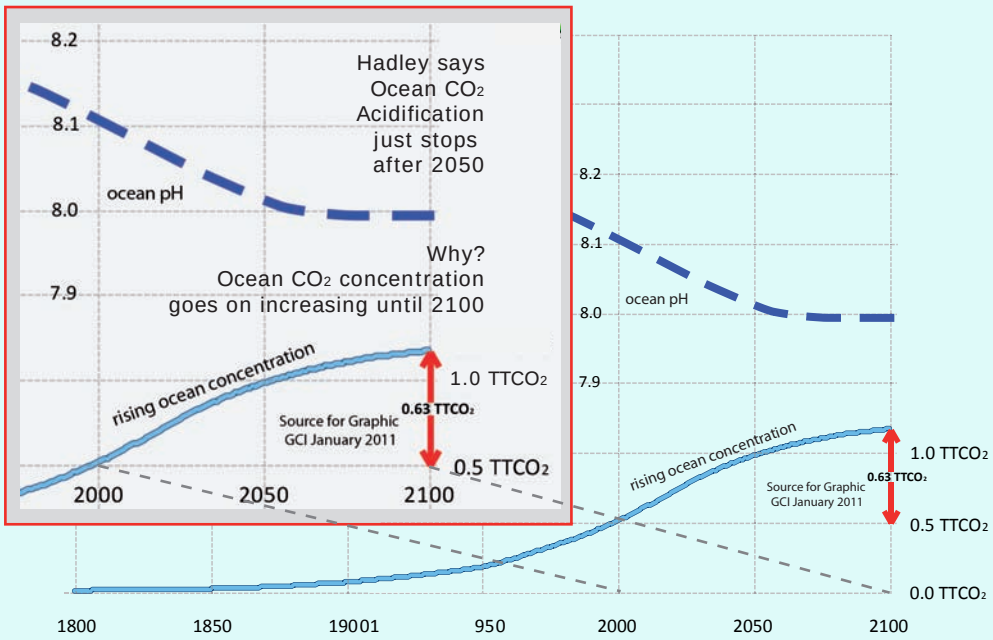
Contraction and Convergence (C&C)
Climate Justice without vengeance

January 2011: - A GCI Memo to THE UK ALL PARTY PARLIAMENTARY CLIMATE CHANGE GROUP [APPCCG]

This report examines how ‘Optimism Bias’ has crept into the UK Government’s Assessment of its chosen “2016 4% Low” CO_2 Emissions Scenario, the scenario on which its Climate Act is based.

It looks at how this bias now extends to the UK Government’s recent projections of the future deposition of CO_2 in the oceans and the resulting increase in CO_2 acidification of the oceans and how these are unrealistically optimistic as well.



DECC says a large ‘consortium’ of experts gave this advice so GCI asked for evidence that all had agreed the result. Though the question covers a matter of five decades starting only in fifty years time [2050 - 2100], it is of relevance here and now.

DECC’s result is quite counterintuitive and another example of why questioning the reliability or otherwise of the climate models and the expert mitigation advice being given to Government is necessary.

The report is on-line at: -
http://www.gci.org.uk/Documents/Acid_Brief_4.pdf

Preface

1. Introduction - CO_2 concentrations in the atmosphere & the oceans & ocean acidification
2. Faster Contraction & Convergence than the rates used in “2016 4% Low” for the UK Climate-Act are needed for better odds on keeping to within the 2^o Celsius maximum temperature rise.
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9. 2009 GCI animates ‘2016 4% Low’ & Sinks as is the UK Climate Act for the Environmental Audit Committee, spelling out HMG’s claim of achieving more than 100% ‘sink-efficiency’ after 2050
10. 2010 GCI asks why rising CO_2 acidification of the oceans would just cease after 2050 in this “2016 4% Low” scenario
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12. An essential note about liquidating fossil carbon into the biological carbon cycle: - CO_2, It doesn’t go back into the mines
13. Graphic sequence showing the arithmetic of how, under “2016 4% Low”, fossil carbon as CO_2 is partly relocated via atmospheric concentration into the ocean where it accumulation causes the increase in CO_2 acidification

Preface

On Tuesday the 18th of January 2011, a well-attended meeting of the All Party Parliamentary Climate Change Group [APPCCG] took place in the UK House of Commons. Under the Chairmanship of Joan Walley MP, three presentations were made to the Group: -

1. Colin Challen former Chair of the Group, made a proposal that a shadow task force needs to be set up in agreement with Her Majesty's Government [HMG]. He argued Contraction and Convergence [C&C] is the basis of the "2016 4% Low" scenario in the UK Climate Act, and a task force should be set up to monitor and assess the growing gap between C&C as argued in the Act and the still 'under-achieving' negotiating process at the UNFCCC.*
2. Aubrey Meyer of GCI, made an exposition about projections of increasing ocean CO_2 acidification in the UK Climate Act. He argued that the Government's claims that this dangerous trend will simply cease after 2050 are counterfactual, They are counter-productive for success with the UNFCCC-compliance at no more than the 2^o Celsius to which we have all been committed since COP-15 in Copenhagen in 2009.
3. Peter Ainsworth former Chair of the House of Commons Environmental Audit Committee [EAC] was asked to give an assessment of what had and what had not been achieved at COP-16 in Cancun in Decemeber 2010. His assessment was rather discouraging as it is clear we are still organising internationally to do too little too late to avoid exceeding 2^o Celsius.

