

Types of waves

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What kinds of waves exist?

- These wave types have very different causes
- An overview will follow of the types of waves and their cause(s)

Wind Waves



Tidal waves



Flood waves



Tsunami waves



Tidal bores



Types of waves

What kinds of waves exist?

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→ Generated by wind



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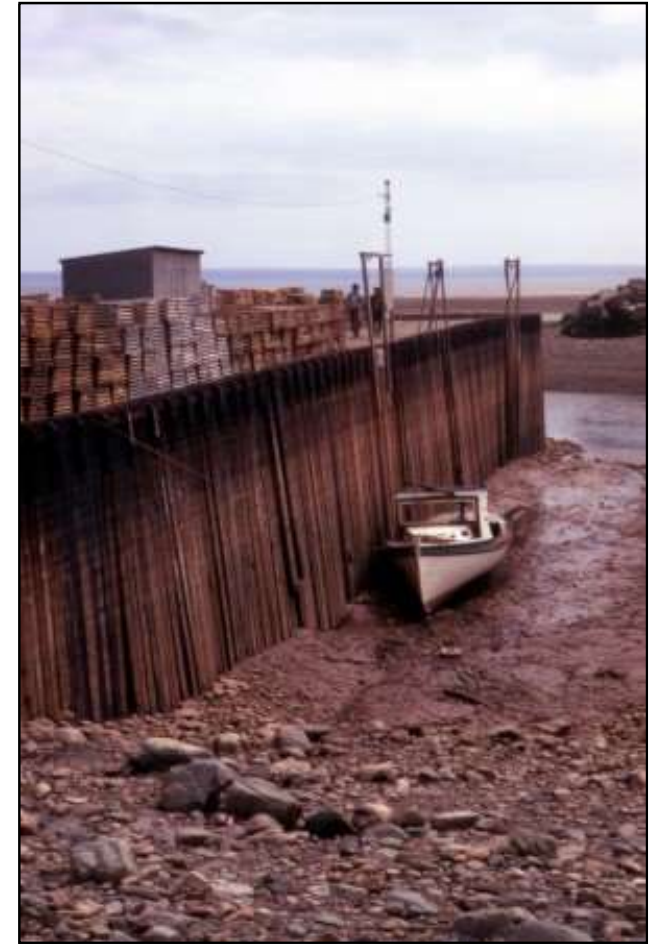
Tsunami waves



Tidal bores



→ Generated by the Moon, Sun and Earth rotation



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→ Generated by excess rainfall, snowmelt



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→ Generated by earthquakes, landslides



Japan (11/03/2011)



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→ Generated by the flood tide (with high tidal range: > 6 m) in a shallow and narrowing river (funneling effect)



What kinds of waves exist?

Wind waves are of particular interest to research activities at UGent - CERG

→ What kinds of wind waves exist?

