

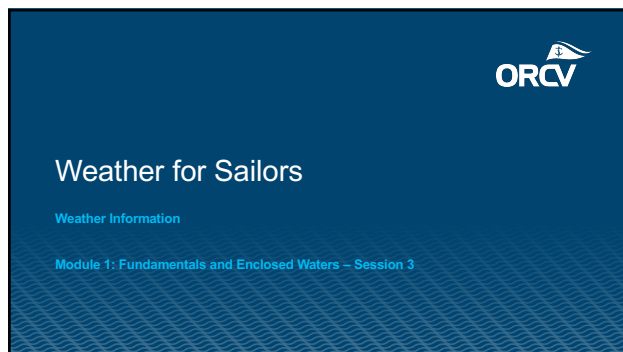


OCEAN RACING CLUB OF VICTORIA

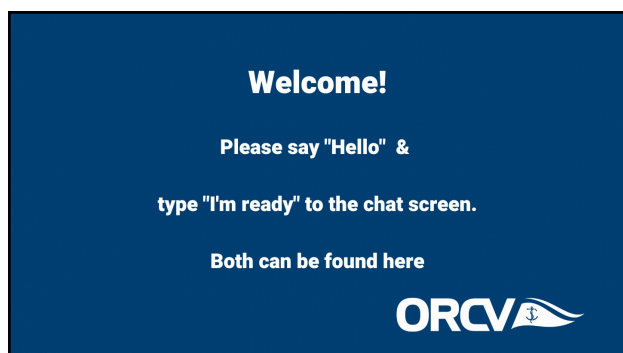
WEATHER FOR SAILORS

MODULE 1 - THE FUNDAMENTALS (COURSE NOTES)
SESSION 3

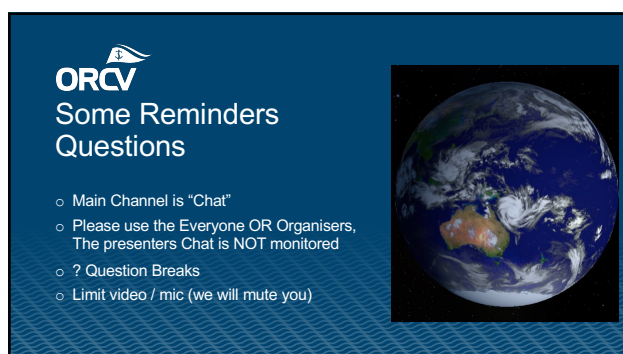




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3

Your Trainers Tonight




Robin Hewitt




Simon Dryden

4


Tonight's Moderators



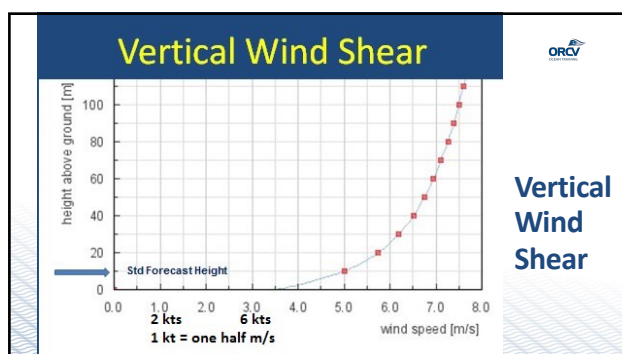
Jill Blunsom



Delma Dunoon



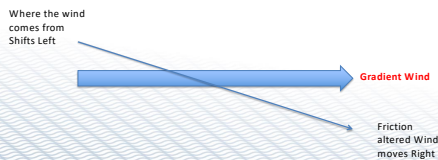
5



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Frames of Reference

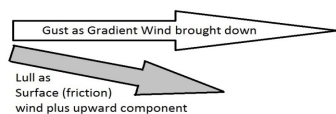
Consider effects as to where the altered wind is blowing towards. In the diagram below the modified W wind becomes a WNW. The effect of slowing a wind causes it to shift to right looking ahead (SH). Be sure to watch for the frame of reference in texts.



7

Gusts and Lulls

- Surface wind over land maybe 1/3 to 1/2 of that aloft, 2/3 of that over sea
- Coriolis turns slowed wind clockwise or 'veers' in southern hemisphere



8

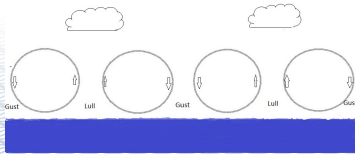
Gusts and Lulls - Stability

- Stability (and Instability) – vertical motion in atmosphere
- Stable air is often cool, dense
- Unstable air often warm, rising. Contact with a warm surface promotes mixing and instability
- Often stable in early morning until solar heating causes air parcels to rise and cause turbulence
- Observing the situation as stable or unstable assists in determining sailing conditions
- Cloud Formation and Type are Indicators

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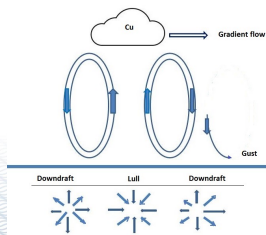
Gusts and Lulls

Patterns of cumulus cloud appear as turbulence increases
Rising air also has a downdraft of cooler air to replace it.
Downdraft brings down gradient wind as a gust
Rising air with surface friction leaves a lull



