MCS 2021 (2mins)



Coastal Geomorphology

A determinant of environmental conservation



Katsushika Hokusai
Hokusai was a Japanese painter and printmaker from the 1700's.

Biggest storms of 2017

- Big storms ciara 2020




"What more noble pursuit of man than to intersperse a barrier between land and sea?"
Sir John Rennie (1794 – 1874) President of the Institution of Civil Engineers
Nature to be commanded must be obeyed
Francis Bacon (1621)

Introduction

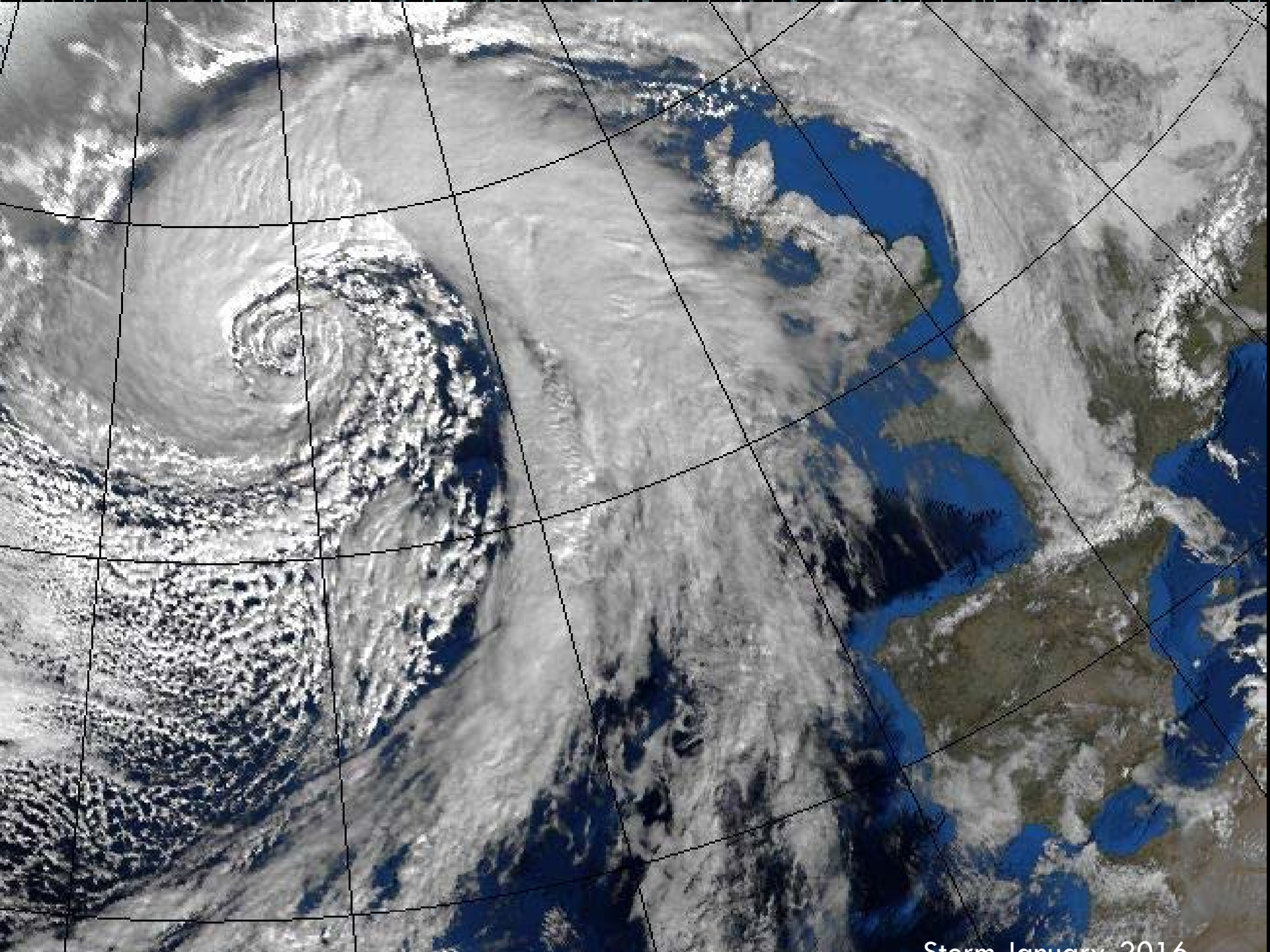
- Coasts are temporary structures, often subject to rapid change.
- Time lapse 84 Years Connecticut
- The location of a coast depends on tectonic activity and the level of water in the ocean.
- The shape of a coast is a product of many processes.
- Human interference in coastal processes rarely increases the long-term stability of a coast.
- Australia Erosion 4 mins







Should Have Gone To Nineveh.


Storm January 2016


Porthleven in Cornwall
© Mike Thomas


Newquay, Cornwall (2014)
© Geoff Tydeman / SWNS.com

Porthcothan Bay in Cornwall (BBC, 2014)



In Portland, Dorset, a rock stack off the coast, known locally as Pom Pom rock, has been washed away. Local historian Stuart Morris, who photographed the rock before and after its collapse, said: "You are talking about a natural stack that was hundreds of tonnes, totally demolished and broken to pieces by the storm." (BBC, 2014)

- Video Hastings 1min





BBC (2014) In Portreath, in Cornwall, a section of the finger pier and harbour wall has been damaged by the waves.





Porthcawl, Jan, 2017)



Aberystwyth (BBC, 2014)





‘Yes I was stupid!


surfside café
JANE HOSGOO


Café










NEWGALE CAMPING SITE




30


Telephone




30


30



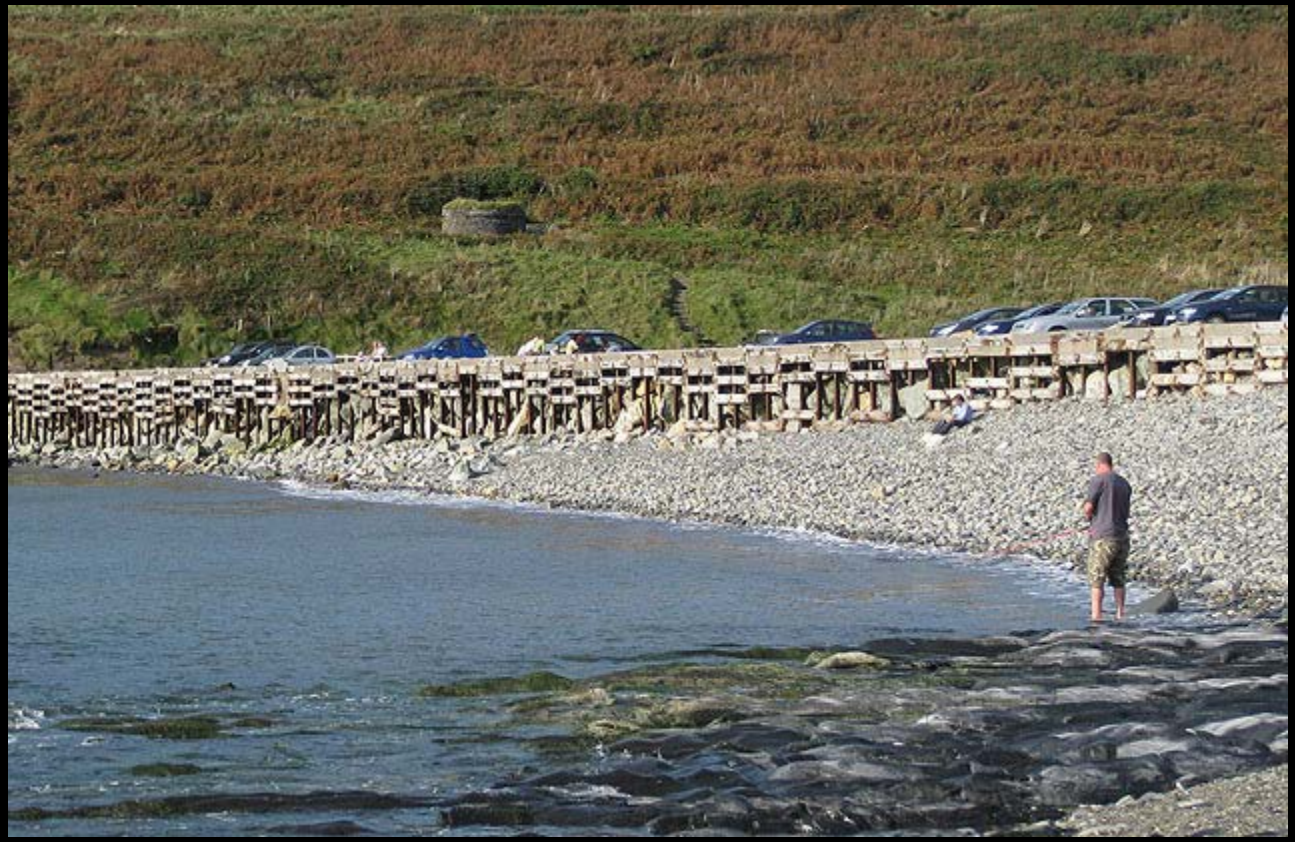


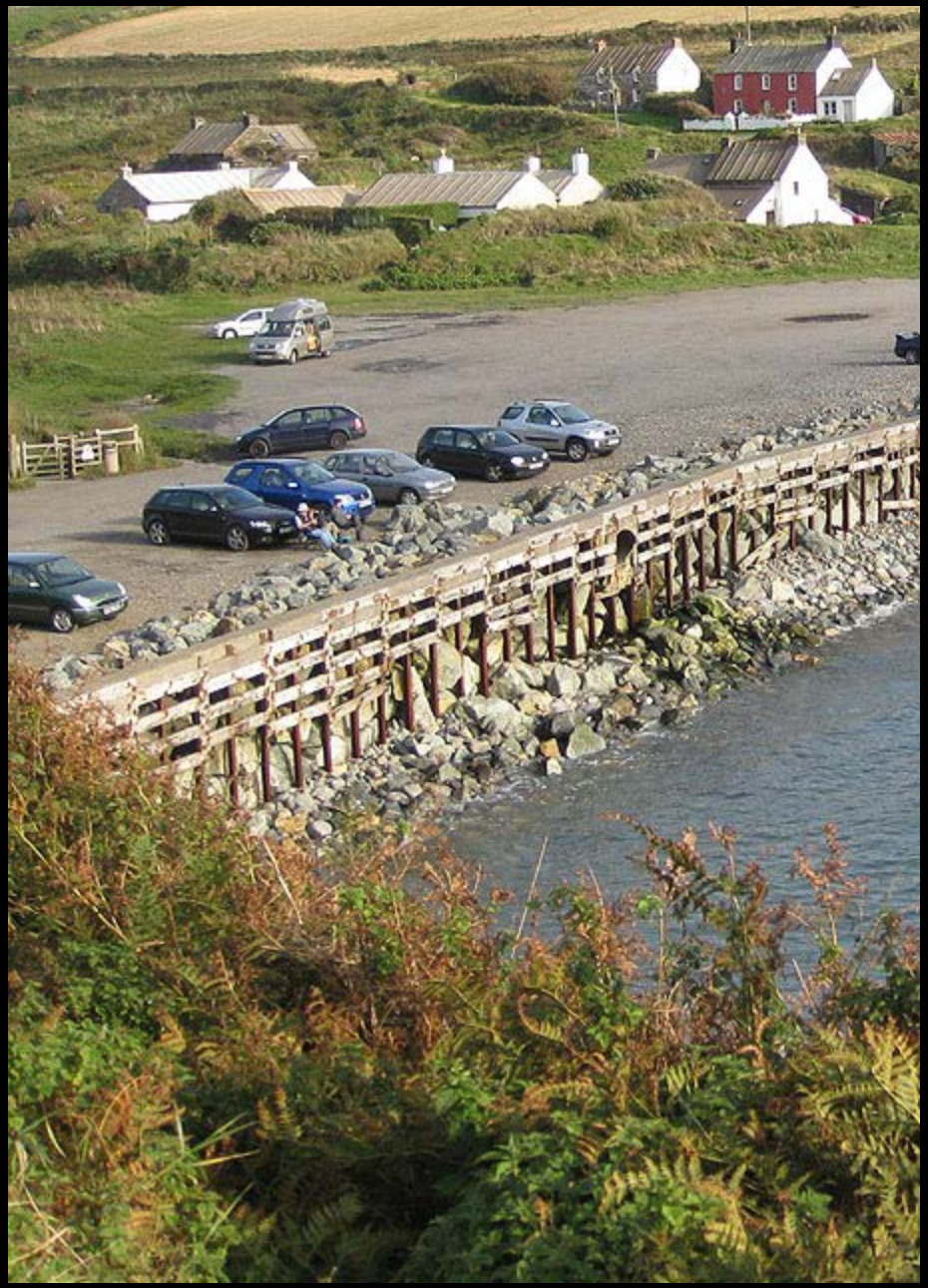

















ABEREIDDY

















a high water quality standard.



© Crown copyright and database rights 2012 Ordnance Survey Licence No. 100023344 - © Hawlfraint y Goron a hawliau'r gronfa ddata 2012 Rhif Trwydded Arolwg Ordnans 100023344

Abereiddy is a sandy/shingle beach popular with tourist

Traeth tywod/cerrig mân sydd yn Abereiddi, ac mae'n

Bathing Water Quality
Ansawdd Dŵr Ymdrochi

Abereiddy is a European bathing water and is monitored by Environment Agency Wales from May to September.

This bathing water usually achieves a high water quality standard.

Mae Abereiddi yn ddŵr ymdrochi Ewropeaidd ac mae'n cael ei fonitro gan Asiantaeth yr Amgylchedd Cymru o fis Mai hyd fis Medi

Mae'r dŵr ymdrochi hwn fel rheol yn cael safon ansawdd dŵr uchel.



© Crown copyright and database rights 2012 Ordnance Survey Licence No. 100023344 – © Hawlfraint y Goron a hawliau'r gronfa ddata 2012 Rhif Trwydded Arolwg Ordnans 100023344

The main sources of pollution that may affect the quality of this bathing water are listed above (based on historical monitoring).
The full details of this bathing water, its catchment, information on all potential pollution sources and how they are managed can be viewed on the Environment Agency website - www.environmentagency.gov.uk/homeandleisure/recreation

---

Mae'r prif ffynonellau llygredd a allai effeithio ar ansawdd y dŵr ymdrochi hwn yn cael eu rhestru uchod (ar sail gwaith monitro hanesyddol). Mae manylion llawn y dŵr ymdrochi hwn, ei ddalgylch, gwybodaeth am yr holl ffynonellau llygredd posibl a sut y maent yn cael eu rheoli i'w gweld ar wefan Asiantaeth yr Amgylchedd - www.environmentagency.gov.uk/homeandleisure/recreation

Abereiddy is a sandy/shingle beach popular with tourist and residents alike, especially with coasteerers, divers and surfers. The area also provides an ideal location for bathing, kayaking and fishing. Abereiddy lies within Castell Coch Cliffs and Llanfryn Quarries Site of Special Scientific Interest (SSSI) and Trwyncastell Cliffs and the Blue Lagoon SSSI, with the bathing water itself being contained within Pembrokeshire marine Special Area of Conservation (mSAC). A large car park adjoins the beach and public toilets are open from Easter to October half-term. The beach is located along the Pembrokeshire Coast Path, which is popular with both tourists and local

Traeth tywod/cerrig mân sydd yn Abereiddi, ac mae'n denu llawer o bobl leol ac ymwelwyr, yn enwedig deifwyr, syrffwyr a phobl eraill sy'n mwynhau campau'r arfordir. Mae'r ardal hefyd yn lleoliad delfrydol i ymdrochi, caiacio a physgota. Mae Abereiddi'n rhan o Safle o Ddiddordeb Gwyddonol Arbennig Clogwyni Castell Coch a Chwareli Llanfryn a Safle o Ddiddordeb Gwyddonol Arbennig Clogwyni Trwyncastell a'r Pwll Glas, ac mae'r dŵr ymdrochi ei hun yn rhan o Ardal Cadwraeth Arbennig Forol Sir Benfro. Mae maes parcio mawr yn ffinio â'r traeth ac mae'r toiledau cyhoeddus ar agor o'r Pasg tan wyliau hanner tymor mis Hydref. Mae'r

STRUMBLE SHUTTLE

PEMBROKESHIRE Coastal Bus Services

Gwasanaeth Bws Arfordir SIR BENFRO

GWIBIWR STRWMBL

A shuttle bus serving the Pembrokeshire coast 2 days a week

Bws gwibio sy'n gwasanaethu arfordir Sir Benfro 2 diwrnod yr wythnos



Service 404: 3rd October 2013 - 3rd May 2014
Gwasanaeth 404: 3ydd Hydref 2013 - 3ydd Mai 2014

404 Strumble Shuttle/Gwibiwr Strwmbl

Fishguard-St Davids/Abergwaun-Tyddewi

Winter Timetable/Amserlen y Gaeaf

3rd October 2013 to 3rd May 2014

Thursdays & Saturdays only

3ydd Hydref 2013 i 3ydd Mai 2014

Dydd Iau & Dydd Sadwrn yn unig

Fishguard (Square)/Abergwaun (Y Sgwâr)	11:10	16:20
Goodwick (Square)/Wdig (Y Sgwâr)	11:14	16:24
Pontiago	11:19	16:29
Strumble Head Junction/Cyffordd Pen Caer (Tre-fisheg)	11:24	16:34
Croes Trefasser Cross	11:31	16:41
St Nicholas (Phone Box)/Tremarchog (Blwch Ffôn)	11:36	16:46
[illegible] (Woollen Mill/Melin Wlan)	11:39	16:49
[illegible] (Arosfan Bysiau)	11:48	16:58
	11:54	17:04
	11:57	17:07
	12:02	17:12
	12:06	17:16
	12:09	17:19
	12:17	17:27
	12:23	17:33




77










© EPA








© Keith Morris/LNP


© Keith Morris/LNP



Swansea

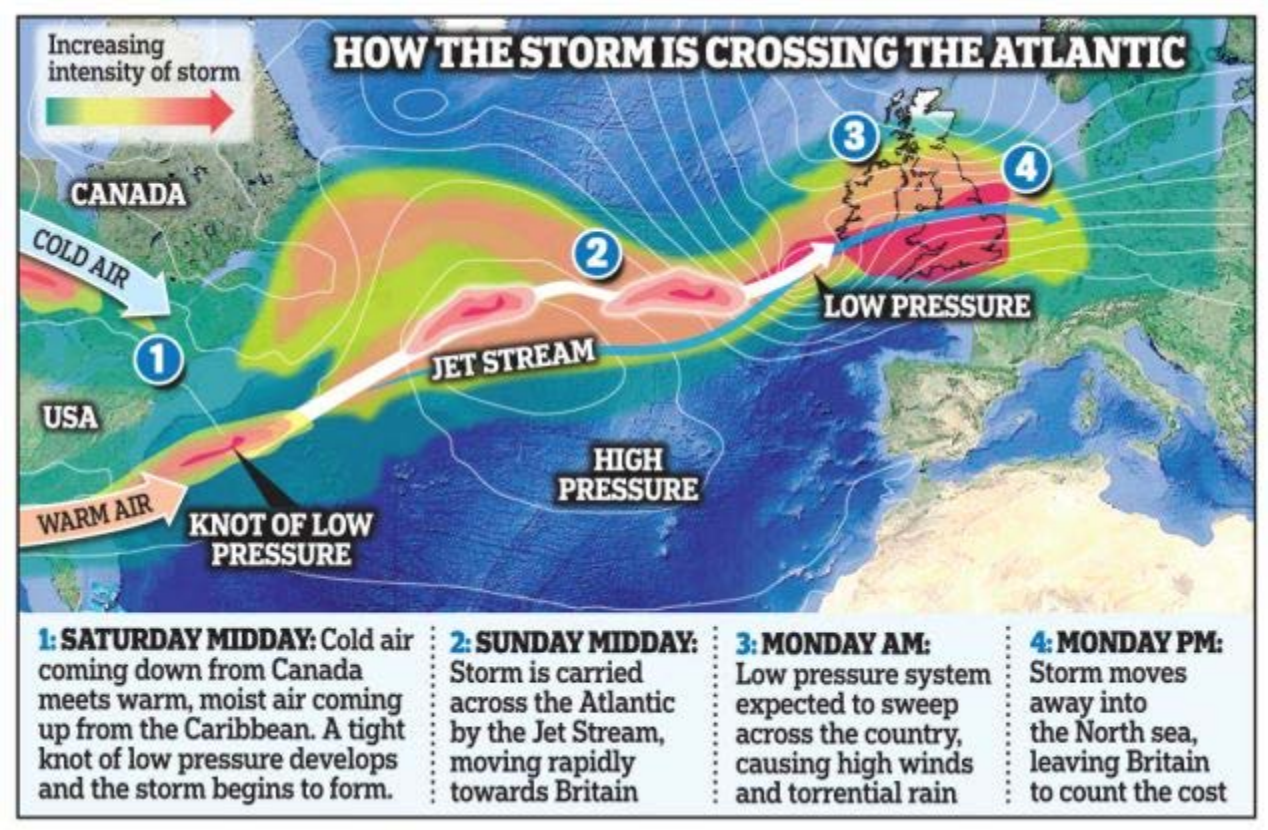




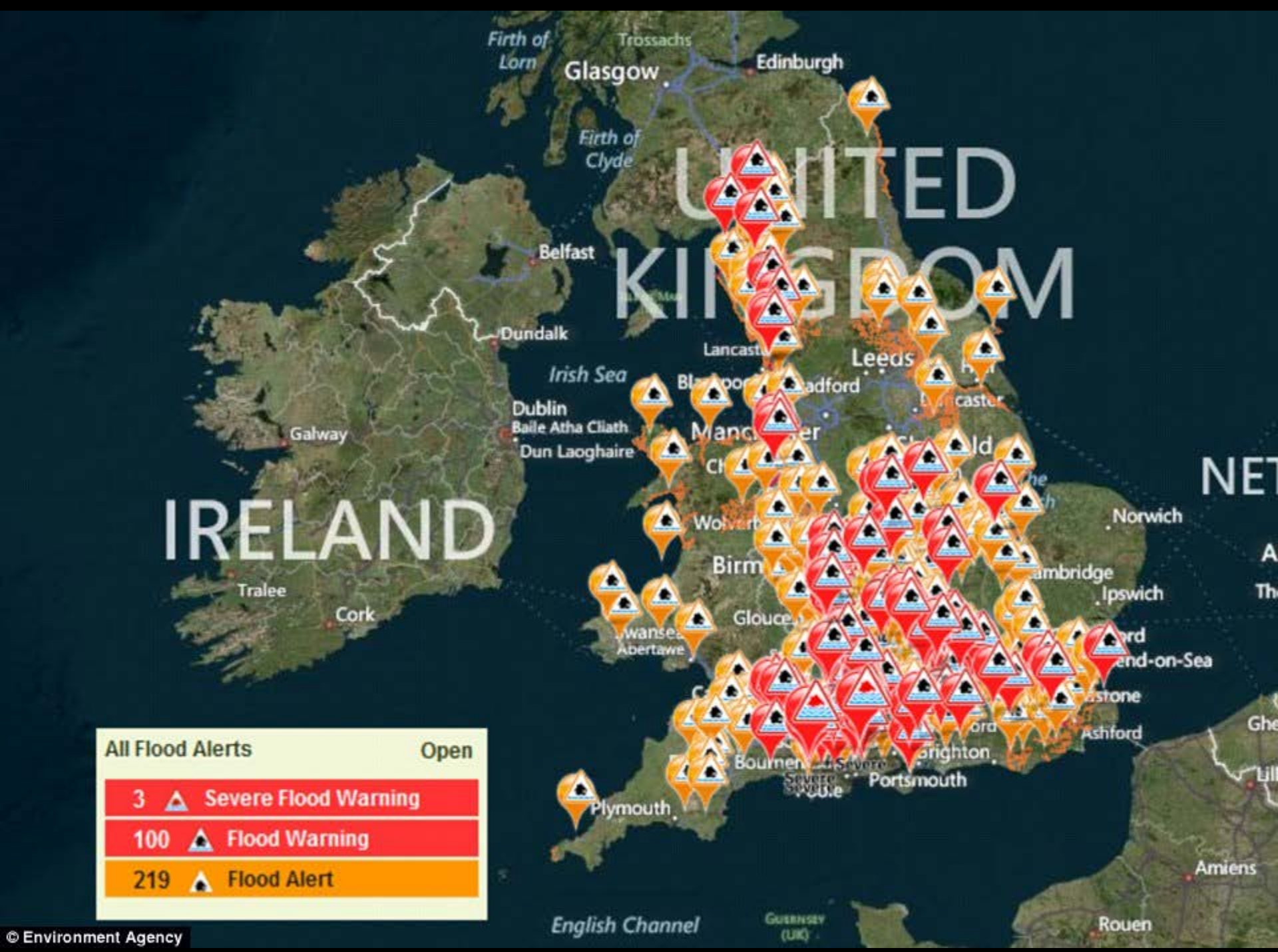
in Amroth,



to Amroth's coastal road



http://www.telegraph.co.uk/topics/weather/10569613/UK-weather-what-caused-the-Christmas-storms-and-flooding.html


Firth of Lorn
Trossachs
Glasgow
Edinburgh
Firth of Clyde
UNITED KINGDOM
Belfast
Dundalk
Irish Sea
Leeds
Dublin
Baile Atha Cliath
Dun Laoghaire
Galway
IRELAND
Norwich
Ipswich
Tralee
Cork
Portsmouth
Plymouth
Ashford
Amiens
Rouen
English Channel
All Flood Alerts
Open
3 Severe Flood Warning
100 Flood Warning
219 Flood Alert
© Environment Agency

Ciara and Dennis 2020



November 2020





Feb 2021








GRAHAM


EMMA ♥ CRAI



Climate change? No, just weather



ANALYSIS
By **David Derbyshire**

A YEAR ago, much of Britain was blanketed in snow after a mild wet December turned into an icy January.

