Ocean, Waves and Surfing

Theory Session

Wave Theory

- Issues

Creation and development of waves – From Energy to Surf

Sun‘s energy heats atmosphere

Low Pressure Systems

Wind Systems

Creation of Waves

Wave Movement

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Basic Maneuver on the Wave

Surf History

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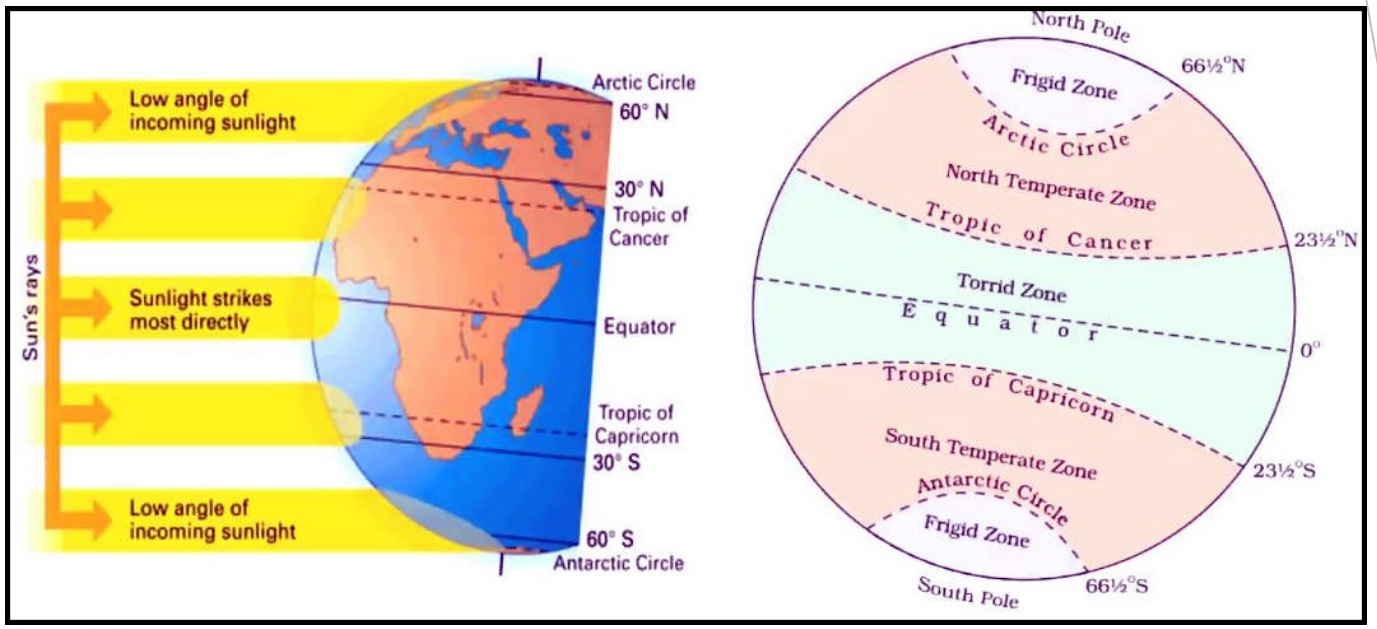
Creation and Development of Waves

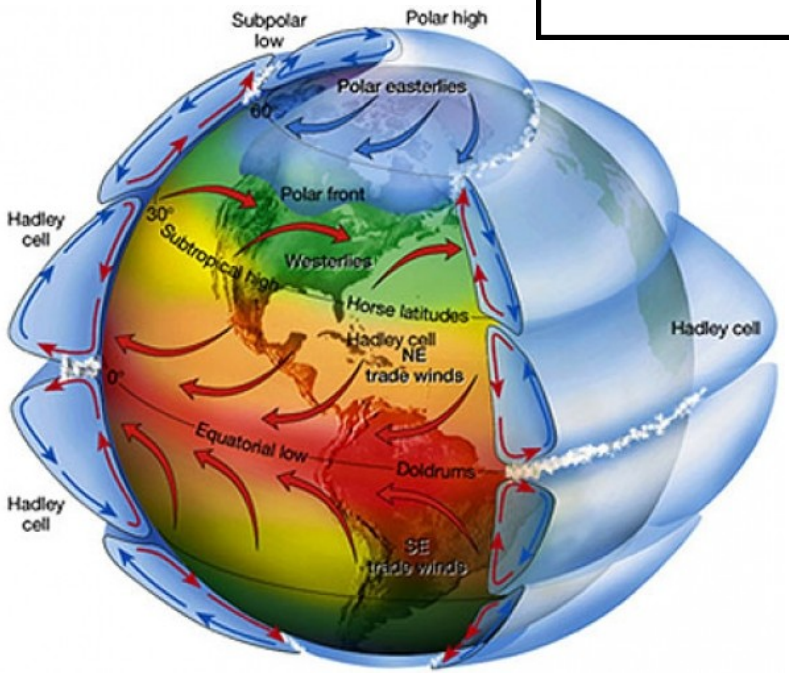
From Energy to Surf

1. Sun‘s energy heats atmosphere
2. Equator gets hotter than poles
3. Air moves to compensate for temperature difference
4. Vortices produced in surface air motion
5. Surface air transfers energy to water surface
6. Waves are generated
7. Waves propagate away from generating area
8. Wave change shape as they hit shallow water
9. Waves break and are surfed
10. SHINY HAPPY PEOPLE

Shortcut:
surfing in the storm

Sun‘s energy heats atmosphere

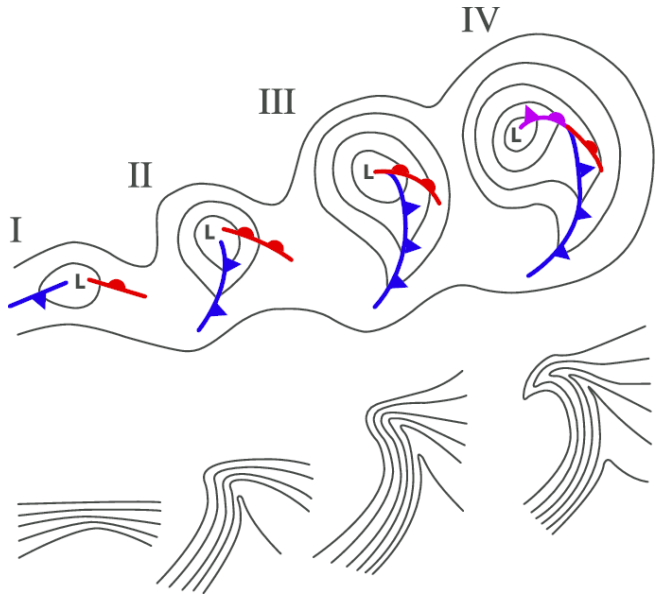


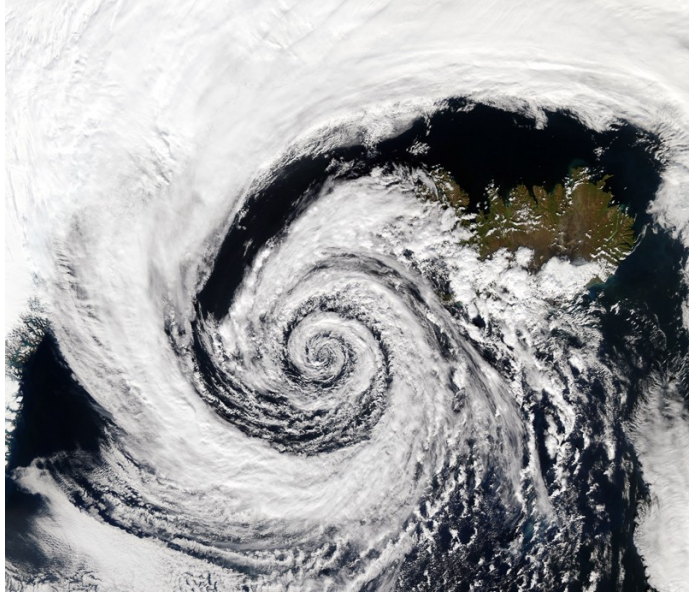


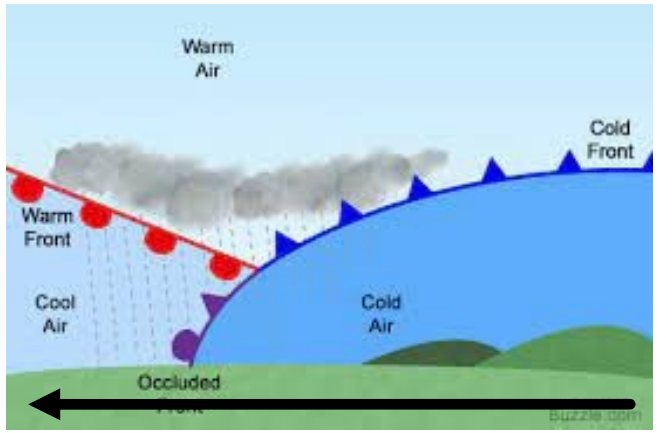
- Sun‘s energy heats atmosphere
- Equator gets hotter than poles
- Air moves to compensate for temperature difference between Equator and Poles
- Rotation of Earth affects wind directions

Low Pressure Systems

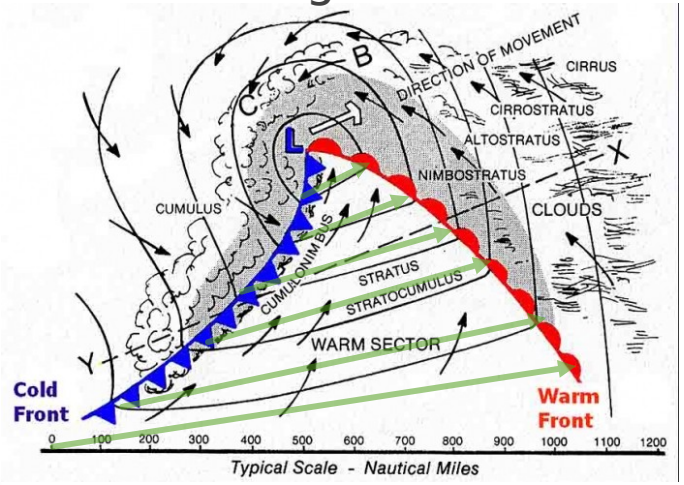
- Developement steps of a low pressure area







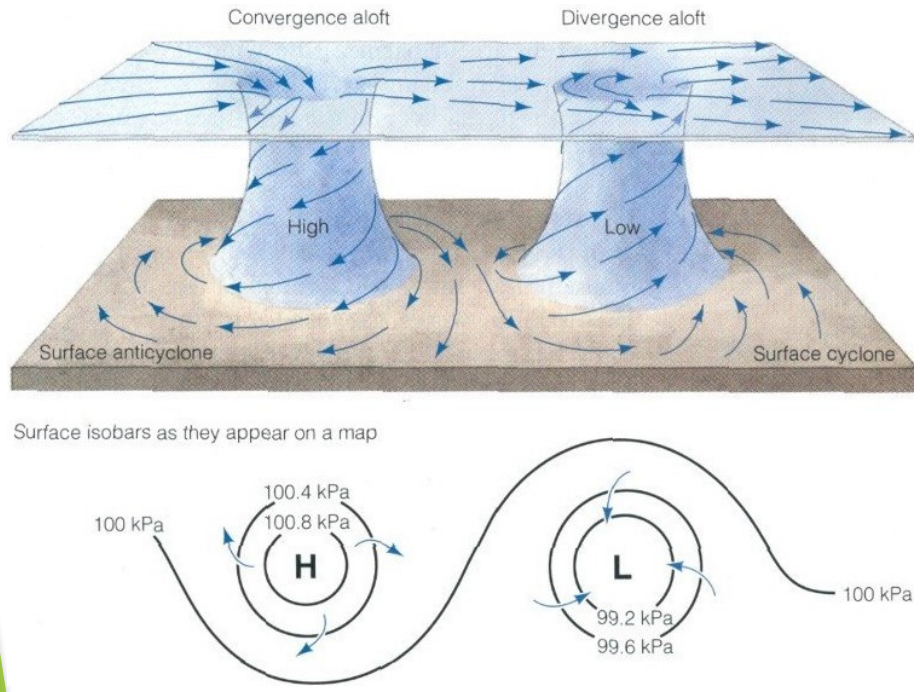
- rough Wind Direction



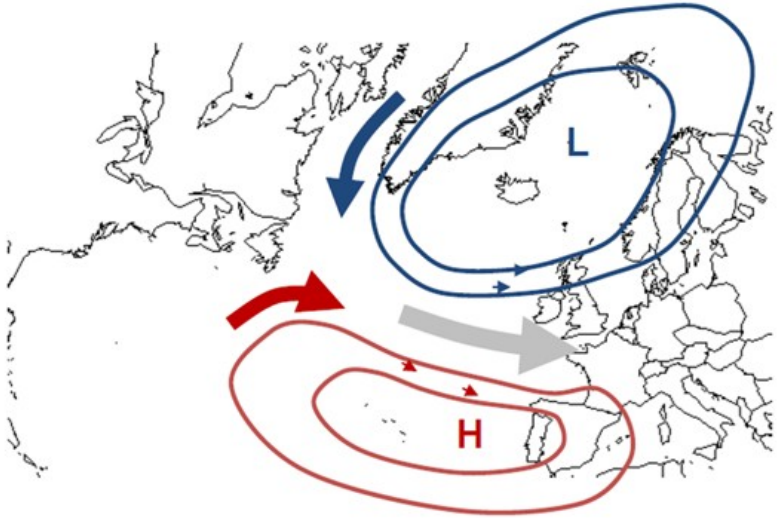
- A disturbance creates a low pressure area
- Cold and warm front form and move against clock sense (northern hemisphere)
- Cold front is faster than warm front and forms an occlusion when catch up to warm front

