send measurements directly to a computer, such as at Reading University. Many instruments are now electronic and look very different to the traditional ones, especially things like max/min thermometers, wet bulb thermometers, barometers and sunshine recorders.

Remote sensing is also used with various measurements taken by satellites orbiting the Earth. Radar is another powerful modern tool, providing information about rainfall. Electronic detectors pick up lightning strikes. Weather forecasts today also often mention UV (ultraviolet light), pollution and pollen levels to help people look after their health (e.g. sunburn, breathing difficulties and hay fever).

Practical weather measuring

As well as instruments gathered together at fixed points (i.e. weather stations) , portable instruments create the possibility of a range of fieldwork opportunities for KS3 geographers, some suggestions are shown below.

The Royal Meteorological Society can lend some instruments to schools free of charge – information can be found at http://www.metlink.org/observations-and-data/instruments/. Otherwise, many simple instruments can be easily made – for example wind speed, direction and rainfall (see

http://www.metlink.org/observations-and-data/top-10-ideas-weather-fieldwork/). Thermometers are found in a wide variety of gadgets from clocks to phones and cars – or borrow some from the science department. Just make sure that they are left in situ long enough to adjust to the temperature.

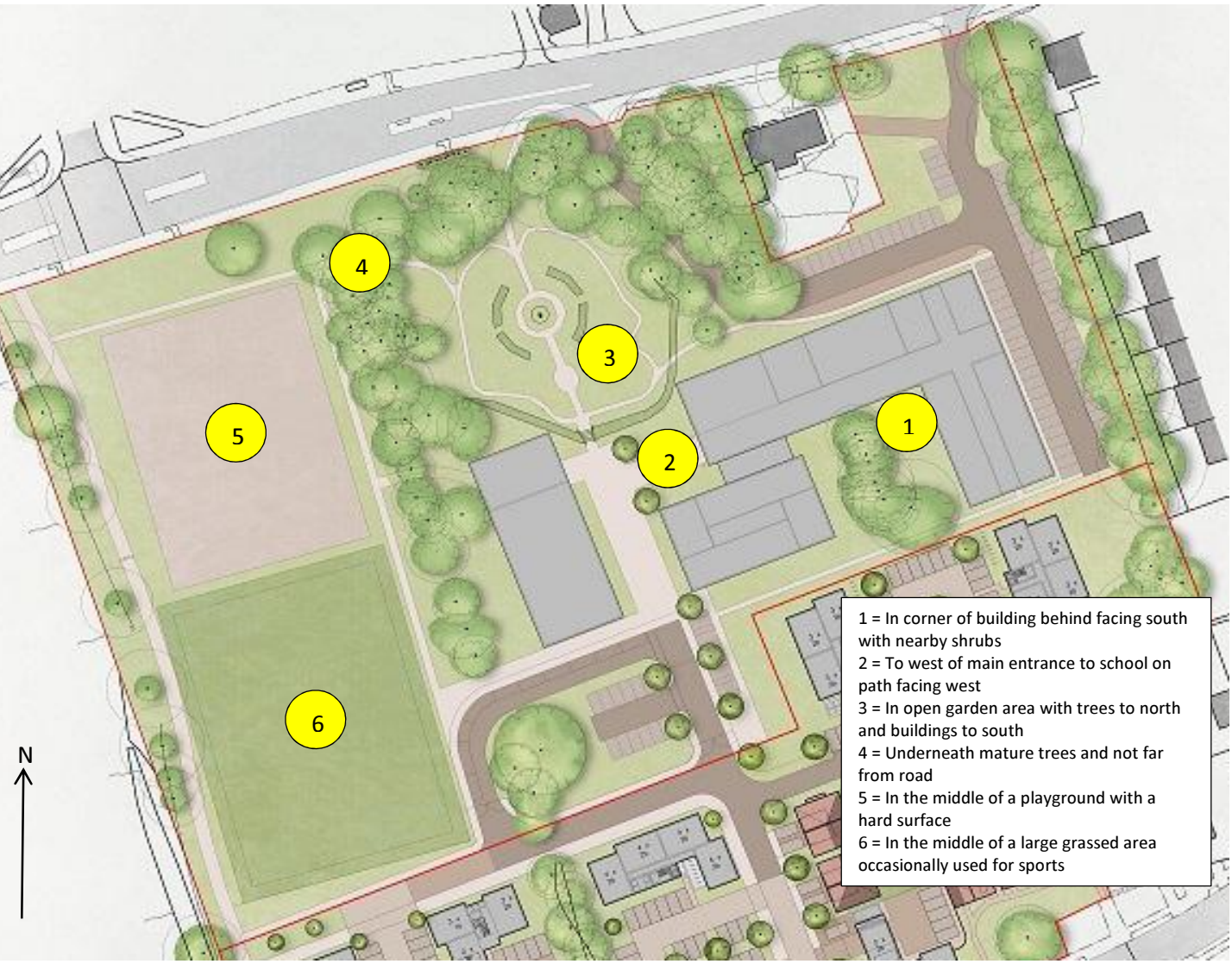
Some suggestions for KS3 fieldwork involving weather readings