Wind Waves

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Flood waves

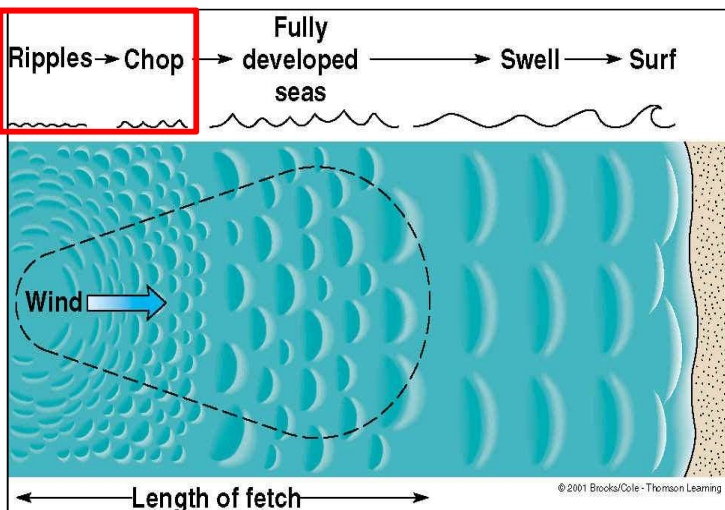
Tsunami waves

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Types of wind waves

Ripples and Chop

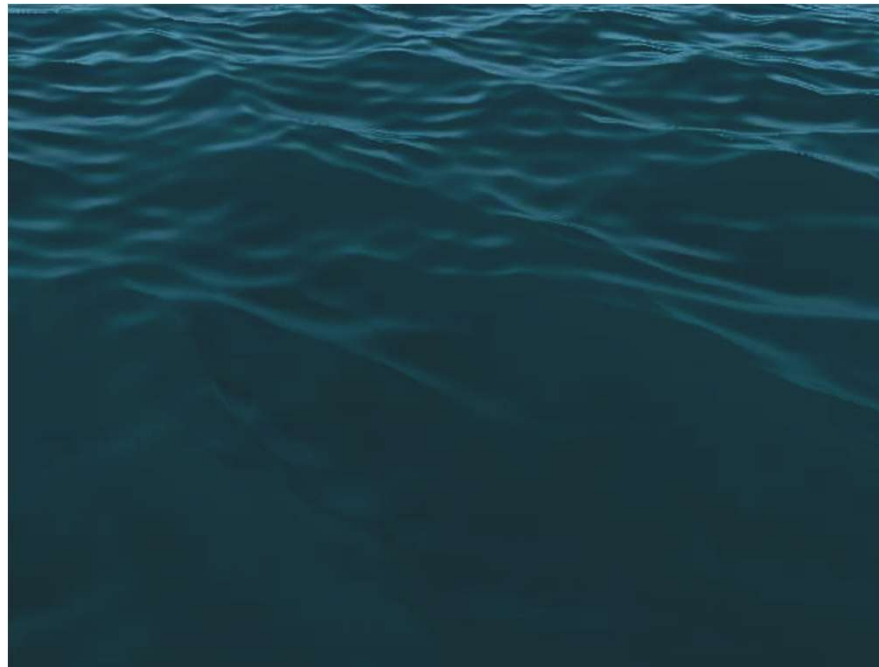
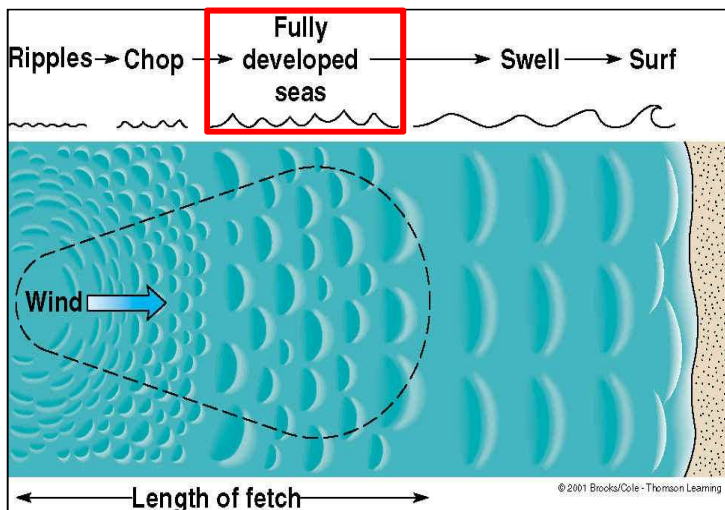