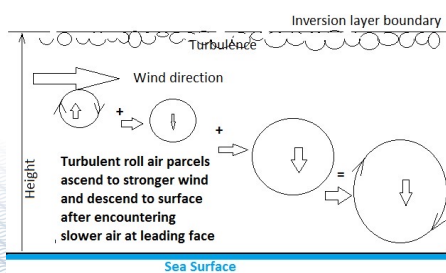
10

Gusts and Lulls – Single Cloud

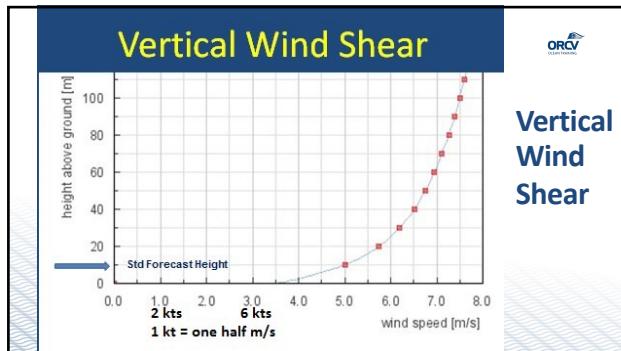


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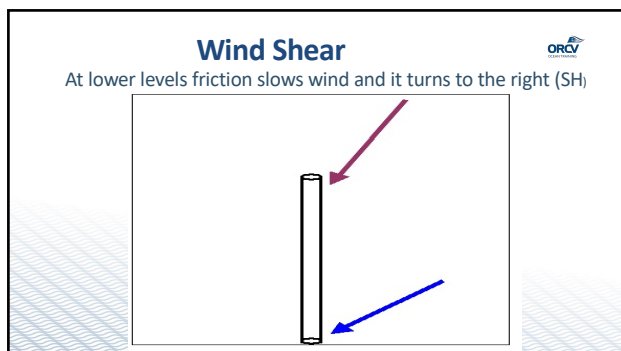
Turbulence Gusts



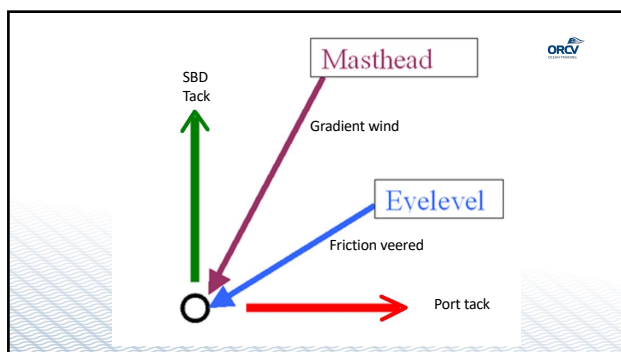
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Questions ?

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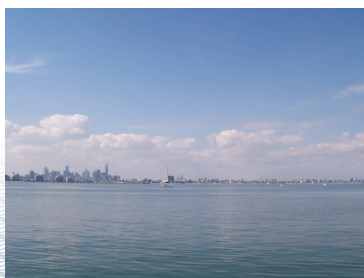
Seabreezes – Local and Ocean

- Land heats and cools rapidly, unlike water
- During day, sun heats land, warm air rises (cloud forms)
- Rising air replaced by air from sea – onshore breeze
- Clouds over land are telltale signs



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Local Seabreeze

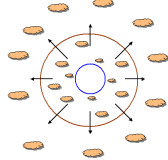


- Often observed autumn and early winter on Port Phillip Bay
- Occurs in light conditions – no gradient wind – and low solar levels
- Small temperature differences, air rises around shore

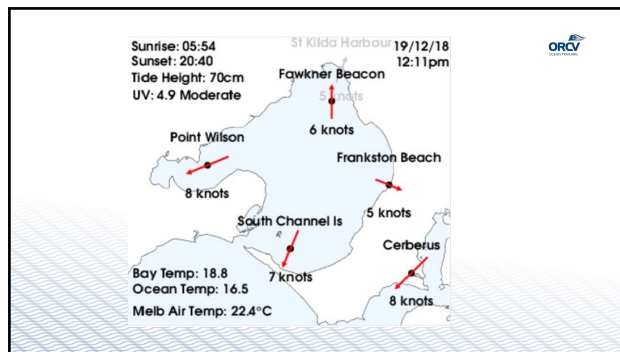
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Local Seabreeze

- Breeze commences at right angles to shore, with sink towards northern Port Phillip Bay
- Forms by about 1030-11am, less than 10 knots
- By 330-4pm, solar levels insufficient and dissipates



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Lake Breezes

- Very Dependant on Surrounding Topography
- Wind shadows and lee effects, fetch
- Strong cool air subsidence overnight and early morning minimizes winds before mid-day unless Gradient Wind is strong.
- Lake breeze similar to local bay sea breeze
- Consider obstructions, valleys and funnelling.
- Local knowledge important.

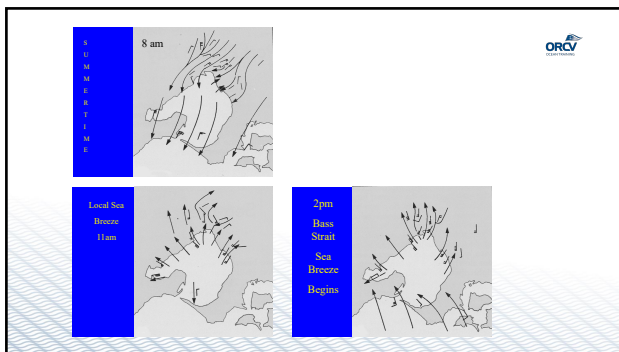
21

Ocean Seabreeze

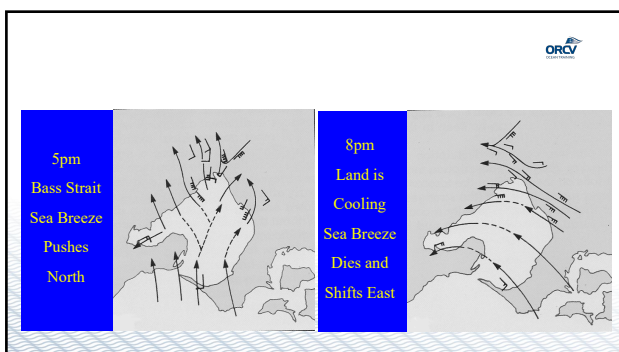


Common in summer, up to ~23 kt S-SE, starts to fade after 5 pm, shifts east as land continues to cool

