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TEACHER RESOURCE

THE NZ SERIES Introducing New Zealand society, history, science and geography to general readers and students.

WEATHER AND CLIMATE NEW ZEALAND

Sandra Carrod

Understanding our weather is key to understanding our changing climate and its impact on our lives. Aotearoa lies in a temperate zone, midway between the warm tropics and the South Pole. The climate ranges from subtropical in Northland to cool temperate in the south. Surrounded by sea, the country has a mostly maritime climate, which makes the weather extremely changeable.

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TOPIC EARTH'S HEAT BALANCE – THE NATURAL GREENHOUSE EFFECT

ACTIVITY 1

- Using the information on page 21, **DRAW A DIAGRAM** to illustrate what happens to the Sun's rays as they enter Earth's atmosphere.
- You could **use arrows of different thicknesses** to show the differing proportions of the Sun's rays, and **use contrasting colours** to show the incoming (mainly shortwave) radiation, and the infra-red radiation that is reflected back from Earth's surface or scattered back from clouds and particles in the atmosphere into space.

Useful websites showing examples of natural greenhouse effect diagrams:

www.niwa.co.nz/our-science/climate/information-and-resources/clivar/greenhouse

www.sciencelearn.org.nz/resources/1004-greenhouse-effect

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ACTIVITY 2 GREENHOUSE GASES (PAGES 21–22)

DRAW UP A TABLE OR GRAPHIC showing key information about the most important greenhouse gases, including these details for each:

- Name of greenhouse gas
- Quantity or proportion found in the atmosphere
- Sources — where does the gas come from? How is it produced?
- Average lifetime in the atmosphere
- How potent is it?

DISCUSSION

1. Some greenhouse gases are made by humans and some are natural but human activities can affect the concentration of natural greenhouse gases in the atmosphere.
   - What human activities increase these atmospheric concentrations?
   - What actions reduce them?
   - What are the main sources of New Zealand's greenhouse gas emissions?
2. Teacher provides a menu of five food choices, e.g. beef, chicken and vegetable dishes. The class debates the effect on greenhouse gas emissions (carbon footprint) of producing each one.

Useful links:

www.sciencelearn.org.nz/resources/2959-greenhouse-gases-and-the-atmosphere

www.environment.govt.nz/publications/new-zealands-greenhouse-gas-inventory-1990-2020-snapshot/#figure-2-gross-greenhouse-gas-emissions-in-2020-by-sector-sub-category-and-gas-type

TOPIC EXTREME WEATHER

HOW HAVE THE WEATHER AND CLIMATE CHANGED WHERE YOU LIVE?

To investigate past extreme weather events over the decades we can explore NIWA's New Zealand Historic Weather Events Catalogue at https://hwe.niwa.co.nz/ The catalogue details notable weather events from the late 1800s to the present day.

Ignoring the timeframe for now, select your region from the 'affected areas' box and check 'all' the hazards and impacts to search for events affecting your part of the country.

QUESTIONS

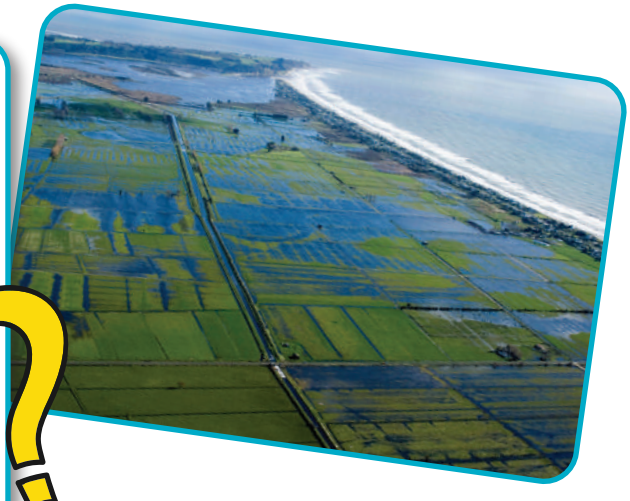
1. How many recorded events are there?

   What proportion of them affected your region alone?

   How many affected a much wider area of New Zealand?

   How many impacted the whole country?
2. List the different kinds of weather events e.g. ex-tropical cyclones; heavy rain and flooding; heavy snowfall/cold snap; thunderstorms/ lightning; high winds.

These are just a few — what other categories of weather events or hazards can you find?



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THE HAZARDS OF EXTREME WEATHER

1. What is the most common weather hazard in your region?

   What kinds of damage and upheaval do these extreme weather events cause? E.g evacuations, road closures, crop damage, casualties.

