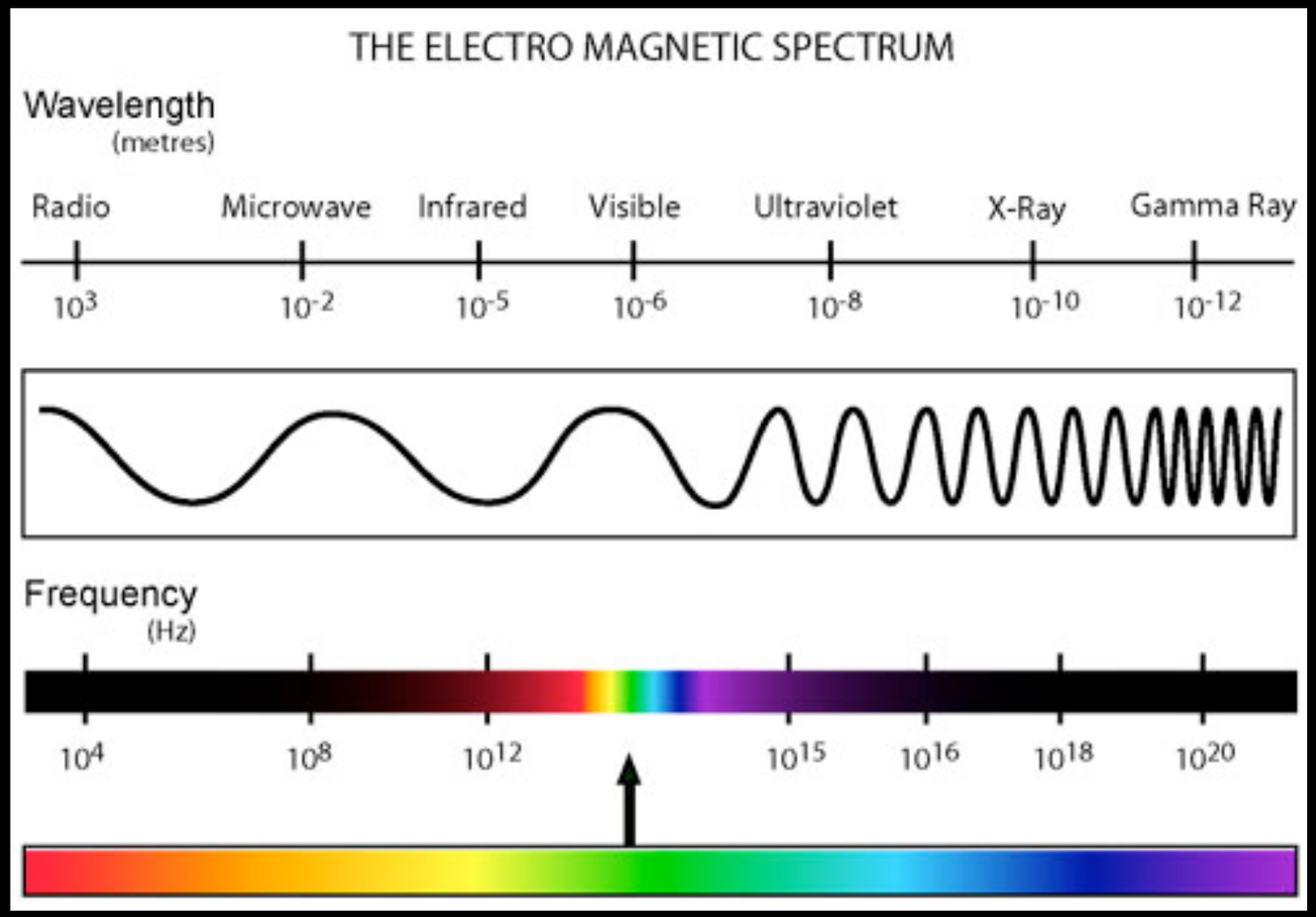
Waves

Waves are ENERGY

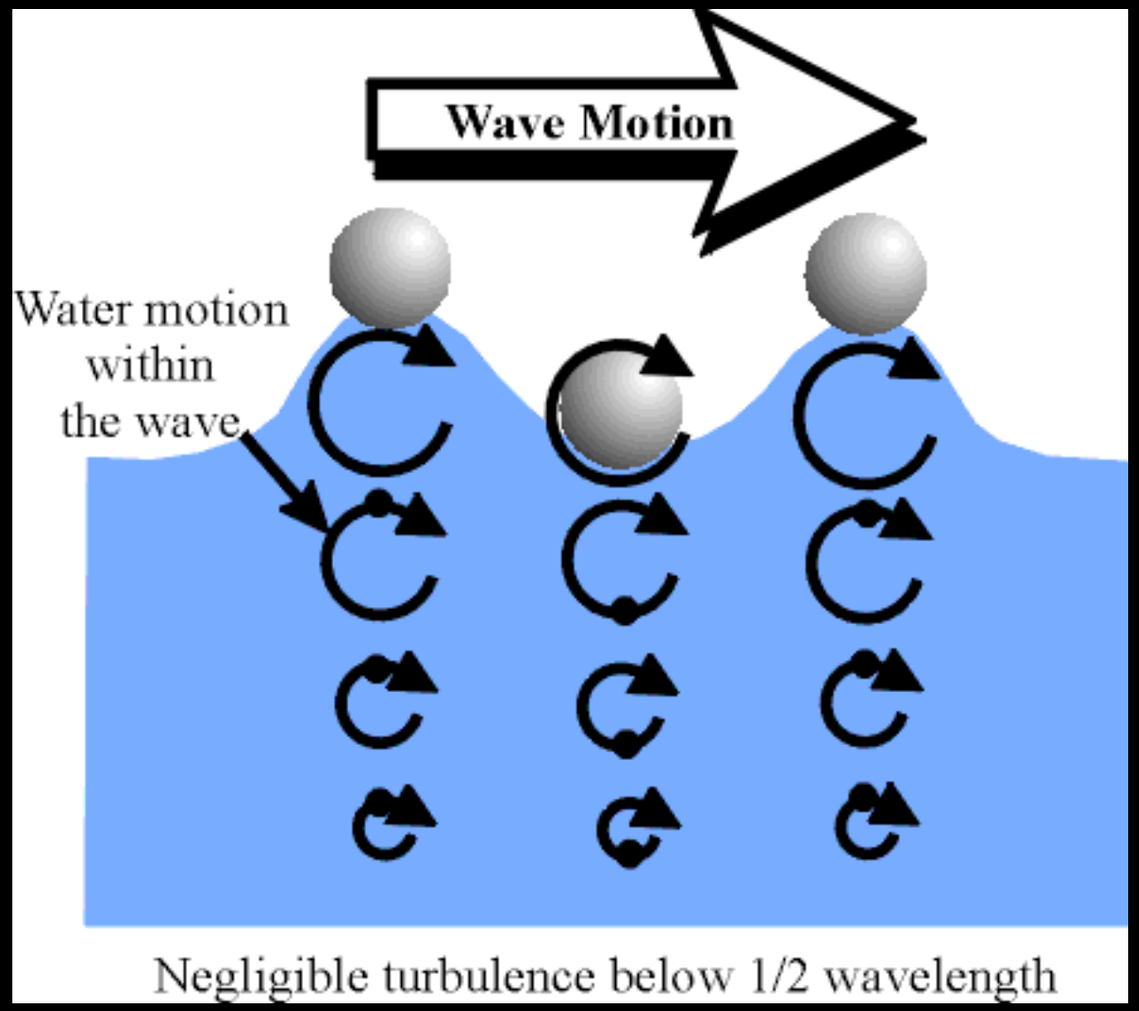
We experience waves every day. Wether it be in the form of visible light, sound, radio or ultraviolet (amongst others) waves shape our experience in the world.

