Ondas

- Definição – ondas de gravidade geradas pelo vento
- Termos básicos, características – amplitude, altura, comprimento, período
- Equações
- Energia
- Alterações na forma
- Reflexão
- Refração
  - Mudança de direção por variação da profundidade
- Difração
  - Mudança de direção pela presença de obstáculos
- Rebentação
  - Instabilidade gerada pela diminuição brusca da profundidade

Ondas geradas por vento

- Ondas de gravidade geradas pelo efeito de fricção do vento e pelo diferencial de pressão produzido. Depende da pista (fetch), da duração e da velocidade do vento.

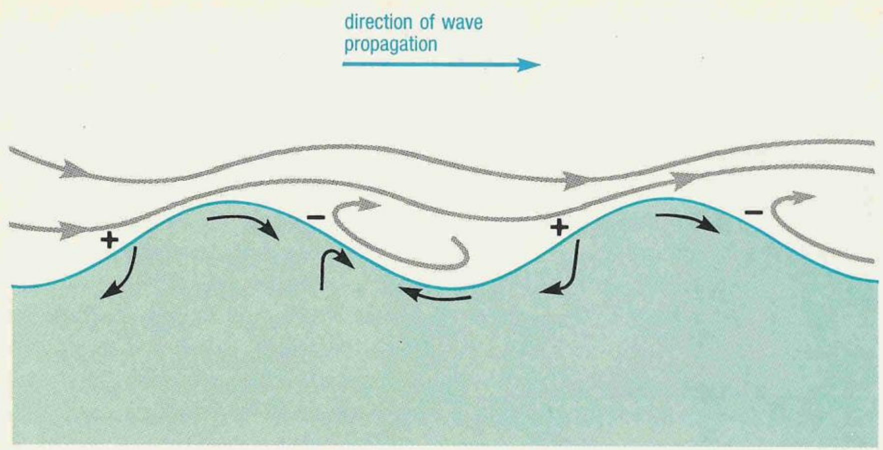


Figure 1.3 Jeffreys' 'sheltering' model of wave generation. Curved lines indicate air flow; short, straight arrows show water movement, which will be explained more fully in Section 1.2.1. The rear face of the wave against which the wind blows experiences a higher pressure than the front face, which is sheltered from the force of the wind. Air eddies are formed in front of each wave, leading to differences in air pressure. The excesses and deficiencies of pressure are shown by plus and minus signs respectively. The pressure difference pushes the wave along.

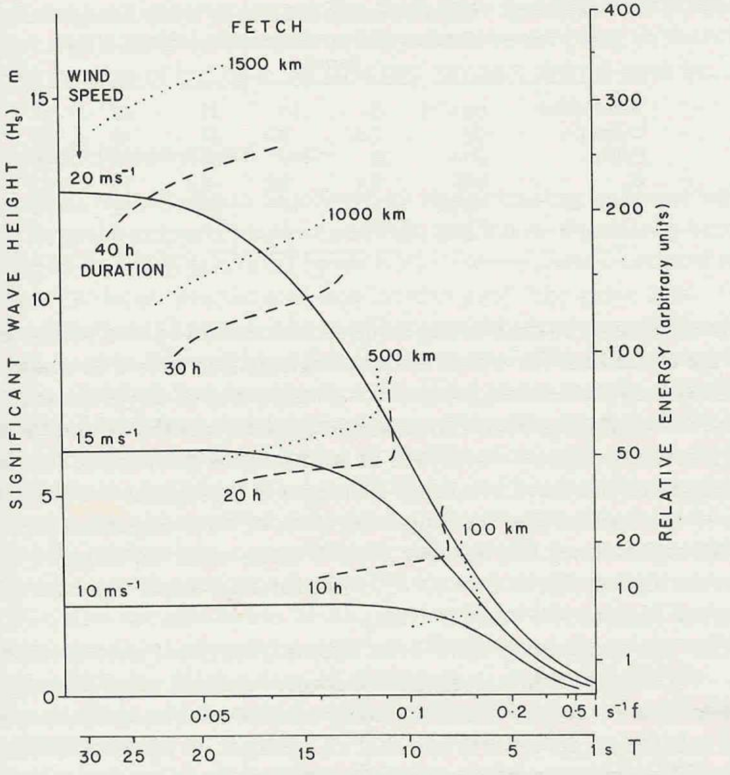
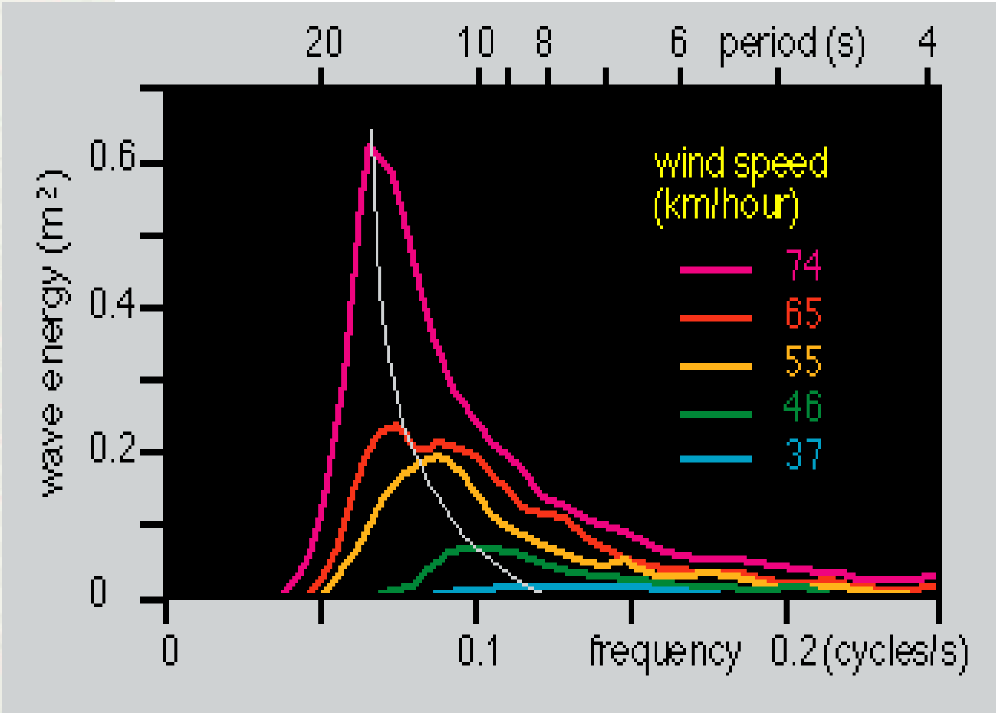