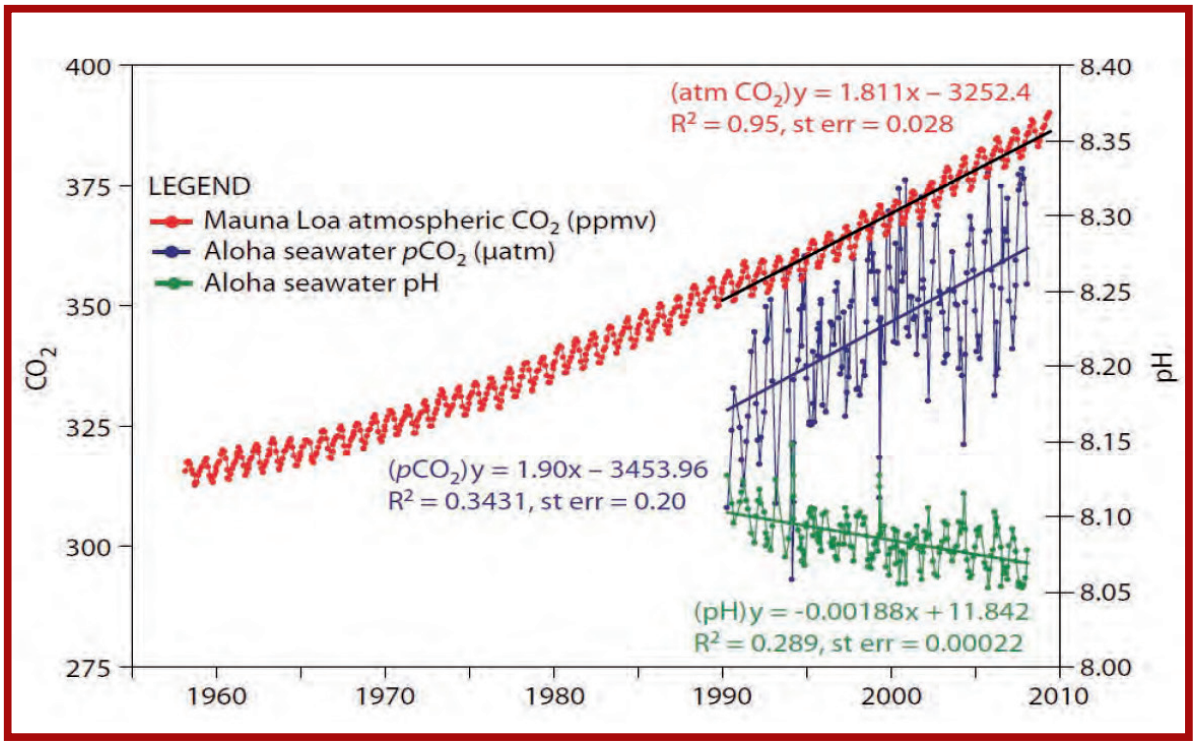
Video links to these presentations are here: -
http://candcfoundation.org/pages/appccg1.html

This report from GCI sets the presentation on CO_2 acidification of the oceans in the wider context of the Enquiry into the Carbon Budgets in the UK Climate Act carried out by the Envrionmental Audit Committee during 2009 after the Act became law.

The persistent concern is that an 'optimism bias' has characterised the Government's projections. We speculate that the reason for this is the perceived need to project a future global emissions scenario that is relaxed enough to be 'politically possible', rather than rigorous enough to be scientifically valid. If this is so, as this short report says, it means the world is drifting into doing too little too late to avoid exceeding two degrees.

* A GCI Report on handling a wide range of uncertainties is here: -
http://www.gci.org.uk/Documents/Uncertainty_Paper.pdf

* A GCI analysis of how C&C was mishandled at COP-15 is here: -
http://www.gci.org.uk/public/COP_15_C&C.swf



1. Introduction

The increasing 'acidifcation' of the world's oceans is a cause for major concern. Acidification is corrosively harmful to coral reefs, shell fish and the foramanifera that are fundamentally active in the oceans 'biological sink' for CO_2. Ocean acidification gradually puts the entire planetary food chain at increased risk of disruption and so puts us all at risk of ecological breakdown.

It is linked to the increasing concentrations of CO_2 in the atmosphere. This in turn is linked to the conditions of CO_2 emissions 'expansion and divergence' that has been in progress from 1800 until the present time. These emissions have been caused by the increasing combustion of fossil fuels and the land-use changes that have occurred since that time.

In the data-image above from Scripps it shows that the CO_2 correlation atmopshere:ocean:acidification is very strong: -

[a] increasing concentrations of CO_2 in atmosphere cause
[b] increasing concentrations of CO_2 in oceans which cause
[c] increasing CO_2 acidification of the oceans

Before 1800, fossil fuels were stored as 'carbon' in 'fossil reservoirs' that have been stable over paleontological time spans - millions of years. In other words it was completely removed from the biosphere and flows of 'biological carbon' and current CO_2 fluxes. In these, 'biological carbon' in trees for example ebbs and flows between autumn and spring as CO_2 [carbon dioxide] is released with the fall of leaves in winter and recaptured by the growth of leaves in spring. In the near term, the release of CO_2 from fossil fuel burning has no such cycle.

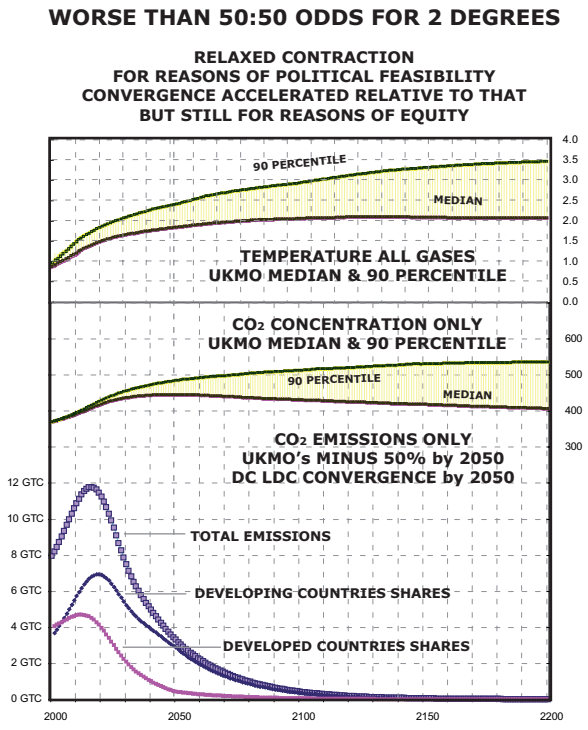
2. Faster C&C than “2016 4% Low” for better odds on with 2°

