

## Climate Change and Sea Levels

Steve Hencher

The climate change argument seems, to me, as a relative layman, to be presented by the media as a dichotomy between the majority (95% has been quoted) of scientists (climate change environmentalists?) that argue that harmful climate change is occurring and that this can be largely attributed to man's burning of fossil fuels such as coal and oil, and a second group who are labelled 'climate change deniers'.

Whether or not those 'deniers' really do believe that climate change is a concocted argument or a 'hoax' and that climate change is not occurring, I do not know – if they do think that, they are evidently wrong from my reading of the literature. Climate change is happening as is being monitored; global temperatures are increasing. It does not automatically follow, however, that I am part of the first group of the majority of scientists who are pictured by the media as crying 'doom' and who seem to plead to switch off the fossil fuel power stations in an attempt (probably a vain attempt in my opinion) to do something to reverse this. The ancient tale of King Canute, demonstrating his inability to stop the tide from advancing, comes to mind.

I do not claim to be privy to all the current data and arguments but there seems to be little attention in the media to pre-historical climate variation and sea level change that is well-established following extensive and reliable research. These data are pertinent to the arguments in my view and the absence of reference to these 'facts' is, again in my view, resulting in a poorly-informed and even misled, public and perhaps politicians. Why the discussion I present below has not really received the hearing it deserves is perhaps because I have missed it, but certainly, whenever I read BBC coverage or hear discussions on the Today programme or on Question Time, I cringe over the apparent fundamental ignorance of the participants to the debate.

As a simple example, in the Prince of Wales' ladybird book on climate change, apparently vetted by scientific advisors, it is stated that there has always been ice at the North Pole. This is true with respect to history (man's documenting of facts) but, I am afraid, is simply not true if one looks over a slightly longer period.

The Prince's view is supported by the Geological Society of London who state in their evidence from the Geological Record on Climate Change that "*proxies of various kinds show that sea-ice has been present in parts of the Arctic for several million years*", referencing a paper by Polyak et al, (2010). That paper actually states in the summary: "*Ice was probably less prevalent during Quaternary inter-glacials and major interstadials, and the Arctic Ocean may even have been seasonally ice-free during some of these times.*" It is these little details that matter.

Arctic ice melt is an essential part of the ice age cycle in that, prior to a cooling episode, the north pole needs to be free of ice, to allow evaporation from the sea surface and precipitation of snow at lower latitudes so that next ice age can develop.

This was pointed out by Ewing and Donn seventy years ago (1956), as quoted in Arthur Holmes in his classic textbook: Principles of Physical Geology (1965):

*“An open Arctic Ocean during the Pleistocene seems to be the only geographic condition which could have produced glacial conditions in northern Canada equivalent to those in Greenland today.”*

Holmes continues:

*“There were considerable ice-sheets over NE Siberia, recent work having shown that they were much more extensive than was formerly suspected. Here again, **an open Arctic** has to be invoked to help in providing the heavy precipitation of snow that was required to sustain them.”*

In other words, melting of the Arctic ice cap is an essential (and usually, natural) part of the cycle for the next ice age to progress. The fact that the current melting, with loss of habitats is taking place under the gaze and dutiful observation of human scientists is the one fact that certainly distinguishes it from the previous interglacial maxima. Another of course is that it might well be happening at a faster speed due to man's polluting influence. Regarding loss of habitats, it is interesting that the evolution of polar bears, from brown bears, is a relatively recent event, probably triggered by isolation of brown bears by glaciation and ice melts. The first polar bear was, it is reported, a brown bear subspecies. Even 10,000 years ago (by which time the most recent ice age was waning), polar bears still had a high frequency of brown-bear-type molars. Only recently have they developed polar-bear-type teeth. This is a blink of an eye, geologically.

Fundamentally, I am concerned that most of the demand to “do something” to slow down climate changes is being argued with reference to data from the last 100 years or so and that longer-term geological data is being overlooked whereas, in my opinion, this is vital to an informed discussion. There is much current argument, and heated argument, linking rising sea level to change in global temperature and, whilst there is a consensus that anthropogenic causes are affecting CO<sub>2</sub> levels and global temperatures (John Tyndall proposed the greenhouse effect of CO<sub>2</sub> in 1861 and Holmes discussed this in great detail in 1965), this is definitely not the whole answer.

Figure 1 shows sea level changes over the last million years with data taken from an authoritative paper in the journal *Science* by Miller et al. (2005 & 2011). The origins of data, errors and assumptions are clearly set out in the referenced papers. These data are confirmed from other sources such as Pirazzoli's (1996) book on sea-level changes.

