CLIMATE & WEATHER

Perhaps the greatest hazard when cruising is bad weather. Fortunately, weather forecasting and real-time reporting have never been better and more available. Getting it right feels like riding a wave; getting it wrong feels like being dumped by a wave.

I usually check the weather after each model run update. If a storm is coming, I check the radar and real-time wind reports regularly.

WEATHER FORECAST MODELS

Weather forecast models are computer simulations that start with current conditions, called the reference. There are three weather forecast models relevant to Australia:

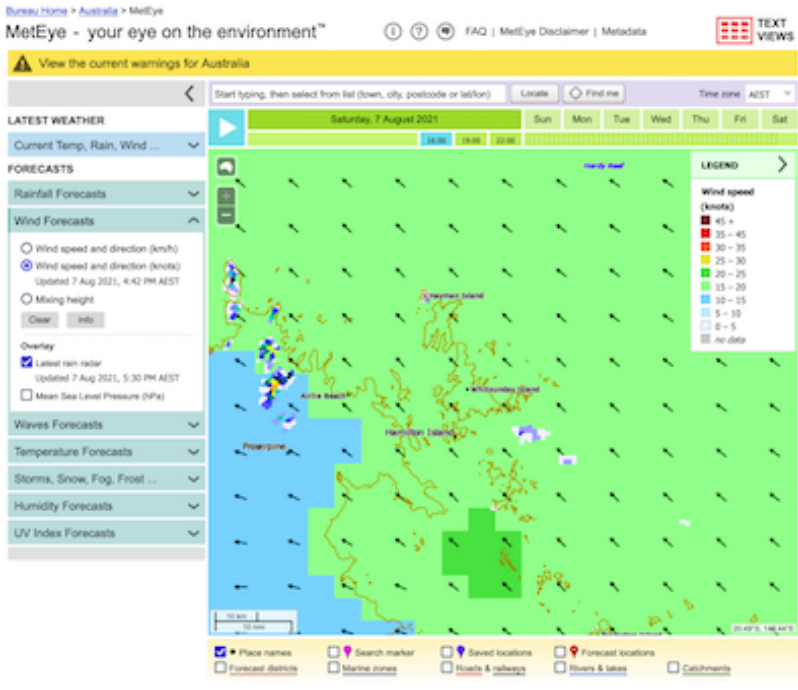
- ACCESS - Bureau of Meteorology Australian Community Climate and Earth-System Simulator, developed by them, based on the UK Met Office's Unified Model. The model was improved in 2025 with the APS4 upgrade. ACCESS-C is a high-resolution (1.5km grid) short-range (36 hours) forecast for the next 36 hours and is updated 4 times per day. ACCESS-C Syd covers the NSW coast, apart from Lord Howe Island. ACCESS-G, the global model, provides medium-range forecasts (10 days) on a medium resolution (12-15km grid). It is updated four times a day, around midnight and every six hours thereafter.

  The model is available on the Windy, WillyWeather, BOM and FishRanger apps. It also powers the MetEye viewer on BOM, which is not recommended as it displays a 6km resolution regardless of the underlying data.

- ECMWF - European model, more accurate than GFS and possibly ACCESS. Available on the Windy and FishRanger weather apps. 9km resolution.

- GFS Model - US NOAA model. Least accurate but free, so this is the one you get on most

MetEye Web-based Weather Viewer



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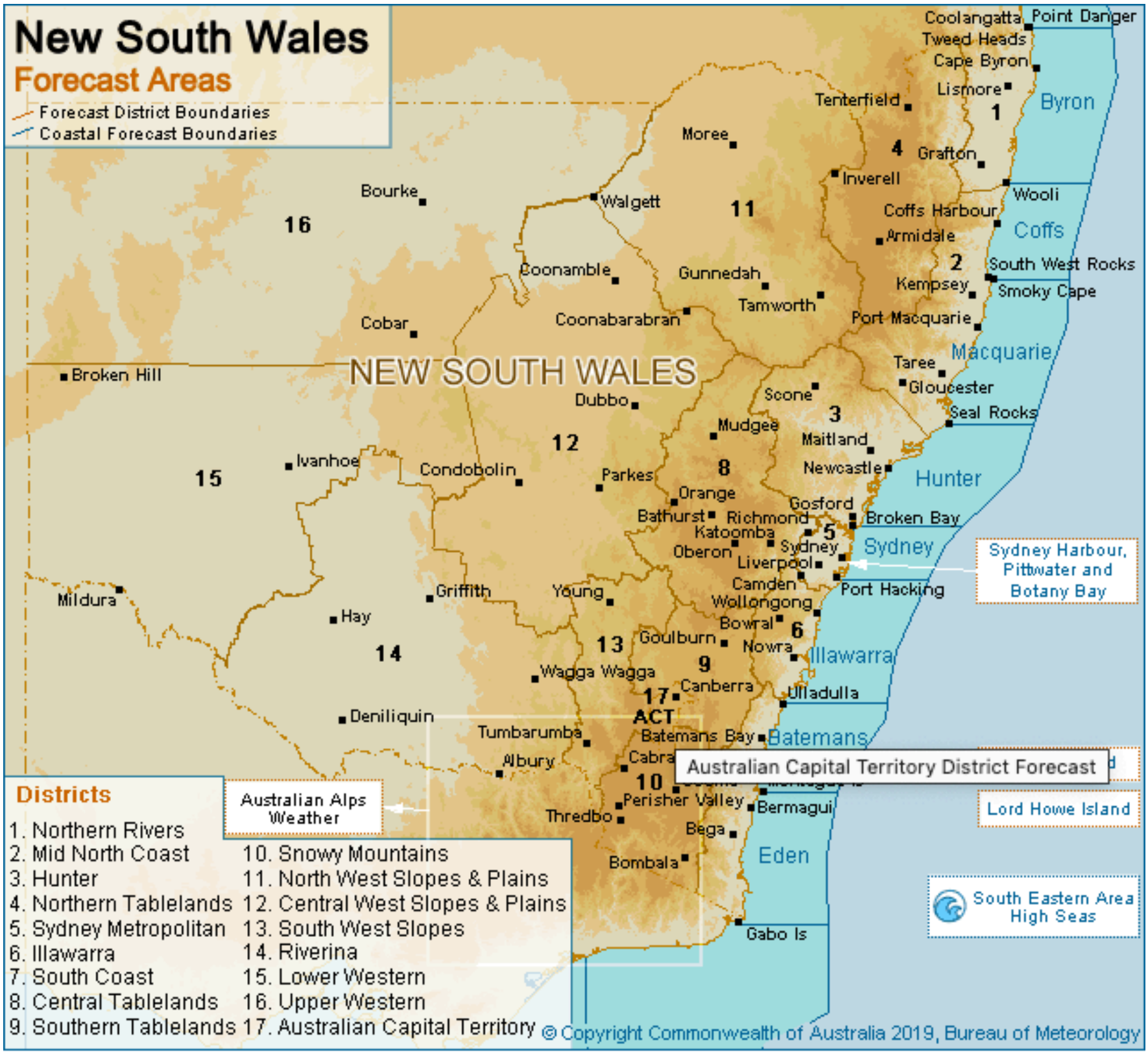
weather apps and GRIB viewers, such as WeatherTrack GRIB. 22km resolution.

- See the Apps section for apps to get this weather information.

COASTAL FORECASTS

The Bureau of Meteorology(BOM) provides marine NSW weather forecasts for each of the blue coastal water areas shown on the map below. Sometimes, the place names for the north and south limits of the coast are used in a forecast. For example, Coffs Coastal Waters may also be referred to by the places bordering the forecast area: Wooli in the north and Smoky Cape in the south.

We provide links to BOM forecasts in each coast's Quick Reference section.



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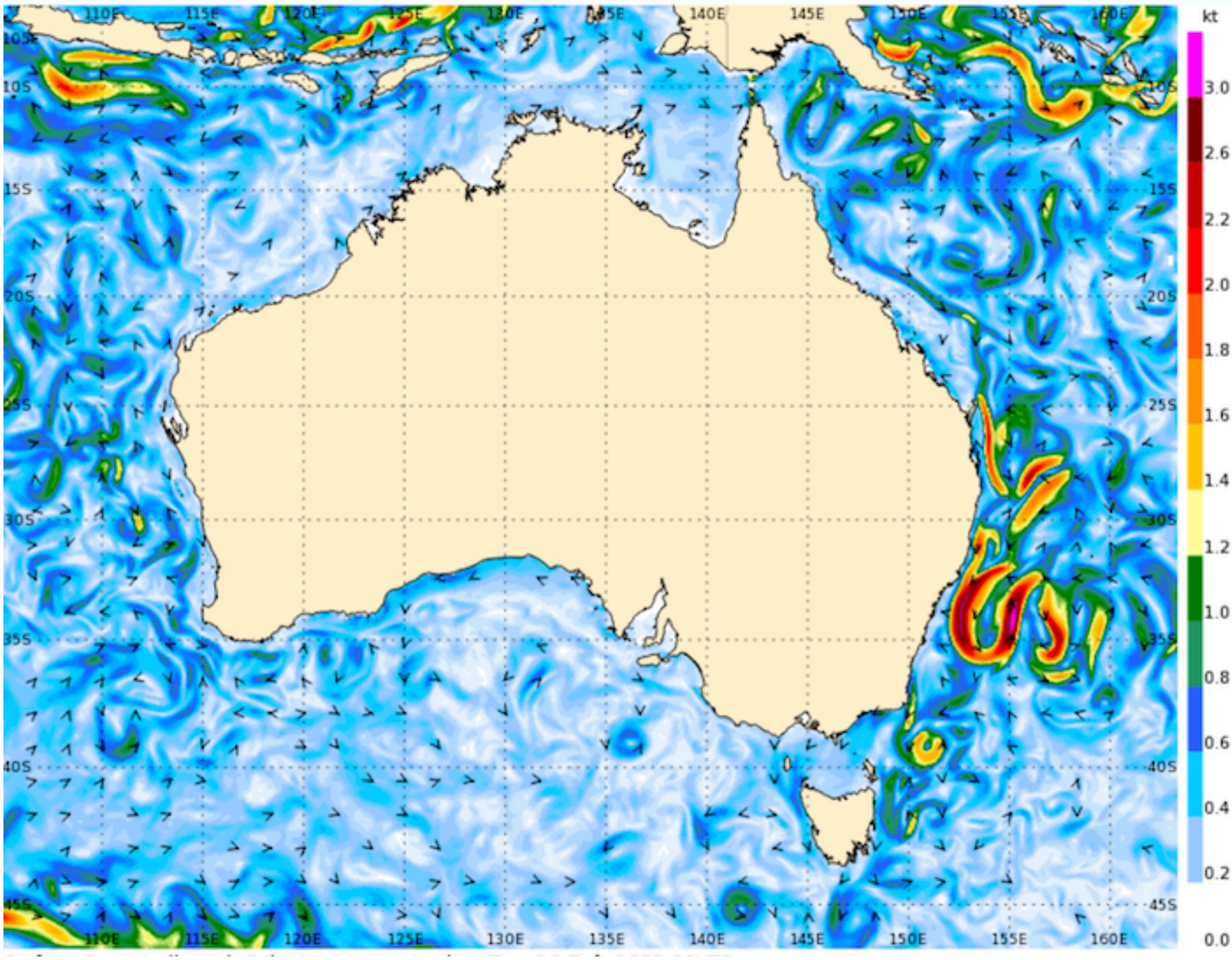
EAST AUSTRALIAN CURRENT

In NSW, the East Australian Current (EAC) runs strongly southward along the coast from the Queensland border to approximately Nowra. It also propagates out several hundred nautical miles out to sea and extends all the way to Lord Howe Island. Along the coast, its strongest core flow is generally found adjacent to the continental shelf and slope.

