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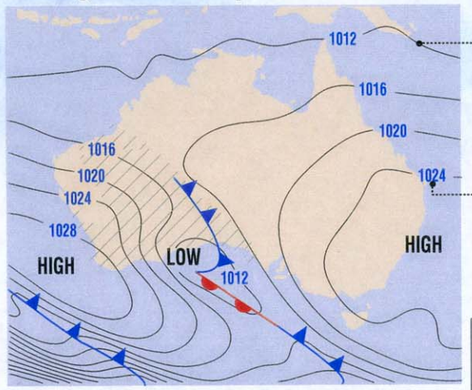
THE MERCURY

Reading the weather

Few sciences are as much the subject of everyday discussion as meteorology or the study of the earth's atmosphere and the weather. It affects each of us every day and we all comment on the ability of scientists to predict the day's weather, making sure that we don't leave the house without hearing, watching or reading a weather report. Although humanity has come a long way in understanding the science of weather since Aristotle coined the term "meteorology" in the 4th century BC, there are still many mysteries to be solved and our ability to predict weather based on scientific evidence is constantly being honed through advances in science and technology.

Reading a weather map



ISOBARS
Joining points of equal air pressure.

Space between isobars indicates wind strength and direction. The closer the lines the stronger the winds.

HECTOPASCALS
Barometer readings of atmospheric pressure.

Indicates rainfall

This is a synoptic chart meaning "seen together"

Highs

When you hear a weather forecaster say that an area of high pressure will dominate the weather. This usually means your region has several partly to mostly sunny days in store with little or no precipitation. Air tends to sink near high-pressure centres, which inhibits precipitation and cloud formation. This is why high-pressure systems tend to bring bright, sunny days with calm weather.

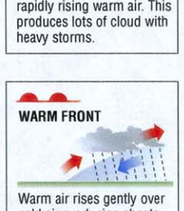
Lows

When forecasters say a low pressure area is moving toward your region, cloudy weather and precipitation result. Air rises near low pressure areas – as air rises, it cools and often condenses into clouds and precipitation. The low strengthens as cold and warm air clash. Low pressure systems have different intensities with some producing a gentle rain while others produce high-force winds and a massive downpour.

COLD FRONT

Cold air flowing in under the rapidly rising warm air. This produces lots of cloud with heavy storms.

WARM FRONT



Warm air rises gently over cold air producing sheets of cloud and light showers.

Tropical cyclones

Tropical cyclones, as their name suggests, are generated in tropical areas of the ocean near the equator.
They are cyclonic, meaning that their winds swirl around a central eye. Wind direction is clockwise in the Southern Hemisphere and counterclockwise in the Northern Hemisphere. Cyclones form in low pressure systems, the eye of a cyclone is always a low-pressure area. The winds swirling around the centre of the storm have a sustained speed of at least 119 km/h, enough to rip up trees and destroy buildings. One of the worst tropical cyclones to hit an Australian city was Cyclone Tracy, which levelled large areas of Darwin at Christmas in 1974.

MAIN PARTS OF A CYCLONE

STORM CLOUDS
Spiral out in upper atmosphere.

WARM AIR
Spiralling up around the eye

EYE
The calm centre of the low pressure system

ENERGY
The heat from the warm sea provides the energy for the cyclone.

IMAGE OF A TROPICAL CYCLONE OFF THE QUEENSLAND COAST

RAIN BANDS – bands of thunderstorms circulating outward from the eye that are part of the evaporation/condensation cycle that feeds the storm

EYE WALL

Winds are clockwise

SPIRALLING WINDS
These are the most damaging winds, beneath the eye wall. Air flows in towards the centre and whirls upward. These clockwise winds gain speed as they approach the eye, like a whirlpool.

Snow

Snow forms when ice crystals in clouds stick together and form snowflakes. When these grow large enough, they fall. No two snowflakes are alike – they come in all sorts of shapes but usually have six sides.