Twelve months on, it's the turn of Atlantic storms, gale force winds, torrential rain and killer waves to batter the UK.

The violent weather systems which made December the stormiest month since 1969 have continued relentlessly into the New Year.

They have been brought to Britain by an unusually fierce jet stream, the ribbon of fast-moving air which blows across the Atlantic from America.

Sitting between 25,000 and 35,000ft miles high, it guides winter storms across the Atlantic and in the past few weeks has been in the perfect position to send them our way.

In a typical winter, the jet stream travels at 100mph. This year it has reached 230mph.

At those kinds of speeds, it causes massive turbulence in the lower atmosphere, forming a rapid succession of low pressure systems which it drags across the Atlantic and dumps on Europe.

Just as a fast jet stream strengthens storms, those powerful storms can increase the strength of the jet stream.

In the last few weeks this feedback mechanism has led to the cluster of violent weather that has battered our shores.

The jet stream is moving so quickly that storms can cross the Atlantic in just a couple of days. Yesterday the remnants of the Hercules storm which brought freezing weather to America were swept up north of Scotland. The Hercules storm warmed up on its journey and was not expected to bring cold weather to this side of the Atlantic.

But it will have contributed to the huge waves smashing the coastline of the South-West of England last night.

Meteorologists are uncertain why the jet stream is so fast this year.

The Met Office believes it may be linked to a natural cycle in Atlantic weather given the unhelpful name of the quasi-biennial oscillation, or QBO.

The QBO describes the cycle of fast moving winds which sit 15 miles above the equator. Every 14 months or so, these winds flip direction – sometimes going from east to west, other times from west to east.

When the QBO is in its westerly phase – as it has been since early 2013 – the jet stream tends to be faster and our weather tends to be stormier in the winter.

But while the QBO may play a role in creating a strong jet stream, a far more important factor is likely to be luck. Or rather, bad luck.

'In some years you have a strong jet stream for a period of time, in other years you have a weak one,' said a Met Office spokesman.

'It is entirely possible that it is just weather – just natural variability. Air moves around, the jet stream moves around and eventually you will get a pattern where you end up with a stormy December and January.'

And what about climate change? In the last few days, environmental groups have used the floods and gales to remind us that extreme weather is forecast to be more common as the world warms up.

It's certainly likely that temperatures globally will increase the risks of extreme weather.

But despite the scaremongering, there is no evidence from the climate models that Britain will get more storms in the future.

Mail, 5/1/2014

Time

- Is it unusual?
- Videohttp://www.youtube.com/watch?v=vbWEYLHMRFI

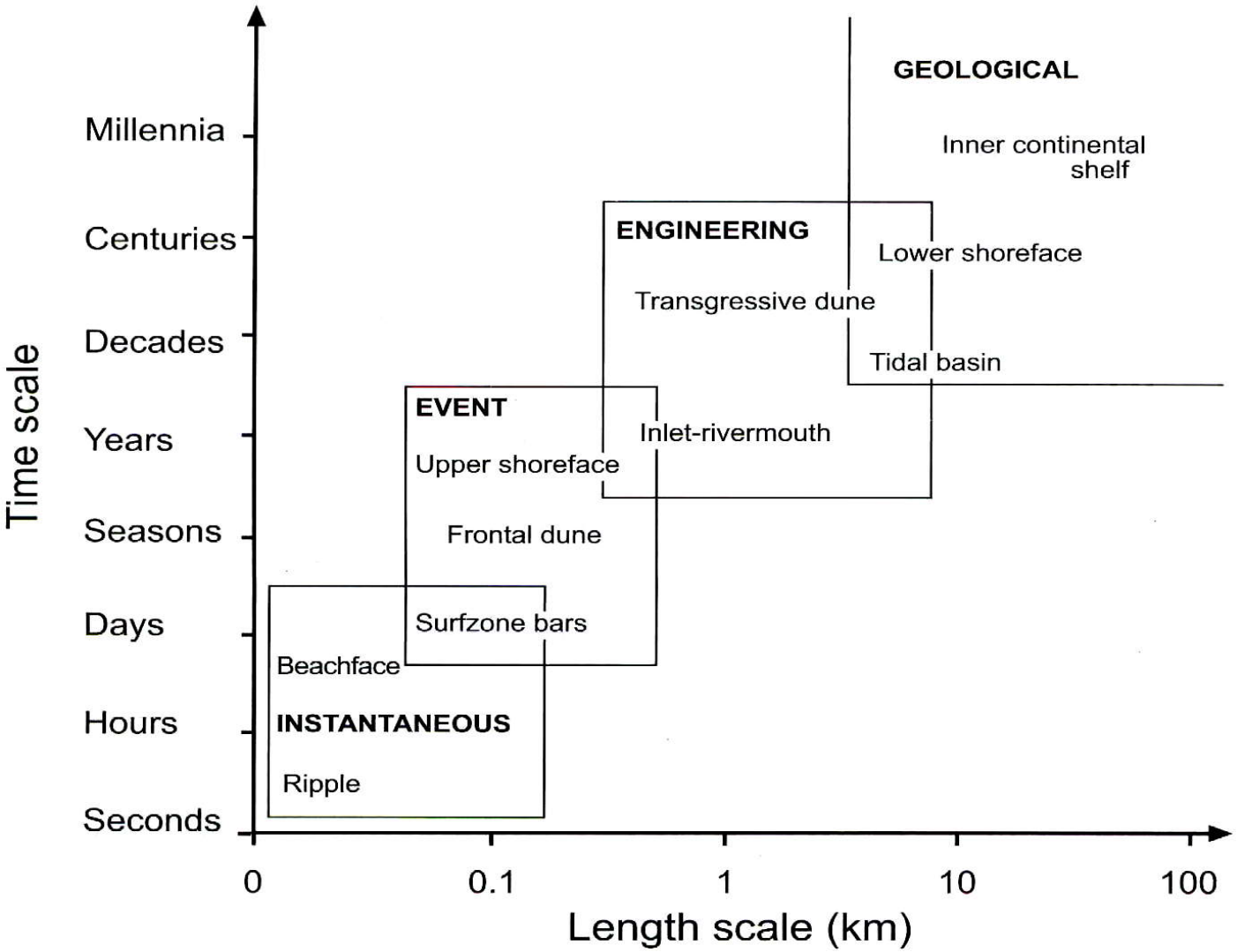


Figure 1.2 – Definition of spatial and temporal scales involved in coastal evolution. Large-scale coastal landforms operate over long time scales, whereas small-scale coastal features respond over short time scales. [From Cowell and Thom, 1994.] [Copyright © 1994 Cambridge University Press, reproduced with permission.]

Coastal Importance

- Arguably the most intensely used of all habitats
- Arguably the largest biodiversity gradient on the planet
- 40% of the global pop. Live within 100km
- The CCSR (2006) report predicted that between 1995 and 2025 there would be a global 35% increase in population living within 60 miles of the sea. Already happened by 2021
  - Furthermore, 75% of the total global population would live in coastal locations (Edgren, 1993).





Coastal Importance

- Changing population is not distributed equally due to the topography and proximity to the sea (Carter, 1988; Small and Nicholls, 2003; Phillips, 2020)
- This dynamic coastal demography makes policy research crucial due to its impacts (Leatherman, 2011) on increased consumption of water, energy, production of waste and coastal infrastructure (Benoit and Comeau, 2005;Williams 2020).
- Most people live on the coast and are impacted by climate change (Williams, 2020)



International importance

- Sea level rise (approx. 3mm/yr), delicate historical and ecological inheritance makes policy considerations particularly challenging (House & Phillips, 2011; IPCC, 2019).
- Intergovernmental Panel on Climate Change (IPCC) coasts and climate change (Masselink, 2011)

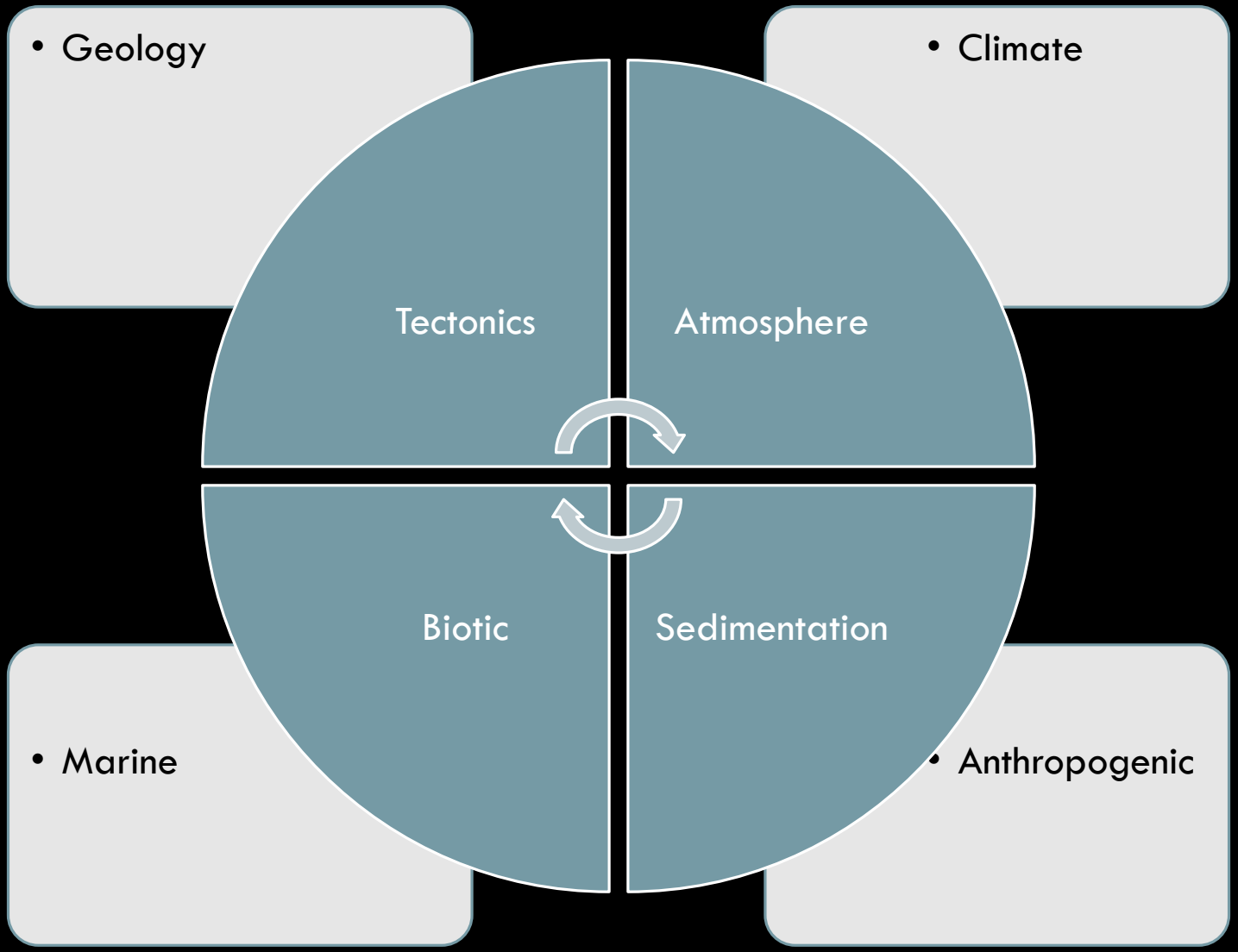


So what are the fundamentals?

- List the physical factors that influence the interface between terrestrial and marine environments.



Coastal factors



Eustatic SL Change

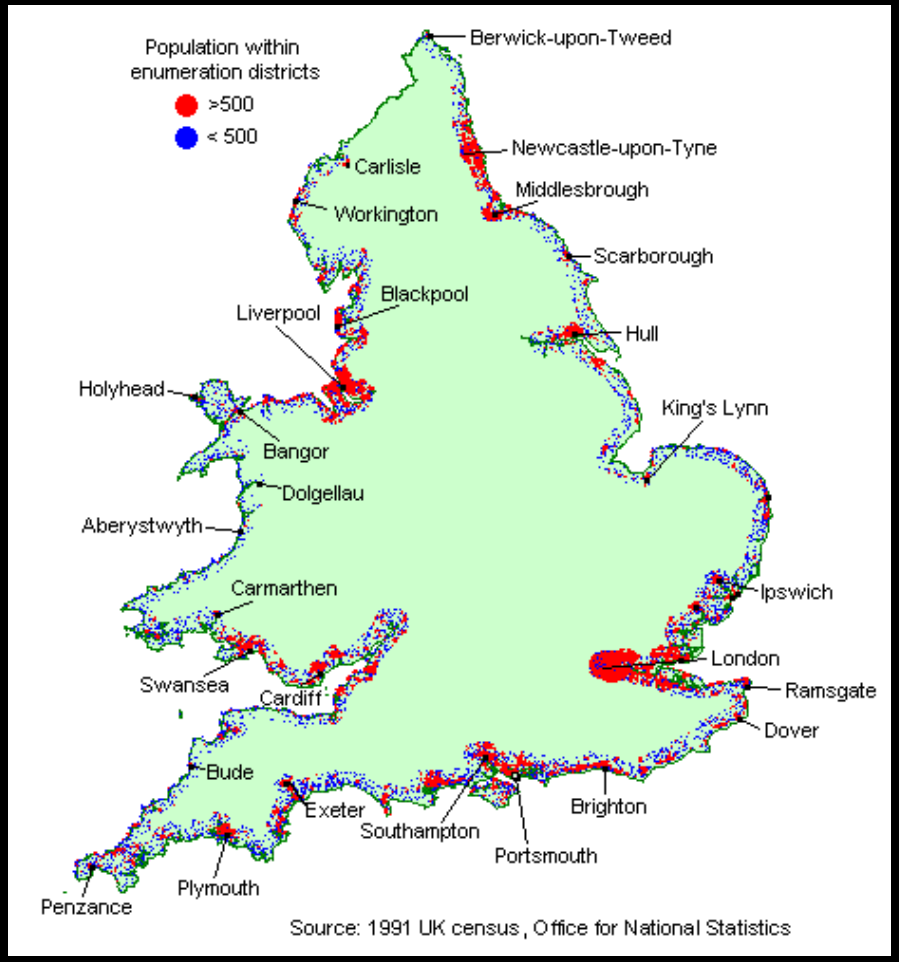
SEA-LEVEL RISE

It has become clear over the past few decades that global sea level is rising at an accelerated rate. Figure 17.2 shows the change in global sea level over the last 150 years reconstructed by Church and White (2006) from an extensive analysis of tide-gauge records and satellite altimeter data. The sea-level curve shows a modest rate of rise of about 1 mm yr^{-1} around 1850, increasing to about 3 mm yr^{-1} at present.

The Intergovernmental Panel on Climate Change (IPCC) has published its Fourth Assessment Report (AR4) which addresses at length the causes and implications of the current and future rise in sea level (IPCC, 2007a, 2007b). Four main contributing factors to the current sea-level rise have been identified: (1) thermal expansion of the ocean water due to an increase in the water temperature; (2) melting of mountain glaciers and ice caps; (3) melting of Greenland ice sheets; and (4) melting of Antarctic ice sheets. These contributions have been quantified and are listed in Table 17.1. For the observed sea-level rise from 1961 to 2003 (1.8 mm yr^{-1}), the cumulative effect of these four factors still left about 0.7 mm yr^{-1} unexplained. However, the use of more sophisticated and comprehensive monitoring has brought to light that melting of Greenland and Antarctic ice sheets has contributed considerably to the observed sea-level rise from 1993 to 2003 (3.1 mm yr^{-1}), leaving only

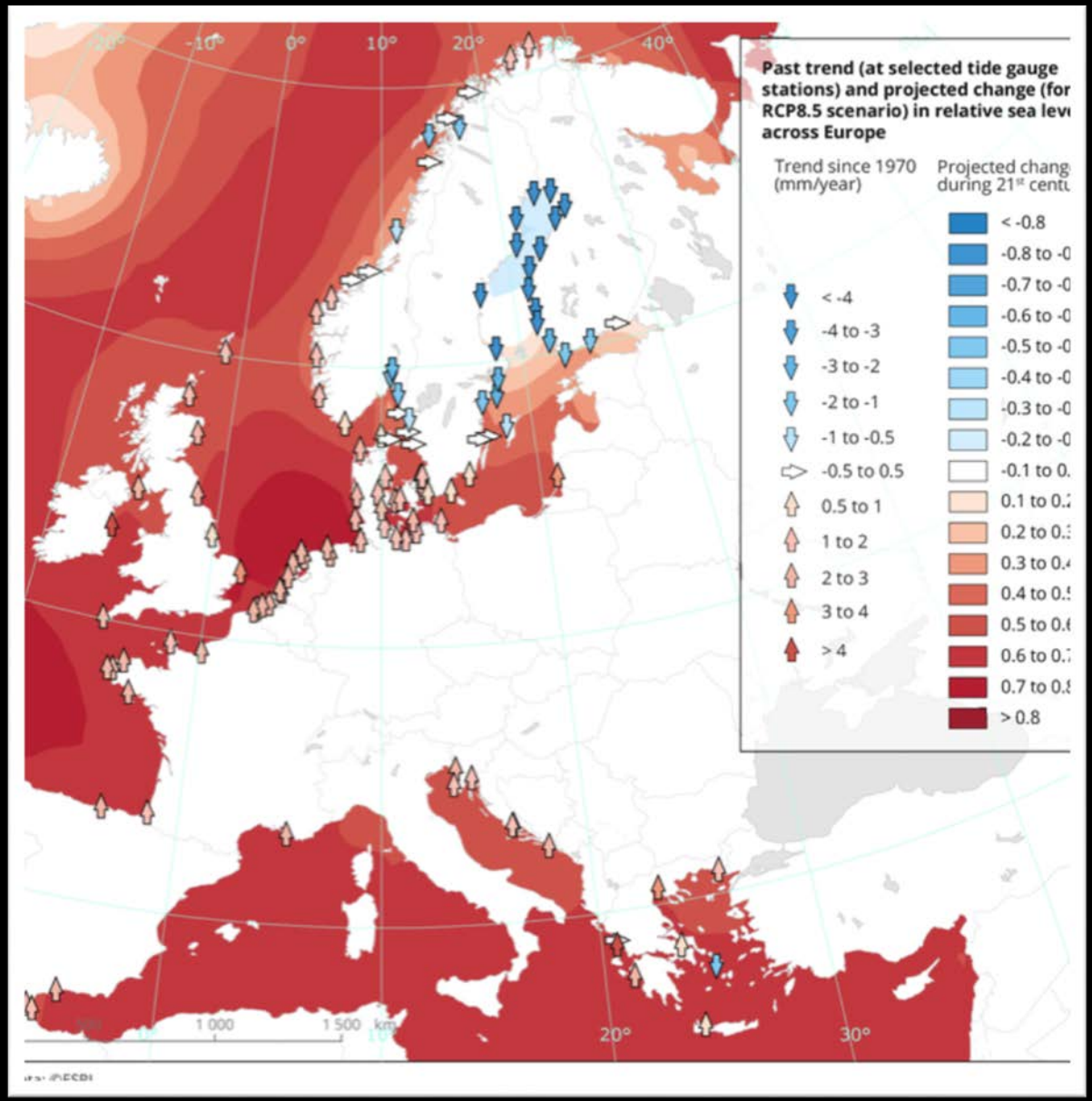
BOX 17.1 ➤

Demographics and SL rise





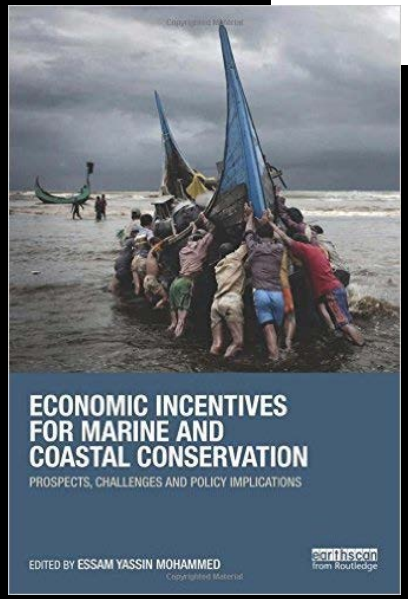
Past trend and projected change in relative sea level across Europe (2021)



The arrows show the trend in relative sea level at selected European tide gauge stations since 1970 (in mm/year) based on data from the Permanent Service for Mean Sea Level (PSMSL). The background colours show projections of European sea level change for 2081–2100 for RCP8.5 (in metres)

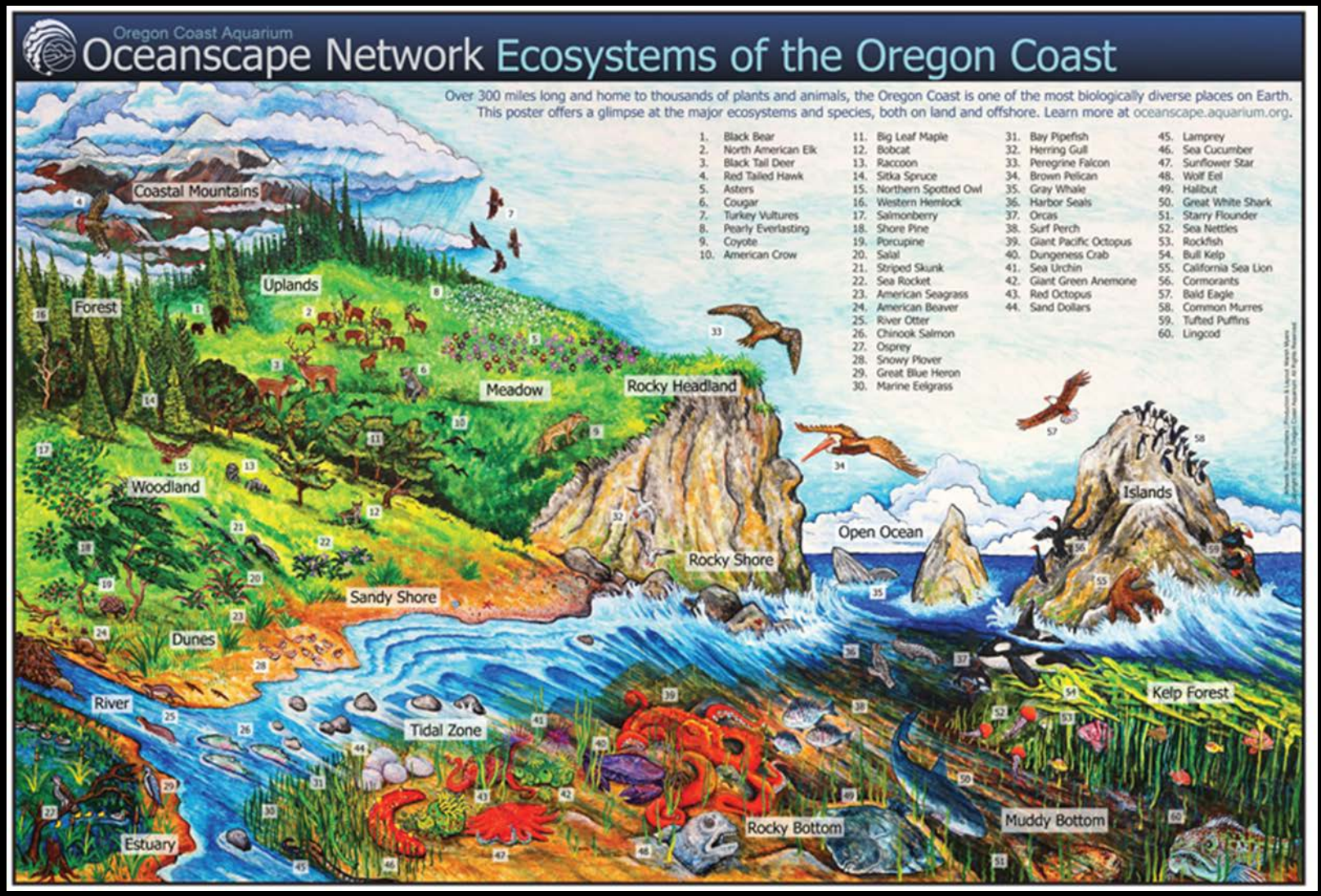
Physical processes that influence the coast and its habitats





- List coastal habitats around the world. Put an image up on the chat.
- Why does this show the importance of physical processes for habitat conservation?