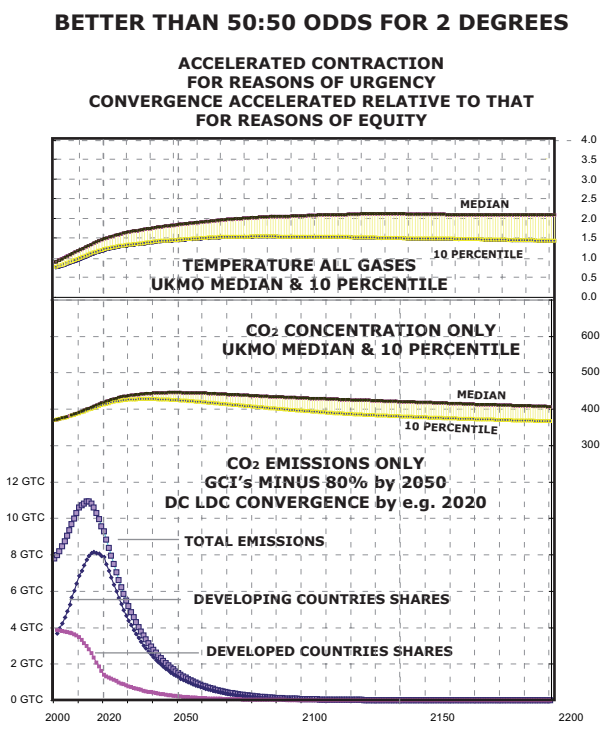
This analysis from GCI scrutinizes the future CO_2 emissions ‘contraction and convergence’ scenario in “2016 4% Low”, as projected by the UK Government [HMG] in the UK Climate Act. Their projection, that ocean acidification will increase until 2050 after which it will just cease though ocean CO_2 concentration continues, is contradicted by the trends. So we do not agree with their claim.

Nor do we hold the view that the HMG’s advisors in DECC and at the Hadley Centre have supported their claim with any credible evidence. If anything, we speculate that with rates of C&C in “2016 4% Low”, the opposite is more probably true and that CO_2 acidification of the oceans will increase throughout the Century ahead and that this in turn will increasingly damage the ocean sink for CO_2 The result of this alone will be that concentrations of CO_2 in the atmosphere will not fall as in their claim of more than 100% sink-efficiency by 2050. The danger is that more probably, these will continue to increase.

We are all now committed to no more than an overall 2° Celsius temperature rise. However difficult it may be, the only way to get better odds for achieving this, is to accelerate the rates of C&C in the Climate Act, as shown below. This was specifically agreed with the Hadley Centre during the enquiry into the Climate Act by the House of Commons Select Committee on Environmental Audit during 2008. See: - http://www.gci.org.uk/Documents/GCI_EAC.pdf

We should - as soon as possible - stop digging up fossil fuels, burning them so CO_2 goes into the atmosphere warming the planet and then goes into the oceans making them more and more acid.





3. 'Optimism Bias' in HMG's defence of 'Emissions Scenario'

The Hadley Centre claim that with "2016 4% Low" scenario in the Climate Act, ocean CO_2 acidification will stop after 2050 because the atmospheric concentration of CO_2 will stop rising and start falling. We view this claim as unsubstantiated and also contradicted by the trends.

"2016 4% Low" was specified by HMG Climate Change Committee and handed to Hadley for modelling along with eight other emissions reduction trajectories. No explanation was given for these choices. As the CCC Report noted, the chances of the preferred case exceeding 2°C by 2100 would be 56%. In the case of the discarded "2014 3% low" this was 51%; no reference was made to this case in the main CCC Report. This is an example of how government advisers have failed to observe the UNFCCC principle of precaution and chosen an optimistic solution.

We accept the need for political consensus, but we don't accept that "2016 4% Low" is sufficient to avoid global temperatures rising above 2° Celsius overall over pre-industrial level. Nor do we believe a consensus built on the 'optimism bias' in the representation of this is wise. We can reflect on the fact that even Hadley, who 'processed' it using the MAGICC climate model, gave only 44% odds for not exceeding 2.2°C .

The opaqueness created on this clouds 13 years of modelling in IPCC and creates concern that: -

> [1] in the 1st, 2nd, 3rd and 4th Reports since 1990 and the Coupled Models introduced in 4th Report, are dismissed by UKMO;
>
> [2] positive feedbacks while acknowledged are not modelled
>
> [3] with "2016 4% Low", atmospheric concentrations are projected to *fall* against Un-Coupled Models and the 'Constant Airborne Fraction' [CAF] of emissions, always estimated at around 50%, with the new scenario goes to zero % at 2050 and minus after that.
>
> [4] a year after the Act and "2016 4% Low", documentation supporting it claims that ocean CO_2 acidification stops after 2050 because *"atmospheric concentration of CO_2 stops rising and starts falling."*

On point [4] if anything this is precisely why *the ocean concentration of CO_2 will continue to increase until 2100 and therefore why CO_2 ocean acidification will increase as well.* We may recall also that with 'median case, 2016 4% Low", while it is claimed that atmospheric concentrations of CO_2 fall from 2050, temperature is projected to *rise* until 2125, with Hadley giving only 44% odds for a maximum of 2.2° in 2125.