Lightning

As a thunderstorm grows, electrical charges build up within the cloud. Oppositely charged particles gather at the ground below. The attraction between positive and negative charges quickly grows strong enough to overcome the air's resistance to electrical flow. Racing toward each other, they connect and complete the electrical circuit. Charge from the ground then surges upward at nearly one-third the speed of light and we see a bright flash of lightning.

Negative electrical charges build up within clouds

Lightning takes the easiest route to earth and tends to strike tall objects like isolated trees

Positive charges gather on the ground

- Light travels faster than sound – so you can work out how close a storm is by counting how many seconds it takes for the sound of thunder to arrive after the flash.
- It's approximately 1km for every two seconds.
- Thunder occurs because the hot lightning makes the air around it expand at high speed making a thunderous boom.

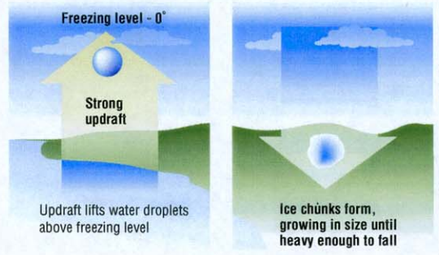
Rain cycle

Mother nature is the great recycler. Water moves around from land to sea in an eternal cycle made possible by evaporation, precipitation and the flow of water to the sea.

1. Sun heats the ocean
2. Ocean water evaporates and rises into the air
3. Water vapour cools and condenses to become droplets, which form clouds
4. If enough water condenses, the drops become heavy and fall to the ground as rain or snow
5. Rain flows back into the ocean through rivers and collects in groundswells

Hail stones

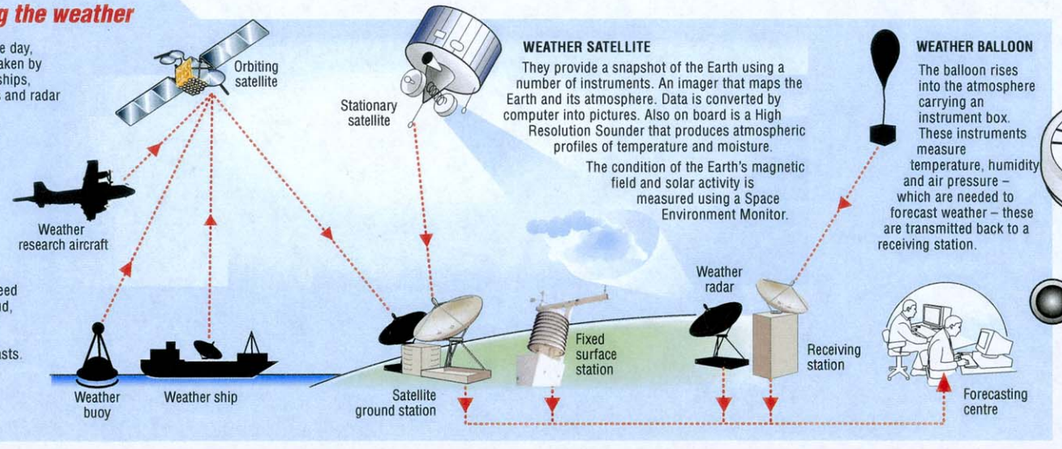
Thunderstorms are often accompanied by hail. Hail forms when strong currents of rising air, known as updrafts, carry water droplets above the freezing level in thunderstorms and the water freezes into ice. Hail often melts before it reaches the ground, but in some cases ice chunks the size of golf balls fall.



Forecasting the weather

Every minute of the day, observations are taken by weather stations, ships, satellites, balloons and radar the world over.

All this data is fed into super computers at forecasting centres. Meteorologists then use this information to draw up maps indicating air pressure, wind speed and direction, cloud, temperature and humidity to make short-range forecasts.