FIG. 12.12 *Co-cumulative wave spectra as significant wave height (H_s) and wave energy against frequency (f) and period (T) for three wind speeds (full lines), four fetches (dotted lines) and four durations (dashed lines). (Adapted from Pierson, Neumann and James, 1955)*



Características

$$C = \frac{L}{T}$$

$$A = \frac{H}{2}$$

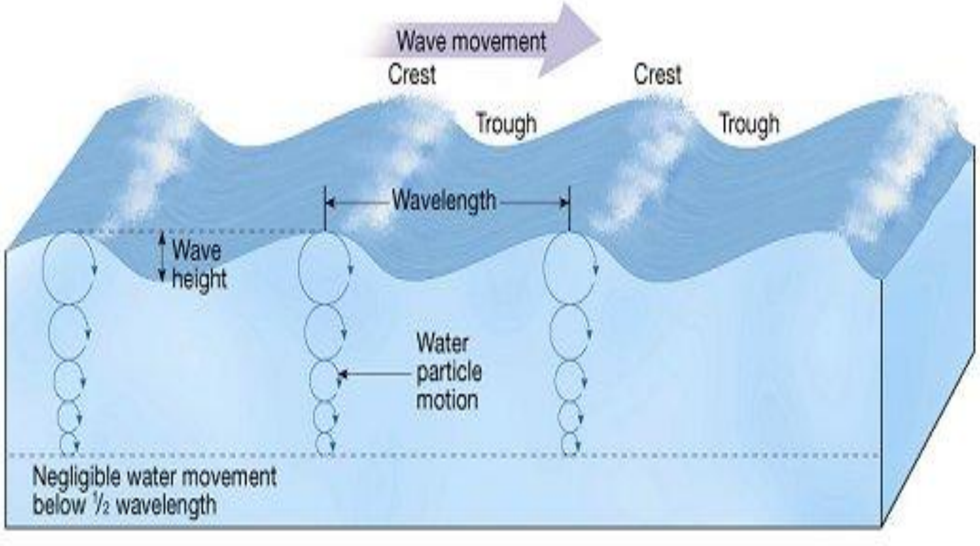
$$Empinamento = \frac{H}{L}$$

$$\eta = A\left[2\pi\left(\frac{x}{L} - \frac{t}{T}\right)\right]$$

$$\eta = A\cos(kx - \omega t)$$

$$k = \frac{2\pi}{L}$$