The key thing to recognise is that this is a stronger current than anywhere else in Australia.

Australian Current Forecast 16 February 2021



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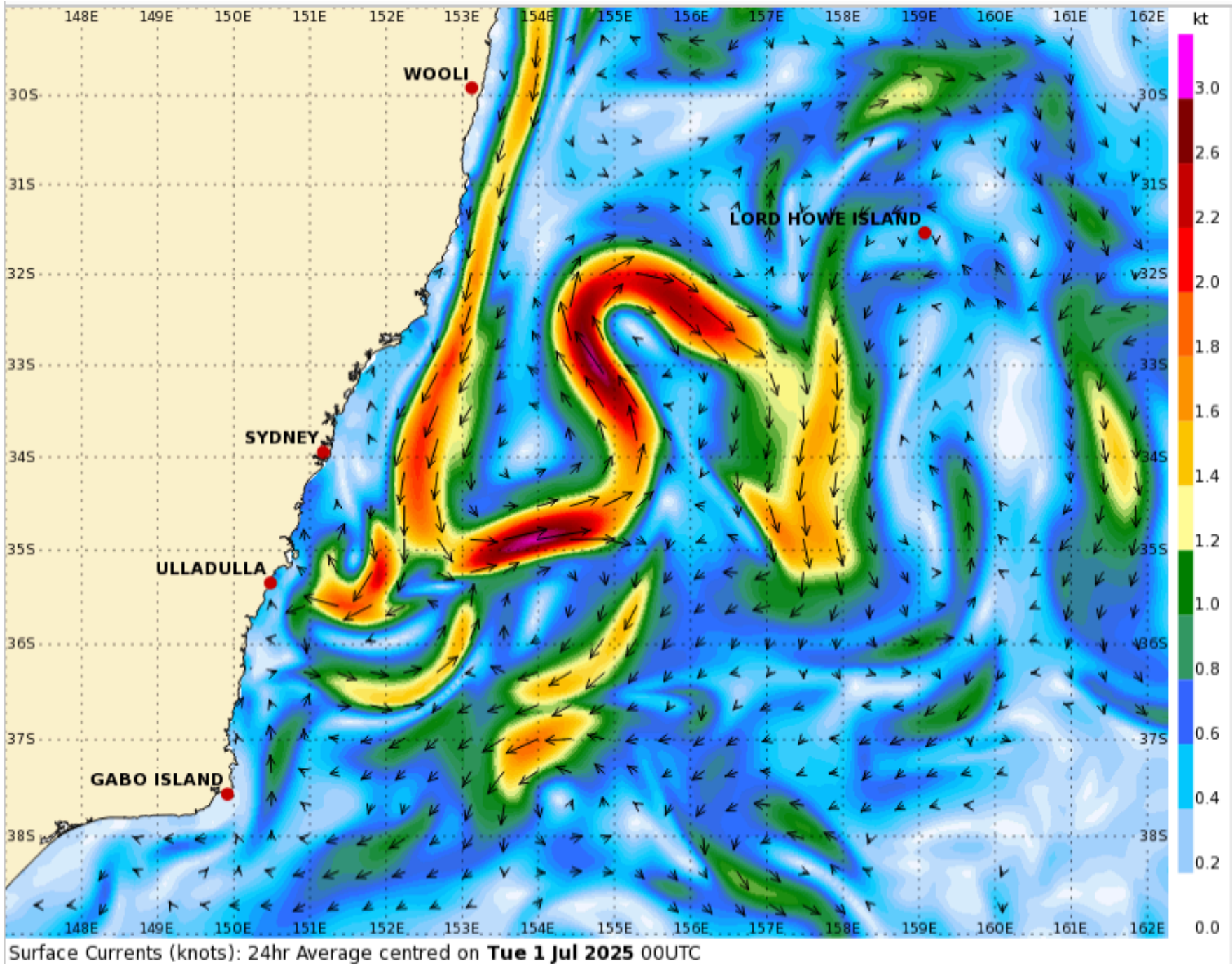
See the maps above and below showing the oranges and reds of the strong EAC.

NSW Current Forecast 1 July 2025



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Swells and wind waves will be steepened when against a current. For much of the coast, this will be a southerly setting current. Lows like East Coast Lows that produce strong southerly winds will produce steeper waves around the current. If you are caught in strong or gale-force southerly winds, try to move out of the current.

BOM provides current forecasts. It uses the BOM and CSIRO OceanMAP model. The Windy App also includes current forecasts. It uses the CMEMs model. It gives slightly different results. Both are well-regarded forecast models.

You can ride it to speed up progress south. Heading north, try to avoid it.

Wind waves and swell against current will be steepened, which can make for uncomfortable, and at higher wave heights, dangerous conditions. Rogue waves, though rare, are more likely within the EAC, as they are in other strong current areas around the world, such as the Kuroshio current off Japan and the Agulhas current off South Africa.

NSW WEATHER OBSERVATIONS

While forecasts are available for the whole coast, weather observations rely on weather stations. Weather apps use the BOM weather stations. Following is a map of NSW with all of the BOM weather stations.

Bureau of Meteorology Weather Stations

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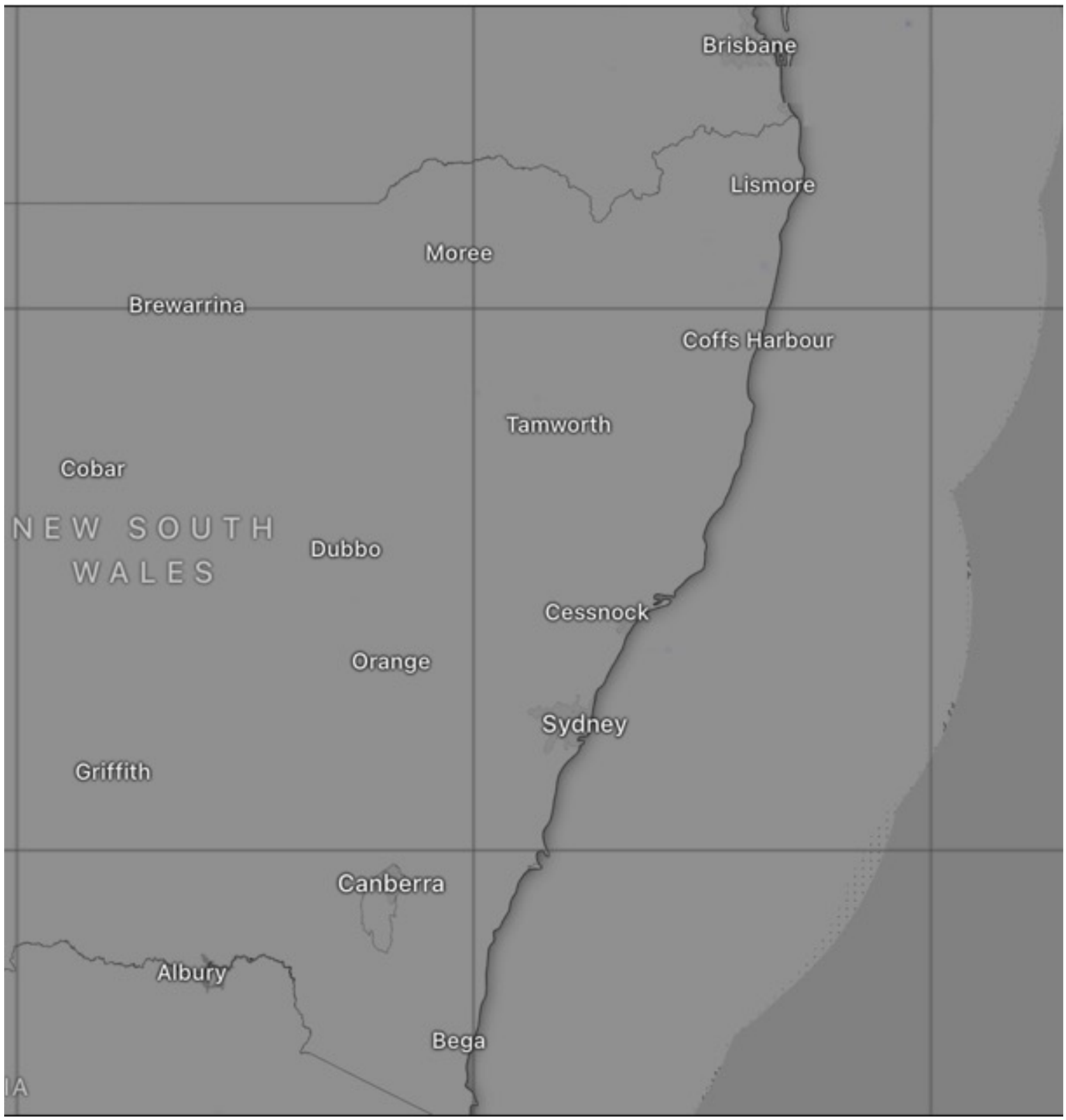
WEATHER RADAR COVERAGE

BOM has complete radar coverage of the entire state and the entire coast, apart from the extreme northwest corner.

Weather Radar Coverage for NSW



Source windy.com

BOM radar is useful for tracking rain and thunderstorms. All of the weather services rely on it for these, regardless of which one you are using.

WEATHER SYSTEMS OF CONCERN

When sailing along the NSW coast, you are in open ocean. There is nothing to reduce the wave height, unlike the Queensland coast, which is mostly protected by reefs.

When conditions are forecast to turn bad, you need to get into an inlet. Safe passage through their entrances, whether it be a bar or a harbour entrance, can be closed out quickly. This is quite different to Queensland, where the only long, exposed stretch is the K'Gari coast.

Both of these points mean the NSW coast is inherently more hazardous than the Queensland coast. Understanding hazardous weather systems and keeping up with weather forecasts is paramount to reducing risk.

LOWS

Five types of low-pressure systems can be hazardous in NSW waters:

- East Coast Lows
- Ex-Tropical Cyclones
- Tasman Lows
- Coastal Troughs
- Transient Lows

EAST COAST LOWS

East Coast Lows ("ECLs"), less commonly known as East Coast Cyclones, are an eastern Australian coast weather phenomenon that often occurs between Eden to the south and the top of K'Gari(Fraser Island) to the north[1]. However, they can track well north of that.

While these storms are not named, they are very dangerous. They feature a closed circular pressure gradient like a cyclone and develop along the coast. Coolangatta is named after a ship of the same name, driven ashore by the first recorded East Coast Low in August 1846.

