New Zealand's Weather

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CONNECTED
SCIENCE • TECHNOLOGY • MATHEMATICS
2012 LEVEL 3

Overview

This article outlines the global influences on the weather. It explores how oceans, continents, and icecaps affect the way air moves, heats, and cools. It then reinforces the concepts explained in "What Makes the Weather" by applying them to the context of weather in the South Pacific and particularly in New Zealand.

Curriculum context

SCIENCE

NATURE OF SCIENCE

Investigating in science

Achievement objective(s)

L3 and 4: Students will ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.

Communicating in science

Achievement objective(s)

L3 and 4: Students will begin to use a range of scientific symbols, conventions, and vocabulary.

PHYSICAL WORLD

Physical inquiry and physics concepts

Achievement objective(s)

L3 and 4: Students will explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces, ... and heat.

PLANET EARTH AND BEYOND

Interacting systems

Achievement objective(s)

L3 and 4: Students will investigate the water cycle and its effect on climate, landforms, and life.

MATERIAL WORLD

The structure of matter

Achievement objective(s)

L4: Students will begin to develop an understanding of the particle nature of matter and use this to explain observed changes.

Key ideas

- The Earth's atmosphere consists of air.
- Air is a mixture of gases.
- Gases are made of particles that can move from place to place, much as liquids do.
- Water can exist in air as a liquid (rain, clouds, mist, and fog), as a solid (snow, and hail), and as a gas (water vapour).
- Changes in the lower atmosphere that we experience as weather are related to temperature and pressure differences in adjacent air masses.
- In general, air particles move from areas of high pressure to areas of low pressure as wind.

ENGLISH

READING

Ideas

Achievement objective(s)

L3: Students will show a developing understanding of ideas within, across, and beyond texts.

Indicators

- Uses their personal experience and world and literacy knowledge confidently to make meaning from texts.
- Makes meaning of increasingly complex texts by identifying main and subsidiary ideas in them.
- Starts to make connections by thinking about underlying ideas in and between texts.
- Makes and supports inferences from texts with increasing independence.

The Literacy Learning Progressions

The literacy knowledge, skills, and attitudes that students need to draw on by the end of year 6 are described in *The Literacy Learning Progressions*.

Meeting the literacy challenges

The following strategies will support students as they engage with the information and ideas in the text. Once they understand what the article is about ("the story"), they will be able to explore the key science ideas outlined in the following pages.

The *Connected* series includes a range of texts that provide opportunities for students to locate, evaluate, integrate, and synthesise information and ideas.

It is expected that students will read across the range of texts in this *Connected* to develop their literacy skills and their understanding of the topic.

Text characteristics

- Abstract ideas
- Maps and diagrams that clarify the text and require interpretation
- A significant amount of subject-specific vocabulary.

1. FINDING THE INFORMATION IN THE TEXT

This article outlines the major influences on New Zealand's weather. The headings in the text list these factors, and the content of each section explains them.

New Zealand's weather is influenced by:

- its position on Earth
- the winds caused by Earth's spin
- low-pressure systems in the Tasman Sea
- the cold seas of Antarctica and the cyclones of the tropics
- El Niño and La Niña.

MODEL by thinking aloud how to **SKIM** headings, diagrams, and maps to get an overview of the text.

By skimming pages 12–17, I notice that the headings refer to factors that affect our weather. The maps and diagrams seem to be explaining these factors, and the photographs illustrate different types of weather.

Tell the students that they are going to **SUMMARISE** the text to understand that the factors influencing New Zealand's climate are interconnected and work together to create the weather in this country. Before they start, **MODEL** how they can summarise the information by tracking key words, facts, and visual information and then putting the information into their own words and ordering it.

Section 1: pages 12 and 13

Heading	Key words	Visual information	My summary
Surrounded by Sea	oceans, hot air, icy air, high humidity	Satellite map showing NZ Map showing NZ's position on Earth	NZ is surrounded by oceans. These big areas of water cool the air from the north and warm the air from the south, so our climate is moderate.

Students can complete a graphic organiser like this for each section. They can then refine and link their summaries to illustrate the main points of the text.

2. INTERPRETING THE MAPS AND DIAGRAMS TO CLARIFY THE TEXT

EXPLAIN that maps and diagrams are an important source of detailed information in non-fiction texts.

Some readers will have a mental image of New Zealand's place on a map of the world. Others may not have formed this image and will need to focus on the locational information in the maps before they can analyse the weather information.

MODEL by thinking aloud how the maps explain the information in the written text.

In this map (on page 13), the yellow arrow shows the direction of the hot air coming from the tropics and the blue arrow shows the cold air coming from Antarctica. Look at the size of New Zealand compared with the size of the oceans.

ASK QUESTIONS to prompt the students to make connections between the photographs, the maps, the diagrams, and the written text.

Tell me how the map on page 15 relates to the photograph on the same page.

3. DEALING WITH SUBJECT-SPECIFIC VOCABULARY

This text includes vocabulary from two subject areas – science and geography.

IDENTIFY and list the geographic vocabulary including the place names – "Antarctica", "continents", "Equator", "North and South Poles", "the tropics", "east", "westerly" – before the students read the article. Have them highlight the place names and locate them on a globe or atlas. This activity will support the students in making connections as they read through the article.

EXPLAIN the meanings of any unfamiliar words on this list. Mark the points of the compass on a whiteboard and add the adjectives for these points – "west", "westerly", and so on.

These activities will reduce the amount of explanation required as students work through the text, so they can focus on the main ideas.

PREVIEW the text by reminding the students to **MAKE CONNECTIONS** to the information and vocabulary they encountered in "What Makes the Weather?"

