



Understanding weather and the weather forecast

Week 2 - What is Weather?

Terry Hart

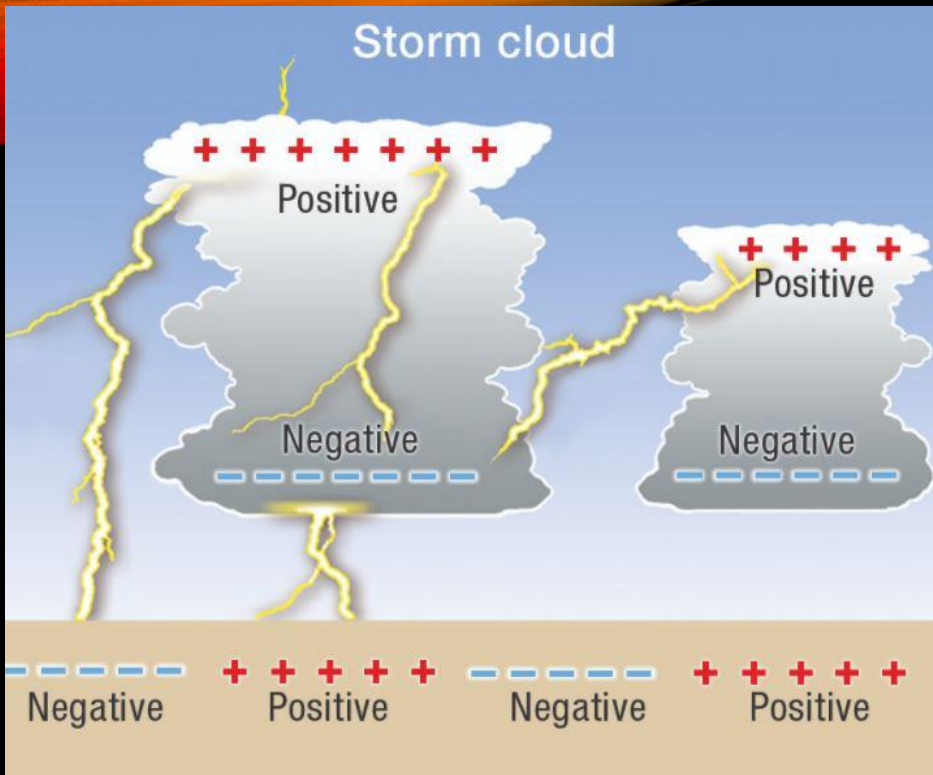
Thu 3 Feb 2022 at 9:45pm



Bolts of crawler lightning, which is responsible for megaflashes, arc across the sky.(ABC Open contributor Ryan Fowler Photography)

ABC News – article on Megaflash Lightning (Ruth Hoskin)

<https://www.abc.net.au/news/science/2022-02-03/megaflash-lightning-what-is-it-and-do-we-see-it-in-australia/100798672>



“Cloud-to-cloud lightning happens the same way, except the charge is moving between differently charged areas in the clouds or the atmosphere.

“This is more common than cloud-to-ground lightning, but it doesn't impact us on the ground as much.”

Cloud-to-cloud can appear as sheet lightning — where the clouds are illuminated by the flash but the bolt is hidden inside the cloud or too far away to see — or crawler lightning.

Bolts of crawler lightning arc out across the top of the cloud like the branches of a tree.

“Crawler lightning is responsible for the megaflashes,” Dr Soderholm said.

The record-breaking megaflashes were created in a giant weather pattern known as the meso-scale convective system, Dr Soderholm said.

"These thunderstorms are not individual thunderstorms, it's one mass of thunderstorm that has merged together.

"These systems can be so large and so intense, there are huge amounts of energy involved that allow it to produce lightning over such distances and for such a duration."

The record-breaking megaflashes probably travelled in multiple steps through the system to last the distance and for so long.

"It would have moved across the storm step by step and potentially multiple flashes within those steps as well," Dr Soderholm said.

We do have such weather systems in Australia.

What causes the spectacular bolts of crawler lightning to flash across the sky?

ABC Weather / By Kate Doyle

Posted Mon 7 Jan 2019 at 6:15pm, updated Mon 7 Jan 2019 at 7:25pm




Lightning Tracing / crawling across sky Nth Australia In UHD 4K.