22

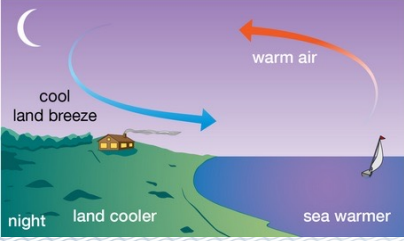


23



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Land Breeze



- Similar process to sea-breeze but in reverse
- Land loses heat into night sky unless cloud cover 'blanket'
- By ~ 1am, land has cooled, sea is warmer, enough for air to rise and offshore land breeze can occur

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Land Breeze



- Starts close to shore (~1nm) and gradually moves outwards. Fades by ~9am
- Cold air – vegetation/smoke smell, sound travels well –old saying "go in until you hear the dogs barking". Just check the depth charts

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Katabatic (Downslope) Winds



- Wind from cold dense air that runs downhill
- The home of katabatic winds – Antarctica – extreme example

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Katabatic Winds

- Yarra River valley, Derwent River/Channel valleys are local inshore examples
- Light gradient winds, at night, cloudless, hilly/mountainous
- Air is colder and denser at height and 'slides' downhill
- Starts about 1 am close to
- Shore, finish by 9am
- eg Yarra Valley
- Inland lakes in hilly/-
- Or mountain areas



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Questions ?

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Katabatic – Bridgewater Jerry, Tasmania



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Congratulations

If you observed

- Stratus cloud
- Alto Stratus cloud
- Strato Cumulus cloud
- Cumulus cloud

An atmospheric inversion

Laminar Flow

Wave Form

Orographic lifting



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Katabatic – Bridgewater Jerry, Tasmania

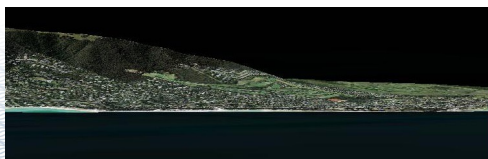
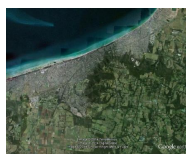


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Obstructions

Arthurs Seat-Dromana

SE Port Phillip Coast 305m



33

Obstructions

Laminar flow = light winds <10kts, ideally <6kts requires relatively smooth surfaces, cool conditions.

Breaks down with steep slopes & instability

Rotor can form or calm area with instability and reverse breeze or wind skip with laminar flow..

Breeze seeks least resistance

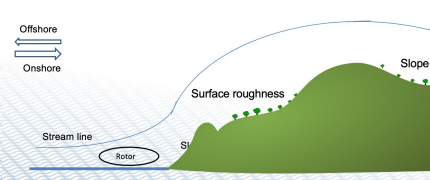
Offshore
Onshore

Stream line

Rotor

Surface roughness

Slope



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Obstructions

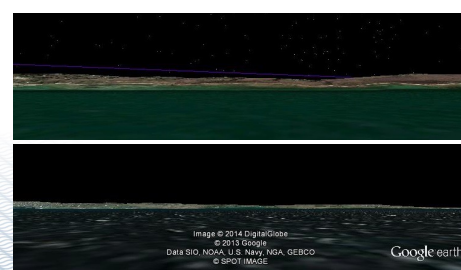


Image © 2014 DigitalGlobe
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© SPOT/IMAGE

Google earth

Imagery Date: 8/16/2013

Eye at: 3 m

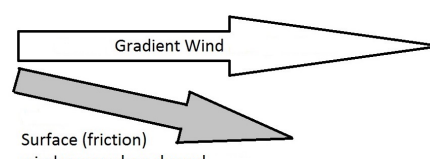
35

Wind Convergence / Divergence

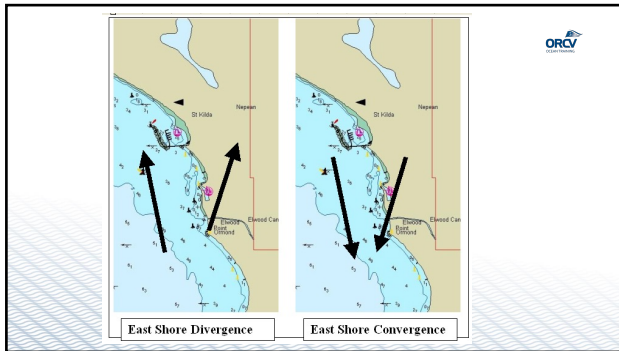
When wind is slowed, it veers (goes clockwise) in southern hemisphere

Gradient Wind

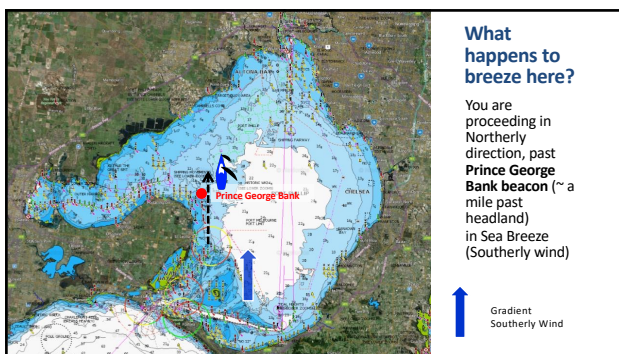
Surface (friction)
wind veers when slowed