The BOM defines an East Coast Low as:

- a closed system (rings of pressure gradient)

[1] Kiem. Journal of Southern Hemisphere Earth Systems Science (2016) 66:162–176

East Coast Low 25/8/21. Gale Warning Issued.

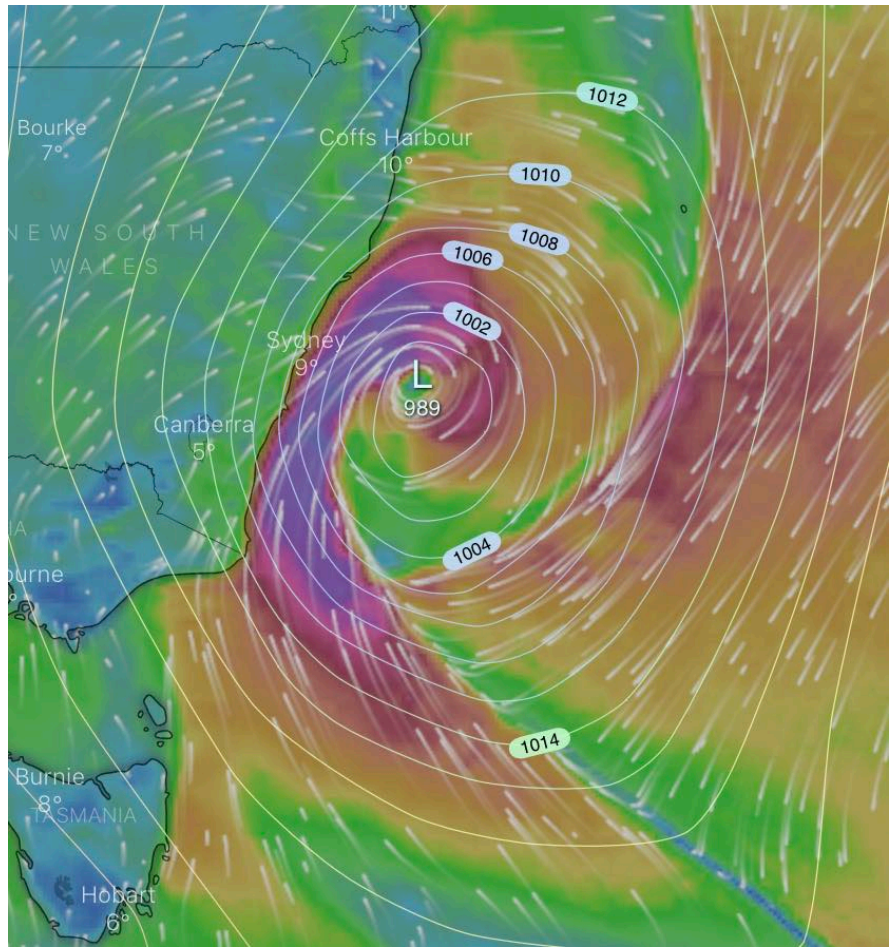


Image: Windy

- forming between 20° S (the Whitsundays) and 40° S (Flinders Island, Bass Strait)
- lingering within 200km of the coast for at least 12 hours
- Having a pressure gradient of 4 millibars per 100km moving towards the centre, or having an intense cyclonic system. They can be up to the equivalent of a category 2 cyclone in wind speed.
- being associated with severe weather

The BOM will issue a Gale Warning if average winds are expected to be 34-47 knots and a Strong Wind Warning if average winds are expected to be between 26 and 33 knots. Gusts can be 40% stronger. It will issue a Storm Force Wind Warning if average winds are expected to be 48 to 63 knots.

The BOM will also likely issue a Severe Weather Warning during the east coast low.

One aspect that makes East Coast Lows extra dangerous is that they develop in the ocean near the coast and then usually track up or down the coast before dispersing out to sea, usually in a few days. Which means one could develop right on top of you. Another is their propensity to develop very quickly, sometimes overnight, in what is known as a weather bomb or explosive cyclogenesis. The 1998 Sydney to Hobart was one of these.

They can produce very large waves with significant wave heights of 5 to 7 metres, which prevent a vessel from seeking shelter across a bar or a seaway, leaving the only option to ride it out at sea.

There are 10 to 20 ECLs per year, with April to October having the most. Most do not last longer than two days.[1] Historically, one of those will feature explosive development.

I have been turned around twice by East Coast Low development while trying to sail from the Gold Coast to Yamba. I have also sought shelter in Mooloolaba after an east coast low, which had passed by to the north, stalled over K'Gari.

EX-TROPICAL CYCLONES

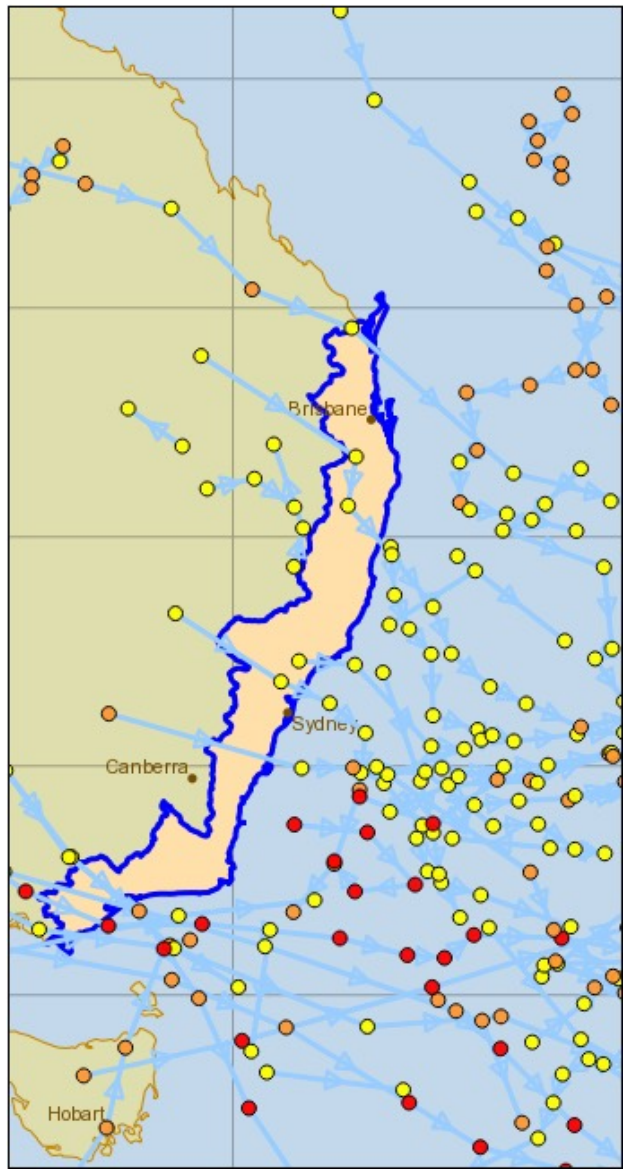
Cyclone season officially runs from 1 November to 30 April. Though primarily a problem for the tropics, ex-tropical cyclones affecting SE Qld usually head over towards New Zealand, creating large swells in the Pacific as they go. Rarely, they travel down the NSW coast.

TASMAN LOWS

If an intense low-pressure system lies further from the coast than around 200 km, it is called a Tasman Low or an Offshore Low.

They can still generate gale-force winds and large swells along the coast.

East Coast Low Tracks 2008 coloured by central pressure from yellow to red



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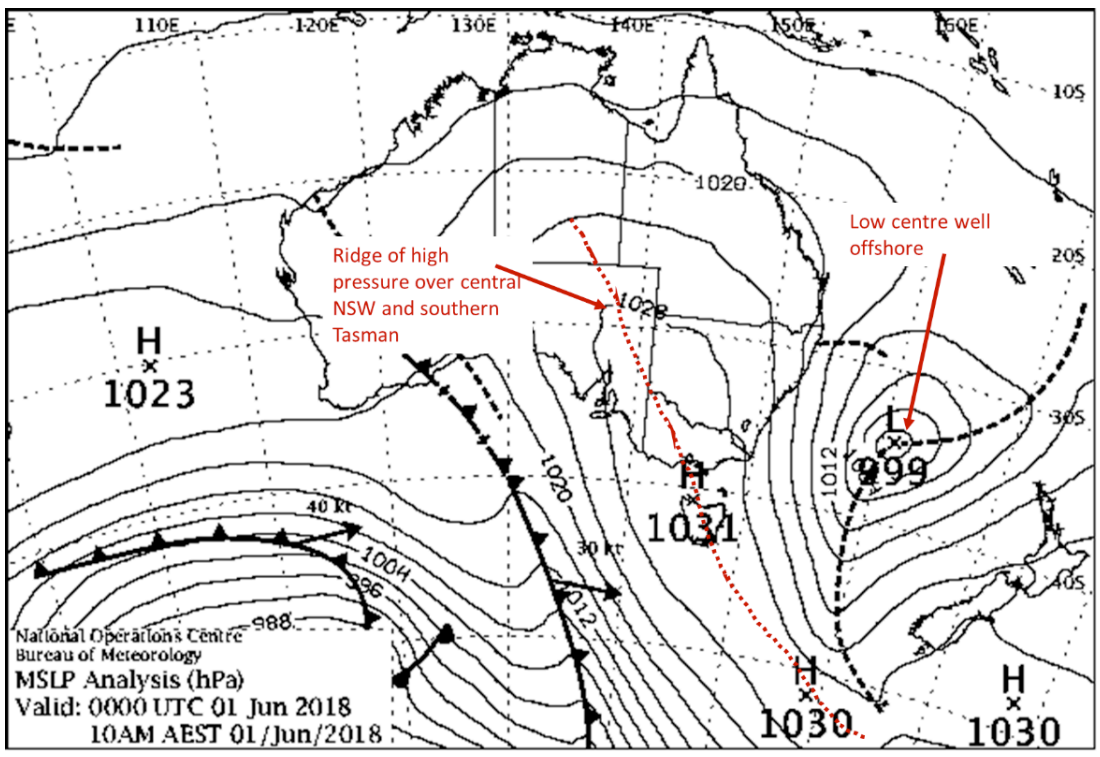
Tasman Low, 1 June 2018