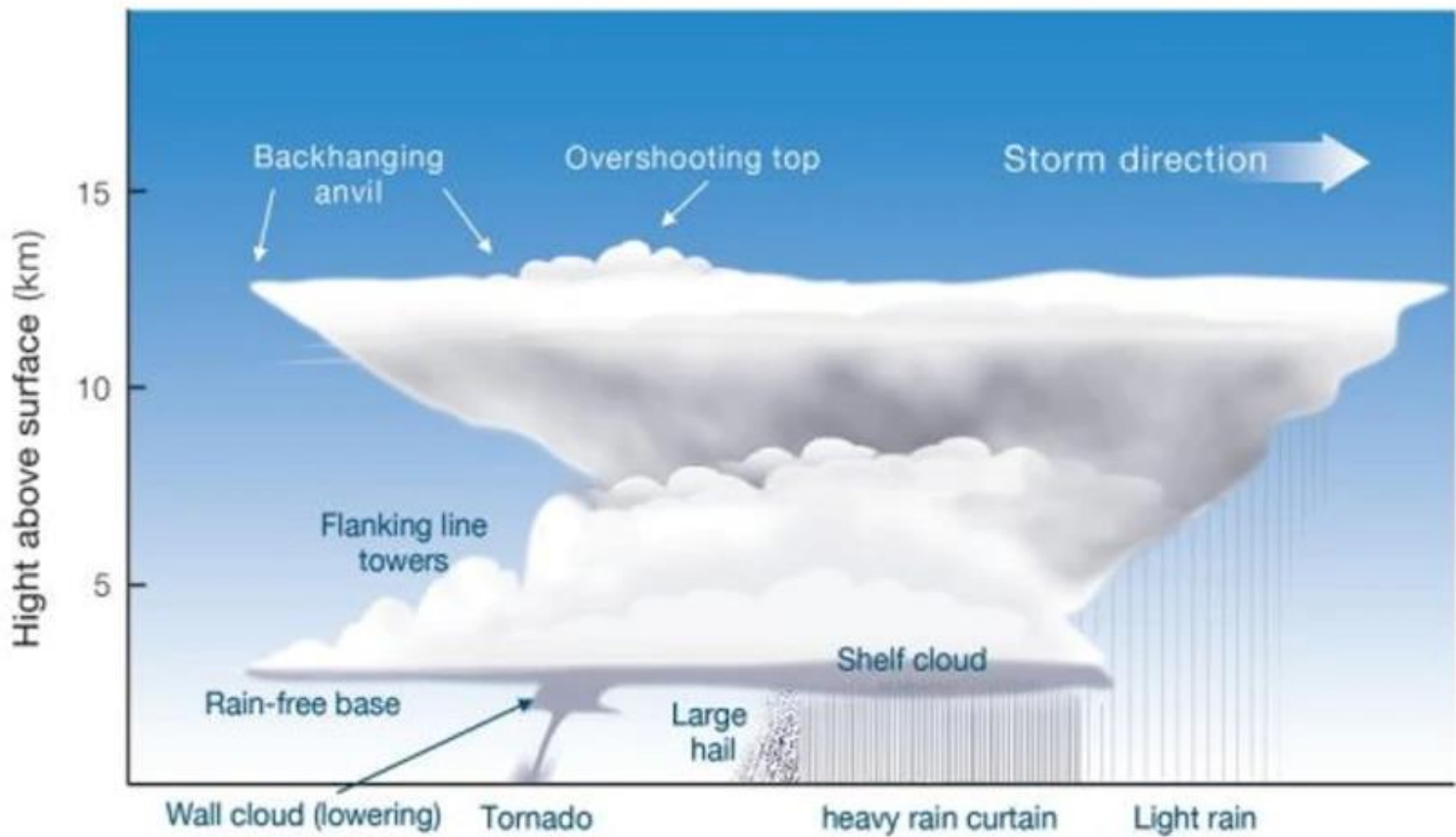
Share

<https://youtu.be/C1HrcNgTDe4>



Watch on  YouTube

<https://www.abc.net.au/news/2019-01-07/crawler-lightning-what-causes-it/10692794>



Jackson Browne, meteorologist at the Bureau of Meteorology, Darwin, said crawler lightning appeared in the upper parts of thunderstorms — in the anvil — the flat expanse of cloud which spreads out at the top of a storm.

“If you look at the structure of a storm, you can imagine the bulk of the storm is the trunk and then the anvil is more like the canopy spreading out.

"The lightning tends to take on that sort of forked appearance of a tree with that lightning spreading up in the upper canopy of the storm."

What causes the spectacular bolts of crawler lightning to flash across the sky?

