Forty Minute Fieldwork: Wind Speed

Key topic areas	Equipment and resources required
• Microclimates	Lengths of thread
• Weather and climate	Anemometers
• Urban design	Digital thermometers
• Ecosystems	Map of the school site
• Air pollution	Data collection chart and clipboard

Context

Wind speed is rarely a single figure in any given area: a variety of complex factors can cause it to speed up and slow down at a micro scale level making it an interesting element to study as part of any microclimate topic.

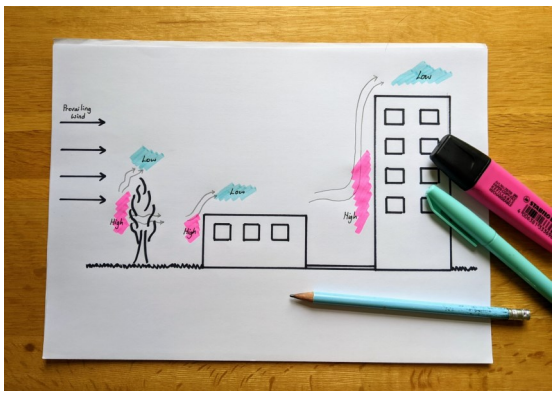
Students should be able to recognise the impact that obstructions will have on wind speed and hypothesise that wind speed will increase at higher altitudes and in open spaces. However, they are less likely to be familiar with the concept of funnelling. Though an obstacle such as a line of trees will slow air movement, it will also allow air to continue to flow. A solid obstacle such as a building however will funnel the movement of air to whichever area offers the path of least resistance, compounding its speed as it does so. This means that it is not uncommon for relatively narrow alleyways between buildings to record extremely high wind speed when compared to open spaces. This is known as the Venturi Effect. Older students may be able to link this movement of air to the equalisation of the pressure gradient (with air moving from areas of high to low pressure).

Micro-scale differences in temperature can cause air to rise and fall creating areas of low and high pressure respectively. Therefore buildings that readily reflect heat, as a result of the materials used to build them, can affect how fast air moves and where it moves to. Different building materials also represent a spectrum of different surface textures, some of which will offer a greater degree of friction to moving air, and cause it to move at slower speeds.

Classroom set up

Prior to going out around the school site it would be beneficial for students to understand what wind actually is. Introduce the concept of wind as the movement of air and that when we feel a strong wind, what we are actually feeling is the pressure against us from the flow of air.

From here students can revise the concepts of high and low air pressure and become acquainted with the idea of equalising pressure (air moving from areas of high pressure to areas of low pressure). Using a series of diagrams representing cross sections of buildings, students can use coloured pens to highlight where they think low and high air pressure might be found and indicate the flow of air using arrow annotation.



An air pressure diagram

In a whole class exercise, students can select from a pre-written list all the factors that can affect the speed at which air moves. The list should include wind direction, air temperature and surface friction / evenness etc., as well as 'Red herrings' such as soil pH and preceding precipitation levels. Students then justify with geographical reasoning why a certain factor on the list may or may not have an influence on wind speed.

In the field

On a map of the school site, mark on a number of locations where wind speed can be measured; enough for pairs of students in the class to cover. Ensure these locations cover as much variety of building shapes and surface textures as possible as well as a site in as open a space as possible (such as in the middle of the school field) to act as a control.

At each site students carry out three tasks which can collectively be recorded in one data collection table.

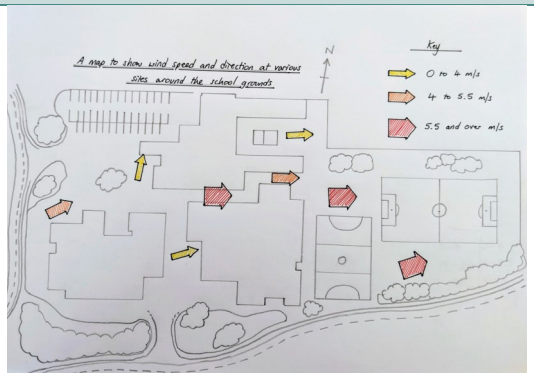
Location No.	Wind direction	Wind speed (m/s)	Air temp. (°C)	Distance to building (m)	Surface textures of note
4	W	1.2	19	3	Glass windows, bare brick walls. Asphalt underfoot

A piece of thread held up to the wind will point directly away from the direction of airflow and by using the North point on their maps, students will be able to note the wind direction. An anemometer, held above their heads, will register the wind speed which can also then be recorded. Students should then observe and note the surface texture of the ground and all vertical structures near to them (i.e. whether they are smooth, reflective, easily moved by the wind etc.) Following this, students can record the air temperature and how far (in metres) the wind speed reading was taken from the nearest building.

Suggested data presentation

On a fresh blank map of the school site, students can use proportionally sized arrows to show both wind speed and its direction in each of the recorded locations. Maths-confident students may be able to calculate the exact width of each arrow such that it is directly proportional to the wind speed.

Alternatively, students can group the wind speeds into sensible ranges and apply a set arrow size to a location if it falls into a particular category.



Key questions for reflection and analysis

- How did proximity to buildings affect wind speeds?
- Which areas of the school site are windiest? calmest?
- Did the areas of the highest air temperatures correlate to those of high wind speeds?
- How might a different time of day / year affect the results we found?
- How might buildings such as a school be better designed to cope with wind speeds?
- What other variables could have been measured in relation to wind speed?
- To what extent are our results reliable and valid?
- Would the collection of more samples have made any difference to our results?

Taking it further

Using the same principles as those at the scale of the school site, students can think about the urban design of their local town. It may be possible to gain local air pollution statistics and students can discuss whether wind speeds help or hinder the dispersal of low level air pollution.