



This document is one of a suite of Factsheets that are part of the support offered to schools and teachers. The Factsheets provide guidance, ideas and link to resources to support your Citizen Science activities. They also contain suggestions for extended learning relating to problem solving, numeracy, geography and social studies. We hope they will provide all the guidance you need to develop lessons to fit with your own curriculum plans. For general enquiries contact – Amanda Malcolm, Citizen Science Coordinator, citizenscience-scotland@tcv.org.uk, 0141 552 5294.

Weather, Climate and Climate Change

Introduction

Commonly it is said that “climate is what you expect, weather is what you get”. In other words weather is the state of atmospheric elements (e.g. temperature, pressure, wind and precipitation) over a short time period while climate in one sense is the statistics of these elements over a long period of time. There are many different scales of climate, from the global to the continental, from the regional to the local and there are many resources you can access through the internet for brief descriptions. A selection of resources follows;

- A brief description of climate and climate classifications http://www.wmo.int/pages/themes/climate/understanding_climate.php#a
- gives an excellent summary of climate and climate zones together with activities and experiments designed for the CfE http://www.metlink.org/pdf/work_schemes/lesson3_pritchard.pdf
- lots of information and help for teachers <http://www.geography.learnontheinternet.co.uk/topics/climatezones.html>
- posters etc <http://www.metoffice.gov.uk/education/teachers/resources>
- what the world’s climate looks like <http://www.metoffice.gov.uk/climate-change/guide/climate/system>

Activity Suggestions –create your own [weather diary](#) and record daily weather elements at your location to illustrate the difference between weather and climate. Compare your data with the long term averages from your area [here](#). See other weather observations and upload your weather recordings at <http://wow.metoffice.gov.uk/>

By the conclusion of the Citizen Science Project it is anticipated that learners will be able to understand:

- Climate – national and global
- Weather – local and national
- Climate Change – the causes and the effects
- Weather Forecasting – methods and modeling
- the rainfall cycle
- the function of rivers level gauges
- how to measure rainfall using a gauge
- the links between rainfall and climate change

Activity Suggestions – Even in a place as small as Scotland climate varies from place to place. Discover the wettest and driest places in Scotland. See if you can work out if where you live is on the wet or the dry side of the country. <http://www.metoffice.gov.uk/weather/uk/climate.html>

The Greenhouse Effect

The Sun provides the energy for the Earth, but without an atmosphere, this energy would be given off as infrared radiation by the Earth and would virtually all go back out to space - creating a very cold planet. (E.g. Mars has a very thin atmosphere and temperatures on the surface vary dramatically from **27 °C to –143 °C** for more detail see

http://en.wikipedia.org/wiki/Climate_of_Mars) Certain gases in the atmosphere stop this from happening, much like glass in a greenhouse, hence why this is called the greenhouse effect.

<http://climate.nasa.gov/kids/bigQuestions/greenhouseEffect/> gives a good summary of the greenhouse effect together with some answers to frequently asked questions.

Climate Change

Scientists know that any changes in the amount of greenhouse gases in the atmosphere will affect the Earth's climate. The more they know about the climate the better we will understand the way in which it affects us and how the climate is changing. The burning of fossil fuels is changing the balance of greenhouse gases in our atmosphere. We need everyone to understand this and act to reduce their impact on the climate. We also need to monitor how climate at the local level is predicted through weather forecasts - the essential tool for long term climate prediction. The science involved in these long term predictions is complex and involves a great deal of effort across the world from thousands of scientists. In the UK the main provider of this science is the UK Met office and teachers can access some of this knowledge at <http://www.metoffice.gov.uk/climate-change>.

Activity Suggestions – use River levels gauge information, the reaction of a river to short periods of heavy rain compared to long periods of steady rain observed. The SEPA website http://www.sepa.org.uk/water/river_levels/river_level_data.aspx allows you to see in real time the effects of rainfall of a river near you. With the new SEPA Floodline service

Rainfall

Rain is the life giving source of fresh water. All life requires water and all land bound life requires fresh water to survive and flourish. Rain is caused by the evaporation of water from the surface of the earth, lakes and seas. It forms into clouds, which transport their cargo of fresh water for huge distances for it to fall as rain. In some countries rain falls in seasons, causing huge floods at some parts of the year but long dry spells in the other. Some countries have very little rainfall, preventing plants from growing and causing deserts to form. Some countries are very cold or mountainous and rain falls as snow for much of the year. We are very lucky in this country to have a wide mixture of snowy, wet and dry periods, never too dry to stop plants from growing, never too cold to always be covered in snow and never too wet to always be flooded.