$$\omega = \frac{2\pi}{T}$$



Equações

$$C = \left[\frac{gL}{2\pi} \tanh \frac{2\pi h}{L} \right]^{1/2}$$

$$L < 2h -- \tanh 2\pi h / l -- > 1$$

$$C_p = \left(gL / 2\pi \right)^{1/2} = 1{,}56T$$

$$L > 20h -- \tanh 2\pi h / L -- > 2\pi h / L$$

$$C_r = (gh)^{1/2}$$

$$\omega^2 = gk \tanh kh$$

Movimentos orbitais

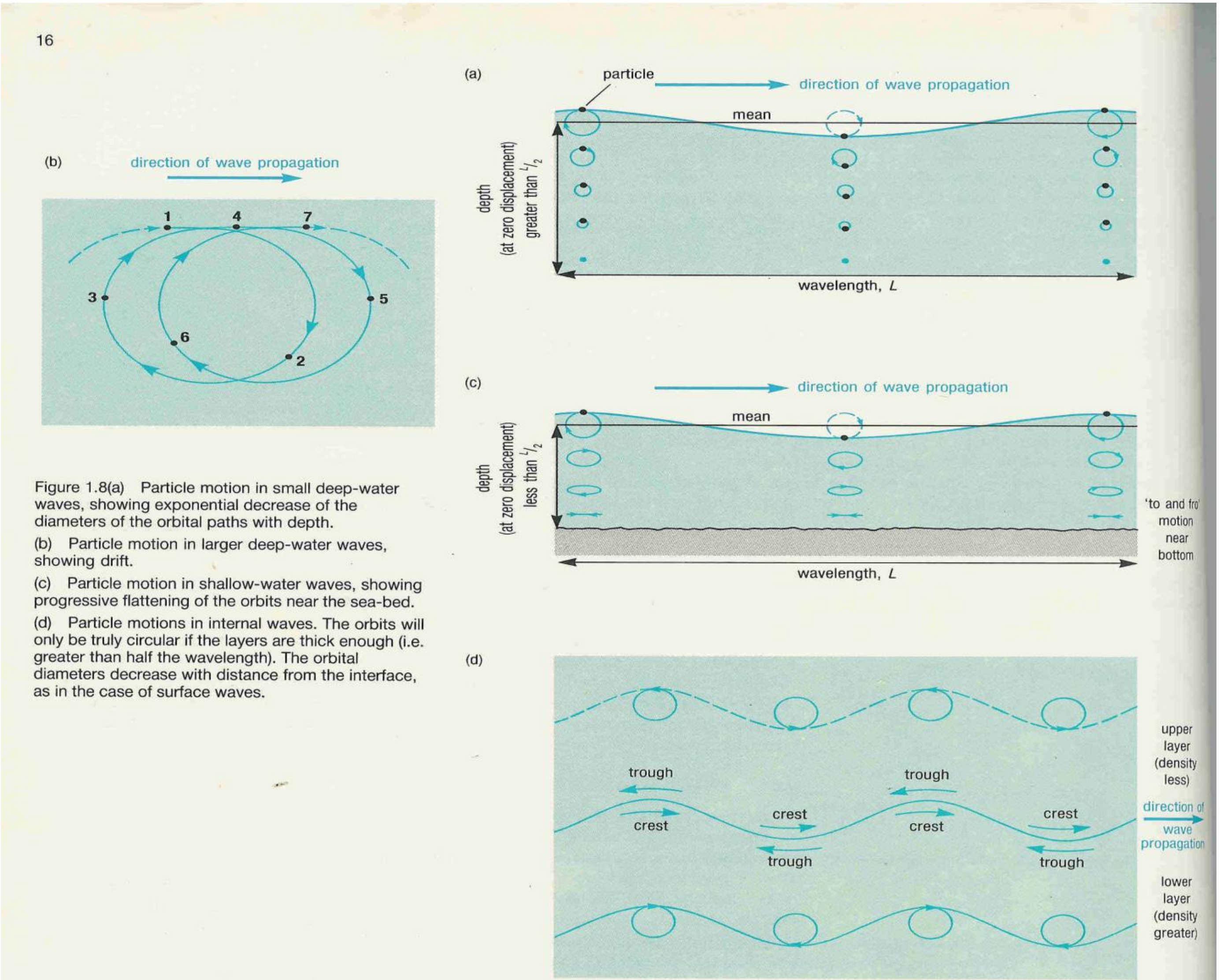


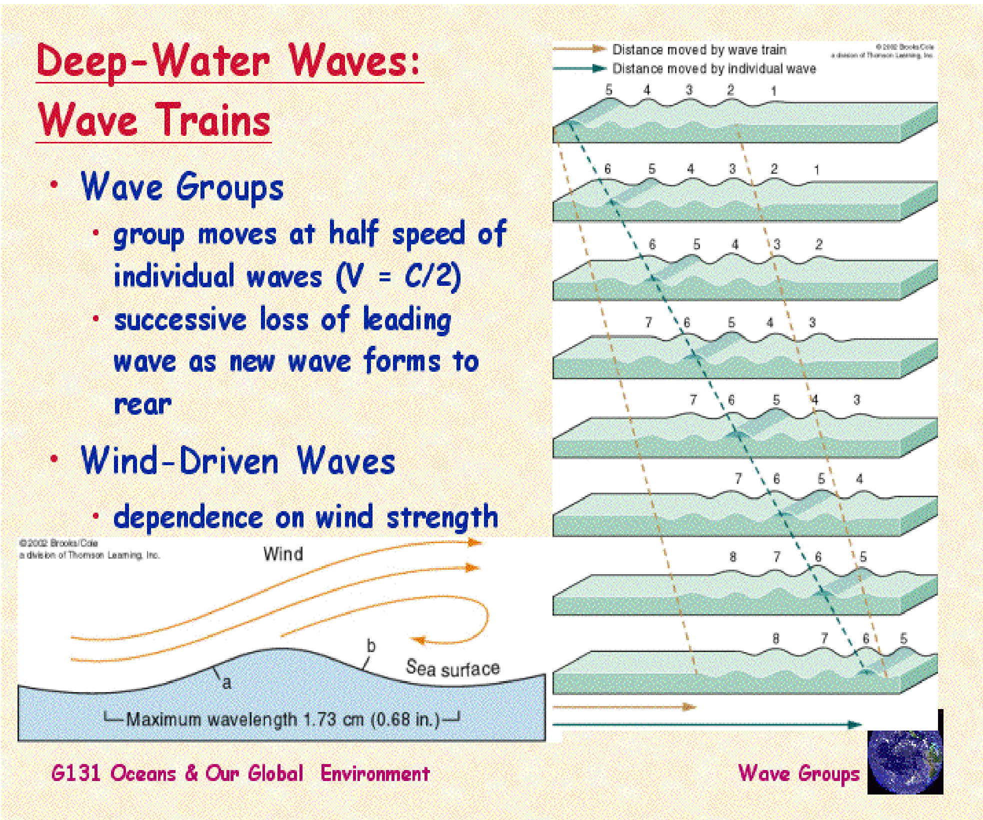
Figure 1.8(a) Particle motion in small deep-water waves, showing exponential decrease of the diameters of the orbital paths with depth.