BBC



Types of wind waves

Fully developed wind sea



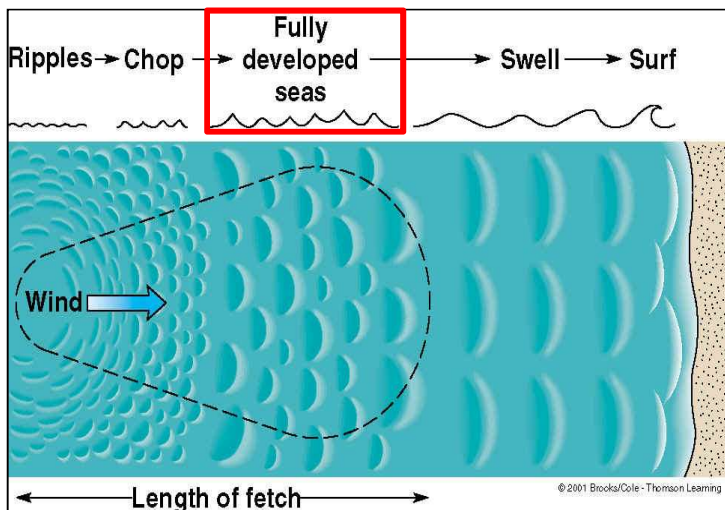
Short crested waves



Types of wind waves

Fully developed wind sea: rogue waves during storm conditions

Rogue or Freak waves



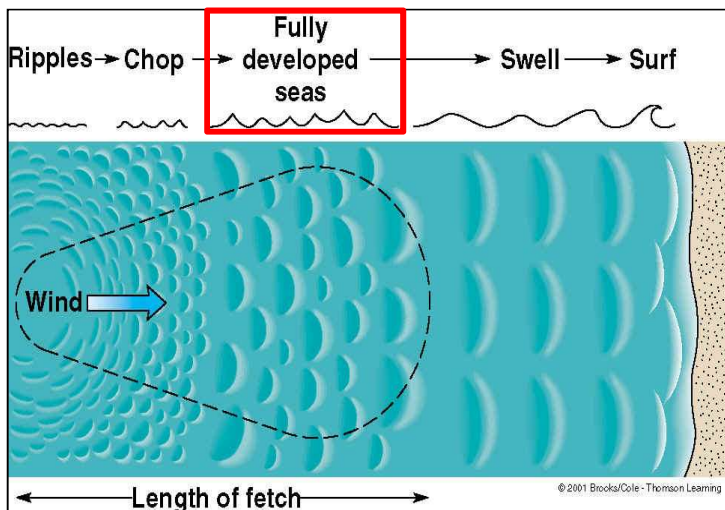
Huge wave impact on a ship, offshore platform,...



Types of wind waves

Fully developed wind sea: rogue waves during storm conditions

Rogue or Freak waves

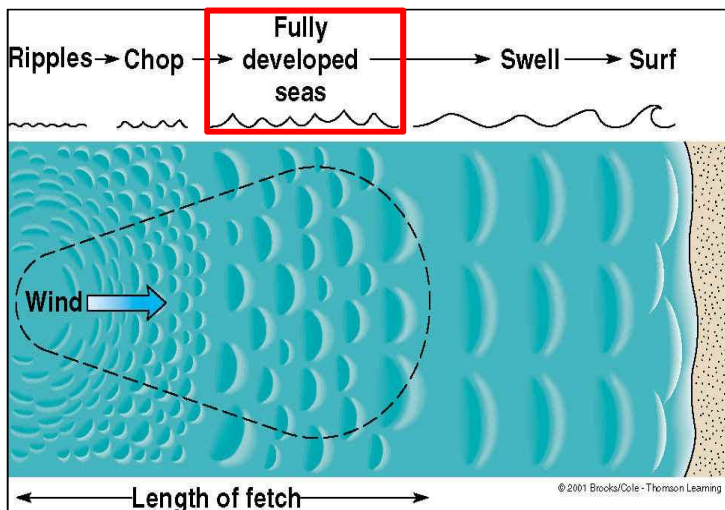


Huge wave impact on a ship, offshore platform,...



Types of wind waves

Fully developed wind sea: rogue waves during storm conditions



Rogue or Freak waves

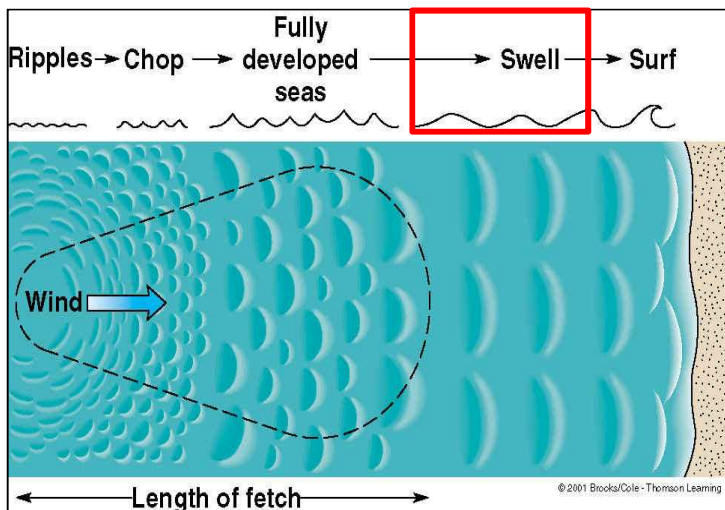


Huge wave impact on a ship, offshore platform,...