   Describe the wide range of activities and aspects of people's daily lives that can be impacted by adverse weather. This can be in the form of a brainstorming activity or a mind map or chart.

2. In your own words, write or record an imaginary news report describing one of the historic weather events from your region. You could include an interview with older family members about their memories of an extreme weather event.

DISCUSSION FOR OLDER STUDENTS (PAGES 30–33)

Go to NIWA's Our Future Climate New Zealand website:
www.niwa.co.nz/information-services/our-future-climate-new-zealand

Explore the different projections on the national maps and identify the various changes your region is forecast to experience over the short, medium and longer terms.

Select ***local charts*** and the ***location*** of your nearest town to view the climate data in graph form. You can select more than one emissions scenario (RCP — Representative Concentration Pathway) to compare the differing graphs.

What are the possible impacts of these climate shifts on your region?

For the projected sea level rise in your area, explore these websites:

www.searise.nz

https://niwa.co.nz/natural-hazards/hazards/sea-levels-and-sea-level-rise

Discuss what can be done to avoid or lessen potential negative effects. E.g. 'Hot days' are days above 25°C. This is the temperature above which beef and dairy cattle can begin to suffer from heat stress.

TOPIC SKY-WISE CLOUD TRACKER

Nimbostratus cloud

Cumulus clouds below, altocumulus clouds above

ACTIVITY 1

Using the text and Cloud Types graphic on pages 59 and 60 of the book to help you, **describe** the meanings of these cloud words:

- Cirrus
- Alto
- Cumulus
- Stratus
- Nimbus (nimbo)

"There are many combinations of basic cloud types, blending their various characteristics (e.g. cirrostratus — high wispy layer cloud) and many sub-branches of each (e.g. altocumulus castellanus, which tower up like castles, and stratus fractus — fast-changing clouds torn by gusty winds). The International Cloud Atlas was first published in 1896 and contains more than one hundred different kinds of clouds."

ACTIVITY 2

These are the internationally recognised abbreviations for the ten main cloud types, or *genera*:

Cirrus	Ci
Cirrocumulus	Cc
Cirrostratus	Cs
Altocumulus	Ac
Altostratus	As
Nimbostratus	Ns
Stratus	St
Stratocumulus	Sc
Cumulus	Cu
Cumulonimbus	Cb

Group these ten genera (cloud types) according to how high in the sky they usually appear: high, middle or low level.

Some clouds can appear at more than one level; nimbostratus is mostly seen in the middle level but can stretch both lower and higher in the sky. Most clouds stretch mainly horizontally but individual 'cauliflower' cumulus can bubble upwards through lower levels and the towering cumulonimbus storm cloud develops vertically through all the levels of the sky.

Altocumulus mackerel sky

Cirrostratus above the Southern Alps

RESEARCH TOPIC FOR OLDER STUDENTS (PAGES 23–24)

WEATHER OBSERVATIONS

Draw a timeline showing how instruments have developed over time, with short explanations of what each is and how it is used for weather observation on land, sea and in space; e.g. weather balloons, anemometers, Stevenson screens, barometers, cloud ceilometers, Argo floats, Automatic Weather Stations (AWS), radio meters and weather satellites, ozonesondes, LIDAR (light detection and ranging), radar, the Dobson spectrophotometer, the mass spectrometer.

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USING THIS RESOURCE IN THE AOTEAROA NEW ZEALAND CLASSROOM

Connection to **Science**

UNDERSTAND/KNOW

The material in this resource is particularly helpful for the Planet Earth and Beyond, and Living World sections of the curriculum through levels 3–8, supporting understanding of the atmosphere and interacting systems at different year levels. The focus from years 3–4 is on the water cycle and weather, 5–6 focuses mostly on the atmosphere and the impact of carbon on climate. The resource also connects to the curriculum sections from level 5 exploring how weather, climate, and humans impact our ecology.

DO

The activities in this resource encourage students to ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop their explanations. They can develop an understanding of socio-scientific issues by gathering relevant scientific information in order to draw evidence-based conclusions.

Connection to **Junior Social Sciences**

UNDERSTAND

The material covered is relevant to the Big Ideas relating to how people use resources and economy, perspectives and power.

KNOW

The material fits neatly into the context of Place and Environment/Turangawaewae me te kaitiakitanga, specifically how climate change and environmental degradation connect to the unsustainable use of resources and the impact on different communities, as well as government responses.

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