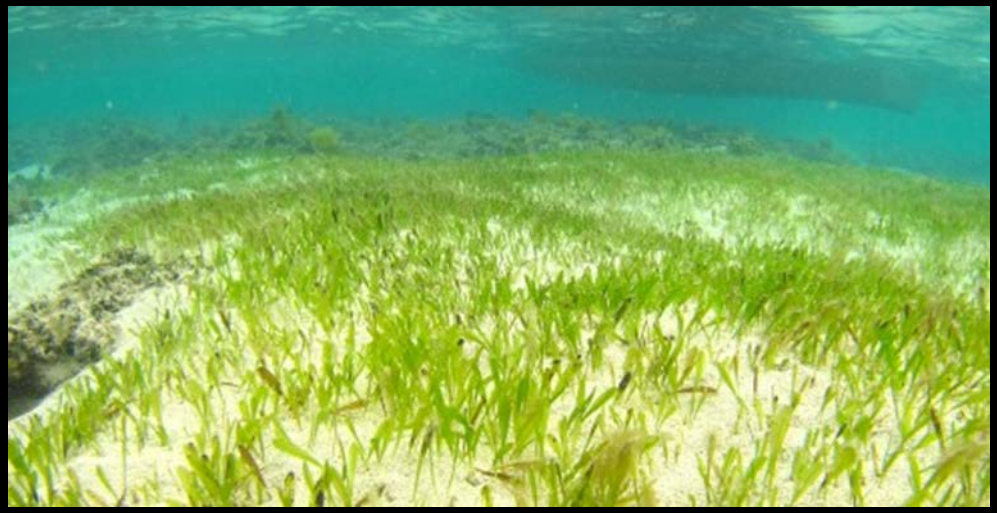
An example, Oregon US



Underwater









Intertidal













Coast













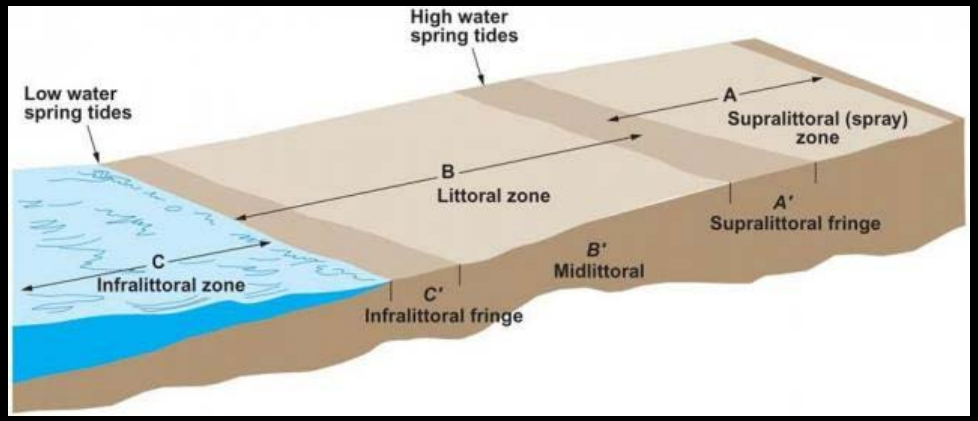
Exercise

- Find an example of coastal habitat conservation that requires an understanding of physical processes.
- Choose one from the list of habitats you considered earlier.
- Present, discuss and put it on group chat.

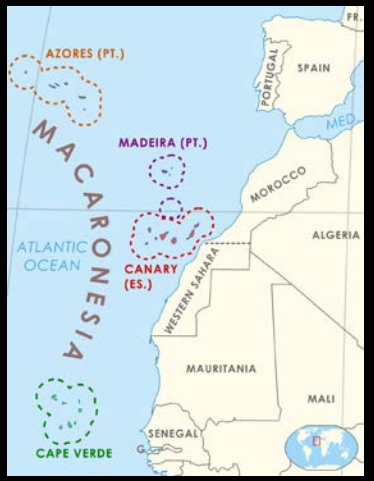


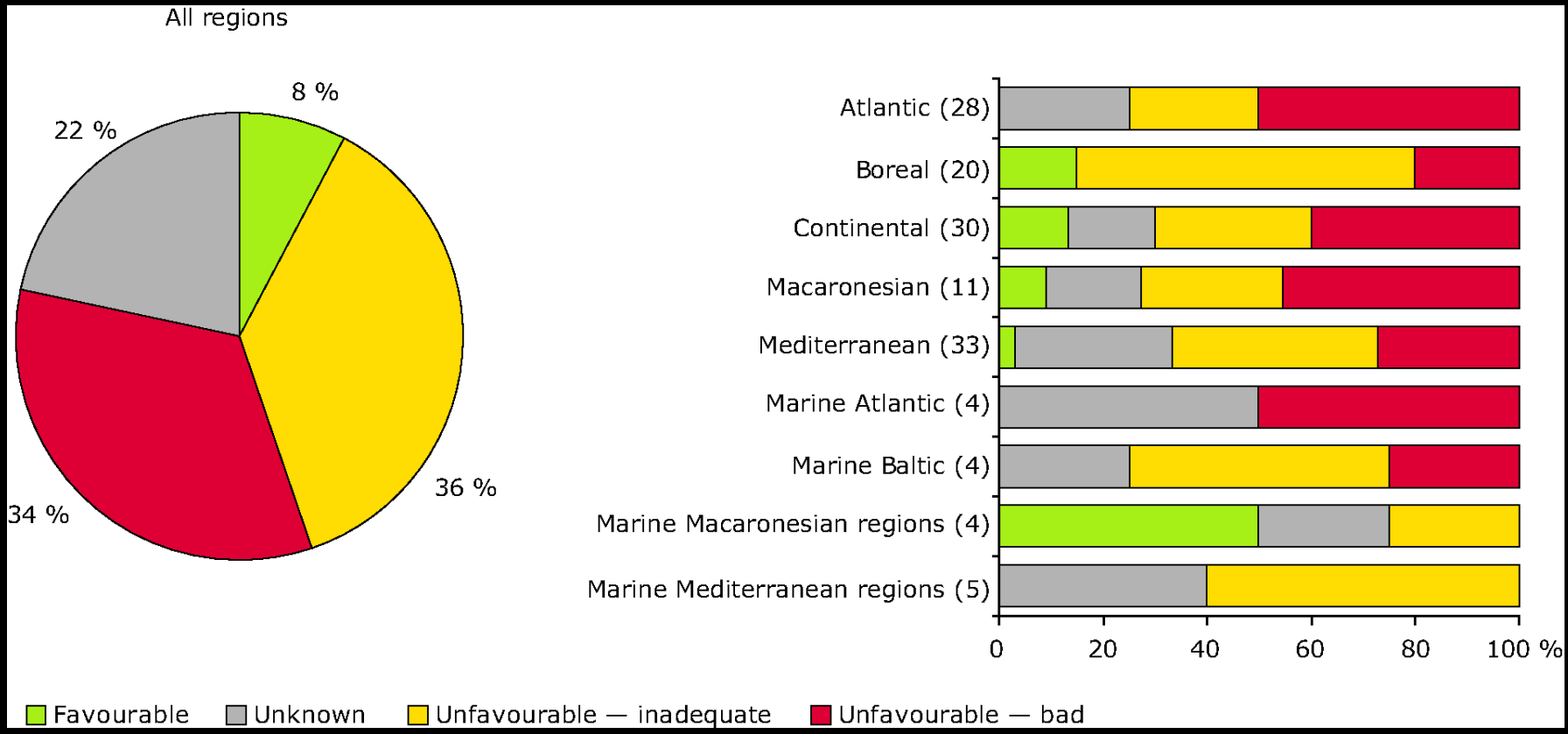
Coastal Habitat Types

- https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification
- Coastal habitats are those above spring high tide limit (or above mean water level in non-tidal waters) occupying coastal features and characterised by their proximity to the sea, including coastal dunes and wooded coastal dunes, beaches and cliffs. Includes free-draining supralittoral habitats adjacent to marine habitats which are normally only affected by spray or splash, strandlines characterised by terrestrial invertebrates and moist and wet coastal dune slacks and dune-slack pools.
- Note EUNIS: **European Union Nature Information System (2021)**



Conservation status of coastal habitat types of European Union interest in the EU-25 (2015)

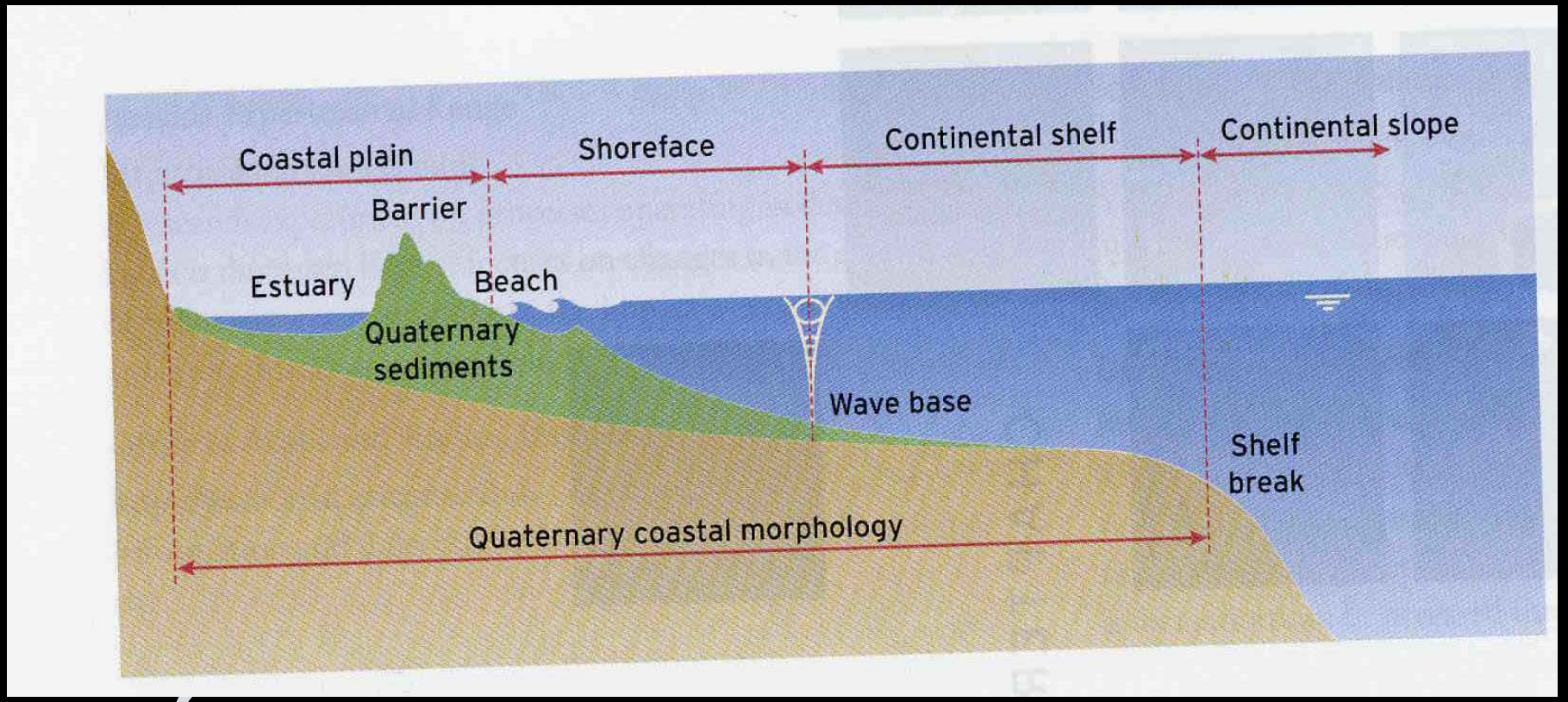




The physical structure and processes within the littoral realm

Theory and application

Coastal Zone Boundaries (Masselink & Hughes, 2003)



Quaternary coastal morphology

Transition from land to sea (Complete the table)

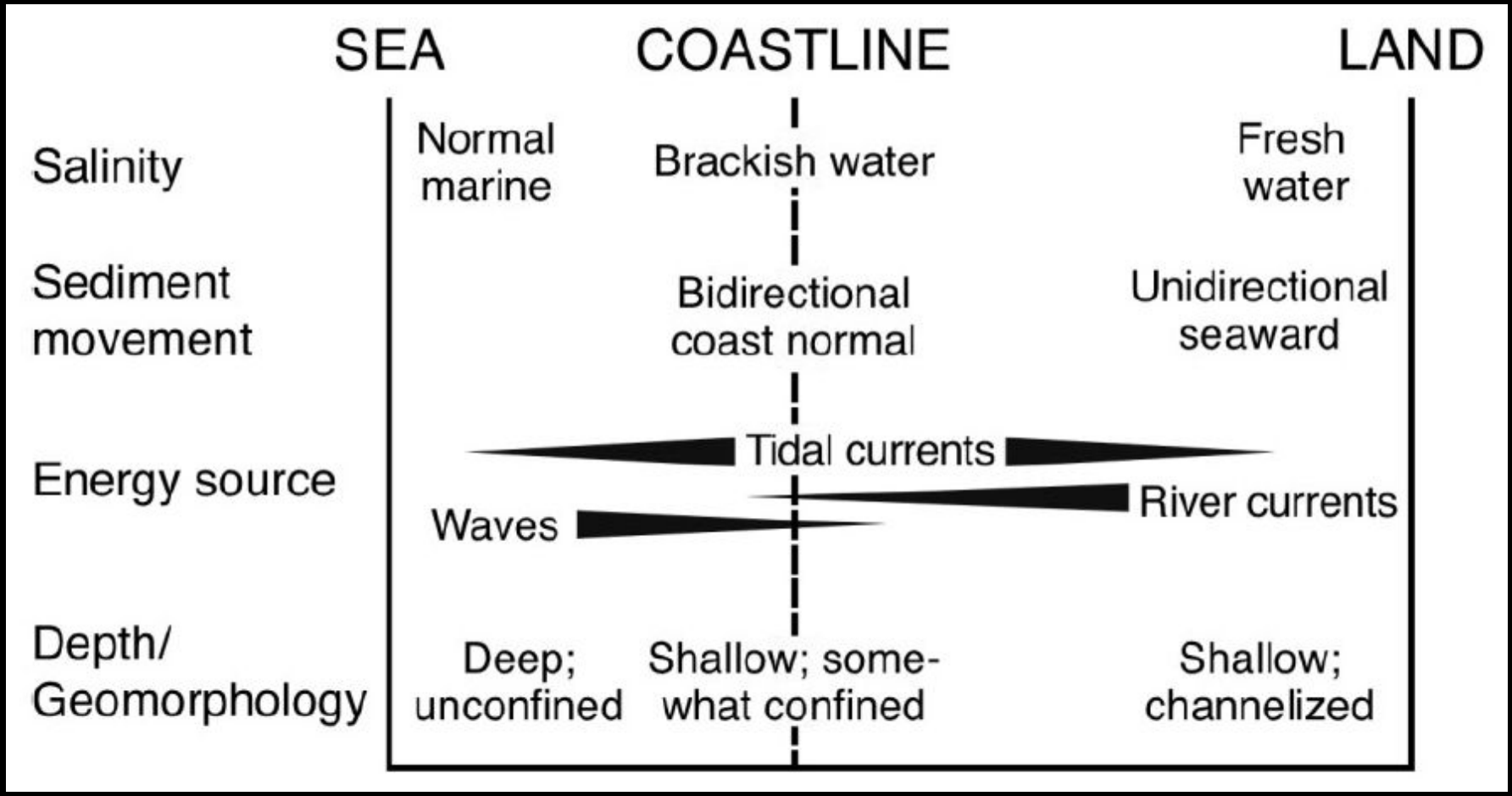




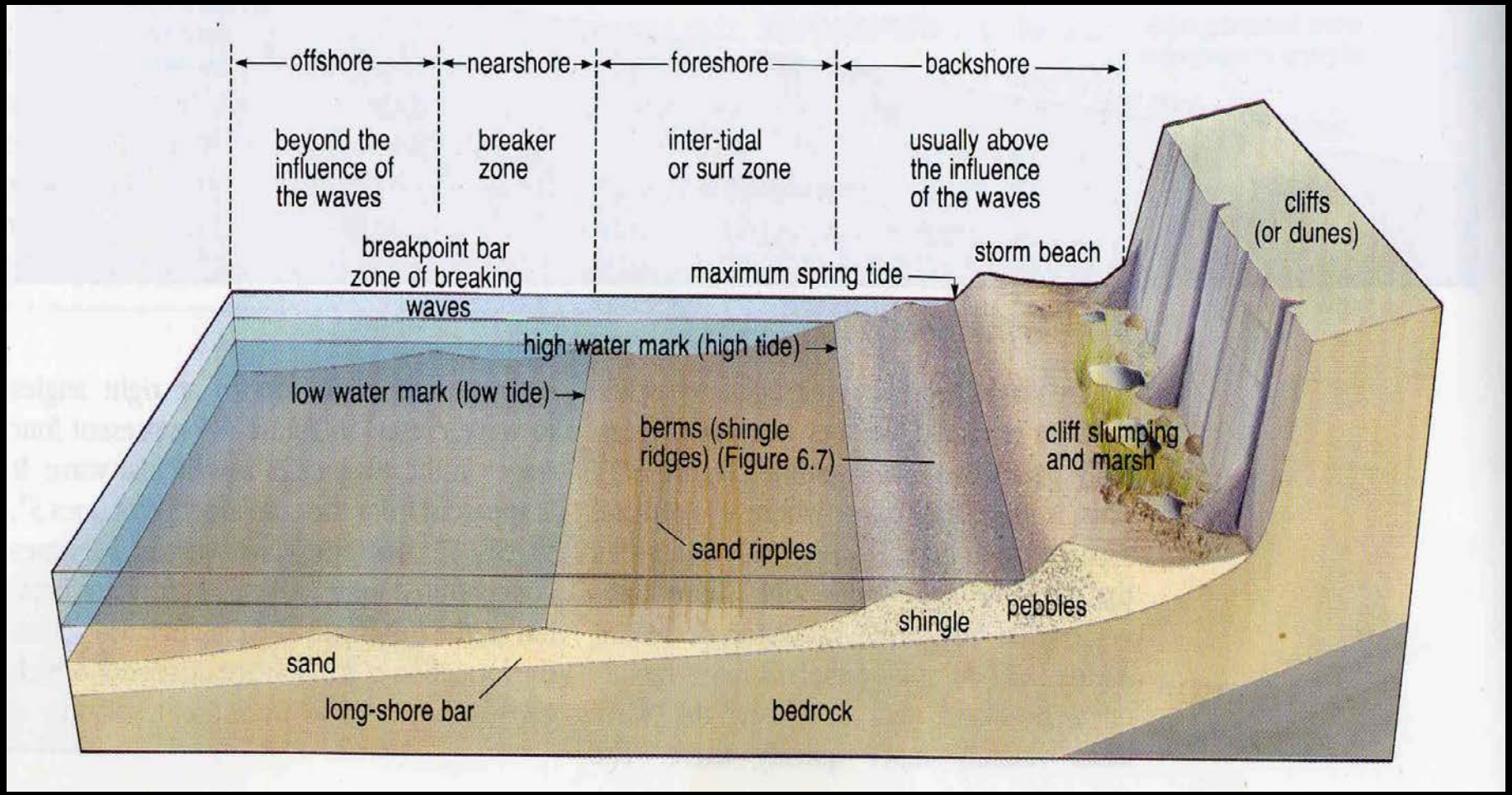
- How to you think these features transform between sea and land?

Feature	Marine	Coastline	Estuary or swamp	Tidal river	river
Salinity					
Sediment movement					
Energy source					
Depth/ geomorphology					
Human influence					

Transition from land to sea

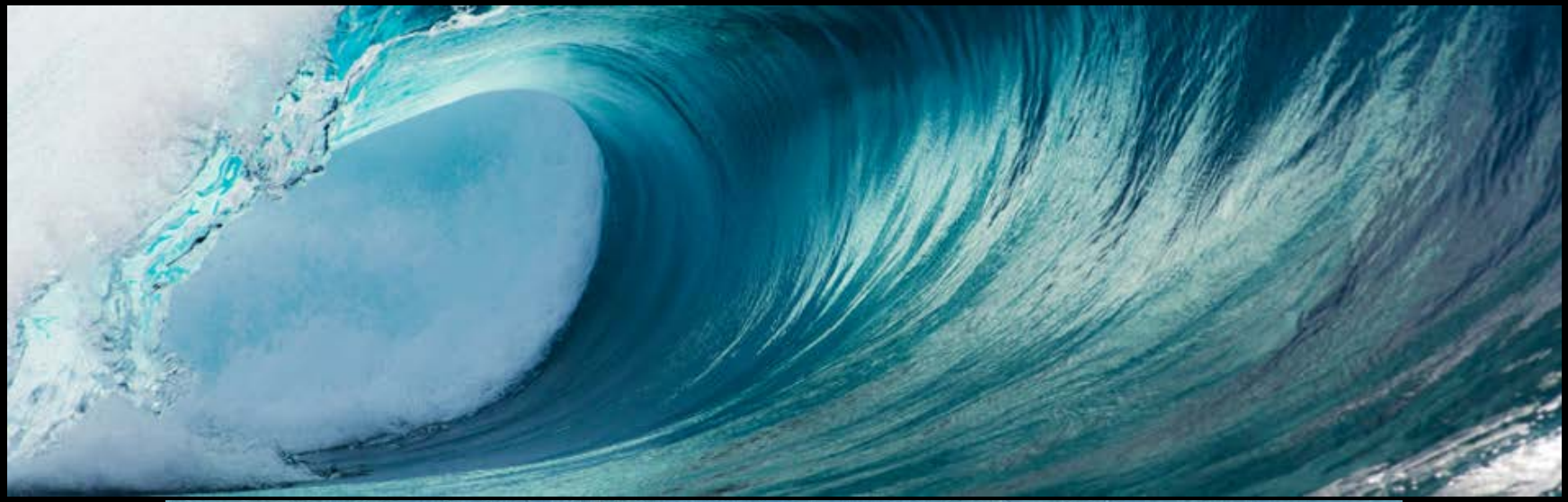


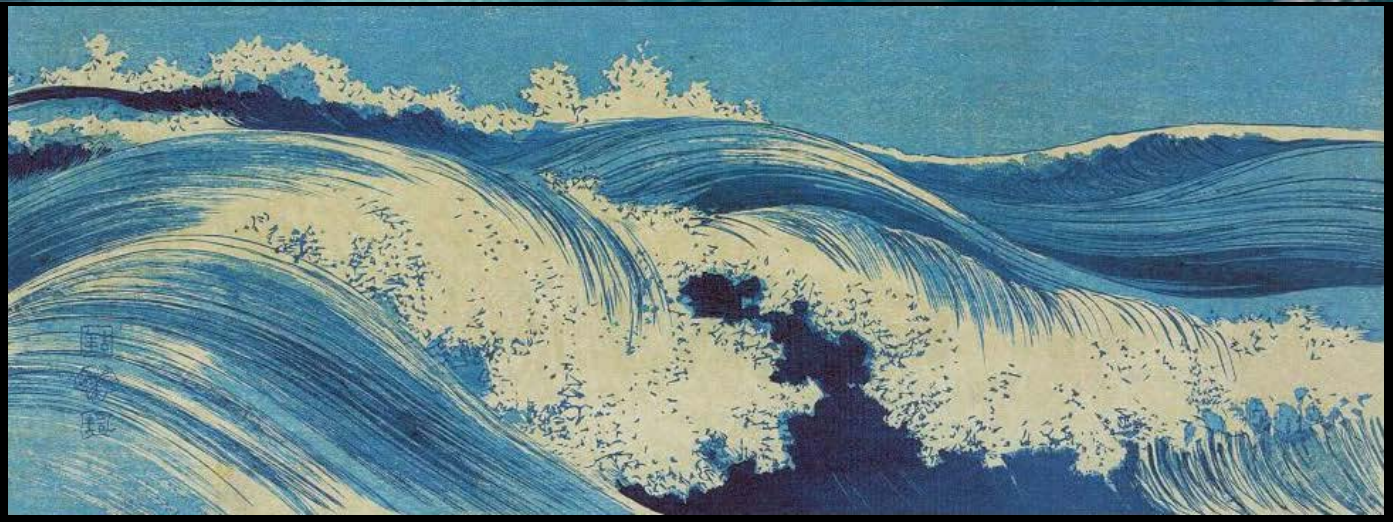
Shoreface: Beach Morphology (King, 1980)



WAVES

NOAA why Waves 30 secs





NINETH WAVE
AIWAZOVSKY, 1850
ST. PETERSBURG MUSEUM



- Rhythm
- Order amongst chaos (Goda, 1970)
- Created by transfer of energy from wind blowing over the sea.
- Increase wind speed > increased drag > increased wave size.
- Waves from local winds travel short distances – Sea waves
- Waves from distant storms travel long distances – Swell

Waves

- Wind energy (Except Tsunamis) due to friction
  - Waves from distant storm- Swell
  - Waves from wind in juxtaposition -sea waves
- Deep water waves
- Swell linked to fetch