36



37




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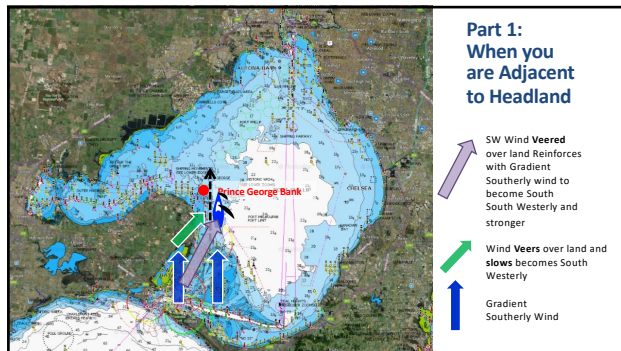
Poll – Exercise 4

You are proceeding in Northerly direction, past **Prince George Bank** in Sea Breeze (Southerly wind)

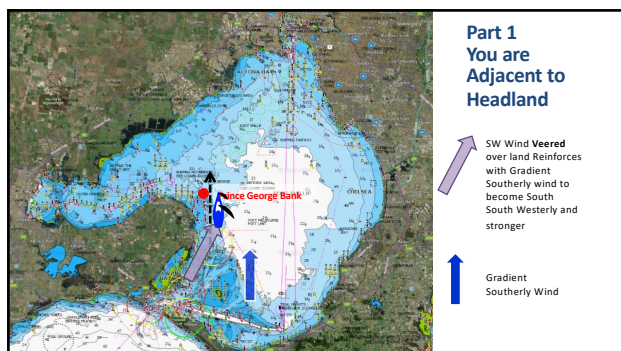
What happens to breeze at **Prince George Bank beacon**?



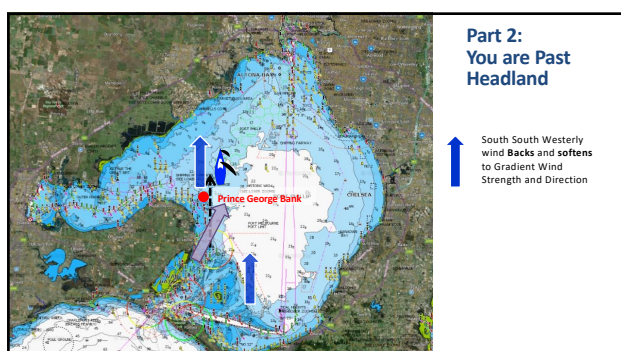
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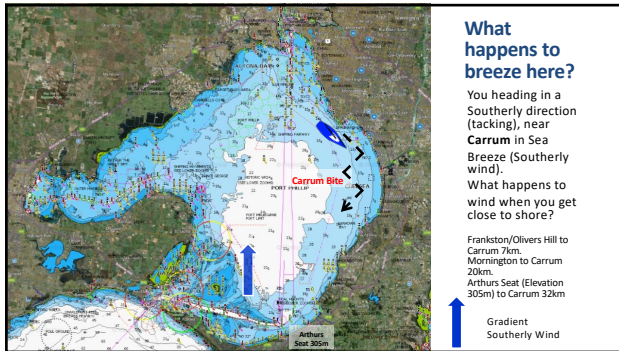
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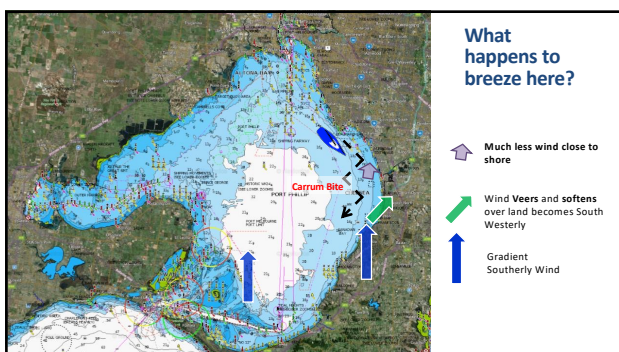
Poll – Exercise 5

You heading in a Southerly direction (tacking), near Carrum in Sea Breeze (Southerly wind).

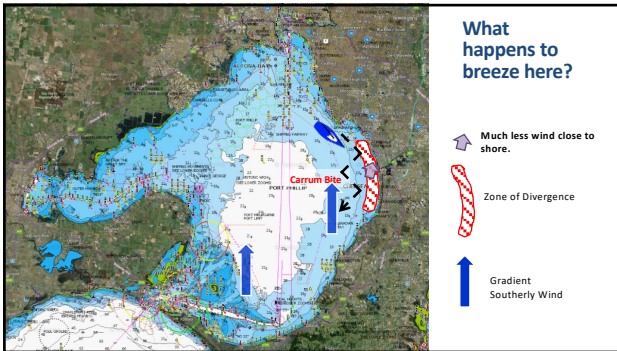
What happens when you get close to shore at Carrum Bite?