The waves in the graphic behave in space in the same manner as ocean waves behave in water.



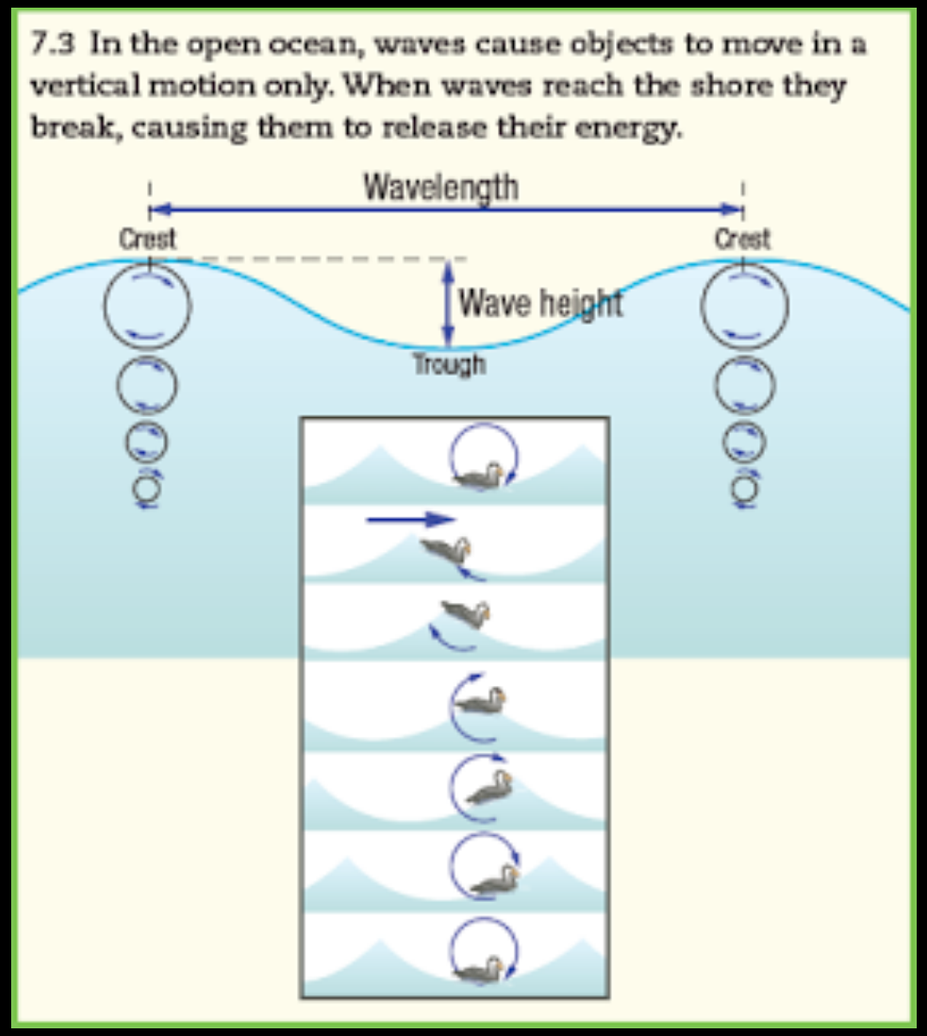
Ocean Waves

Ocean waves originate from wind. When the wind blows on water there is friction where the water and the earths atmosphere meet. The longer the wind blows over a parcel of water in one direction, the more the energy is imparted from the air to the water. As waves begin to form they overlap and the energy (and size) begin to multiply. This phenomenon is known as Fetch. The waves energy extends far below the water's surface.