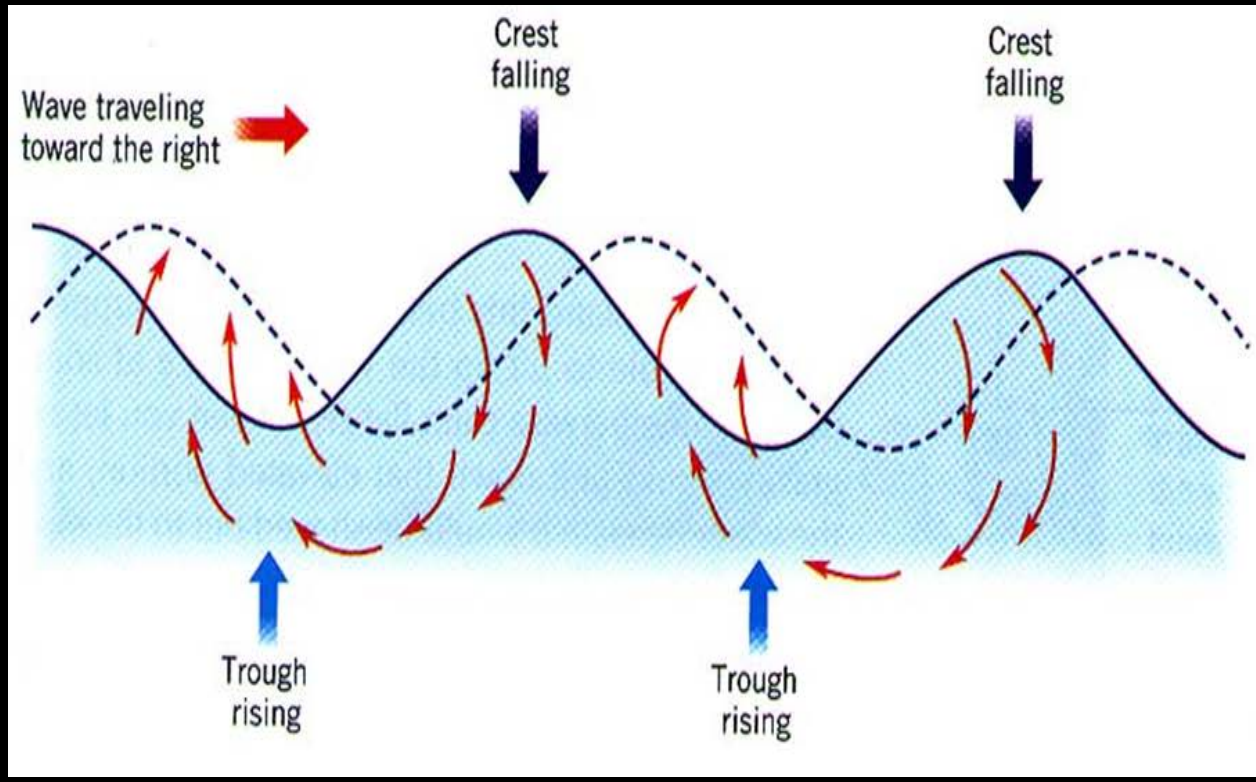
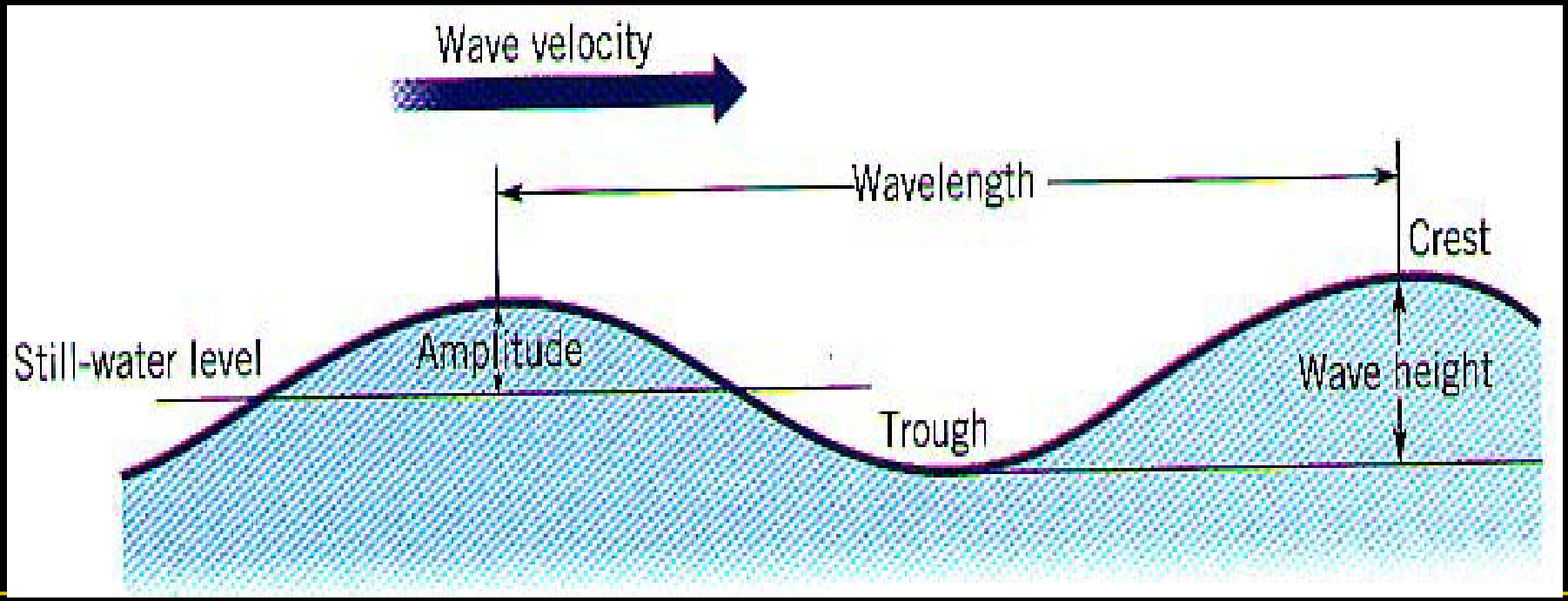


Figure 9.10

Waves travel because gravity pulls the water in the crests downward. Forced out from beneath the falling crests, the falling water pushes the former troughs upward, and the wave moves to a new position, as indicated. (Notice that the actual motion of the water itself beneath these waves is circular or *orbital*, which confirms our experience that we are carried up and forward as the wave approaches, and down and back as it passes.)

Terminology

- Velocity C Movement of crest in given time
- Height H (Crest to trough generally max. 6m)
- Period Between successive Waves) T
- Length (dist. Successive crests) L
- Energy E (Mean 11 tonnes per m2)
- Steepness H/L (Cannot exceed 1:7 = 0.14)



Linear wave theory

- Deep water: Orbital/sinusoidal symmetrical hence a smooth repetitive oscillation
- Shallow water: Elliptical (asymmetrical) imp. sediment

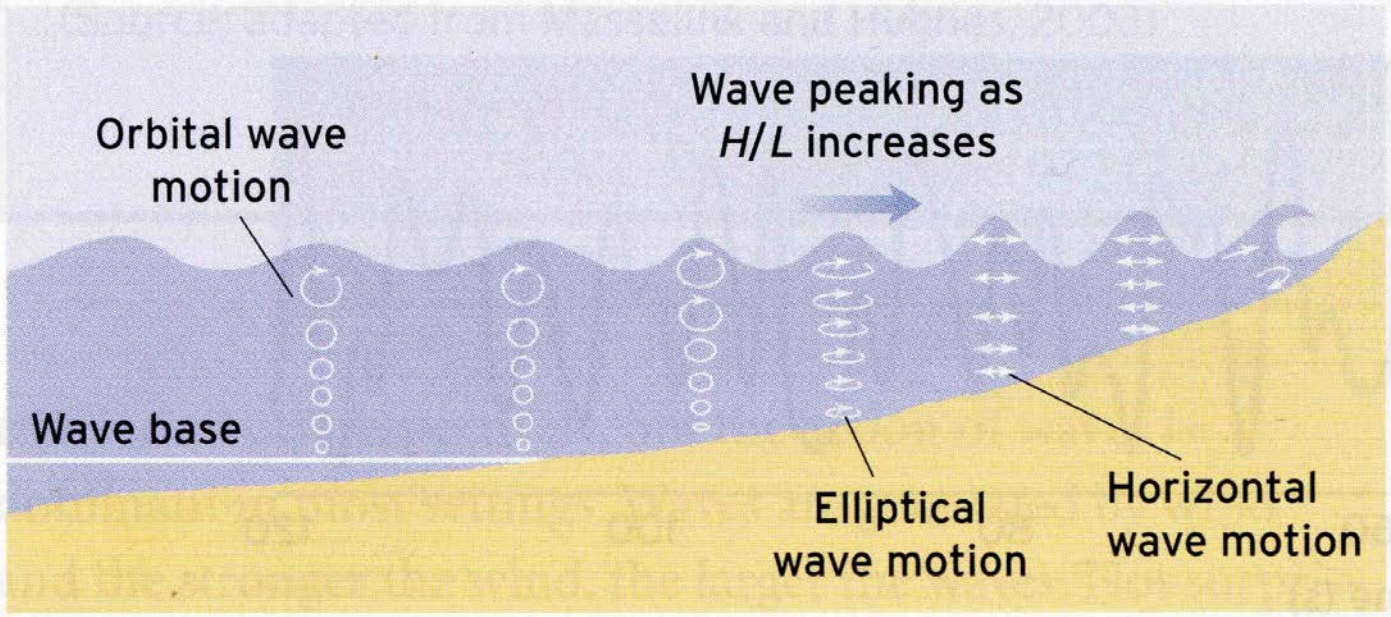


Figure 17.9 Motion of water particles under waves according to linear wave theory.

Deep water waves

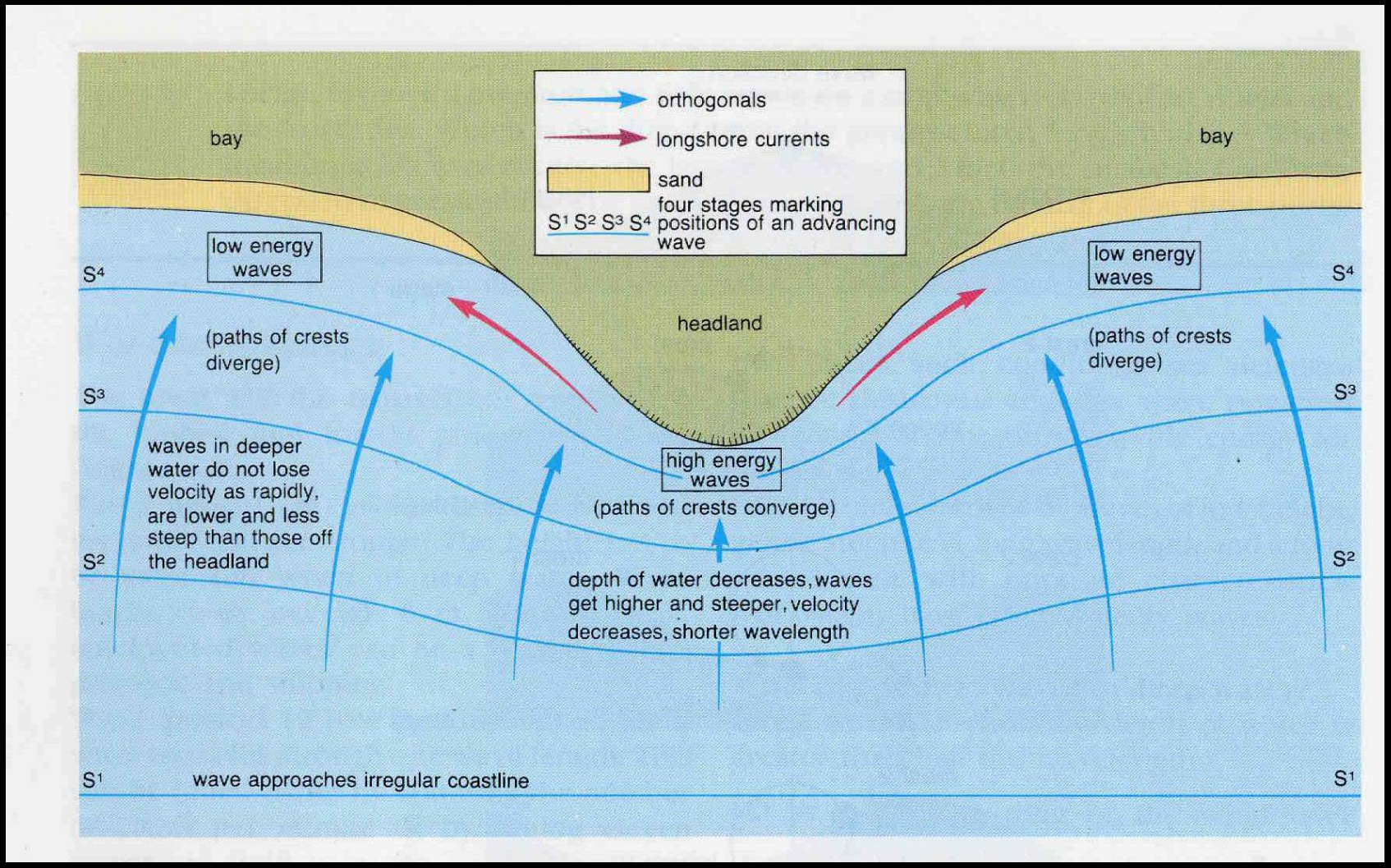
How does the ocean move?



TED Ed

Wave characteristics

- Intermediate depth waves



Intermediate depth waves

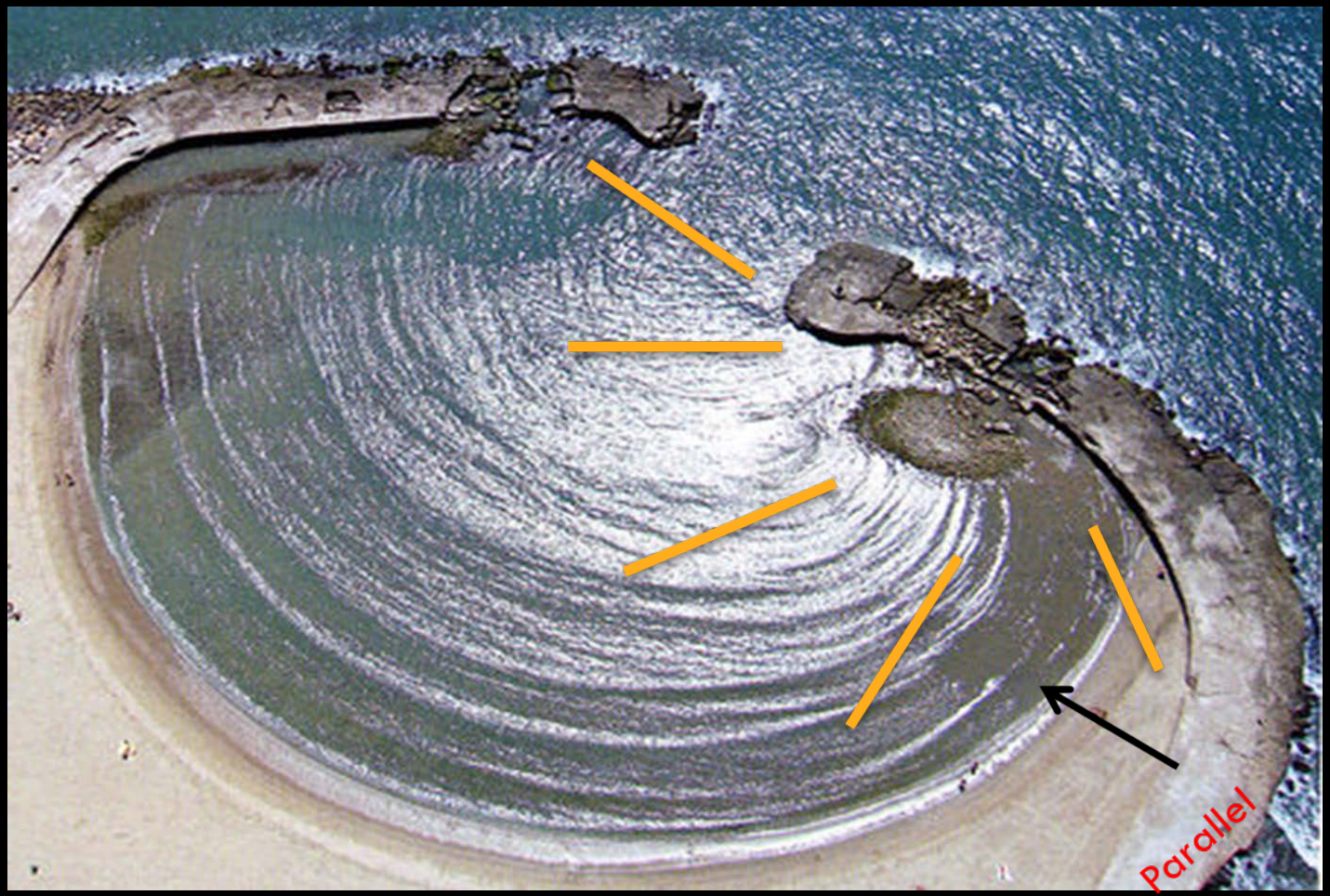
- Shoaling Waves (change height in shallow water, e.g. sandbanks)



Powell, 2020: Mixons: Bracelet Bay

Intermediate depth waves

Refraction (floor contours)=change in wave direction=crest aligns parallel to bottom contours which reduces the wave angle. Complexity = variations in height & energy on the coast



Shallow processes

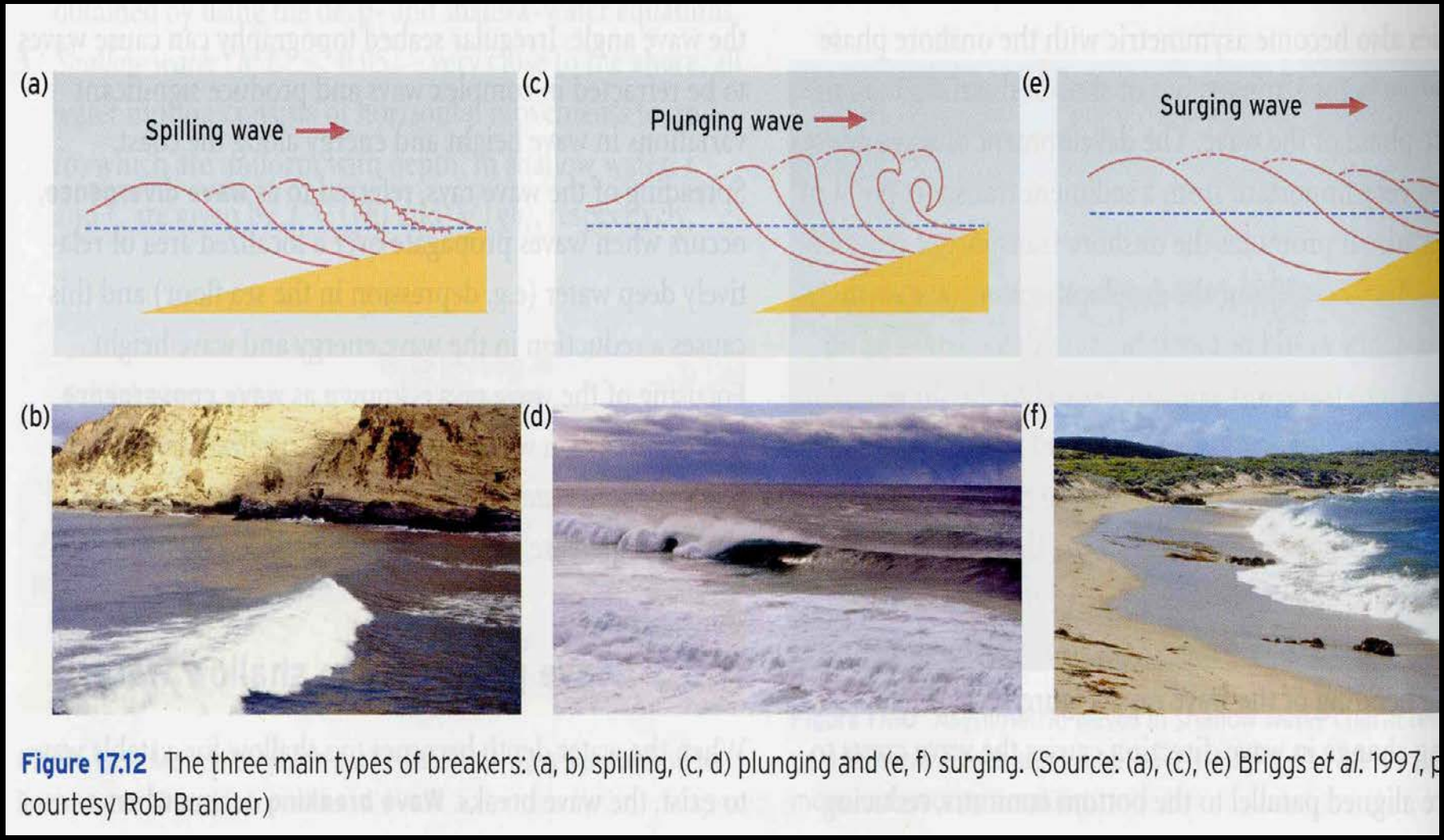
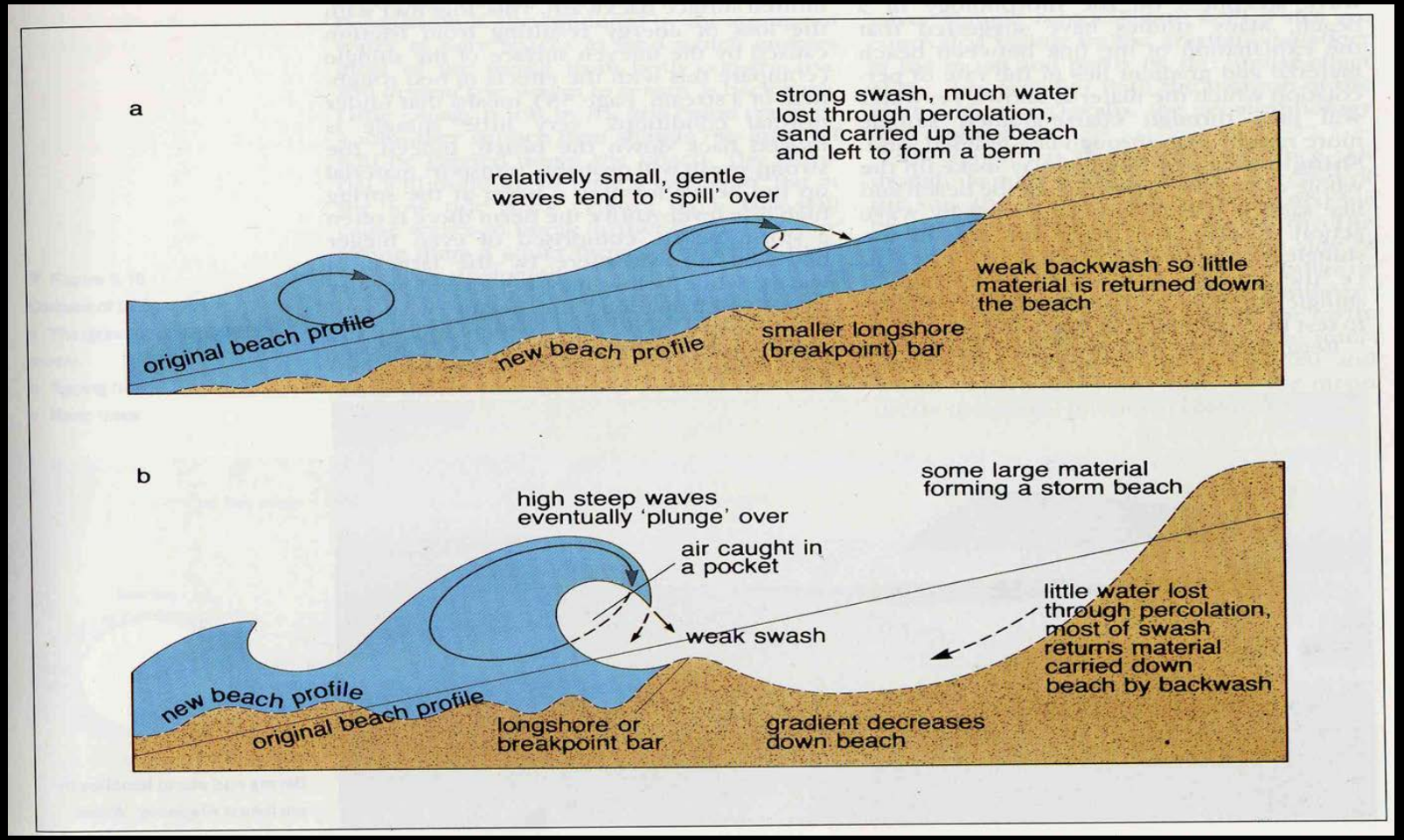


Figure 17.12 The three main types of breakers: (a, b) spilling, (c, d) plunging and (e, f) surging. (Source: (a), (c), (e) Briggs *et al.* 1997, p
courtesy Rob Brander)