Types of wind waves

Swell waves: no direct influence of the wind anymore

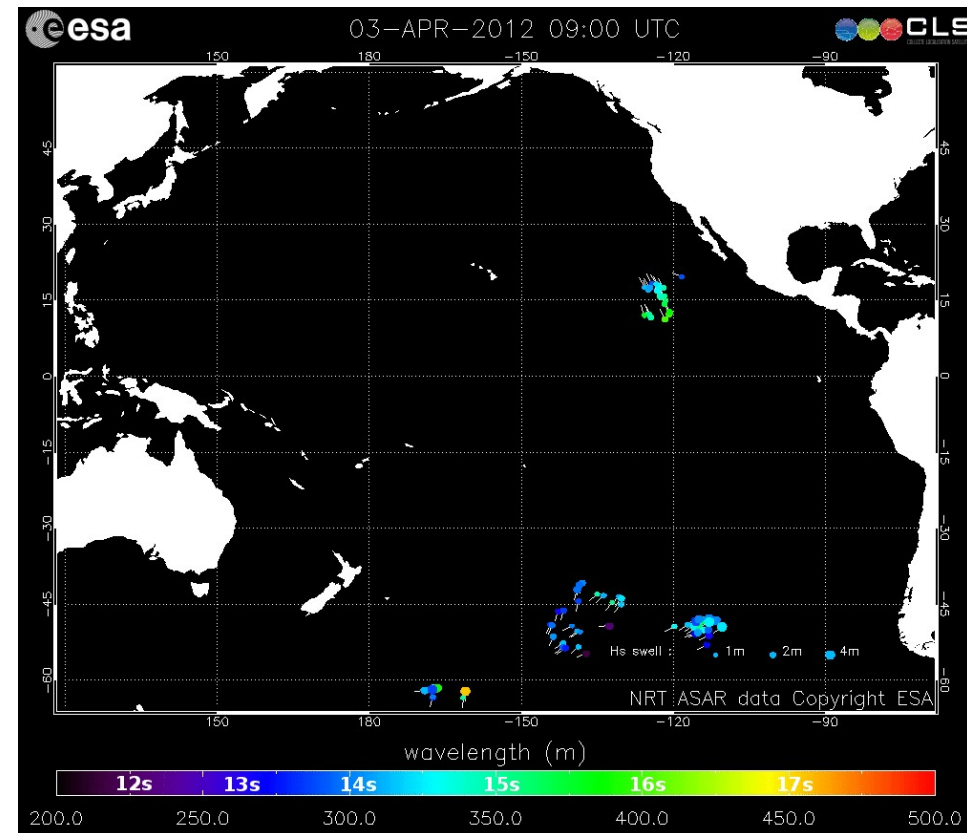
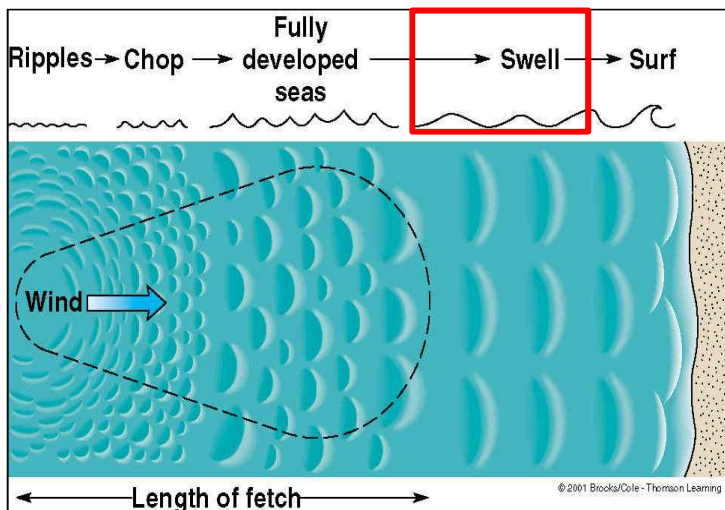


Long crested waves



Types of wind waves

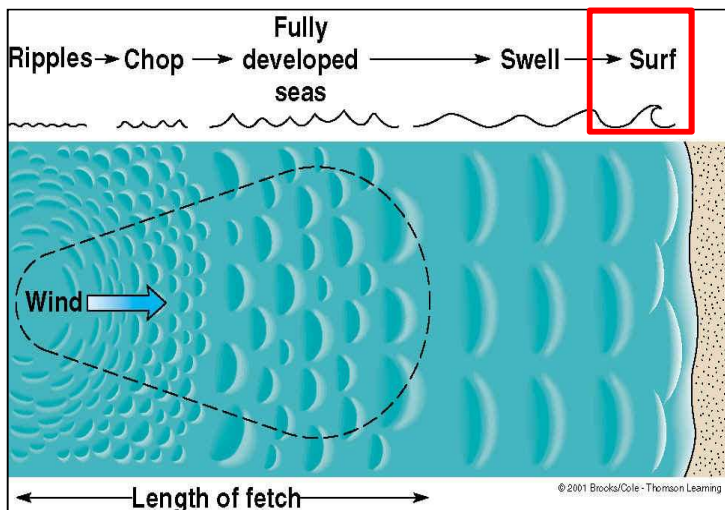
Swell waves: can travel thousands of kilometres before reaching land



