Technical Course for Coaches Level 3 – Wind Strategy

World Sailing

Two categories of wind

Gradient winds as a result of Low and High Pressure systems

Local or thermal winds

Their behavioral pattern is different therefore we need to adopt the strategy accordingly

Local Thermal Winds

Sea Breeze

- Created in daytime and blows from the see towards the land
- It is created from the different temperature of the land vs sea

Land Breeze

- Created in the night and blows from the land towards the sea
- It is created from the different temperature of the land vs sea

Sea breeze

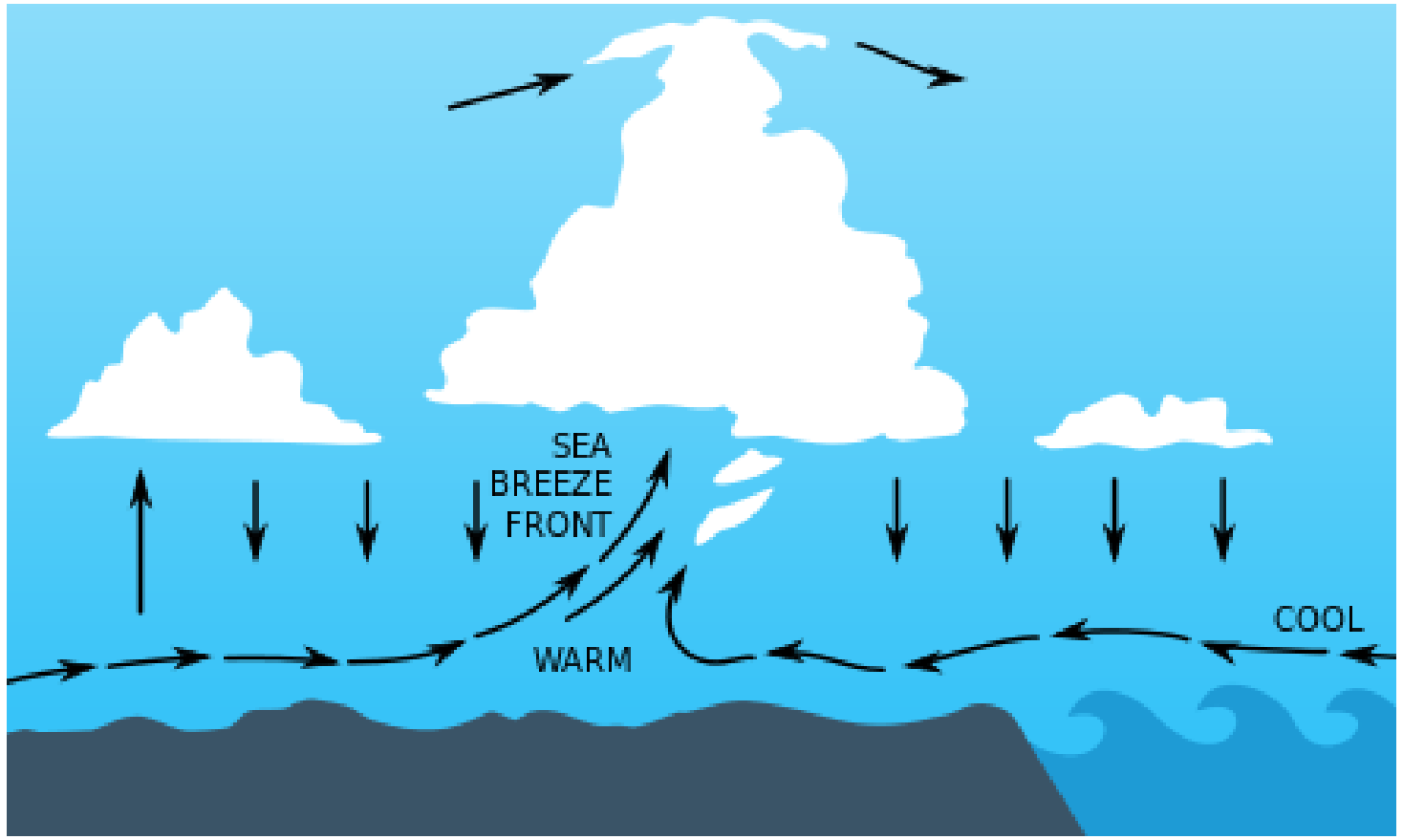
- The sun starts to heat the sea and the land
- The land is heated faster than the sea
- The air gets buoyant and starts moving upwards
- Cold air from the sea moves inland to replenish the air

Sea Breeze

Conditions and Signs

- Clear sky
- Enough sun to start heating the earth. In land a rise in temperature of 1-2° C above sea temperature is enough to start the process.

If clouds are formed above hills next to the beach is a sign that the upward movement has begun.
If a cloud above sea starts to disappear that means that the wind stream starts to move towards the land.



Sea Breeze

How it behaves:

- It is created around midday
- The direction is vertical to the beach
- It moves clockwise
- The basic mechanism of sea breezes remains the same in both the Northern and Southern Hemispheres.
- It is finalised after 3 hours, and the direction is 20 degrees from the beach

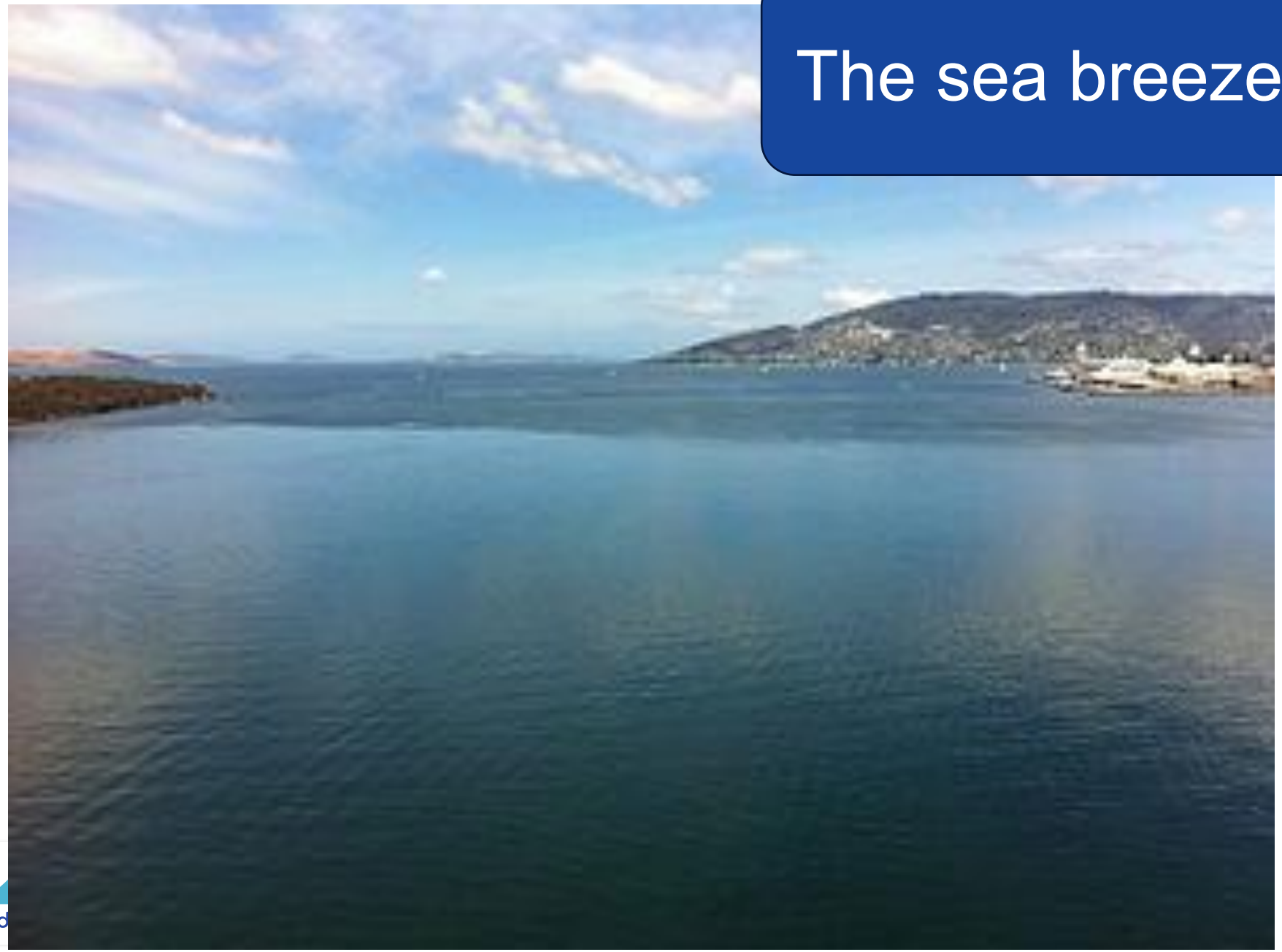
Typical behaviour of the sea breeze

The wind direction follows the sun

It starts around midday

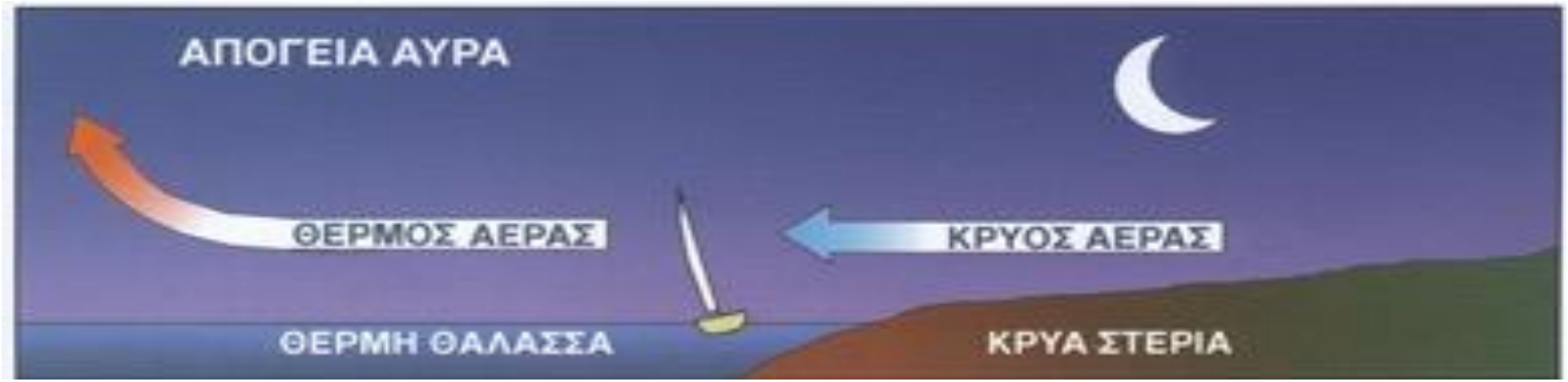
Final direction is 20 º from the shore

The sea breeze is coming



Night Breeze

- At evening the land gets cold faster than the sea
- The air gets buoyant above the sea
- The breeze is building from the land towards the sea