Activity Suggestions – Within the OPAL activity there are many opportunities to expand beyond the simple experiments in the survey to deeper study of weather, climate and climate change. A full rundown of all activities can be found here <http://www.opalexplornature.org/climatesurvey> with video support

Rainfall patterns are heaviest over hills and near coasts. In Scotland this means that the north and west are generally wetter than the south and east. Rainfall patterns also change over the seasons, generally wetter in autumn and winter. As we are an island nation and rapidly changing weather sweeps in from the Atlantic Ocean, this can make it very difficult to see patterns emerging.

A current cause for concern is Climate Change, which is a natural phenomenon caused by changes in the mix of gases in the air, especially carbon dioxide, which slowly alter global temperature and rainfall patterns. Over the last two centuries, the burning of coal, gas and oil (known as fossil fuels) to power factories, heat homes and drive cars has released lots of carbon dioxide. This is altering the long term weather patterns, making it hotter and drier in summer and wetter in winter. So a cold, snowy winter or a wet, mild summer may seem to be the opposite of what is expected but this is just short term weather. Longer term patterns do show the changes. This is of great concern as plants and animals can't adapt to these changes. We too are affected as floods and droughts become more frequent.

Measuring Rainfall, Rainfall measuring is probably the least subjective of any weather data. So many mm in so many hours or days. As compared to changing temperature throughout a day, varying wind speed or strength of sunlight.

The effects of rainfall can also be seen on rivers as levels rise and fall and puddles form and dry out. A [plastic rain gauge](#) can be purchased by each school to compare to the ones made by the pupils. There will be differences in reading between the gauges. Explore the reasons for this. The sighting of the gauge (wind, rain shadow etc), the shape of the gauge bottle (especially the lower extremes), the scale of measurement, solutions and improvements that can be made.

Activity Suggestions – Make your own rain gauge <http://www.metoffice.gov.uk/education/kids/things-to-do/weather-station/rain-gauge>. You can find out how much rain falls where you live by making your own rain measure.

Using the Met Office, Weather Observation Website (WOW) <http://wow.metoffice.gov.uk/> the data collected by the class can be uploaded. The data can then be analysed on the site and compared with other schools and organisations data. <http://wow.metoffice.gov.uk/education>

Pupil made rain gauges will create errors making their data invalid compared to the plastic. This should be seen as an example of why consistency and care are needed to ensure that recording of data can be trusted and valuable.

Outcome statement	Curriculum area
Having investigated the practical impact of inaccuracy and error, I can use my knowledge of tolerance when choosing the required degree of accuracy to make real-life calculations. MNU 4-01a * Responsibility of all	Numeracy > Number, money and measure > Estimation and rounding
I can apply my knowledge and understanding of measure to everyday problems and tasks and appreciate the practical importance of accuracy when making calculations. MNU 4-11a * Responsibility of all	Numeracy > Number, money and measure > Measurement
When analysing information or collecting data of my own, I can use my understanding of how bias may arise and how sample size can affect precision, to ensure that the data allows for fair conclusions to be drawn. MTH 3-20b	Mathematics > Information handling > Data and analysis
I can explain some of the processes which contribute to climate change and discuss the possible impact of atmospheric change on the survival of living things. SCN 3-05b	Sciences > Planet Earth > Processes of the planet
I understand how animal and plant species depend on each other and how living things are adapted for survival. I can predict the impact of population growth and natural hazards on biodiversity. SCN 4-01a	Sciences > Planet Earth > Biodiversity and interdependence
By using a range of instruments, I can measure and record the weather and can discuss how weather affects my life. SOC 1-12a	Social studies > People, place and environment
I can investigate the relationship between climate and weather to be able to understand the causes of weather patterns within a selected climate zone. SOC 3-12a	Social studies > People, place and environment
I can identify threats facing the main climate zones, including climate change, and analyse how these threats impact on the way of life. SOC 4-12a	Social studies > People, place and environment
During practical activities and design challenges, I can estimate and measure using appropriate instruments and units. TCH 1-13a	Technologies > Craft, design, engineering and graphics contexts for developing technological skills and knowledge