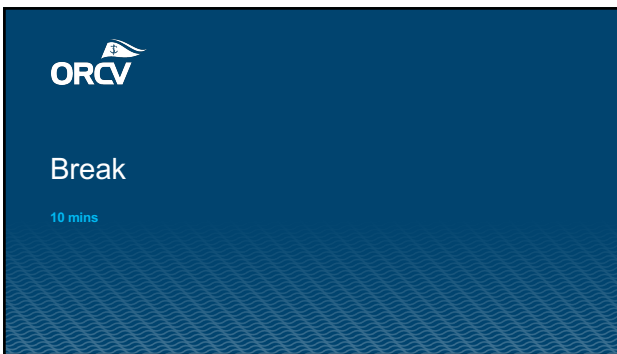
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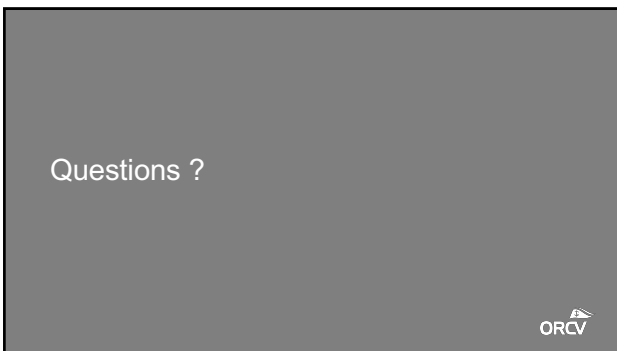
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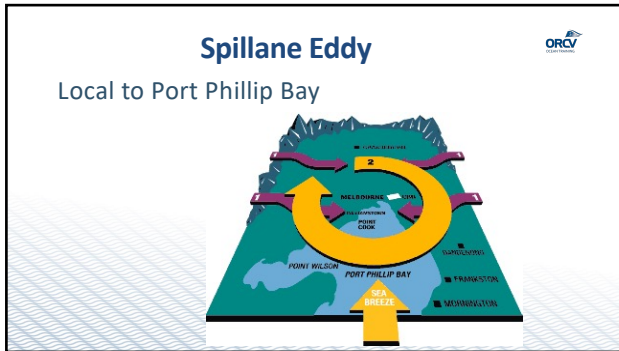
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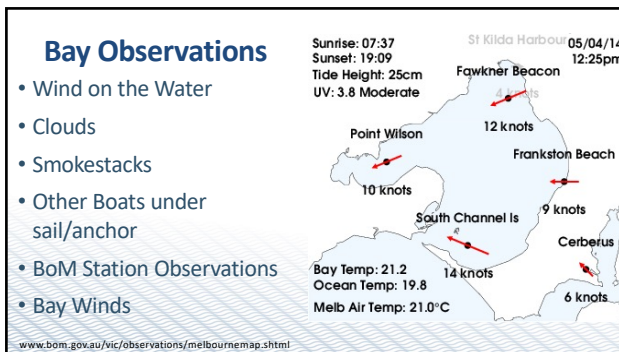
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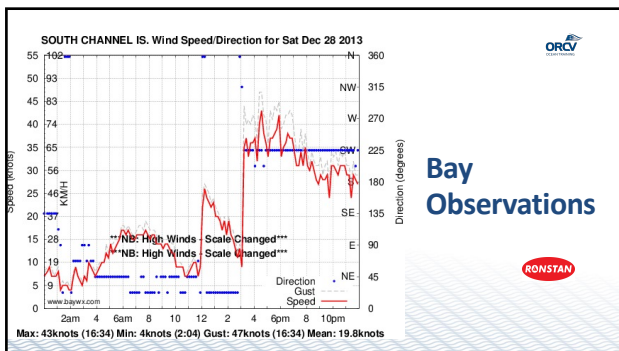
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Bay Tides and Currents



- What are Tides?

Main forces that cause tides

- Gravitational pull of moon & sun
- Earth's rotation

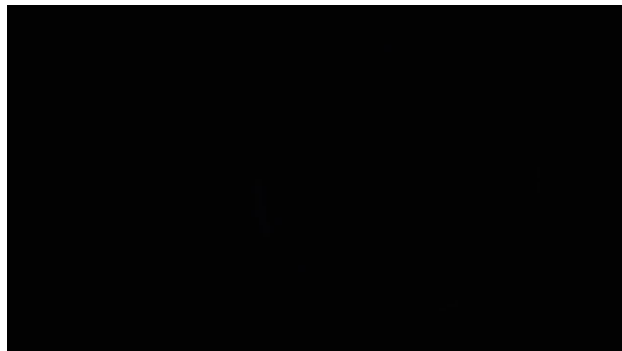
What are Currents?

Depth can influence speed of Current

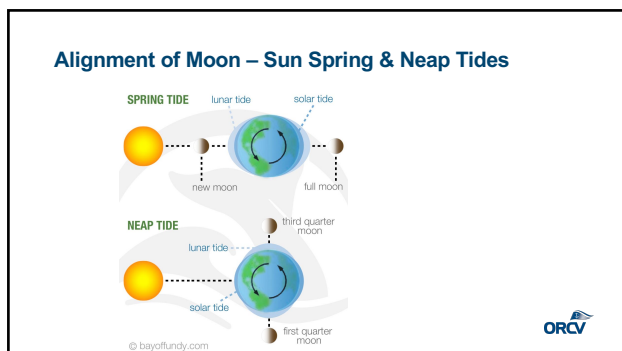
Waves form on ocean at varying heights

- Current, depth & coastline shape determine power of waves

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Bay Tides and Currents

- Tide tables and graphs show the variations in tide, often with a lag time
- Semidiurnal - 2 High & 2 Low per day
- Diurnal - 1 High & 1 Low per day
- The bigger the range the stronger the currents

MELBOURNE (WILLIAMSTOWN)
LAT 37° 52' LONG 144° 56' TIME ZONE +1000
TIMES AND HEIGHTS OF HIGH AND LOW WATERS

MARCH – 2014

Time	m	Time	m	Time	m	Time	m
1	0217 0.79	9	0220 0.36	17	0325 0.78	25	0328 0.43
2	0813 0.81	10	0823 0.89	18	0945 0.35	26	0953 0.88
3	1408 0.88	11	1411 0.85	19	1545 0.77	27	1603 0.30
4	2054 0.22	12	2111 0.85	20	2213 0.32	28	2303 0.84
5	0218 0.81	13	0257 0.39	21	0405 0.89	29	0412 0.44
6	0818 0.34	14	0849 0.86	22	0930 0.28	30	0954 0.86
7	1325 0.83	15	1326 0.31	23	1525 0.81	31	1549 0.21
8	1924 0.23	16	1958 0.82	24	2254 0.33		2217 0.82
9	0404 0.84	17	0435 0.42	25	0425 0.82		0409 0.84
10	1036 0.27	18	1039 0.82	26	1107 0.24		1054 0.84
11	1625 0.86	19	1605 0.32	27	1715 0.24		1746 0.81
12	2204 0.25	20	2247 0.79	28	2331 0.34		2316 0.81
13	0447 0.87	21	0447 0.76	29	0500 0.85		0514 0.43
14	1035 0.25	22	1044 0.40	30	1108 0.35		1108 0.81
15	1625 0.86	23	1623 0.78	31	1750 0.88		1750 0.37
16	2204 0.27	24	2247 0.77				
17	0404 0.84	25	0435 0.42				
18	1036 0.27	26	1039 0.82				
19	1625 0.86	27	1605 0.32				
20	2204 0.25	28	2247 0.79				
21	0447 0.87	29	0447 0.76				
22	1035 0.25	30	1044 0.40				
23	1625 0.86	31	1623 0.78				
24	2204 0.27						
25	0404 0.84						
26	1036 0.27						
27	1625 0.86						
28	2204 0.25						
29	0447 0.87						
30	1035 0.25						
31	1625 0.86						