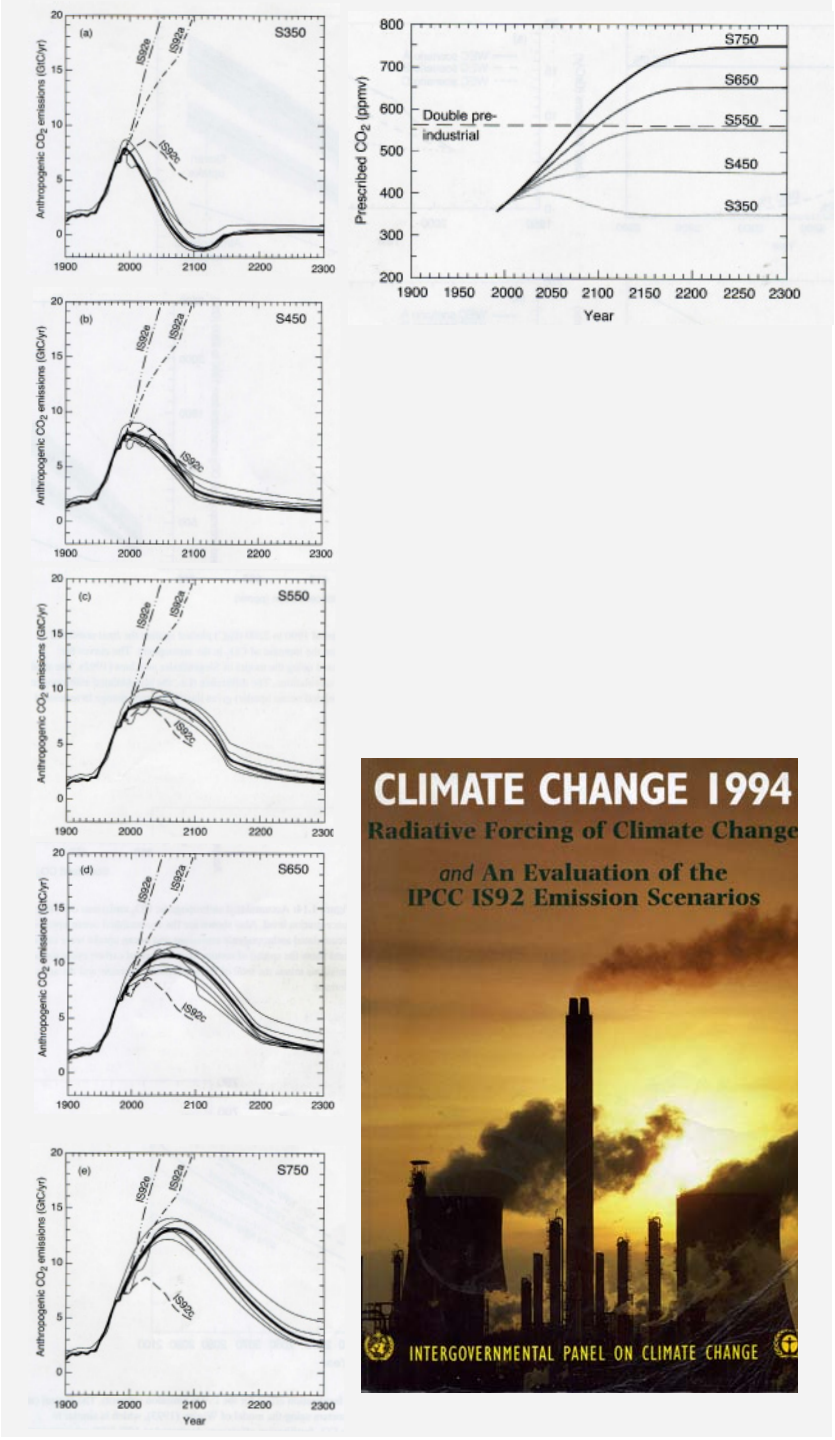
In sum, this forms a pattern of what we have chosen to call 'optimism bias'. Could there be a perceived need to project a future global emissions scenario that is relaxed enough to be 'politically possible' rather than one rigorous enough to be scientifically valid? If so, it means the world is drifting into doing too little too late to avoid 2° Celsius.

4. IPPC Contraction:Concentrations scenarios.

In between the First and Second Assessments of 1990 and 1995, the IPCC introduced a special report published in 1994 on Contraction:Concentration scenarios.

Below are the results they published. They are from the so-called ‘Berne Model’. These are ‘carbon cycling’ future CO_2 emissions in ‘contraction-events’ of different sizes with different rates for different CO_2 concentration outcomes.

Essentially this assumes that the ‘air-borne fraction’ of emissions remains ‘constant’ [CAF] at around 50% over future time as it has been observed to be in times past.



Values shown are for;

350 ppmv

450 ppmv

550 ppmv

650 ppmv

750 ppmv

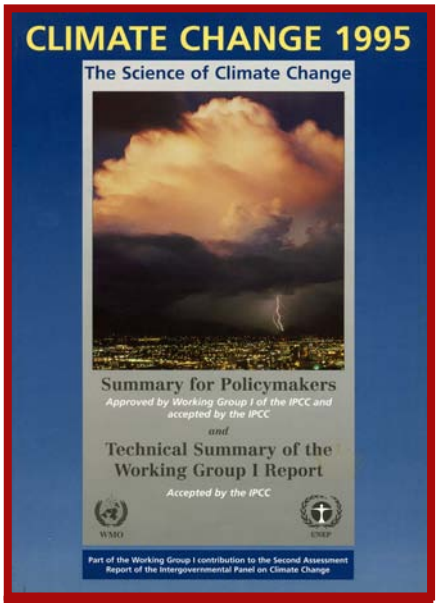
where ppmv means “parts per million by volume” for atmospheric CO_2 concentration outcomes, as shown in the upper right-hand corner of the graphic.

Each is associated with a corresponding emissions ‘contraction-event’ in descending order in the left-hand column of the graphic.

In IPCC Second Assessment [2005] 350 ppmv was dropped and 1,000 ppmv was introduced, but the CAF pattern of future flows of CO_2 emissions to changing levels of CO_2 stock in the atmosphere, remained consistent in IPCC until 2007.

5. Constant Airborne Fraction [CAF] stays in IPCC throughout IPCC 2nd, 3rd and 4th Assessments

These IPCC contraction:concentration scenarios remain the model in the Second Assessment Report [SAR] of 1995, the TAR of 2000 and the AR4 of 2007.