Wind Systems

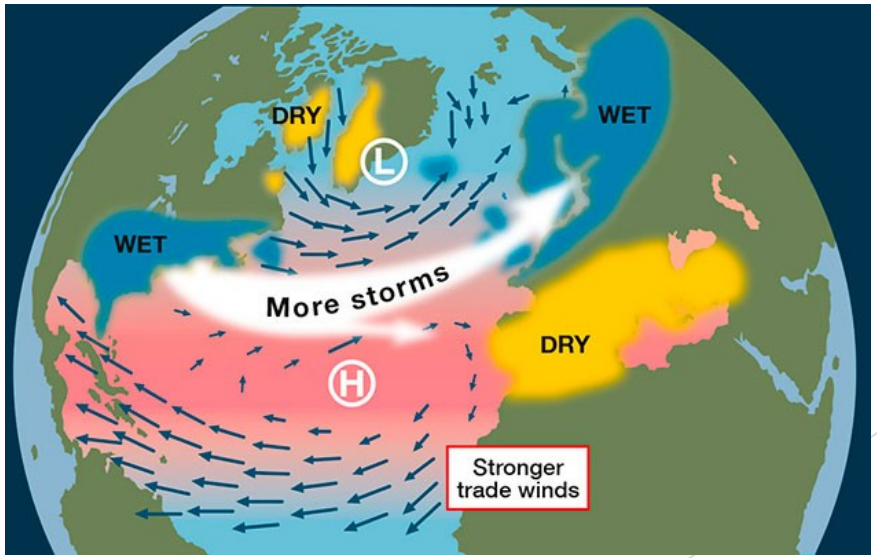
- Dynamics of Low and High



- Typical Winter Situation in Europe: Island Low and Azores High



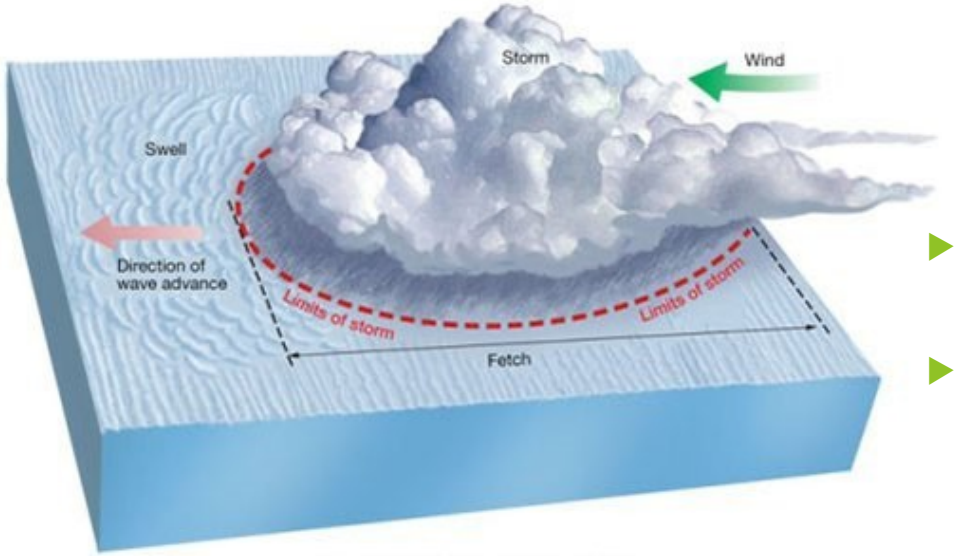
- Impact on wind and weather

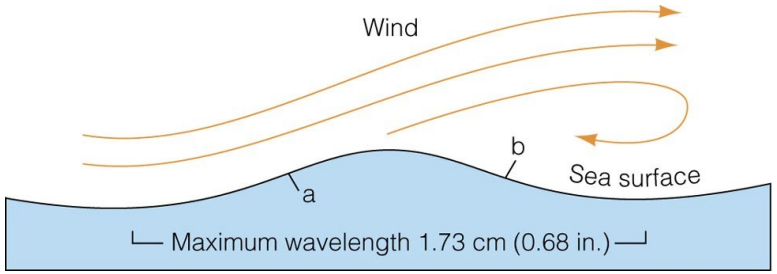


Creation of Waves

- The Energy - Sun: The sun does not heat the earth equally and causes changes of pressure
- The Engine - Wind: The Atmosphere seeks to adjust differences of pressure

- Wind blows over an area - small ripples form - more surface to catch wind - Waves continue to grow in size - Waves organize and accumulate = SWELL

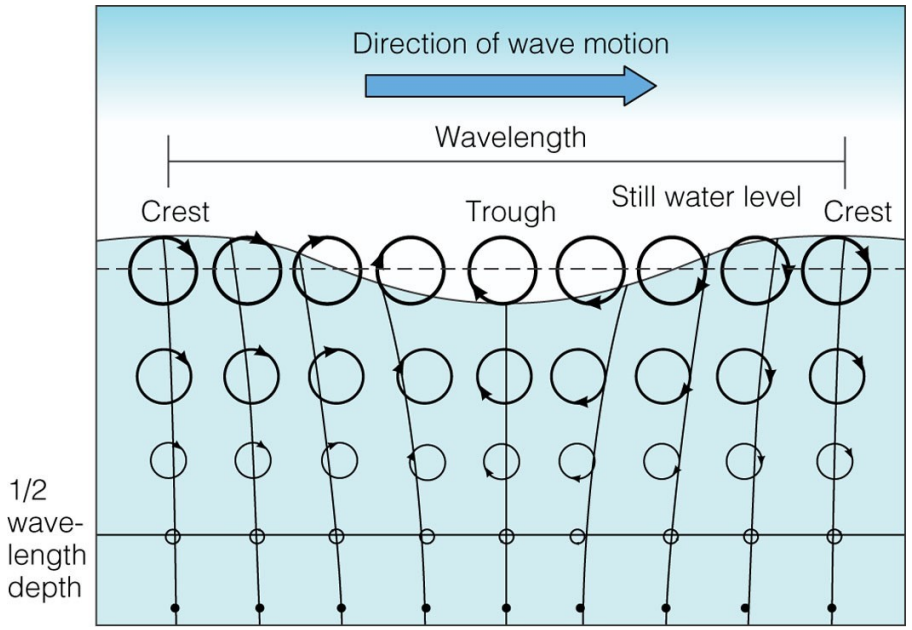


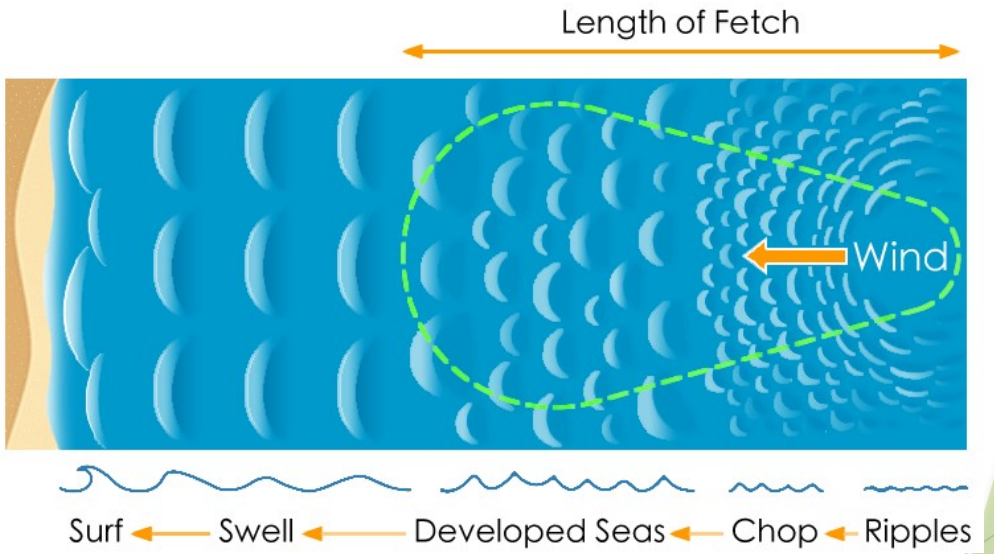


- Fetch: is the length of water over which a given wind has blown without obstruction
- Wave high depends on
  - wind speed
  - length of the fetch
  - And duration the wind blows

Wave Movement

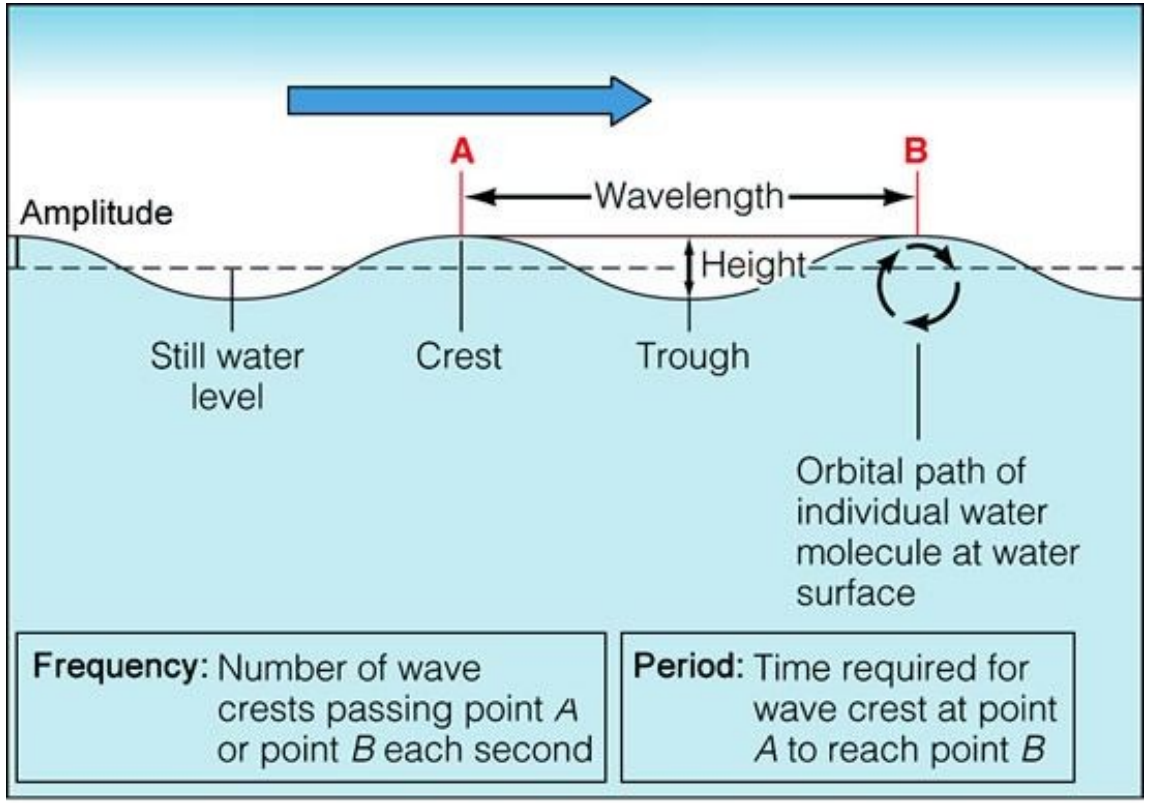
- There is common opinion that waves are made by the movement of water from one place to another. This is a wrong assumption.
- The water molecules do not travel from one place to another but use a medium at it's disposal, like radiowaves through the air. Through water, energy travels as waves:





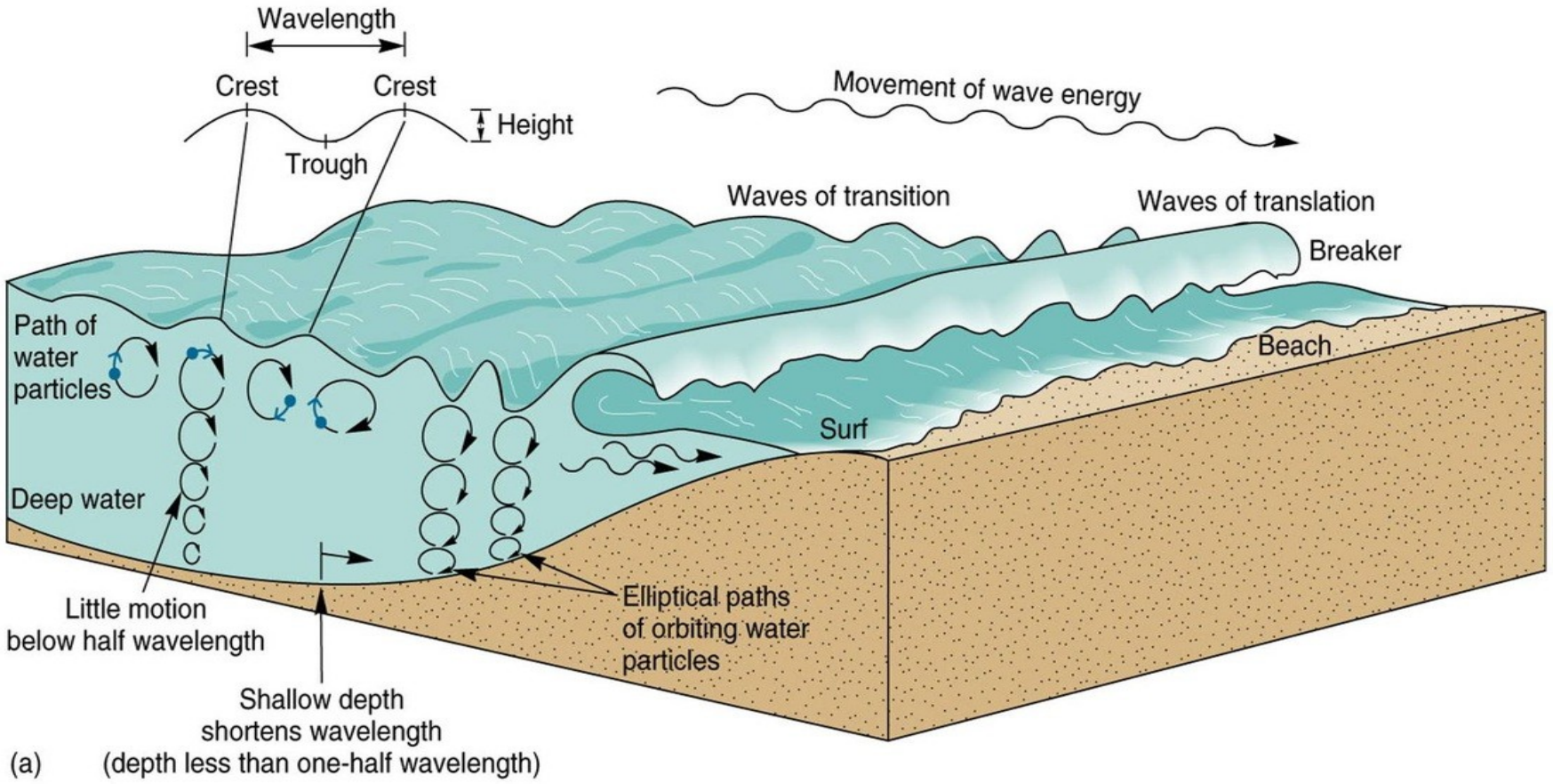
Wave Length & Height

- Length of wave: Period (Sec) – time required for wave crest to next wave crest
- Height of wave: in feet / meter – difference in feet between Crest and Trough
- Amplitude: in feet / meter - difference between calm sea level and crest