© Commonwealth of Australia 2013 – Bureau of Meteorology
National Tide Centre
Add one hour to the times when Daylight Saving Time is in force

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Bay Tides and Currents



- Why is Tide Direction and Speed important?
- How can we tell on a Yacht what the tide direction and strength is?

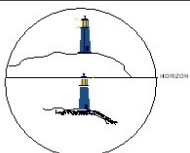
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Check for Tide!

Check drift with a transit

GPS against speed and course

Drift of floating object in
Or angle of vessel wake



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Estuaries and Bays



- In the Southern Hemisphere mid-latitudes-
- Coriolis at work, but watch for land effects.
- Face the direction of tidal flow
- Stream will tend to be on your left
- Bends in narrow channels will favour currents to outside radius of bends, shallows increase flow rates.
- Tide turns first at shallows or edges.

60

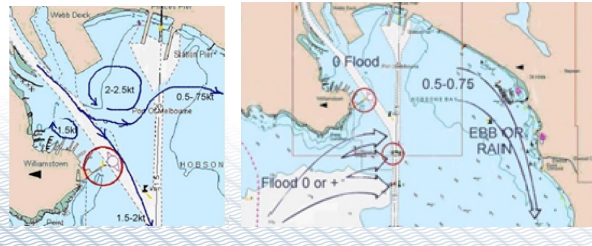
Bay Tides - Northern Port Phillip Bay



- Strong wind influence – northerlies/southerlies – water ‘heaped up’
- Yarra outflow influence – heavy rain
- Rivers generally

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Bay Tides – Northern Port Phillip Bay



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Bay Tides -- Port Phillip Bay



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Bay Tides – Southern Port Phillip Bay



- Tides at Port Phillip Heads
- Difference between tidal heights and tidal streams (momentum)
- Slack water is not at change of tidal height at the Heads, rather ~3 hours after change - corresponds roughly to Low/High water in north of Bay (Williamstown)

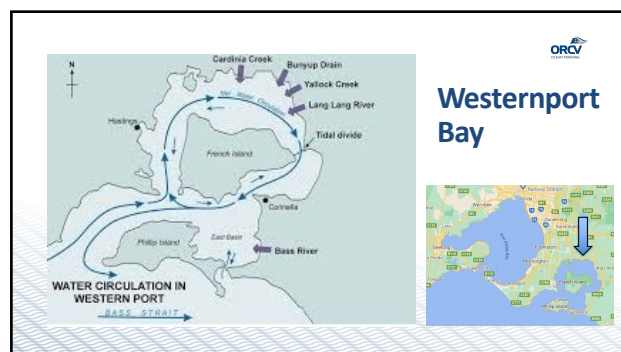
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Bay Tides– Southern Port Phillip Bay

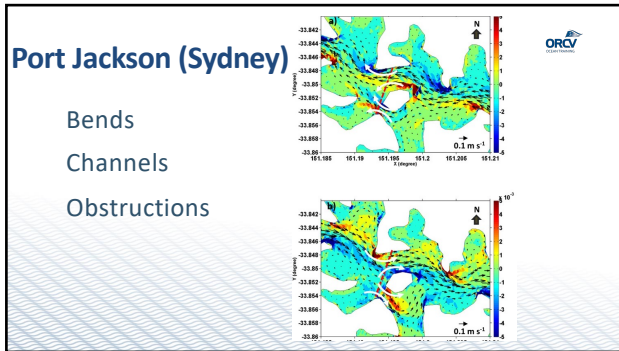


- South Channel, West Channel
- 2 knots flood or ebb maximum
- Varies as tidal range and rule of twelfths
- Dissipates quickly at Hovell to North
- Dissipates very quickly at West Channel Pile
- To Geelong-1.5kts max @ Pt Henry

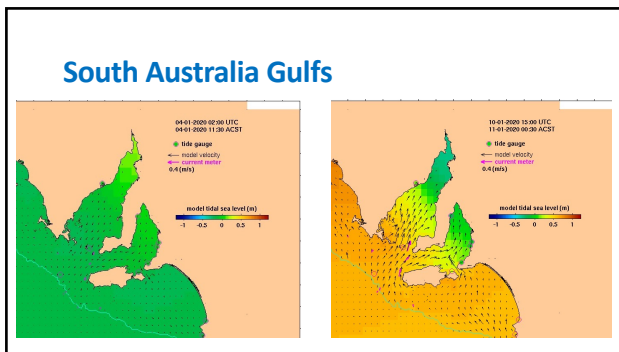
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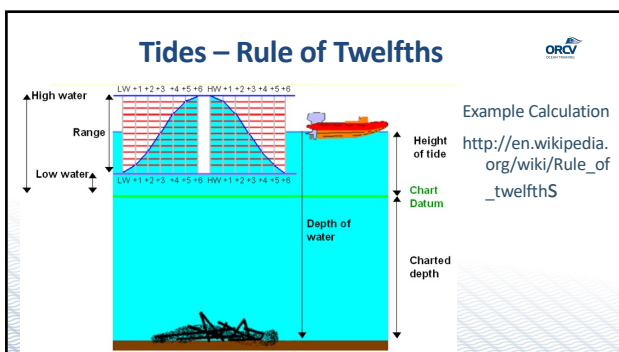
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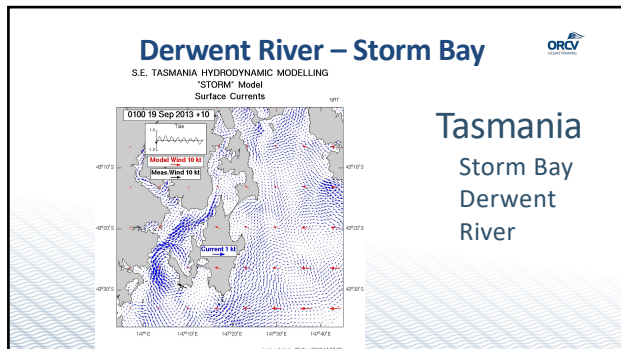
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Technology to Consider