Characteristics of constructive (a) & destructive (b) waves



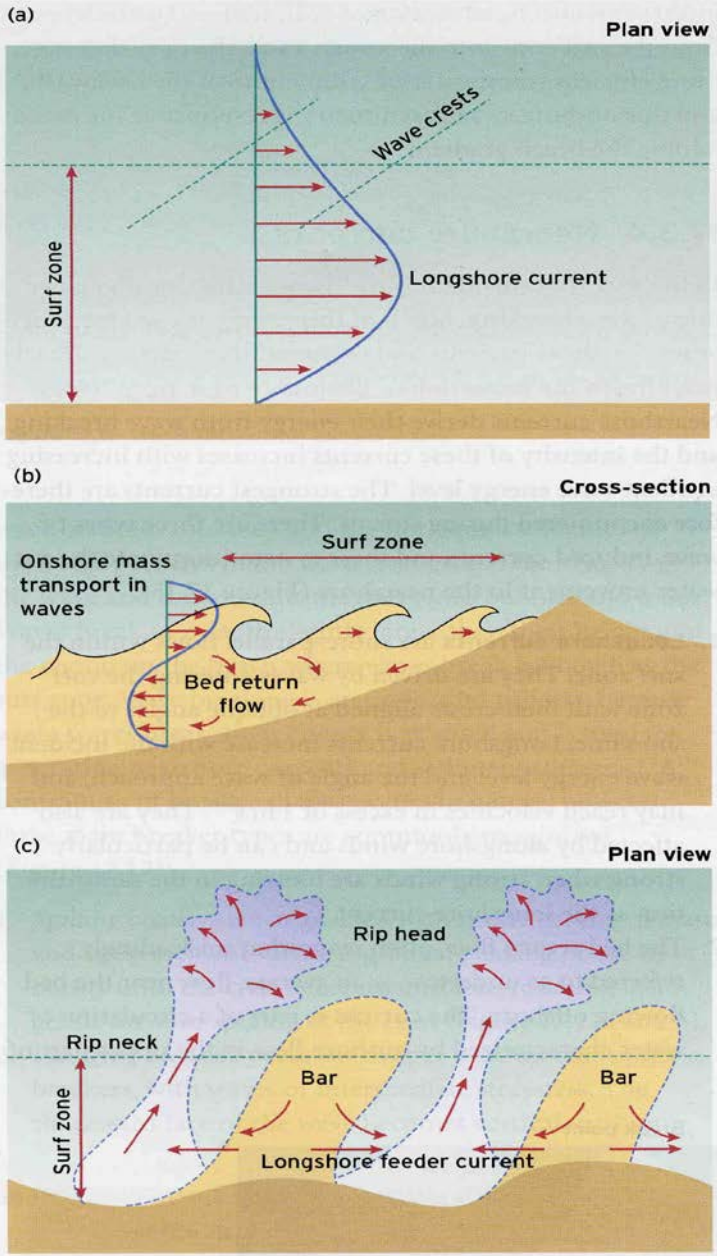
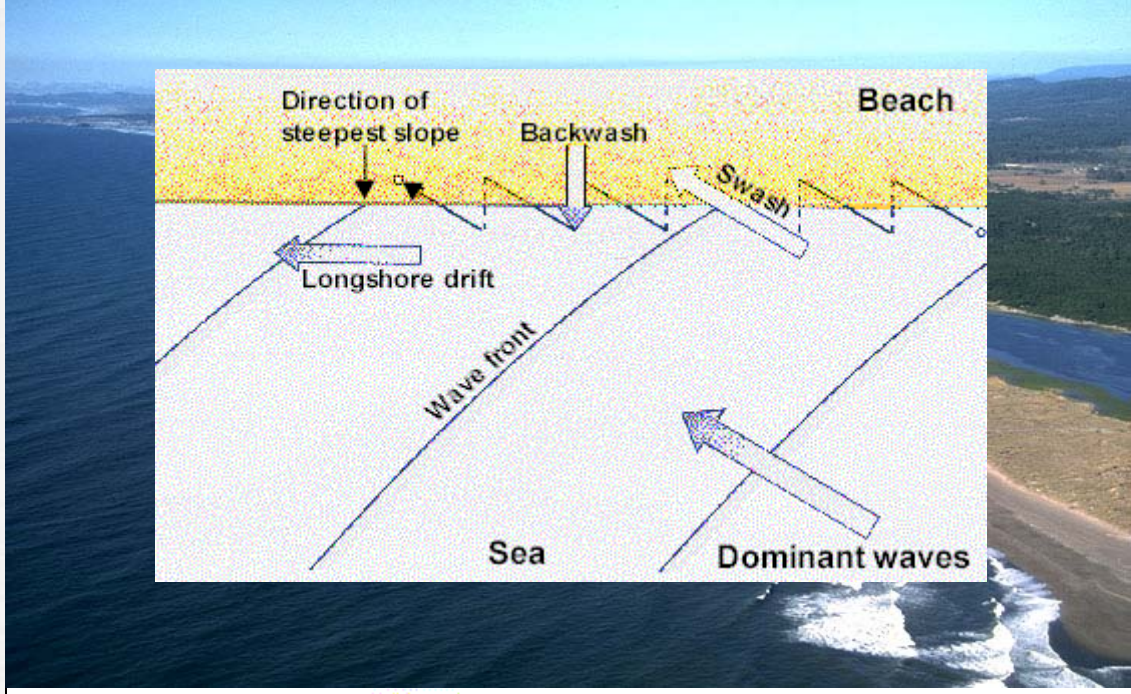
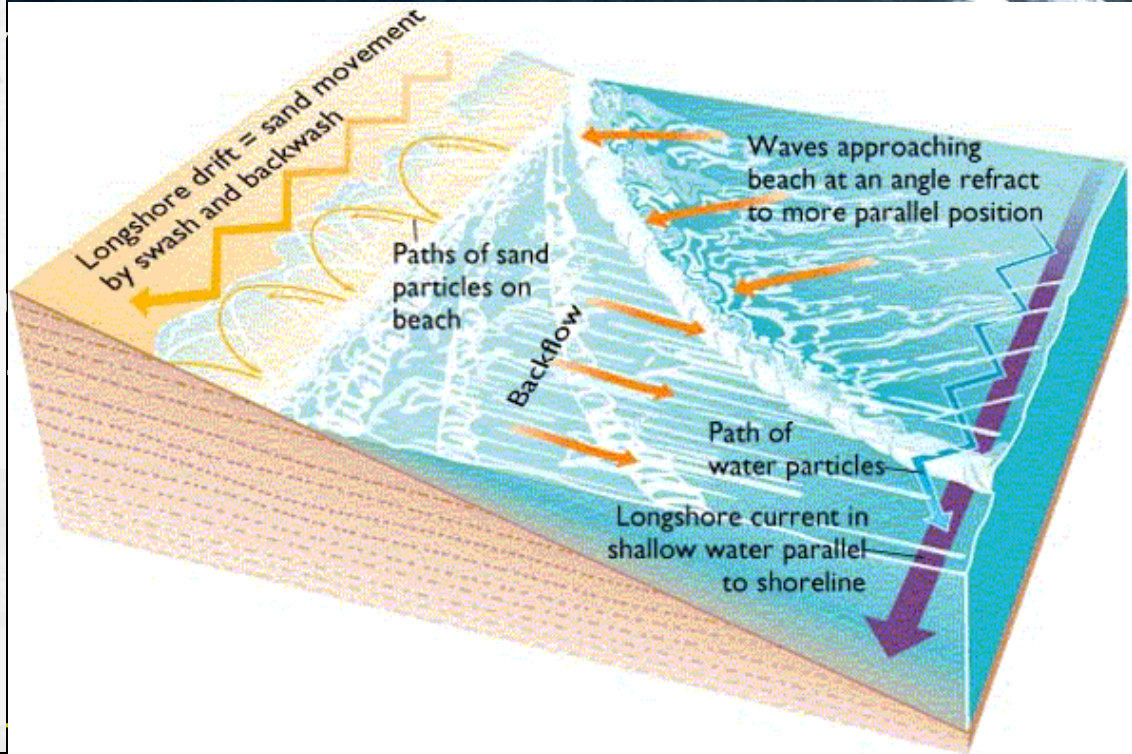


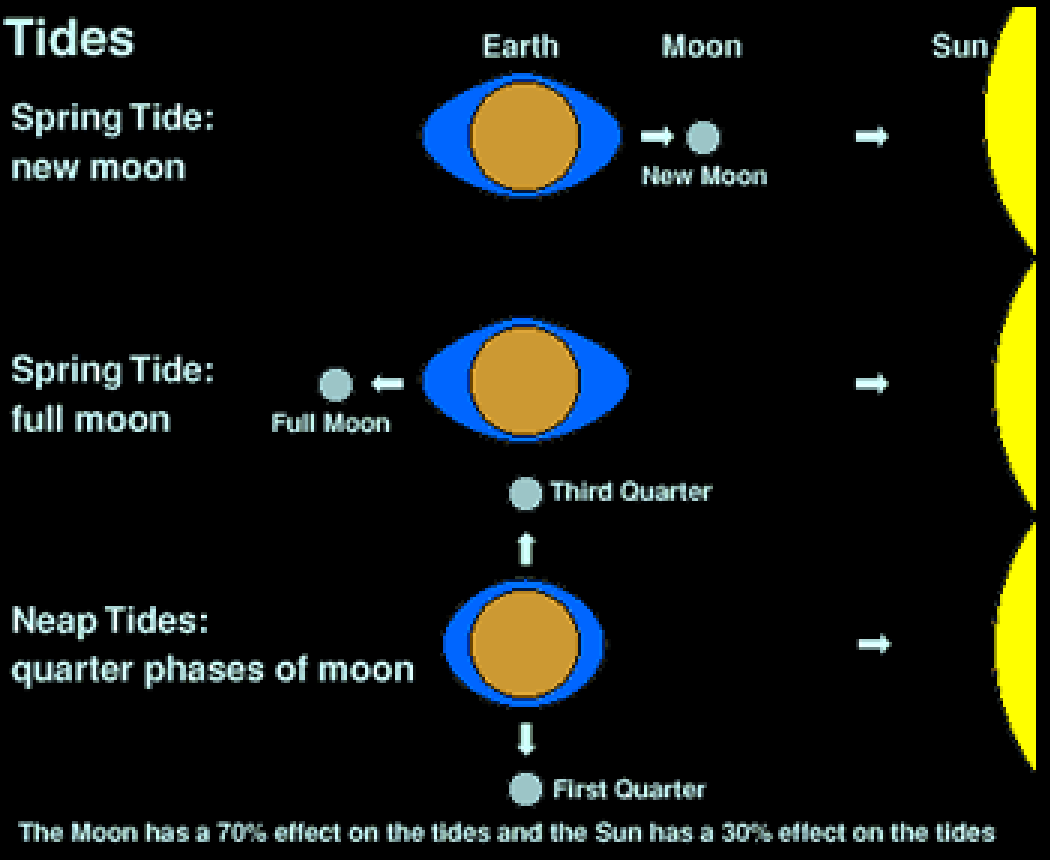
Figure 17.15 Quasi-steady currents in the surf zone: (a) shore-parallel longshore currents due to obliquely incident waves, (b) vertically segregated bed return flow or undertow and (c) horizontally segregated rip currents as part of the nearshore cell circulation system. (Source: after Masselink and Hughes, 2003)

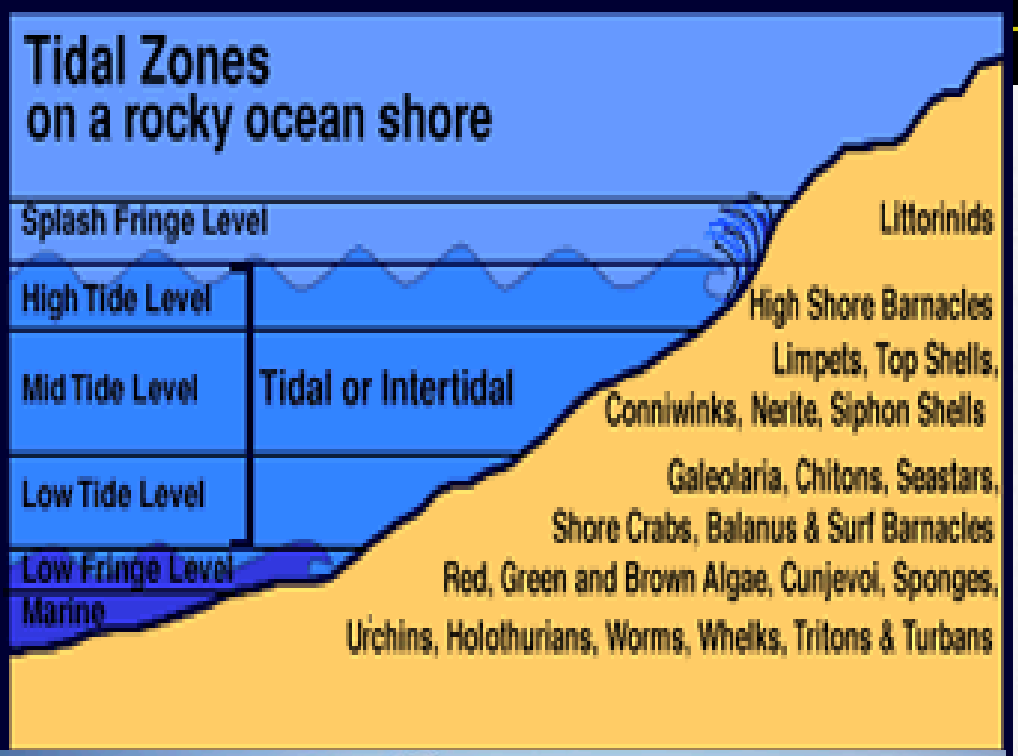


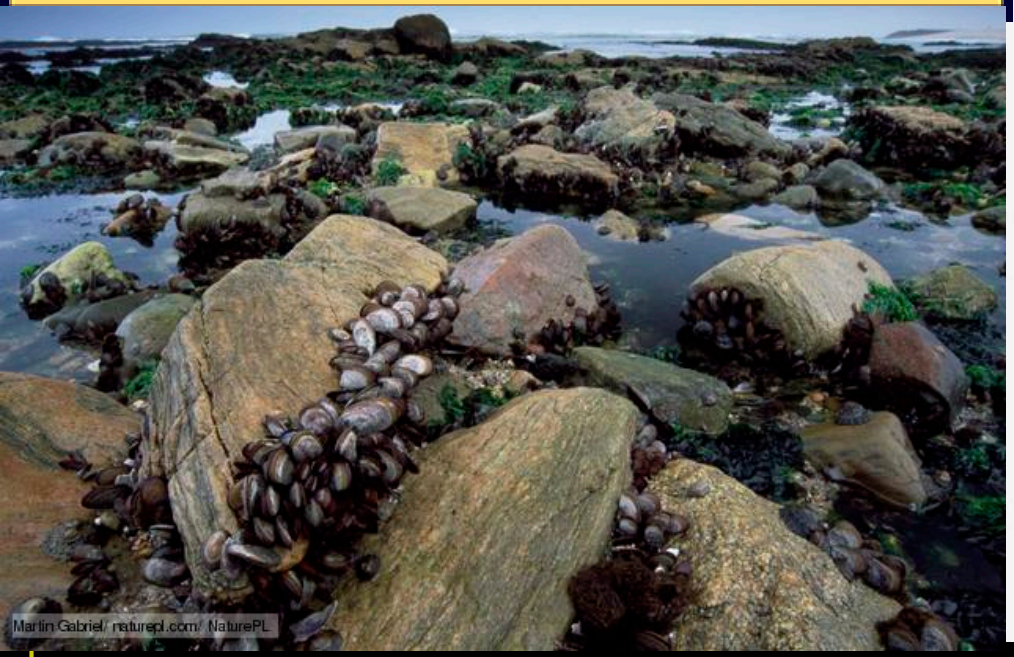


TIDES

- Complicated(12.5 hours lunar component 12 hour solar)
- Tidal range (What is it for Swansea? Is this significant? Why?)
  - Twice daily
  - Micro <2m
  - Meso 2-4m
  - Macro >4m
- Spring
- Neap (moon around earth 28 days therefore neap to neap 14 days)







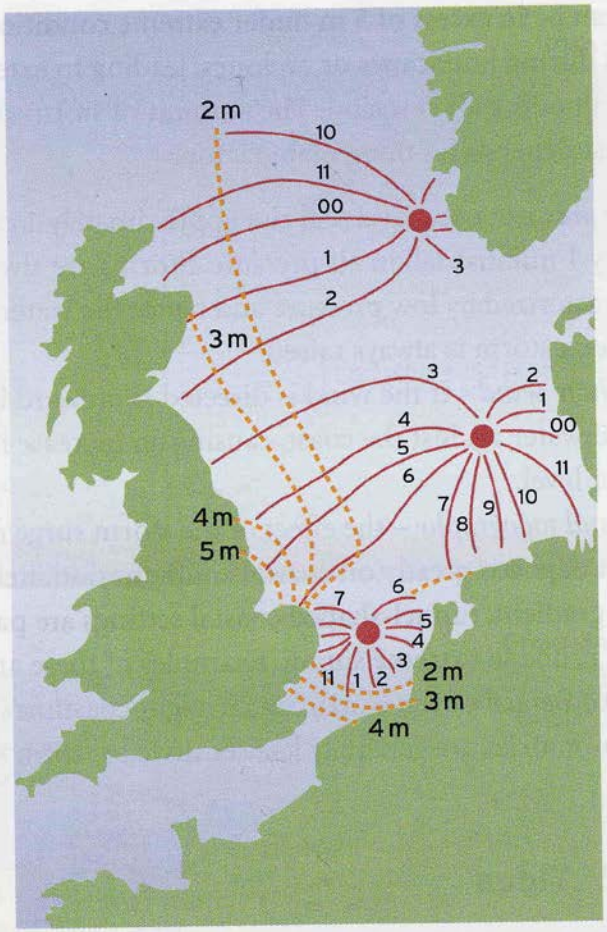


Figure 17.18 Map showing amphidromes in the North Sea. The dashed lines are lines of equal tidal range, whereas the solid lines show how the tidal wave propagates in an anticlockwise direction around the centre of the amphidrome. The numbers indicate where the tide is at the same stage in the tidal cycle (in hours). Along a line labelled '1', for example, the tide is one hour into the tidal cycle. (Source: Masselink and Hughes, 2003)

Storm Surge

- Higher sea level than expected high tide (5m)
- Why?
  - Low pressure (1cm rise for every 1 millibar fall)
  - Coastal topography (funnel e.g. Bay of Bengal)
  - Onshore winds
  - Hurricane
- February 1953 in the North Sea
- New York
- What is the impact on coastal conservation?
  - Habitat destruction and creation

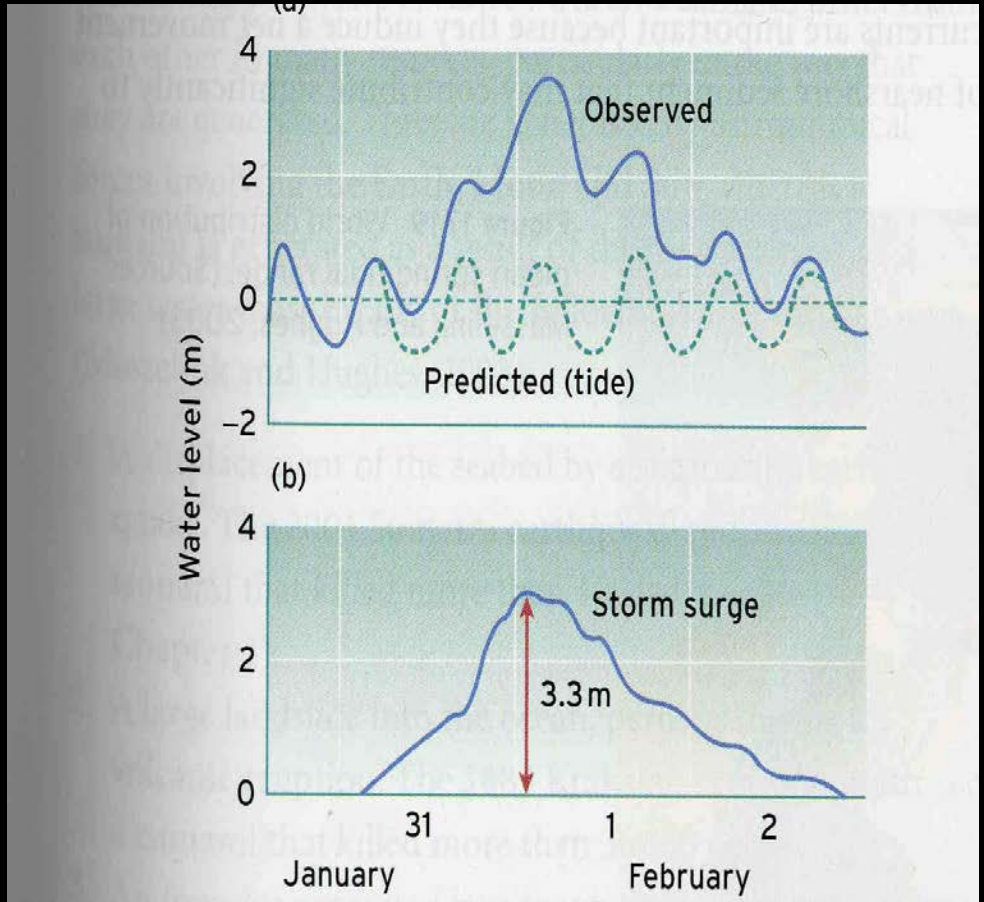


Figure 17.17 (a) Graph showing the predicted (dashed line) tidal water level and observed (solid line) water level at the Hook of Holland, January to February, 1953. (b) Graph showing the residual tide, which is attributed to storm surge, reached 3.3 m. (Source: Masselink and Hughes, 2003)

Tsunami



- Displacement of a body of water (Masselink, 2008)
  - Submarine earthquake (2004 Sumatra 100,000 dead, habitat destruction)
  - Landslide into the ocean (Krakatau, 1883 36,000, habitats changed and gave opportunity for recovery)
  - Impulse from meteorite impact (geological evidence of mega-tsumami (Bryant, 2001)
- Open ocean: long wavelength (100s km) and height <1m but typically speeds of 700km hour in depths of 5km
- Continental shelf: shoal and reduce wavelength, increase height
- Shore: tens of metres in height, devastation in a short period of time

Practical

- Choose a coastal feature we have discussed
- Tides Lucy
- Storm surge Martyn
- Tsunami Rebecca Lia
- Waves Jack Meirion

1. Research and present what are their physical properties
2. Research and present an example of their impact on humans and habitats
3. Research and present examples of how Working with Nature helps mitigate their impact and/or benefits an environmental issue e.g. renewable energy.

