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Report by Working Group 2 of the IPCC, February 2022

The Inter Governmental Panel on Climate Change (IPCC) is responsible for a massive programme of work which is part of the UN Environmental Programme. The IPCC has been operating for some time, and its work is probably the largest, most important, international programme of evidence gathering and scientific analysis ever undertaken by our species. Its breadth and depth is astonishing. The latest report is by Working Group 2 of the IPCC (Working Group 1 published their latest report last year) and is available online. It is a staggering 3,949 pages long. It is an important document, but is written in very dense scientific text, making it difficult to read and absorb.

Some key points that I take from it:

- Over the last 200 hundred years the burning of fossil fuels by humans has led to a significant sharp (in geological timeframes) increase in atmospheric carbon dioxide, reaching levels not seen on Earth for tens of millions of years.
- The increased concentration of carbon dioxide has caused a range of climate effects, varying from one part of the world to another. Overall, there has been a gradual (in human timeframes) increase in average global surface air air temperatures.
- One of the consequences of this increase in average global air temperatures has been a destabilisation of icesheets around the world, leading to significant melting of glaciers, arctic, and Antarctic ice, and the Greenland ice sheet. It is likely that this destabilisation will take thousands or tens of thousands of years to reverse.
- So, climate systems around the world are changing, the changes are accelerating, because human burning of fossil fuels and the resulting emission of carbon dioxide continues to increase, and ice sheets are melting. The latter is causing gradual (in human timeframes) rises in sea level, which is also affected because the oceans are warming, causing the sea water to expand.
- The IPCC has developed a range of approaches to cope with the massive uncertainties in forecasting the future. Some of the uncertainty is due to the fact that it is very difficult to predict what the 195 or so nations around the world (and their populations of people) will do in the face of this challenge. There is also uncertainty in the science involved, understanding

the physical, chemical, biological, etc processes involved in the global systems, to provide a basis for forecasting.

- The last major IPCC reports were in 2015. Since then the science has improved, through massive efforts to gather evidence from around the world on the atmospheric, oceanic, etc systems, and also to refine the scientific models. The science has been developing for 40 or 50 years, and is continually improving. The IPCC also has a number of teams involved around the world, using a range of models, and part of the activity is to look at the range of forecasts produced by these teams. These things all provide a basis for increasing confidence in the forecasts.
- To cope with the uncertainty about what the 195 nations will do, the IPCC has developed a range of scenarios of future emissions. One of these is that at the global level, things carry on pretty much as they are (which is seen as a worst case scenario). At the other end is a scenario where at a global level the 195 nations aggressively reduce their emissions over the next 30 to 50 years. The latter leads to global average temperatures in the range 1.5 to 2 degrees C within the next few decades. The former leads to global average temperatures increasing into the 5 degree C plus territory.
- Based on the current evidence and scientific models, the IPCC considers that the more likely scenarios and forecasts are somewhere in the middle, with peak carbon dioxide emissions coming somewhere during the second half of this century, and global average temperature rises of something like 3 degrees C.
- We know that carbon dioxide stays in the atmosphere a long time, between 300 and 10,000 years. The challenge at the moment is to slow down the rate at which we add to the amount already in the atmosphere, the effort to get to net zero. Once we have done that, the next challenge will be to start reducing the amount of carbon in the atmosphere by trying to go to negative emissions (absorbing more carbon dioxide than is emitted).
- Because of the long time that carbon dioxide stays in the atmosphere, and the even longer time that the ice sheets take to respond to even small changes in global average temperatures, the changes in the climate that are underway as a result of the burning of fossil fuels by humans over the last 200 years, will continue for several hundred if not thousands of years. In geological timeframes the changes are fast. In human timeframes the changes will be gradual.
- The impact of all this on biodiversity and human populations varies dramatically from one part of the world to the next. In the worst affected parts of the world (mostly the equatorial regions) the IPCC forecasts droughts, crop failures, and famines, and biodiversity loss of in the range 50% to 75%, as well as inundation of coastal areas due to sea level rise. In less severely affected parts of the world (eg northern europe), the impacts are not as great, for example biodiversity loss in the range 20% to 30%. One of the likely "adaptations" to climate change at a global level, particularly given the gradual (in human timeframes) changes, is that species will migrate away from the more severely affected areas to the less severely affected areas. In human terms this may lead to breakdown of societal structures in some parts of the world.

For the reasons given at the top of this thread, I have not been able to read and absorb the whole of the IPCC report (I doubt that any one individual can do that), but I believe that the above is a reasonable

take on some of what it says. Others may look through the report and come to a different understanding.

The next major IPCC report (by Working Group 3 - expected at the end of this year) will include analysis of the actions being taken by governments around the world, and how effective these are in terms of reducing emissions.

PS - as an aside, Bill Gates in his recent book *How to Avoid a Climate Disaster*, was brave enough to include an estimate of the number of people who might die as a consequence of climate change if emissions growth stays high, which is that by the end of this century about 5 times more people might die each year as a result of climate change than have died as a result of Covid 19 (about 75 extra deaths per 100,000 people). No doubt we all have different views about Bill Gates, but we need to have some way of putting this in perspective. One thing Bill Gates is clear about in his book, getting from the amount of greenhouse gases we emit to the atmosphere now (which he estimates as 51 billion tons a year) to zero, which he is clear is where we need to get to, is going to be difficult.

Ralph Watts for
Dorset Climate Action Network