(b) Particle motion in larger deep-water waves, showing drift.

(c) Particle motion in shallow-water waves, showing progressive flattening of the orbits near the sea-bed.

(d) Particle motions in internal waves. The orbits will only be truly circular if the layers are thick enough (i.e. greater than half the wavelength). The orbital diameters decrease with distance from the interface, as in the case of surface waves.

- Velocidade de grupo



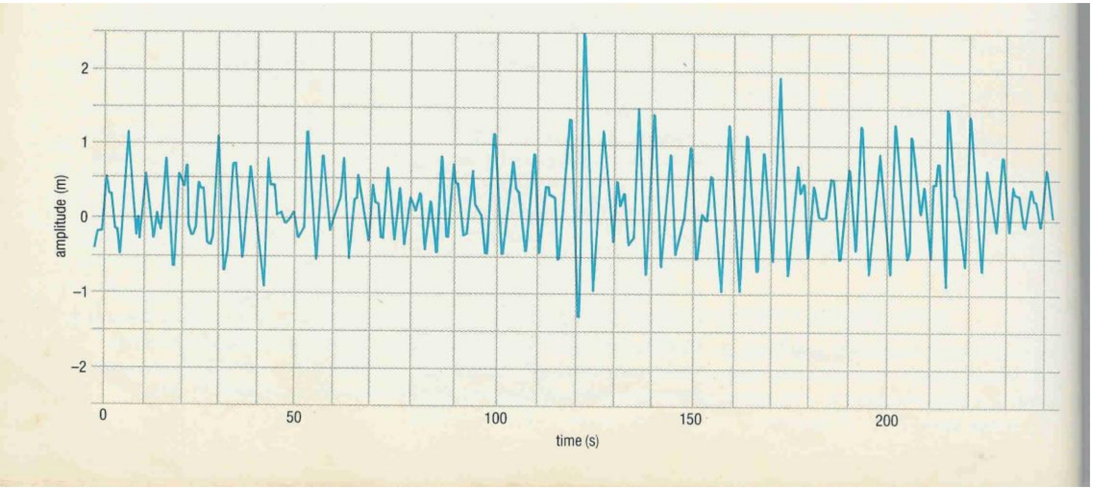
$$C_g = \frac{C}{2}\left[1 + \frac{2kh}{senh2kh}\right]$$

$$kh << 1 --> senh2kh --> 2kh$$

$$Cg = Cr$$

$$kh >> 1 --> senh2kh >> 2kh$$

$$Cg = Cp$$



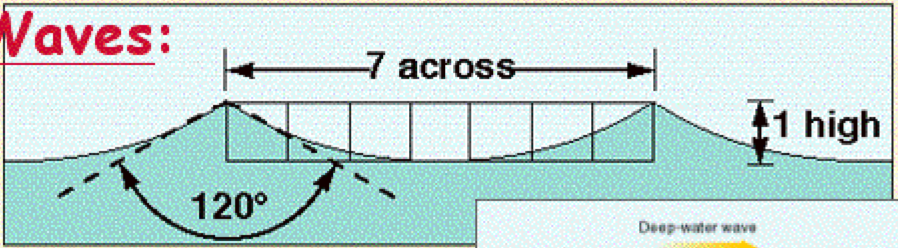
For many marine applications, for example the routing of ships or the design of platforms, only the heighest waves are of interest. The quantity **significant wave height** has therefore been introduced. It is defined as either H1/3 or H1/10, ie as the average of the 1/3 or 1/10 heighest waves over an observation period. (The use of H1/3 is more common than the use of H1/10). From observations, the largest wave height Hmax is related to the significant wave height

