

Factsheet 2: The basics – the physical effects of climate change

This is the first of two factsheets explaining the effects of climate change. This one explains the basic science. The next one explains the implications for human society.

Climate change will have a wide range of effects. First, the bands of climate in the world will move. The very hot climate of the Sahara will move north to the Mediterranean. Northern Europe will become like the Med. And the Arctic will become like Northern Europe.

In the southern hemisphere the climate will move south in the same way.

The climate will also move up. The low hills will become like the plains, the slopes of the mountains like the hills, the high reaches of the mountains like the slopes.

The changes will be least at the equator, and strongest in far North and far South. The Arctic has already seen an increase of several degrees in temperature.

The Earth has warmed before. But humans have not seen warming on this scale. And when the ice ages came, the human population was very small, and was able to retreat over thousands of years – to walk away from the ice.

Now we have almost 7 billion people, in a fixed and very complex economic and social system. Moreover, the climate will be changing very quickly.

Plants and animals will face worse problems. Many animals will be unable to move fast enough. But even if they could, dense human settlements lies in the way. For trees and plants which move over generations by casting seeds, the problem will be worse.

The different species of life in any one area also part of an ecological web. Eliminate some species, and many more will be threatened. Estimates of the

number of species that will be lost are 30% and up. But there is no real way of knowing.

The daily weather, as opposed to the long term climate, will also become much more unstable. This will create more extreme weather events.

Rains, seas, storms, heat waves and fires

The rains will change, the seas will rise, and storms will grow stronger.

In many areas, the rains will weaken or fail, with prolonged drought in some regions. Then the crops will fail, farmers will lose their livelihoods, and people will starve.

In some areas, conditions will get better and yields will increase. But on balance, farmers will lose.

The rains will also come in more unreliable ways. The rains in temperate regions will be more like tropical rains, falling in hard bursts the soil cannot absorb. Much rain will come out of season, when it is no use, or so hard in the growing season that it kills the crops.

Hard, long rains create floods that destroy crops, homes and cities.

All over the world, the glaciers have already begun to melt. They will disappear. This threatens irrigation water for farmers and drinking water for cities. The glaciers of the Himalayas feed many rivers, including the Hindus, the Ganges, the Brahmaputra, the Irrawady, the Mekong and the Yangtze. More than a quarter of the world's farmers depend on that water.

Storms will grow stronger, wetter and more energetic. Tornadoes and hurricanes, in particular, will increase. Tornadoes are caused by a long hot spell on land. Hurricanes are caused by a long hot spell on the ocean. The higher the temperature for longer, the bigger the storm and the higher the winds. (Hurricanes are also called cyclones and typhoons.)



Hurricanes and tornadoes will also extend further north in the northern hemisphere, and further south in the southern.

Storms will also combine with sea level rise to destroy coastal cities. The sea level will rise over years, and decades, as the ice packs melt. It is the ice over land that matters – the sea does not rise when sea ice melts. The two key ice packs are Greenland and Antarctica. Greenland is smaller, but will melt sooner. Both ice packs are melting faster than expected.

Over years, perhaps generations, they will flood the coastal cities – New York, Shanghai, Mumbai, Alexandria, Singapore, London, Lagos, Havana and all the rest.

But for many cities it will not be gradual. Hurricanes and other tropical storms push forward a 'hurricane surge'. This works like a tsunami. It is a wave of water that the hurricane has been pushing in front. Across the open sea that wave may only be 15 centimetres, or 6 inches, high. But then that wave hits rapidly shallowing water at the coast, and the pressure behind it creates a very high wave, moving very fast. This is also what happens with a tsunami.

Hurricane Katrina, in New Orleans in 2005, for instance, was not a very strong hurricane. But when the hurricane surge hit the coast of Louisiana, it was 18 feet, or 5.5 meters high. That force combined with a rise of 3 feet, or 1 meter, in sea level rise, to destroy the city's flood defences.

With stronger hurricanes, coming further north and south, higher hurricane surges will combine with rising sea levels. In many cities, the rise along the coast will be gradual for many years. Then the city will be destroyed in a matter of hours.

Warming also creates fires and heat waves, for obvious reasons.

It is happening now

These are the likely first consequences of global warming. Almost everything we have described is already happening somewhere.

We now have drought in Australia, southern China, Mongolia, Central Asia, the African Sahel, parts of Southern Africa, northern Ghana, northern Kenya, the south-western United States and northern Mexico. In Central Asia, Afghanistan, Darfur and Chad, the drought has lasted most of the last forty years. We have seen floods in Pakistan, on the Mississippi, and in Australia. Tropical storms have doubled in total strength. Bangladesh and Burma have both seen the worst cyclones ever to hit those countries. Harvests have been hit in many parts of the world.

This is not the future. This is now. Almost all of these events, except for the melting in the far north, are within the bounds of the possible. They are not unprecedented. They cannot be explained simply by climate change. In each case we have to say, climate change made this more likely.

But they also suggest what is coming. The future events will be more intense, more common, and stretch further. They will also interact with each other, so that people face more than one disaster.

With abrupt climate change, disasters will come thick and fast upon each other, in one country and across the world. That will erode readiness, defences, logistics, food stocks and compassion.

Moreover, all of this will happen within the limits of modern market economies, with the kinds of societies and governments we have now. And that will turn a natural disaster into a human catastrophe. *Factsheet 3 – natural disasters and human society*, explains what this will look like.

This is part of a series of factsheets on climate change produced by the ITF, www.itfclimatejustice.org