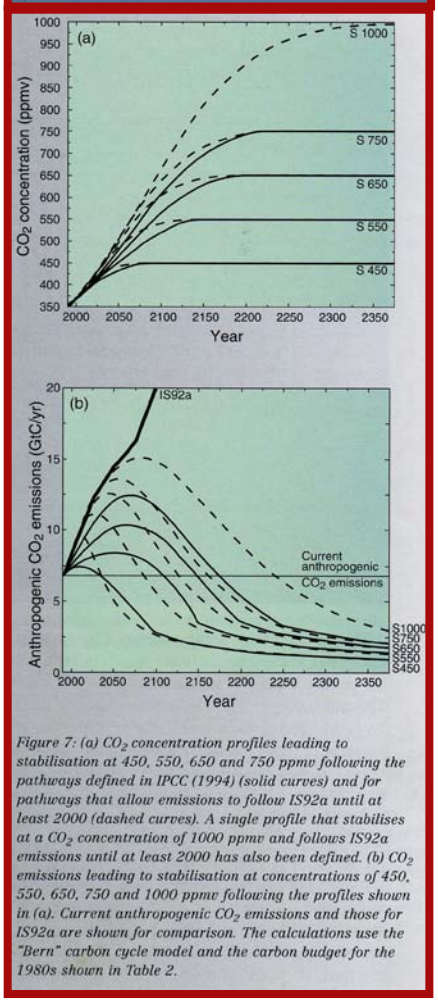
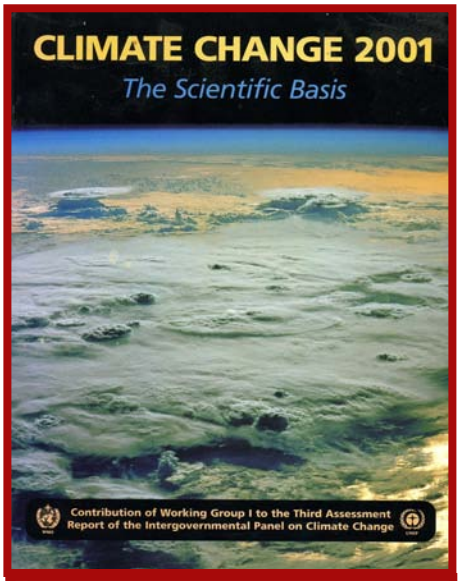


Figure 7: (a) CO_2 concentration profiles leading to stabilisation at 450, 550, 650 and 750 ppmv following the pathways defined in IPCC (1994) (solid curves) and for pathways that allow emissions to follow IS92a until at least 2000 (dashed curves). A single profile that stabilises at a CO_2 concentration of 1000 ppmv and follows IS92a emissions until at least 2000 has also been defined. (b) CO_2 emissions leading to stabilisation at concentrations of 450, 550, 650, 750 and 1000 ppmv following the profiles shown in (a). Current anthropogenic CO_2 emissions and those for IS92a are shown for comparison. The calculations use the "Bern" carbon cycle model and the carbon budget for the 1980s shown in Table 2.



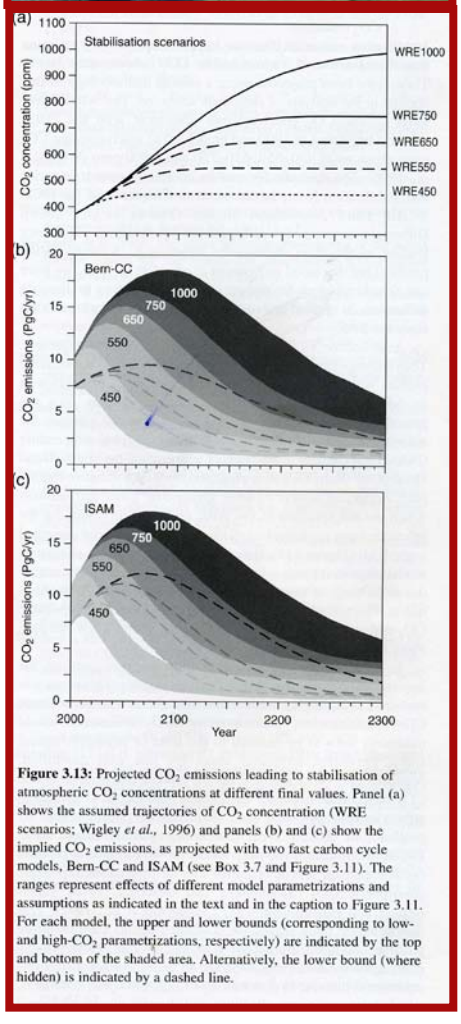
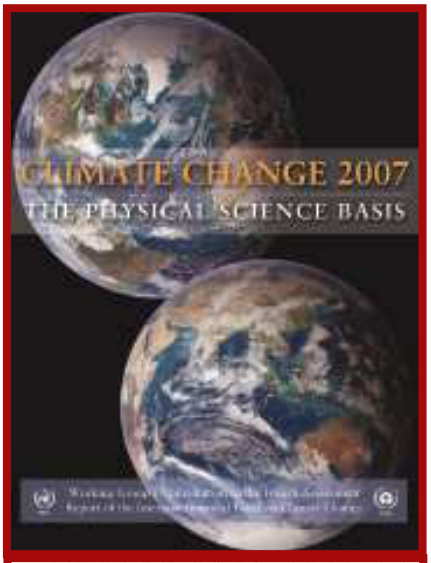
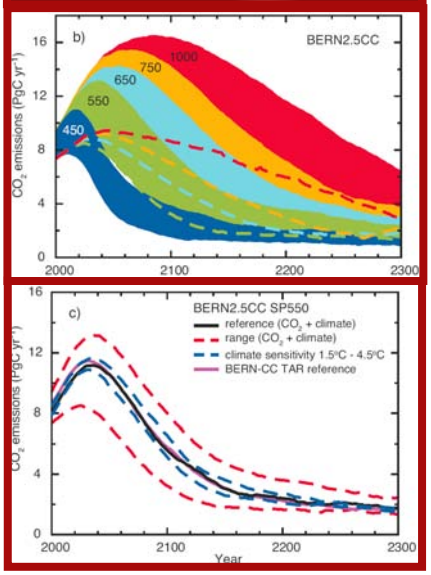


Figure 3.13: Projected CO_2 emissions leading to stabilisation of atmospheric CO_2 concentrations at different final values. Panel (a) shows the assumed trajectories of CO_2 concentration (WRE scenarios; Wigley *et al.*, 1996) and panels (b) and (c) show the implied CO_2 emissions, as projected with two fast carbon cycle models, Bern-CC and ISAM (see Box 3.7 and Figure 3.11). The ranges represent effects of different model parametrizations and assumptions as indicated in the text and in the caption to Figure 3.11. For each model, the upper and lower bounds (corresponding to low- and high-CO_2 parametrizations, respectively) are indicated by the top and bottom of the shaded area. Alternatively, the lower bound (where hidden) is indicated by a dashed line.