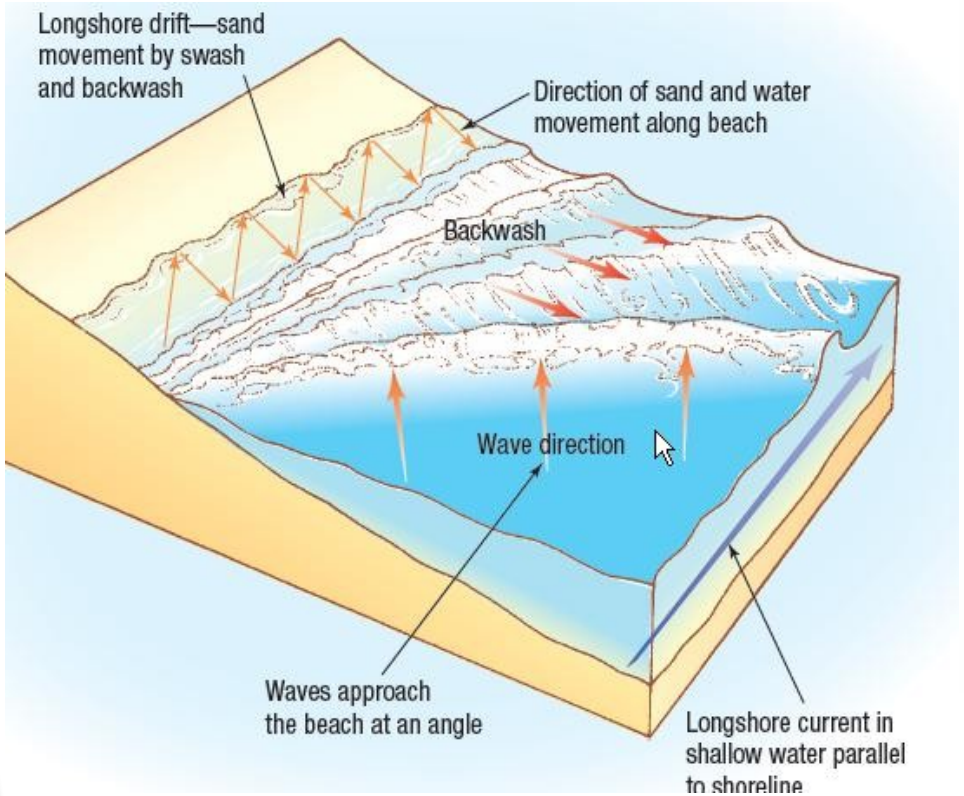
Waves reaching shallow water & coasts

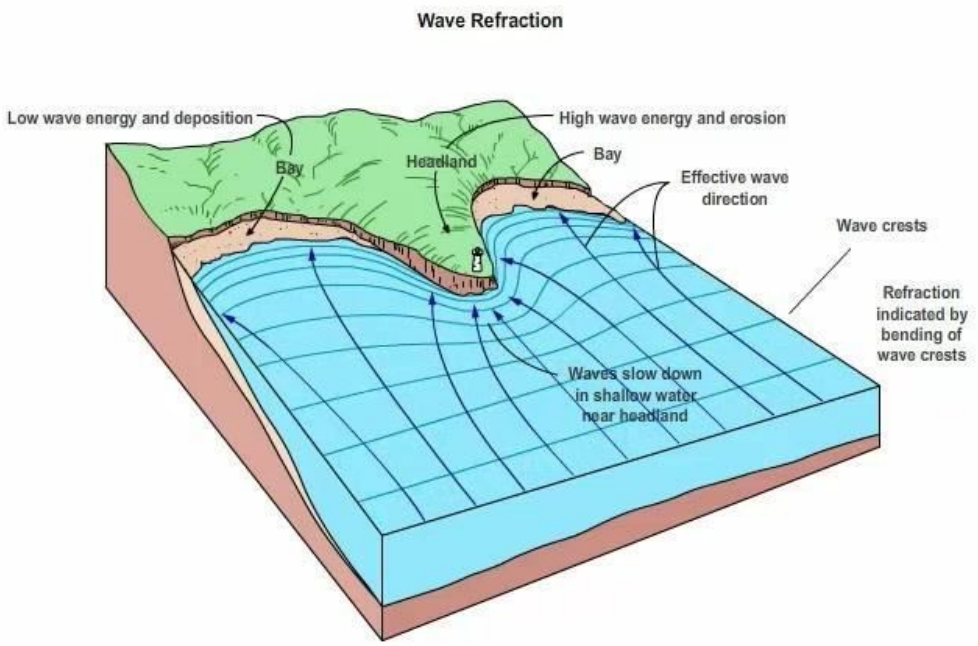
- Motion of orbiting water is flattened
  - Wave Heights increase
  - Wave Periods decrease
  - Wave Speed decreases



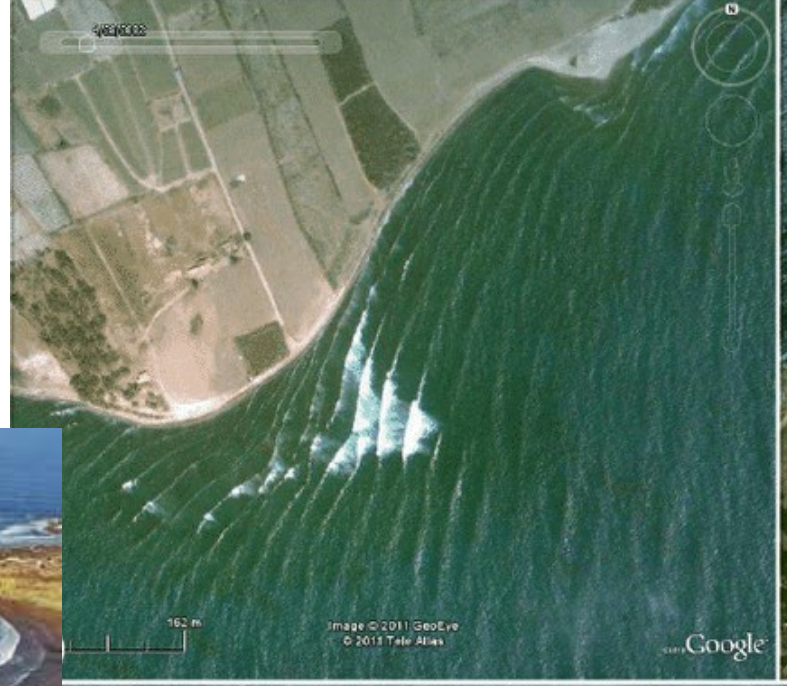
Waves Reflection & Refraction

- Wave refraction (longer period of wave - more refraction)
- Wave reflection & drift



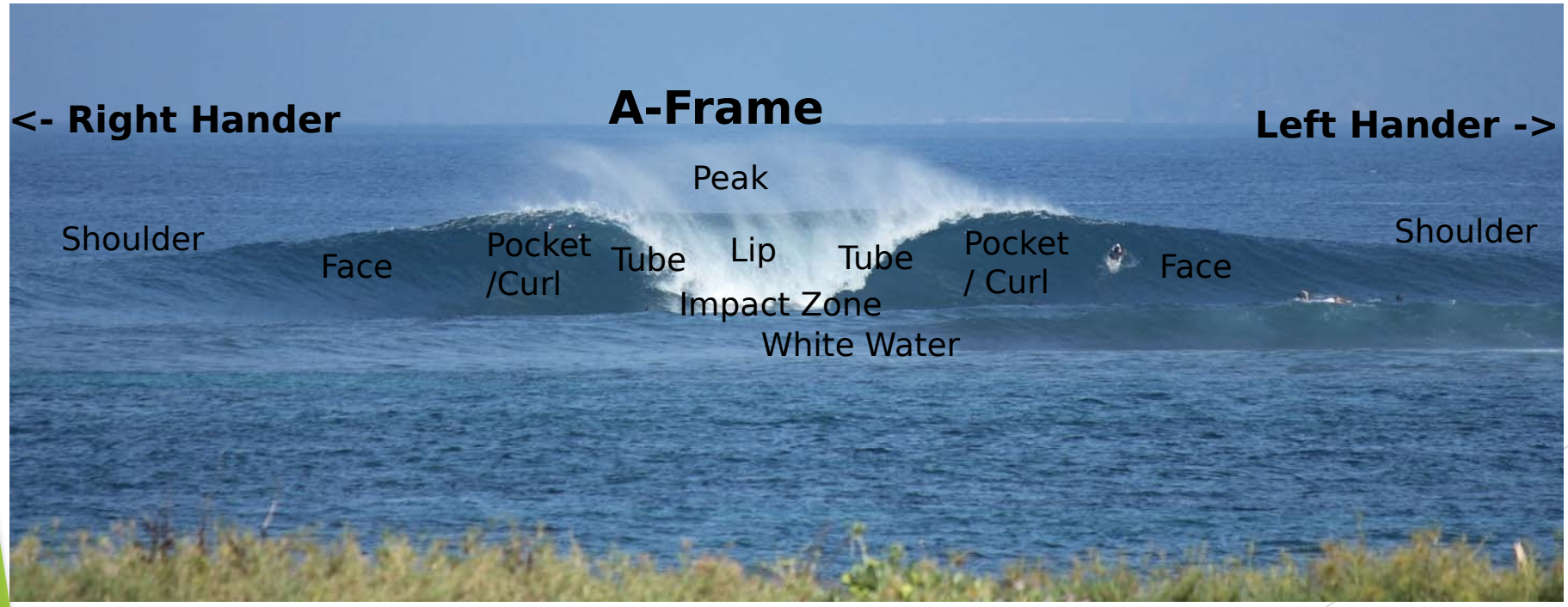


Wave Reflection & Refraction Exemples



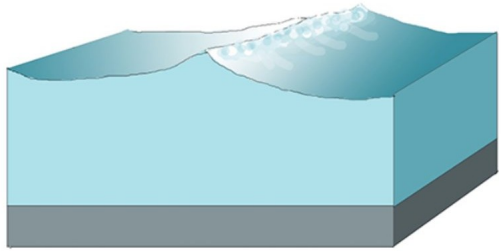
Breaking Wave

- General rule of thumb: wave breaks if
  wave height / water depth > 0,78
  - 1m high Wave breaks around 1,3m Water depth

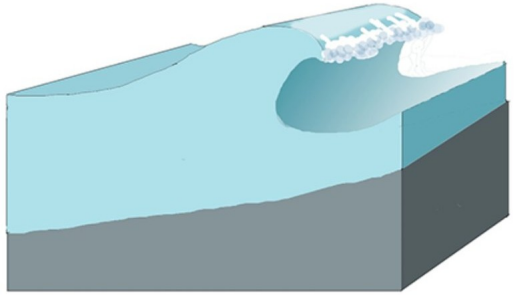


Breaking Wave Types

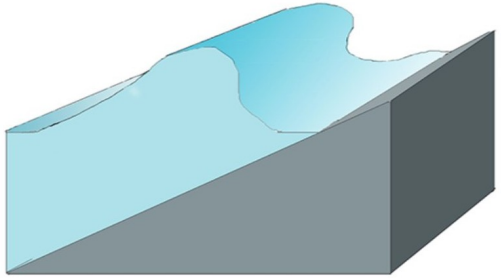
- Spilling wave: low power, gentle slope



- Plunging wave: high power, steeper slope

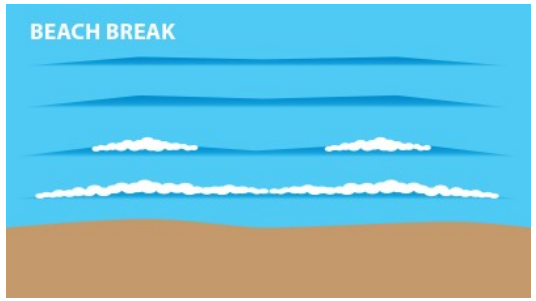


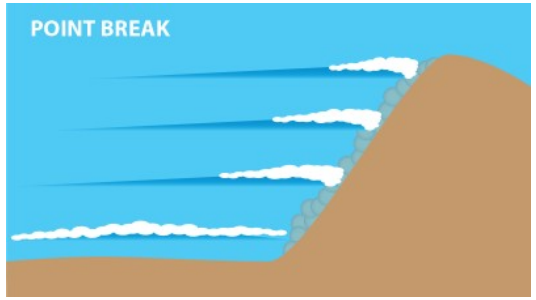
- Surging wave: tidal waves, Tsunami waves, steepest slope

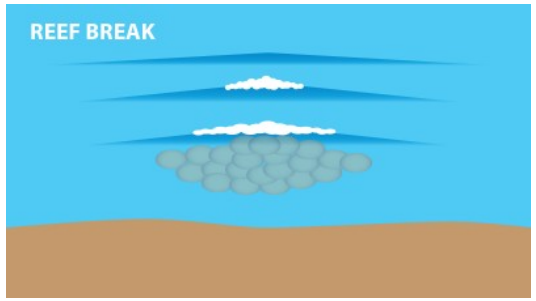


Grounds – Type of Breaks

- Beach break: wave breaks on sandy bottom (shape of bottom changes)
- Point break: wave breaks along the shoreline of a headland
- Reef break: wave breaks on rocky bottom (shape of bottom remains consistent)