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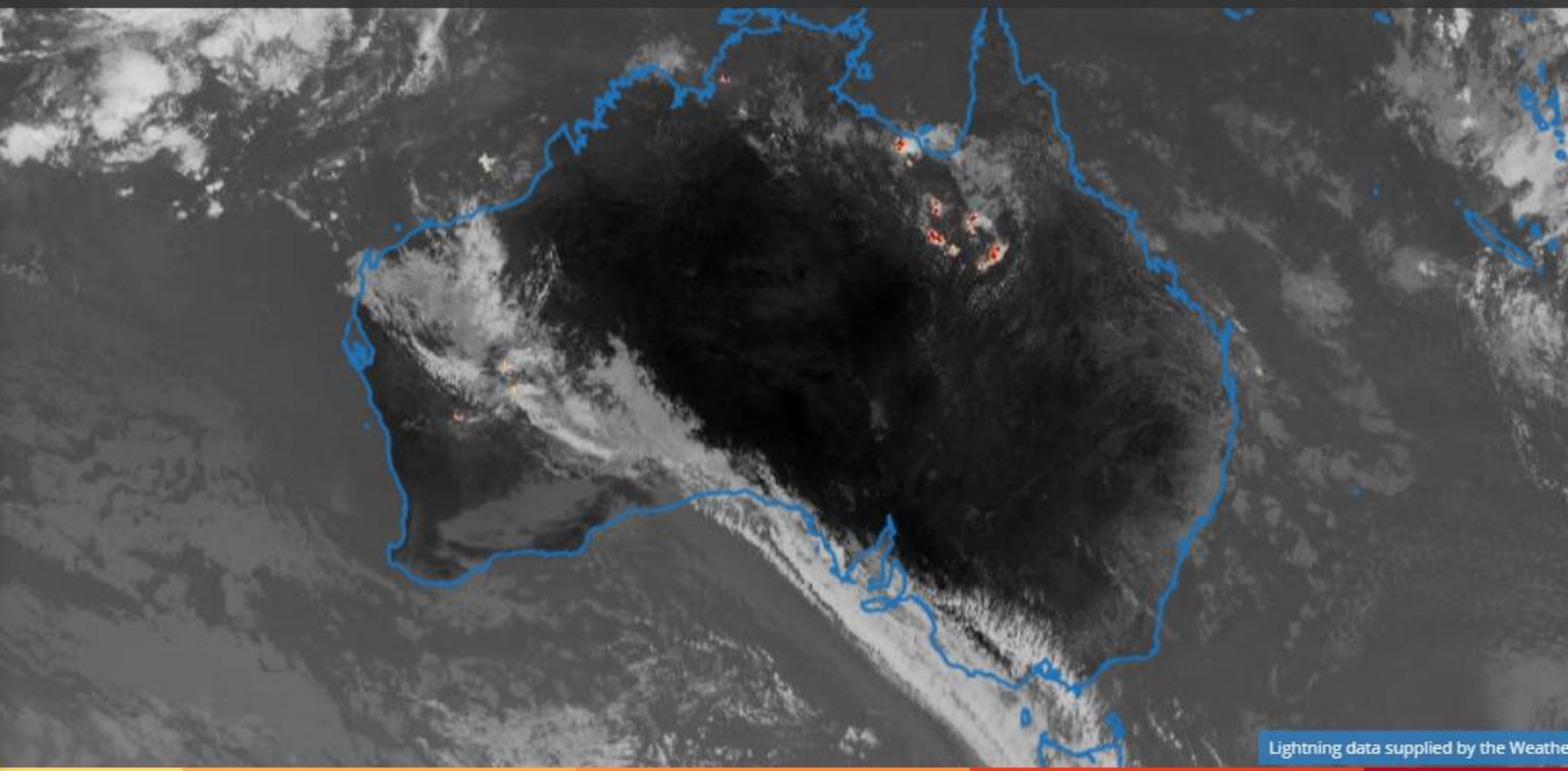


This spectacular example of crawler lightning was captured by Geoff Green in the Eastern Kimberley on January 4, 2019.

<https://youtu.be/C1HrcNgTDe4>

Lightning

- Day + Night
 - Visible Greyscale
 - Infrared Greyscale
 - Infrared + Zehr
 - Lightning
-
- Cities
 - Roads
 - Boundaries
 - Coastal
-
- Show Legend
 - Show Coordinates