$H_{max}/H_{1/3}=1,45$

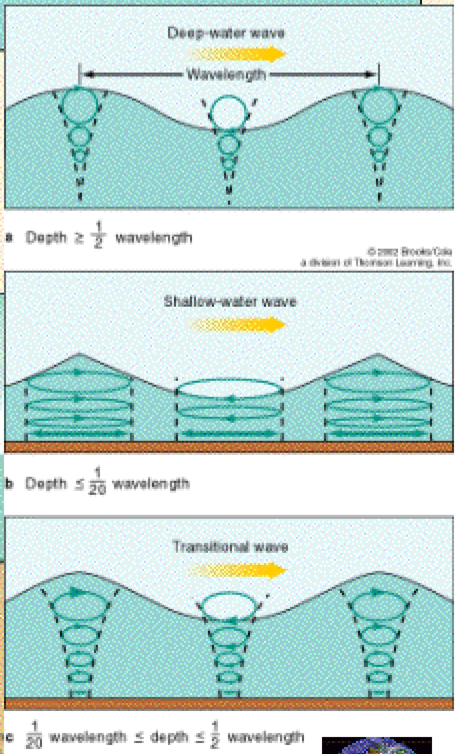
Alterações

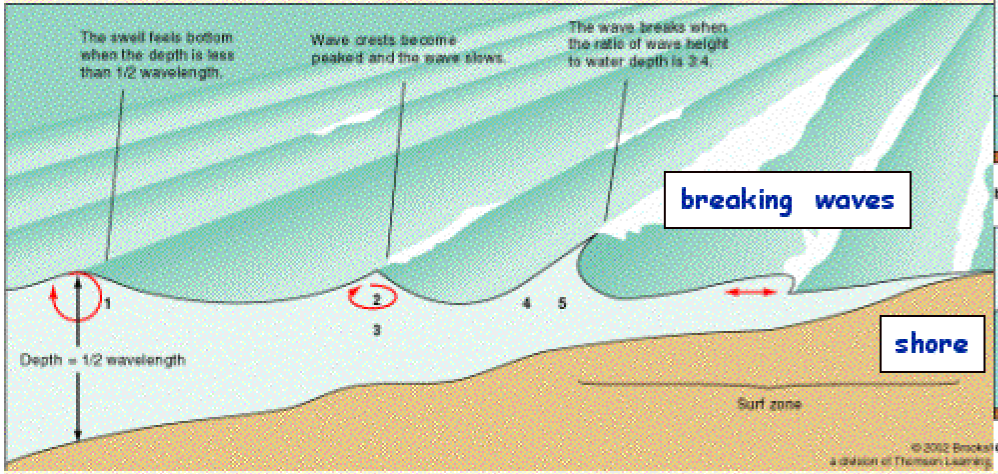
- Alterações devidas a profundidade
- Alterações devidas a obstáculos
- Alterações devidas à correntes

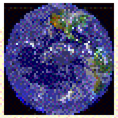
Shallow -Water Waves:



- Steepness
  - steepness = H/L
  - when H/L = 1/7, waves break
- Waters affected by shallowing
  - waters become elliptical when depth < L/20
  - wavelength decreases, height increases