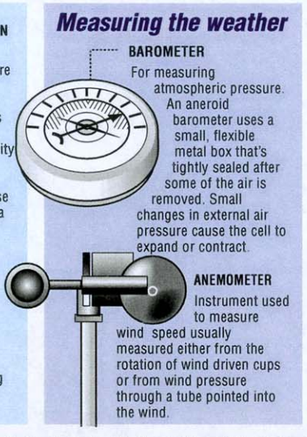


WEATHER SATELLITE
They provide a snapshot of the Earth using a number of instruments. An imager that maps the Earth and its atmosphere. Data is converted by computer into pictures. Also on board is a High Resolution Sounder that produces atmospheric profiles of temperature and moisture.

The condition of the Earth's magnetic field and solar activity is measured using a Space Environment Monitor.

WEATHER BALLOON
The balloon rises into the atmosphere carrying an instrument box. These instruments measure temperature, humidity and air pressure – which are needed to forecast weather – these are transmitted back to a receiving station.

Measuring the weather



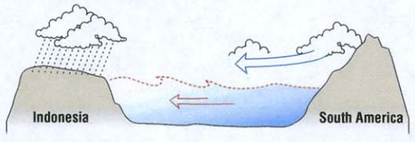
BAROMETER
For measuring atmospheric pressure. An aneroid barometer uses a small, flexible metal box that's tightly sealed after some of the air is removed. Small changes in external air pressure cause the cell to expand or contract.

ANEMOMETER
Instrument used to measure wind speed usually measured either from the rotation of wind driven cups or from wind pressure through a tube pointed into the wind.

Drought and El Nino

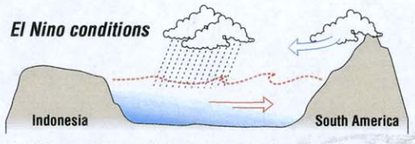
El Nino is the perfect example of how truly global weather patterns can be. A simple change in direction of the prevailing winds across the Pacific Ocean affects continents on different sides of the globe.

Normal conditions



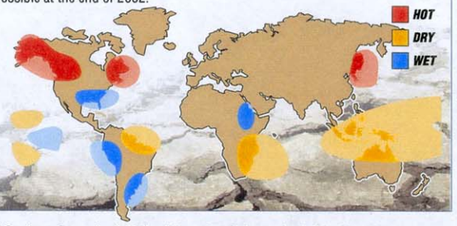
Trade winds blow from the east along the equator, pushing warm water into the Pacific Ocean.

El Nino conditions



An El Nino condition results from weakened trade winds in the western Pacific Ocean near Indonesia, allowing piled-up warm water to flow toward South America.

Every 5-7 years the winds, normally blowing from east to west, change direction pushing warm water toward the coast of South and Central America where it piles up causing humidity, rains, floods and savage waves. Meanwhile the west Pacific becomes drier, with drought in Indonesia and Australia. It was dubbed El Nino- the Christ Child- by South Americans, because the phenomenon normally begins at Christmas. El Nino also affects the amount and type of fish in the ocean because nutrients are not washed up from colder layers of water deep in the ocean as they are under normal conditions.
Although the phenomenon (the warming of the coastal waters off South America) has been known of for centuries, it only became known to western science 100 years ago. It is only since the '60s that in-depth monitoring and research have brought a better understanding of its effects and a link to drought in Australia. The current drought in NSW is not linked to El Nino but climatologists say that conditions may become worse with an El Nino event possible at the end of 2002.



NewsGraphic - Artists: **WILL PEARCE** **Editor: Troy Lennon** Source: Australian Bureau of Meteorology (02) 9296 1555; NASA; Guide to Weather by Michael Allaby, Dorling Kindersley; Weather By Brian Cosgrove, Dorling Kindersley; Why Does Lightning Strike, Dorling Kindersley; Helping you understand weather, usatoday.com; howstuffworks.com; University of Southern Queensland: National Oceanic and Atmospheric Administration