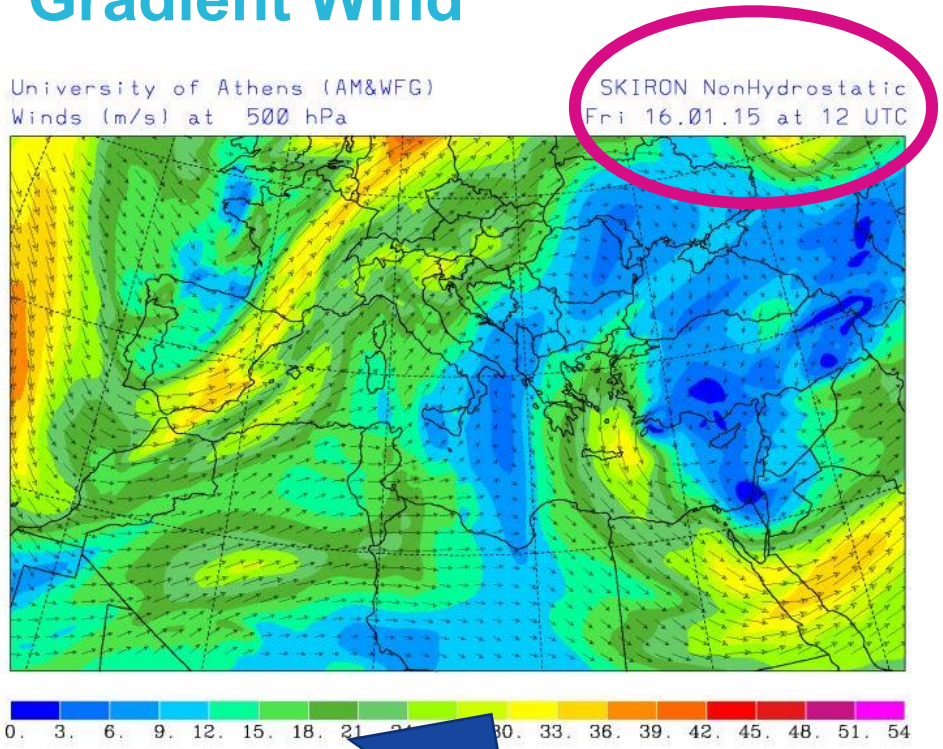


Gradient Wind

- The gradient or geostrophic wind is the wind created due to the difference in pressure between the isobars of a high- or low-pressure system. It blows between 1000 and 2000 m above sea level
- This wind can get down to the surface under certain circumstances
- This wind is significantly stronger than the surface wind

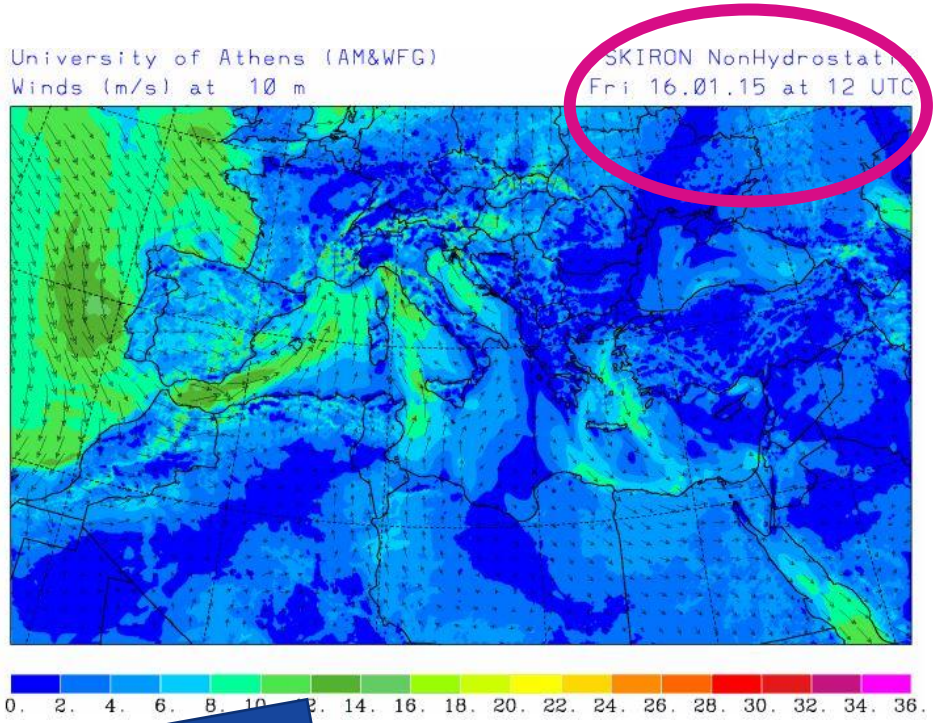
Wind Strength at 5000m vs 10m

Gradient Wind



30m/s
58kts

The wind 10m above sea level

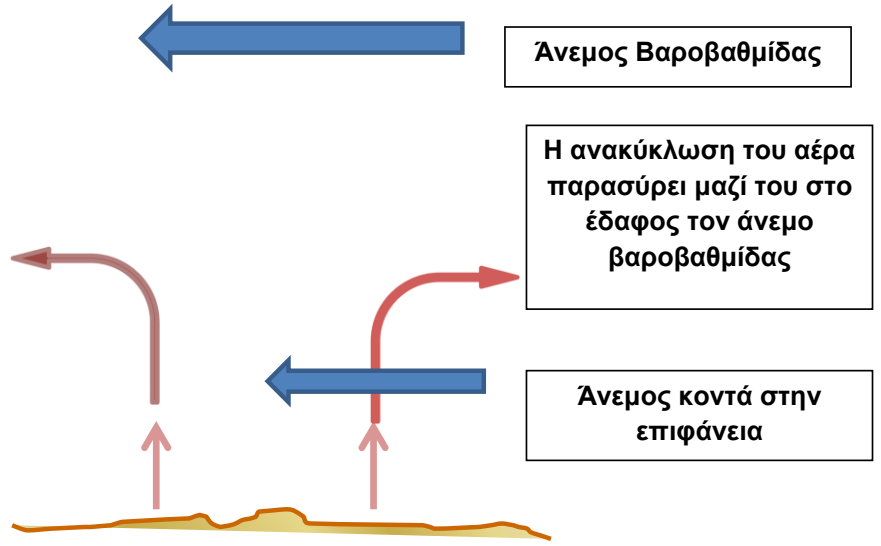


5m/s
10kts

World Sailing

Requirement to descent the gradient wind to the earth level

The gradient wind can come to the surface when the air above the surface gets hot and buoyant and starts lifting



Hot ground

Requirement to descent the gradient wind to the earth level

When the atmosphere is hazy the air is stable.

The air doesn't get lighter to start lifting and the gradient wind cannot come down to earth.

Gradient Wind

No wind on ground level

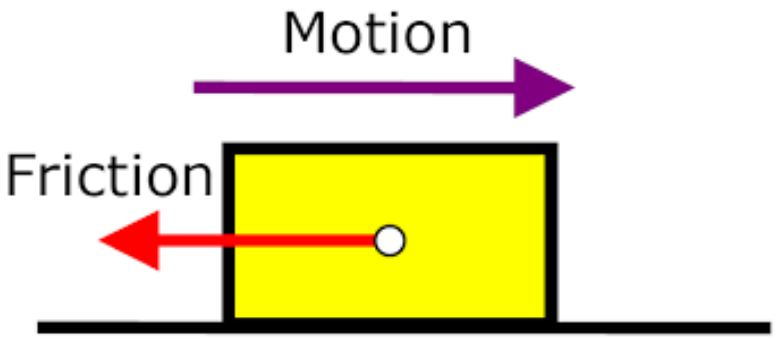
Cold ground

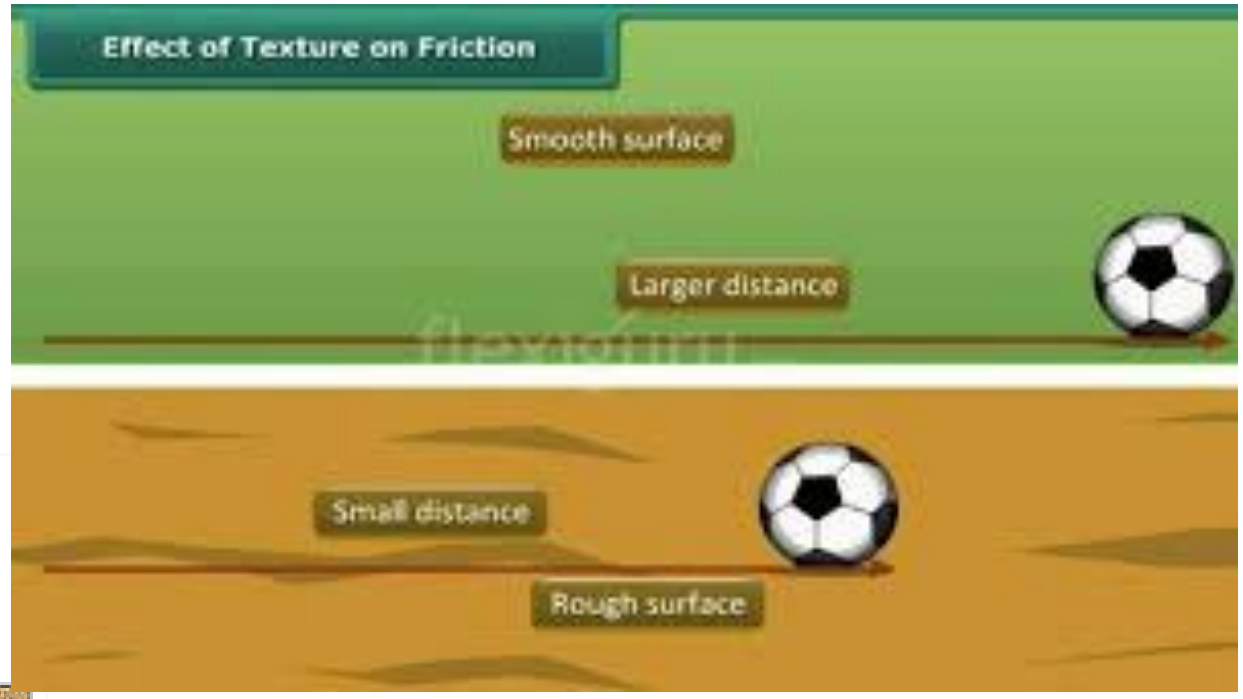
Gradient wind cannot come down to earth due to the hazy atmosphere.