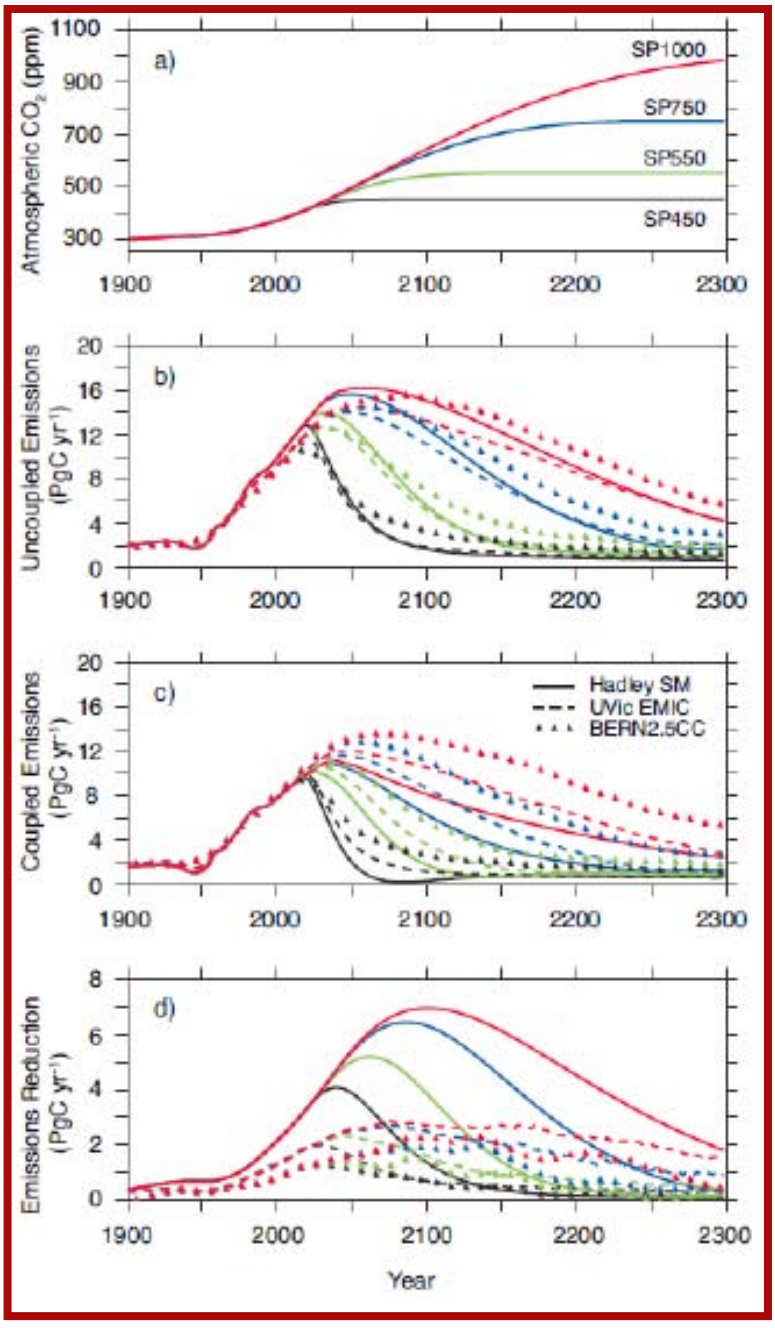
6. In IPCC'S AR4 Assessment [2007], '*Coupled* Carbon Cycle' modelling is introduced for the first time

However, '*uncoupled*' contraction:concentration scenarios were introduced and compared with '*coupled*' scenarios for the first time in the IPCC's AR4 in 2007.

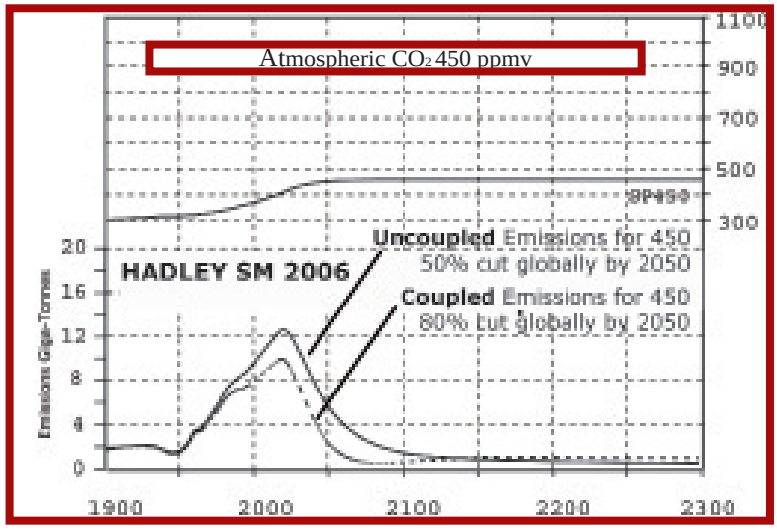
Concerns had been growing about feedbacks to the carbon cycle that could become increasingly 'positive' with time.

'Positive feedback' means the 'Constant Airborne Fraction' of emissions in the atmosphere could be amplified due to carbon sinks becoming less 'efficient' as global warming progresses.

These scenarios, from the C4 Modelling Intercomparison Programme [C4MIP], on average contracted all previous contraction-events by about 30% for any given concentration outcome.



