The benefits of CO$_2$ cuts made now, such as avoided floods and droughts, will be felt within the lifetimes of most people alive today, new research indicates. The study’s authors say their work dispels myths that the main effects of CO$_2$ emissions will not be felt for many decades. They estimate that it could take 10 years for the maximum warming effects of a one-off CO$_2$ emission to occur.

The misconception that CO$_2$’s greatest effects will not occur for many decades is widespread in both scientific and policy discussions, the researchers say. Although their study supports claims that its effects will be felt far into the future, it also suggests that its greatest impacts on the Earth’s temperature could be much sooner than previously thought.

The study investigated when the warming impact of an emission of CO$_2$ will be strongest, and the corresponding increase in temperature. Using a total of 55 computer models, the researchers simulated the effects of a one-off release of 100 gigatonnes of carbon (GtC) into the atmosphere. They assumed the background concentration of CO$_2$ was 389 ppm (parts per million), which was the actual concentration in 2010–2011. There were 6000 model runs altogether; each run was a different configuration of three of the 55 models and each produced a possible picture of how the climate would respond to the emission within the next 100 years.

The results suggest that there will be immediate warming effects of the emission, and that maximum warming, i.e. the greatest increase in temperature, will occur 10.1 years after the CO$_2$ was released. This was the median average result, and the researchers suggest that it is also ‘very likely’ that maximum warming could occur at any time between 6.6 to 30.7 years post-emission.

The maximum warming effect was projected to be 2.2 millikelvin (mK: 1 mK = 1/1000th of 1 kelvin) per GtC. Again, this is a median estimate, and they also consider a temperature rise within the range of 1.6–2.9 mK/GtC to be very likely.

After the early peak in warming, the emission’s effects on temperature will slowly fall as CO$_2$ is absorbed by oceans, forests and other natural sinks. However, the fall is relatively small and drops to a median warming effect of around 1.9 mK/GtC after 100 years. Indeed, the researchers believe that the warming response will persist well beyond 100 years.

The researchers point out that the worst effects of climate change, such as maximum sea level rise, will not occur within the next century. However, there are other impacts that will be felt much sooner, such as droughts, heatwaves and flooding, which are expected to increase with changes in temperature. Therefore, they say their study indicates that cuts in carbon emissions now will benefit not just future generations, but current generations too.