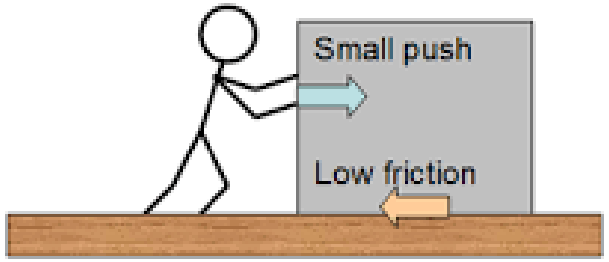
The Effect of the Clouds

When clouds appear in the sky then you expect oscillating conditions as well as areas of different pressure.

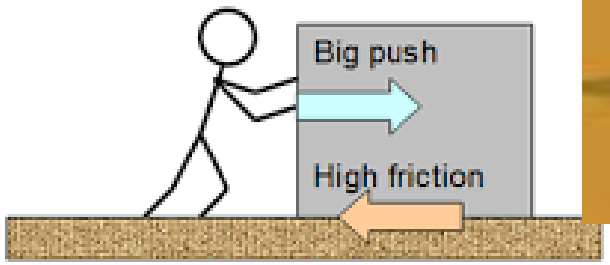
Under the cloud the wind is colder therefore the gradient wind comes down to the surface more difficult, So under the cloud it **is lull** and the wind is backed. **Between the clouds** the gradient wind comes easier on to the surface, so we **have gust** and the wind is veered.







Smooth surface

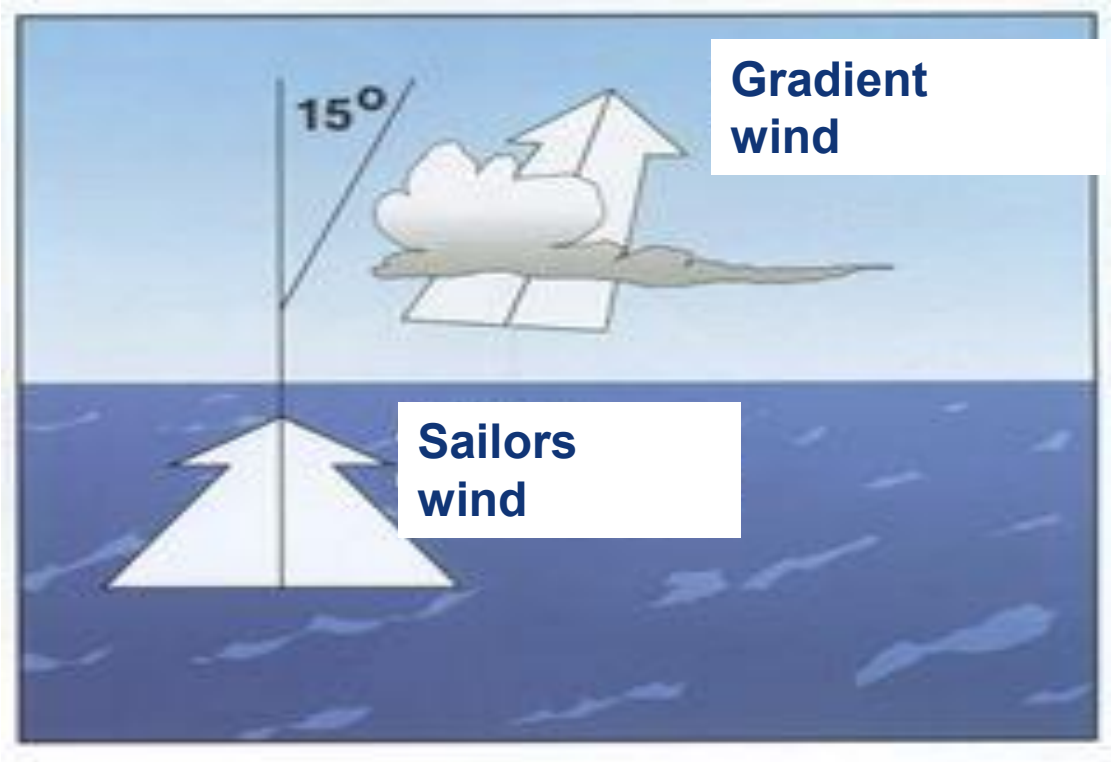


Rough surface

The Effect of Friction on the Gradient Wind

Above the sea

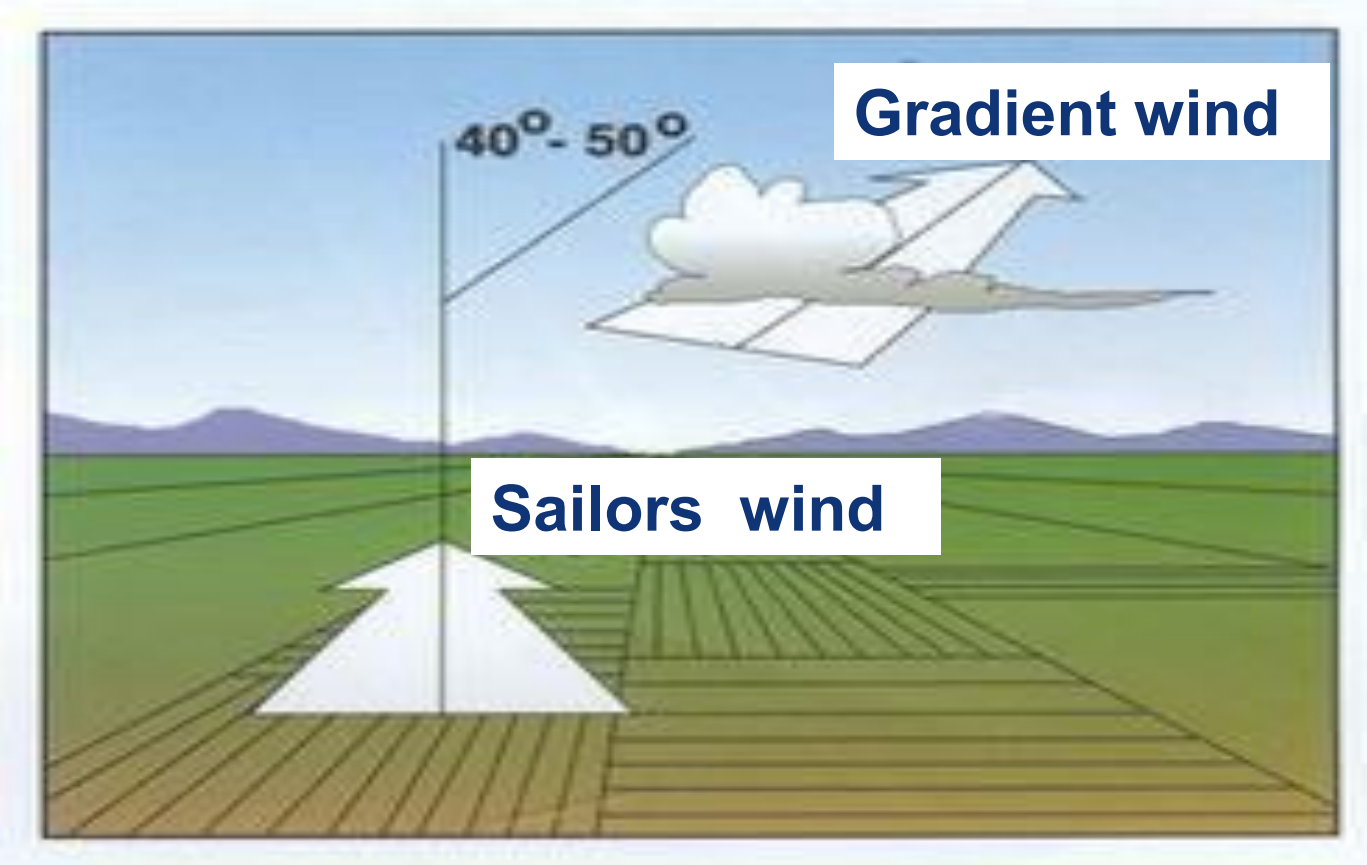
- The wind speed is reduced by 30%
- The wind shifts by 15 ° anticlockwise



