CLIMATE CHANGE AND HUMAN ACTIVITY

by

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There are several dimensions to the recent public discussions and arguments concerning climate change that raise interesting questions. Among the most obvious of these dimensions, has been the polarization of the debate into climate change scepticism – the idea that climate change is not happening - and the idea that climate change is entirely the product of human activity. On both sides, there has been a good deal of rhetoric designed to support the positions advocated - much of it at the expense of informed and reasoned argument, and much of it dressed up to look like evidence.

It is not a reasonable thing to say that the climate is not changing; climate change is a reality. Similarly, is it not reasonable to say that the amount of carbon dioxide and methane and in the atmosphere has little or any effect on surface meteorology. Nonetheless, it is mistaken to believe that climate change is entirely the product of human activity. In the following paragraphs I shall try to articulate why that is, and also ask some questions that, up till now, seem not to have been raised in the public arena.

Water vapour, carbon dioxide and methane are all greenhouse gases. Of these gases, methane is by far the most effective – about 25 times more so than carbon dioxide (CO2). The greenhouse effect is, essentially, the process in which heat (infra-red radiation) from the sun is absorbed and then retained by the atmosphere. However, in the earth's case, a good deal of this heat is also lost back into space. There is a delicate balance that needs to be maintained in this respect: if there was no greenhouse effect, the earth would become extremely cold and life of any kind would struggle to survive. If the greenhouse effect was much more efficient, our atmosphere would end up similar to that of the planet Venus; it would be almost permanently covered in cloud, there would little, if any, diurnal temperature variation and the surface temperature might exceed 400°C. Since the time of the industrial revolution (c.1750), human activity has been responsible for an increased concentration of CO2 in the Earth's atmosphere and, to a lesser extent, other gases like methane. In the developed world this has, in recent times, been curtailed somewhat; but any reduction here is compensated for by the activities of developing countries – especially China. Thus, if the efficiency of the greenhouse effect is influenced by the composition of our atmosphere it follows that human activity – through emissions – must affect it. Beyond emissions, human influence also extends to the eradication of features that absorb carbon dioxide, such as the destruction of the rainforests; overall however, it is plankton in the oceans which absorbs the most CO2. If the ecological makeup of the oceans changes in a way that lowers its capacity to absorb CO2 then this will, with emissions (manmade or otherwise) remaining as they are, increase the amount of Carbon Dioxide that is free in the earth's atmosphere, since the absorption rate will be slower.

What seems to have been forgotten – certainly within the media and politics – is that the earth's climate has continually changed throughout its history, sometimes with alarming rapidity. The factors that influence global climate are complex and are not solely related to atmospheric composition. The path that the earth describes around the sun – its orbit – varies from near circular to much more elliptical and back again over a period of about 95,000 years. Currently the earth is closest to the sun during the summer of the southern hemisphere

and furthest away during its winter. Thus (at present) the climate is, generally speaking, a little more extreme in the southern hemisphere than it is in the northern, since the summer of the northern hemisphere is cooled slightly due to its greater distance from the sun and its winter is warmed slightly due to its greater proximity to the sun. As the earth gradually oscillates between these two situations, energy transference patterns within the atmosphere change accordingly and affect surface meteorology. In addition, the axial inclination of the earth – its tilt if you like – also varies over a cycle of about 40,000 years between about 22° and 24.5°. This means that the amount of solar radiation received by polar latitudes varies and that will have a profound effect on the ice-caps. Fluctuations in solar activity can also influence climate, as can volcanic eruptions that emit large quantities of greenhouse gases and dust into the atmosphere. A single large eruption could easily compensate for months of substantial cuts in human related emissions. In addition, eruptions which emit large quantities ash and dust can temporarily cool the climate by not allowing as much solar radiation through as usual.

Short term colder spells – over periods of about 500 years or so – often coincide with what is termed the Maunder minimum. This is a cycle within a cycle: a short term cycle – the solar cycle – takes place over a period of about 11 years and represents changes in solar activity (often betrayed by the apparition of sunspots) and, as such, the amount of electrically charged particles streaming into the earth's upper air. Usually these changes are quite marked but every few hundred years they appear to be repressed and the sun undergoes much longer, less energetic, periods with relatively little sunspot activity. It is not fully understood how the solar cycle affects our climate but in most cases, the Maunder minimum has coincided with much cooler global conditions. And it would seem sensible to look to the sun for understanding climate, since it is the sun that drives energy transference patterns in the earth's atmosphere. The last cooler spell was that which occurred between 500 and 150 years ago – a period known as the little ice-age. It is also worth noting that, during the latter part of this period, human activity was increasing the concentration of CO2 in the atmosphere.