- BoM www.bom.gov.au
- PredictWind www.predictwind.com
- Windy www.windy.com
- Tidetech www.tidetech.org
- BayWind www.baywind.com.au
- WeatherZone www.weatherzone.com.au

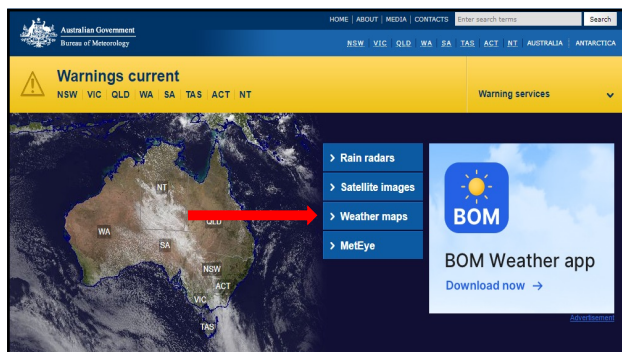
What you get from the internet vs. what you don't

71

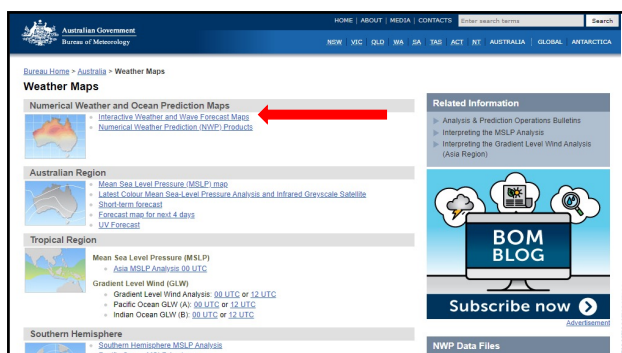
Weather for Sailors
Module 1: Fundamentals and Enclosed Waters

- Fundamentals of weather terminology - Definitions
- The Barometer, Air Pressure
- Calibrating your Barometer
- Vectors in sailing
- Laws of Motion and forces on a yacht
- Global weather patterns arising from Earth's Orbit around Sun, Earth's rotation on it's axis
- Coriolis
- Weather map
- High & Low Pressure systems
- Determine Gradient wind direction and strength from weather map
- Seasons and Seasonal Patterns
- The forecasting process and models
- Stability
- BoM Site - Marine, Maps, MetEye, BoM Lite, Observations
- Fronts, Thunderstorms, Squalls
- Weather effects on sea
- Weather Warnings
- Waves & Tides
- Clouds - an introduction and their signs
- Gusts and lulls, wind shear
- Sea breezes - Local and Ocean
- Land breezes, Katabatics
- Obstructions, Convergence / Divergence - Veering and Backing
- Topography, land effects
- Tides and Currents, Bathymetry
- Technology to consider