Waves in open water

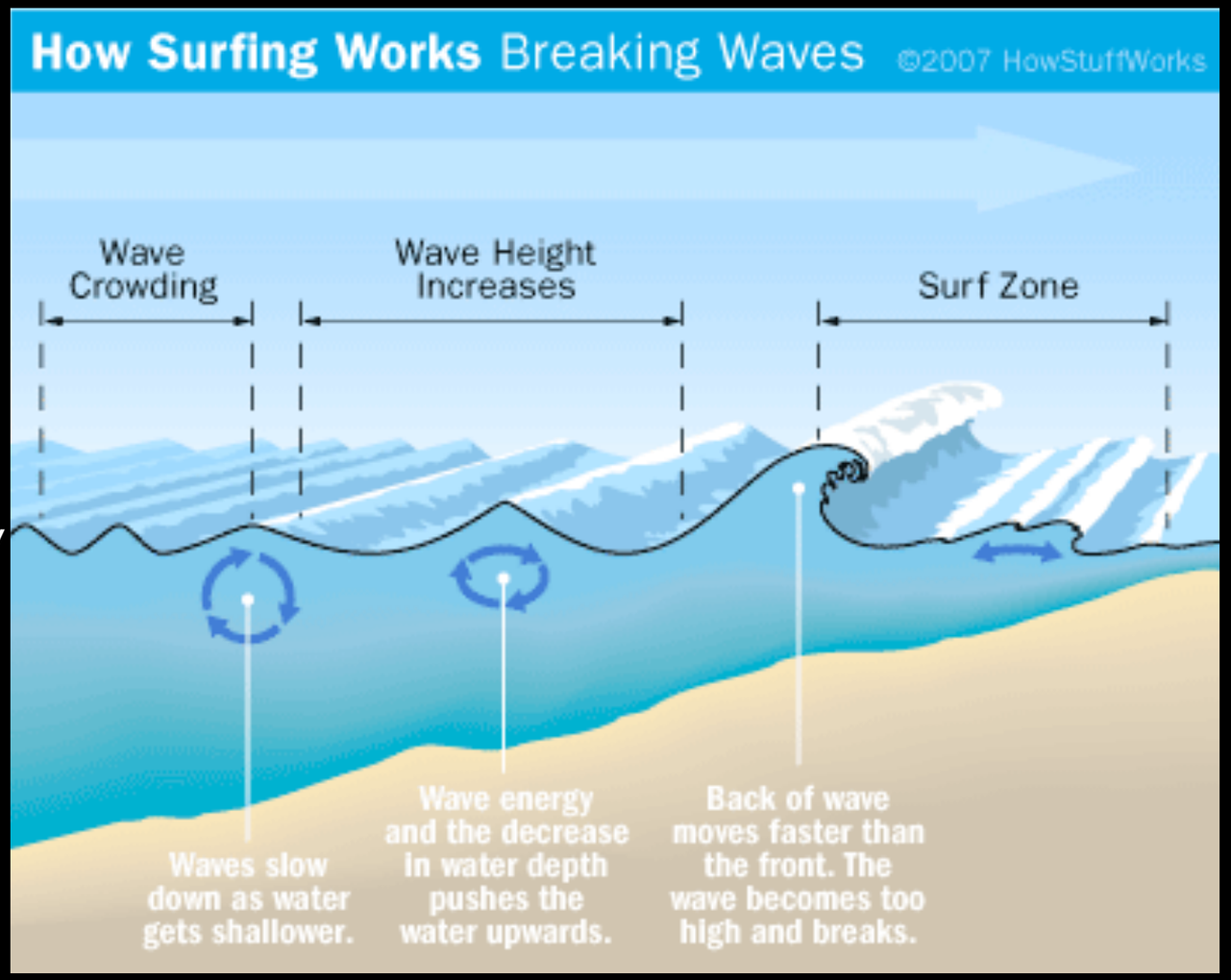
Energy moves very freely in water when unobstructed by land masses. Very little water moves until the energy travels across the body of water in question. Note the graphic to the right. The Seagull actually moves a small amount as the wave passes underneath it. The tallest part of the wave is called the crest; the lowest is called the trough. For lifeguarding/surfing purposes, the wavelength (the distance from crest to crest) is called the period and is measured in seconds.



7.3 In the open ocean, waves cause objects to move in a vertical motion only. When waves reach the shore they break, causing them to release their energy.