Lightning data supplied by the Weather

High Frequency

<http://satview.bom.gov.au/>

Weatherzone Web Site

weatherzone^o

WEATHER

RADAR & CHARTS

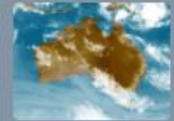
NEWS

BUSINESS

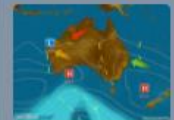
HELP



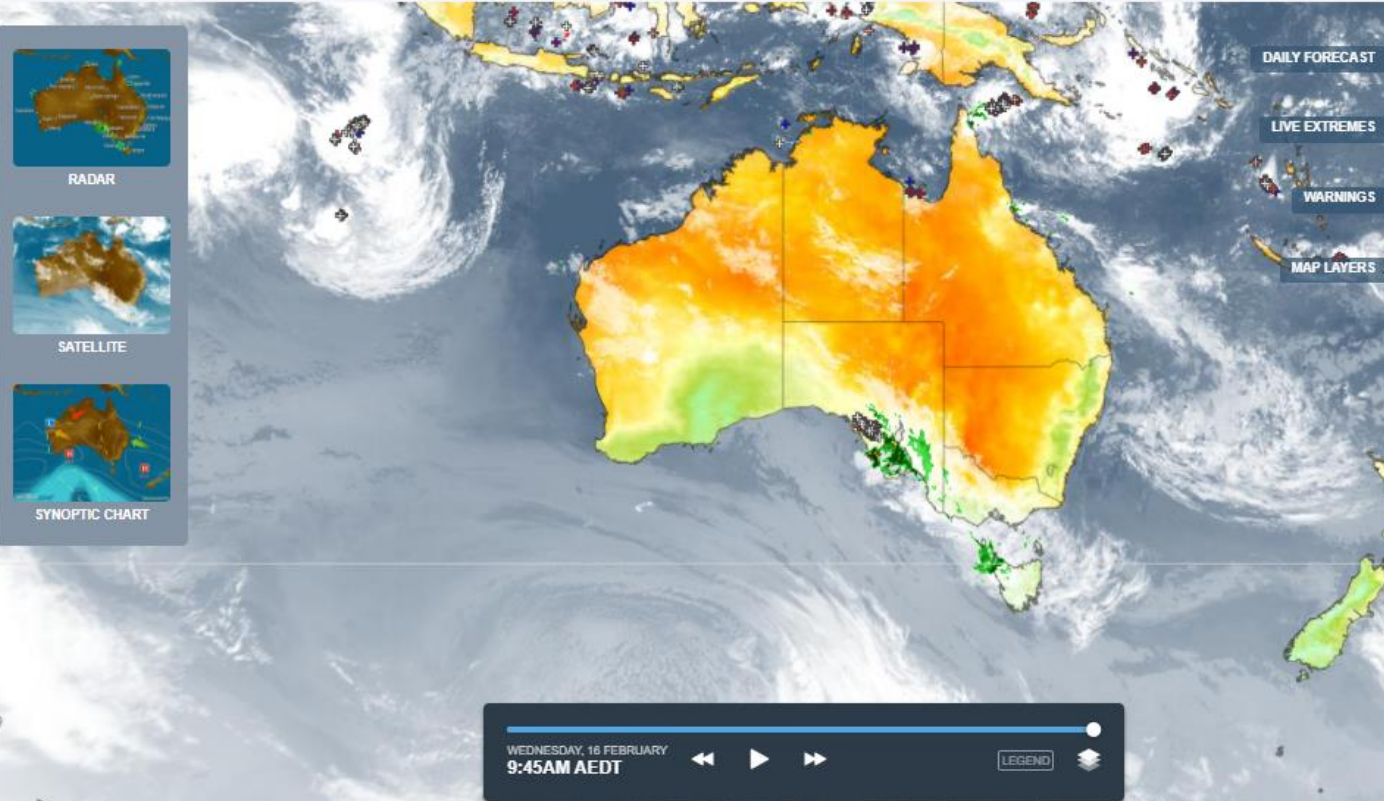
RADAR



SATELLITE



SYNOPTIC CHART



DAILY FORECAST

LIVE EXTREMES

WARNINGS

MAP LAYERS

MAP LAYERS



Temperature Gradient



Terrain



Day/Night Satellite

WEATHER OVERLAYS

- Lightning
- Rain Radar
- Pressure (isobars)
- Tropical Cyclone Track Map
- Temperature Observations

DETAILED RADAR

WEDNESDAY, 16 FEBRUARY
9:45AM AEDT



LEGEND



<https://www.weatherzone.com.au>

Weatherzone Web Site

The screenshot displays the Weatherzone website's satellite map interface. At the top, a dark blue navigation bar contains the 'weatherzone' logo and menu items: WEATHER, RADAR & CHARTS, NEWS, BUSINESS, and HELP. A user profile icon and a settings gear are also visible on the right side of the navigation bar.

The main content area features a large satellite map of Australia and surrounding regions. On the left side of the map, there are zoom controls (+ and -) and a 'LOCATIONS' button. On the right side, there are 'MAP LAYERS' and 'LOCATIONS' buttons. A scale bar at the bottom right of the map indicates 500 km.

At the bottom of the map, a blue timeline shows the current time as 'WEDNESDAY, 16 FEBRUARY 9:20AM AEDT'. The timeline includes playback controls (back, play, forward) and a 'DURATION' slider set to '1 hour'. Other controls include 'SPEED' set to 'Normal', a 'LEGEND' button, and a 'MAP LAYERS' button.

On the right side of the interface, there is a sidebar with several sections:

- Terrain (Dark)**: A button to toggle terrain data.
- Satellite Layers**: A section with five options: Day/Night (checked), Visible, Infrared, Enhanced Infrared (PRO), and Water Vapour (PRO).
- WEATHER OVERLAYS**: A section with five options: Cloud Cover, Daily Location Forecast, Fire Risk Hotspots, Lightning (PRO), and Observations Plot (PRO).