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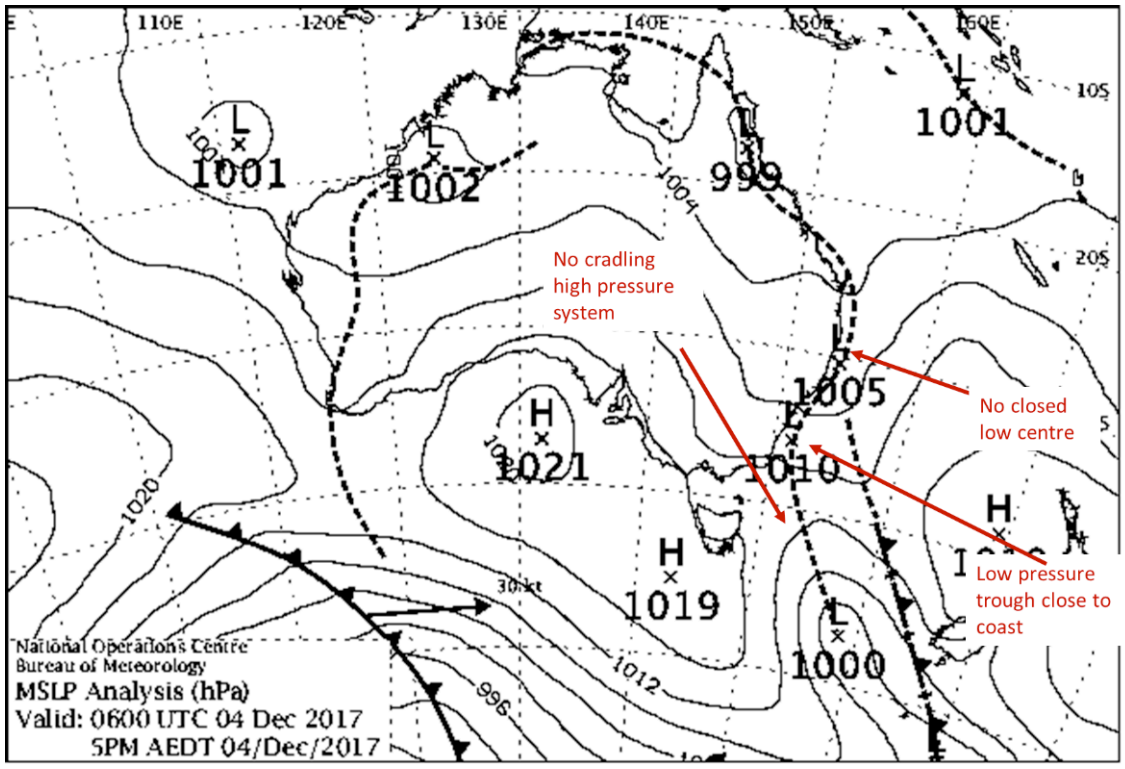
A strong Tasman Low with a central pressure of 984 developed in the last week of 2025. It generated Force 12 winds in New Zealand. At its strongest, the low was centred 1,500km off the NSW coast. So, coastal winds were light along the NSW coast. Powerful long-wavelength swells hit the coast with large waves and killed 4 people. The Botany Bay offshore waverider buoy recorded a significant wave height of 2.8 - 3.6m with maximum waves between 5.6 and 6.3m. These measurements were in deep water, not at the coast. These would have been higher. Long-wavelength swells are those over 200m long, with a peak energy wave period of 14 seconds. You can get the wave period from the wave rider buoys.

COASTAL TROUGHS

A coastal trough is a low-pressure system that develops or moves very close to the coast but does not have a single, closed circulation. They can develop lows inside of them with stronger winds.

Coastal Trough - 4 Dec 2017

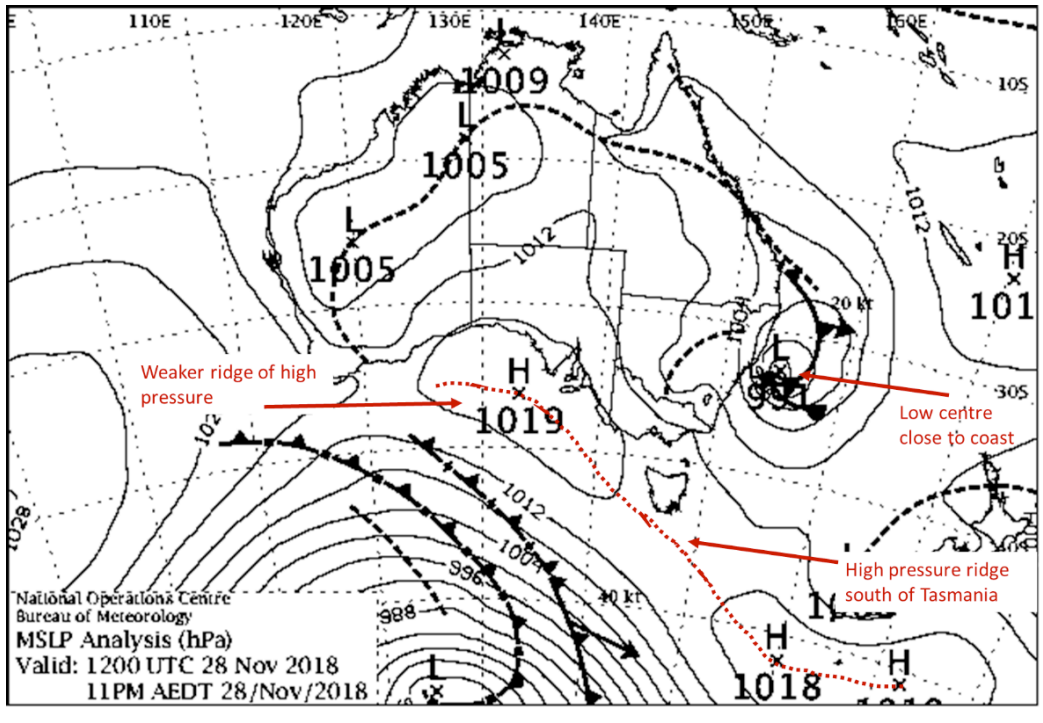


TRANSIENT LOWS

This is similar to an ECL, but it moves quickly away from the coast, thus not breaking the minimum 12-hour coastal threshold to meet the definition of an ECL.

They tend to develop on land and then rapidly intensify on the coast.

Transient Low - 28 Nov 2018



OTHER WEATHER SYSTEMS OF CONCERN

There are three other weather systems of concern:

- Strong cold fronts
- Severe thunderstorms
- fog (rare)

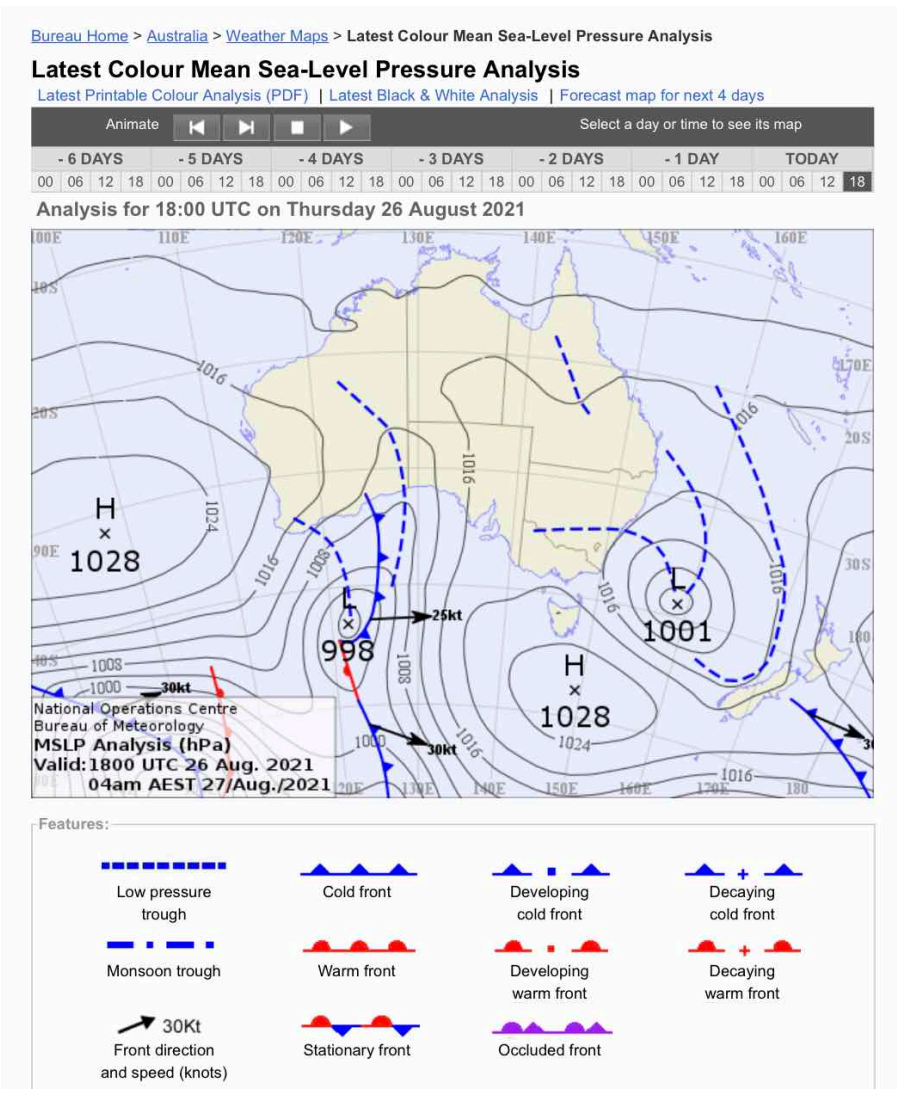
STRONG COLD FRONTS

Due to the Coriolis effect, cold fronts move across Australia from west to east. They cause temperatures to plummet and often bring a sudden arrival of strong winds, storms and rain.

Cold fronts have cold air, with winds usually from the south or southwest, which wedges under the warm air, which has a more northerly wind. When the cold front hits, the wind will back and swing around in an anti-clockwise direction.

Wind speeds frequently reach 30 knots, with wind squalls up to 72 knots having been recorded. These winds last for several hours.

Mean Sea-Level Pressure Analysis Map



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When the cold air pushes under the warm air, it rises and condenses. This can produce thunderstorms and rain.

BOM publishes a mean sea-level pressure analysis every day, together with forecast maps for the next four days.

The one shown to the left is from 26 August 2021. It shows a cold front, indicated by the blue line with blue triangular protrusions in the Southern Ocean. It is shown as heading east at 25 knots.

Cold fronts run along the southern part of Australia and are felt most strongly in Victoria to Southern Queensland.

Because cold fronts move across the country at a known speed, BOM can forecast their arrival accurately days in advance. You can

therefore use these forecasts to plan your passages. Also, strong cold fronts can be predicted based on damaging winds experienced as the front passes over the population centres of Melbourne and Sydney. These stronger cold fronts will often be described as vigorous cold fronts.

SOUTHERLY BUSTERS

The NSW coast has a type of strong cold front that occurs in spring and summer, known as a southerly buster.

It is defined as southerly winds gusting in excess of 29 knots with a 3-hour temperature drop of at least 5 °C. They travel from the south coast of NSW to the mid-north coast, generally reaching their maximum intensity between Nowra on the Shoalhaven Coast and Newcastle on the Hunter Coast.

Storm front with roll cloud (higher up) and shelf cloud (lower down). Taken 2025.

Used with permission.

A typical southerly buster is between 20 and 60 nautical miles wide, with the strongest winds centred on the coastal strip and lasting 30 to 60 minutes. They move from south to north.

They are sometimes accompanied by Arcus clouds, either a roll cloud or a shelf cloud (often connected to a thunderstorm front), running perpendicular to the coast, announcing the buster.

There is an average of 32 per year in NSW, with 5 of those affecting Sydney.

SEVERE THUNDERSTORMS

BOM classify Severe Thunderstorms as any that produce large hail (2 cm in diameter or greater), damaging wind gusts (90 km/h or greater), tornadoes or heavy rainfall conducive to flash flooding.