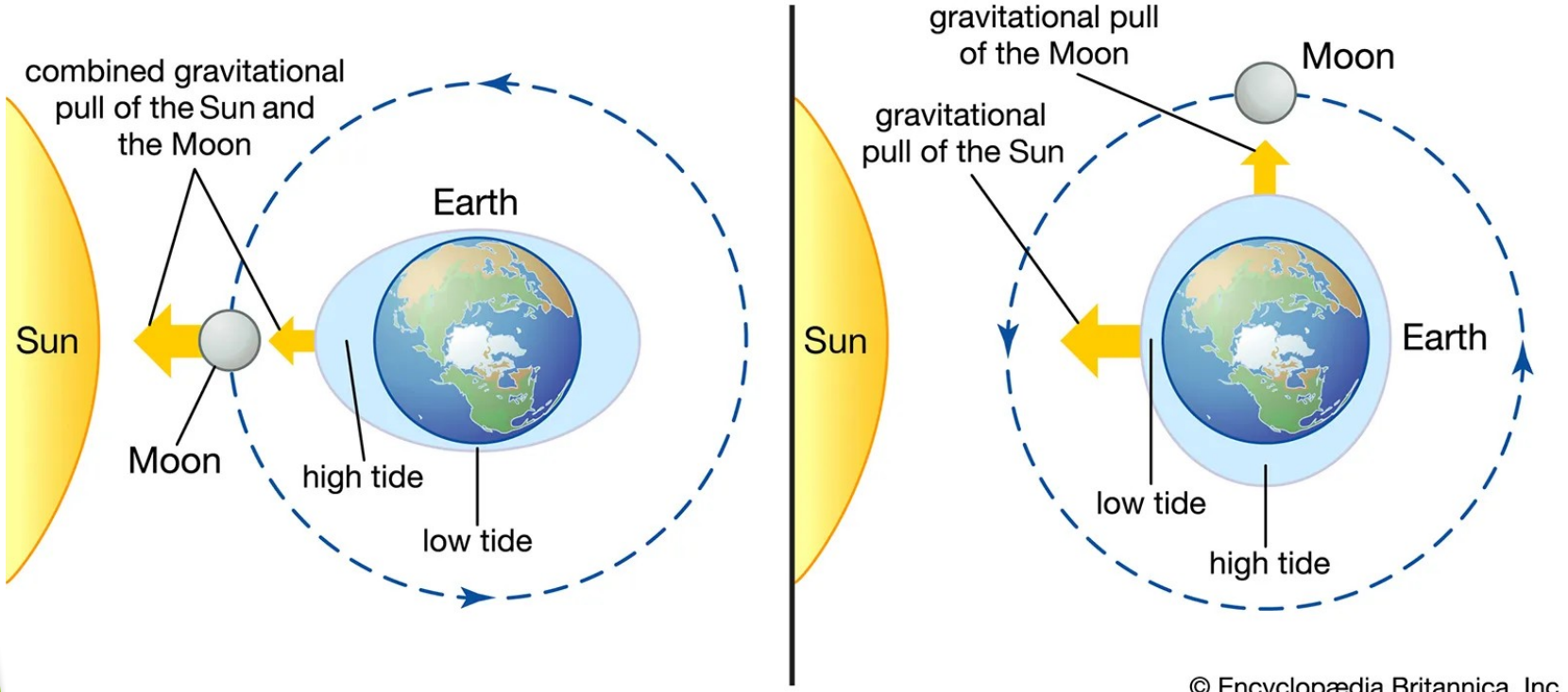






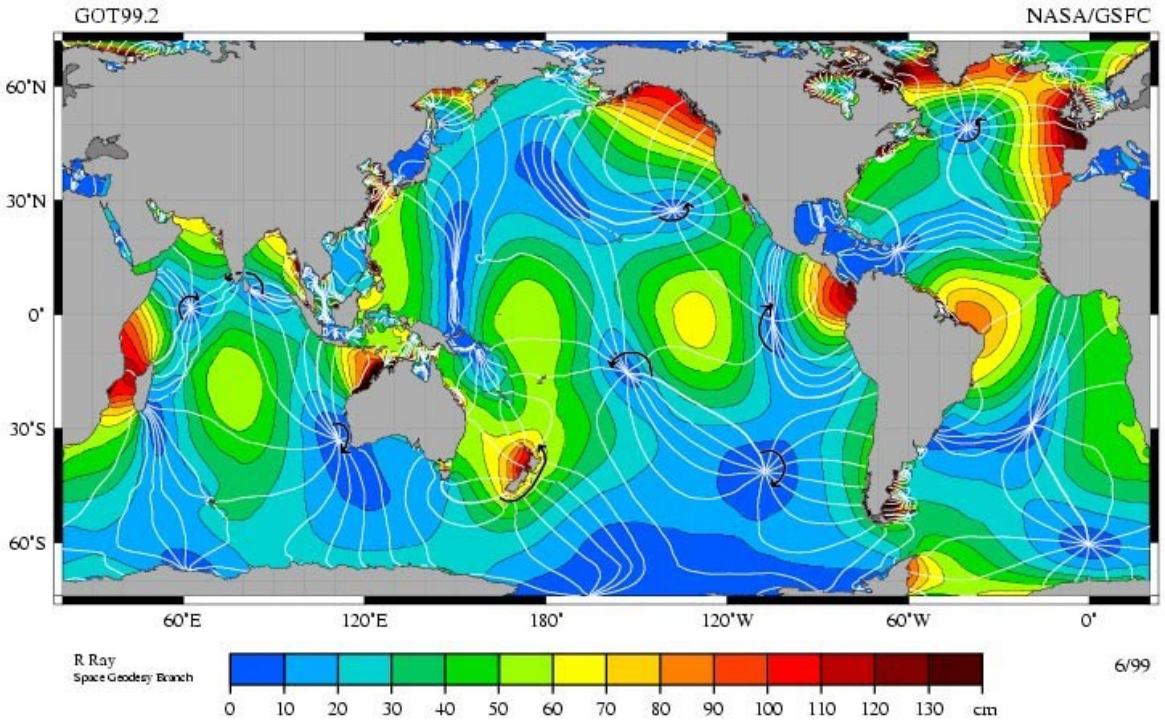
Tides

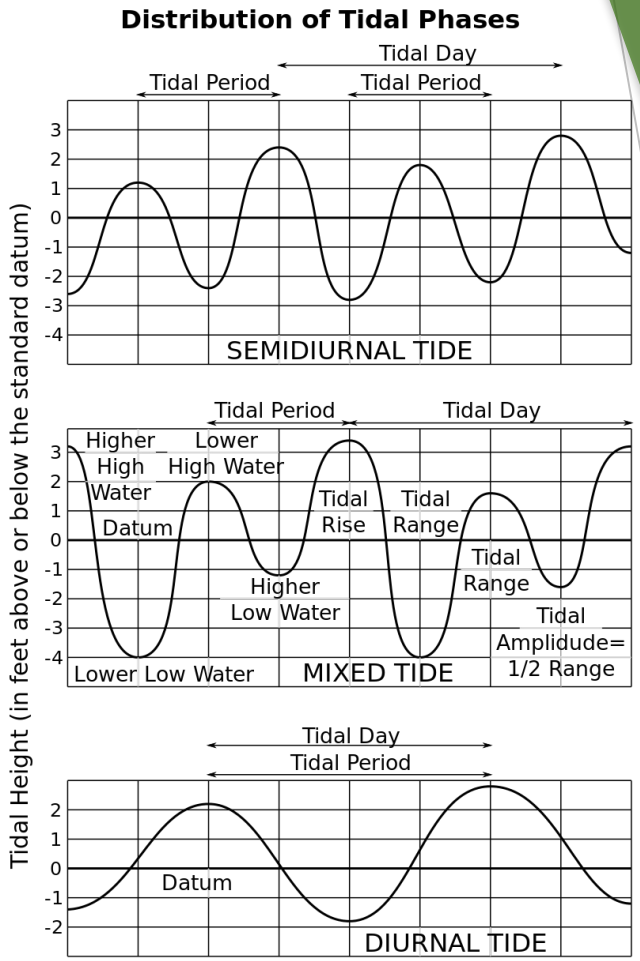
- Constant fall and rise of sea level caused by following forces
  - Gravity of Moon
  - Gravity of Sun
  - Centrifugal force (rotation of Earth) vs gravity of Earth

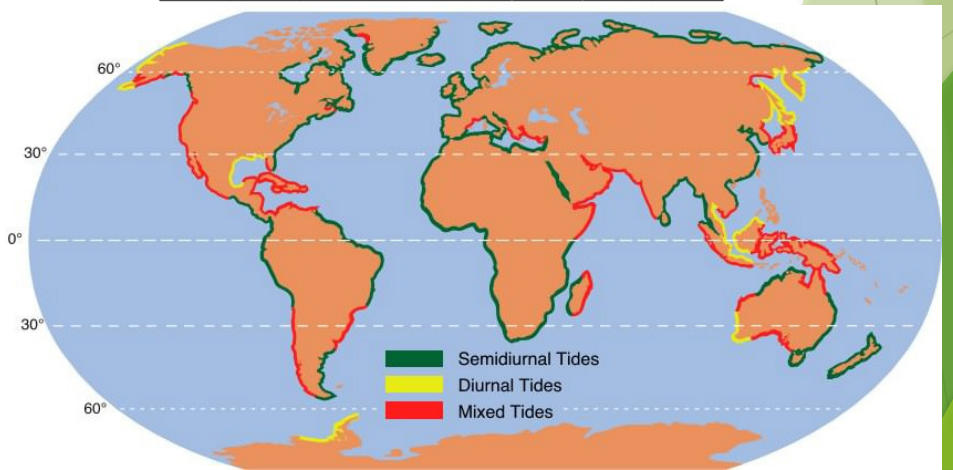


Tides

- Tides vary
  - on location
  - In tidal range (difference between High and Low Water)
  - In Distribution of Tidal Phases (High Water, Low Water)
    - At steep shores with deep water -> lower tidal change
- Tides effect on Surf and rips
- In Portugal: Semidurnal – 6h25 min between high/low

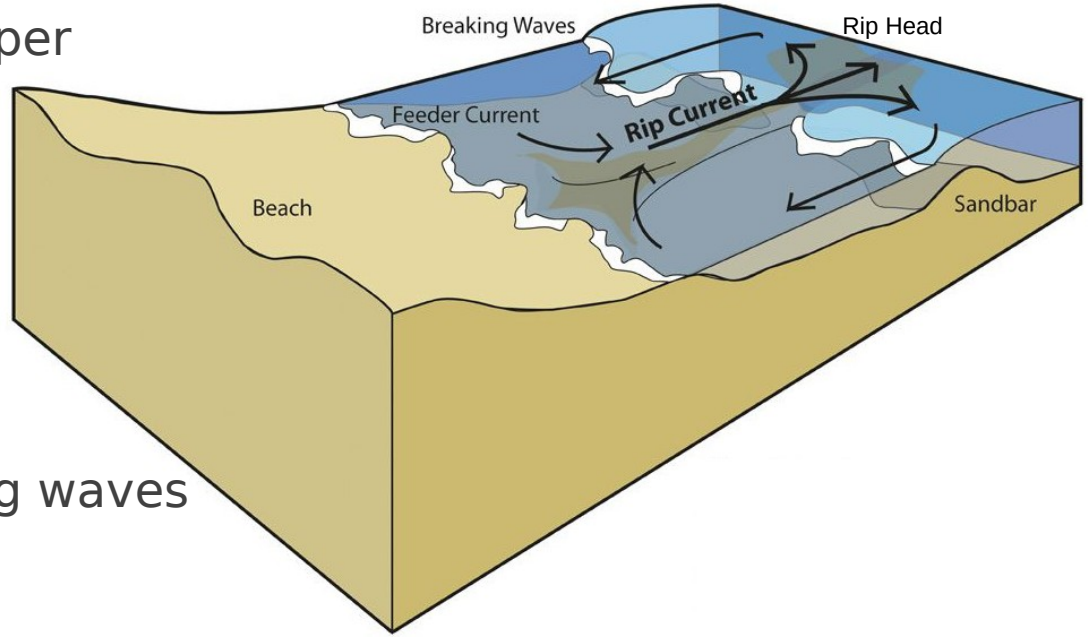




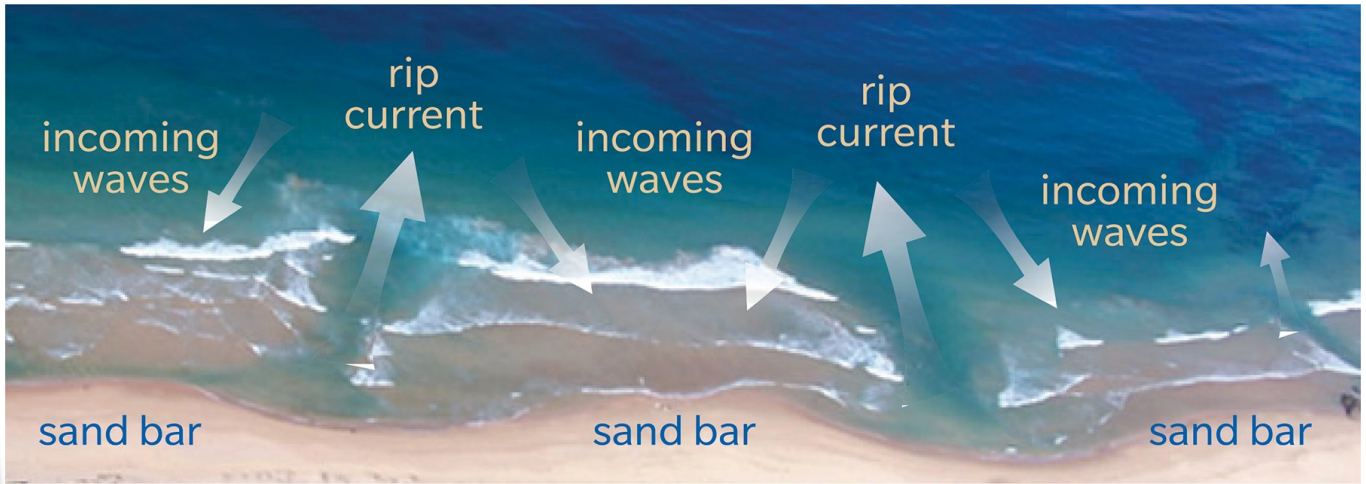


Currents

- In shallow water shoreward breaking waves transport water to beach
- Rips transports water back to deeper water



- Use Rip Current to reach line-up
- Do not paddle against Rip Current
- Escape Rip Current: paddle 90° to Rip Current in direction of breaking waves



Rip Currents

- How to detect:

  Usually no or lesser waves breaking in rips

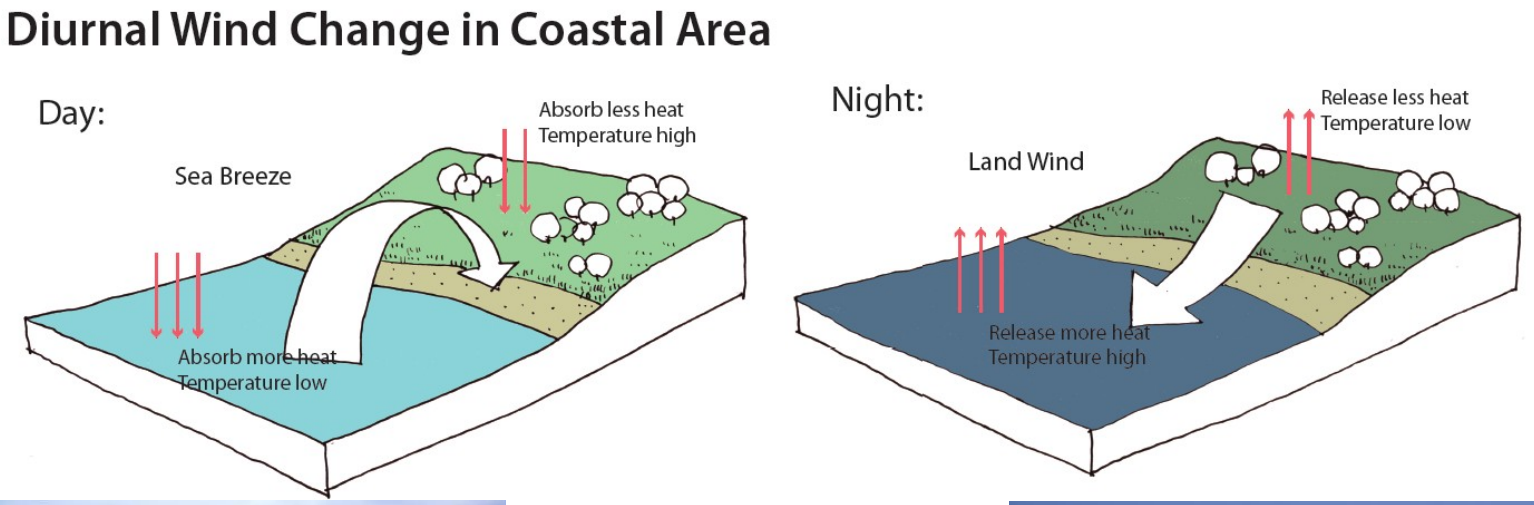
  the sand being stirred up from the bottom

  The surface of the water may be choppier or rougher, which is created by the incoming and outgoing flows of water colliding.

  The movement of foam, driftwood and other surfers paddling out

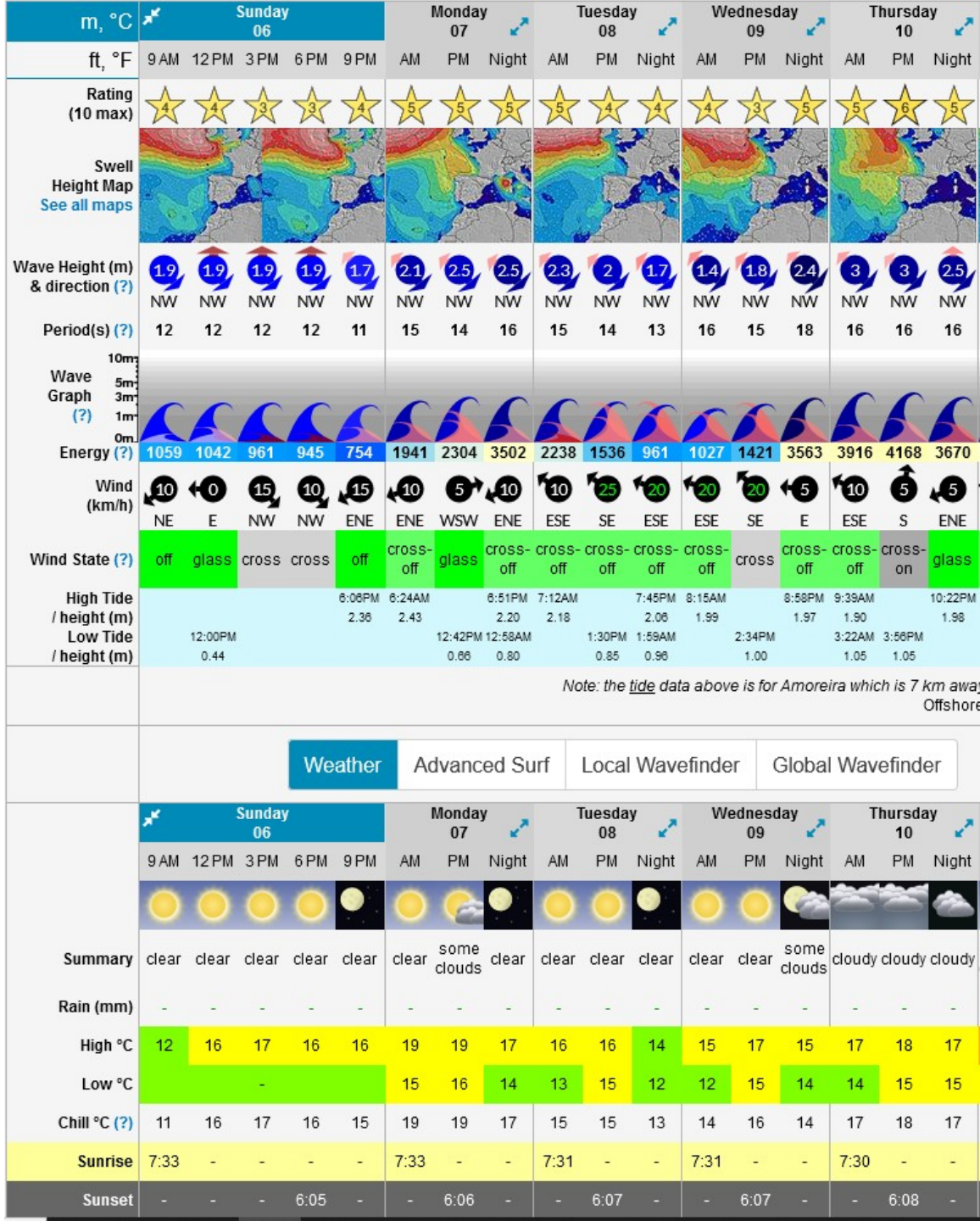
Local wind at coasts

- Onshore: Sea Breeze - Wind blows from sea to coast – choppy waves
- Offshore: Land Wind – Wind blows from land to sea – delay breaking of waves, clean setting – mostly perfect surf
- sideshore, glassy (lack of wind)



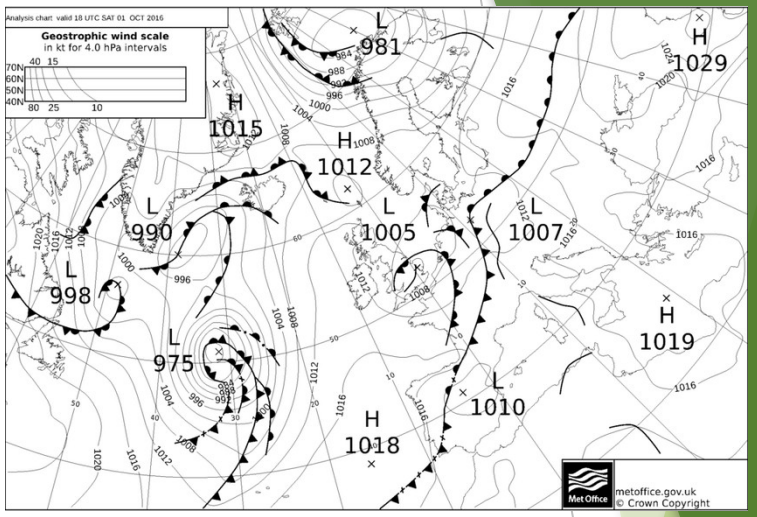
Surf Forcast

- Surf Forcast Websites:
  - https://www.surfline.com/
  - https://www.surf-forecast.com/
  - https://de.magicseaweed.com/
- Provide for certain surf spots and time predicted wave and weather conditions
  - Wave Height, Period and Direction (Energy and informations of second swell)
  - Wind Speed and Direction (and Wind State)
  - Time and Height of Low and High Tides
  - Other Information:
    - Time of Sunrise and Sunset
    - High and Low Temperature
    - Cloud Coverage
    - Rainfall
- Based on Buoy data and Weather models

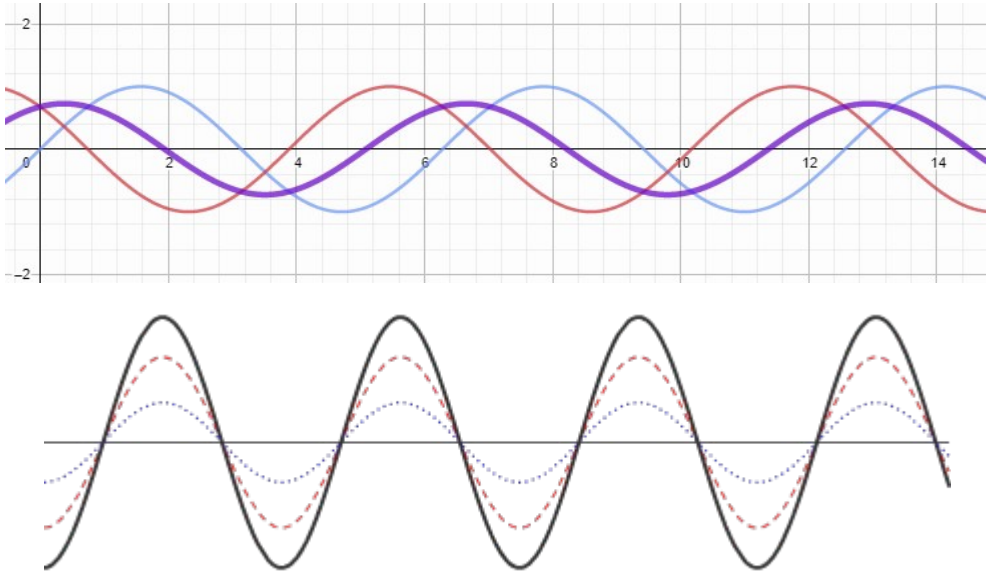


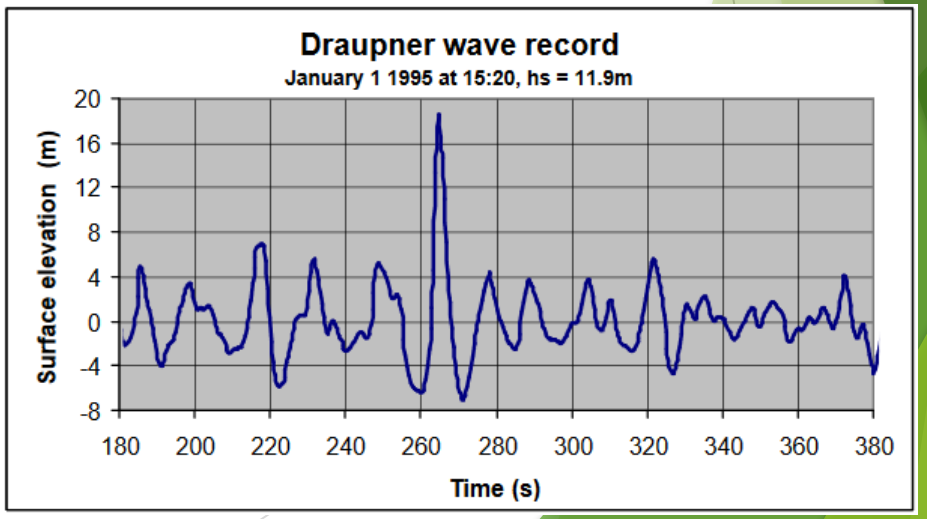
Model Waves vs. Natural Waves

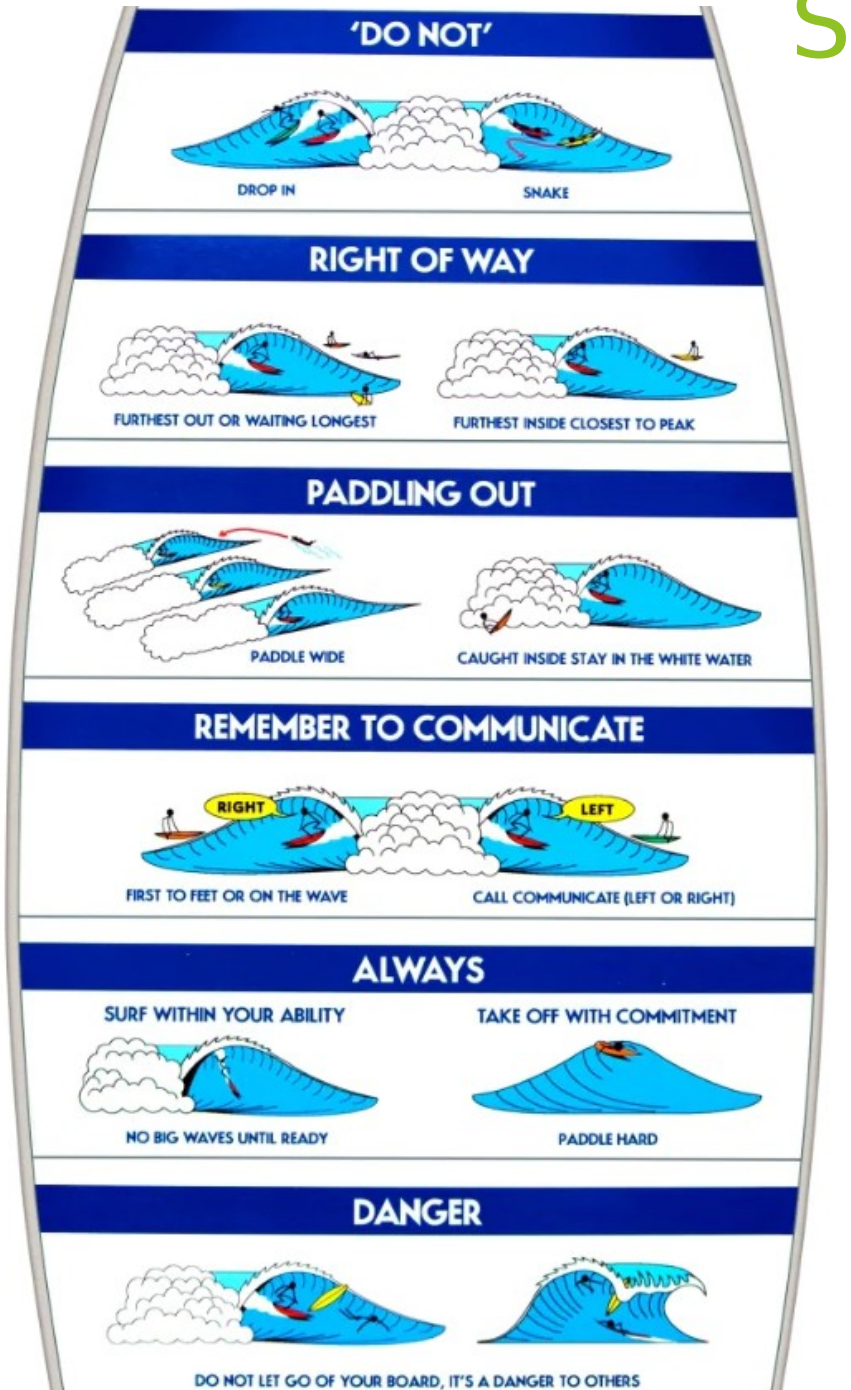
- Different height, periods, directions and speed
- 2 or more wave overlay each other at certain time &
- Freaky Waves / Monster Waves