Small changes in climate caused by any one of these things can alter the life-cycles of plants and animals that absorb greenhouse gases and increase or decrease absorption rates, affecting climate later on. And although temperature is important in this respect, the amount of solar radiation and the reflectivity of the surface of the earth can also have a profound effect. Ice and snow covered surfaces reflect up to 80% of solar radiation whilst desert and vegetation may reflect only 20% to 30%. This determines how much radiation then gets absorbed by the atmosphere – the less the earth reflects, the more it absorbs. Without other factors, the more we absorb the warmer it would continue to become, since the polar ice caps would melt and the percentage of radiation reflected would drop. However, during the carboniferous period (363 to 290 million years ago) the earth was much warmer than it is now; there was a great deal of vegetation and very little, if anything, in the way of polar ice caps. This suggests that factors such as reflectivity are far from decisive in their capacity to alter climate because after the carboniferous the earth cooled again. Similarly, during the carboniferous there was far more CO2 in the atmosphere than there is now – enough, indeed, to make the air poisonous to humans. This exposes a common myth that, somehow, humanity is creating abnormal levels of CO2 in the earth's atmosphere. In fact, we cannot create it but can only release it. The carbon was there already – as part of the earth's makeup – in the form of fossil fuels; prior to that, of course, it was in other forms. What we are doing – all we are doing – is transferring it from one part of the earth to another either through the direct use of fossil fuels or through materials derived from them such as plastics. There have been far higher and far lower levels of CO2 in the atmosphere throughout the earth's history than there are at present. One could,

therefore, look at the increased emissions that are a result of human activity and our subsequent attempts to cut them as just further stages in the earth's evolution. Such a philosophical perspective is not of much help in terms of responding to the effects of climate change; it is however a perspective that throws a more sober light on thoughts about the earth's climatic history.

In more recent times, but before human activity impinged much on the composition of the atmosphere, there is evidence of substantial and rapid climate change. 13,000 years ago there was an astonishingly rapid increase in global temperature of between 6°C and 10°C in the space of only 100 years. Yet, only 2000 years later, the temperature suddenly dropped and the ice re-advanced only to retreat again after a few hundred years; by 10,000 years ago the last of the ice retreated from Britain. Global sea temperatures are still substantially below the average over geological time but they are rising (and have been since the end of the last ice age) and polar ice is, with some exceptions (parts of eastern Antarctica), still retreating. What is interesting however, is that shortly after the rapid global warming of 13,000 years ago, summer temperatures, in what is now southern England, were higher than those of today. These figures have largely been obtained through analysis of sediments and pollen samples found on beetles that lived at the time. Indeed, there has been significant climatic variation right up to the present day. During the Iron Age the climate cooled before warming again during Roman times and the Middle Ages. And, in Roman times vines were grown for wine-making in Northern England and Scotland – at the present time this is not possible though it may be in the foreseeable future. That warmer spell ended around 800 years ago and the climate again cooled and between 500 to 150 years ago in Britain, the so-called Little Ice Age occurred. These shorter term climate fluctuations could be described as peaks and troughs within a general trend of post glacial warming. Since then, the climate has gradually warmed and it appears that recently (in the last 30 years or so), the rate of warming has increased. Over the last 20 years there have been a greater number of water shortages during summer and fewer colder winters. Some claim that there has also been an increase in storm events. In the short term this might be true but, in fact, the 20th century was one of the quietest since official meteorological records began in 1659. The storm in October 1987 (misnamed hurricane) was the most severe of the 20th century but, anecdotally at least, there have been comparable storms in previous centuries. In 1287 a storm washed away a village on Romney Marsh (on the border of Kent and East Sussex) and has been compared in later histories to West Indian hurricanes – at least in terms of ferocity. A similar storm occurred in 1572. It is unlikely that the 1987 storm was on a par with either of these storms.