A severe thunderstorm warning is issued when a thunderstorm is expected to meet any of those criteria. 5-10% of thunderstorms reach severe status.

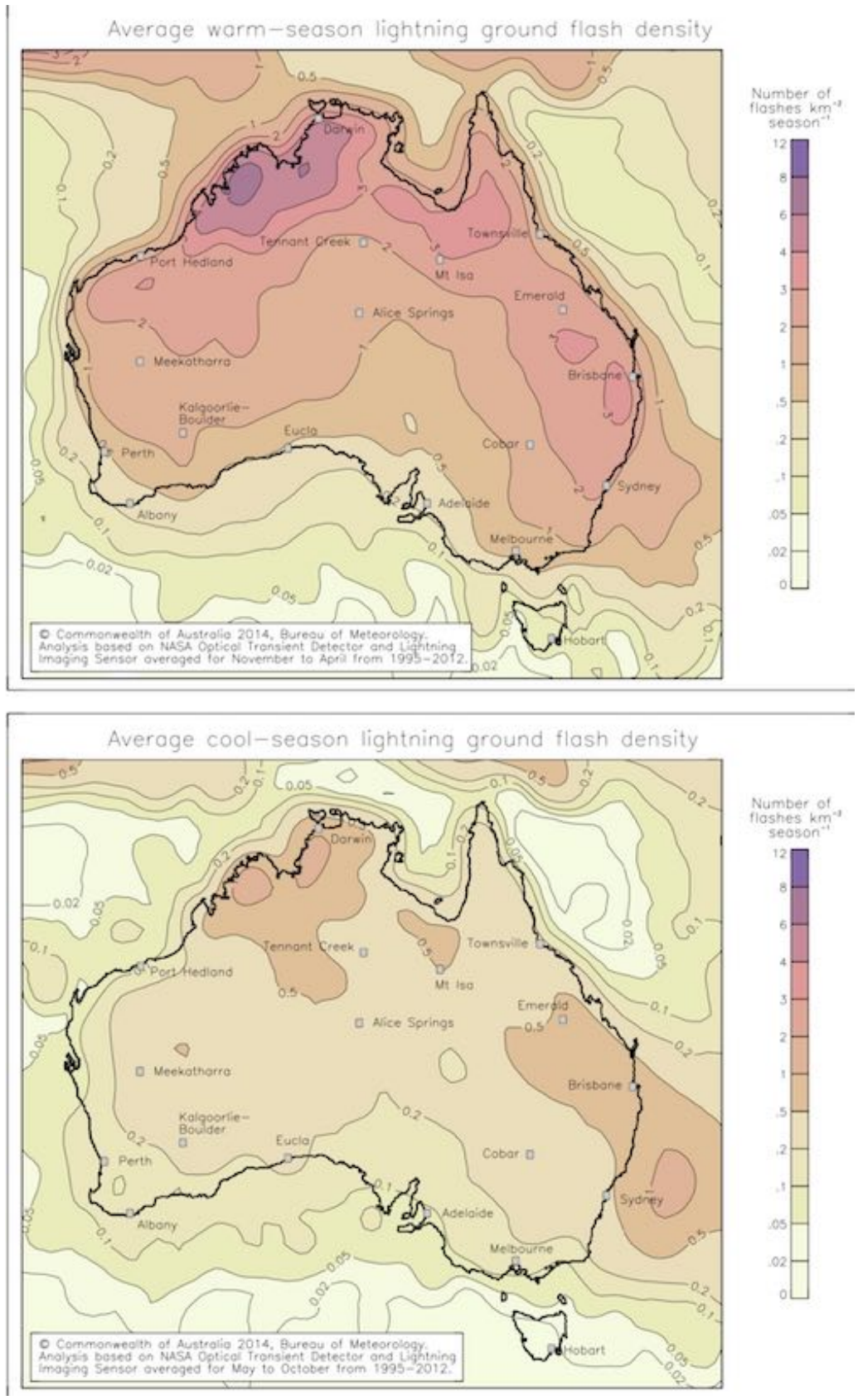
According to BOM research, thunderstorms are more common in late spring and early summer, with a peak in November.

The whole NSW Coast is an area of higher storm density.

For winter cruising, note that thunderstorms are almost as common. This coincides with the range of cold fronts.

For coastal NSW, the usual pattern is a build-up during the day with the thunderstorm travelling west to east

Lightning Ground Flash Densities for Nov to April (top map) and May to Oct (bottom map). 18 year period.



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and crossing the coast from mid-afternoon to late evening, with the peak time along the coast of 5 pm (BOM records for Brisbane). If you are further out to sea, the storm will occur later. You can see them forming up, starting with high cumulus clouds and gradually getting taller and darker at the bottom.

You may well be at an anchorage when it hits. The winds will be in the direction the storm has come from, which may be different to the prevailing winds before the storm. This may mean that the storm finds you on a lee shore, and secondly, your anchor has to reset under extreme load as the storm front hits.

In the subtropics, the most severe thunderstorms are caused by supercells. A supercell has a mesocyclone, a persistently rotating updraft that sustains it. They can last for several hours and travel several hundred kilometres. These storms can cause tornadoes over land and waterspouts over water.

The supercell storm shown to the right produced 9 cm hail, which damaged virtually every boat in the marina, including mine. It smashed two hatch windows.

Notice that it has not just one but three stacked shelf clouds. This indicates it is pulsing and is likely to be long-lived. The three stacks also indicate it has a massive updraft. This storm kept hail aloft until it merged into the 9cm hail.

The winds were up to 70 knots and reversed as the centre of the storm passed over. A

Supercell. 24 November 2025. Manly Boat Harbour QLD

Photo courtesy of Billy Morris. Used with permission.

neighbouring catamaran parted its lines and ended against the bow of Curlew Escape. Boats were torn off moorings from the Gold Coast to Bribie Island. The Insurance Council declared an insurance disaster. The estimate cost of the damage from this storm was $1.7 billion. The remarkable thing about this storm, which I saw pass over Coolangatta about 11am, a few hours before it got to Moreton Bay, is that it was a single, isolated storm about 5km across.

SEA FOG

Sea fog forms when warm, moist air is cooled by cold ocean water. Because the East Australian Current sends warm water down the NSW coast, it tends to occur more often along the southern coast away from the warming influence of the current and is more common in Winter and Spring.

It can be caused by coastal upwelling, where warm water is pushed away from the coast to be replaced by cold water. A tongue of cold water can establish along the coast extending in from the south.

It is rare. Unfortunately, BOM does not track prevalence because automated weather stations cannot report on it.

Keeping watch by radar or AIS and transmitting AIS location and heading data is a way to track other vessels and for them to see you. However, not all recreational vessels have AIS or radar. Fortunately, large ships will have both.

The last time we were in fog was 2024, when we were in a pea-souper coming out of Shoalwater Bay. There was a military exercise on and naval ships in the area. We kept outside the exclusion area, but we were close enough to a naval ship for them to sound their foghorn at regular intervals. It is very hard to tell the distance from a foghorn. Being military, they were watching us on radar and AIS, but not transmitting on AIS.

Fog also prevents you from seeing waves, markers, lights, and other vessels, increasing navigation risk.

AVERAGE WIND CONDITIONS

Regardless of whether you are sailing or motoring, no one wants to pound into the waves. Learning the seasonal wind patterns is key to a pleasant time on the water. The BOM has wind records going back to the 1950s, which we can use to look at long-term averages.

A wind rose is a diagram that, for a given location, shows the frequency of wind from each direction and its strength. It conveys decades' worth of data in a single image.

We show wind roses in each coastal chapter at 9 am and 3 pm.

HOW TO READ A WIND ROSE

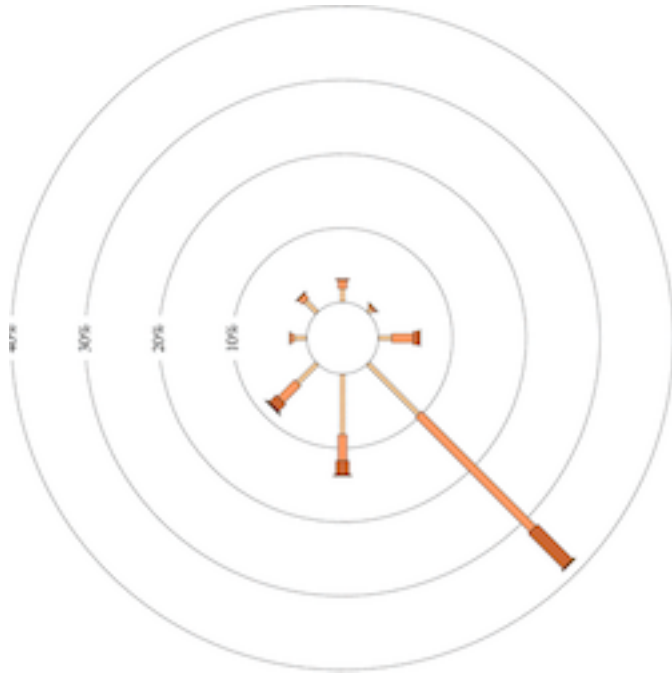
A wind rose shows what looks like an old-fashioned telescope. Each segment of the telescope represents a 10km/hr range of wind speed. The BOM wind roses are measured in km/hr, not knots. To convert from km/hr to knots, multiply by 1.8. The length of each segment is the percentage of time that speed blew. Finally, each direction of the compass has a telescope.

Wind speed is colour coded.

For the following wind rose, which is for Rockhampton in the dry season at 9 am, winds came from the SW, W, NW, N, NE and E less than 10% of the time.

They came from SE 40% of the time and S 15% of the time. Of the SE direction, about half the time it was 10 to 20 km/hr, and a quarter was 20 to 30 km/hr.