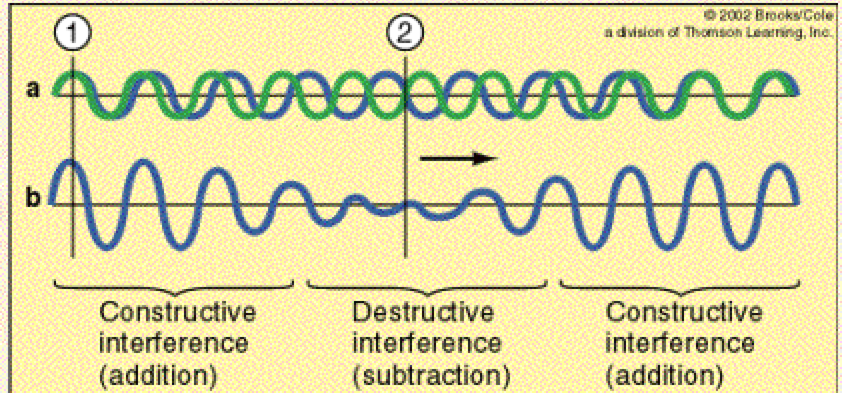


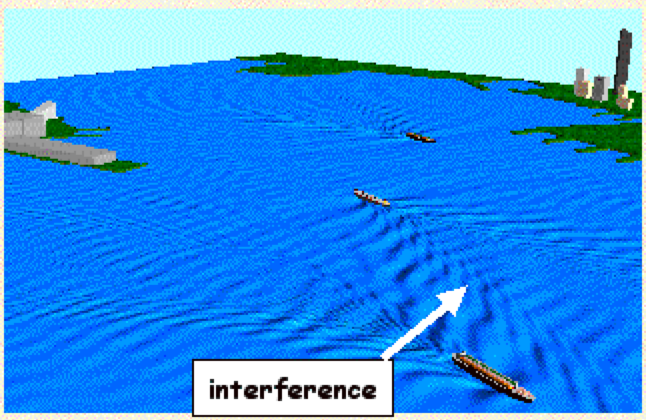


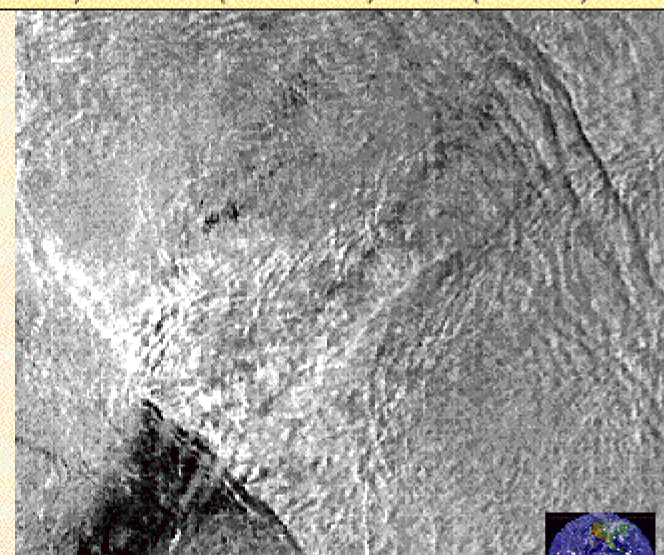


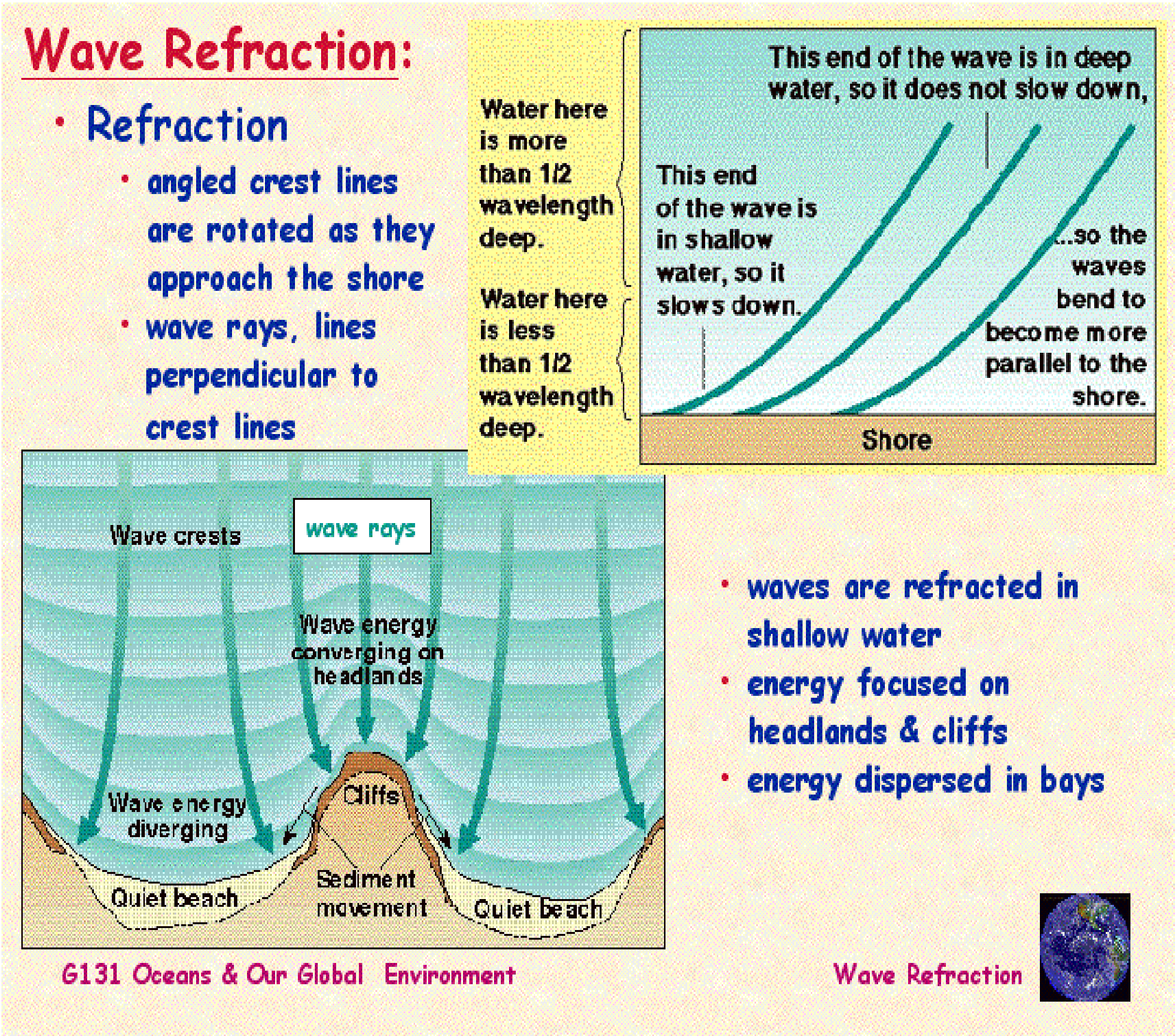
Wave Interaction:

- Wave combination
  - waves intersection
  - may reinforce one another (construc -tive interference)
  - or cancel one another (destructive interference)