- Example: 2 Waves (red, blue) – same Height, Period and Direction, but different speed
  purple: sum of both (freak/monster/rogue wave):







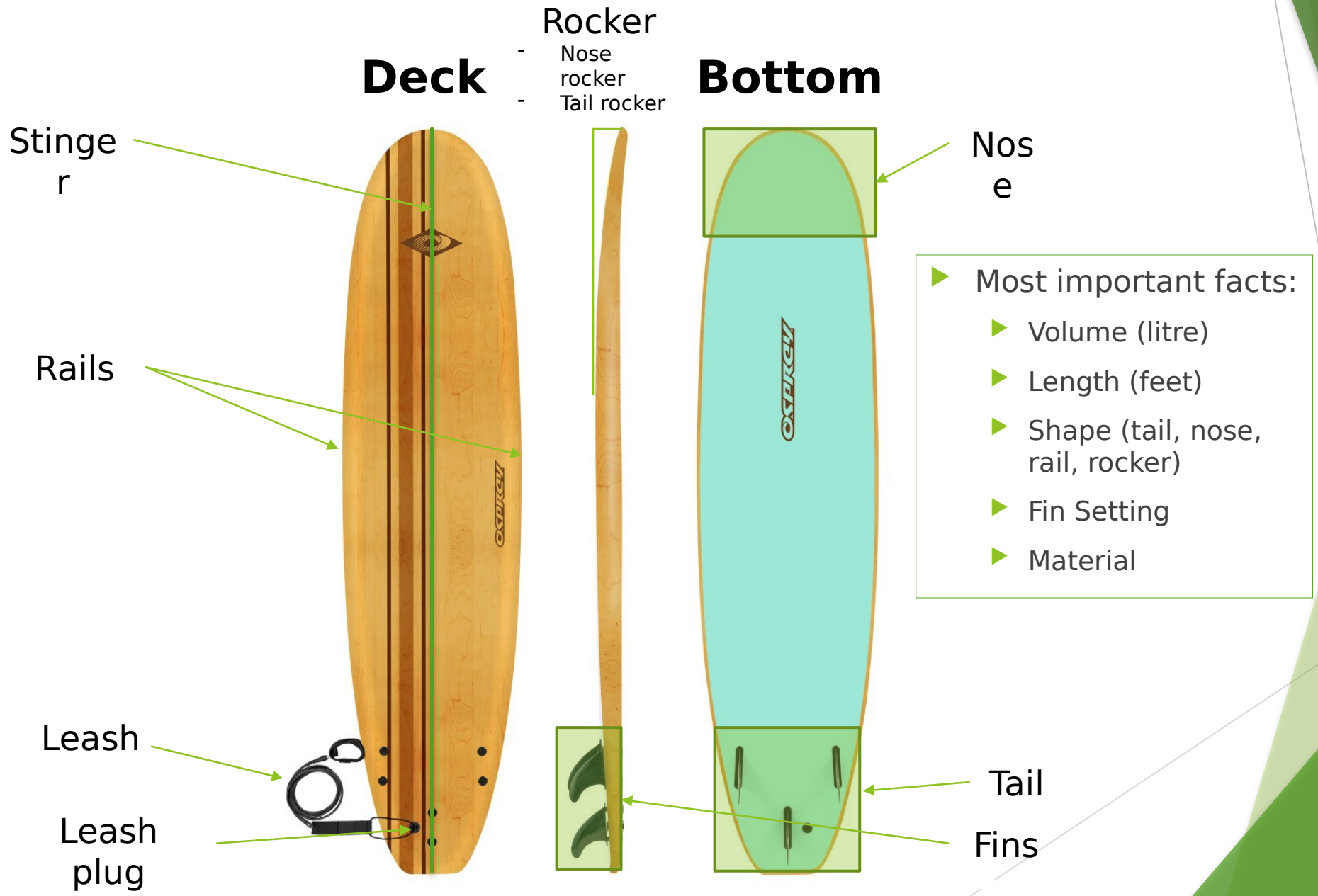
Surfer's Code

- Do not Drop in and do not snake
- Right of Way – First:
  - Furthest out or waiting longest
  - Furthest inside - closest to peak
- Paddling out:
  - Paddle wide
  - Caught inside – stay inside the white water
- Communicate: First to Feet or on the Wave call left or right
- Always Surf within your Abilities
- Take off with Commitment
- Do not let go of your Board

Surf Etiquette

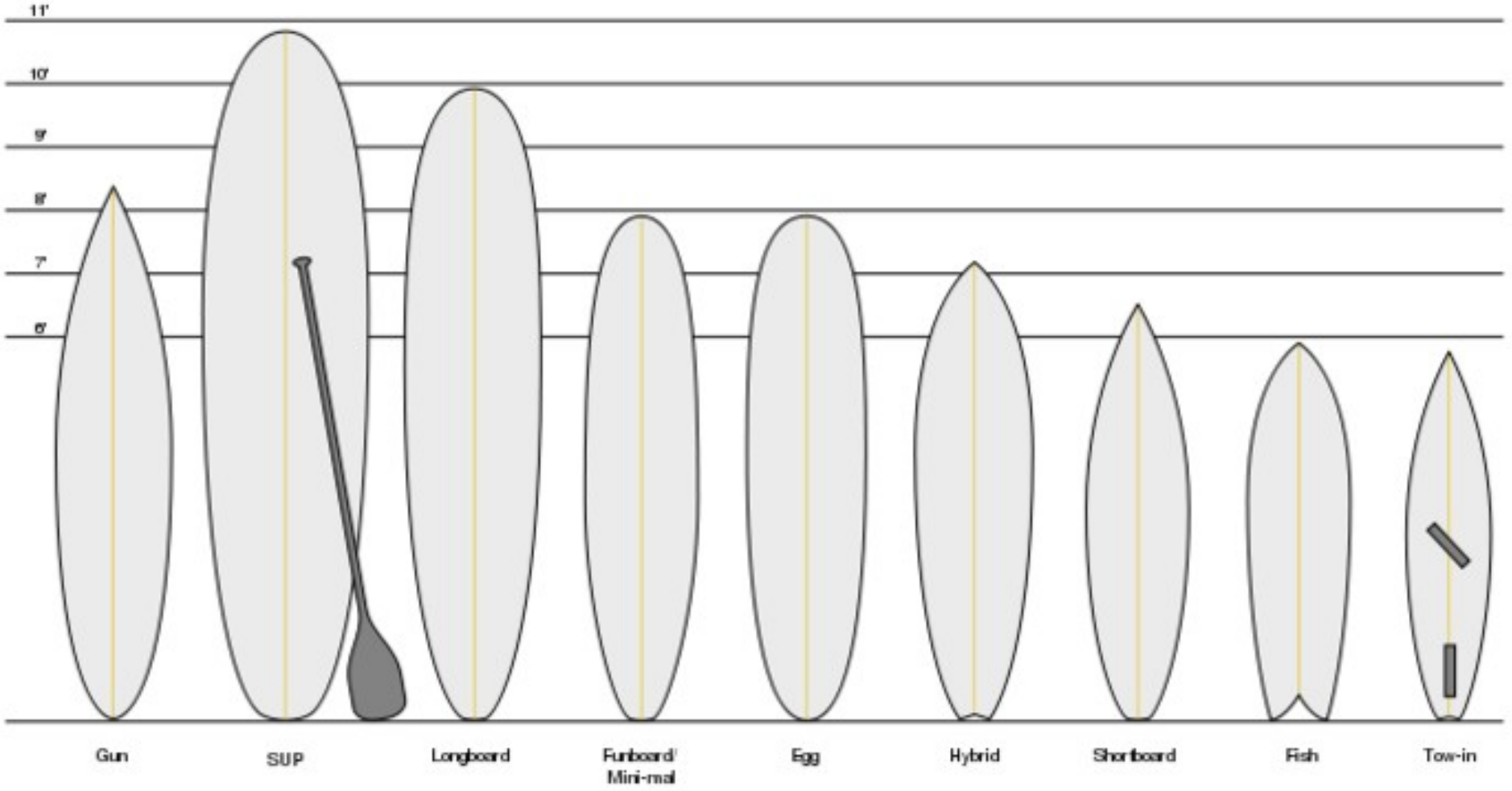
- Give Swimmers always way
- Show respect to locals
- Do not be a wave hog
- Respect and protect nature

Board parts



- Most important facts:
  - Volume (litre)
  - Length (feet)
  - Shape (tail, nose, rail, rocker)
  - Fin Setting
  - Material

Surf Board Types



- Different board shapes

Surf Board Types

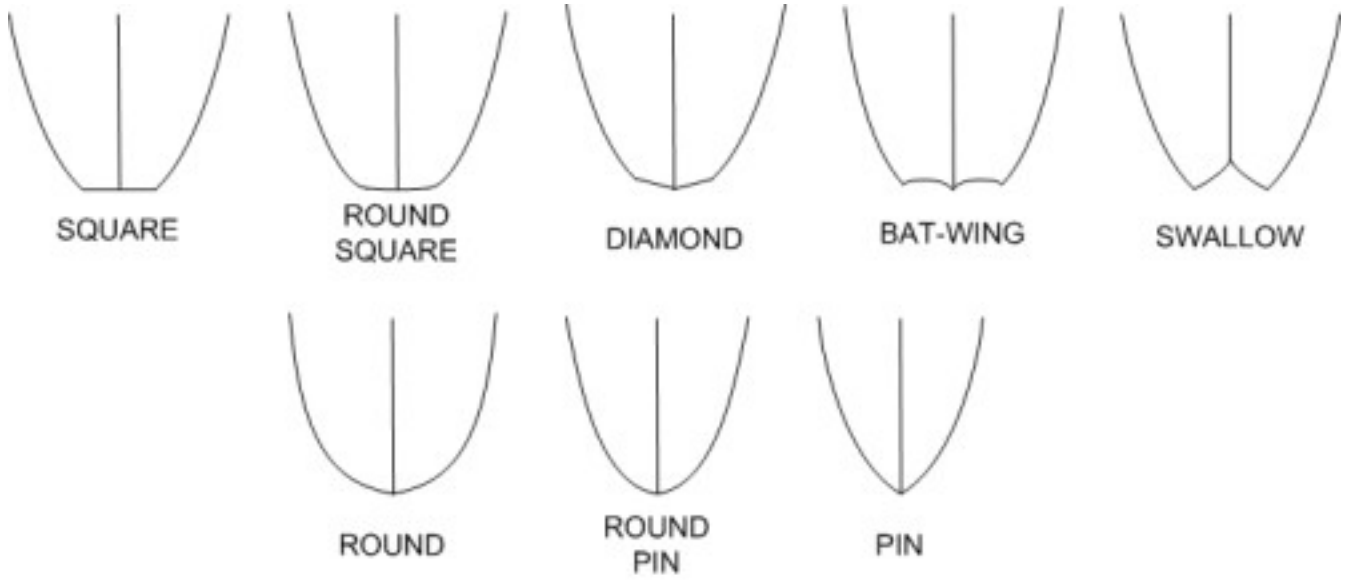
SHORTBOARD

FISH

LONGBOARD

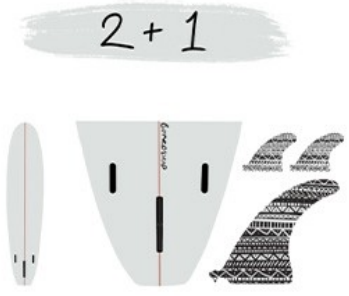
Type	Shortboard	Fish	Longboard	Funboard, M Malibu	Gun
Length	5'-7'	5'-6'6"	9'+	6.5'-9'	7'-11.5'
Volume	Very low	Low	Very High	High/medium	low
Shape	Pointed nose, thruster	Swallow tail	often single fin	Smaller longboard shape	Pointed nose, similar but longer than shortboard
Wave type	Large range, better on stronger/higher waves	Large range	Best on small waves (under head high)		Very big waves
Advantages	Radical maneuveurs	Stable even on bad conditions	Wave catcher	Perfect beginner board Wave catcher	Stable on high speed
Disadvantages	Hard to catch waves	Lower maneuvrability	low maneuvrability	lower maneuvrability	Hard to catch waves

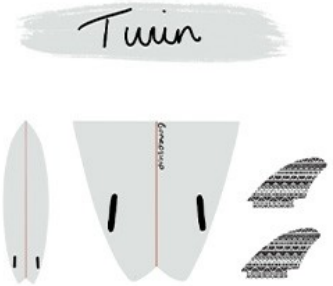
Surf Board Properties – Tail Shapes

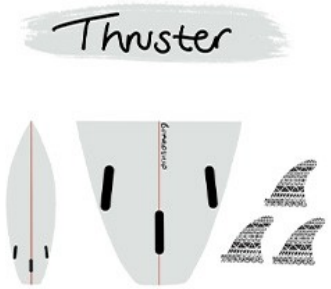


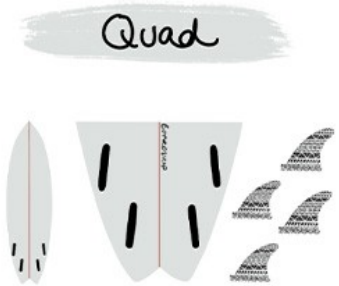
Tail Shapes	Characteristics
Square	Less hold in steeper waves, easy to turn and to generate speed because of more volume
Round	Between Square and Pin
Pin	Better hold in steeper waves, harder to turn
Swallow (fish)	Easy to speed up and better hold