The Effect of Friction on the Gradient Wind

Above the ground

- The wind speed is reduced by 50%
- The wind shifts by 40° – 50° anticlockwise




Gradient wind
Sailors wind
Gradient wind
Sailors wind
The two winds converge resulting in a band of more wind
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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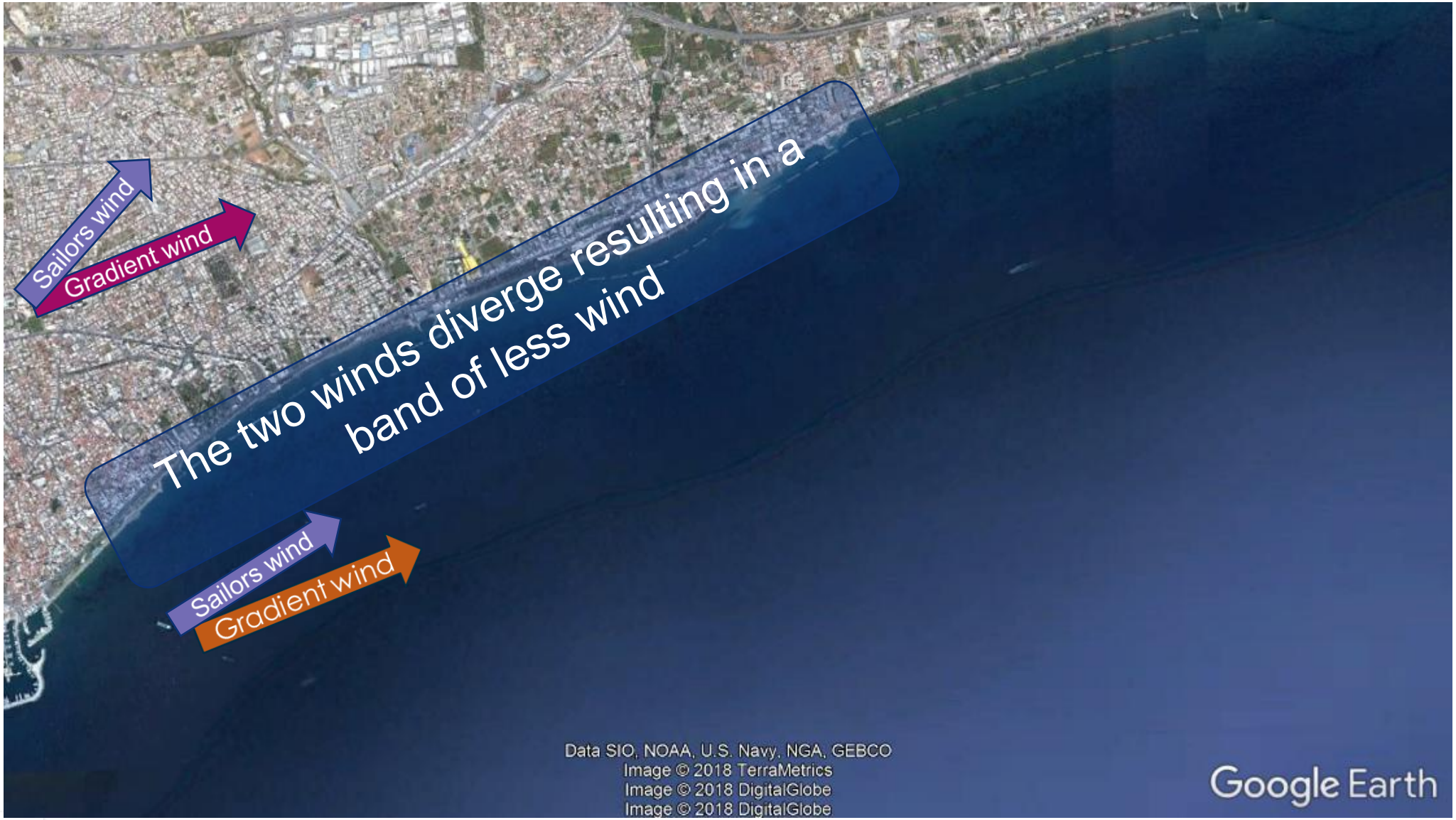
Sailors wind
Gradient wind
The two winds diverge resulting in a band of less wind
Sailors wind
Gradient wind
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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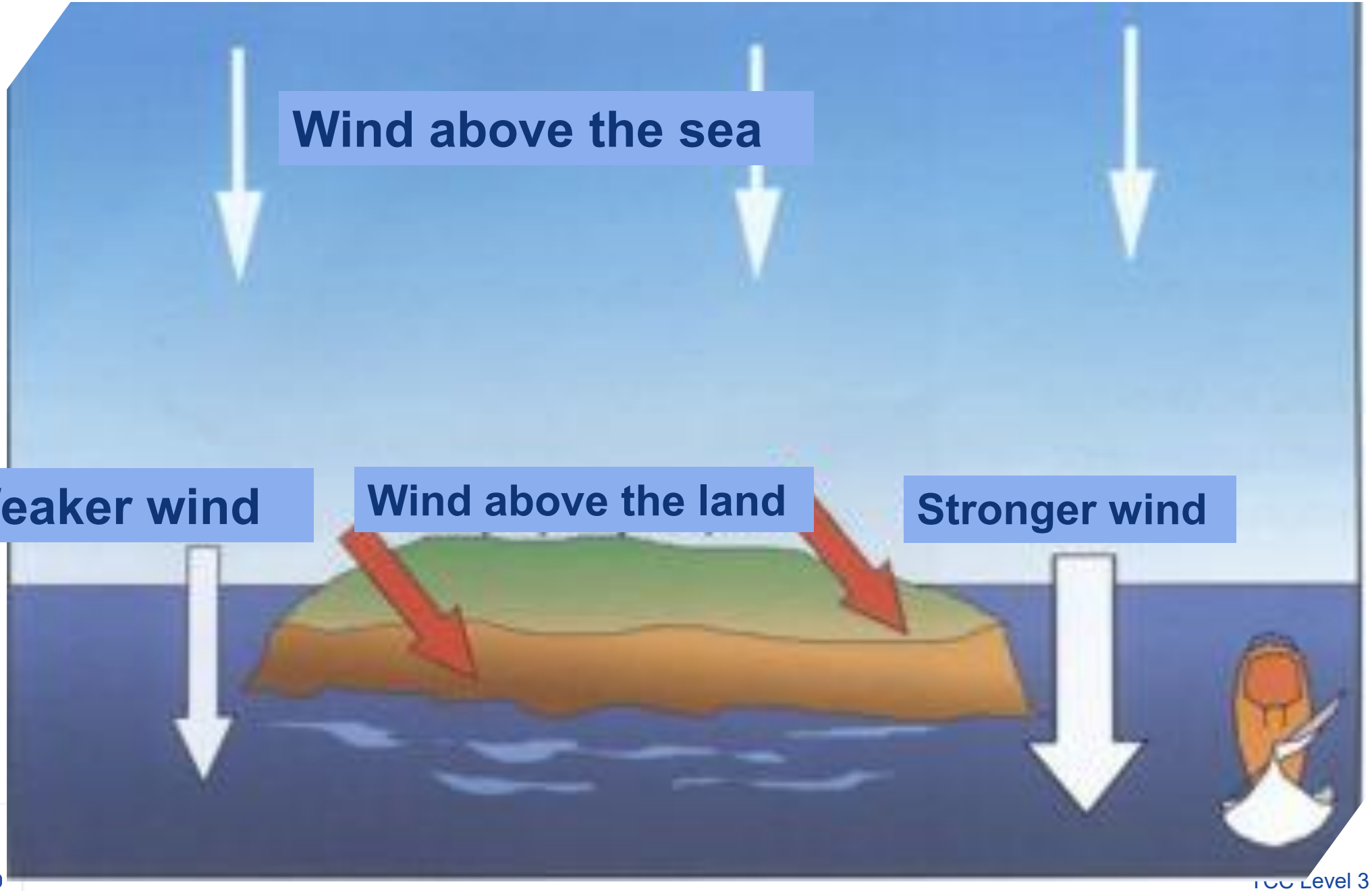
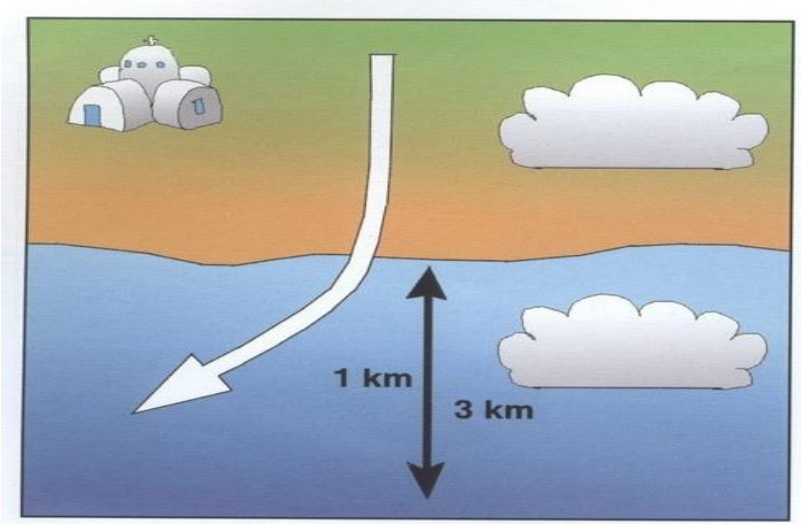
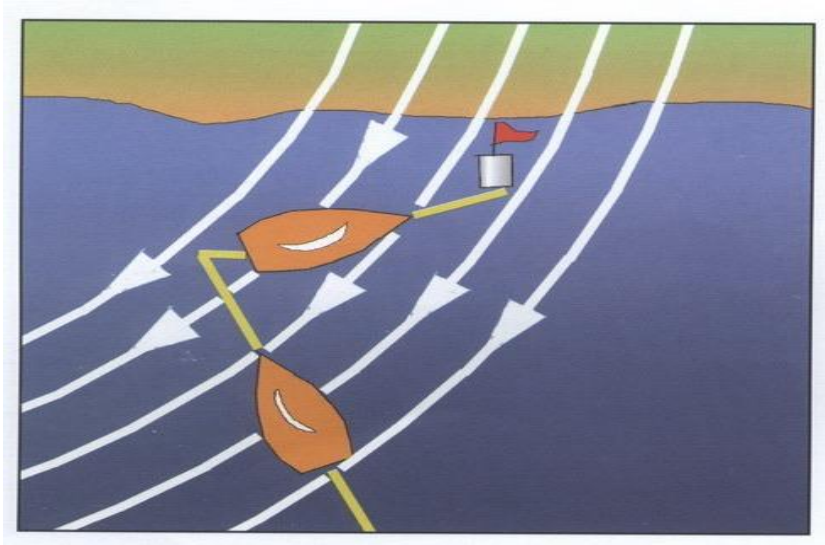