Swell animation from ESA satellite ENVISAT ASAR instrument

Types of wind waves

Surf zone waves: wave shoaling and wave breaking in shallow water

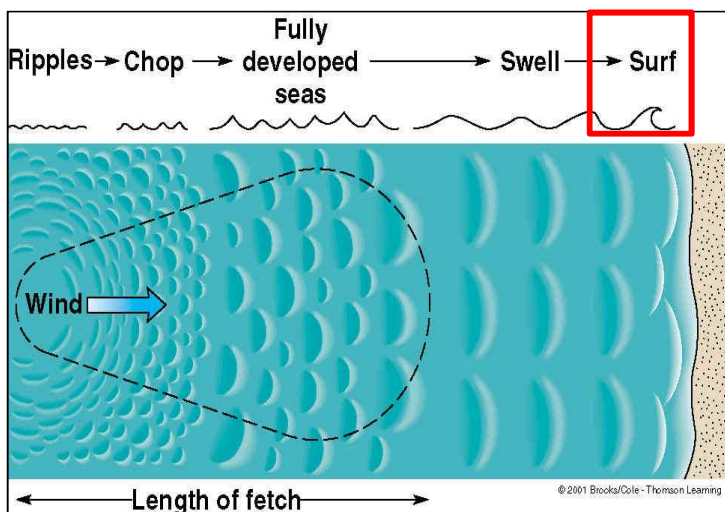


BBC



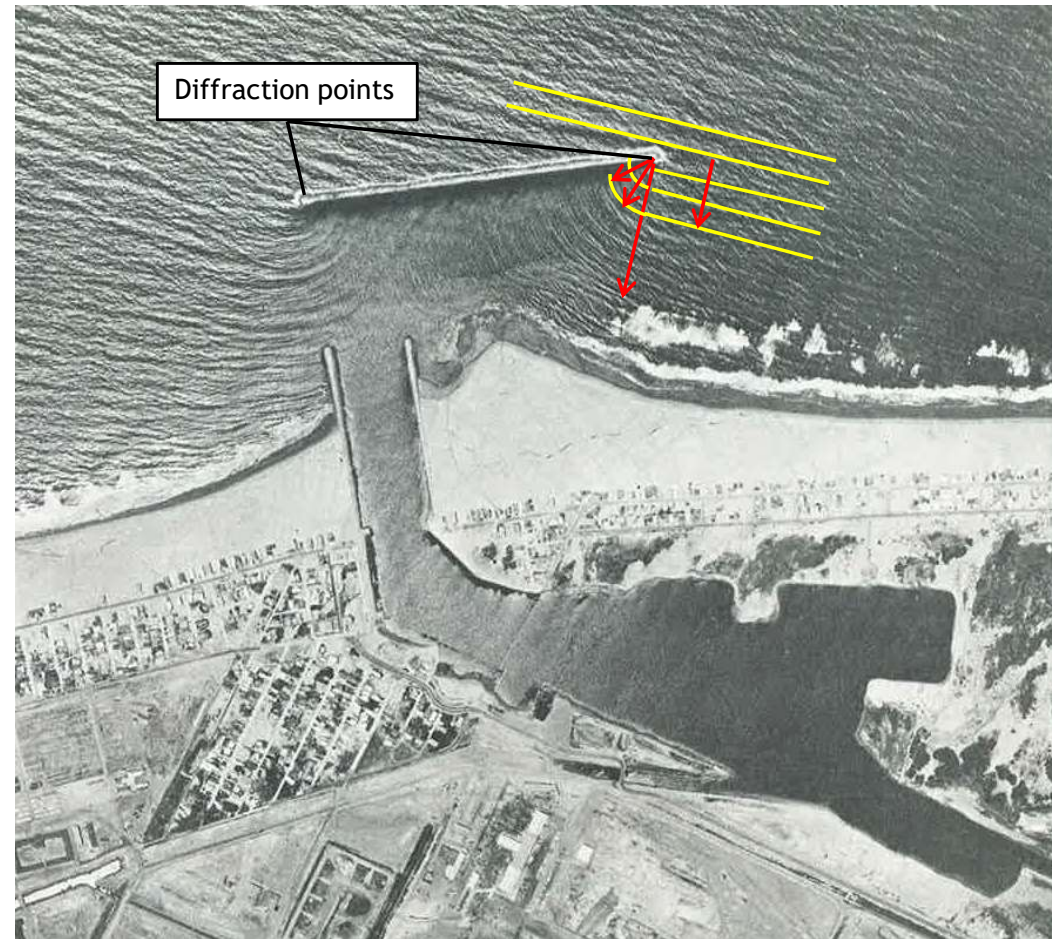
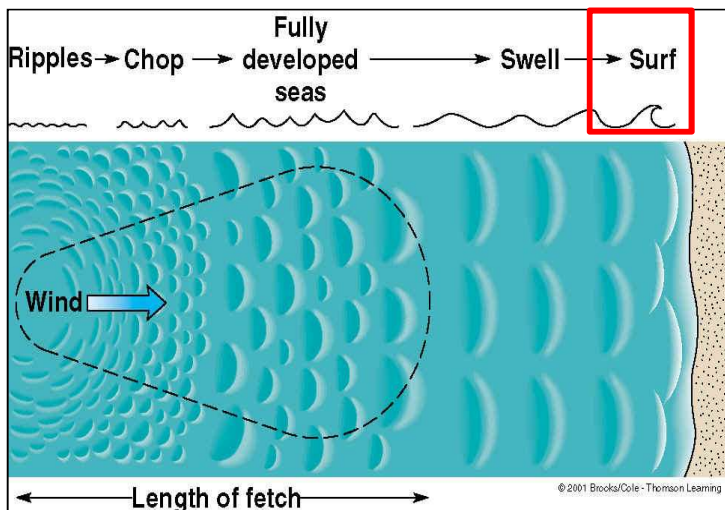
Types of wind waves