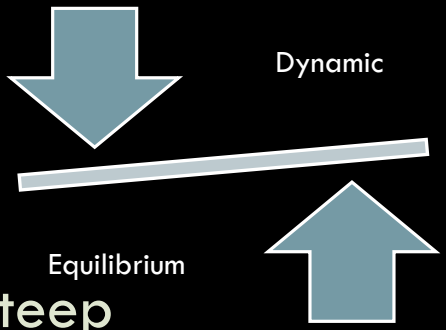


SYSTEMS

- 4 main factors in beach systems
  - Tide
  - Sediment (size)
  - Wave period (T)
  - Wave height

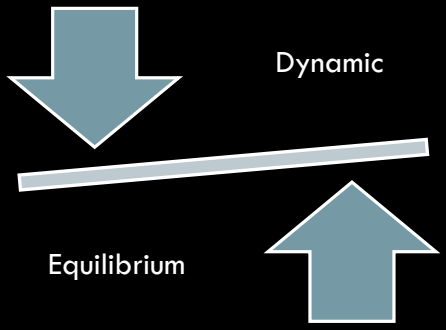


Beach type

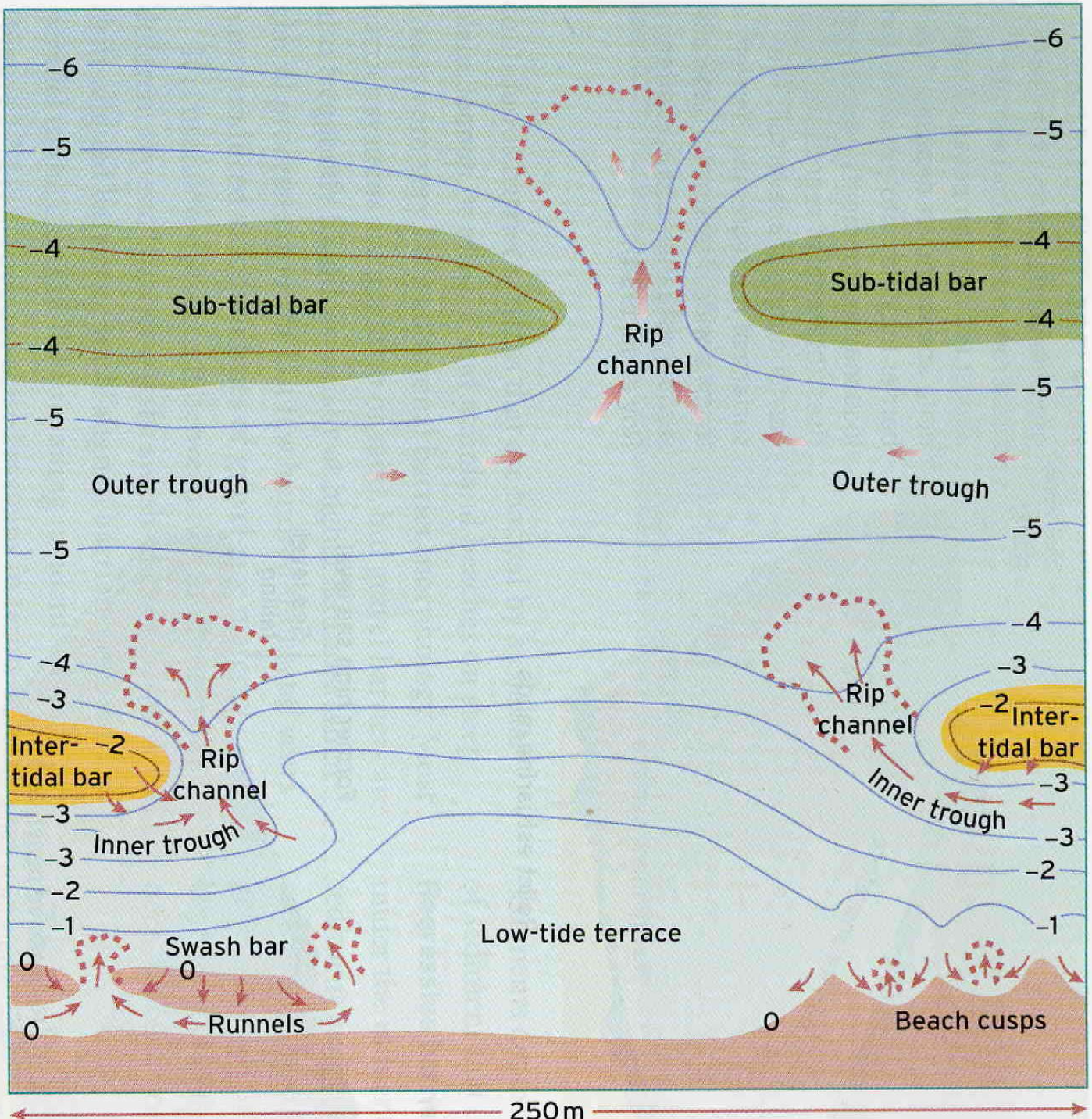


- Described between: wide & flat to narrow & steep
- Wave dominated or tide dominated
- Sand Wet sand reduces percolation
  - Therefore limited energy loss (most of the energy returns in backwash
  - Creates a longshore bar at low tide mark (hence waves break further from the shore=energy dissipation) How could beach nourishment help coastal communities?
  - If sand dries in prevailing/strong winds sand dunes form beyond backshore

Beach type cont'd



- Dynamics between waves, sediment and beach profiles. Generally:
  - Destructive waves move material seawards (plunging/surfing) (H >1m, L approx 20m, T 10-14 per min.)
  - Constructive move material landwards (surging/spilling) (H <1m, L approx100m, T6-8 per min.)
  - Shingle beach moves material landwards
  - Sand moves material seawards


-6
-5
-4
Sub-tidal bar
-4
-5
Rip
channel
-6
-5
Sub-tidal bar
-4
-4
-5
Outer trough
Outer trough
-5
-5
-4
-3
Inter-
tidal bar
-2
Rip
channel
-3
Inner trough
-3
-2
-1
Swash bar
0
0
Runnels
Low-tide terrace
-4
-3
Rip
channel
-2
Inter-
tidal bar
-3
Inner trough
-3
-2
-1
0
Beach cusps
250 m

Sediment budgets

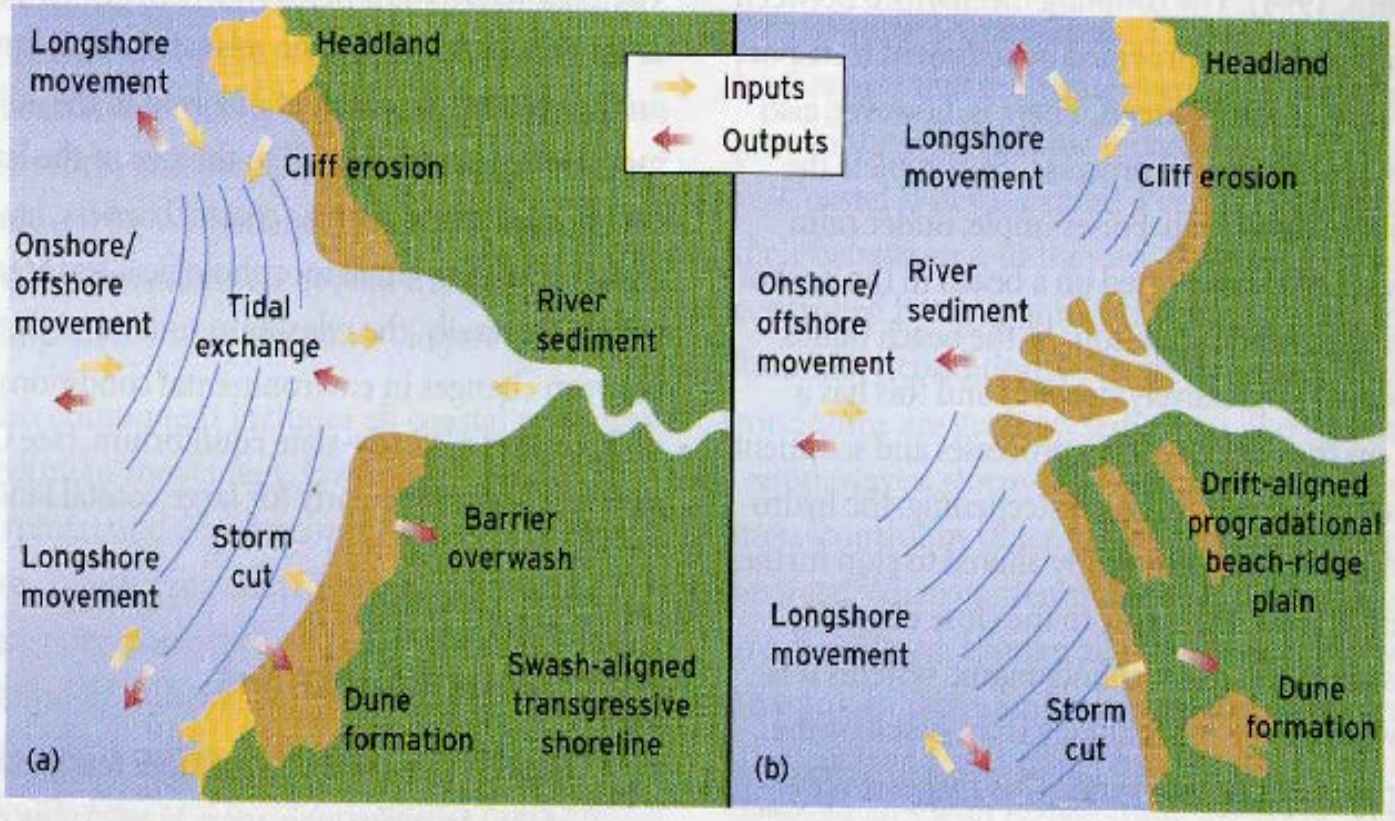


Figure 17.5 Qualitative examples of coastal sediment budgets. (a) Riverine sediment may be deposited into an estuarine embayment, which may also receive sediment from the seaward direction through tidal processes. (b) On a deltaic coast, riverine sediment contributes to the coastal sediment budget, and is moved up the drift-aligned coast, giving rise to a beach-ridge plain. (Source: adapted from Masselink and Hughes, 2003)

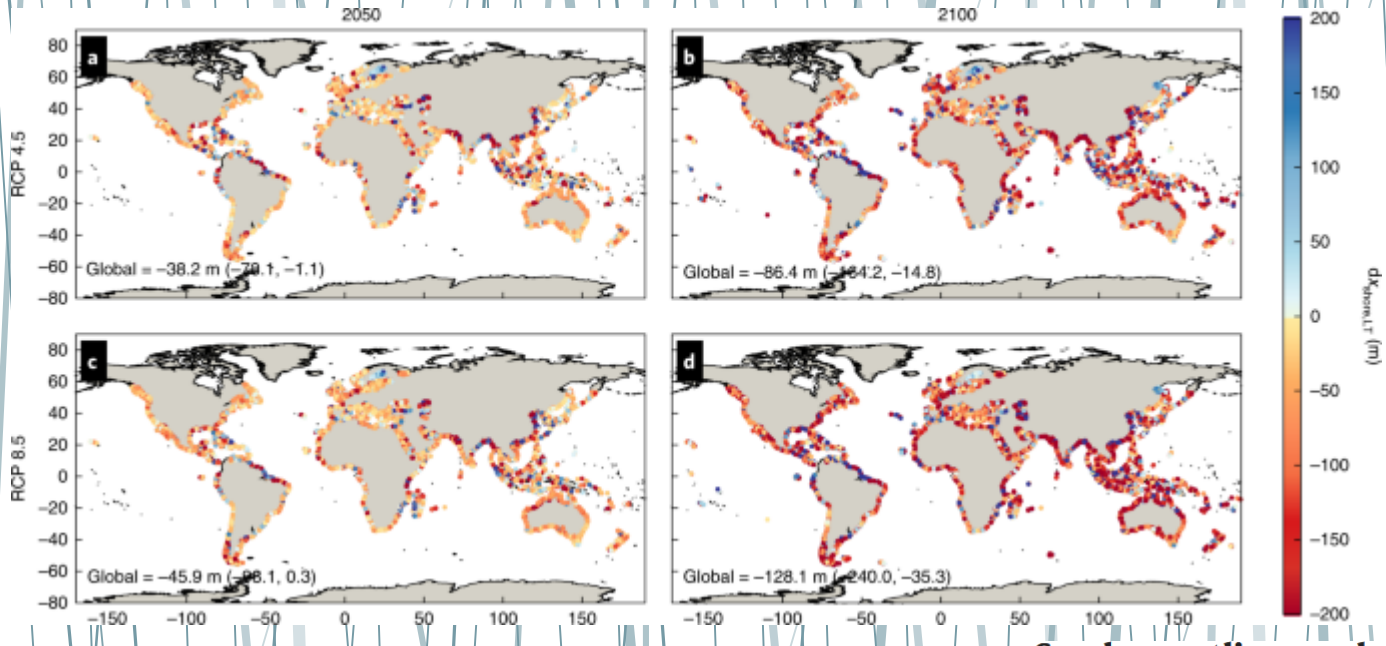


Fig. 1: Projected long-term shoreline changes

Sandy coastlines under threat of erosion

Michalis I. Vousdoukas ✉, Roshanka Ranasinghe, Lorenzo Mentaschi, Theocharis A. Plomaritis, Panagiotis Athanasiou, Arjen Luijendijk & Luc Feyen

Nature Climate Change **10**, 260–263(2020) | Cite this article

8351 Accesses | **48** Citations | **3079** Altmetric | Metrics

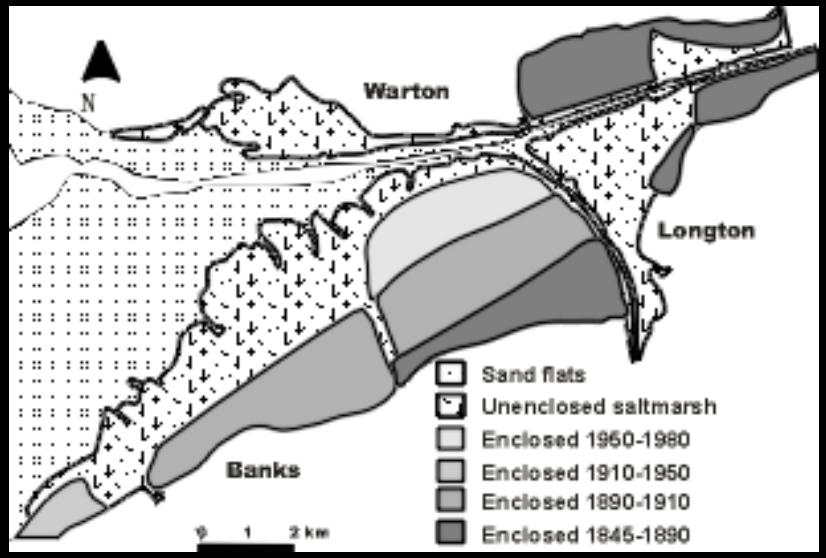
Erosion and deposition

Processes and landforms

[Britain's collapsing coastline | Behind The Story 2020 (6 mins)]

EROSION

- The loss of land or encroachment by the sea through a combination of wave attack and, in the case of coastal cliffs, slope processes (e.g. high groundwater levels). This may include cliff instability, where coastal processes result in the periodic reactivation of landslide systems or promote rock falls. (DEFRA 2004)
- 70% of sandy coastlines are eroding (Bird, 1985)



Erosion

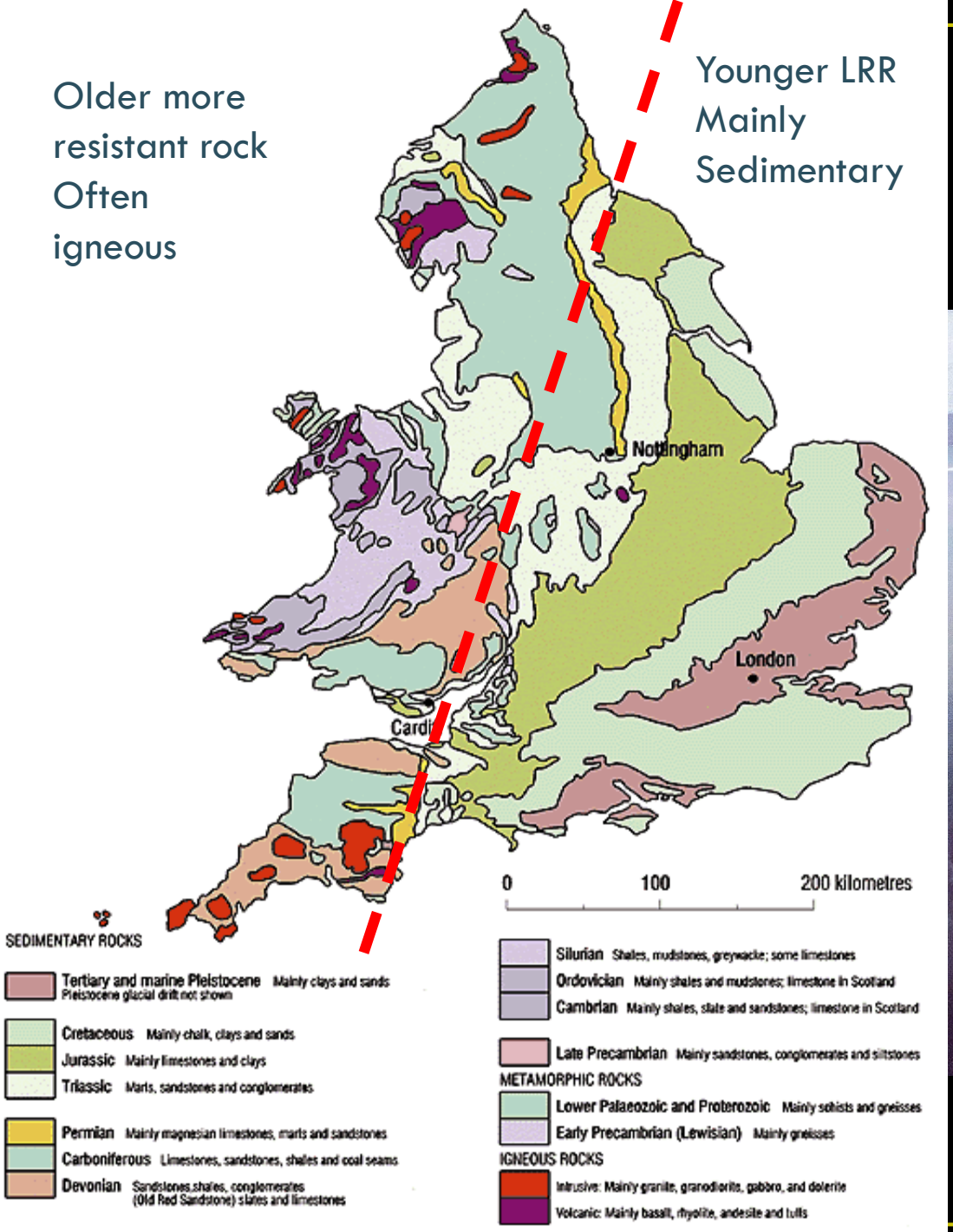
- *Hydraulic Action*
  - *The waves hitting the cliffs apply pressure to the air in the cracks and pores within the rocks. This causes an increase in pressure in the pores and cracks causing them to implode.*
- *Abrasion/ Corrasion*
  - *Various sediment grades (LOAD) are used by the sea as a tool, the sediment is hurled at the base of the cliff by the sea, breaking off other sections of rock. (Esp. Exposed coasts)*
- *Attrition*
  - *Sediments colliding progressively reduce in size*
- *Corrosion*
  - *This occurs within granular rock, for example*
    - *The sandstone at Black Gang Chine., I of Wight. With the rise and fall of the tide the salt within the sea water crystallises within the pores and breaks the rock apart from the inside.*
    - *Chemical reaction e.g. Carbonic acid in L/S coasts*
    - *Also secretion from blue/green algae*

Erosion cont'd

- *Wave Pounding*
  - *The action of the waves hitting the cliff base and breaking it up. (could be 30 tonnes per m^2 and seawalls may need replacing every 25yrs (Waugh, 2009)*
- *Sub-aerial*
  - *From above, water, freeze thaw etc. Leads to slope processes*
- *Anthropogenic*
  - *Especially influences rate and cost but the processes are the same.*

Older more resistant rock Often igneous

Younger LRR Mainly Sedimentary

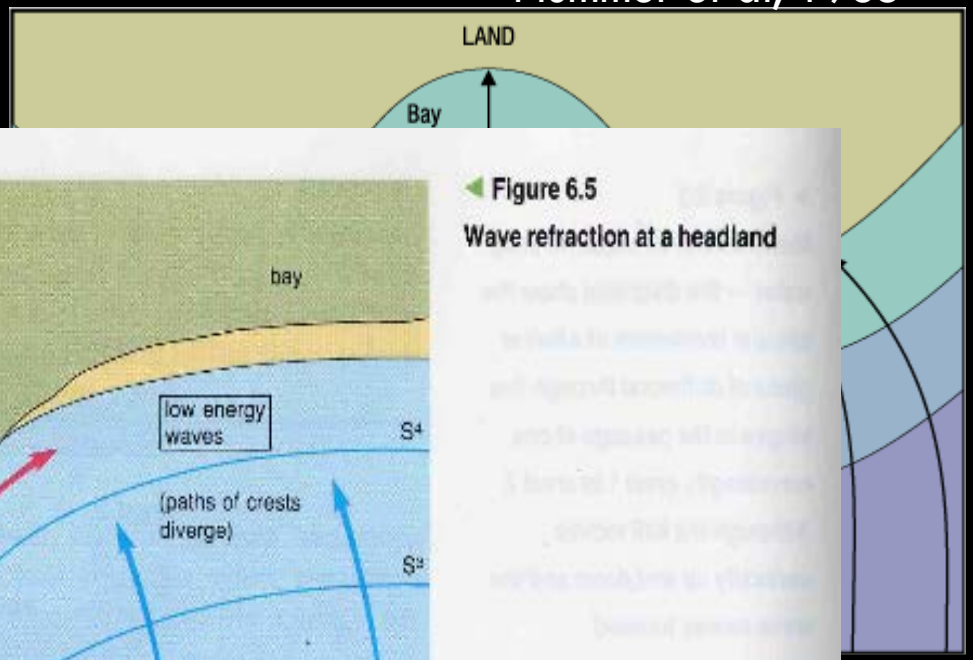




Erosional Landforms

- Headlands & bays
-

Plummer et al, 1985



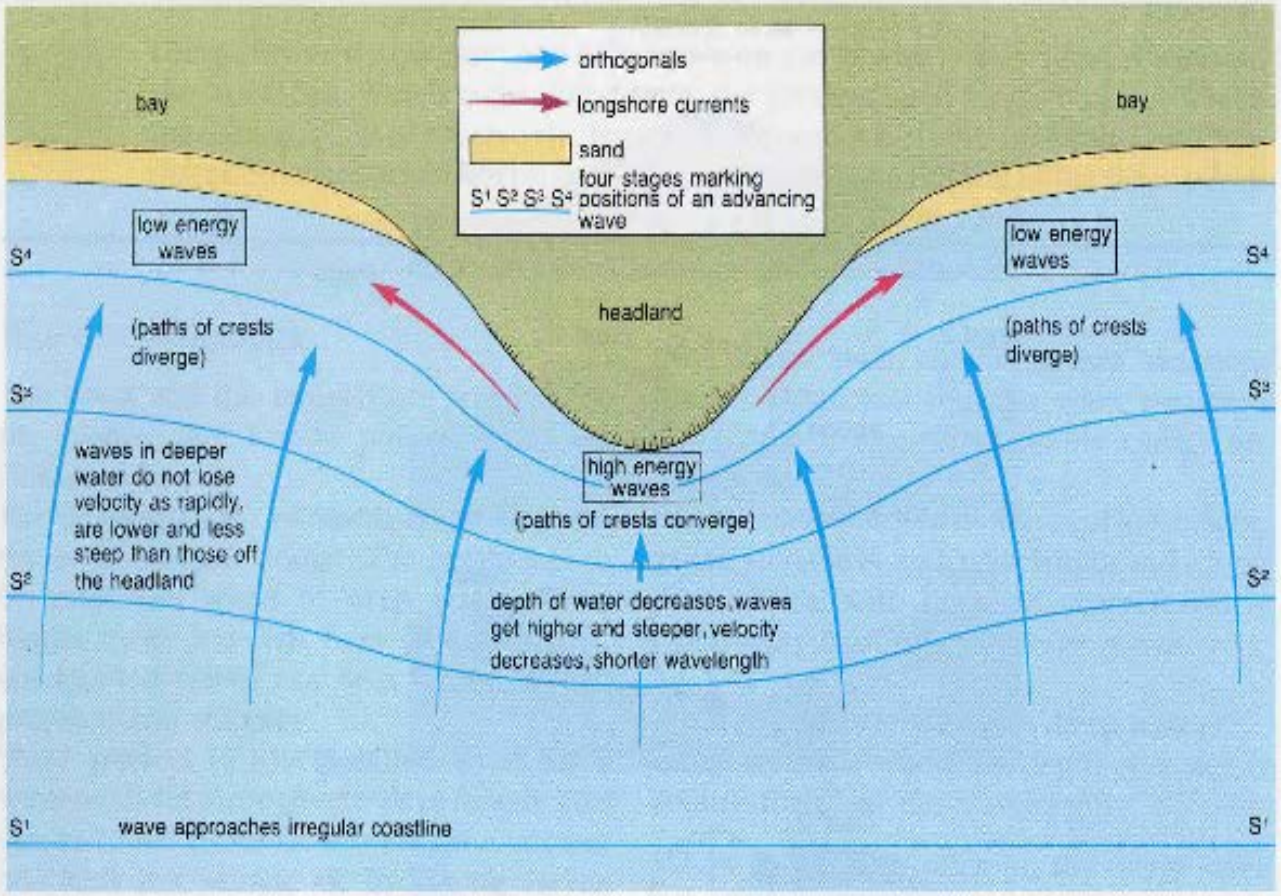
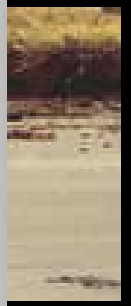
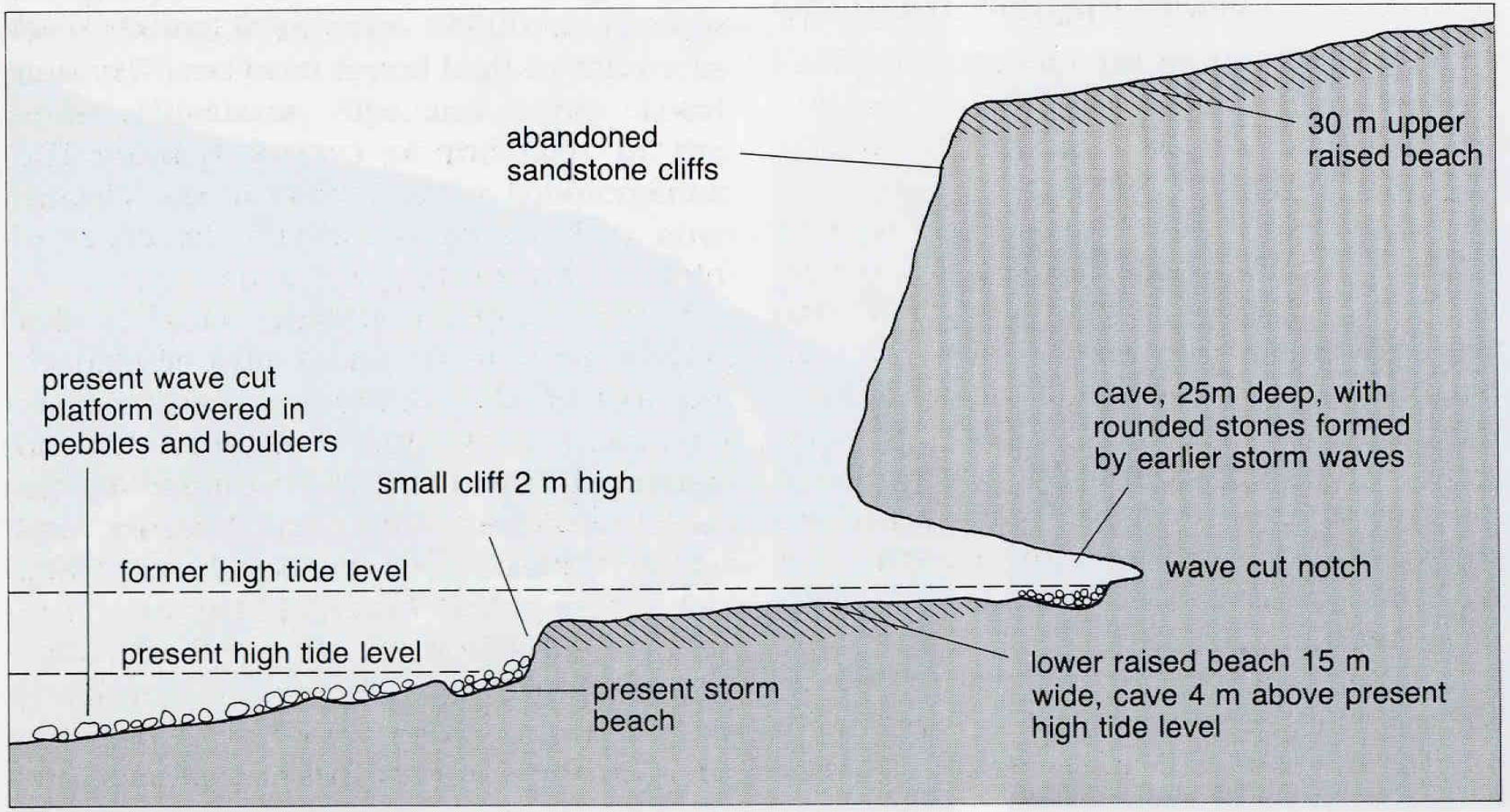