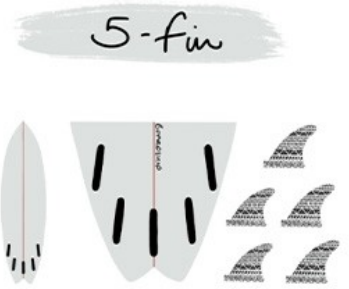
Surf Board Properties - Fin setting





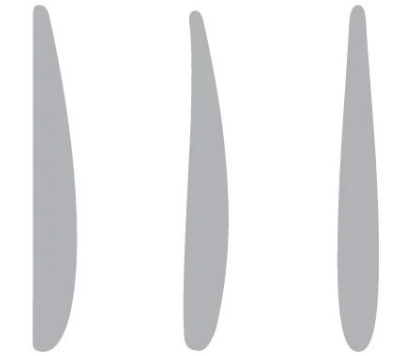






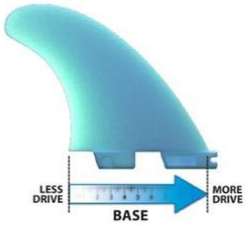
Fin Settings	Characteristics	Best on conditions
Single Fin	+ Less drag, more speed + great for smooth, slow turns - Hard for quick, sharp turns	Small-medium waves Bigger weaker waves
Twin	+ provides good speed + more stable than single fin + high manoevrability - Can Feel loose on steeper waves	Small-medium waves
Thruster	+ very high stability & manoveurability - Slower than Single/Twin (middle fin drags most)	All conditions
Quad	+ faster than Thruster + better control in steeper waves - Can feel bit loose	Powerful, clean conditions

Surf Board Properties - More about fins



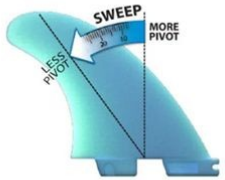
FLEX

A FLEXIER FIN WILL PROVIDE A SKATIER FEEL ON MORE PLAYFUL WAVES, BUT A STIFF FIN IS IDEAL IN FASTER MORE HALLOW WAVES.



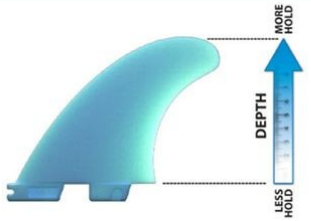
BASE

LONGER FIN BASES CREATE TRAJECTO-RIES FOR WATER TO GO PAST (FASTER RIDE). FOR SHARP TURN CHOOSE SMALLER FIN BASES.



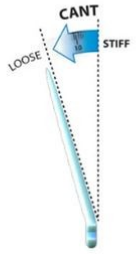
SWEEP

FINS WITH MORE SWEEP OR RAKE GIVES A LONGER TURNING ARC, LESS SWEEP OFFERS A TIGHTER TURNING ARC.



DEPTH

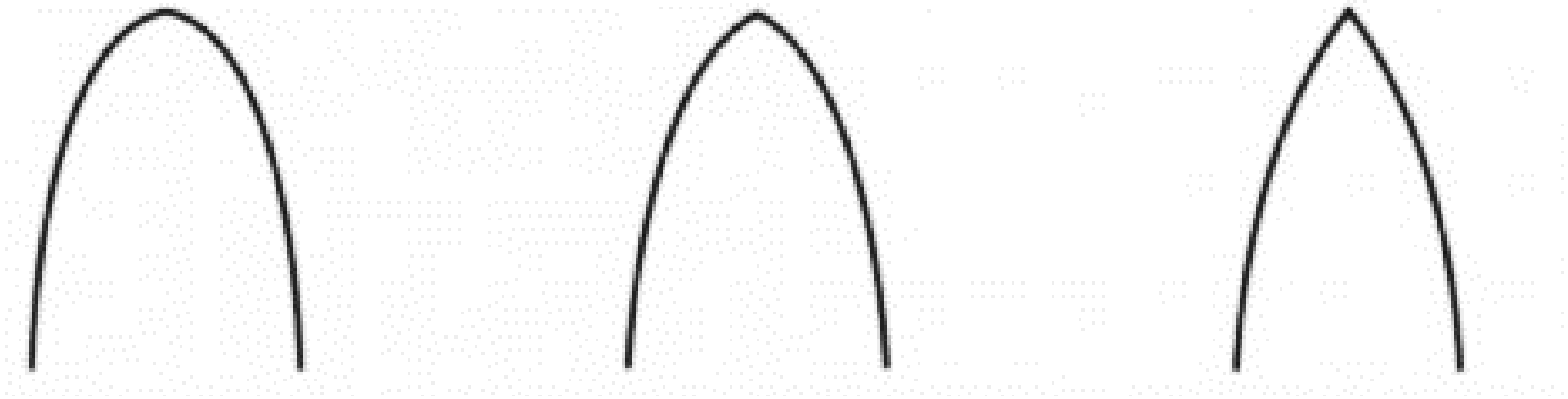
MORE DEPTH THE MORE HOLD, THE SHORTER THE DEPTH THE MORE A BOARD WILL SLIDE AND RELEASE.



CANT

LESS CANT FINS GIVE YOU MORE ACCEL-ERATION. MORE CANT FINS GIVE YOU MANEUVERABILITY.

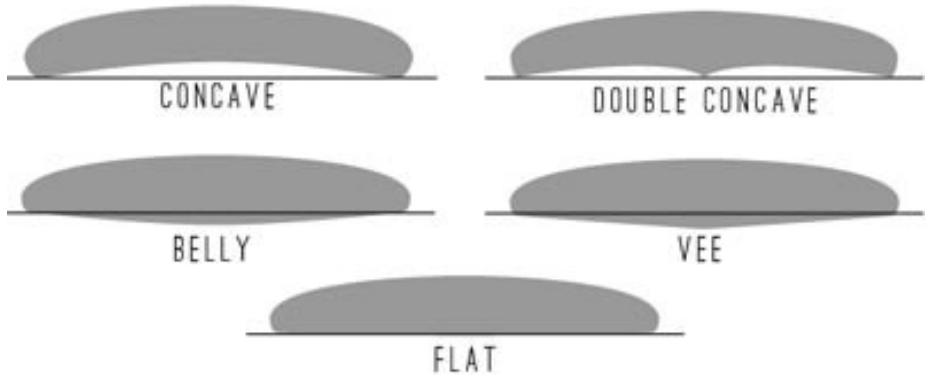
Surf Board Properties – Nose shapes



Rounded Nose ⟷ **Pointed Nose**

	Characteristics
Rounded Nose	+ more buoyancy and lift, + increase paddling speed + easier to stand forward on the board (nose riding) - Less maneuverable
Rounded Point Nose	*in between Rounded and Pointed Nose*
Pointed Nose	+ more maneuverable and responsive at rail turns - less bouyancy and lift - reduced paddling speed - bogging at lower speeds

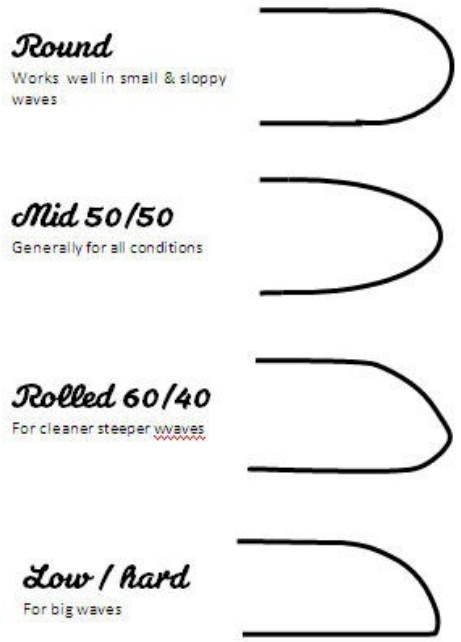
Surf Board Properties – Bottom Shapes



Bottom shapes	Characteristics
Flat	+ Provides Speed and easier to glide - harder to turn & easy to slide off during bottom turn -> Best for small, weak, mushy conditions
Belly / Vee	+ Easier to control and turn from rail to rail very responsivly - Water escapes on each side of the rail – slows you down -> best for fast waves
Concave / Double Concave	+ provides speed, lift and acceleration + rails „dig“ into water – controlled tight turns - Difficult to ajust turns as rails get sticky -> Best for clean, good conditions

Surf Board Properties - Rails

Rail Shapes	
Soft	+ more stability & buoyancy because of more volume + more speed
Hard	+ more hold and control on powerful waves + increased Turnability



Rail Foil	Characteristics
50/50	+ increased buoyancy and stability
60/40	*in between*
80/20	+ great hold on steep waves + high agility - Not forgiving ;-)

Surf Board Material

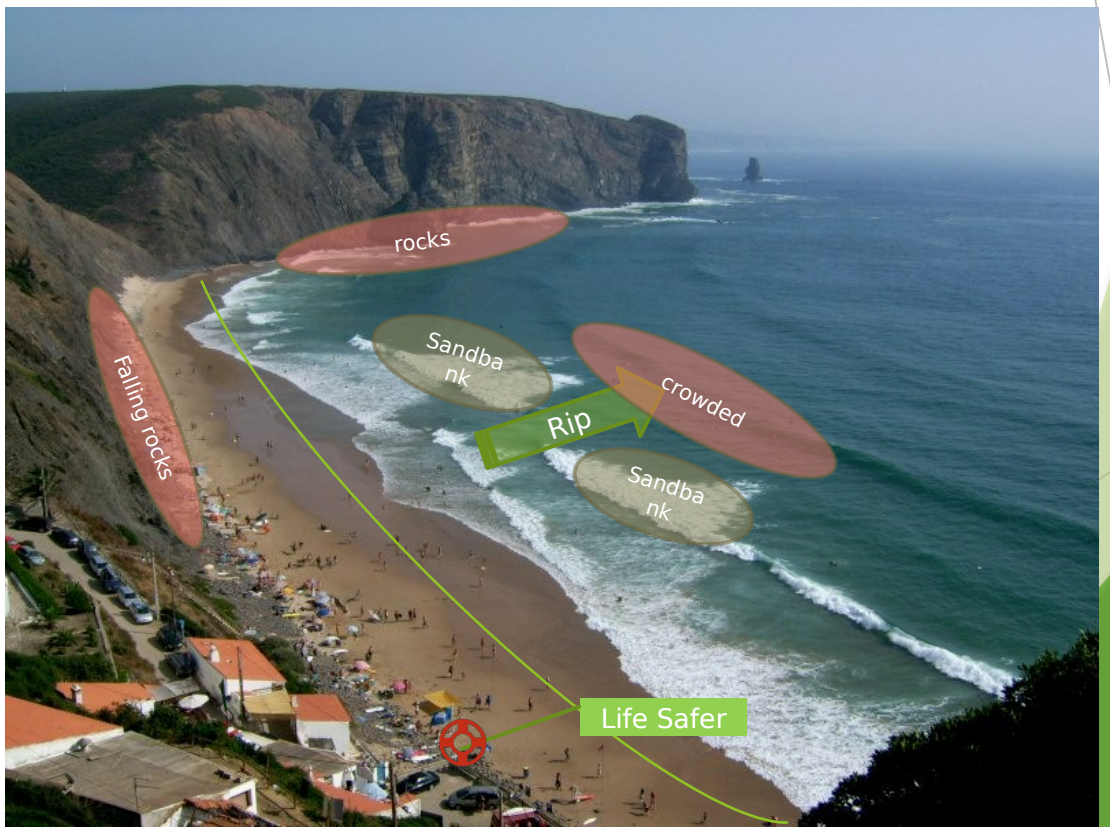
- interior is made of foam
- Stinger (wood) gives stability

	Polyester	Epoxy (EPS:Expanded polystyrene)
Characteristics	• more practical and economical than epoxy resin. In the manufacturing process cheaper • less floatability	• 90% of its volume is occupied by oxygen light weight (15-30% more floatability) • More ecological in manufacturing process • more resistant material • more flexibility and response

Spotcheck

Always check your spot before surf

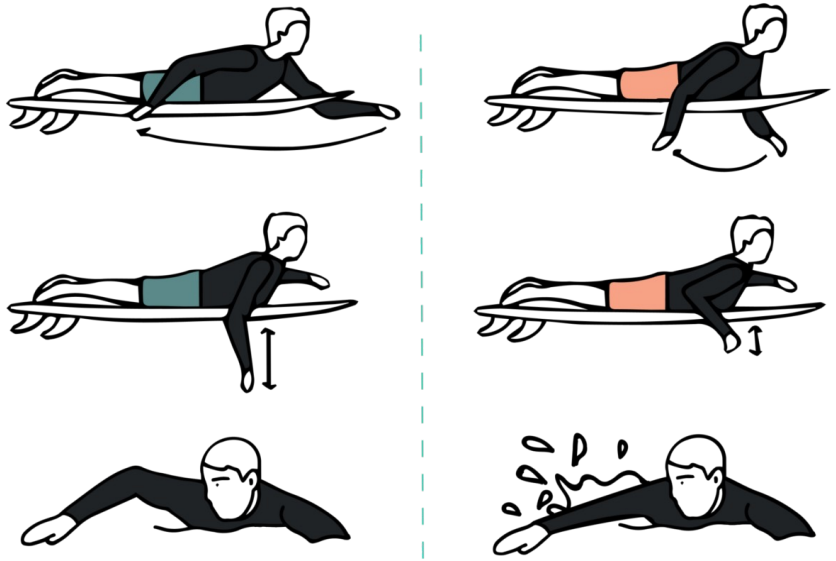
1. Tides: spotcheck during low tide!
2. Ground (beachbreak, reef, point)
3. Rip currents & breaks
4. Other dangers (crowd, falling rocks)
5. Emergency (life safer, flag, access, next Hospital)