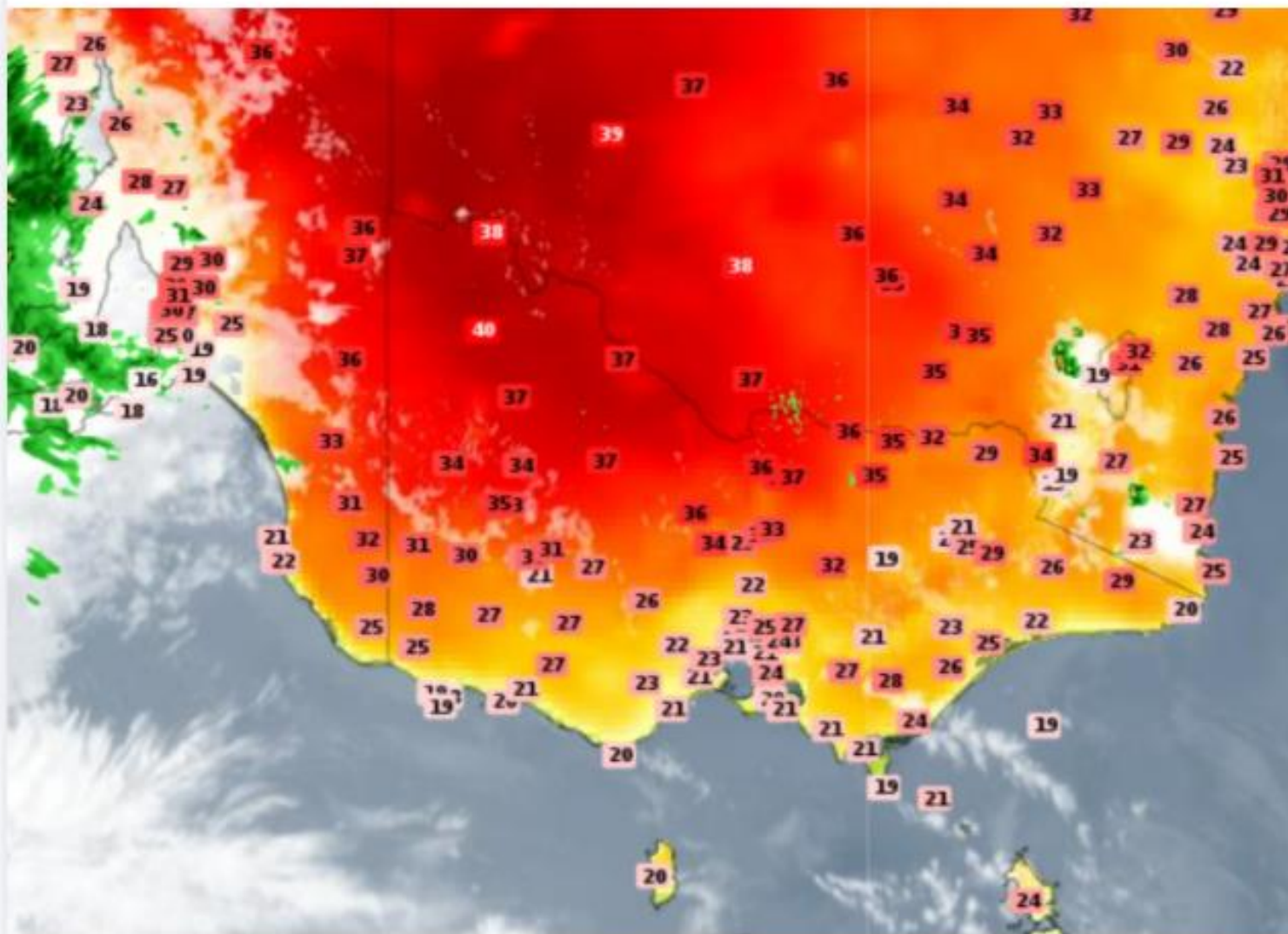
<https://www.weatherzone.com.au/satellite>

ANTHONY SHARWOOD, 15 FEB 2022, 5:19 PM AEDT

Huge temperature contrasts in Victoria today

SHARE

Tuesday 15 February 2022







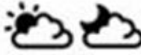






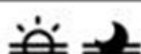











Latest News





Task:

- Write description of yesterday's weather as if it were a forecast
- Include a one or two word précis (and icon)

Graphic (day/night)	Mobile graphic (day/night)	Icon number	Graphic number description
		1	Sunny
		2	Clear
		3	Mostly sunny, Partly cloudy
		4	Cloudy
		6	Hazy
		8	Light rain
		9	Windy
		10	Fog
		11	Shower
		12	Rain
		13	Dusty
		14	Frost
		15	Snow
		16	Storm
		17	Light shower
		18	Heavy shower
		19	Cyclone

Melbourne Forecast

 View the current warnings for Victoria

Forecast issued at 5:05 am EDT on Wednesday 16 February 2022.

Forecast for the rest of Wednesday



Max **27**

Possible late shower.

Possible rainfall: **0 to 1 mm**










Chance of any rain: **40%** 

Melbourne area

Partly cloudy. The chance of fog early this morning. Medium (40%) chance of showers in the afternoon and evening. The chance of a thunderstorm in the afternoon and evening. Light winds becoming northwest to northeasterly 15 to 20 km/h in the morning then tending southeast to southwesterly 15 to 25 km/h in the middle of the day.