Example Wind Rose



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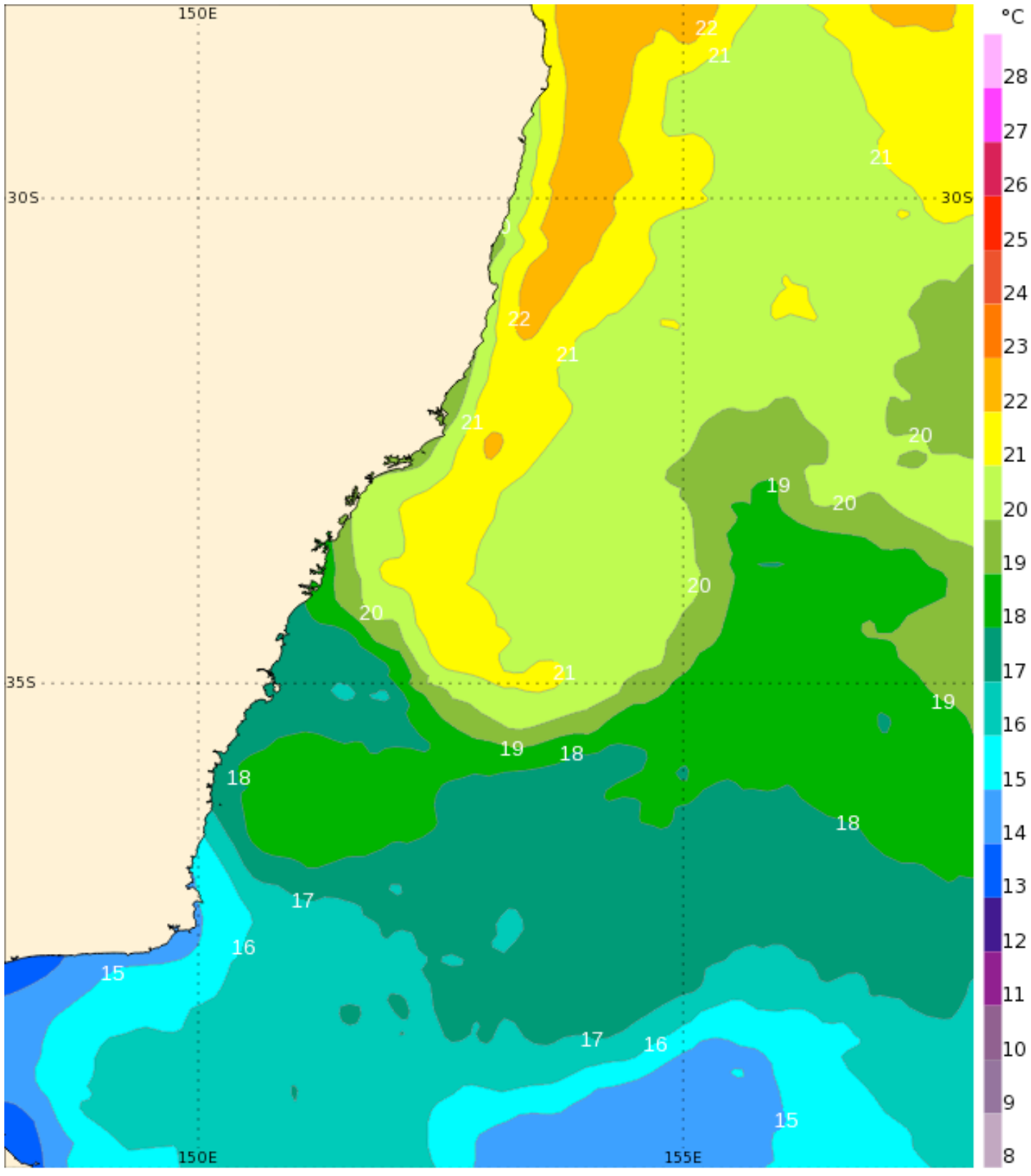
WINTER SEA SURFACE TEMPERATURE

The map below shows typical NSW sea surface winter temperatures.

The East Australian Current brings warm tropical water south from the tropics, raising the temperature along the coast. The warm water interacting with a blob of cold, high-pressure air also powers East Coast Lows.

Sea Surface Temperatures, 11 July 2025



Sea surface temperature (deg C): Daily analysis for **Fri 11 Jul 2025**
(c) Copyright Australian Bureau of Meteorology | **RAMSSA**

WAVES

As forecasted and reported, waves have two components: swell and sea waves (also called seas or wind waves). Wind waves are generated by local wind. Their height and direction depend on the strength of the wind, how long it has been blowing, and the distance over water the waves have been allowed to build up, known as fetch. Swell waves are regular, longer-period waves generated by distant winds. The stronger the distant wind, and the longer it blows, the higher the swell caused. They can propagate for thousands of kilometres. Winter storms and summer cyclones can generate a large swell.

The combination of the two is known as the sea state. When you look at a forecast that shows swell and wind waves separately, you will notice the total wave height is not simply the sum of the two added together. It is given by the following formula:

$$\text{Total Height} = \text{sqrt}(\text{Wind Wave Height}^2 + \text{Swell Wave Height}^2 + [\text{Secondary Swell Height}^2])$$

The physics of waves (though rogue waves are an area of active research) is well understood. See Fredric Raichlen, Waves, The MIT Press, 2012.

SIGNIFICANT WAVE HEIGHT

Wave forecasts are not given as the simple average. Instead, forecasts show the significant wave height (H_{sig}), defined as the average of the highest one-third of wind waves.

BOM calculates this for each 26.5-minute wave sampling period. Statistically, 86% of waves will be lower than the significant wave height and 14% above it. It is also statistically expected that there will be three waves every 24 hours that are double the significant wave height.

FETCH

Fetch is the uninterrupted distance over the sea that the wind can blow. The reason rivers and bays have lower waves is that wave generation is limited by fetch.

If you are doing coastal sailing, westerly winds have a small fetch, and their height will be limited by fetch.

If the winds are from any other direction, they have a fetch of thousands of km. A large swell can travel at 60-70 km/hr, so, for example, swell from distant storms in the Tasman will take around a day to reach the NSW coast.

BREAKING WAVE DEPTH

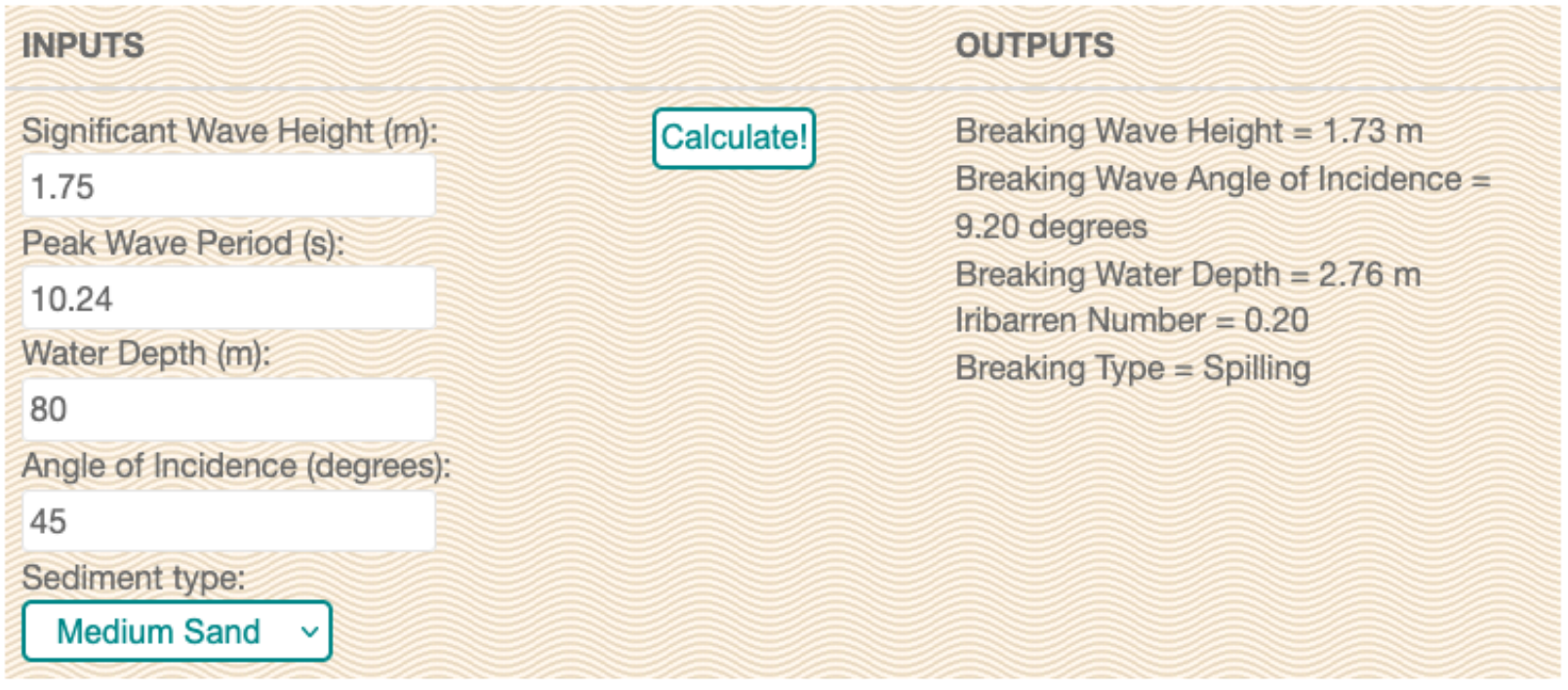
In deep water, meaning where the depth of the water is greater than half the wavelength, bottom effects are negligible, and the length of a wave is directly related to its period. The NSW wave buoys are in deepish water, usually around 80m.

When waves encounter water depth that is less than 5% of their wavelength, they are shallow-water waves, and depth alone determines wavelength and speed.

As they feel the bottom, they start to slow down. Shallow water waves get higher as it gets shallower, due to the conservation of energy. They become steeper and start breaking when the ratio of wave height to wavelength is > 1/7, when the wave's crest peak is steep (less than 120˚), or when the wave height is three-fourths of the water depth (H => 3/4 D). Higher waves, which have more energy, break in deeper water than smaller waves.

If we know the significant wave height, the depth of the Waverider buoy, and the approach angle of the waves, the breaking wave depth can be calculated. The Swellbeat Surf Wave Calculator takes care of the details.

Take an example from 30 December 2025 for Wooli, south of Yamba. These are close to average conditions for the NSW coast.



This tells us that the significant waves should not break until the depth gets lower than 2.76m. The minimum entrance depth at the Clarence River Bar at Yamba on the leads at 10/11/25 was 4.7m. So we should not see breaking waves there. We would expect waves over 3.1m to break there. Statistically, there will be several of these per day.

If the bar depth is less than 2.76m, we will have fairly constant breaking waves.

EFFECT OF CURRENT

Current against waves will also shorten their wavelength and steepen them, causing them to break more easily. If the current is following the wave, it has the opposite effect. The stronger the current, the more the effect.

In NSW, this effect is relevant to:

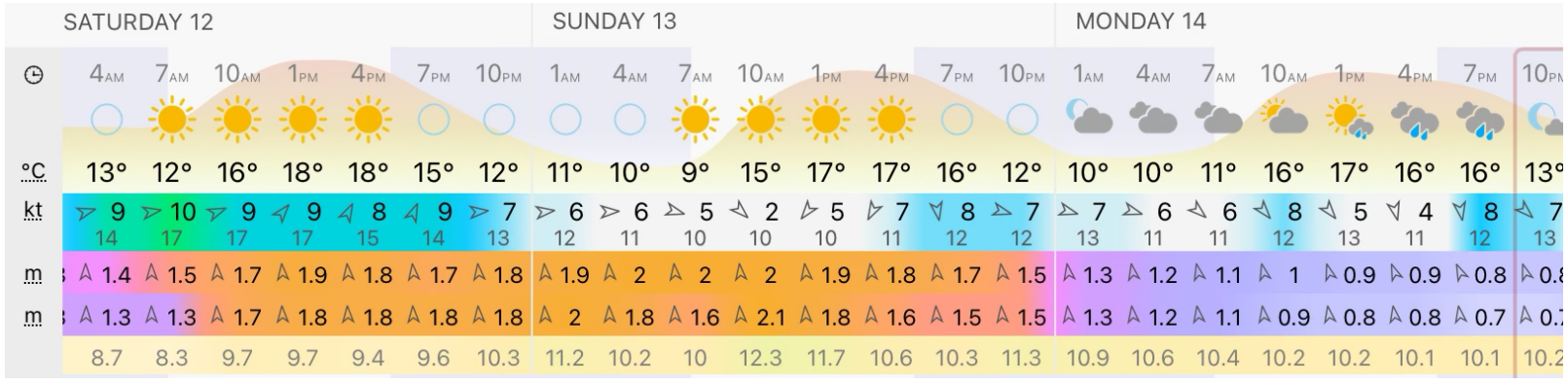
- The East Australian Current. If you have a strong southerly and a 2 knot opposing EAC, you can find less steep waves with less breaking if you move inshore out of the current (though do check the EAC forecast as it moves around).