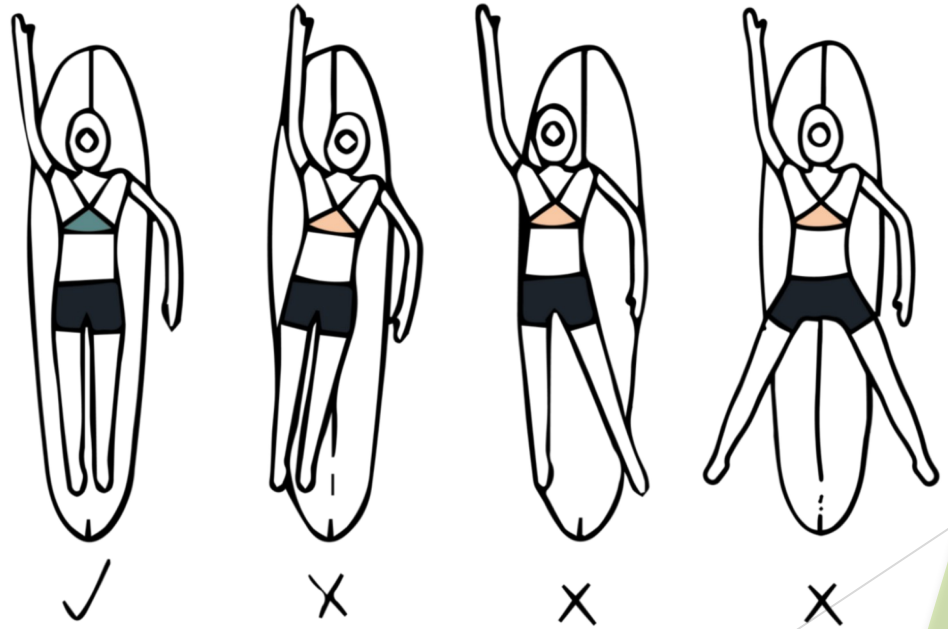


Paddling Basic Position

- Paddling = long strokes
- neutral hand
- elbow into the water
- from the middle push strong till the end
- paddle right, then left, not at the same time

Situation	Paddle form
Paddle out	brisk, powerful and continuous that you can maintain for a couple of minutes without effort
Positioning in the line-up	Slow, relaxed paddling
Maneuveaurs (turtle roll, pop up, …)	fast, powerful paddling that can be sustained for up to 1 minute



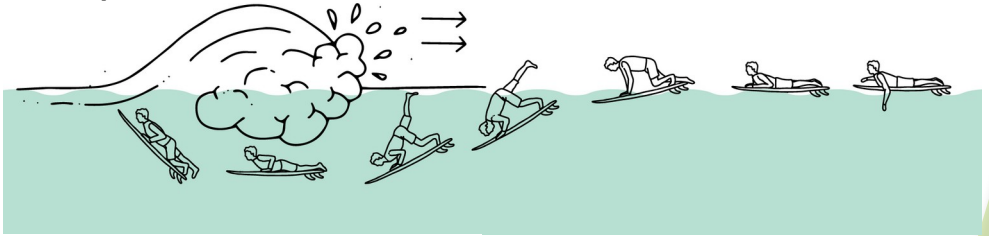


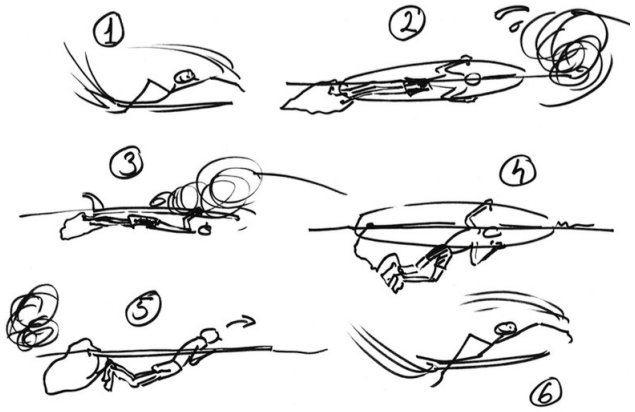
Basic Board Techniques

- Turn your board = sit/weight to tail – nose comes out of the water, rotate feet and paddle with arms to turn
- Emergency brake = sit back, grab the rail and pull the board to your body, maybe a bit angled

Basic Paddle Out Techniques

- White water dive = paddle hard, lay on the board, weight to the front when white water approaches ~1m, after passing … paddling),
  Alternative: cat position for little higher waves
- Turtle roll = paddle hard straight towards breaking wave, 1,5m before the wave, grab the nose, turn the board upside down, elbows on the board and pull the board to your head, one foot to the deck – after wave passed, turn your board upside and pull yourself sideways onto the board with your arms, and continue paddling
- Duck Dive (boards with less volume) = paddle hard straight towards breaking wave, shortly before arriving the wave, hard push on the nose of the board
- No Chicken Dive!





Pop Up/Take off and Positioning

- 3-steps Take off:

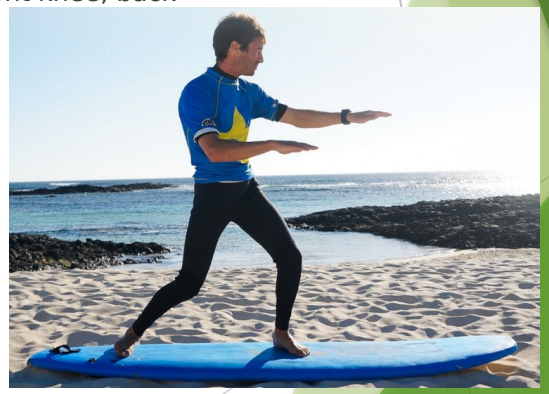
1. hands to the chest, fingertips show to the nose
2. Backfoot to the knee
3. Front foot between the hands, stand up low and
arms shoulder high, knee positioning!

- Common mistakes:
- Hands not at the chest, on the rail
- Heel not on the board
- Position and direction of feet
- Elbows low
-

- Alternative:

1. Jump Take Off (for sportive students) based on 3-step take off
2. Knee take off (for students with back issues): Front foot between the hands, stand up low and
arms shoulder high, knee positioning!
   - Hands to the chest, show to the nose
   - Stretch arms and increase your upper body, drag your feet to cat position on board
   - Step with front foot between your hands and stand up low, arms shoulder high, knee positioning!

- Positioning after Take off:
- Back foot 90° to stinger near finns
- Front foot around 45 ° to stinger
- Upper Body facing direction, chin in one line to front knee, back knee bend inside
- Low hips through deep squat
- Front arm shoulder high showing direction
- Back arm higher than shoulder



Basic Maneuver on the Wave

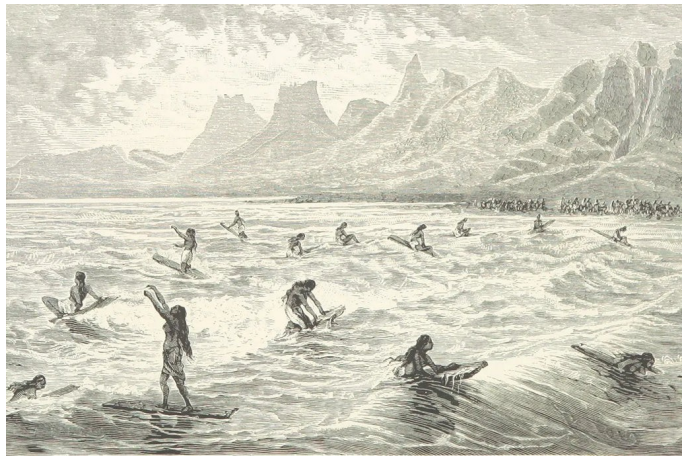
- **Bottom Turn**
  1. speed up from pop up to get as much speed as possible
  2. Reaching the wave trough bring weight to your back foot and look to the shoulder of the wave
  3. Get lower and turn you upper body to the shoulder and initiate giving pressure to the inner rail
  4. Going up the wave again, decompress and straighten your upper body

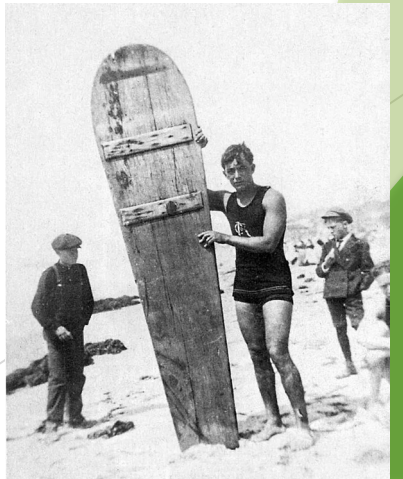
- Minor bottom turn/shallow bottom turn: are common on soft shoulder waves and are often followed with maneuvers like cutbacks and top turns. The minor bottom turn brings the surfer more diagonally to the shoulder/face of the wave.
- Major bottom turn/deep bottom turn: this turn is tighter than the minor bottom turn and is often used when the maneuvers are more advanced. Often followed by maneuvers like barrels, airs and snaps. he wave.

- **Top Turn**
  1. Aim for the shoulder of the wave weight mostly on backfoot
  2. As you coming up the wave, decompress, straighten your body
  3. When you are up ¾ of the wave, turn your head and look to wave trough, turn shoulders, arms and hands – hips and legs follow the rotation
  4. Going down the wave compress and bring weight forward

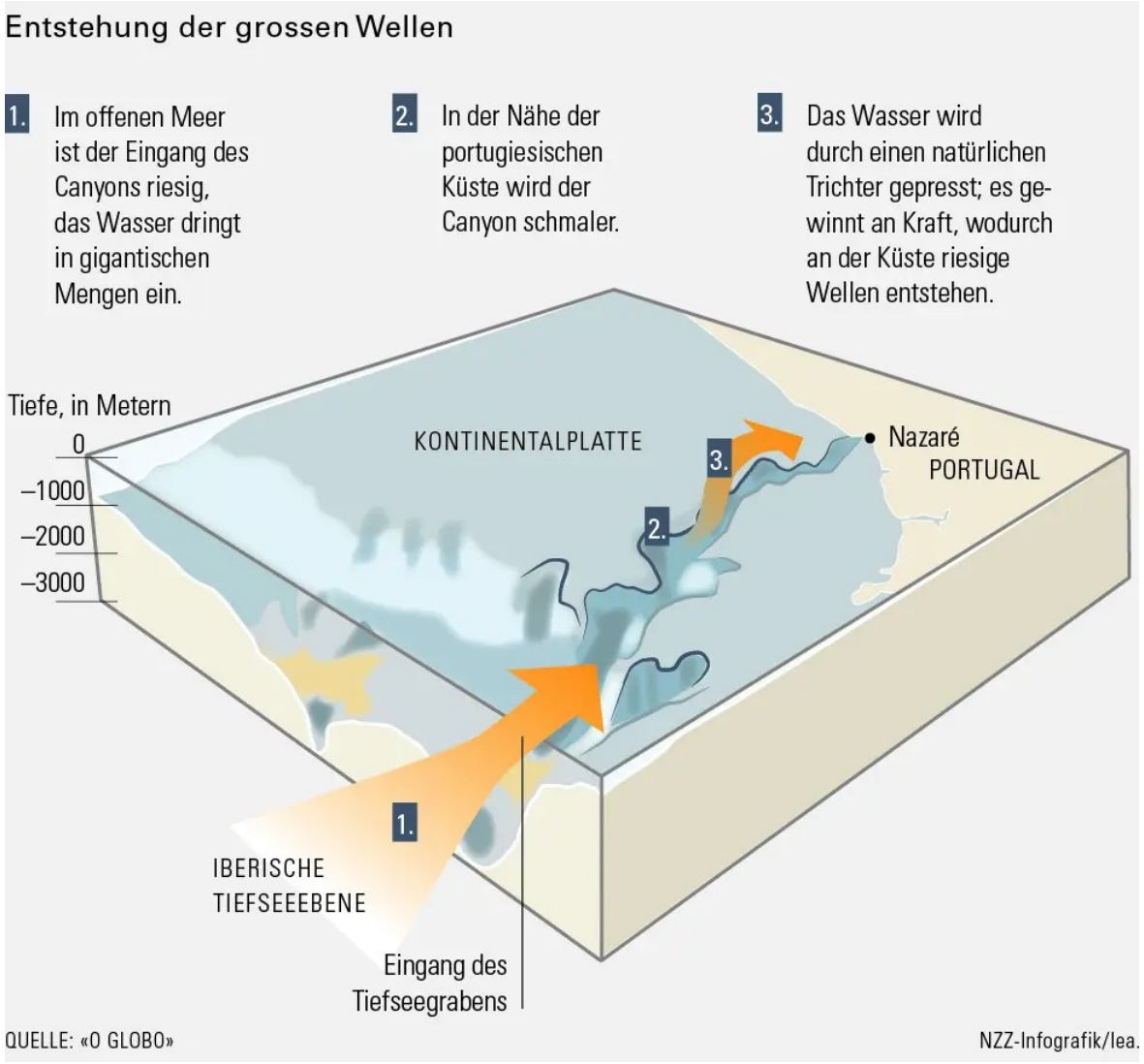
History of Surfing

- Peru: The Moche Culture 3000-5000 years ago – surfing sitting/kneeling
- Polynesia: Polynesian culture/Hawaii and Tahiti (first stand up surfing): Bodyboarding and surfing
- California 1885-1919 George Freeth
- 1975 first professional surf tour started
- Endless Summer (https://en.wikipedia.org/wiki/The_Endless_Summer)
- Surf & Skateboarding California Venice Beach (Dogtown & Z-Boys) -> Progressive Skateboarding and surfing
- https://www.imdb.com/title/tt8106568/ Momentum Generation





Nazare


Entstehung der grossen Wellen
1. Im offenen Meer ist der Eingang des Canyons riesig, das Wasser dringt in gigantischen Mengen ein.
2. In der Nähe der portugiesischen Küste wird der Canyon schmaler.
3. Das Wasser wird durch einen natürlichen Trichter gepresst; es gewinnt an Kraft, wodurch an der Küste riesige Wellen entstehen.
Tiefe, in Metern
0
–1000
–2000
–3000
KONTINENTALPLATTE
Nazaré
PORTUGAL
IBERISCHE TIEFSEEEBENE
Eingang des Tiefseegrabens
QUELLE: «O GLOBO»
NZZ-Infografik/lea.