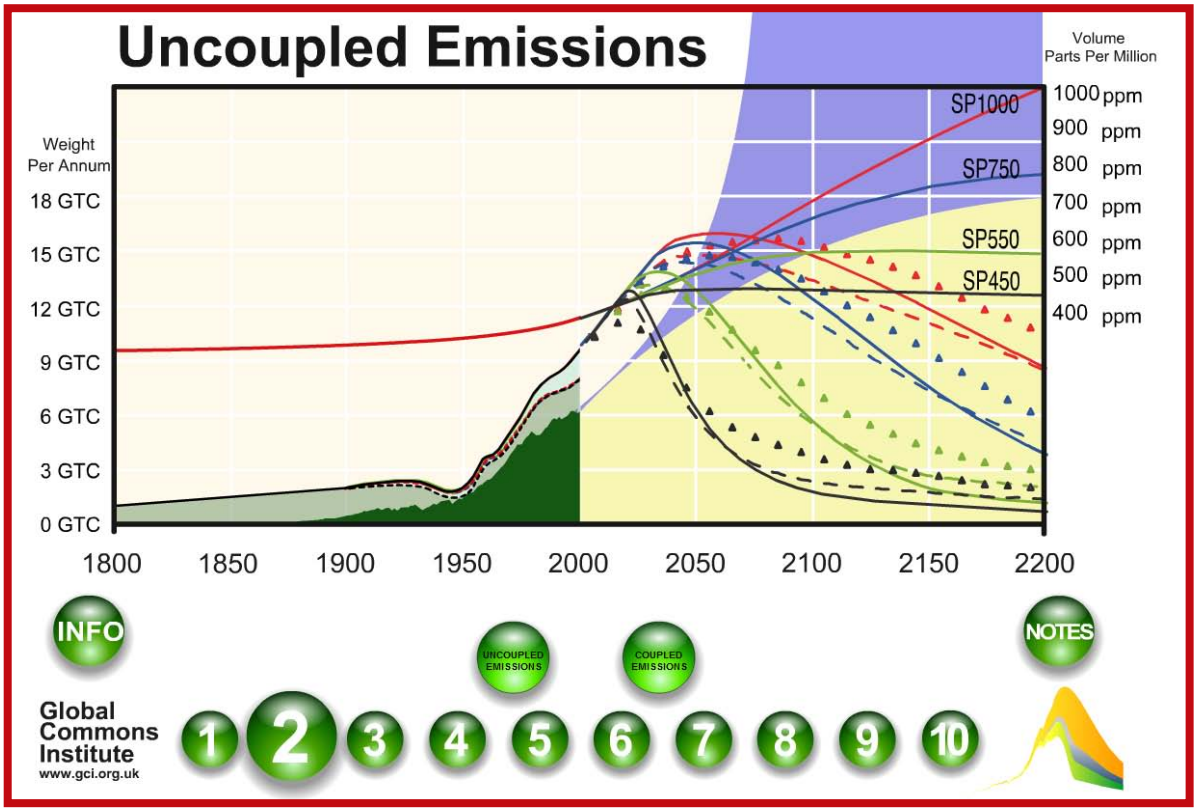
450 ppmv had been judged to be the level that is consistent with achieving a temperature outcome no more than an overall two degrees above pre-industrial.

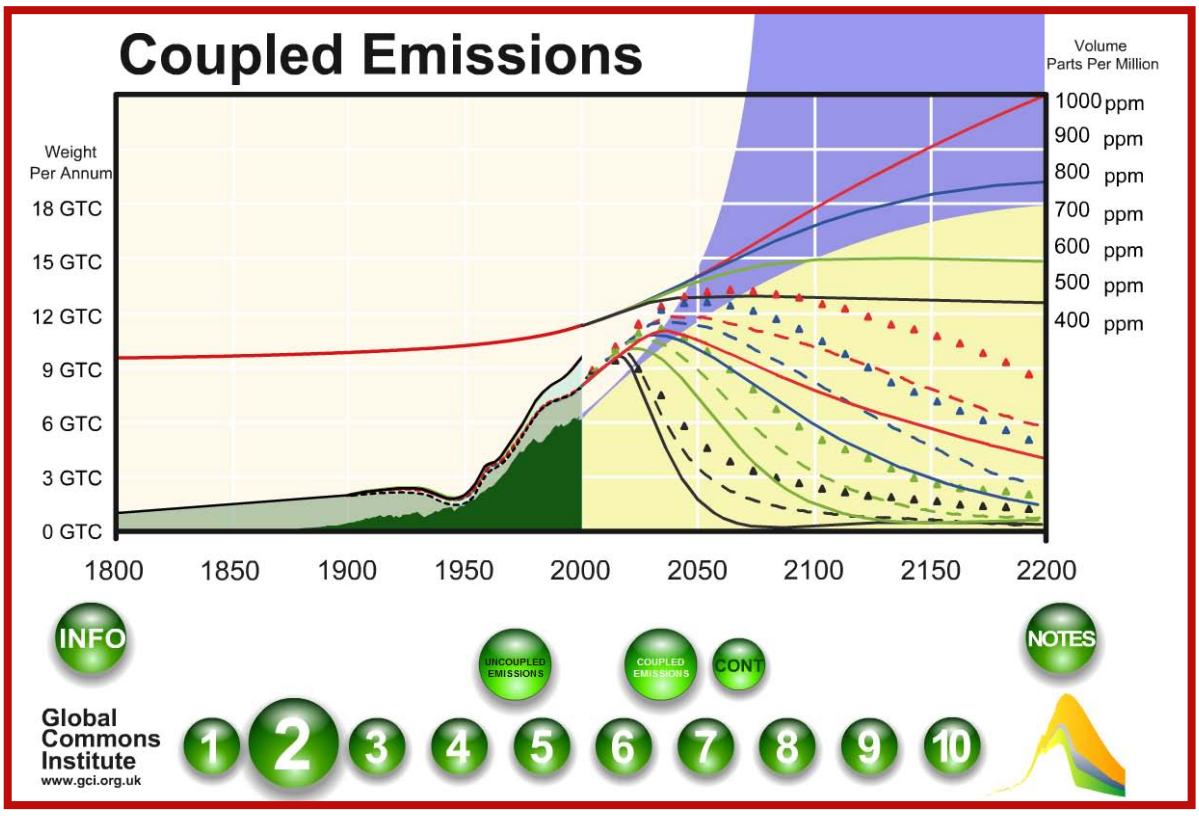


But C4MIP shows that the *coupled* contraction event needed for this requires near zero emissions globally by 2050 and not 2100, as had been portrayed up until that time with *uncoupled* models.