- River flows and tidal flows across bars. It is for this reason that you avoid crossing bars with an outgoing tidal current. We either want still water (no effect) or the last of the incoming tidal flow (dampening effect).

WAVE FORECASTS

BOM produces a graphical wave forecast from their Auswave digital model for northeast Australia. It is used in their weather forecasts. The Windy app also uses it.

Windy Wave Forecast for Port Macquarie Ocean Side

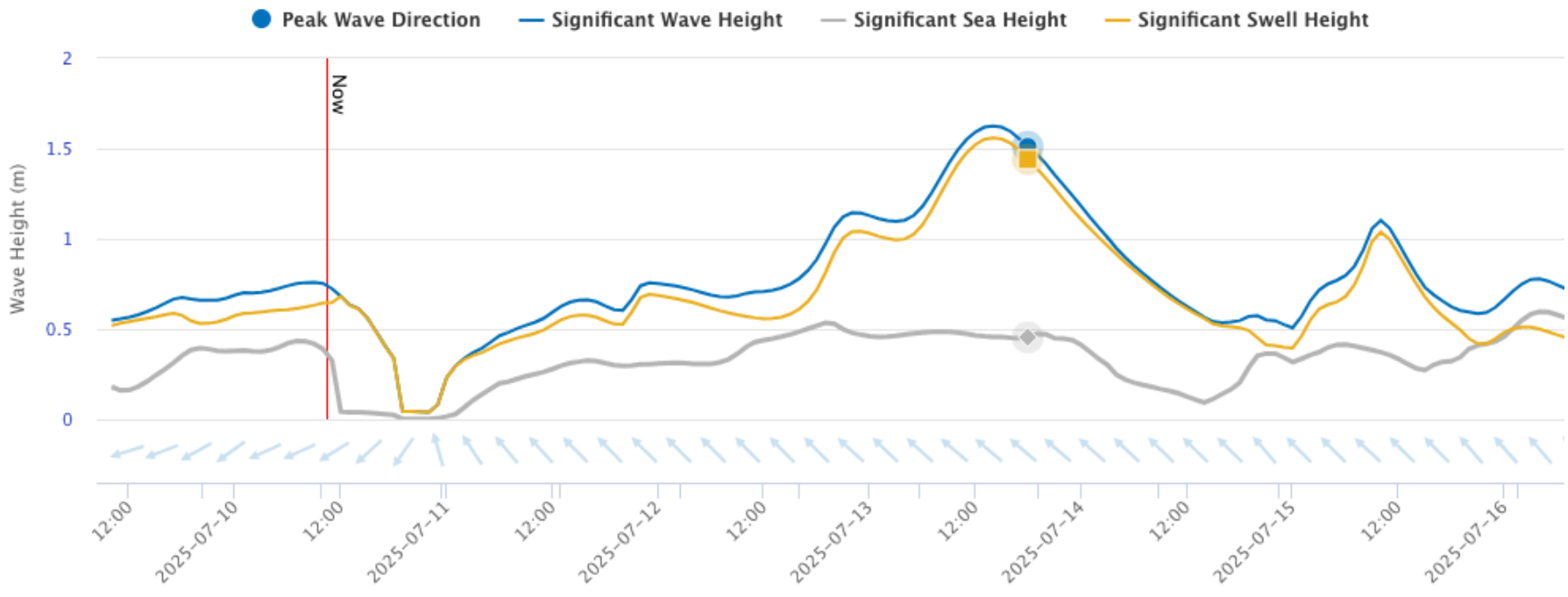


Source windy.com

NSW also has the NSW Nearshore Wave Tool. You select a point on the map at either the 10m or 30m contour, and it gives you a 7-day wave forecast.

You can compare it to the Windy forecast for the same location and time period.

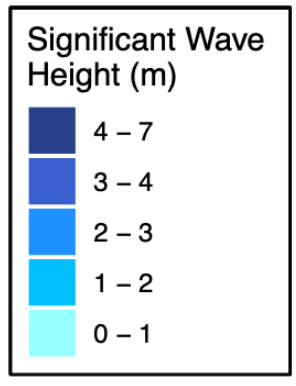
NSW Nearshore Tool Wave forecast for Port Macquarie 10m Contour



AVERAGE WAVE CONDITIONS

In NSW, there are 3 networks of wave riding buoys that generate real-time data: Manly Hydraulics Laboratory, UNSW and Port Authority of NSW. We provide links to these for each coast. For MHL, we show wave roses by season and significant wave height by month.

WAVE ROSES



A wave rose is a diagram that, for a given location, shows the frequency of waves from each direction and their $H_{sig,}$ or significant wave height. Like wind roses, they convey decades' worth of data in a single image.

An example wave rose for the winter season at Crowdy Head is shown to the right. For each of the 16 wind directions, there is a bar chart. Each bar is broken into coloured segments, with the colour indicating the wave height and the length of the segment the percentage of time the waves were in that height band.

Take SSE as an example. In winter, the waves come from this direction 33% of the time. 18% of the time they were SSE and 1 - 2m.

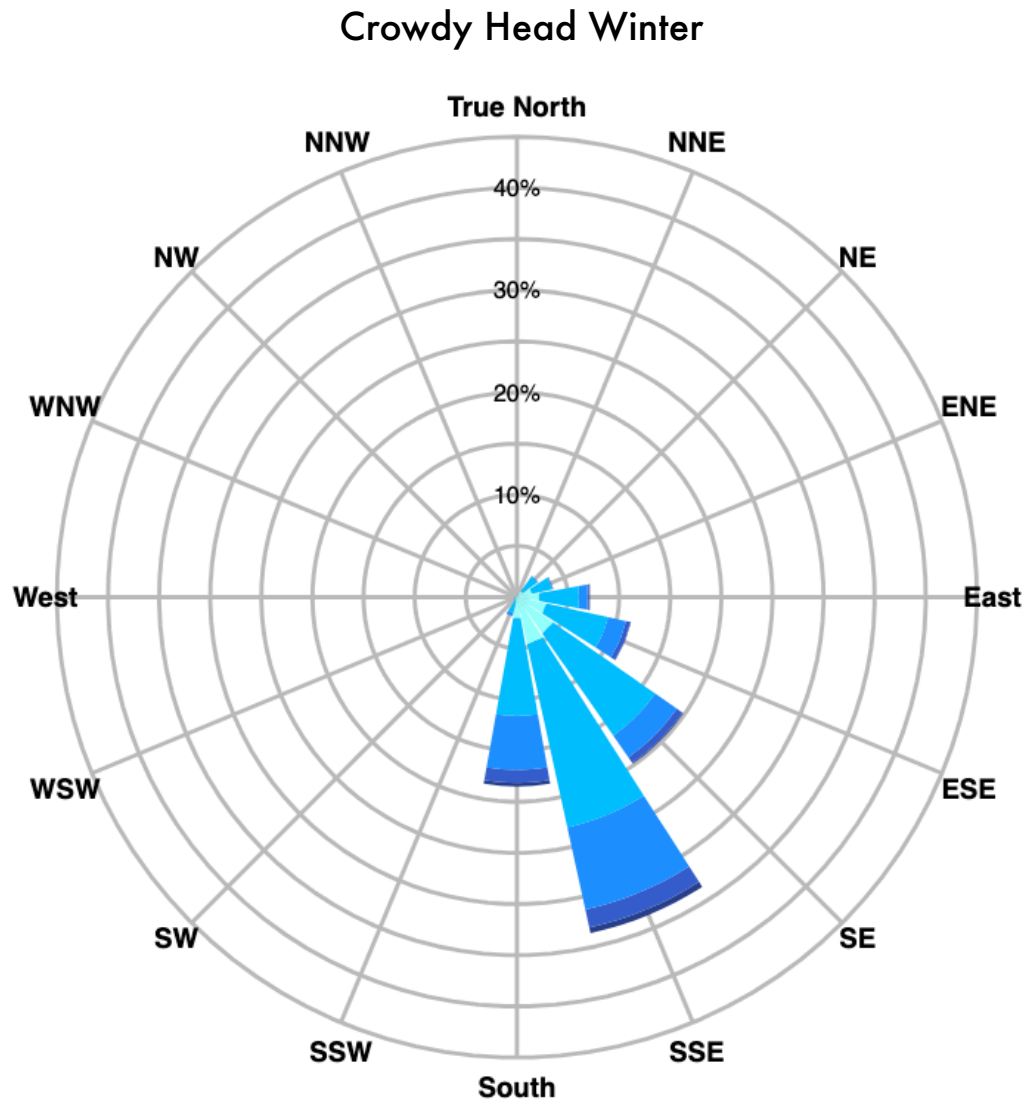
With a glance, you can see that the waves are almost always southerly.

SIGNIFICANT WAVE HEIGHT BY MONTH

While the wave roses show decades of data averaged together, another way to look at things is significant wave height by month.

We also include on each coast with MHL data a chart showing the Significant Wave Height by Month. The example below is for Crowdy Head.

This shows the minimum, average and maximum significant wave height by month. In NSW, there is little variation in these statistics. Also, every month can have large waves.