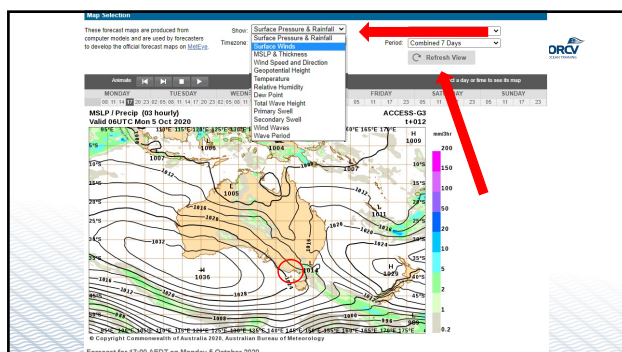
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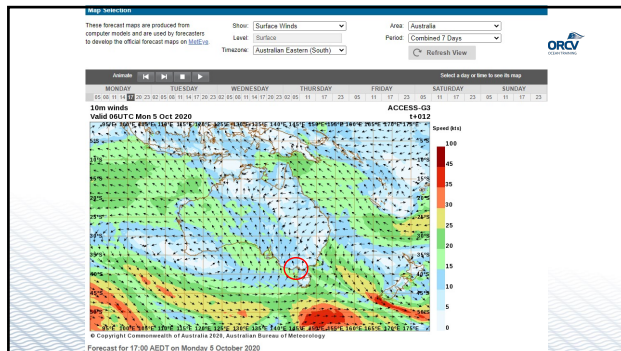
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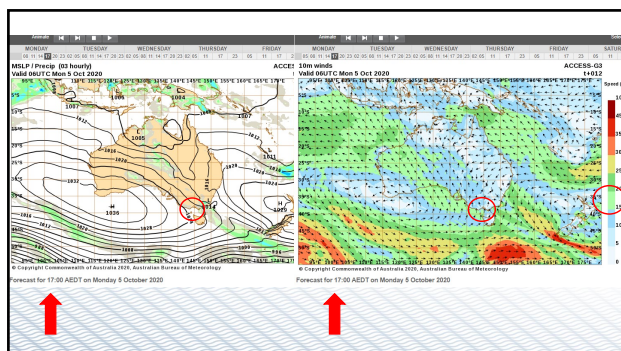
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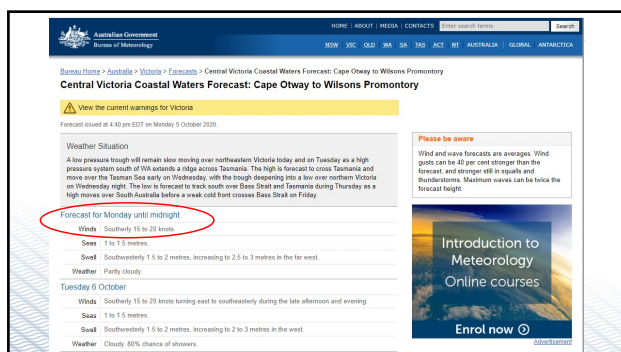
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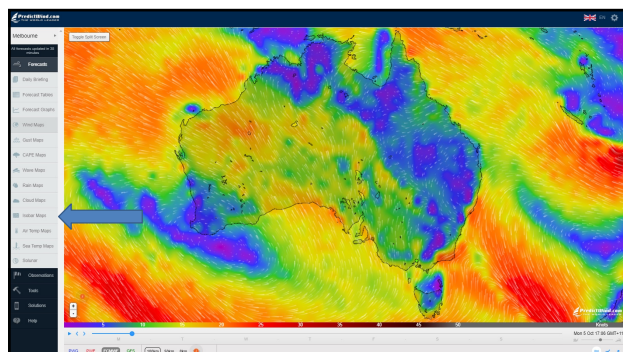
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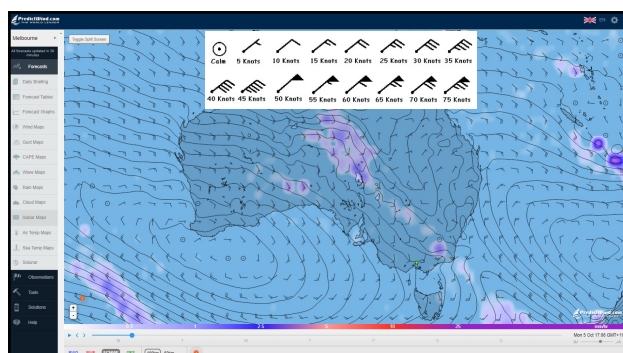
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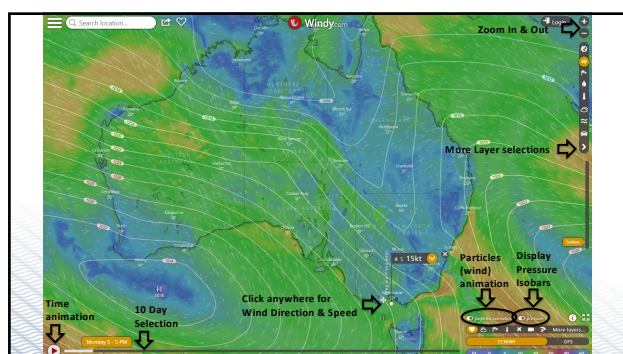
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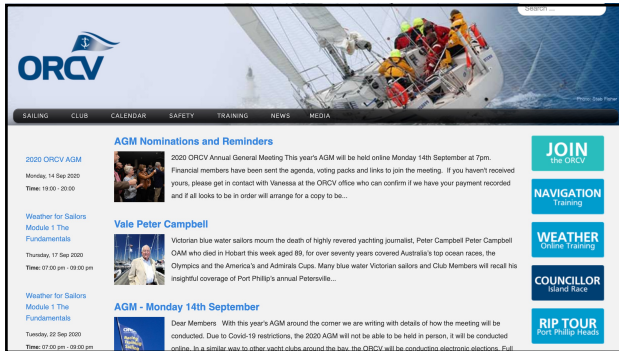
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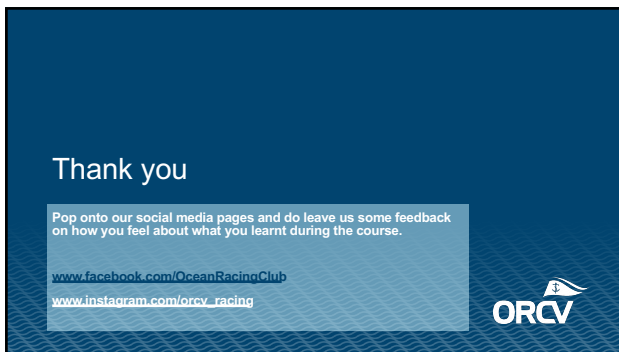
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82



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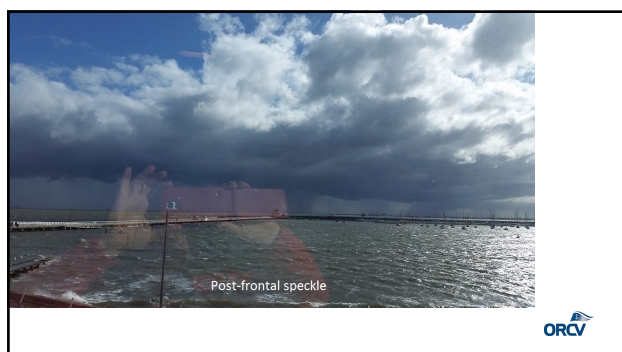
84



85



86



87

Lenticular Clouds



Lenticular cloud over Port Phillip am

88

Cumulus-Cloud Streets



89

Sea Breeze begins cloud-Newcastle

90



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