Surf zone waves: wave refraction in shallow water



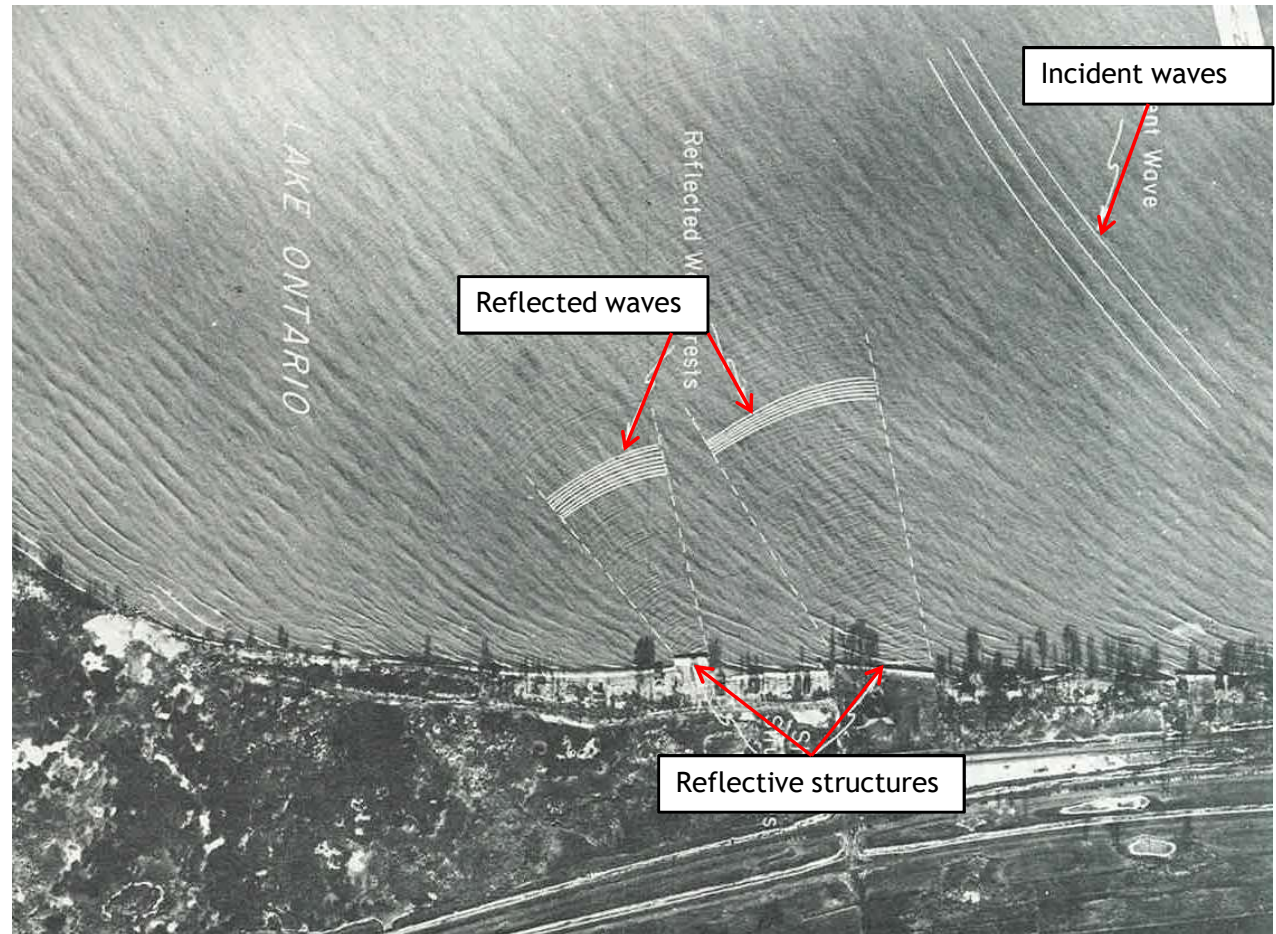
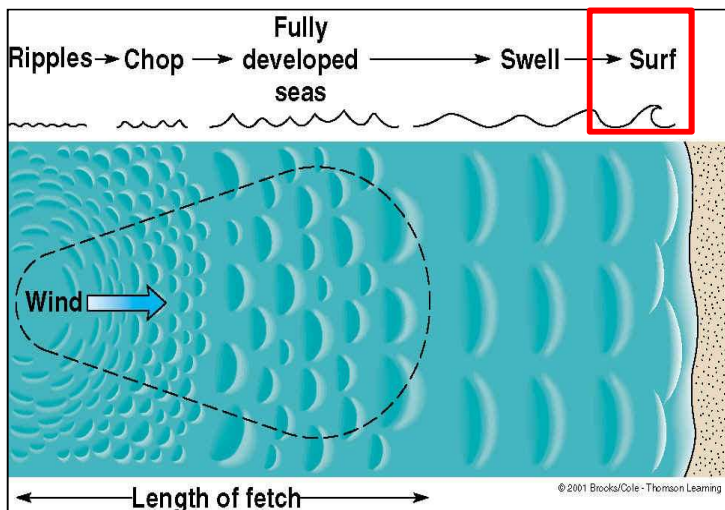
Types of wind waves