Figure 2 shows changes over just the last 20 thousand years which is a very short time geologically, with a few historical and pre-historical dates added to put it in perspective.

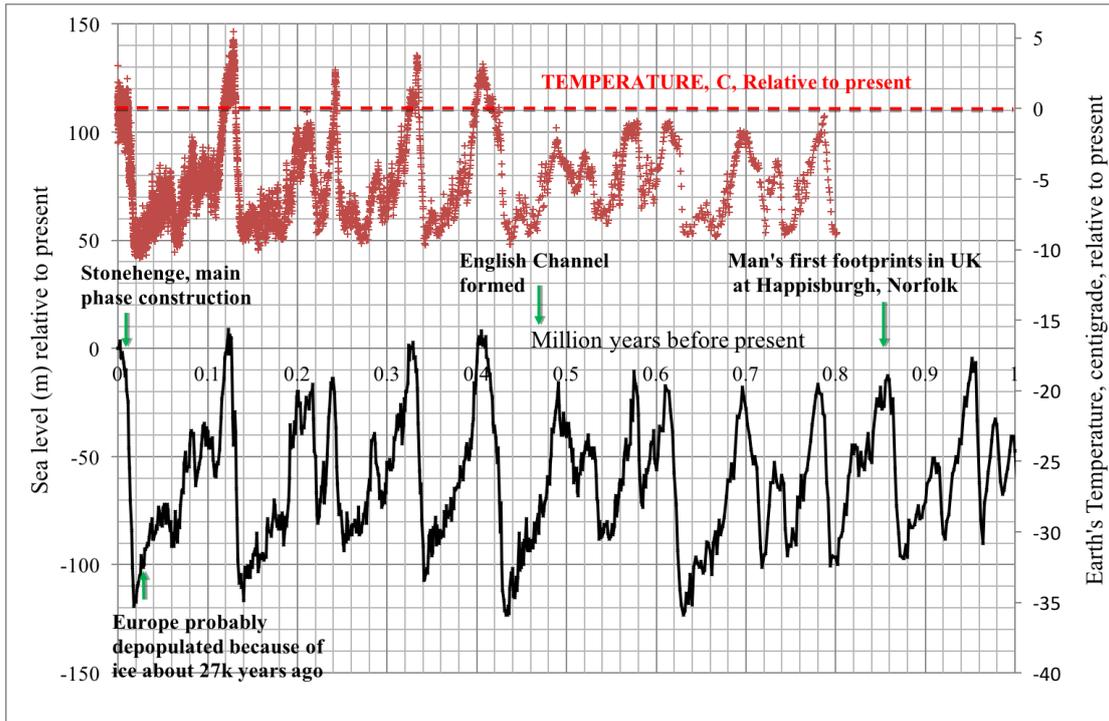


Figure 1 Sea level changes and global temperatures over last 1 million years with some significant events.

