Sea Level Change

Photo: Environment Agency

The Suffolk Coast and Heaths

- An Area of Outstanding Natural Beauty

Sea Level Change

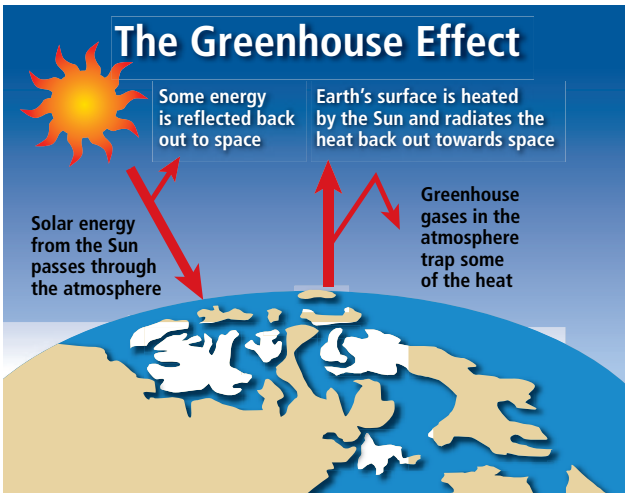
What is causing sea levels to change?

Sea level is the level of the surface of the sea relative to the land. This can change by either the land moving against a static sea height (isostatic changes), the sea height changing against a static land mass (eustatic changes) or both at the same time. The relative movement of both the land mass and the sea will determine the observed change in sea level. Sea level rise is widely considered to be one of the most significant effects associated with climate change to threaten the UK.

Tide gauges measure this net variation in relation to a fixed benchmark on land. Tide gauge data also allow us to estimate how sea levels have changed over the last hundred years. However, the length of many records is limited, with only about a third of the records extending to 20 years or more. Estimates based on available data indicate that sea level in the south and east of England over the last 100 years has risen between 10-20cm. This has been caused by both eustatic and isostatic changes.

Global Warming:

The past 100 years has seen the world's atmosphere warm up by about 0.5°C and, due to the increasing atmospheric concentrations of carbon dioxide and other 'greenhouse gases', it is likely that the world will continue to warm. The greenhouse effect helps to regulate the temperature of the earth and is one of the earth's natural processes. Greenhouse gases in the atmosphere act as a blanket, trapping heat from the sun and keeping the earth warm. Without the natural greenhouse effect the temperature of the earth would be about -18˚C, instead of its present average 14˚C. The concern, then, is whether human activities are enhancing the greenhouse effect.



Since the Industrial Revolution, we have been increasing the thickness of this blanket, mainly through burning fossil fuels. Fossil fuels are coal, oil and natural gas, which are remains of organic matter from millions of years ago. As a result of increased burning of these fuels, previously 'locked up' greenhouse gases are being released and the world's atmosphere is getting warmer. Continuous monitoring of carbon dioxide (CO_2) leaves us in little doubt that the chemical composition of the atmosphere is changing. Current research has also shown that there is a build up of two other 'greenhouse' gases, methane and nitrous oxide. All of the 'greenhouse' gases have natural mechanisms that release the gas into and remove it from the atmosphere (sources and sinks). We are now getting an imbalance between the sources and sinks, with the sinks – like the rainforests which are getting much smaller - unable to remove the extra gases accumulating in the atmosphere that have been generated by human activities.

The results of global warming are:

1 Melting ice. Glaciers and ice-sheets are melting, contributing more water to the system.

2 Thermal expansion. The oceans are warming up in response to global temperature rises, making the water less dense and increasing water volume, causing sea level to rise.

3 Changing weather systems. More warm water in the oceans is driving more energy in to the weather systems, causing greater extremes such as high winds, heavy rain, storm surges and flooding. Increased frequency and severity of storms have also been occurring causing increased wave activity.

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Isostatic movement (the vertical movement of land)

In south-eastern England the land is slowly sinking. This is a re-adjustment of the land after the last ice age when heavy glaciers existed over the north of the country but not the south. The retreat of ice from the North West, and the resulting removal of ice weight, has caused the land to readjust and tilt downwards south of a line running approximately from Teesmouth to Anglesey, and upwards north of this line.

