

The Climate Change Debate

Since my first article on 'Evidence for climate change' was published in the March issue of 'Avenues', two relevant and important events have occurred, (1) Earth Hour and (2) collapse of part of the Wilkins Ice Shelf in Antarctica.

Earth Hour. On 29 March, the city of Christchurch joined forces with at least 30 million people from 24 cities throughout the world to take a stand against one of the planet's biggest threats, climate change, resulting in an impressive 12.8% power saving for Christchurch. With this response, you may wonder why we are bothering to debate the issue of human induced climate change when we see the overwhelming support for such an initiative as Earth Hour. Most people, including the vast majority of scientist, seem to understand the seriousness of burning fossil fuels. It is only a very small minority of scientists including Dr van der Lingen who class themselves as climate change sceptics or 'agnostics.' Our professional bodies recommend that we do not publicly engage in debates over climate change as it gives a platform for the vocal minority to express their views which are often scientifically incorrect or carefully selected to distort a longer term trend. This will undoubtedly be the advice that the former US Vice President Al Gore will have received influencing his decision not to engage in televised debates.

For my part, I welcome the discussion and the opportunity to allow readers to make their own minds up on this important issue. I am not advocating catastrophic climate change and that civilisation is going to end in the near future, but I am saying that human induced climate change is real, and that we, and our Earth's animals and plants will have to adapt to rapidly changing climatic conditions as a result of human influence on our climate system. I am not being dogmatic about the time frame for change and that is why I mention in my introduction the collapse of the Wilkins Ice Shelf on the Antarctic Peninsula, one of the global hot spots.

Wilkins Ice Shelf. The recent collapse was predicted but has occurred at least 30 years ahead of most predictions. I mentioned in my March article that our climate system is complex and interactive which makes computer-based predictions uncertain. This uncertainty and variations from one model to the next provide climate change sceptics with unjustifiable ammunition to dismiss the whole concept of human induced global warming. There have been major advances in the development and use of climate models over the past 20 years and the current models give us a reliable guide to the direction of future climate change. I can assure readers that most scientists and particularly the Inter-governmental Panel on Climate Change (IPCC) are conservative in their predictions. The 'premature' collapse of the Wilkins Ice Shelf illustrates this nicely and suggests some changes may take place even more rapidly than predicted. The uncertainty around computer-based predictions should not be used to disregard the well-understood physical principles and evidence for human induced climate change. Furthermore, just because there are some errors or exaggerations in Al Gore's movie 'An inconvenient truth', this is absolutely no reason why Dr van der

Lingen should ‘throw the baby out with the bathwater’ and disregard the evidence for human induced change.

Let me now comment on the key points of difference between the views that Dr van der Lingen had made in his articles in February (Part 1) and April (Part 3) issues of Avenues and his criticism of my March article (Part 2). This debate with Dr van der Lingen is about the reality or not of human induced climate change, not about the time frame for change and not about the perceived catastrophic nature of the proposed change.

Local versus Regional Change

Dr van der Lingen uses local examples to illustrate the point that climate is not warming. He showed an annual temperature record for Christchurch from 1905 to 2005 with no overall warming (Figure 3 February Avenues), and he showed a temperature record for the South Pole (1957-2006) with what he states is a cooling trend (Figure 6 April Avenues). The Franz Joseph Glacier is also often used by climate change sceptics as an example of a glacier that is advancing and bucking the global warming trend.

It is simply not appropriate to pick and choose local records over a short time period to make global statements due to local complications and due to the complex nature of the climate system. Dr van der Lingen makes this very point in his criticism of Al Gore by pointing out that the melting of the snow on Mt Kilimanjaro is due to deforestation and not global warming, yet he goes on to use local examples himself in his February article to counter global warming.

We need to consider long term records (1850 to the present) where they are available and we need to look at global averages. The graph I published in March (Figure 4) clearly shows how global average temperatures have risen since 1850. New Zealand is an island in the middle of the Pacific that has very complex climate cycles. New Zealand, never mind Christchurch, is not the place to make global predictions, and Antarctica as I mentioned in March, has the added complication of the hole in the ozone that needs to be taken into account in this complicated system that we live in. Dr van der Lingen dismisses my views on Antarctica by selecting a scientific paper that states a minority view that the lack of warming in Antarctica is not due to the ozone hole (as I stated) but due to El Nino. This is the way that science advances. Alternative ideas are published, discussions and debates take place, and in some cases only time will tell who is correct. However, with regard to Antarctica, something as significant as the ozone hole is undoubtedly a key component of the current climate system in Antarctica and it is certainly my view, and the view of many experts in the field, that it is keeping most of Antarctica cold when most of the rest of our Earth is warming.

Weather versus Climate

Dr van der Lingen starts his April “Apocalypse cancelled” article by listing a series of recent world-wide extreme **cold** events making the point that our Earth is not actually warming. However, as we all know, our climate system has enormous amounts of variability on day to day, month to month, and year to year time scales. Much of this variability (once you account for daily cycles and the seasons) is what we are all familiar with – **the weather**. Although some aspects of weather are predictable much is apparently chaotic and unrelated to external factors.