Wind above the sea
Weaker wind
Wind above the land
Stronger wind

Offshore Wind

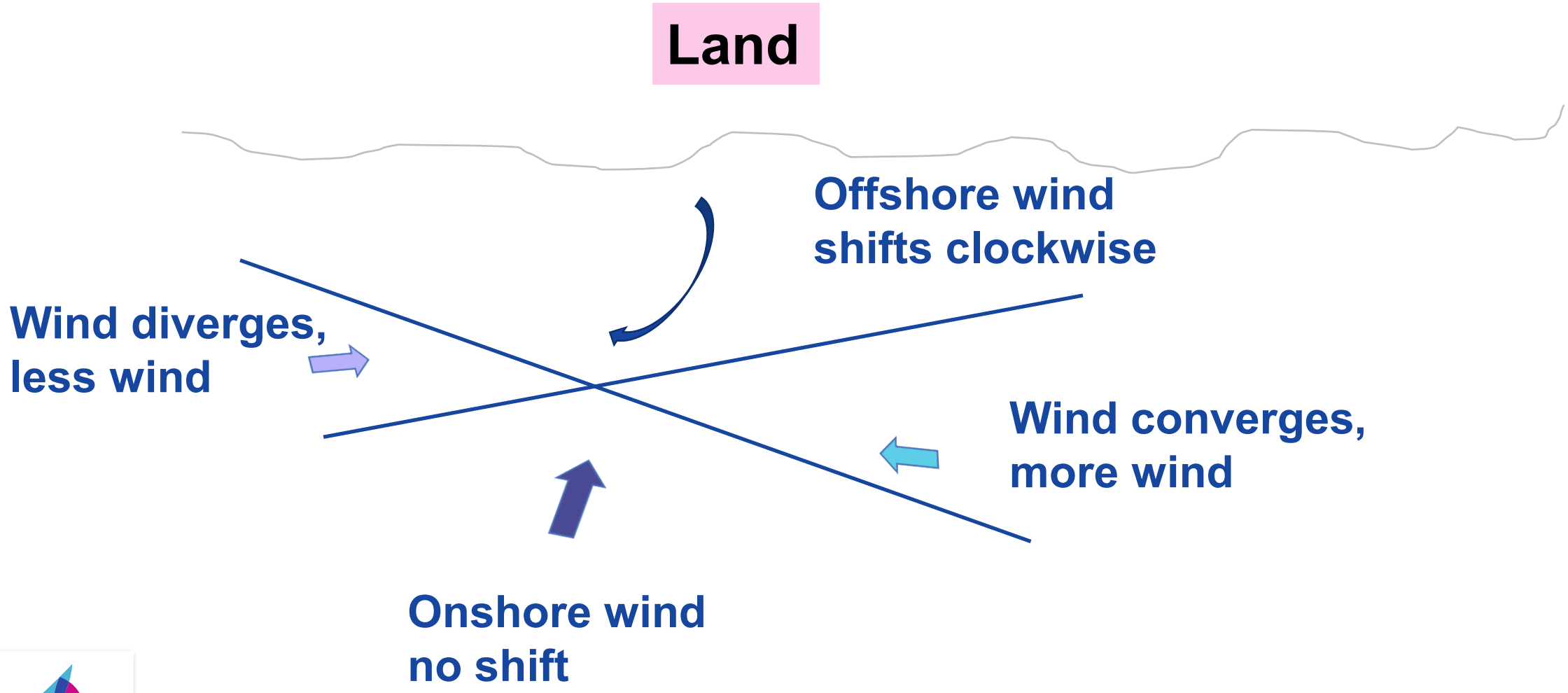


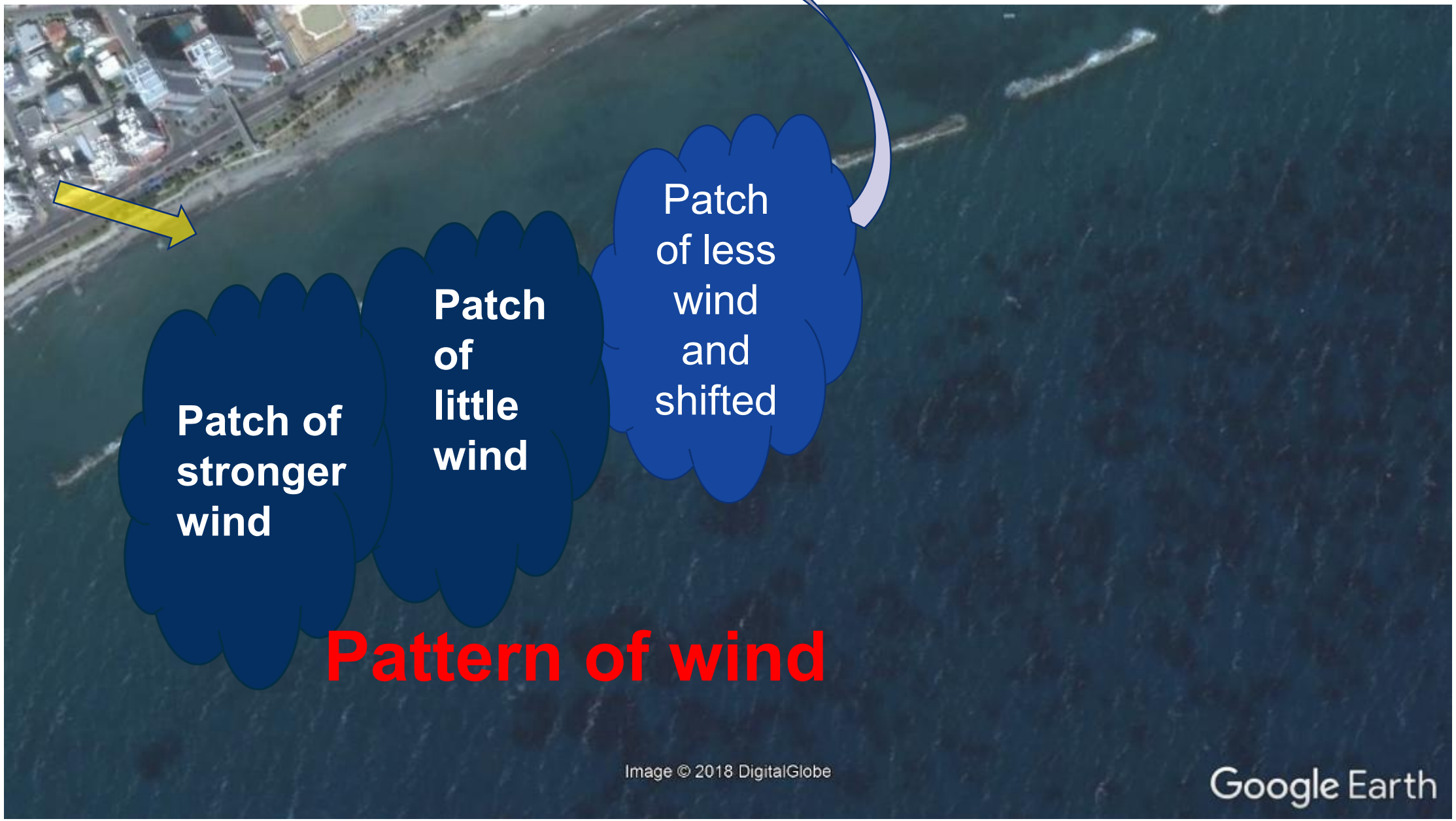


When the wind is offshore then, when the wind enters the sea, it starts shifting by 30° clockwise.

Therefore when the upwind mark is next to the shore we approach the mark on a starboard tack. As soon as we get the first left shift we tack to port

Rule of Thumb




Patch of stronger wind
Patch of little wind
Patch of less wind and shifted
Pattern of wind
Image © 2018 DigitalGlobe
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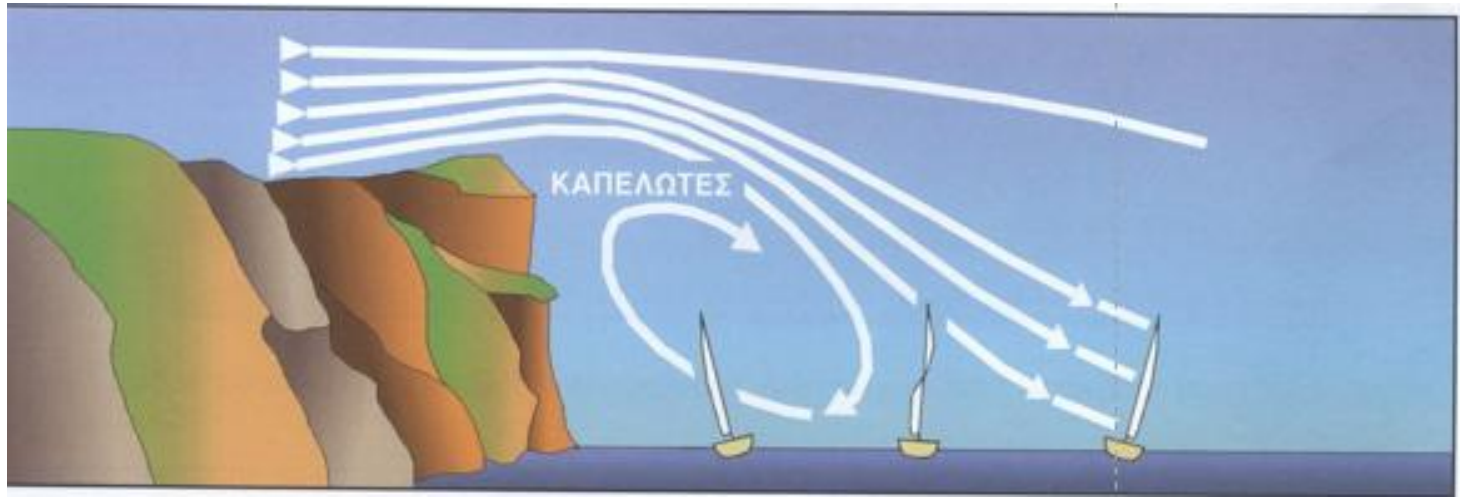
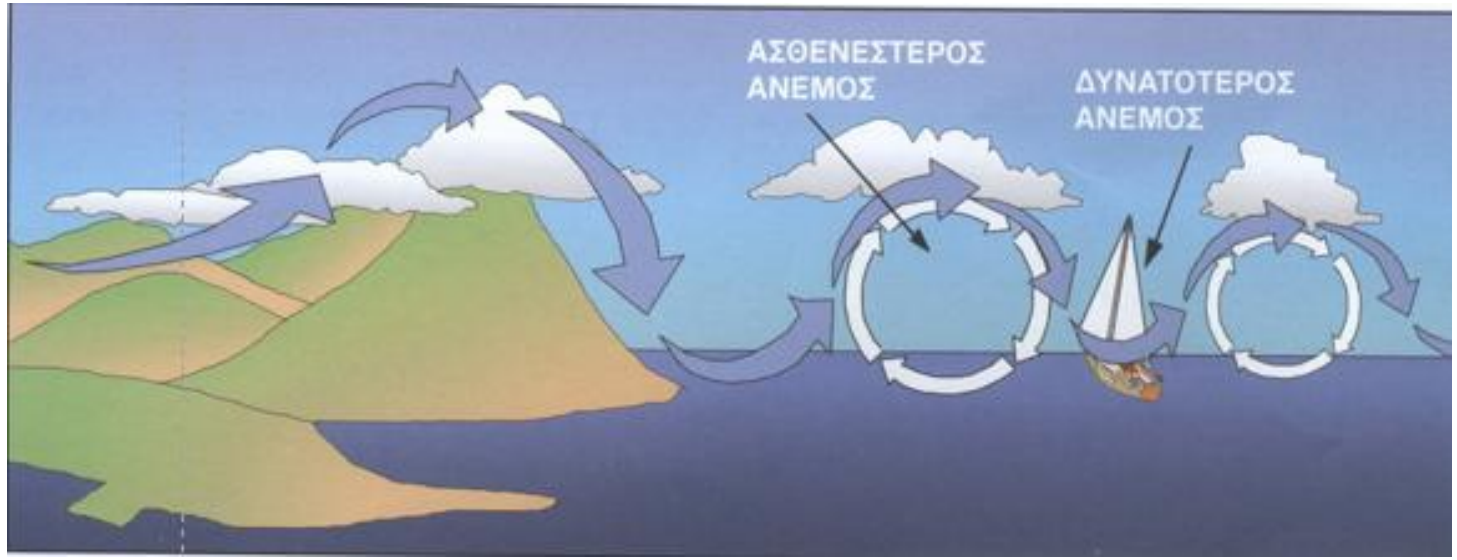
Have you ever watched a river?