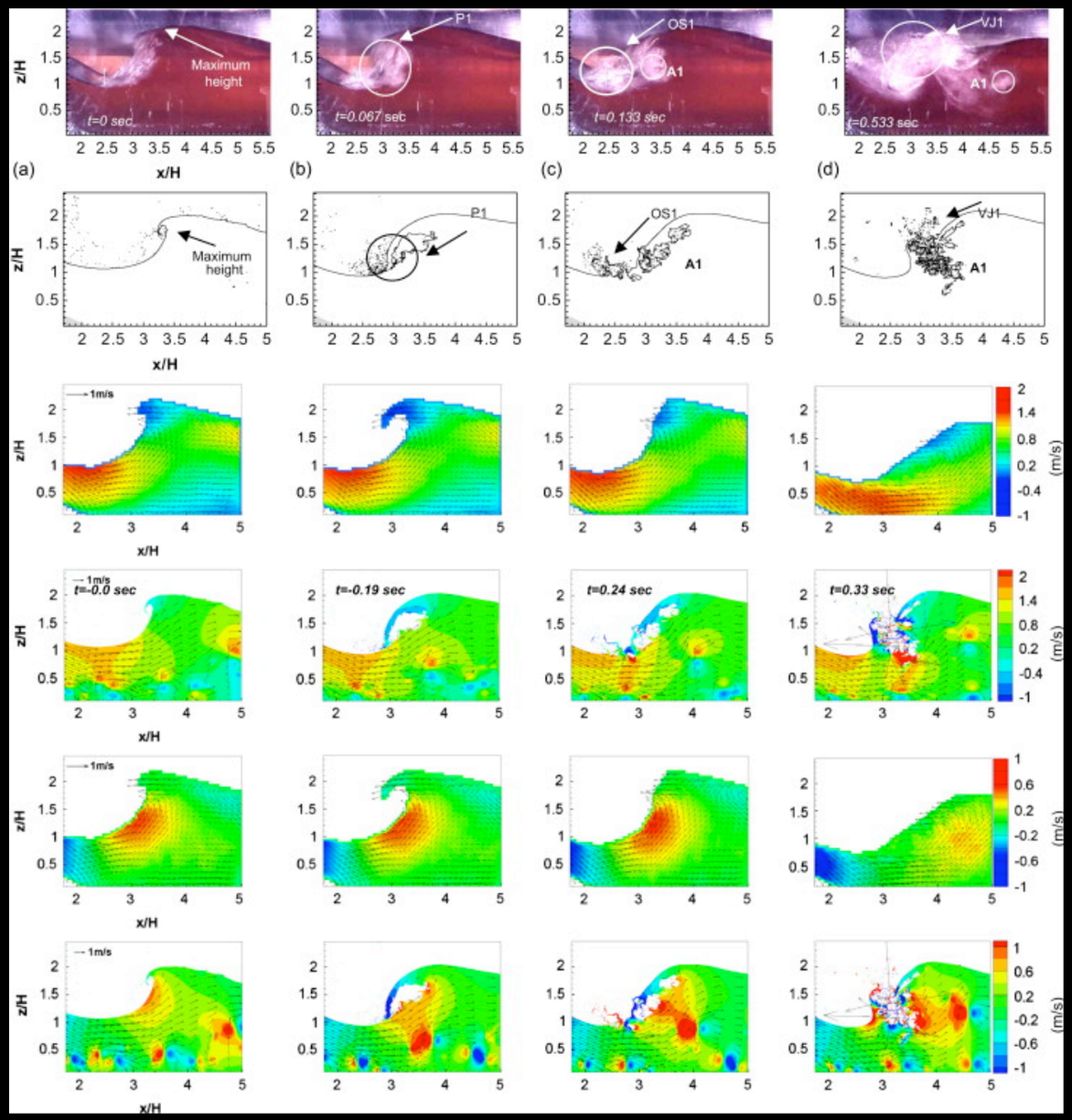
Why a wave breaks

Waves that were moving freely through open water eventually finds their way into shallower water and the deepest reaching portions of the wave begin to drag along the ocean bottom. When the lower part of the wave slows enough it causes the the crest of the wave to topple over leaving the disorganized energy we call whitewash. It is this process that creates the breaking waves we see at beaches around the world.



So where is the most energy?

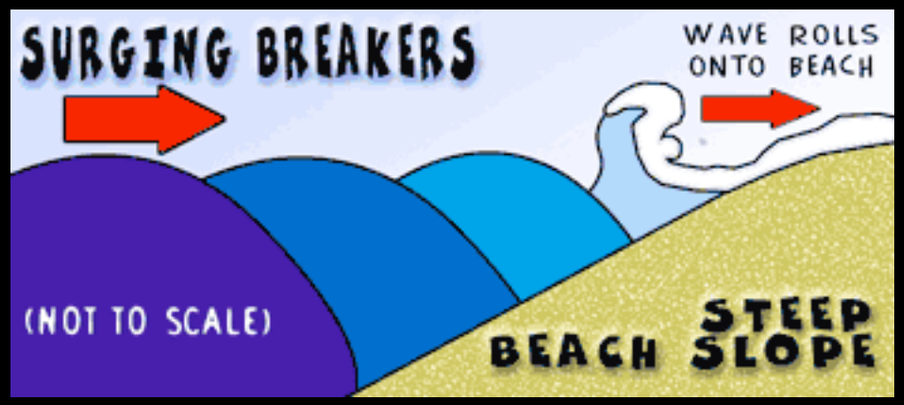
The graphic to the right shows a diagram of a breaking wave. The red area is the place in the wave with the most energy. Note that the energy becomes more disorganized as the wave crest topples over and lands in the wave trough, but the energy never moves too far from the wave trough. We traverse through the wave by going under the area with the most energy.

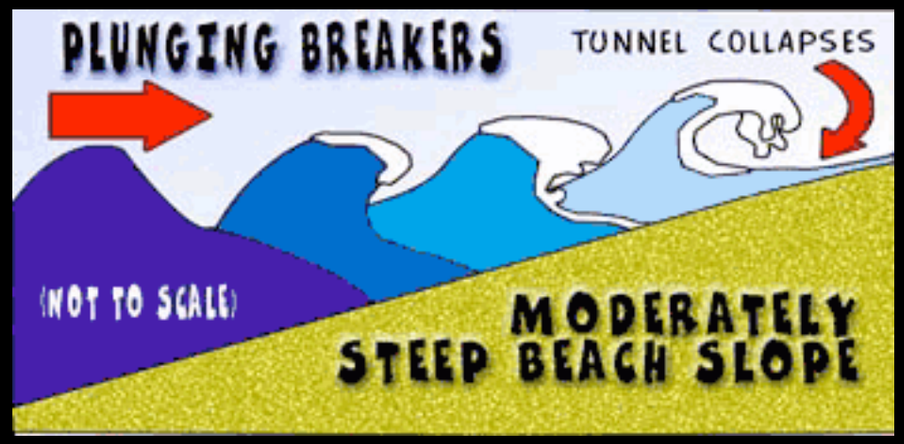


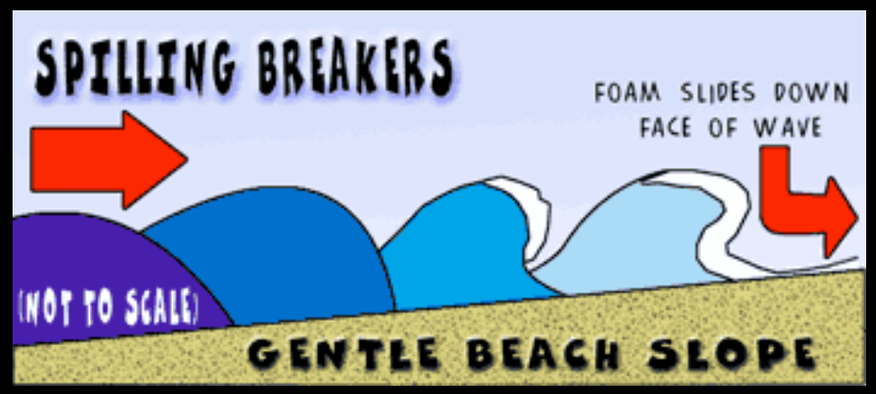
There is very little energy below the turbulent ocean surface.