There are several things that need to be highlighted. The first, and most important, is that the climate has always changed, with and without human presence, sometimes at great speed. It therefore follows that, no matter which way one looks at it, humanity cannot be solely responsible for climate change as is often suggested. – If it were then, presumably, the climate would have remained static until human action resulted in the emission of substantial quantities of C02 at the start of the industrial revolution. Either that, or there needs to be a lucid, incontrovertible, scientific explanation for why, in the last 250 years, climate change has been caused entirely by the actions of humanity but, prior to that, triggered wholly by other factors. Why have non-human factors completely stopped acting since human ones have started? – That is a question that those who claim climate change is entirely the product of human action need to answer. The second thing that needs to be highlighted is that while atmospheric composition certainly plays an important role in climatic conditions, it is by no means a decisive factor. Other factors such as the eccentricity of the earth's orbit, its axial "wobble", how energetic the sun is over longer periods, ecological changes, as well as

changes in the earth's reflectivity all impact on climate. These things are probably all interconnected and show that, while atmospheric composition is a component that affects climate, it is by no means the sole determinant of change. The globe has been warming since the last ice age but it has not been a constant temperature climb; there have been periods of cooler weather, such as those of the Iron Age and the "little ice age" and warmer, wetter, eras such as those of Roman times. Thus, as I've said, the warming has not been steady – there have been short term peaks and troughs within a general trend of warming. Most of these peaks and troughs occurred before substantial human interference. The argument that, in the past, climate change was caused by other factors, but in our own age is caused purely by humanity needs clear scientific justification. It is inevitable that increased levels of C02 will result in the atmosphere becoming more efficient at retaining heat. Nevertheless, even if human carbon emissions were cut by 100% this would not stop climate change. – Neither can we say with any certainty by how much the climate would alter as a result. The fact that the global warming rate has increased more rapidly in recent years has some human influence behind it but it might also be the case that the increase is a part of another short term fluctuation such as those that occurred in Roman and Dickensian times. Until one can decisively separate out (proportionally as a percentage) human influenced warming from warming caused by other factors, it will not be possible to say, with any certainty, by how much we are influencing the climate and by how much carbon emissions cuts will impact upon it.

Of course, there are countless complex political reasons why governments are keen to emphasise mankind's responsibility. The media too, are not guiltless in this respect – always on the lookout for a sensational story after a particular weather event such as a storm or flood; and the blame game gives scope for sanctimony which often seems to find an outlet in environmental agitators.

Arguments surrounding climate change often seem to conflate the wrong things; for example climate change is often considered a fundamentally political issue. Clearly, depending on what changes take place, fundamental political issues may arise but they are, in terms of climate change itself, second order issues; second order because climate change itself is not political. It would be a first order issue if, somehow, politics was directly related to changing in climate in the same way that the CO2 content of the atmosphere is related to it. Yet one continues to encounter criticism of the various opinions and arguments expressed concerning whether or not humanity is responsible for climate change as right or left wing. Climate change sceptics – those who do not believe in any significant man made influence – are popularly considered right wing; those who believe humanity to be killing the planet and solely responsible for it are often taken as liberal lefties. How is the belief that climate change is not answerable to humanity right wing? Similarly, how is the belief that we are killing the planet left wing? Of course, the political options discussed and implemented in response to climate change can legitimately be labelled right or left wing just as they can be in response to the recent economic conditions, for instance. But it is, I think, wrong – and misleading – to lend arguments about climate change itself such political dimensions. Discussions that centre on climate change and its global consequences, should be wholly informed by science, though that should not preclude continued dispassionate assessment of the scientific methods through which predictions are made and solutions found. In both cases, a conscious effort should be made to keep discussion free from the kind of hysteria and sanctimony that has revealed itself in the recent protests in Copenhagen and in the mouths of certain journalists and headline grabbing politicians. In the end, although it brings the issue of climate change to the public consciousness, much environmental agitation of this kind detracts from a

perspicuous and informed view of the many dreadful and deplorable things we do to the environment. Consequently, it becomes increasingly difficult to address the situation properly and develop informed, coherent and sagacious policies in response.

Part of the reason that much of the public declines to take climate change seriously is because there are still several high profile contradictions in government policy – the highest of these being the two new runways scheduled to be built in the UK in the next few years in order to accommodate increase the number of flights to and from the UK. There is, to the best of my knowledge, no corresponding drop in air traffic elsewhere on the globe to compensate for this. Other contradictions include nothing being said about high emission sports such as formula 1 which, apart from the races themselves, involve race testing and the continued development of cars by each team throughout the year. –And the amount of power used each Christmas on lights and other forms of entertainment seldom, if ever, provokes comment. Surely these things, non-essential as they are, should be the first practices to be reassessed in the light of concerns about emissions? – That would, perhaps, provide a little more time to develop emission-cutting solutions to those things that are more essential to our everyday lives, and inspire a greater degree of public support.