Proponents for and against human induced climate change need to take the longer term **climate** view and not jump on the band wagon (we are all guilty of this) when it snows in Jerusalem or Europe experiences a heat wave. It is the long term changes that matter. The weather changes that Dr van der Lingen refers to are reflected in the additional point that Dr van der Lingen makes that average world temperatures dropped by 0.595°C between Jan 07 and Jan 08. Again, we have to look at the long term record since 1850. The graph he published (Figure 1, April Avenues) shows the variation in average global temperatures from year to year. It is huge, -look at the spiky nature of the graph. We cannot make predictions on a yearly basis. It is the long term trend that counts.

There are many natural factors contributing to this yearly variation, the single most important being El Nino-La Nina oscillations. Our global climate is currently being influenced by the cold phase known as La Nina that began to develop in early 2007. La Nina, is a cooling of the surface temperatures of the central and eastern Pacific and is predicted to lead to cold conditions across the world this year (lower average global temperatures as seen in 2007) and, as reported in *The Press* recently, warmer waters and a milder Autumn in New Zealand. La Nina has strengthened further during early 2008 significantly contributing to a lower global January temperature in 2008 compared to recent years. However, once La Nina declines, it is very likely that renewed warming will occur, as was the case when the Earth emerged from the strong La Nina events of 1989 and 1999. While the trend in global temperatures is predicted to remain upwards we will continue to see variability of this kind and extreme weather events.

Dr van der Lingen also uses a graph of global mid-troposphere for the last 28 years to show the lack of correlation between temperature and carbon dioxide levels and a decrease in temperature in recent years. He has carefully selected a small portion of a much longer record published in the IPCC reports that tells a different story showing temperature increase over a longer period of time.

Understanding the past

As a geologist I am very familiar with Earth history, despite what Dr van der Lingen infers (he misquotes my March article) including previous glaciations, past greenhouse worlds with high CO₂ levels and changing configuration of the continents. Yes, we can and do learn from the past, but we have to keep the information that we

draw from the past in context and make sure we are comparing 'like with like'. In some cases this is difficult as often we don't have the full story and some components in our current earth system were missing in the past, for example, land plants were not present in the very distant past. Dr van der Lingen shows a graph of temperature and CO₂ levels going back 560 million years and prior to the evolution of land plants. His graph (Figure 4, April Avenues) shows that during one of the Earth's major, well known glaciations, approximately 300 million years ago, CO₂ levels in the atmosphere were lower than today supporting a potential link between CO₂ levels in the atmosphere and temperature and the presence of ice in the polar regions. Equally, many periods of high CO₂ levels have no ice in the Polar Regions.

There is no doubt that most valuable information and understanding of how our Earth functions comes from the recent past and once again I refer to the ice core record which Dr van der Lingen casts doubt on. This is ironic as he uses the ice core record in his arguments against Al Gore's movie in Part 1 to draw conclusions on the precise relationships between CO₂ and temperature as he sees it, yet he points out in Part 3 that the ice core record does not reflect actual atmospheric composition levels. He can't have it both ways. The principles behind ice core data are well studied and well understood and clearly demonstrate that trapped atmospheric gases reliably reflect past atmospheric compositions taking into account any exchange of gases prior to snow being converted to ice and the system becoming closed. Dr van der Lingen uses data from fossil leaf stomata to create uncertainty around ice core data, yet far less is known about the link between fossil leaf stomata and CO₂ levels. Fossil leaf stomata may be species dependent, and may be influenced by other factors like soil and atmospheric moisture levels.

The ice core record clearly shows us how our climate system has functioned over the past 650 000 years and puts in context the point that Dr van der Lingen makes about our climate having warmed for the past 18 000 years as illustrated by the retreat of the Tasman Glacier. He is correct, but it is the context that is important. The Vostok Ice Core record shows very nicely the cyclical nature of our climate over the past 430 000 years, a time when we can make direct comparison. There has been a very regular warming and cooling on a 100 000 year cycle due to regular variations in the way the Earth moves around the sun. For the past 18 000-20 000 years we have been on the natural warming part of that cycle and as correctly pointed out by Dr van der Lingen astrophysicists predict that we should be entering a cooling phase. In reality, our Earth is continuing to warm at a rate that is far greater than the natural warming seen over the past 18 000 years, and, as I have already explained in Part 2, that is due to the enhanced greenhouse effect from burning fossil fuel resources that is overpowering the natural climate controls that our Earth experienced previously. It is the rate of warming that is significant and the fact that we should be at the top of the natural warming cycle and starting to cool.

A saturated 'gassy' argument

Finally, in counter to the point that Dr van der Lingen makes that there is already so much CO₂ in the atmosphere that its effect on infrared radiation is 'saturated' and that any additional carbon dioxide will have no further warming effect. The Earth's atmosphere is not even close to being in a state of saturation even in the lower atmosphere. Even if the lower atmosphere were saturated we would still get an increase in greenhouse warming because absorption would continue in the thin upper atmosphere (which is unsaturated). There is no doubt that adding carbon dioxide to our atmosphere will make the greenhouse effect stronger regardless of the level of saturation in the lower atmosphere.

In conclusion, remarkable as it may seem, humans have the capability of influencing our climate system. We have seen it at a global level through the release of chlorofluorocarbons (CFCs) and their effect on ozone levels. We have seen it at a local level through atmospheric pollution around our big cities and now we are seeing it on a global scale with increasing CO₂ levels in our atmosphere resulting in an enhanced greenhouse effect and global warming. Whatever the magnitude of the effect, we need to take action now and not wait to see if polar bears are capable of adapting to human induced changes in our climate system. By then it would be too late.