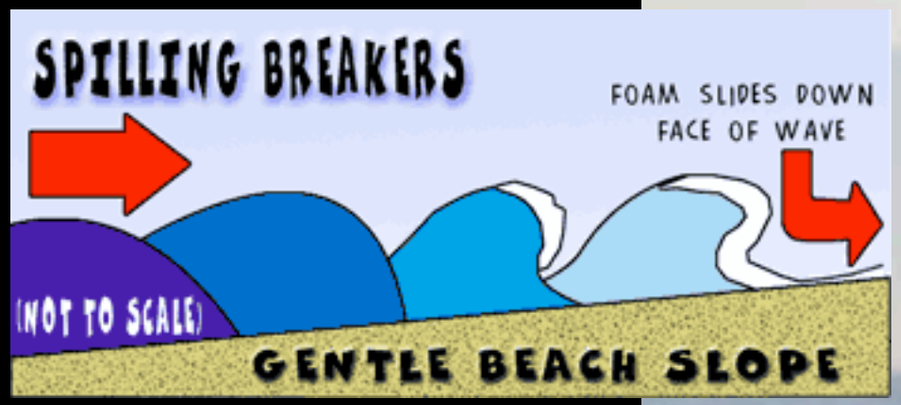
Bathymetry

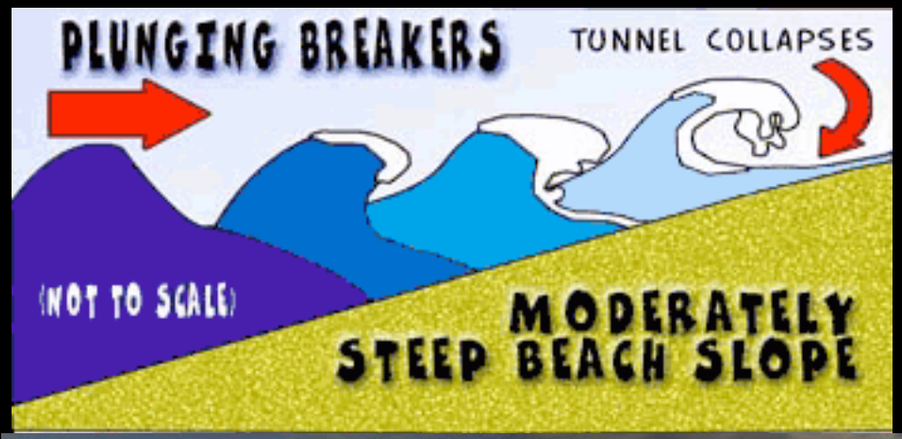
Bathymetry is the geography of the ocean bottom. It is intricately linked to the shape and size of breaking waves, wave formation, and wave propagation. Deep ocean canyons and reefs are prime examples. The more dramatic the change in ocean floor geographic features the more dramatic the change in the waves above the ocean floor. There are three very basic categories that waves can be broken into. Surging Waves, Plunging Waves and Spilling Waves.