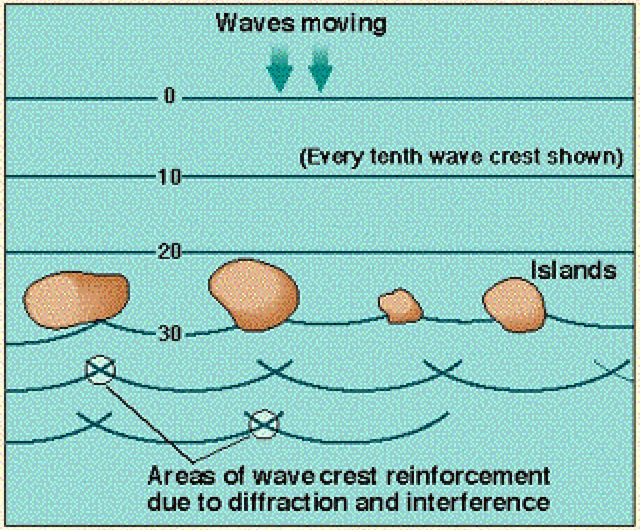




$$\frac{Sen\,\phi_1}{Sen\,\phi_2} = c_1 \big/ c_2$$

Wave Reflection and Diffraction:

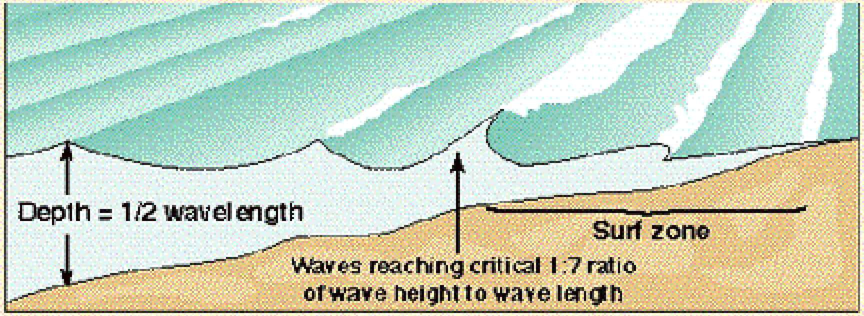
- Reflection
  - smooth straight barriers reflect waves
- Diffraction
  - wave movement through narrow openings causes interference

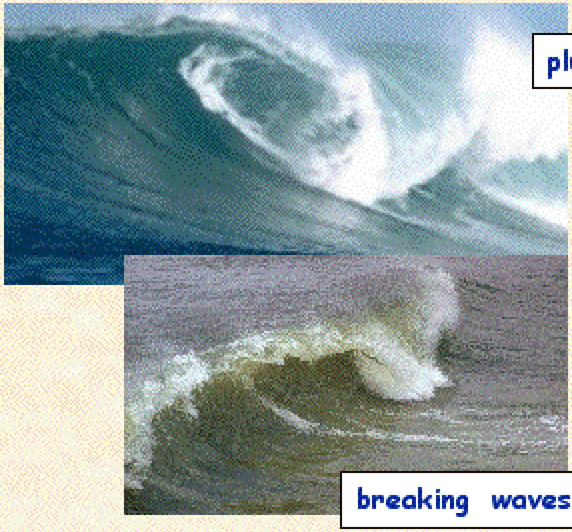


island diffraction

Surf Zone:

- Breakers
  - occur in surf zone when H/L = 1/7
- Types
  - breaking, plunging, spilling
  - depends on steepness & width of shoreline





breaking waves

plunging waves


081-Fx.44-1:20-1575


C81-Fx.44-1:20-1574

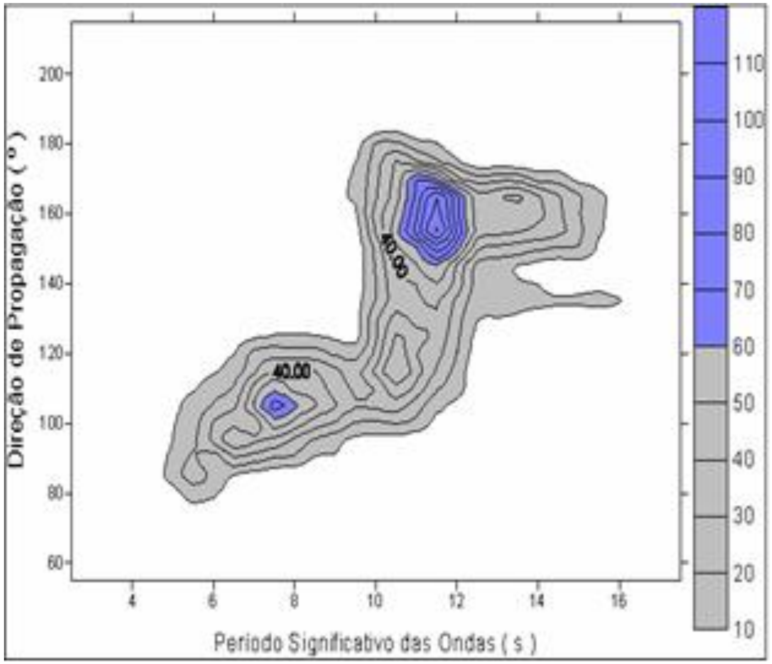


Figura 35. Altura significativa medida pelo ondógrafo direcional localizado a 32º10'002"S e 51º58'913" W no período entre13 de maio e 25 de junho de 2005, durante o Experimento Cassino. (Cuchiara et al., 2007).