These gradual land movements continue to this day which means that the coastal areas around East Anglia are vulnerable to sea level rise even without the impacts of global warming.

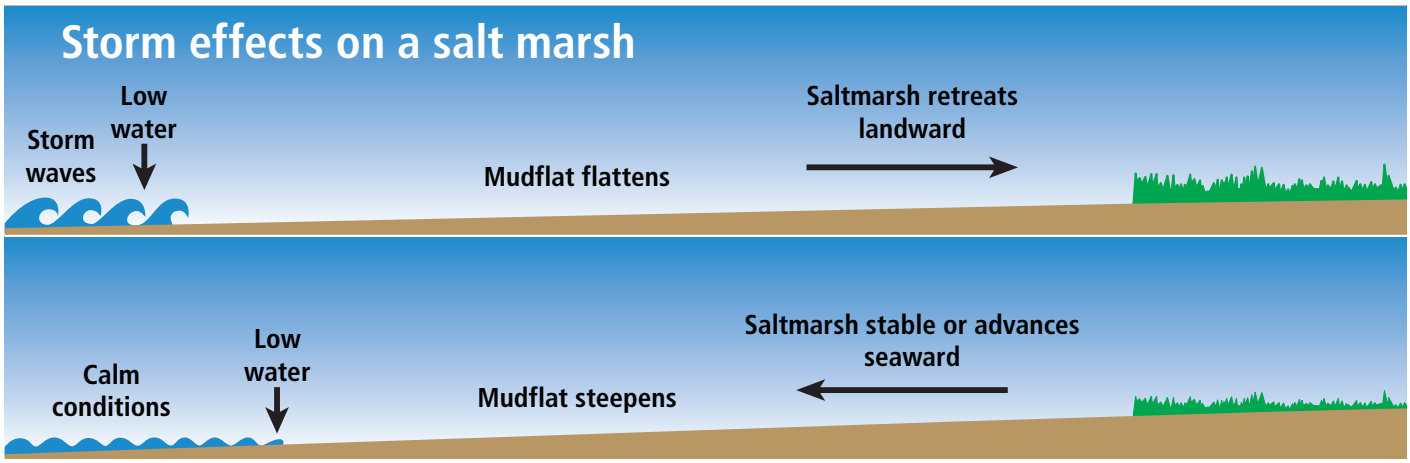
Threats from changes in sea level

Rising sea levels threaten to flood low lying land, increase coastal erosion and encourage saltwater intrusion into coastal and fresh water aquifers. Globally, a rise in sea level of up to one metre over the next hundred years could severely damage human settlements and health, agriculture, freshwater supply, fisheries, and coastal ecosystems. Nearly 70% of the world's beaches are eroding and retreating due to the present rate of sea level rise.

Habitats threatened

The UK coastline is home to a wide variety of habitats: shingle ridges, saline lagoons, dunes, saltmarshes, intertidal sand and mud flats, and sand beaches. Approximately 10% of nature reserves are close to the coast and an estimated 62 SSSIs (Sites of Special Scientific Interest) are located in low lying parts of England and Wales. All of these are at risk from sea level rise.

Saltmarshes in particular are an important coastal habitat, not only for wading birds and wildfowl, for nursery areas for fish, and as a 'carbon sink', but also as a key form of natural coastal protection. They help to dissipate wave energy by slowing down the waves passing over them, through friction. Saltmarshes are an ever changing habitat responding to the changes in relative height of the land in relation to the sea in the intertidal area.



However, saltmarshes are under threat. The natural response of coastal habitats to rising sea levels would be to retreat inland, but when an artificial barrier exists (e.g. a sea defence wall) this cannot happen and the habitat is squeezed into a smaller space ('coastal squeeze'), and eventually is either swamped or eroded away. Not only does this mean less of the habitat available (and increasing human 'hard' sea defences mean there are less places for new inter-tidal habitats to be naturally formed) but the important contribution to lessening wave energy is also lost, meaning the full force of the sea acts directly on the sea defence, making it more vulnerable. It is then more likely to fail, requiring further costly work to improve it.