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Significant Wave Height by Month in metres

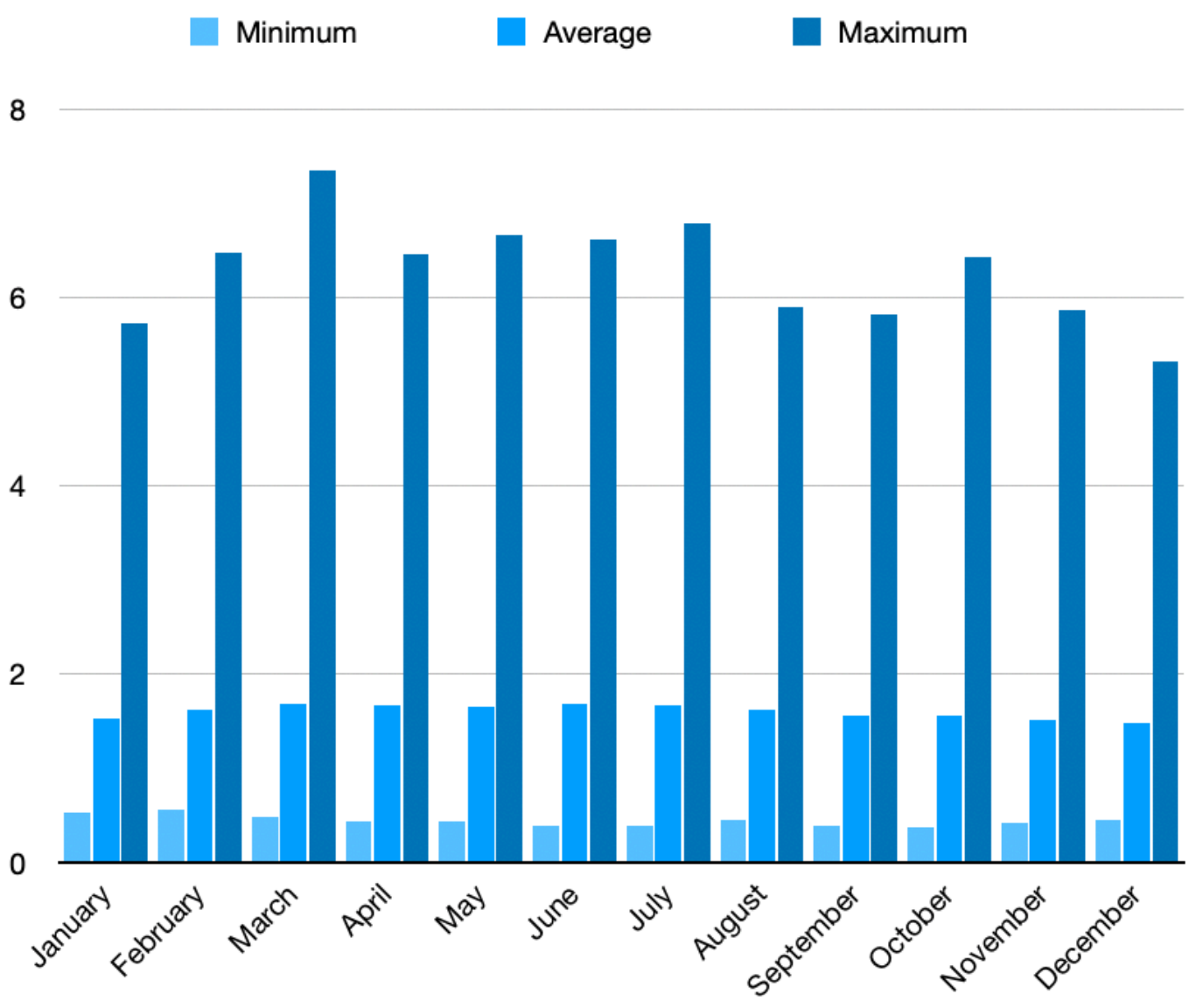


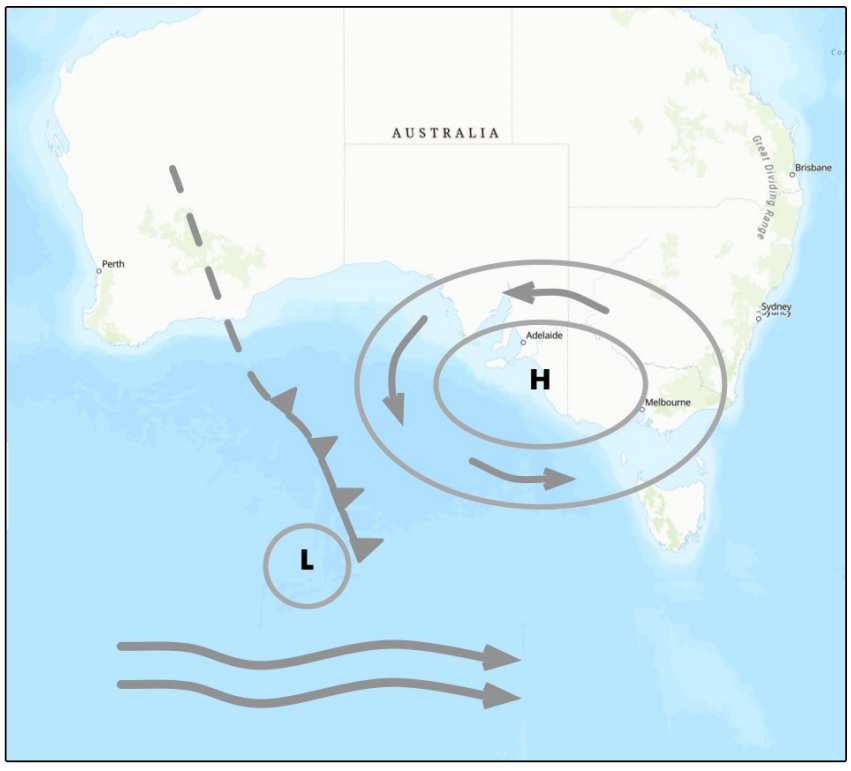
Chart by the author. Data © 2025 Manly Hydraulics Laboratory, DCCEW. Used with permission.

OPTIMISING WEATHER FOR CRUISING

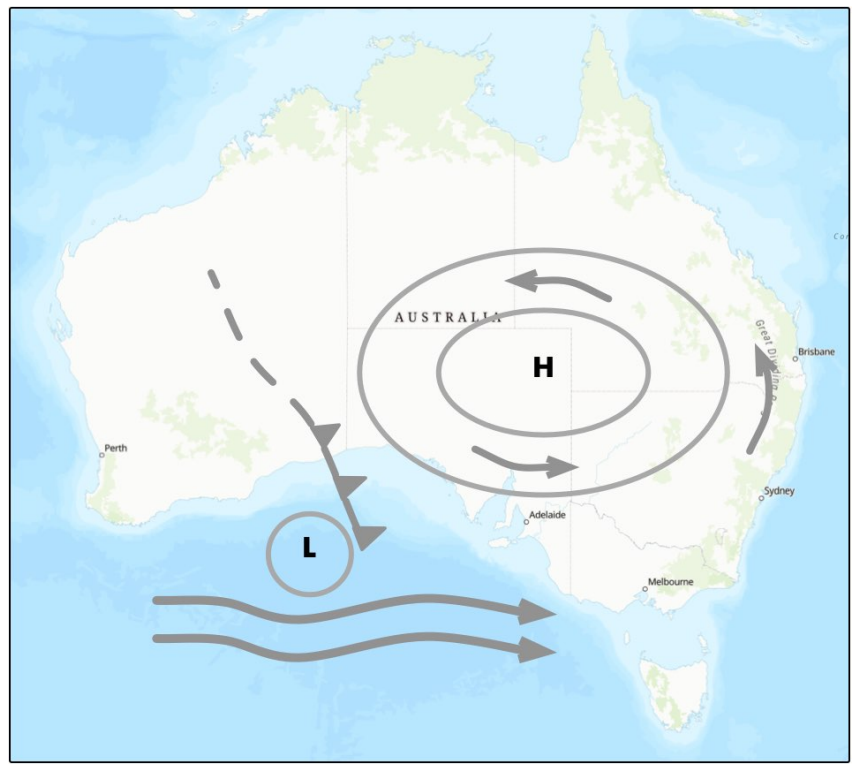
THE AUSTRALIAN SUBTROPICAL RIDGE

The average wind direction in NSW is influenced by the Australian Subtropical Ridge. This is a series of high-pressure systems that move from west to east. In the summer pattern (November to April), the ridge moves south. Its average latitude is 36-38° S. In the winter pattern (May to October), it moves north with an average latitude of 28 - 30° S. This is illustrated below.

Summer Pattern

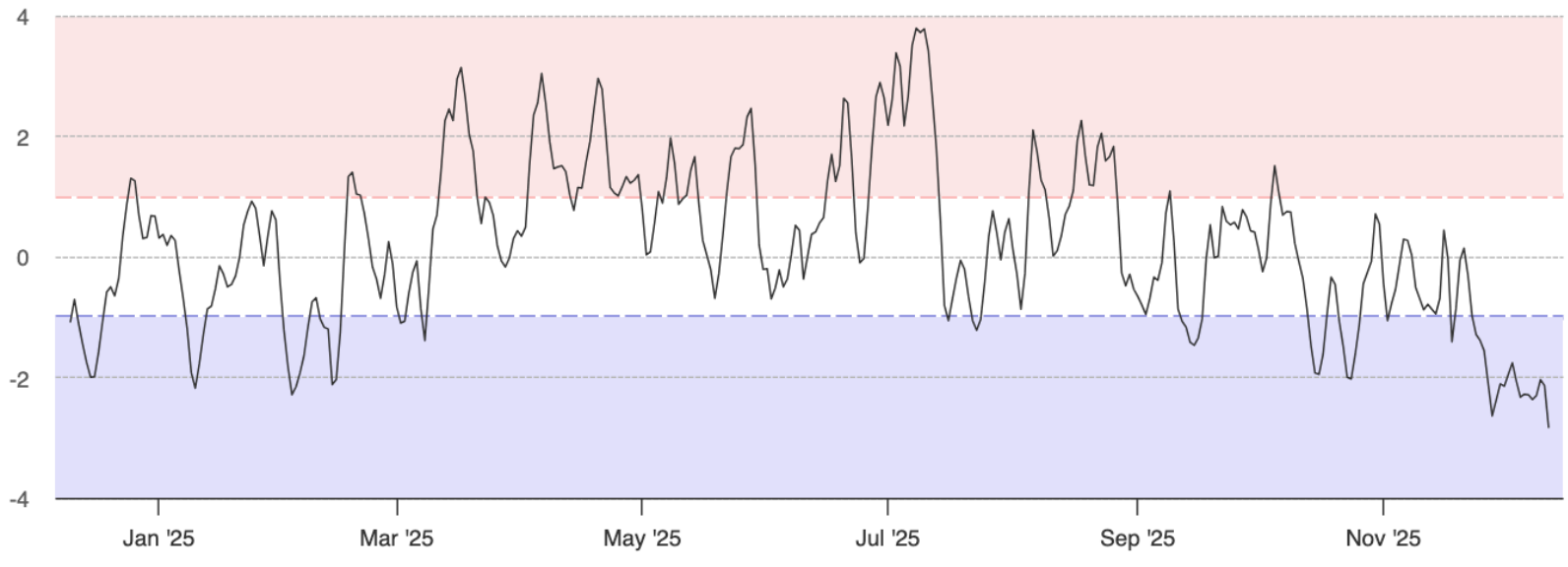


Winter Pattern



SOUTHERN ANNULAR MODE

The position of the ridge is further tweaked by the Southern Annular Mode ("SAM").



A positive SAM is when the westerly winds move further south than normal for the time of year. A negative SAM is when the westerlies move further north than normal for the time of year.

BOM routinely forecasts the SAM.

EFFECT ON WINDS

Winds around highs circulate in an anti-clockwise direction in the southern hemisphere.

WINTER

In winter, the ridge and hence the series of high-pressure systems is further north, sitting over southern Queensland to central NSW. In NSW, the winds will be variable with more westerlies and southerlies. The average pressure of the highs is higher in winter, making the winds, on average, stronger. The afternoon sea breeze effect, powered by the heating of the land, is reduced, lessening the afternoon onshore breeze. Offshore winds are more common.

SUMMER

In summer, the ridge and hence the series of high-pressure systems are generally over southern NSW/Victoria. As a high approaches the coast, the winds over much of NSW will be southeasterly and then as it passes over, they will become northerly. As the land is hotter in summer, the afternoon sea breeze is stronger. Onshore winds are more common.