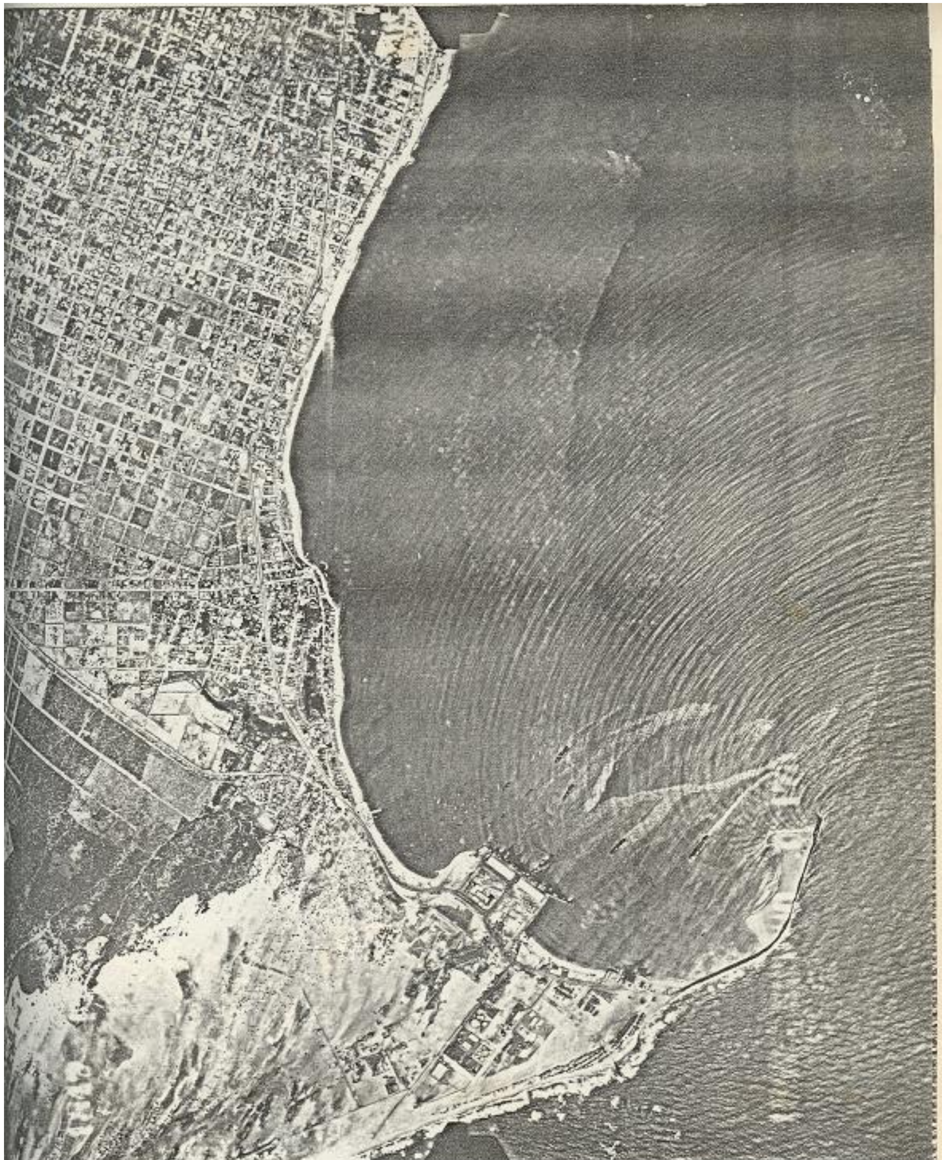
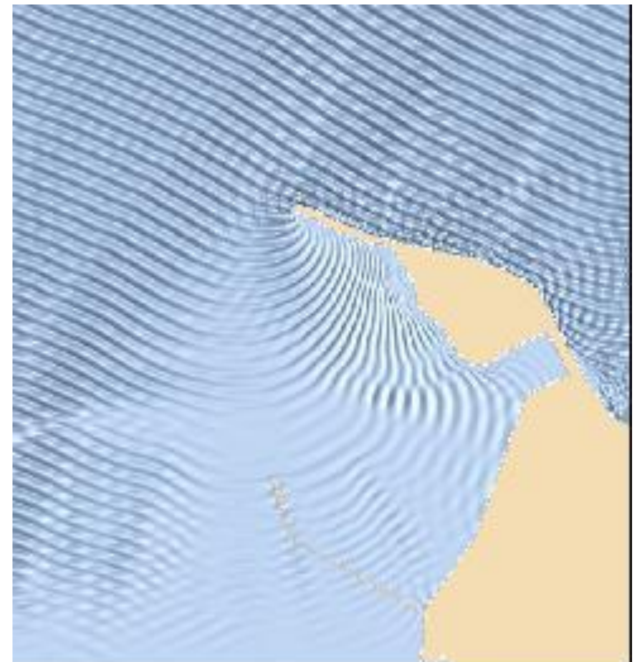


Figura IX.15 - Caminhamento de areias na parte interna do molhe do Mucuripe, antes da construção do espigão de retenção na praia do Futuro.



Water Transport:

- Waves
  - toward shore
  - seaward return focused at specific points
- Rip Currents
  - stir sand
  - forms turbid water
  - pose potential danger to swimmers
- Energy Release
  - spray
  - storms extend far up beach