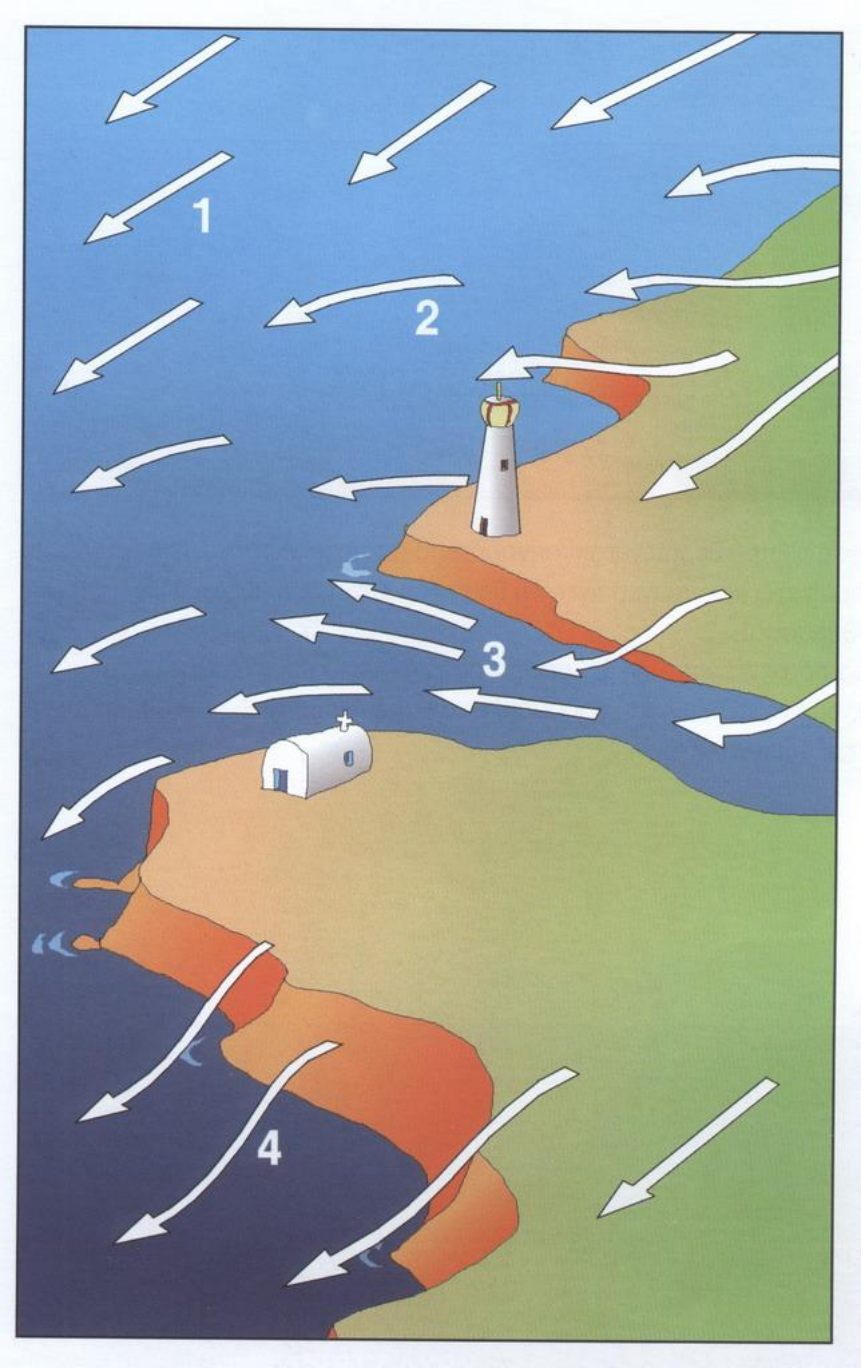
Water is a fluid just like the air!



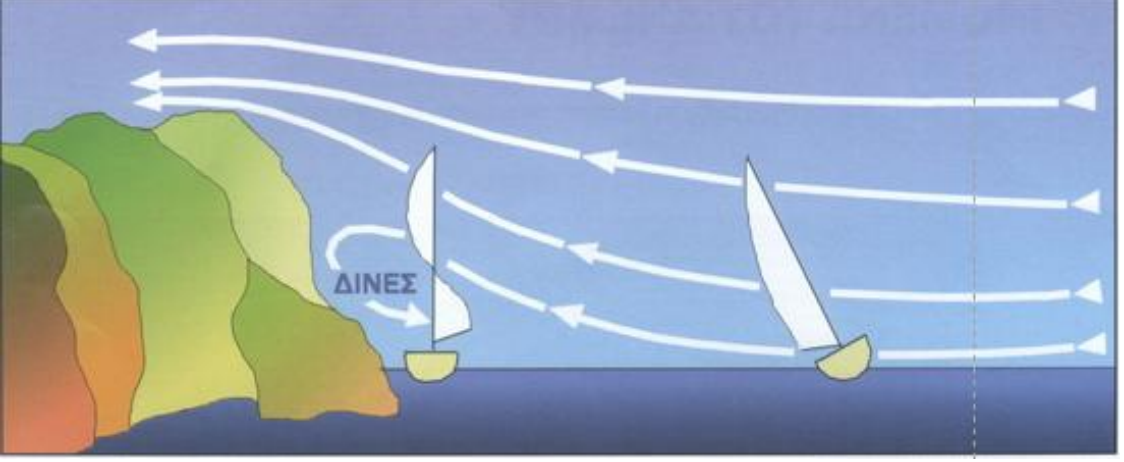
When the wind comes from a stiff hill towards the sea reversed eddies are formed so avoid the area next to cliff



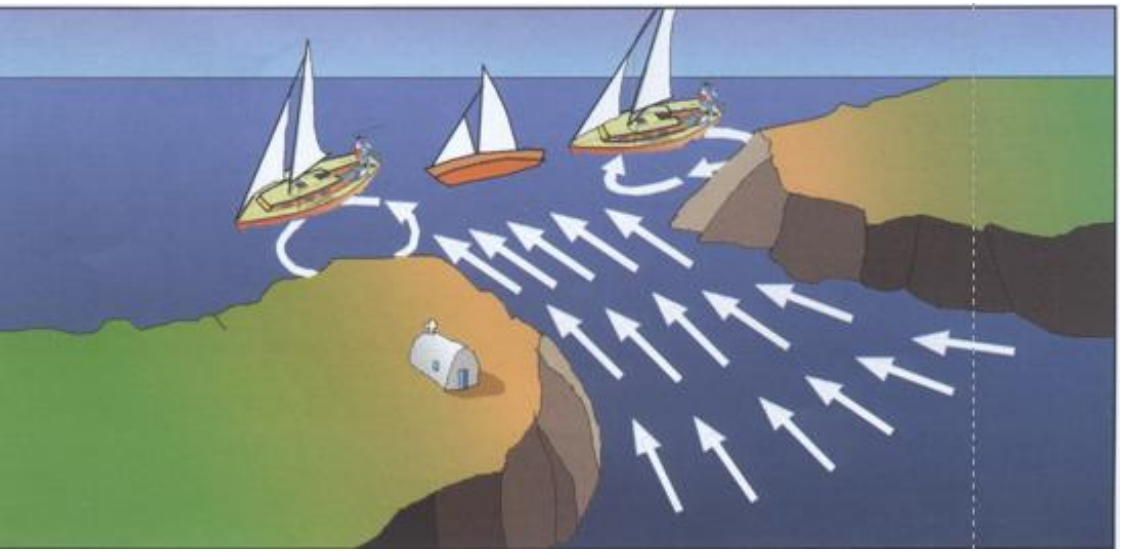
When the wind comes from a stiff hill towards the sea expect areas with more wind and areas with less wind



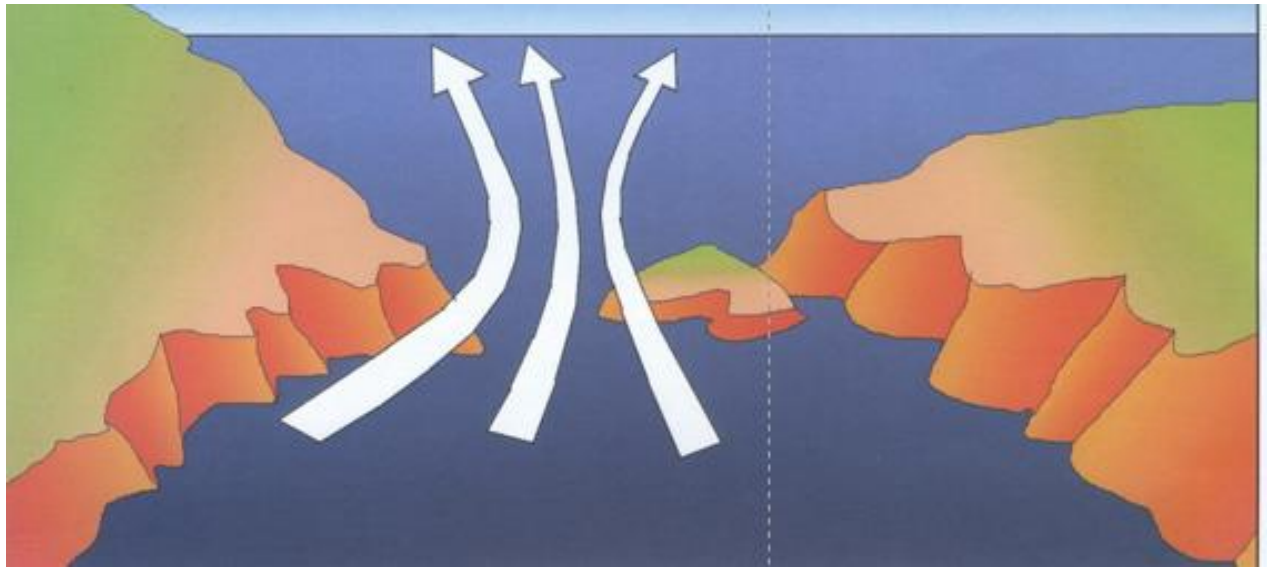
When you go to the race area observe carefully the area for the land morphology.
This will help you to understand how the wind will behave.

