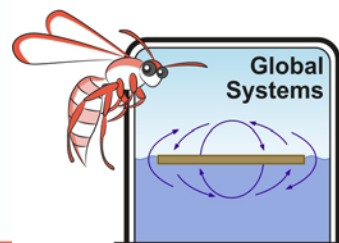


Climate Change and Sea Levels – Teachers Notes



Satellite photographs show us that both Arctic and Antarctic ice is melting at an increasing rate. Ice that was bound up in ice caps, glaciers and sea ice is melting, as is the ice in high altitude mountain glaciers.

Melting ice itself does not directly contribute much to an increase of ocean volume. Ocean water expands because of heat held within the atmosphere.



Using your knowledge of kinetic energy, explain why water expands when it is heated. Water is a liquid. At room temperature, the force of attraction between its molecules balances the kinetic energy, which forces them apart. This balance allows water molecules to slide over each other and fill the bottom of their container. As the water heats the kinetic energy of its molecules increases and they vibrate more energetically filling a larger volume. At boiling point their kinetic energy exceeds their force of attractiveness and they fly free to become water vapour molecules and fill the available space.

Cold ocean currents flow from the poles and warm ocean currents flow from the equator. Water cycles around the globe in currents mixing and transferring heat. The Global Conveyor Belt distributes heat around the world affecting climate, agriculture and disease control. Anything that interferes with its regular flow can cause problems.

What drives the Global Conveyor Belt, a major group of interacting currents that circle the planet? *Hint: There are two drivers*

The initial drivers of currents are:

1. Surface water in the polar oceans is chilled by cold winds. It becomes colder and denser and sinks down creating cold currents that run along the ocean bed.
2. When seawater freezes, the ice formed is pure water. The underlying water becomes saltier and therefore denser. This increases the downward density pull and further drives the cold current.

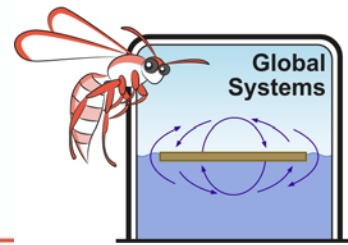
(Note – warming surface waters are pulled towards the poles to replace the sinking colder waters)



Recent flows of cold meltwater from the Greenland Ice Cap are slowing the passage of northward flowing water of the North Atlantic Drift. The “Cold Blob” as it is called is affecting the passage of warmer water. This current from the equator is responsible for keeping most of northern Europe’s coastline warmer than it would otherwise be and is very important to agriculture. Farmers near the

coast can have crops ready two months earlier than those inland. If the warm current is halted most of northern Europe will experience a climate much like that of Siberia.

Climate Change and Sea Levels – Teachers Notes



Watch the YouTube video, “What the Earth would look like if all the ice melted”. The video only lasts 2m 45s and you will find out what London, Dakar, Calcutta, Miami and Beijing have in common! [If all the ice melts they will all be under water.](#)

In many countries, economic infrastructure such as roads, railways and ports lie at the edge of the ocean. London has already built major barriers to counter the effect of rising sea levels over the last twenty years. Our northern iron ore towns of Port Hedland and Karratha lie on the coast. They were built on the flat coastal plain and already have some defences erected to protect the towns from past cyclonic storm surges. Would it be easy to build these ports further inland? [Definitely not. It would also be very expensive.](#)



The independent and sovereign Republic of Kiribati is an island nation lying in the Central Pacific to our northeast. It is composed of 33 coral atolls most of which lie less than 1m above sea level. The population depends on their gardens for most of their food supplies and on shallow aquifers for fresh water. Recent storms surges have soaked their gardens in salt water, which killed the coconut palms and papaya trees. Scientists predict that their risk of flooding will have increased 200 times by 2080 if the present rate of temperature increase continues. Most islanders are not rich and cannot afford to build sea defences or desalinate salt water for drinking.

What effects will a slight rise in sea level have on the people of Kiribati?

[Storm surges could sweep away their homes and ruin their gardens. Salt water will invade the fresh groundwater. This will be a dangerous place to live. The population would have to move elsewhere.](#)

Should Australia accept these climate change refugees? Explain your answer. [Any reasoned answer.](#)

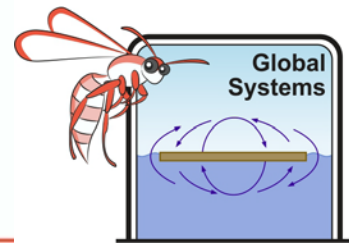


Lose your albedo and you will have lost your cool!

Melting ice from glaciers will also have an effect on Earth’s **ALBEDO**. What is “albedo” and how can this change the temperature of our land and ocean?

[Radiation entering Earth’s atmosphere is absorbed by dark surfaces and reflected by light surfaces back out into space. Light coloured surfaces, such as ice and snow, reflect the infrared rays and keep the underlying water and rock and overlying atmosphere cool. Areas where ice has melted are no longer protected and will warm. The darker the surface the more heat will be retained.](#)

Climate Change and Sea Levels – Teachers Notes



How can we use the albedo effect to reduce our air conditioning bills without cladding the house in ice? [Painting the surfaces with white or light coloured paint will reduce heat entry into the house. A recently published study by researchers at NASA and Columbia University has concluded that painting the surfaces of a city's roofs white or a light colour could potentially reduce its ambient temperature by 5 or more percent during hot summer months. The city of San Francisco has reduced their power bills by painting roofs white.](#)

Barefoot Australian children have used this knowledge to use road crossings and not get hot feet. How did they do this? [They jumped over the hotter black bands and only stood on the white bands of the crossing.](#)