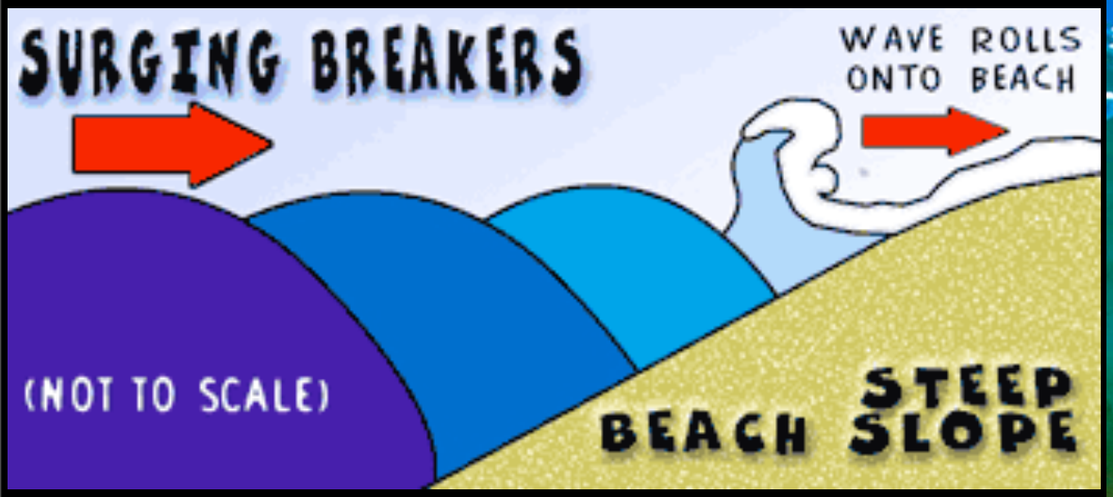


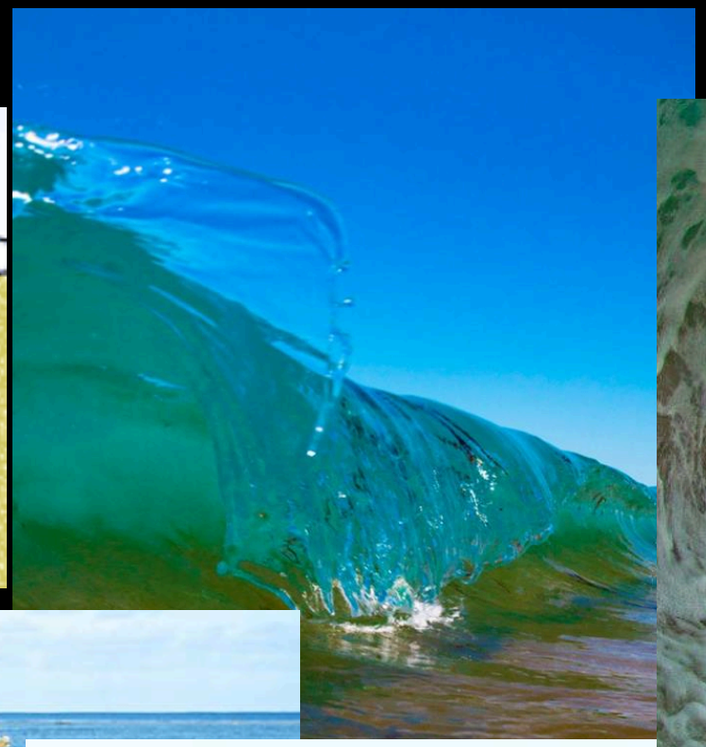

SPILLING BREAKERS
FOAM SLIDES DOWN
FACE OF WAVE
(NOT TO SCALE)
GENTLE BEACH SLOPE




GONCALO RUIVO, INDONESIA
PHOTO: JOAO BRACOURT


BEVAN WIGG, MATAKANA, NZ
PHOTO: RAMBO ESTRADA


SURGING BREAKERS
WAVE ROLLS ONTO BEACH
(NOT TO SCALE)
STEEP BEACH SLOPE

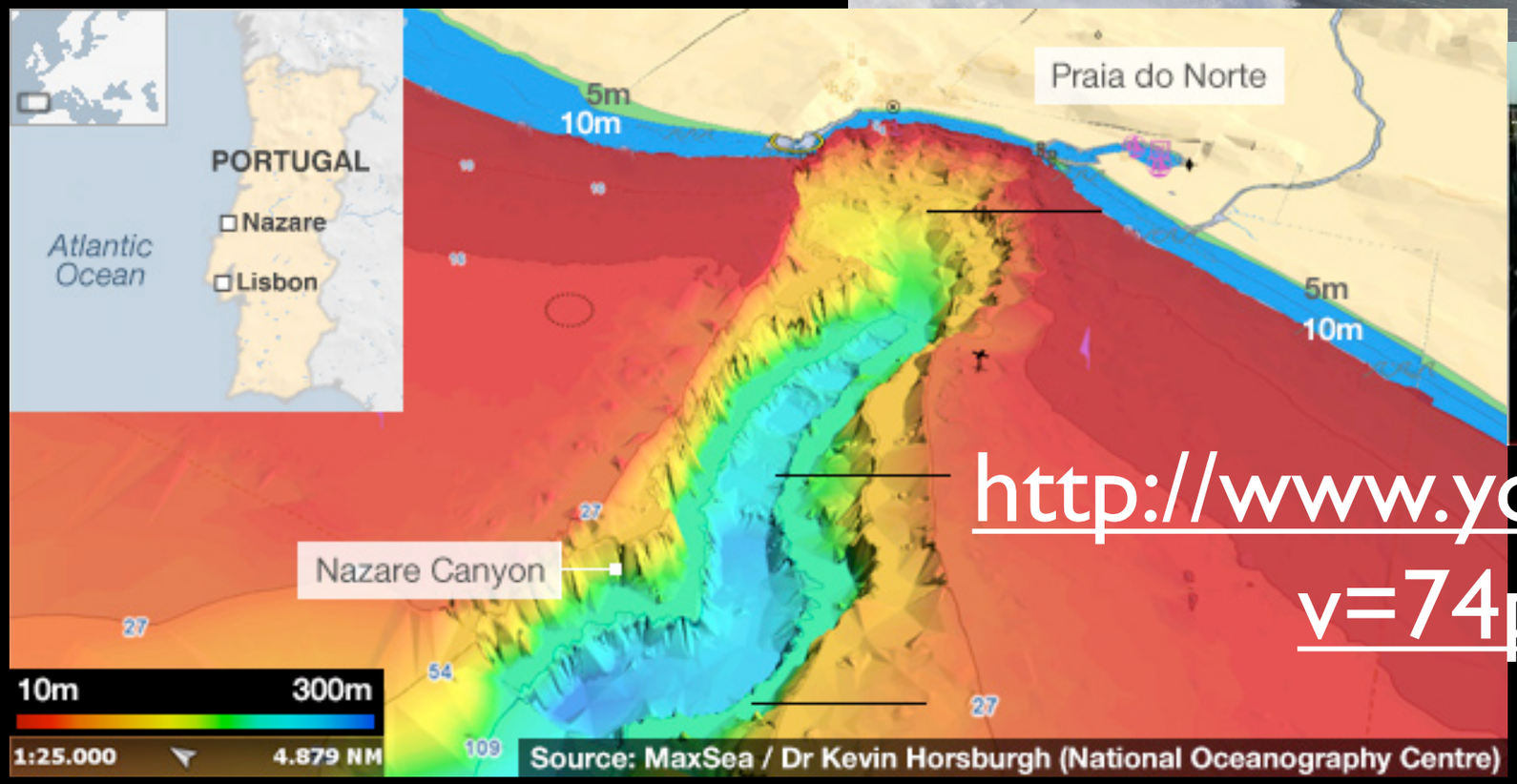


Famous Waves

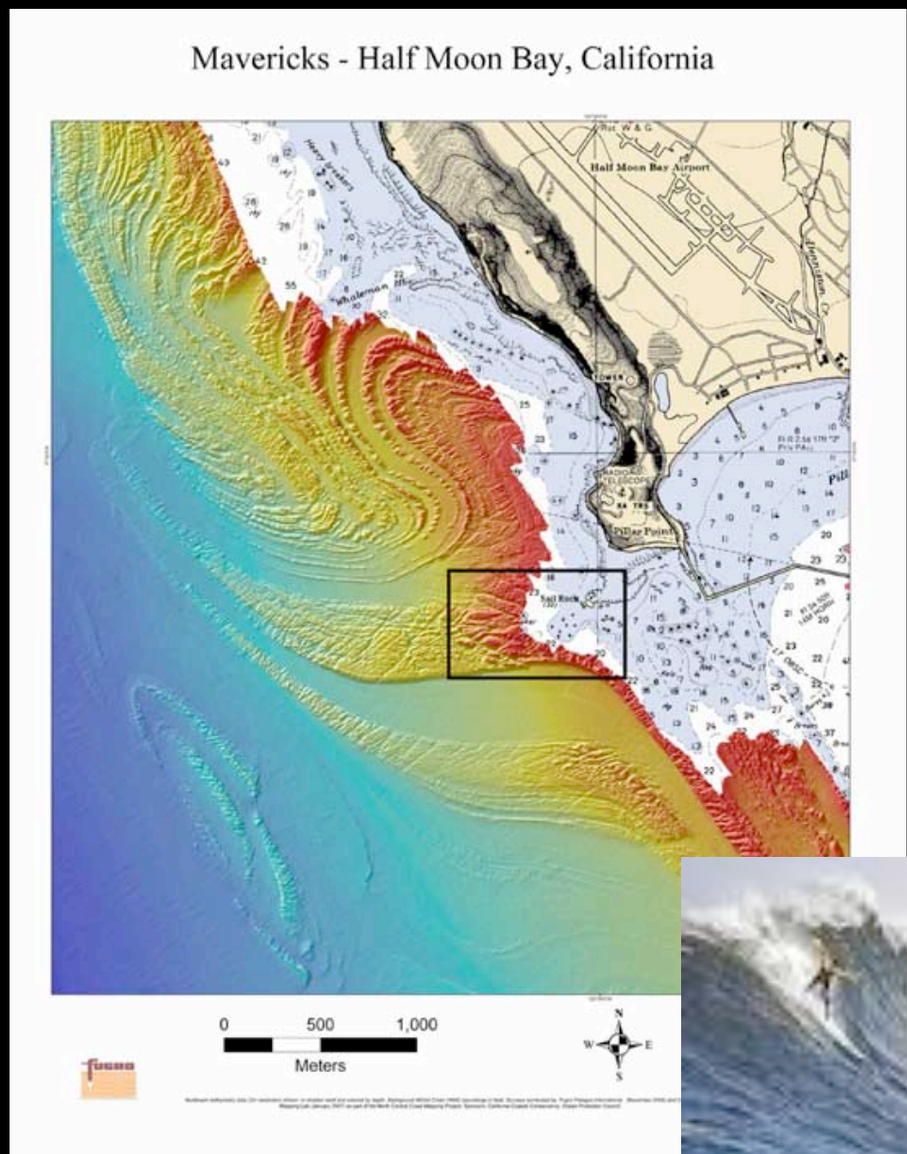
(and their Bathymetry)