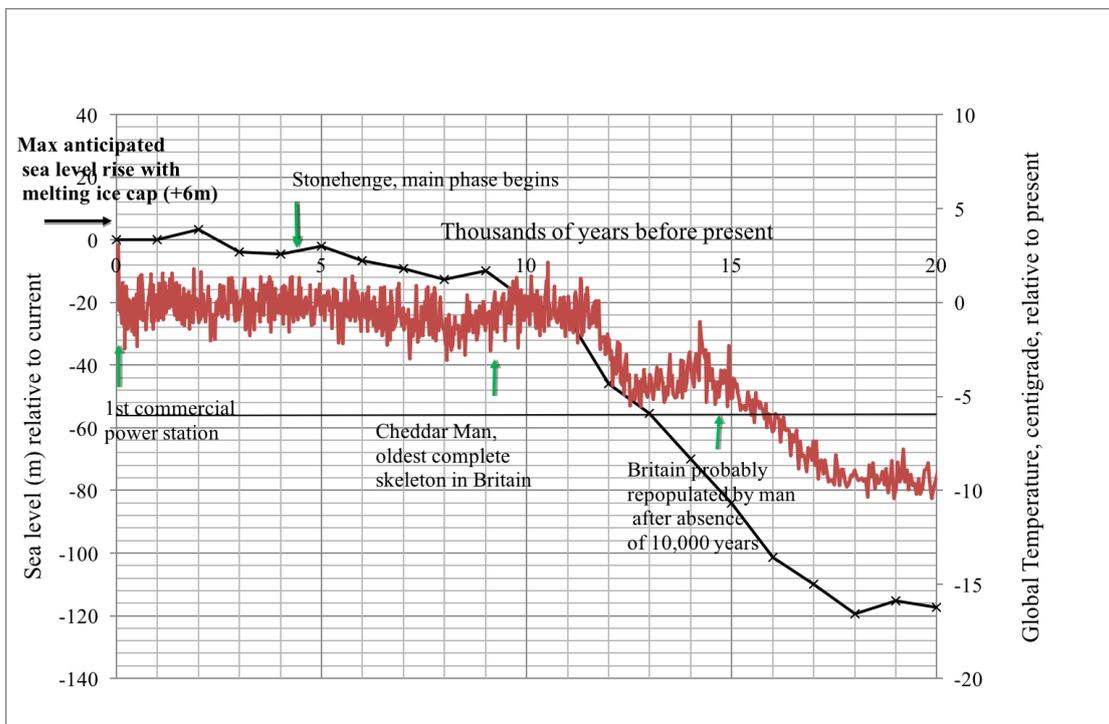


Figure 2 Same data as Figure 1 but restricted to the last 20 thousand years.

To these figures, I have added variations in global temperature over the last 800,000 years (from the EPICA data set and original paper in Science by Jouzel, et al, 2007)

whereby it can be seen that temperatures have generally been lower than current but have exceeded this by about 5 degrees.

It is clear from these data that sea levels are linked to global temperatures and further, that associated glaciations (ice ages) have caused migrations of early man. Only since the last glacial maximum has Europe been consistently occupied. The graphs have a certain regularity that imply that in another few thousand years, man will have to cope with thick ice sheets over much of northern Europe and Canada. The 6 metre rise in sea levels currently predicted is associated with melting of the Arctic ice cap (before a reversal and new cooling cycle takes over). The extent of melting envisaged by some scientists (all of Antarctica and Greenland ice sheets) would cause much higher rises (and the flooding of major cities) but this level of rise has not occurred previously over the Pleistocene period and is unlikely if the 'natural' processes responsible for the ice age cycles (probably related to processes in the Sun – still not understood to my knowledge - rather than any trigger on Earth) take the same course as they have over the last million years or so.

Current estimates of rise in sea level range from about 1 to 3 mm per year, which is actually very slow compared to the rate over 10 thousand years following the last glacial maximum as shown in Figure 1 when the rise was of the order of 7 mm per year. Note that relative sea level rose globally during that time by perhaps 120 metres.

That rise was associated with considerable lands having being flooded. From these data (pre-dating anthropogenic causes) it seems that further changes are inevitable even though it is accepted that carbon emissions due to man's activities are contributing to rise in temperature and that curbing such emissions would help postpone matters.

These prehistoric rises would of course have been accompanied by massive changes to weather patterns, desertification and so on as will also, in my opinion, be inevitable in the future.

The current fears over swamping of islands such as the Maldives by sea level rise are not due to some new phenomenon. Charles Darwin, following the Voyage of the Beagle, reasoned correctly that the development of fringe reefs and coral atolls were the result of relative rise in sea level with the coral growth just keeping up with the change (tens of metres over a long period). He thought it was due to gradual subsidence of the underlying volcanic islands, but Daly in 1910 showed that these features “*are an inevitable result of the Quaternary oscillations of climate and sea level.*” (quote from Holmes, 1965). So, however we might fear for the swamping of shallow islands in the oceans due to sea level rises, I am afraid that this is nothing new.

My concern is that the public and policy driving-politicians are perhaps being misled over our ability to affect the fundamental rates of climate change and that this is dominating research, funding allocation and actions in an ill-informed way. This is not a matter of climate change denial (it is definitely happening) but being realistic as to what can be done.

My own view is that it should be the *consequences* of climate change (which to me seem largely inevitable given the geological record) are where focus is required. These consequences include flooding and sociological migratory factors (combined with over-population), restricted by national boundaries. Man was forced to migrate several times from what is now Britain over the last 100,000 years because of cooling temperatures (Stringer, 2006) but would find this difficult in the future as the climate cools again as seems likely.

Anthropogenic changes in the short term are of course extremely important and burning carbon definitely causes pollution and increased CO<sub>2</sub> emissions. However, my chief concern is regarding pollution (I grew up in the smog of London and have worked in the smog of China) and overpopulation of countries that cannot sustain life in a reasonable way, rather more so than climate change. Air pollution, water supply and condition of the seas (the dreadful pollution of plastic and dumping of chemicals) and sanitation are key issues and this is where our attention should be focussed rather than trying to convince people that we can prevent climate change in some acceptable way. Again, the story of King Canute comes to mind.

If the scientific resources currently focussed on 'geo-engineering' climate, were aimed instead or, at least more strongly, at improved water supply, energy supply and air quality for third world countries and for ensuring that such countries can withstand the poor weather that they are and will be increasingly forced to endure then I think the outcomes would be better.

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