Fire Danger - High

Sun protection recommended from 9:40 am to

Location	Min	Max
 Melbourne	-	27
 Geelong	-	27
 Laverton	-	27
 Tullamarine	-	30
 Scoresby	-	30
 Watsonia	-	31
 Mount Dandenong	-	26
 Yarra Glen	-	32
 Frankston	-	28

Geelong Forecast



View the current warnings for Victoria

Forecast issued at 5:05 am EDT on Wednesday 16 February 2022.

Forecast for the rest of Wednesday



Max **27**

Cloudy.

Chance of any rain: **30%** ■■■□□□□□□□

Geelong and Surf Coast area

Cloudy. The chance of fog early this morning. Medium (40%) chance of showers this evening. The chance of a thunderstorm in the afternoon and evening. Light winds becoming southerly 15 to 25 km/h in the early afternoon then becoming light in the late evening.

Scoresby Forecast



View the current warnings for Victoria

Forecast issued at 5:05 am EDT on Wednesday 16 February 2022.

Forecast for the rest of Wednesday



Max **30**

Late shower or two.

Chance of any rain: **50%** ■■■■■□□□□□

Melbourne area

Partly cloudy. The chance of fog early this morning. Medium (40%) chance of showers in the afternoon and evening. The chance of a thunderstorm in the afternoon and evening. Light winds becoming northwest to northeasterly 15 to 20 km/h in the morning then tending southeast to southwesterly 15 to 25 km/h in the middle of the day.

- What elements are most important?
- how far ahead are you interested?
- Imagine you are sailing on Port Phillip or in Bass Strait....
- Imagine you are an aircraft pilot..
- Aerodrome forecast
- A bushfire-fighter
- a farmer
- (Fill in table)

	Temp.	rain	cloud	wind	RH	Pheno mena	How far out?
You							
Farmer							
Firefighter							
Sailor							
Aircraft Pilot							

	T	rain	cloud	wind	Storms	MSLP	How far out?	Detail
You	x	x	x	?	x		7 days	Broad
Sailor	x	x	?	X	X		1-2 days	Local detail
Farmer	x	X	?	x	x		Days-seasons	Local
Bushfire fighter	X	X	?	X	X		Days	Site specific
Aircraft Pilot	x	x	X	X	X	X	Now – 24 Hours	Very detailed

* MELBOURNE YMML

TAF YMML 121714Z 1218/1400
16005KT 9999 -DZ BKN012
BECMG 1222/1300 24005KT CAVOK
FM130300 17012KT CAVOK
BECMG 1310/1312 29005KT CAVOK
FM131600 36010KT CAVOK
TEMPO 1218/1222 BKN010
RMK
T 19 19 23 28 Q 1012 1013 1013 1011

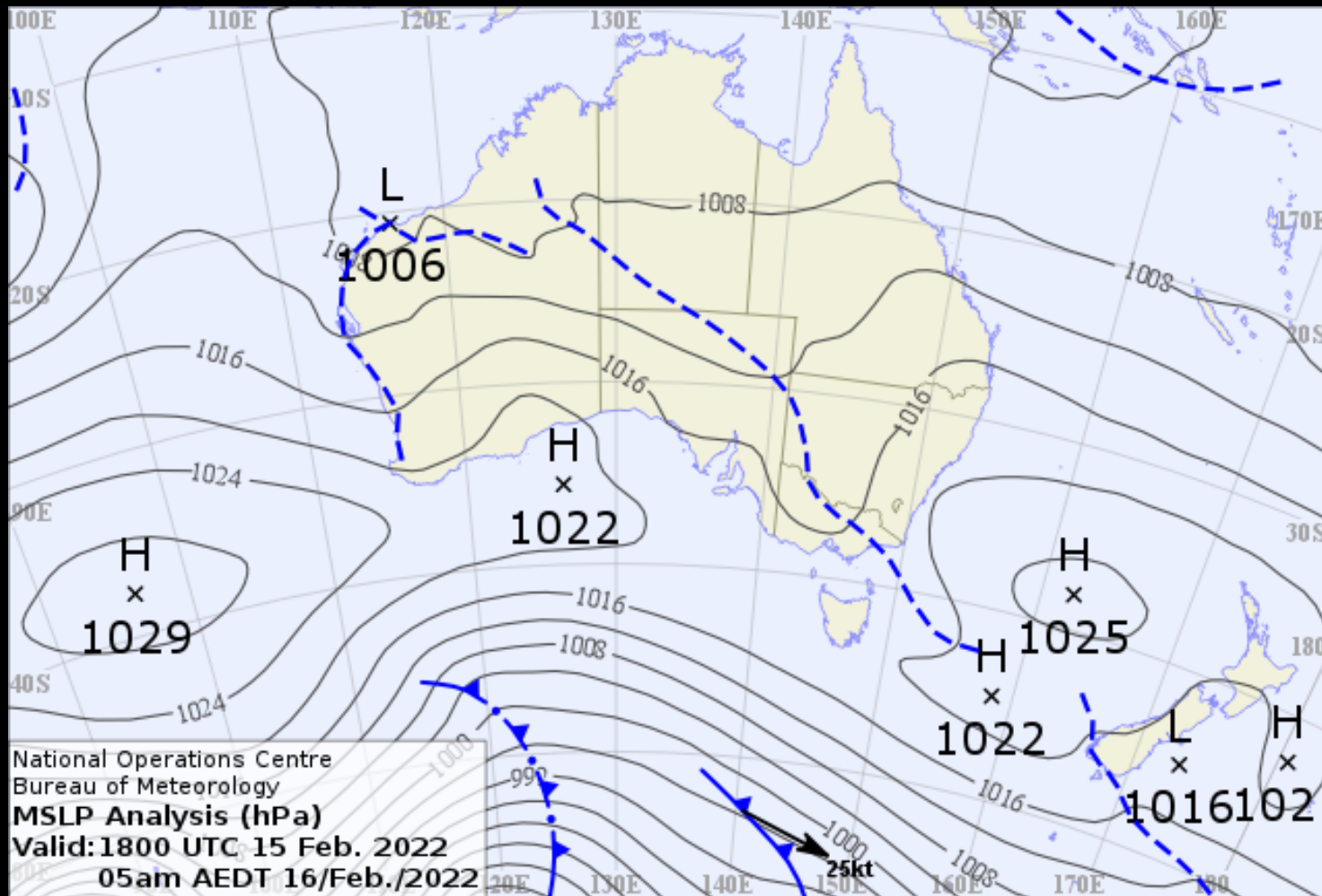
This like Mean Sea Level Pressure. It is important for setting the altimeter so the pilot knows how far he/she is above sea level