Nazare, Portugal

Nazare has an underwater canyon that compresses wave energy. The canyon ends into a piece of land that sticks out into the ocean. This is called a point break. Point breaks generate waves that peel from one spot in deeper water into the shallower water. For this reason, Many of the worlds best surf spots are point breaks.



http://www.youtube.com/watch?v=74pnrYPozcU

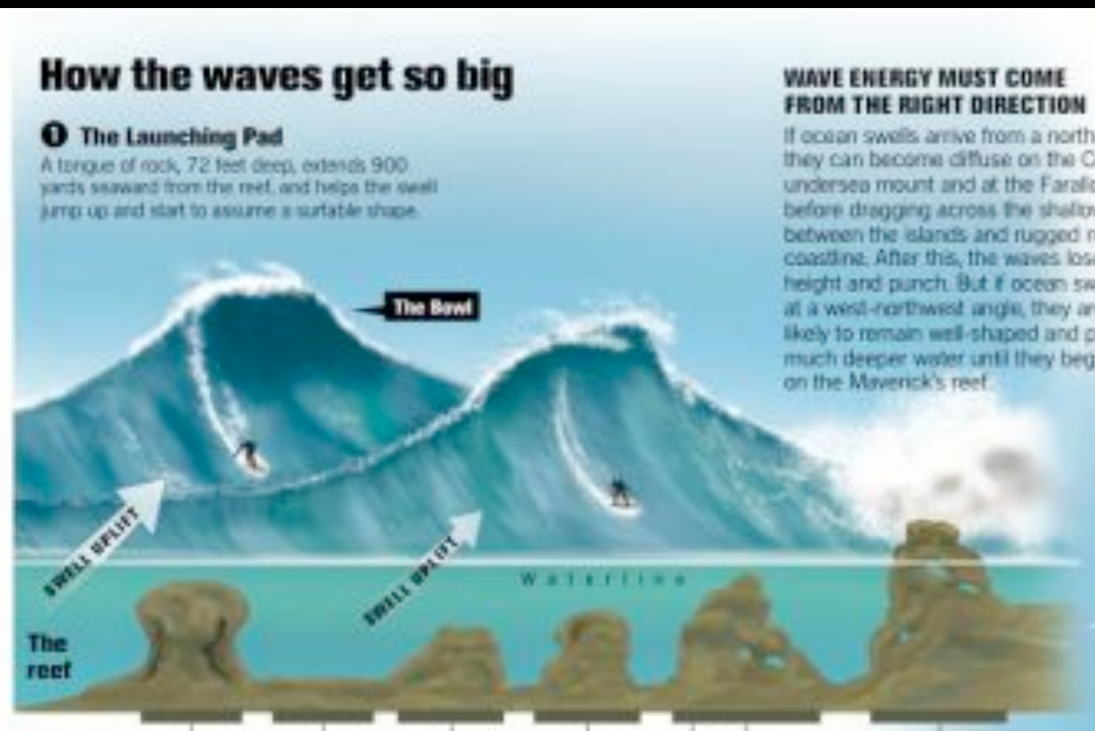


http://universalsports.com/video/2014-mavericks-invitational-surfers-wipeout/

Maverick's, Ca

How the waves get so big

Surfer and his big wave gun



1 The Launching Pad
A tongue of rock, 72 feet deep, extends 900 yards seaward from the reef, and helps the swell jump up and start to assume a surfable shape.

2 The Thumb
The first ridge of the Maverick's reef, 20 feet underwater, is a smooth, mushroom-shaped, undercut mound. As the swell hits, it forms a wall with a curved face, what surfers call the Bowl. Most surfers start rides here.

3 The Cauldron
This broad trough, 30-35 feet deep, between the first and second ridges, can take a dump from a breaking wave and fill with seething, aerated water.

4 The Fingers
The second, third and fourth ridges of the reef form increasingly shallow steps, making the wave lurch upward in spasms, throw out its lip, and break.

5 The Boneyard
The third and fourth reef ridges are a cruel mass of broken shapes, riddled with holes and valleys. Surfers fear being held down and pinned here.

6 The Reef
The final finger of the reef includes the rocks visible above the ocean surface as they extend from the large Sail Rock to the round Mushroom Rock.

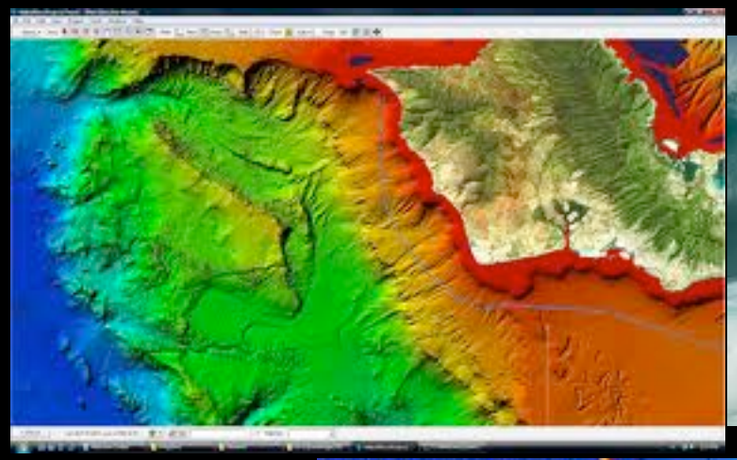
WAVE ENERGY MUST COME FROM THE RIGHT DIRECTION