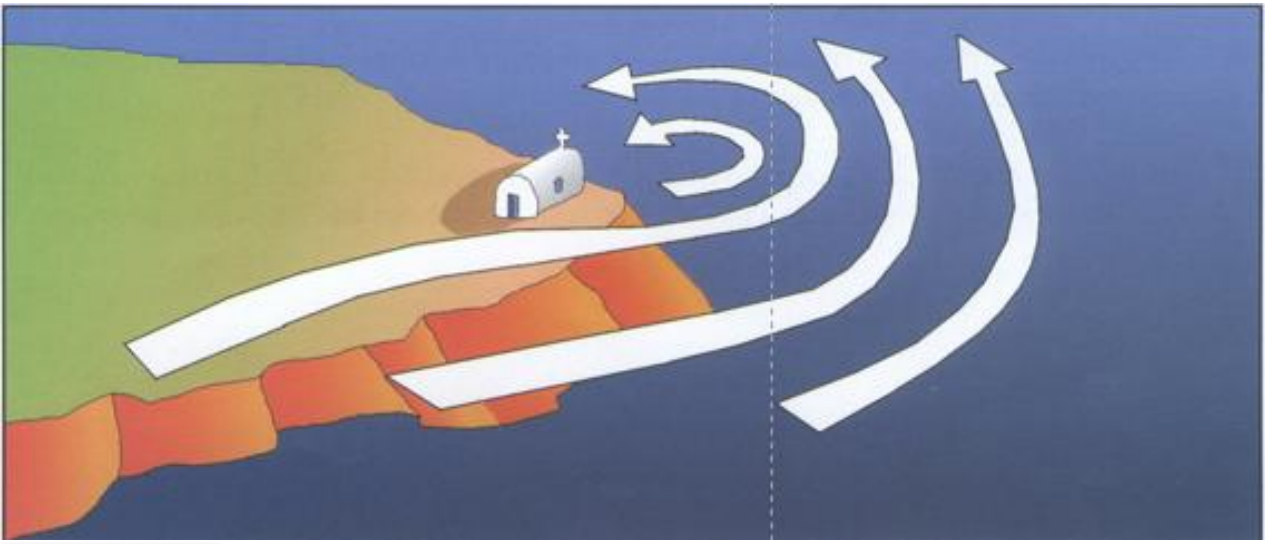


The wind starts lifting to pass the obstruction 5 times the height of the obstruction, so next to the hill is less wind.



The wind accelerates .
The wind curves at the end

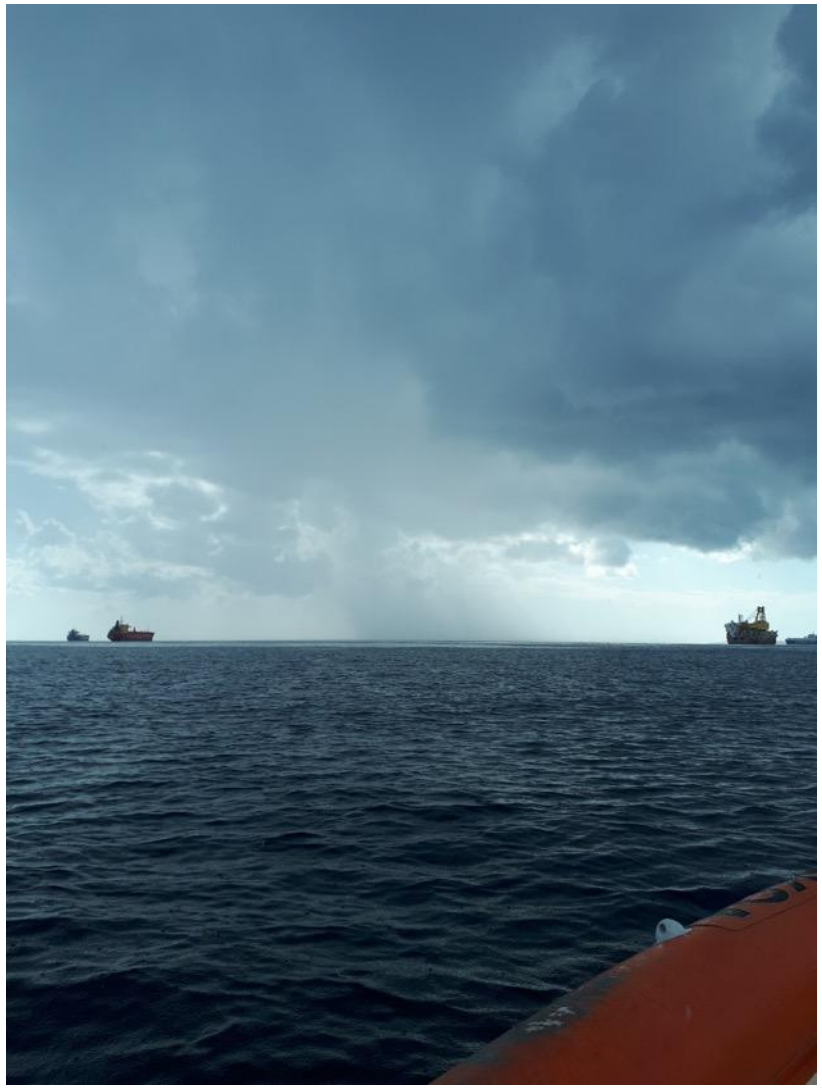


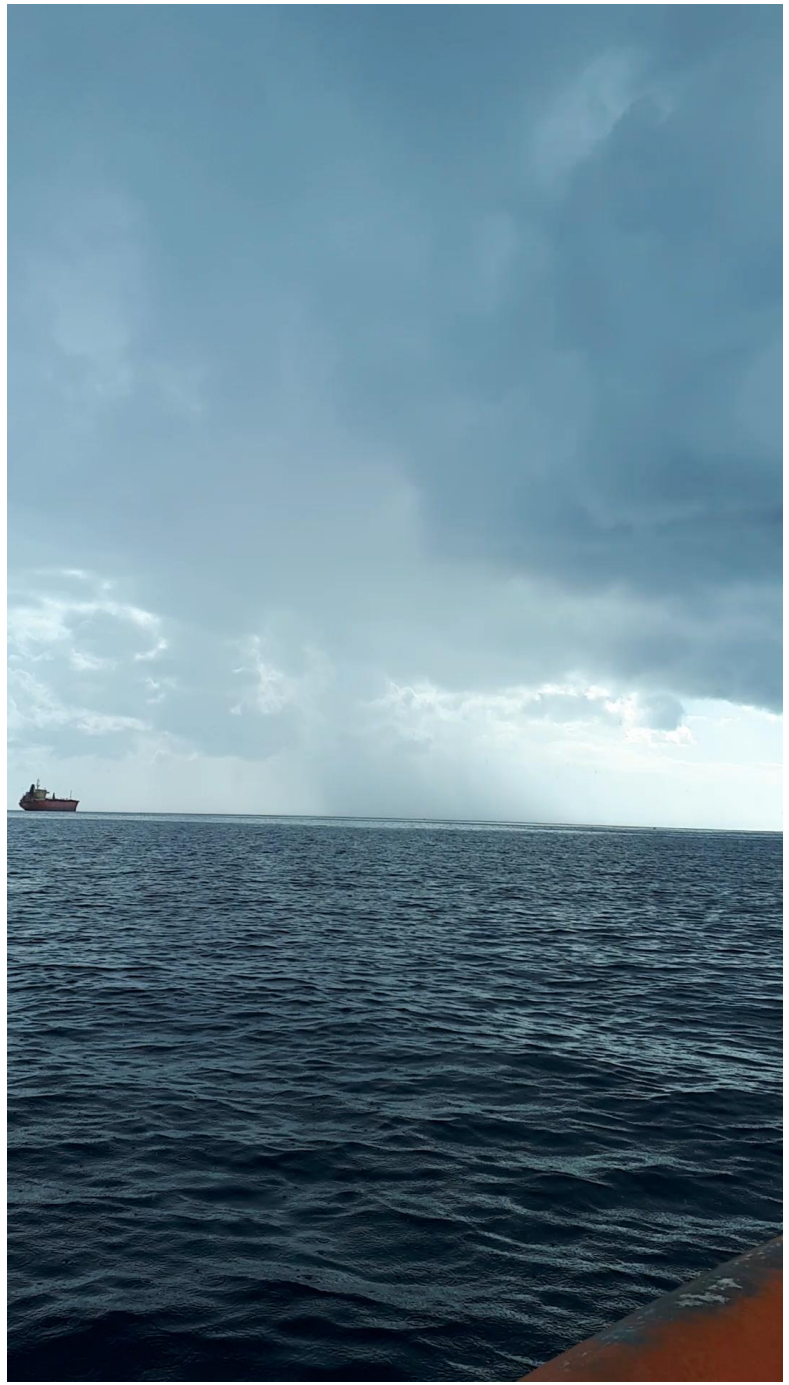



3000m
2000m
1000m
0m
-15
-10
-5
+5
-10
0
+10
A
B
C
D
E

Rain Clouds

With the rain wind is coming down to earth.





Watch the wind dropping from the cloud before the rain comes.