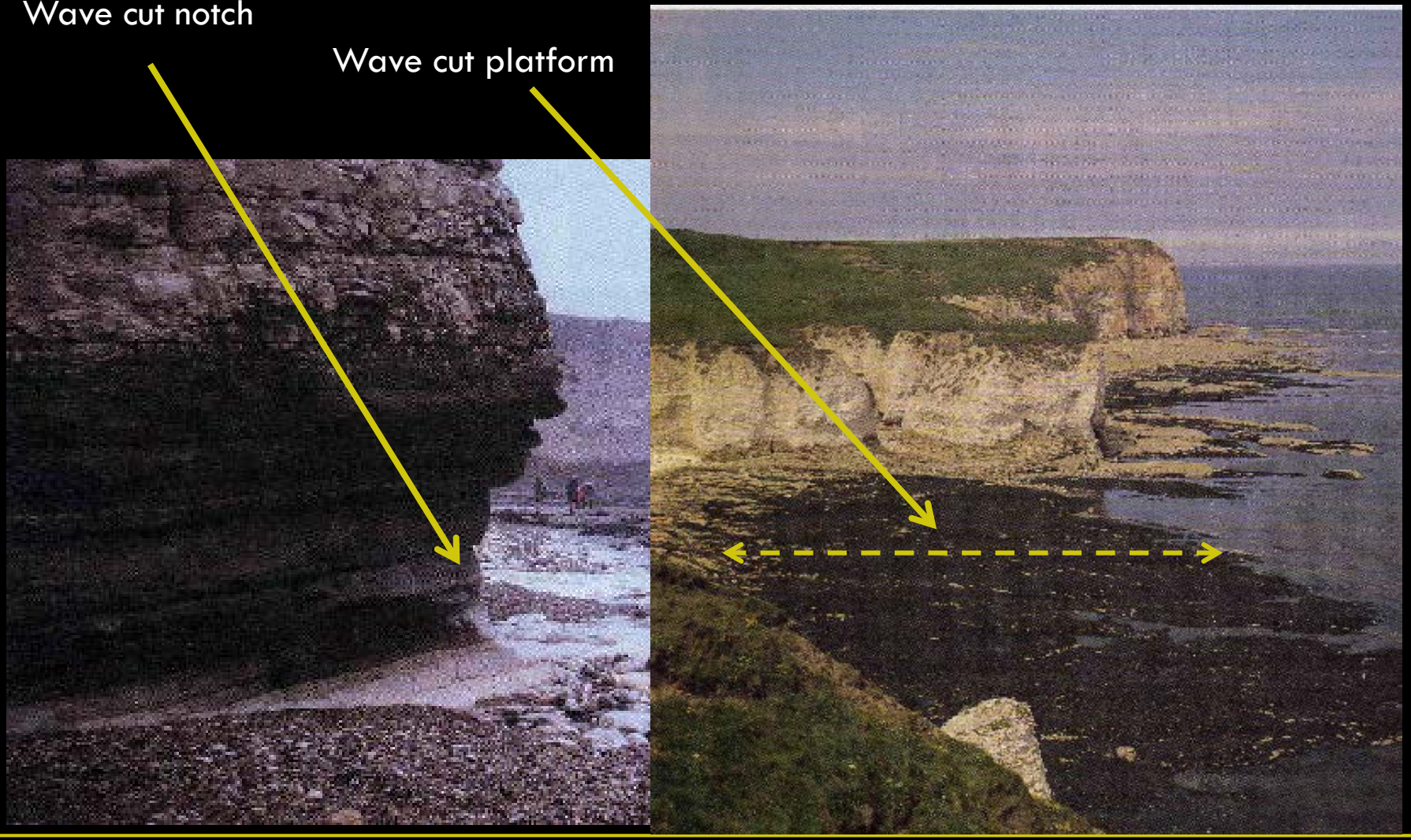
Figure 6.5
Wave refraction at a headland



Notch

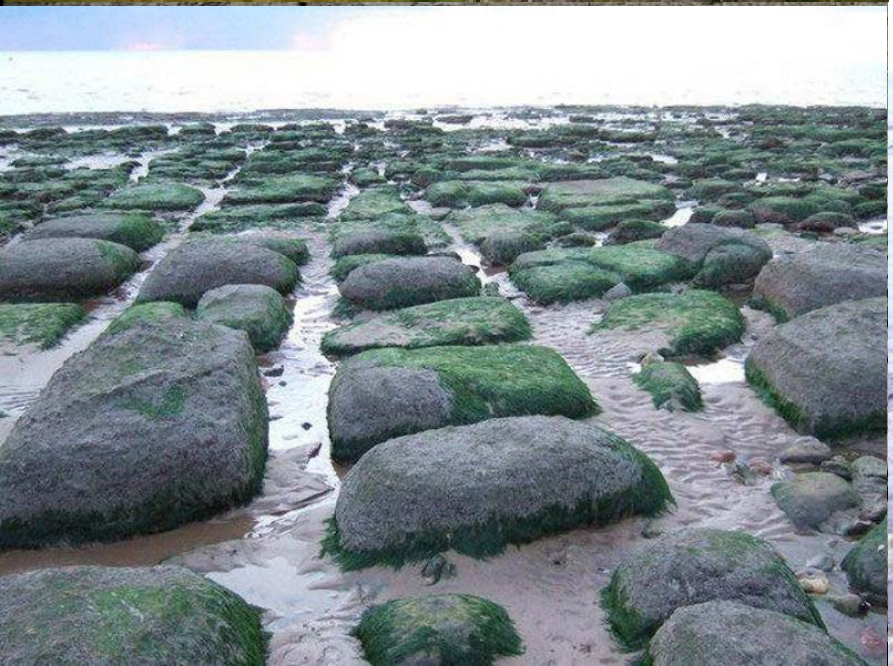

abandoned
sandstone cliffs
30 m upper
raised beach
present wave cut
platform covered in
pebbles and boulders
cave, 25m deep, with
rounded stones formed
by earlier storm waves
small cliff 2 m high
former high tide level
wave cut notch
present high tide level
present storm
beach
lower raised beach 15 m
wide, cave 4 m above present
high tide level

Flamborough Head, Yorks.



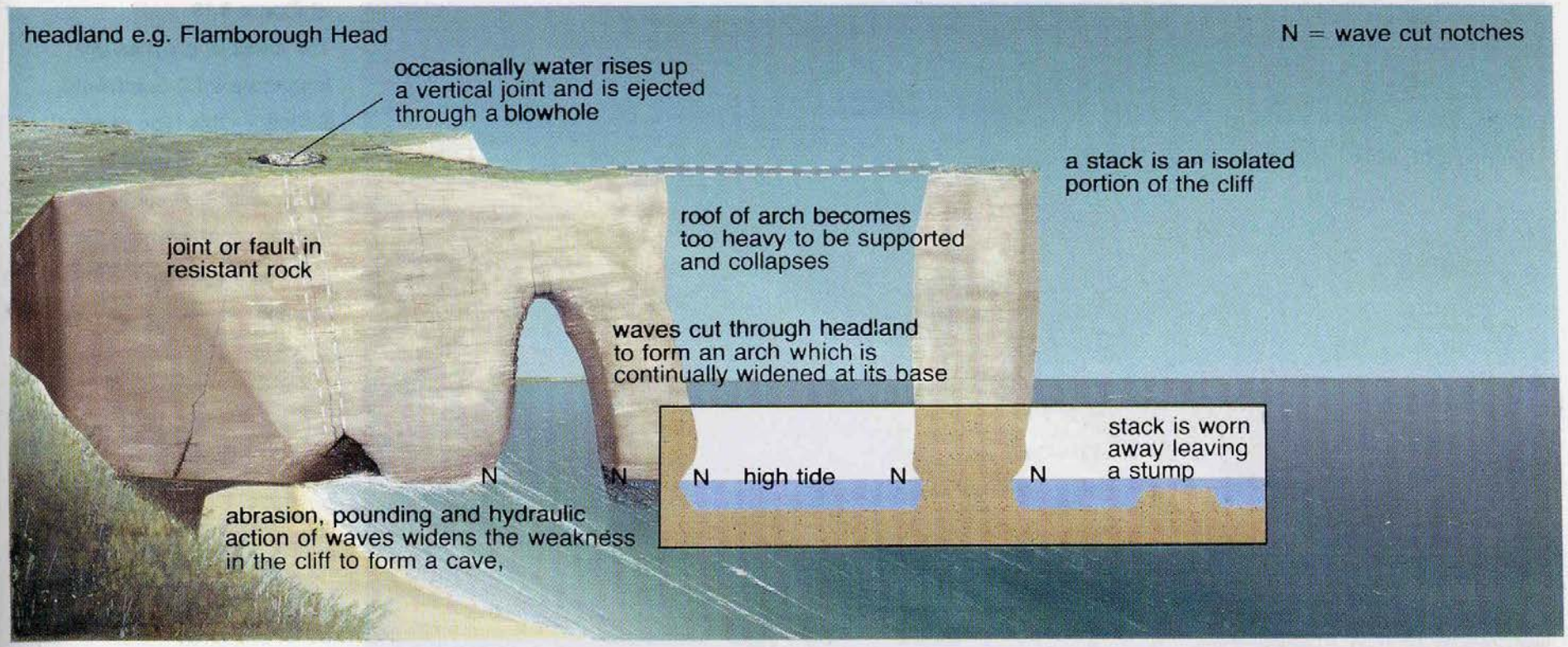


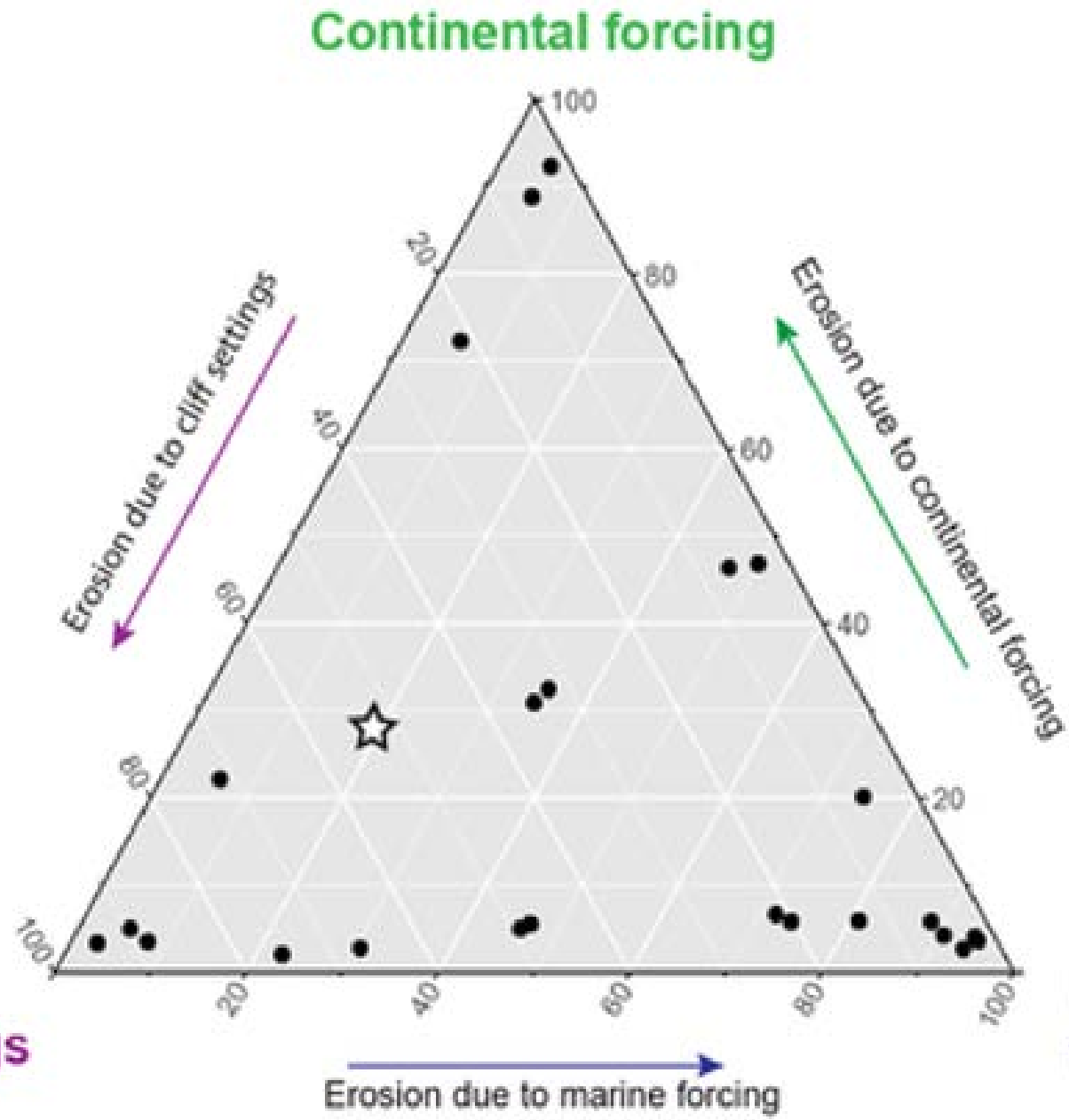









headland e.g. Flamborough Head
N = wave cut notches
occasionally water rises up a vertical joint and is ejected through a blowhole
a stack is an isolated portion of the cliff
joint or fault in resistant rock
roof of arch becomes too heavy to be supported and collapses
waves cut through headland to form an arch which is continually widened at its base
N
N
N
high tide
N
N
stack is worn away leaving a stump
abrasion, pounding and hydraulic action of waves widens the weakness in the cliff to form a cave,



ne forcing
Swell
idal range
...


© 2001 Chris Nicholson
www.NicholsonPrints.com

Cliffs (80% world's coasts Masselink, 2010)

- Relative rates of sediment supply and removal
- Rate is principally associated with rock type & form
- Erosional coasts morphology (next slide)

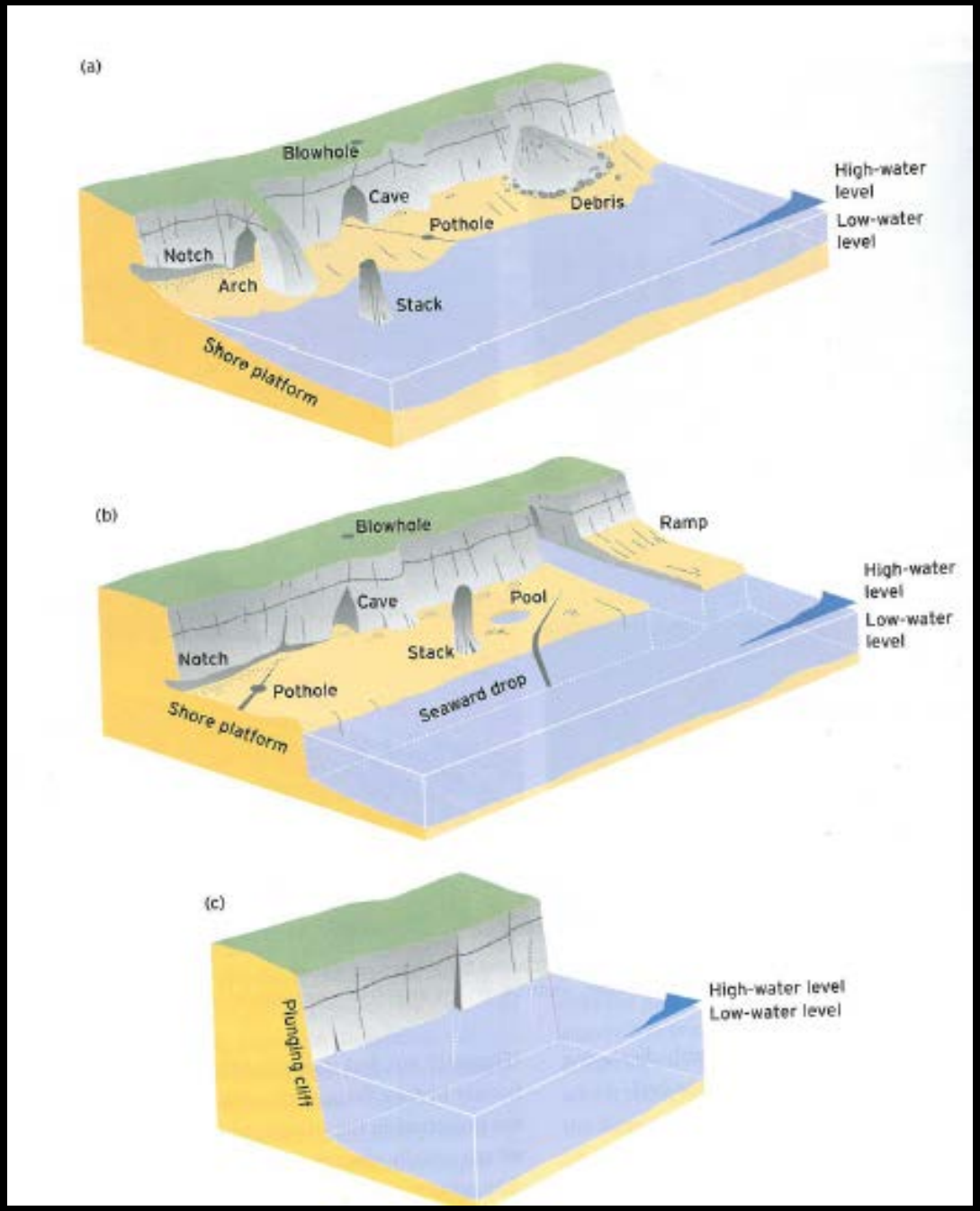
  - Sloping shore platforms
  - Sub-horizontal shore platforms
  - Plunging cliff

} Sunamura, (1992)

Morphology

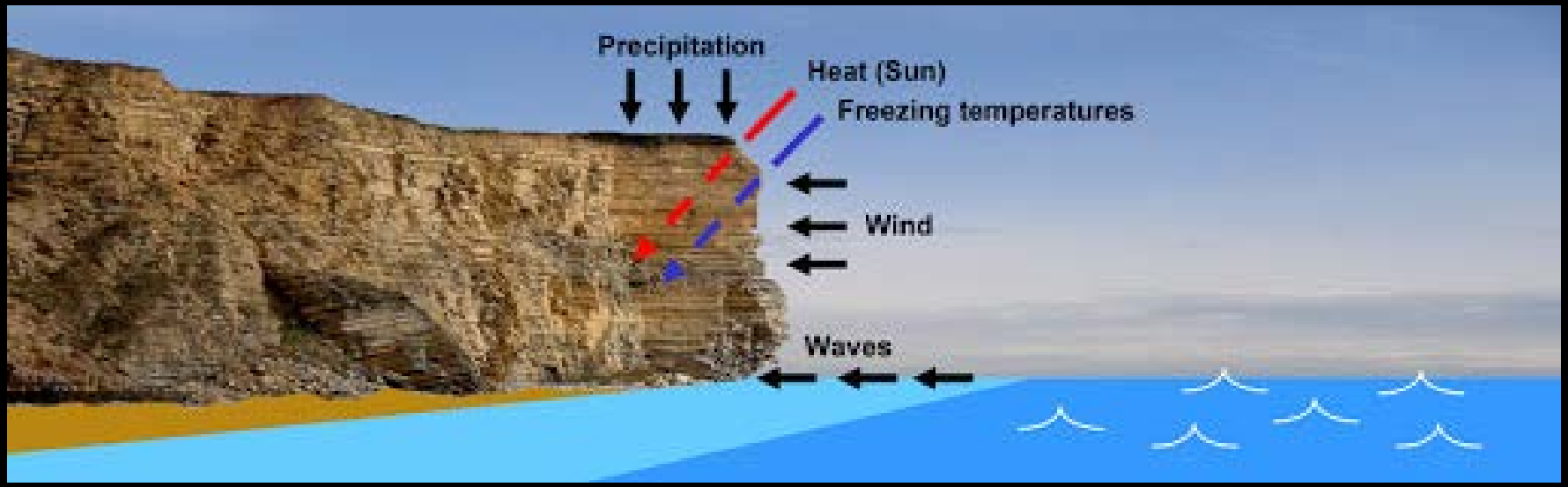
- Major morphologies on rocky coasts. Erosional features:
  a) Sloping shore platform
  b) sub-horizontal shore platform
  c) plunging cliff

(Sunamura, 1992; Masselink, 2008)



Processes

- Episodic Mass movement (slope processes)
- Rock break-down (coastal erosion processes)
- Marine rock removal (Marine processes)



Summary of article in Nature 2020

02 March 2020

Sandy beaches are endangered worldwide as the climate changes

Sea-level rise and coastal shifts could wipe out nearly half of Earth's sandy seashores by the end of the century.

•Storm surges, waves and rising seas could help to erase almost half of all sandy beaches by 2100.

Michalis Vousdoukas at the European Commission's Joint Research Centre in Ispra, Italy, and his colleagues analysed the shift of sandy shorelines around the globe between 1984 and 2015. The team then estimated future shoreline changes driven by geological factors, such as sand loss, and human activities that affect sediment supply. The researchers also modelled the effects of rising water levels and growing storm-surge height — both caused by increasing sea levels — on shorelines.

By the end of the century, many of the world's coast lines will have retreated by more than 100 metres from their positions in 2010, even if atmospheric levels of greenhouse gases rise only moderately. The Democratic Republic of the Congo, the Gambia, Suriname and Pakistan are among the places where more than 60% of beaches would be affected. Australia could lose the greatest amount of sandy coastline: at least 11,426 kilometres.

Coastal planners could stave off much of the erosion by carefully managing beaches.