REUSE TERMINOLOGY so that it becomes an integral part of students' vocabulary. Amplify the terminology by using it in sentences, quickly providing a definition, and then carrying on with the rest of the sentence.

IDENTIFY and list the science-specific vocabulary.

PROMPT the students to write a glossary of this vocabulary after reading, using the text as a source for the definitions.

DISCUSS the title of the section on page 15.

What does "Australia: Nursery of Lows" mean?

Exploring the science

The following activities and suggestions are designed as a guide for supporting students to develop scientific understanding as they explore the influences on New Zealand's weather.

Key ideas

- The Earth's atmosphere consists of air.
- Air is a mixture of gases.
- Gases are made of particles that can move from place to place, much as liquids do.
- Water can exist in air as a liquid (rain, clouds, mist, and fog), as a solid (snow, and hail), and as a gas (water vapour).
- Changes in the lower atmosphere that we experience as weather are related to temperature and pressure differences in adjacent air masses.
- In general, air particles move from areas of high pressure to areas of low pressure as wind.

Activity 1: *Modelling how the Earth's spin creates wind*

The article states (on page 14) that different places on Earth's surface travel at different speeds depending on how close they are to the North or South Poles. One role of science is to investigate the validity of current explanations. Scientists often construct models to test explanations. This activity allows students to model the different speeds of rotation and build their understanding.

Review the lower diagram of the globe on page 14 and discuss the movement indicated by the arrows. If a globe is available, use it to model the rotation of the Earth. Remind the students that this is a model of the world.

Explore how they might use simple models made of polystyrene balls and bamboo skewers to test the speed of Earth's rotation at different points. Alternatively, use prepared models. Place coloured pins in three different points in a line between the South Pole and the Equator. Ask the students to model the distance each pin travels over one day by rotating the model once. Establish that it takes the same time for each pin to rotate once. Ask the students to identify which pin is moving the fastest.

To consolidate the students' understanding, ask them to model the speed of each point by walking around circles that radiate from a centre point on the ground. The centre point represents the location of the North or South Pole, and the circles represent different latitudes. Have the students work in groups of four or five, with each student taking a turn at each latitude. Have one student act as observer each time to check that they all start and finish at the same time.

Activity 2: *Exploring how water and air behave when their temperature is changed*

Any significant changes in the temperature of land masses and the surrounding sea can influence the weather conditions in the neighbouring regions. The particles in gases (such as air) and liquids (such as water) respond in a similar manner when heated or cooled. Scientists often use liquids to model how air behaves because water is much easier than air both to contain and to see changes in.

The full instructions for this activity can be found in BSC Book 50, *Storms: Extreme Weather*, pages 10–11, under Rising and Falling Air. When part of a mass of water or air is heated, this can cause convection currents to form. These currents can be clearly demonstrated when a mass of hot coloured water is placed in a large container of cold water. Ensure that your students understand that this activity uses water as a model to demonstrate how air behaves when heated.

After completing the activity, ask your students what they think happens to air as it moves over a land mass in summer. Explore with the students the significance of weather phenomena such as the nor'wester in Canterbury and the contrasting Fremantle Doctor in Western Australia.

Activity 3: *Where does most of New Zealand's weather come from?*

Much of New Zealand's weather is caused by conditions that form around Australia and in the cold Southern Ocean.

Over a period of several weeks, have the students collect weather maps from newspapers, television, or the Internet. Have them refer to the relevant sections of "What Makes the Weather?" to help them understand the weather maps. Work with them to identify significant weather features and track them over time. Follow both highs and lows and identify how they affect the force and direction of the wind. As the weather changes, help the students to notice the patterns on the maps that indicate this change. Have them record the changes that take place with wind direction, cloud types, and temperature changes.

Move on to predicting the weather, starting when conditions are settled. Have the class predict when they think the weather is going to change and why. Refer to pages 86–88 of *Making Better Sense of Planet Earth and Beyond* for further ideas on predicting weather.

Activity 4: *Testing our thinking*

In groups or as a class, have the students discuss what they have learnt from their reading and previous activities. Ask them to decide on an aspect of weather that they would like to investigate. The students will plan and carry out an investigation to test their explanations of their learning. The investigations could be to:

- answer questions they may have
- provide evidence to confirm generalisations they have made
- fill gaps in their knowledge and understanding.

Some starter questions to explore

- *Why does Fiordland have the highest rainfall in New Zealand?*
- *How is snow formed?*
- *Why is it so humid in Auckland?*
- *Why do the hottest temperatures in New Zealand usually occur in central Otago?*
- *How can I make a model of a hurricane?*
- *How does the Beaufort Wind Scale work?*

MINISTRY OF EDUCATION RESOURCES

- *Making Better Sense of the Material World*, Water, pages 23–33
- *Making Better Sense of Planet Earth and Beyond*, Weather, pages 63–90
- Building Science Concepts (BSC series): Book 58: *Ice: Melting and Freezing*; Book 15: *Where's the Water?*; Book 31: *Water and Weather*; Book 30: *The Air around Us*; Picture pack: *Weather*
- For appropriate tasks, see the Assessment Resource Bank site and linking documents to the Making Better Sense books and the BSC series
  - http://arb.nzcer.org.nz/resources/science/bsc.php
  - http://arb.nzcer.org.nz/resources/science/bettersense

FURTHER RESOURCES

- Erick Brenstrum (1998). *The New Zealand Weather Book*. Nelson: Craig Potton Publishing.
- www.niwa.co.nz/our-science/climate/information-and-resources/clivar/elnino
- See also resource lists in BSC and Making Better Sense books

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