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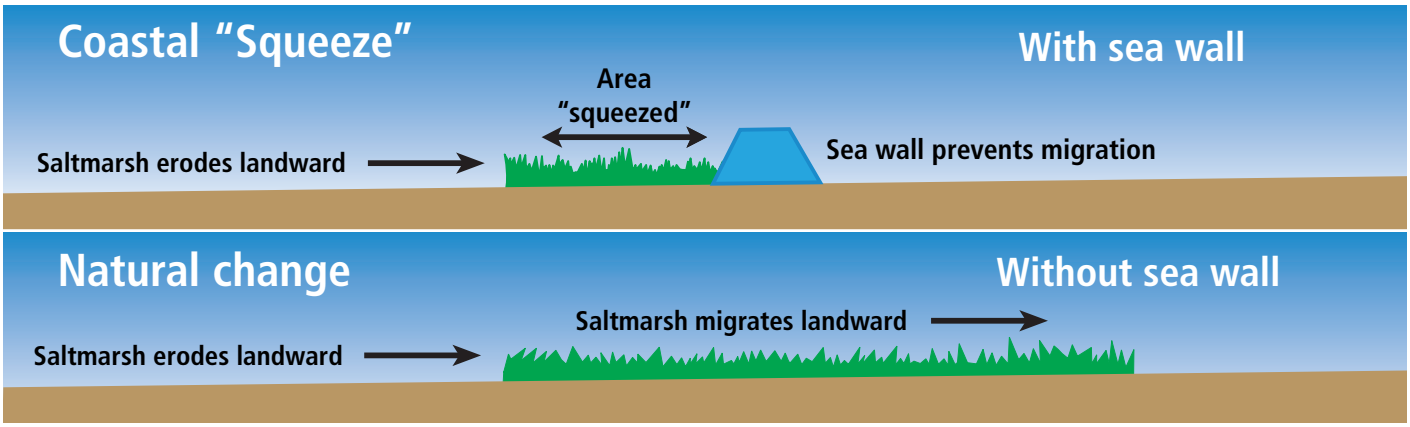

Species threatened

For many of the migratory birds dependent on the UK coastline, a significant proportion of their habitat is at risk from sea level rise. Birds nesting close to the high water mark, such as little terns, are particularly at risk from flooding. Approximately one third of the UK's redshank population nests on East Anglian saltmarshes which are currently experiencing erosion. Sand and shingle beaches on eroding coastlines are home to nearly a fifth of UK ringed plovers.

People

Most of the world's major cities are situated on coasts, and many of these are built on land less than a few metres above sea level. In the UK many of our nuclear power stations, such as Sizewell, are in coastal locations, requiring continual upkeep and monitoring of sea defences. Many of the country's most valuable industries are situated near sea level on vulnerable estuaries. The East Anglian region is a predominantly agricultural region with much productive farmland on low lying land near the coast, so if sea level rises as predicted, it will pose many challenges.

What will happen in the future?

How much sea level will change in the future will depend on many factors and for this reason estimates for the future are uncertain. However the evidence from the 20th century indicates it is a major problem for us all.

Some observed impacts of sea level change in the 20th century (source: Environment and Heritage Service)

Global mean sea level	Increased at an annual rate of 1-2mm during the 20th century
Duration of ice cover of rivers and lakes	Decreased by approximately two weeks during the 20th century in the far north
Arctic sea-ice extent and thickness	40% thinner in summer in recent decades. Decreased in extent by 10-15%
Non-polar glaciers	Widespread retreat
Snow cover	Global area decreased by 10% since 1960's
Permafrost	Thawed in parts of polar and mountainous regions

The Coastal Knowledge Fact Sheets have been produced by the Suffolk Coast and Heaths Unit
www.suffolkcoastandheaths.org
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