Surf zone waves: wave diffraction by breakwaters, headlands,...



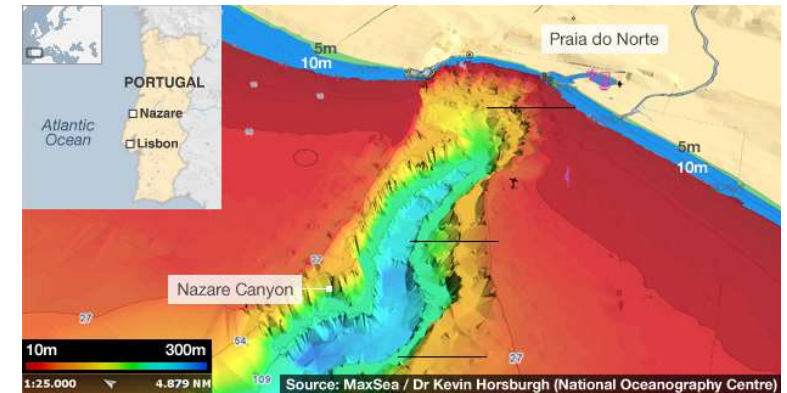
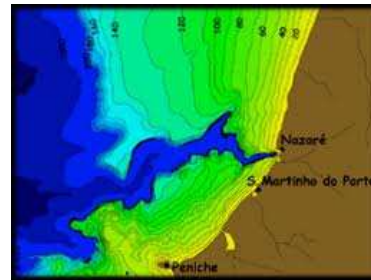
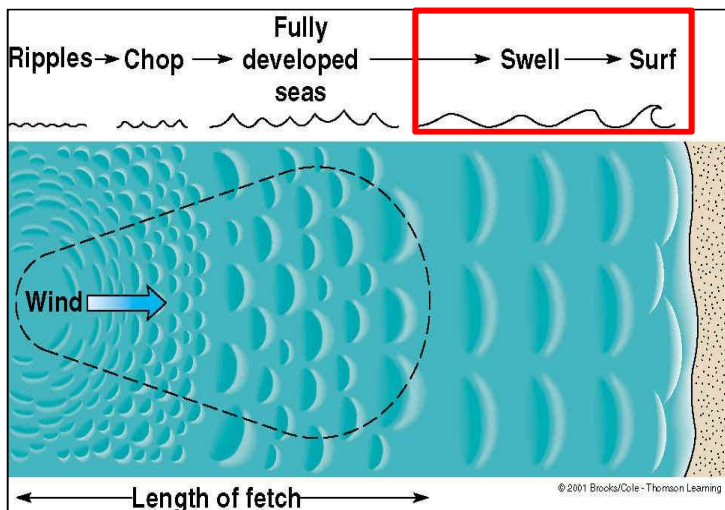
Types of wind waves