<table>
<tr><th>Fieldwork aim</th><th>Practical arrangements</th></tr>
<tr><td>To discover the variations in weather patterns on a school site</td><td>Choose contrasting locations (perhaps 5 or 6) around a school site and set up thermometers and anemometers (or use bubbles). One site should be in the best location for accuracy, while others could be near a building, in a shaded area, in a sunny area, under a tree, near a pond, high up and low down. Link the observations to where the students like to congregate. http://www.metlink.org/wp-content/uploads/2013/06/USBmicroclimate.pdf and http://www.metlink.org/pdf/teachers/urban-wind-teachers-notes.doc Explore GIS or other methods of recording the data collected.
AND/ OR do the same inside the school – how do students' perceptions of different classrooms compare to the temperature measurements in those rooms?</td></tr>
<tr><td>To discover the variations in temperature from the centre of an urban area to a rural area on one day</td><td>Choose systematic (evenly spaced) points along a straight transect from the centre of a town or city to a purely rural area. There is guidance at http://www.metlink.org/pdf/teachers/teachers_notes_uhi.pdf .</td></tr>
<tr><td>To discover the relationship between student behaviour and the weather</td><td>Over a one month period, ask your students to record the weather (temperature and wind speed) – alternatively they could use archived data from wow.metoffice.gov.uk.
The teacher should rate students' attention in lessons over this period using the following scale
<table>
<tr><th></th><th>Behaviour</th></tr>
<tr><td>1</td><td>No interruptions from the class</td></tr>
<tr><td>2</td><td>Very few interruptions to the lesson</td></tr>
<tr><td>3</td><td>When they are completing their own work some pupils get distracted</td></tr>
<tr><td>4</td><td>A few pupils start to distract each other and lose focus for longer periods 5 Level</td></tr>
<tr><td>5</td><td>Level of noise starts to increase and more off task behaviour is seen</td></tr>
<tr><td>6</td><td>Pupils are distracted from their work and find it difficult to work</td></tr>
<tr><td>7</td><td>Lots of interruptions to the lesson from a range of pupils both in their own work and when listening to the teacher</td></tr>
<tr><td>8</td><td>Constant interruptions to the lesson, unable to work in the lesson</td></tr>
</table>
Students could then use scatter graphs to investigate whether there is a correlation.</td></tr>
<tr><td>To compare the weather experienced on a school site in one week with those</td><td>Set up a school weather station (thermometer, rain gauge and anemometer) and take readings at 09.00 every day for a week. Use a website such as WOW.metoffice.gov to gather</td></tr>
</table>

experienced in a contrasting UK location	the same weather readings from a chosen contrasting location.
To link the weather to the amount of discharge in a selected stream	Take rainfall and cloud cover readings at 09.00 daily in the catchment area of a stream for two weeks prior to a second measuring of the stream (depth, width, velocity). Measure the stream at the start of the two weeks and the end of the two weeks.
To link traffic and people flows to local weather conditions	Take weather readings at a few safe locations in an urban environment and carry out counts of people and traffic passing these sites or others nearby on days which are dry, and wet.
To link the perceptions of the quality of an urban environment to the weather	Select a transect through an urban area that covers all types of urban zone. At one or two points in each urban zone (could be random or systematic) students use a pre-prepared questionnaire to score the quality of the urban environment. At the same time at these sites weather readings are taken. This exercise is best repeated in different weather conditions.

Many school sites are large enough to provide a variety of sites where the weather elements will vary from a location in a large grassy space. The figure below shows the plan of a school site in Reading and the location of contrasting sites for weather measurements. Each of these sites has an influence that would affect accurate measurements, such as the influence of buildings or trees.

The Wren School site, Southcote, Reading



As well as plans of school sites, Google maps can provide satellite images which can be used for GIS presentations

Geographic Information System image to show results of temperature and precipitation weather readings for 10.00 in July at the Wren School site, Southcote, Reading (background image from Google maps satellite view – note that this image is before the new plans for the school as shown above).

Secondary data sources

Once weather readings at a site have been obtained it is useful to consider the bigger picture in order to explain the weather measurements obtained. Simple options include:

Radar images showing current and recent rainfall: http://www.raintoday.co.uk/ . This can be used as a great introduction to forecasting – the need to know not just where it is raining now but how fast that rain is moving. Can the class estimate when the rain will reach them/ stop?

Satellite images also help to identify the position of weather systems through the shape and amount of cloud cover. http://www.sat.dundee.ac.uk/gallery/

Websites such as http://wow.metoffice.gov.uk allow students to see their school in the context of wider observations.