TTF SPECI YMML 122130Z 30006KT 9999 SCT010 SCT012 20/17 Q1013
RMK RF00.0/000.2
FM2230 24005KT 9999 SCT020

* Note: The latest TTF automatically supersedes the TAF for the 3 hr validity of the TTF, unless otherwise

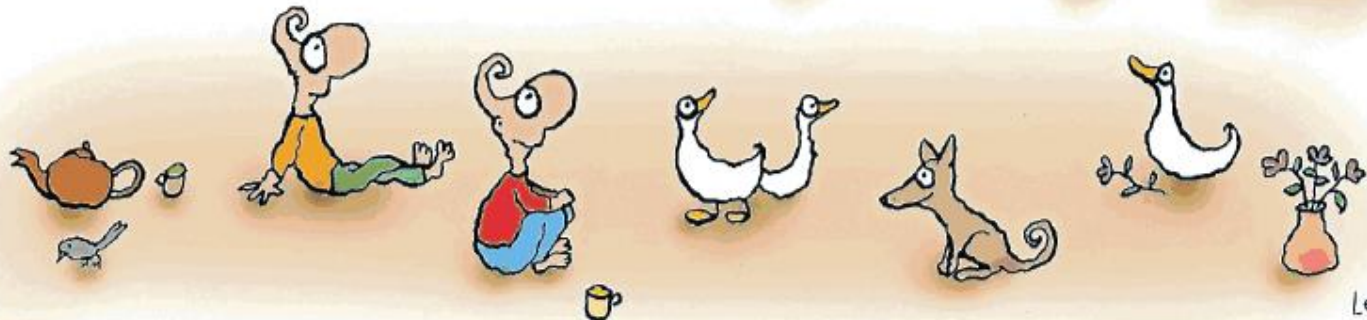
This weather map shows lines of equal Mean Sea Level Pressure (MSLP).

Why is MSLP so important?



Leunig

Mr. Curly delivers a lecture on the wonderful enigmas of weather patterns using the current weather map, which as always, has been created with help and advice from the local ducks at Lake Lacuna. The official weather forecast for Cunly Flat this week is: 'Lovely mysterious weather for ducks, goats and children'.