Surf zone waves: wave reflection by coastal structures



Types of wind waves

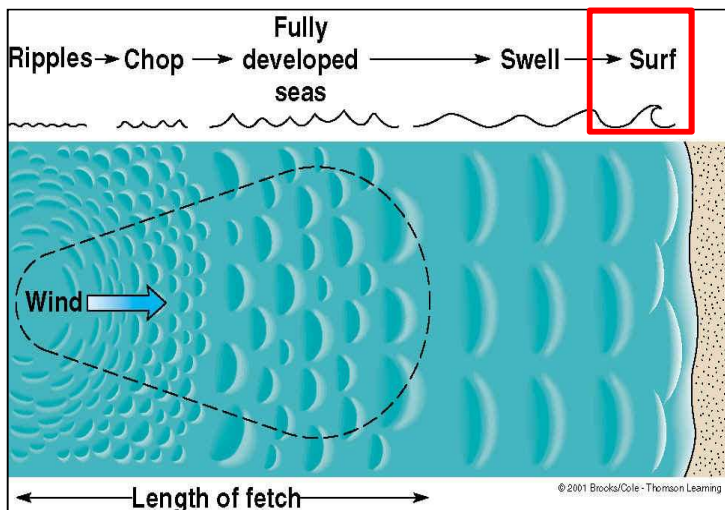
Focused swell waves: focusing of waves by refraction on slopes of submarine Nazaré Canyon



Surfing 30 m high focused swell waves (Nazaré, Portugal)

Types of wind waves

Surf zone waves: interactions with coastal structures



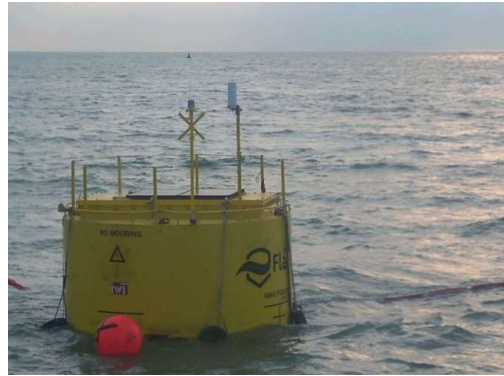
Wave overtopping at a reflective seawall (Penzance, UK)



Andy Saulter (27/12/2011)

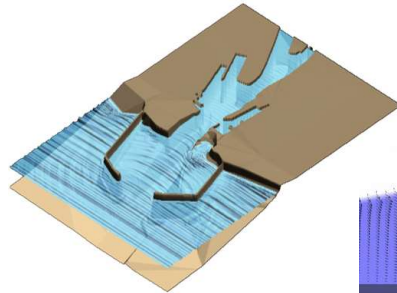
Storm waves (+storm surge) hazard to coastal safety

Wave energy

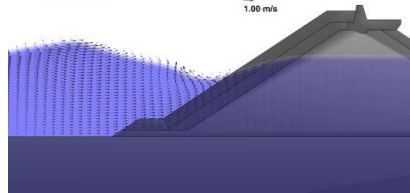


Wave energy converter (FlanSea)

Numerical modelling

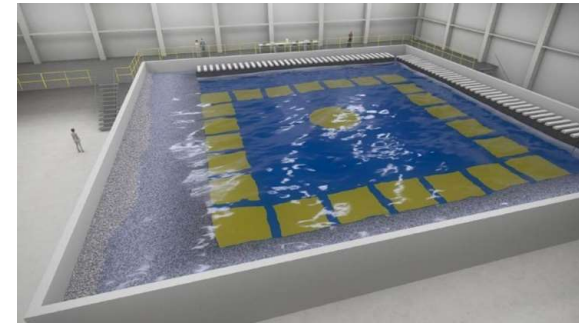


Ostend harbour
wave penetration



CFD modelling of porous
flow in breakwater

Hydraulic physical modelling



Coastal and Ocean Basin (COB)



Wave flume

Field measurements



Zeebrugge - Wave run-up



Wave overtopping

Coastal protection



Ostend - Breakwaters



Zeeheldenplein - Stilling wave basin