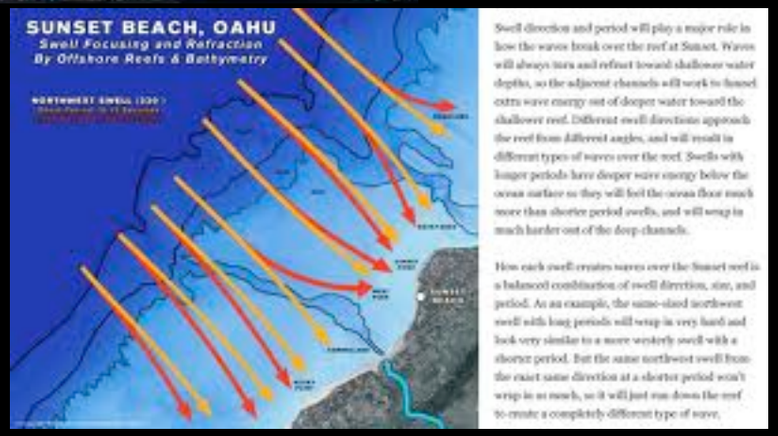
If ocean swells arrive from a northerly angle, they can become diffuse on the Cordell Bank undersea mount and at the Farallon Islands, before dragging across the shallow shelf between the islands and rugged mainland coastline. After this, the waves lose their height and punch. But if ocean swells arrive at a west-northwest angle, they are more likely to remain well-shaped and potent in much deeper water until they begin to rise on the Maverick's reef.

Sources: USGS, image of ocean floor by USGS and depiction of Half Moon Bay developed by Robert E. Crippen (JPL) and Ross Stein (USGS) and PG&E

JOHN BLANCHARD / The Chronicle

The North Shore, Oahu





The north shore of oahu in the state of Hawaii is several reefs that border the islands coast. Each of the breaks has a unique characteristic and together form one of the most dense surfing havens in the world. Famous Breaks include but are not limited to: Pipeline, Wiamea Bay, and Haleiwa.

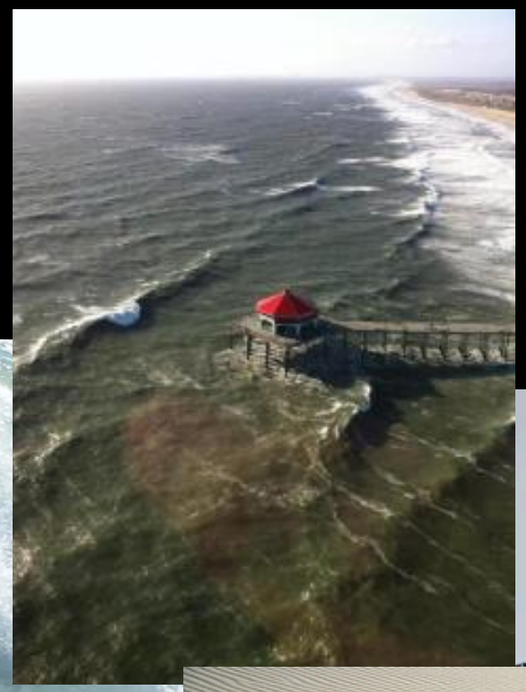
http://www.surfline.com/surflinetv/featured-clips/north-shore-december-2010_51021

http://www.surfline.com/surflinetv/featured-clips/mechanics-of-haleiwa-oahu_78599

http://www.surfline.com/surf-news/the-mechanics-of-waimea-bay_51419/

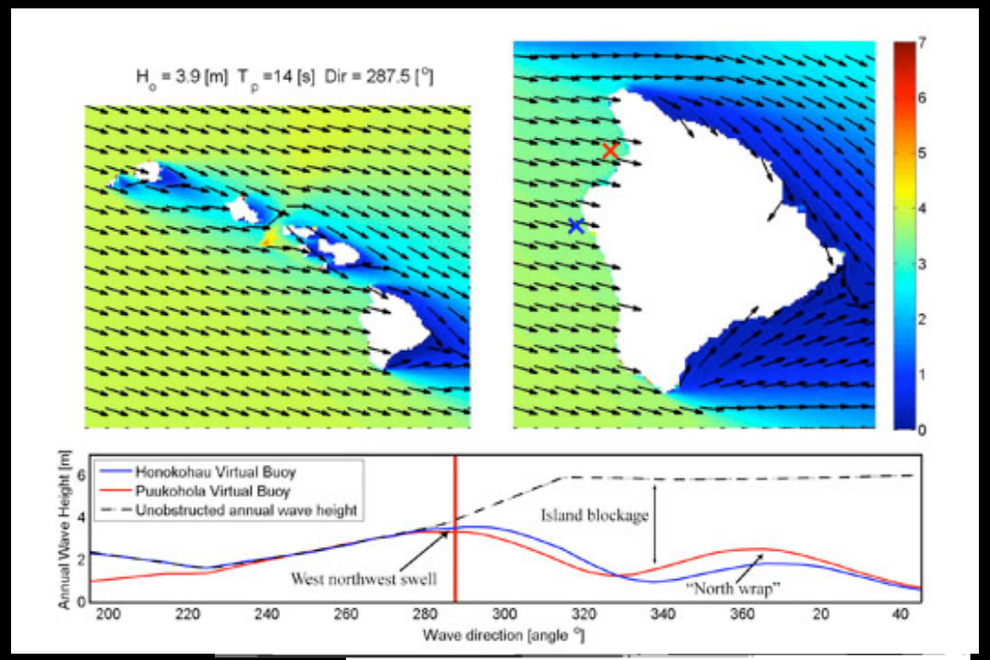
HB and Newport

Huntington and Newport are beach breaks. Waves break over sandbars and near the Jetties and piers.



The Shifting sands and exposure to swells year-round create consistent surf, but on any given day one part of the beach may be dramatically different from the rest. Large surf Tends to break all at one time due to the relatively gradual slope of the ocean bottom bathymetry. When this happens the waves are walled.

Southern California is subject to Island Shadow. Island shadow occurs when a swell is blocked from reaching the mainland by an off-shore island. Incoming waves warp and bend as the energy passes around and eventually past the Island changing the direction the swell travels in or blocking it completely. Northern Orange County also receives additional swell because of the phenomenon of Island Shadow. Waves bend around Santa Catalina Island and the Channel Islands and sneak into Huntington Beach.



The Graphic to the right shows the Island shadow of a south swell blocking large portions of the south bay and Santa Barbara as well as a northern swell hitting the Hawaiian islands.