Leunig

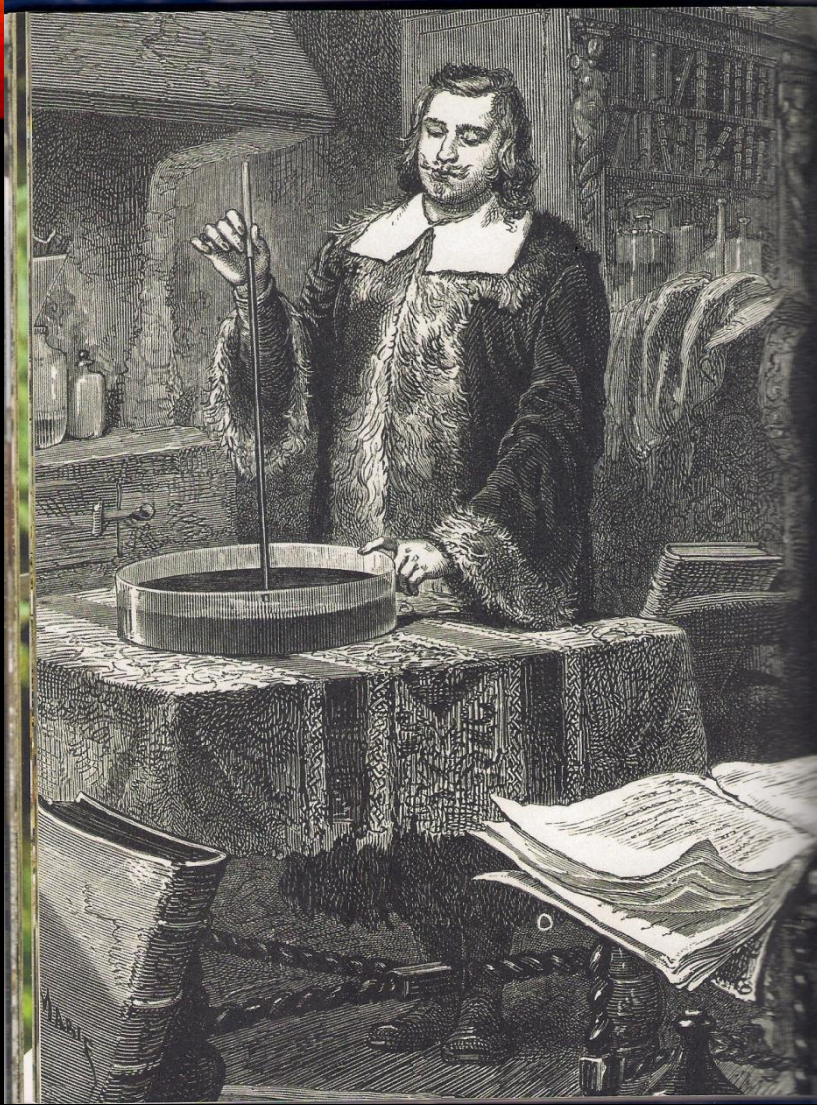
We looked at what makes up weather and ended up with **pressure**. It is not something we feel day to day but it is a crucial weather element. **Why?**

Weather maps show lines of equal atmospheric pressure at sea level, called **isobars**. **Why is air pressure so important?**

Air pressure is due to the fact that air has weight.

Galileo was puzzled why a suction pump could only raise water to about 9 metres.

His associate, Evangelista Torricelli (1608-47), reasoned that air had weight and when the weight of the water column equalled that of the atmosphere, an equilibrium had been reached and the water column could not be raised any more.



Torricelli also recognised that for a denser liquid, the column would be shorter. He used mercury and showed that a column of only about 760 mm (30 inches) could be supported.

“We live immersed at the bottom of a sea of elemental air, which by experiment undoubtedly has weight, and so much weight that the densest air in the neighbourhood of the surface of the earth weighs about one four-hundredth part of the weight of water.”

Torricelli, 1644

Torricelli observed that the mercury level changed from day to day and he noticed a link between pressure and weather.

“Winds are produced by differences of air temperature , and hence density, between two regions of the earth.”

Scientists after him (including Blaise Pascal) used his barometer to show that pressure was lower at higher altitudes.

The SI unit of pressure is the Pascal (Newton per square metre). For convenience the hectoPascal (hPa) is used (100 N/m^2) which is numerically the same as the millibar (mb).

The Newton is a unit of force - the force required to accelerate a mass of 1 Kilogram at a rate of 1 metre per second per second (1 m s^{-2})

Global average is 1013.25 hPa
i.e. about 10,130 kilograms per square metre
14.7 pounds per square inch

Harvard
Pressure
Video

People using barometers noticed that changes in pressure were related to changes in the weather, and particularly that storms were associated with low pressure.

Before rapid communication:

- not possible to make a map of the weather or to track storms
- there developed tentative ideas that storms moved
- Some maps were made on past storms by collecting and analysing reports.

Turning point - The **telegraph** made mapping the weather in close to real-time possible.

Mid 19th century controversy about the wind flow in storms:

- Did winds circulate around a low?
- Or did winds blow into a low?
- Spiralling winds – both circular and inflow components?.

It seems logical that if there is a pressure difference, air should move from areas of high pressure to areas of low pressure. If not, why not?

Why the three basic rules for reading weather maps in our part of the world:

- The wind blows clockwise around lows, and anticlockwise around highs (in the Southern Hemisphere; the opposite way in the Northern Hemisphere)
- the closer the isobars (lines of equal pressure), the stronger the wind
- rain and thunderstorms tend to occur in the low pressure zone between highs.

Next -we will begin to look at where these rules come from.

Forecast weather maps www.bom.gov.au