

# Feeling the Heat: Climate Science and the Basis of the Convention



The year 2013 provided more clarity about human-generated climate change than ever before. On 2013 Sept 27, the UN Intergovernmental Panel on Climate Change (IPCC) released the Working Group 1 contribution to its Fifth Assessment Report (AR5), which looks at the science of climate change.

**It is categorical in its conclusion: climate change is real and man is the main cause.**

**There are some basic well-established links:**

- The concentration of greenhouse gases in the earth's atmosphere is directly linked to the average global temperature on Earth;
- The concentration has been rising steadily, and mean global temperatures along with it, since the time of the Industrial Revolution;
- The most abundant greenhouse gas, carbon dioxide, is the product of burning fossil fuels.

Greenhouse gases occur naturally and are essential to the survival of humans and millions of other living things, through keeping some of the sun's warmth from reflecting back into space and making Earth livable. But it's a matter of scale. A century and a half of industrialization, including clear-felling forests and certain farming methods, has driven up quantities of greenhouse gases in the atmosphere. As populations, economies and standards of living grow, so does the cumulative level of GHG emissions.

AR5 part 1 took stock of where we are and what we now know. For the first time, Working Group 1 could provide a comprehensive assessment of sea level rise, and its causes, over the past few decades. It was also able to estimate cumulative CO<sub>2</sub> emissions since pre-industrial times and provide a CO<sub>2</sub> budget for future emissions to limit warming to less than 2 degrees C. About half of this budget was already emitted by 2011!

**Thanks to the IPCC, this is what we know:**

- From 1880 to 2012, average global temperature increased by 0.85°C. To put this into perspective, for each 1 degree of temperature increase, grain yields decline by about 5 per cent. Maize, wheat and other major crops have experienced significant yield reductions at the global level of 40 megatonnes per year between 1981 and 2002 due to a warmer climate.
- Oceans have warmed, the amounts of snow and ice have diminished and sea level has risen. From 1901 to 2010, the global average sea level rose by 19 cm as oceans expanded due to warming and ice melted. The Arctic's sea ice extent has shrunk in every successive decade since 1979, with 1.07 million km<sup>2</sup> of ice loss every decade.

- Given current concentrations and on-going emissions of greenhouse gases, it is likely that by the end of this century, the increase in global temperature will exceed 1.5°C compared to 1850 to 1900 for all but one scenario. The world's oceans will warm and ice melt will continue. Average sea level rise is predicted as 24 - 30cm by 2065 and 40-63cm by 2100. Most aspects of climate change will persist for many centuries even if emissions are stopped.

## How did we get here?

Climatologists were the first to sound the alarm in the 1960s and 1970s. These scientists noticed that concentrations of CO<sub>2</sub> in the atmosphere were increasing, and that it was correlated to a steady increase in global temperatures. Ice core research backed up this observation, and anecdotal evidence - which had long been trickling in from scientists in many disciplines, farmers and fishermen, as well as amateur nature observers and enthusiasts— began to add up.

More than two decades after these first urgent calls, governments created the United Nations Framework Convention on Climate Change. As far as international agreements went, negotiation of the Convention was fast - especially one on such a vastly complex issue. It was ready for signature at the Earth Summit (formally known as the 1992 United Nations Conference on Environment and Development in Rio de Janeiro).

What led to the creation of the UNFCCC was the first assessment report of the Intergovernmental Panel on Climate Change, released in 1990. The Panel was created by the World Meteorological Organization and the United Nations Environment Programme in 1988, and this first report reflected the views of 400 scientists. Its primary message: global warming was happening and something had to be done about it.

## **This is a sample of observations that finally propelled climate change into popular consciousness:**

- **Snow cover:** Since 1978, annual average Arctic sea ice has shrunk, with larger and larger decreases in summer observed each decade. Mountain glaciers and snow cover, on average, have declined in both hemispheres.
- **Rain and drought:** Since the Industrial Revolution, there have been significant changes in precipitation patterns globally - it now rains much more in eastern parts of North and South America, northern Europe and northern and central Asia, but less in the Sahel, Mediterranean, southern Africa and parts of southern Asia. Globally, the area affected by drought is likely to have increased since the 1970s.
- **A hotter world:** Over the past 50 years, cold days, cold nights and frosts have become less frequent over most land areas, and hot days and hot nights, more frequent.
- **Extreme weather:** An increase in intense tropical cyclone activity in the North Atlantic has been observed since about 1970. Warm air is fuel for cyclones and hurricanes.
- **The seasons:** Spring events come earlier and plants and animals are moving upwards and polewards because of recent warming trends.
- **Nature:** Scientists have observed climate-induced changes in at least 420 physical processes and biological species or communities.