World Sailing


clockwise shift
Wind
Wind bend
Around the ship
Wind
Wind
Anticlockwise shift
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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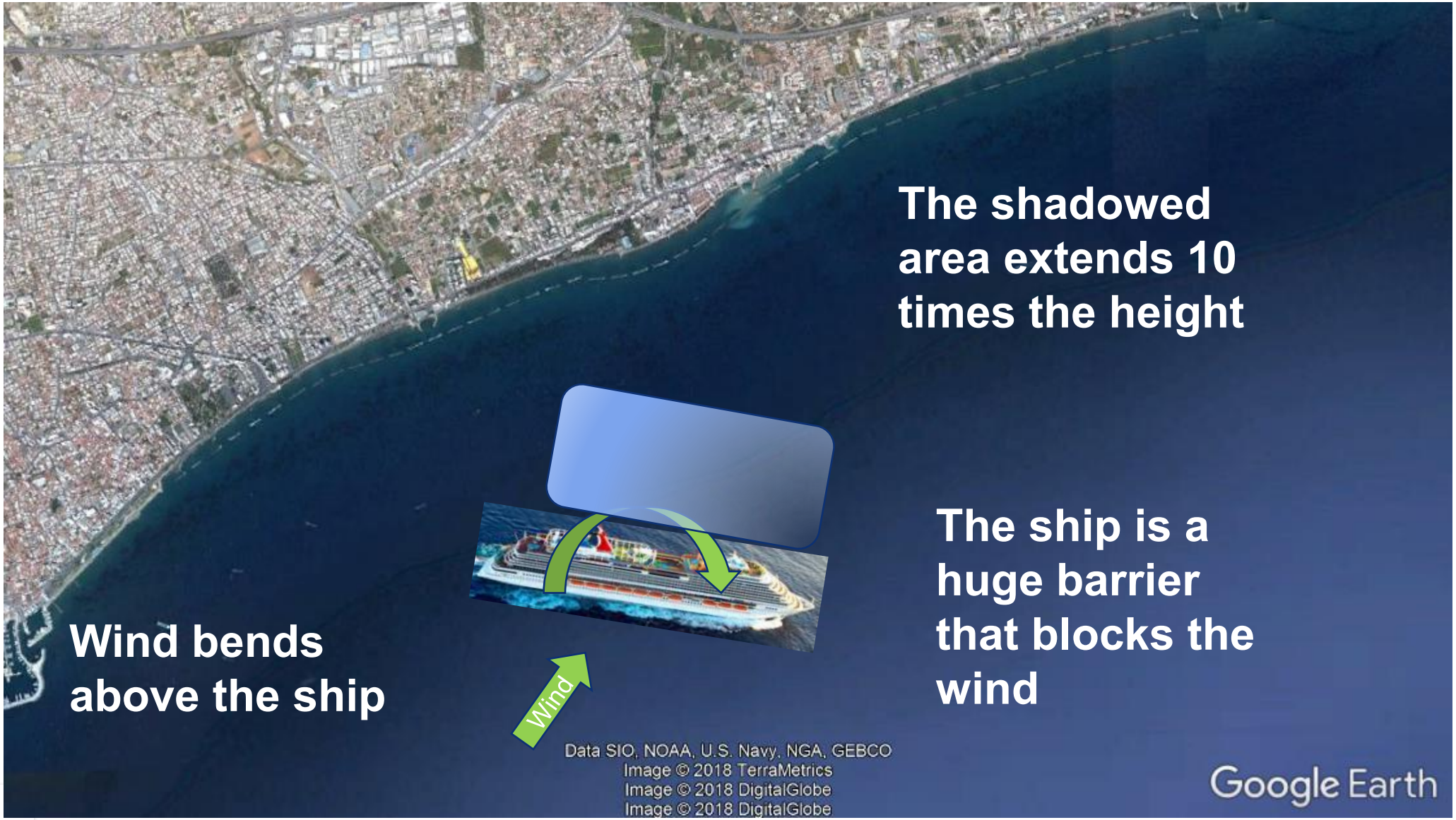
The shadowed area extends 10 times the height
The ship is a huge barrier that blocks the wind
Wind bends above the ship
Wind
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2018 TerraMetrics
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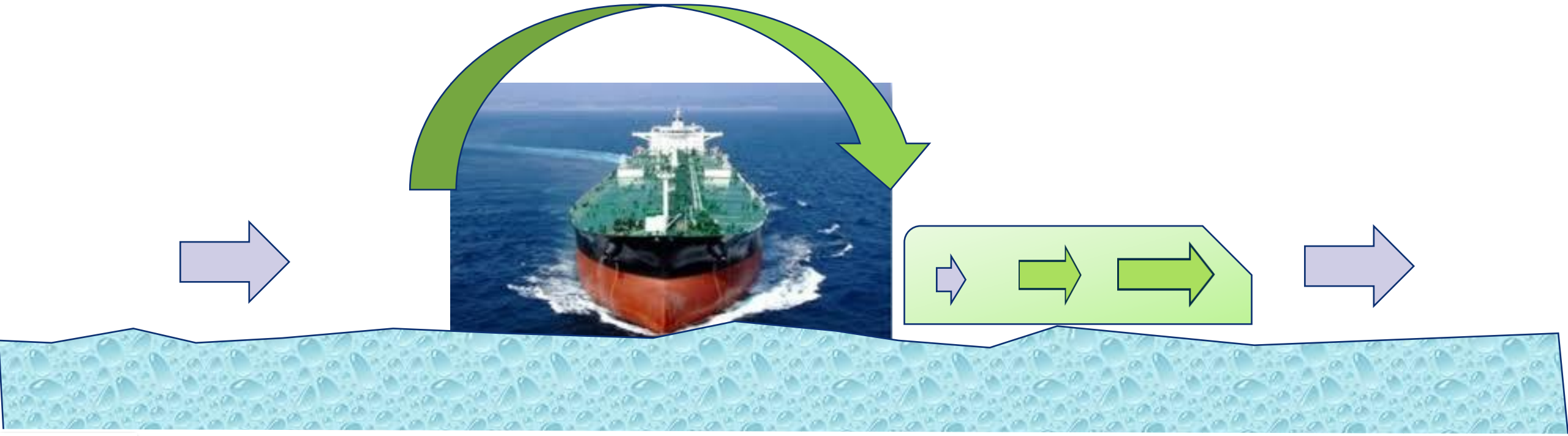
The shadowed area extents 10 times the height The wind is fully undisturbed at distance 30 times the height of the ship



During Start

- Imagine the sails as a wind barrier.
- Little wind shift in both ends.

Wood Next the Seaside

The wind gets clear at the distance of 30 times the height of the trees.

Rounding the Upwind Mark

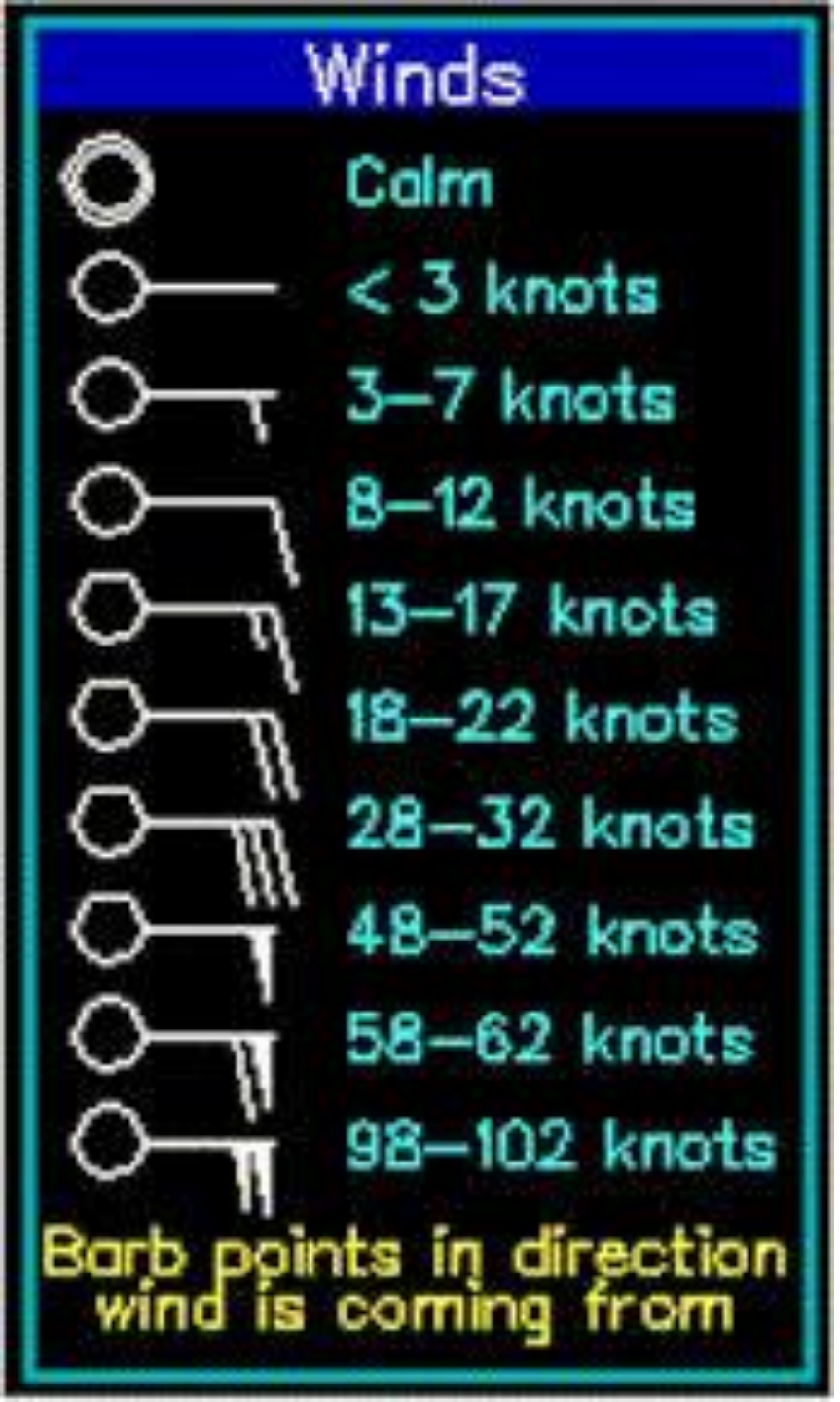
The port boat has made a mistake as it approaches the mark behind a wall.

Wind

Each stripe of the windsock represents 3 kts.

When full extent the wind is blowing at least 15 kts.

Beaufort Number	mph (knots)	Description	Probable Wave Height	Effects on Land
0	1-3 (1-3)	Light airs	Flat	Flag hangs limp, smoke rises vertically
1	4-7 (4-6)	Light breeze	0 - 1/2 foot	Flag stirs, leaves rustle wind felt on face
2	8-12 (7-10)	Gentle breeze	1/2 - 1 foot	Flag occasionally extends, leaves & twigs in constant motion
3	13-18 (11-16)	Moderate breeze	1 - 1 1/2 feet	Flag flaps, small branches move, dust and paper raised
4	19-24 (17-21)	Fresh breeze	1 1/2 - 2 1/2 feet	Flag ripples, small leafy trees begin to sway
5	25-31 (22-27)	Strong breeze	2 1/2 - 4 feet	Flag snaps, larger branches in motion, whistling in wires
6	32-38 (28-33)	Moderate gale	4 - 5 1/2 feet	Flag fully extended, whole trees in motion, resistance to walking
7	39-46 (34-40)	Fresh gale	5 1/2 - 7 1/2 feet	Twigs and small branches broken off, difficult to walk
8	47-54 (41-47)	Strong gale	7 1/2 - 10 feet	Structural damage occurs
9	55-63 (48-55)	Whole gale	10 -13 feet	Trees broken or uprooted, considerable structural damage



ΑΓΑΠΗΜΕΝΑ

ΒΑΣΙΚΑ | ΚΑΘΗΜΕΡΙΝΑ | ΕΠΙΣΤΗΜΗ | ΔΙΑΦΟΡΑ

Νόμισμα | Θερμοκρασία | χρόνος | Ταχύτητα

1 | m/s

1	m/s
3,28084	ft/s
0,001	km/s
60	m/min
196,850394	ft/min
0,06	km/min
3,6	km/h
2,236936	mi/h (mph)
1,943844	knot
0,002941	mach