Nature Clim. Chang. (2020)

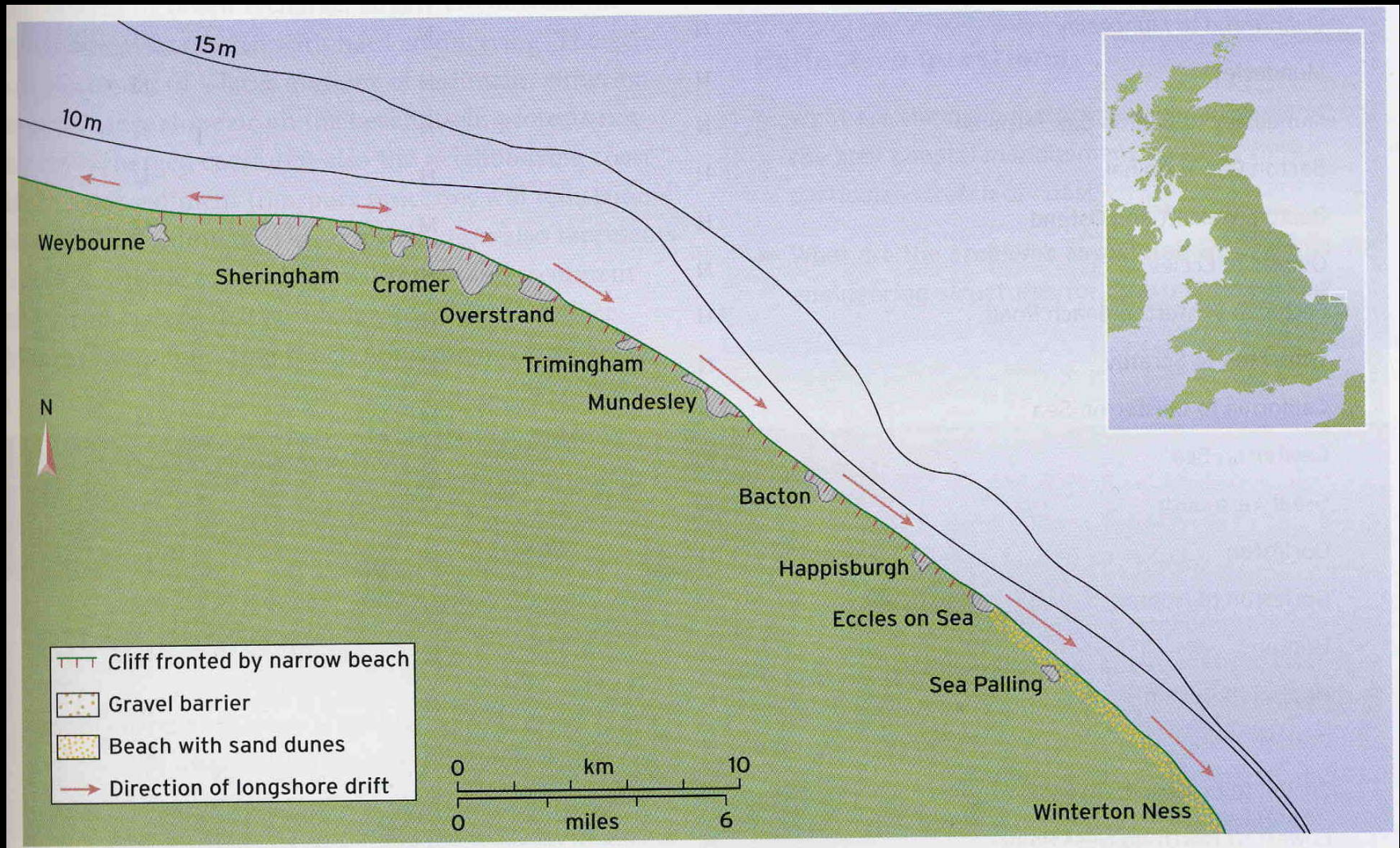


Figure 17.43 The north Norfolk coast is characterized by large littoral drift rates (up to 400 000 m^3 yr^{-1}) and rapidly eroding soft cliffs (1–2 m yr^{-1}). Holding the line is not sustainable and the preferred management option for most of this coastline is managed realignment.

BOX 17.6 ➤




(C) Mike Page 31.05.2004


26.10.2004 (c) Mike Page

Clickview 15 mins

- Coastal Conservation
- How does the coast influence our environment?



DEPOSITIONAL LANDFORMS



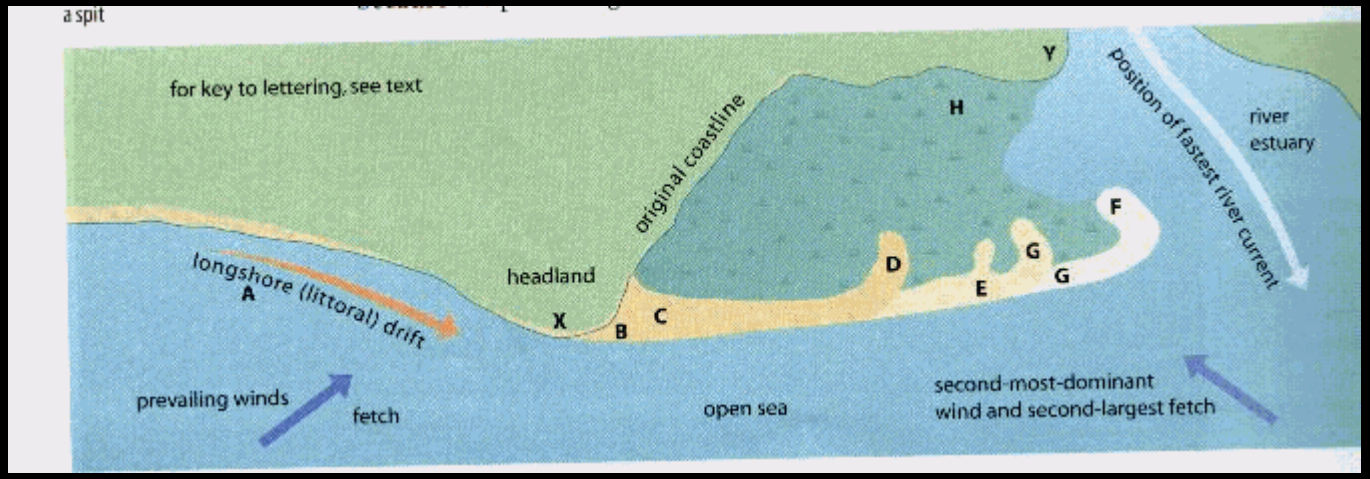
Queensland

- How do these depositional features influence habitat management?
- Why is it important to study coastal processes for habitat management?
- What maybe the influence of SL rise?

DEPOSITIONAL LANDFORMS

- Beaches
- Spits
- Dunes
- Saltmarsh
- Bars and tombolos
- Cuspate forelands





DEPOSITIONAL LANDFORMS

- Beaches

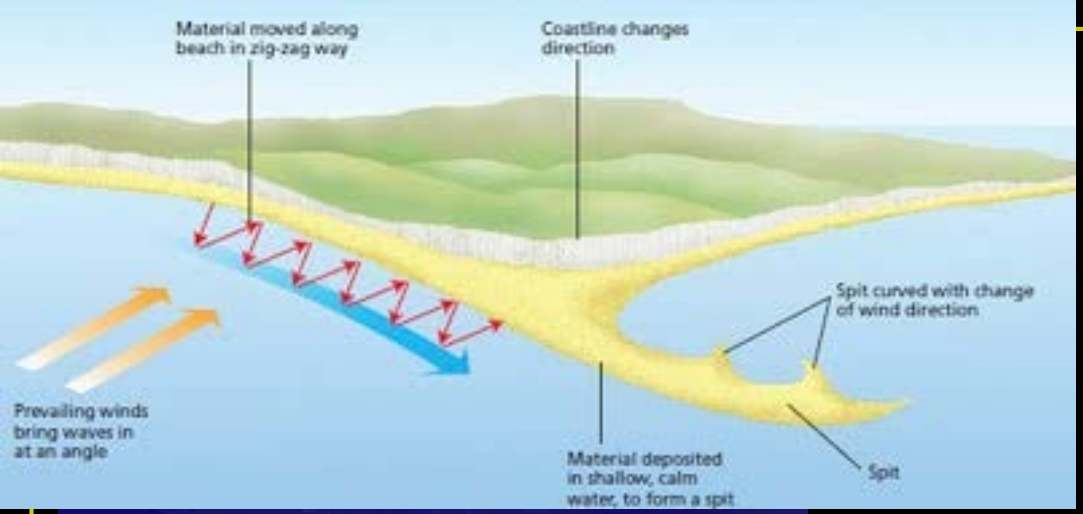












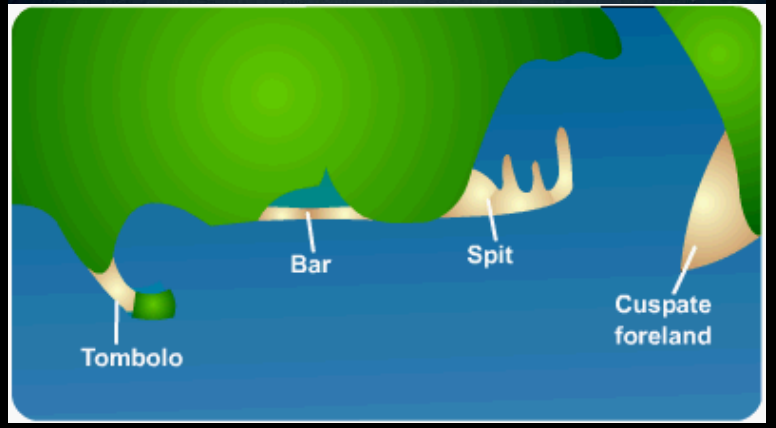








- Spits
- Bars and tombolos

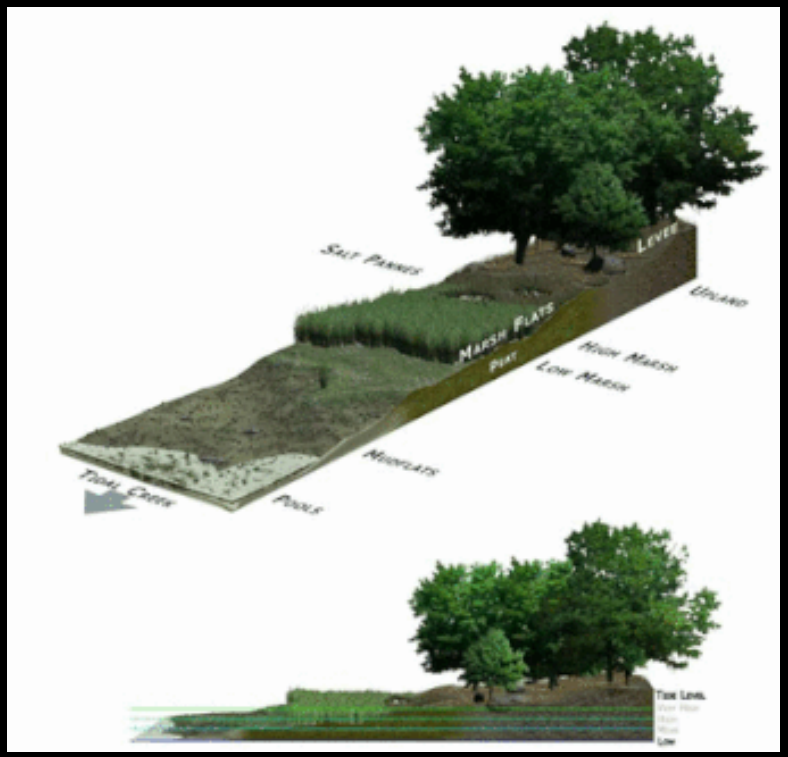


DEPOSITIONAL LANDFORMS

DEPOSITIONAL LANDFORMS

- Saltmarsh







Cwm Ivy

- Number of clips and discussion points
- Watch clips and discuss





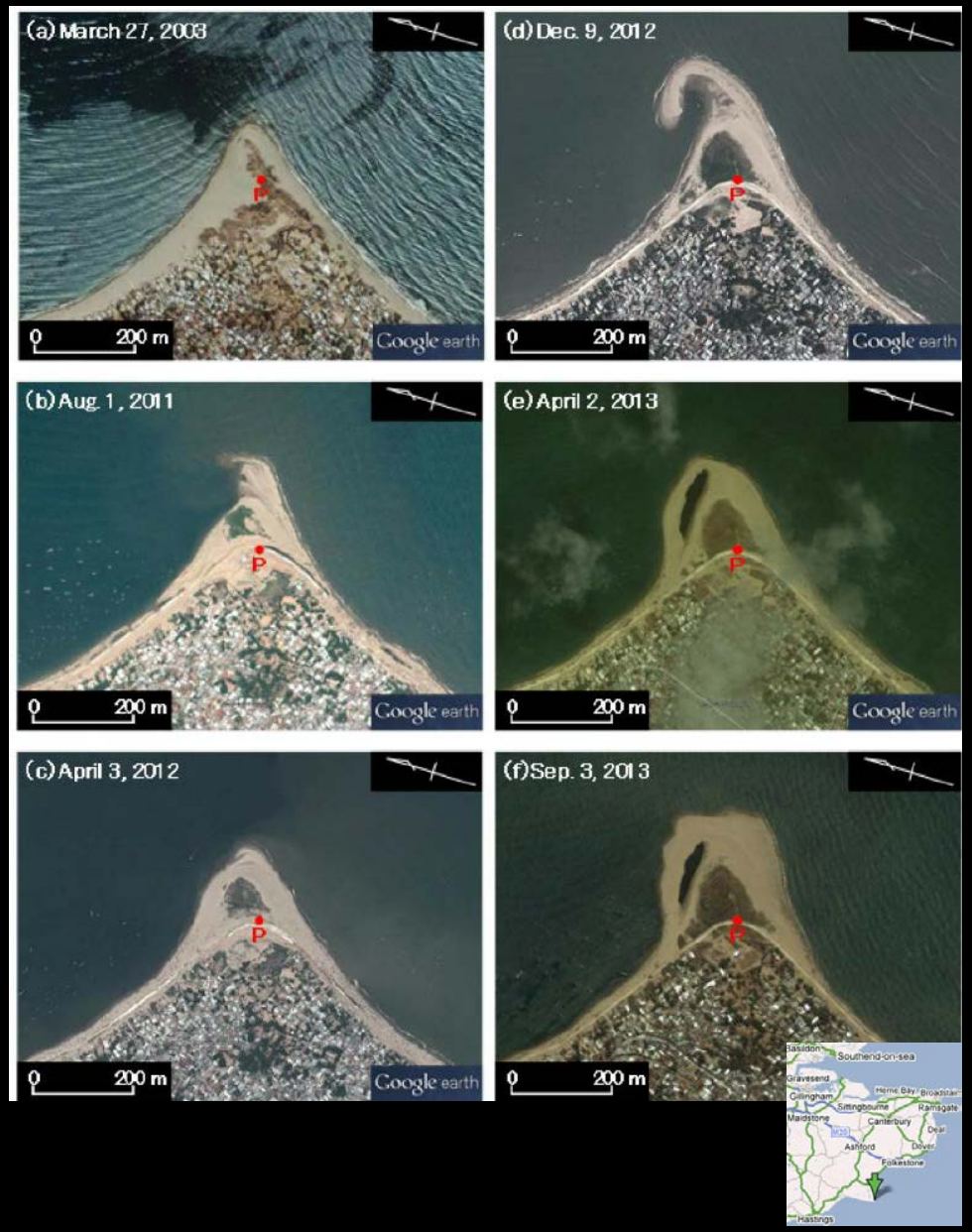




DEPOSITIONAL LANDFORMS

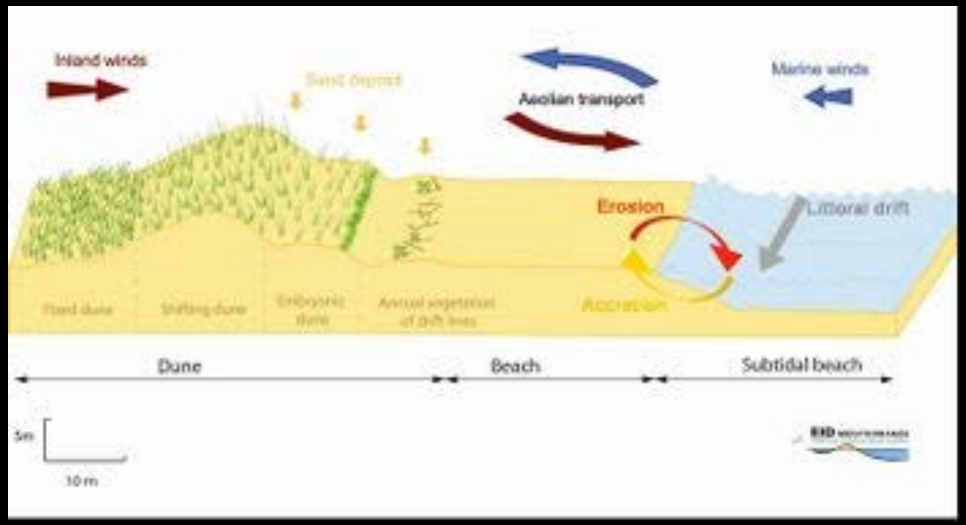
- Cuspate forelands (e.g. Dungeness) 2 LSD from opposite directions meet to produces ridges at 90° to each other





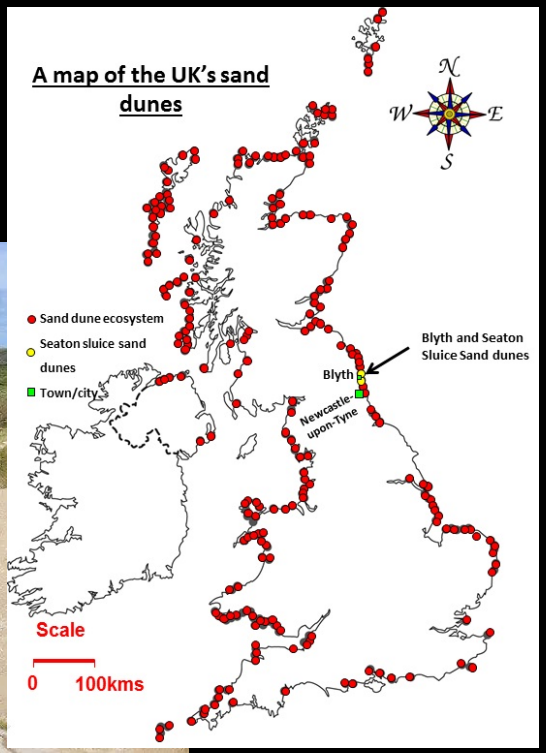
DEPOSITIONAL LANDFORMS





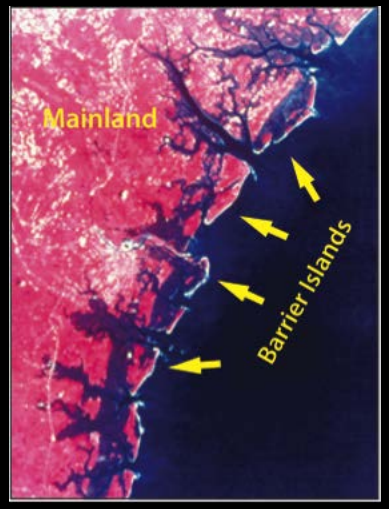
- Dunes





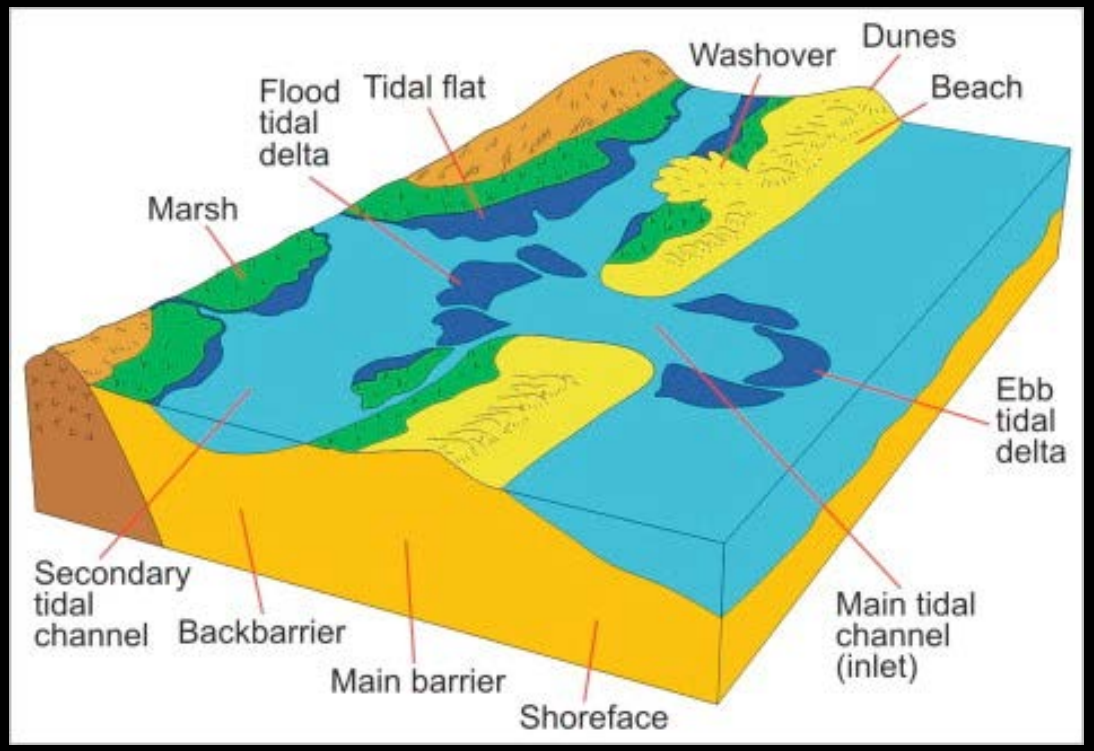
DEPOSITIONAL LANDFORMS

- Island barriers









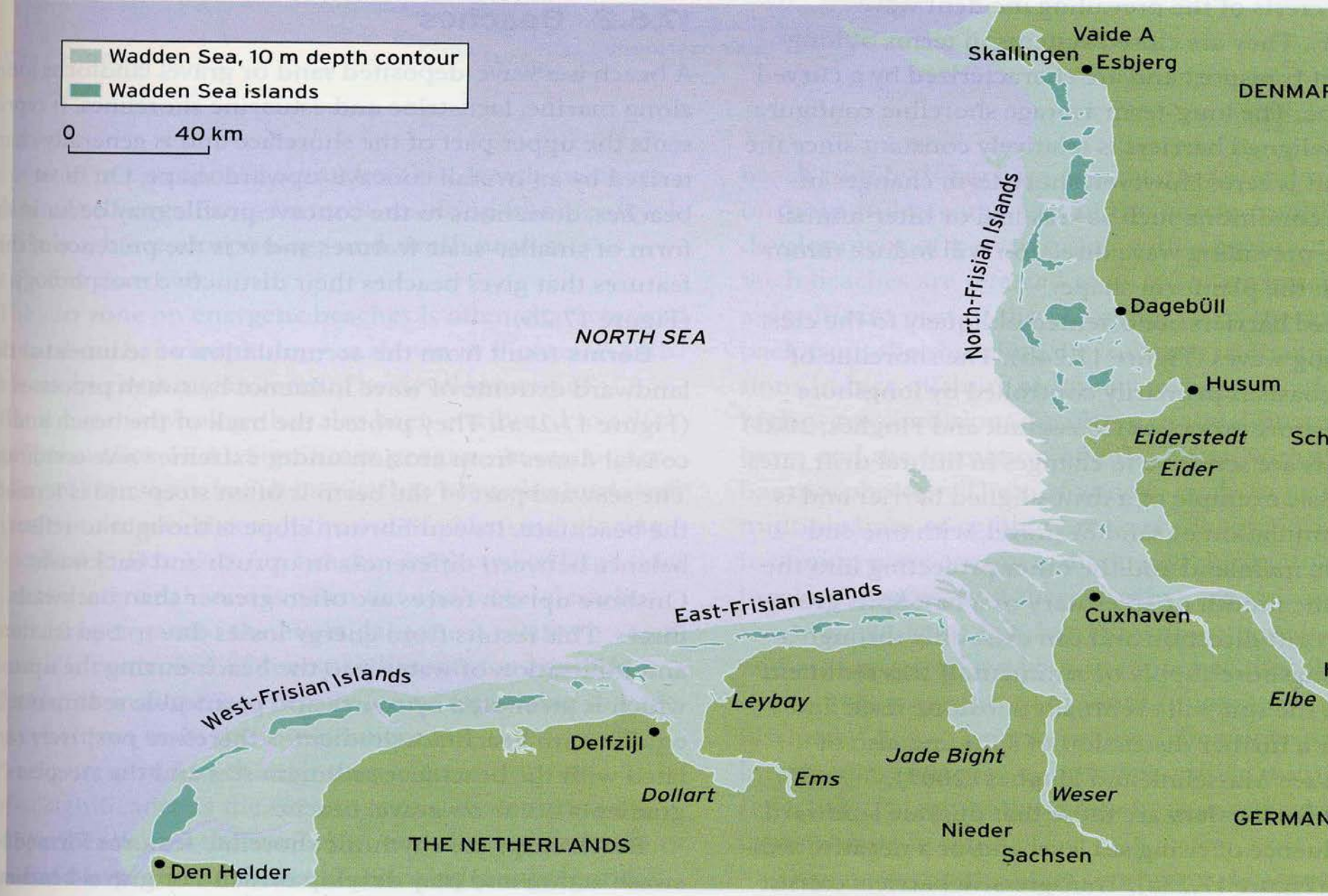


Figure 17.23 Barrier islands of the Wadden Sea in north-western Europe. (Source: after Hofstede, J., 2005, Danish-German-Dutch Wadden Environments, in E.A. Koster (editor). *The Physical Geography of Western Europe*. Oxf University Press, Oxford, 185–205. Copyright Oxford University Press. Reprinted by permission.)

Management of coastal processes: The case of the National Trust

- Living with change: Our Shifting shores
- Examples of NT coastal process management
- Shifting Shores Report 6 mins ALL

1. Formby 3 mins
2. Beach huts Studland 2 mins
3. Blakeney Freshers 3 mins
4. Sussex, Birling Gap 2 mins

PowerPoint

View the video footage and research what is happening at your allocated location

- Note location on a map.
- How does your example contribute to the global environmental agenda (IPCC 2021 etc)
- How does your example show adaptation?
- How does your example impact on humans and habitats
- What is the main lesson for management of physical processes and conservation?