7. **GCI animated & compared 'Coupled Carbon' & 'Uncoupled Carbon Cycle' modelling for DEFRA** [2007]

In 2007, GCI produced a detailed animation comparing these two sets of projections for Hilary Benn, the then Minister at DEFRA. It particularly targeted a comparison of the 'uncoupled' and 'coupled' runs for 450 ppmv. DEFRA tended to ignore all this, but it is available on-line at: - http://www.gci.org.uk/animations/BENN_C&C_Animation.exe





8. GCI submitted a detailed assessment of the '2016 4% Low' Carbon-Budgets and Sinks in the UK Climate Act for the Environmental Audit Committee [EAC - 2009]

In 2008, the Environmental Audit Committee of the UK House of Commons began a year long enquiry into two questions: -

1. Where did the UK carbon budgets come from?
2. Are they adequate to keep within a 2 degree limit?

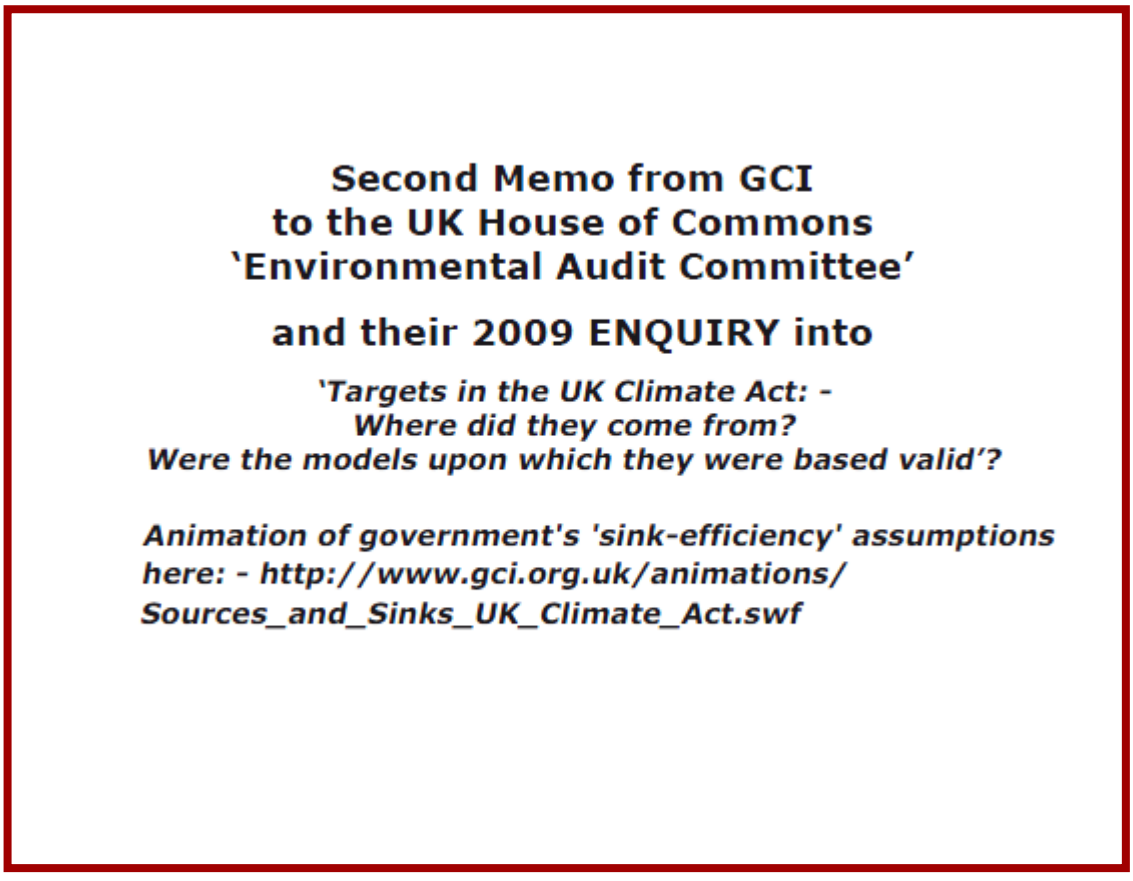
The answers we gave were in principle simple and to the point: -

1. They came from Contraction and Convergence [C&C],
2. But the C&C rates applied by the Government with "2016 4% Low" were too slow to keep within 2° overall temperature limit.

Initiating investigation of the issues raised in this Memo to the AP-PCCG in 2009, GCI submitted two detailed memos and gave spoken evidence to this EAC enquiry and these are available on-line at: -

http://www.gci.org.uk/Documents/EAC_Carbon_Budgets_Enquiry.pdf
http://www.gci.org.uk/Documents/GCI_EAC.pdf

The key point for us was covered by Adair Turner [Chairman of the Government's Climate Change Committee in his reply to Colin Challen MP who asked, "*Do you agree that if for reasons of urgency the rate of Contraction needs to be accelerated, that for reasons of equity the rate of Convergence needs to accelerated relative to that."* Adair Turner said he agreed with that.



9. GCI submitted detailed assessment of the '2016 4% Low' Carbon-Budgets and Sinks in the UK Climate Act for the EAC [2009]

In 2008 the Climate Act and "2016 4% Low" passed into law. GCI produced a detailed animation of this for the House of Commons Environmental Audit Committee [EAC].

This particularly targets a comparison of the various rates of 'sink-efficiency' required to achieve the Act's three stated rates for atmospheric concentrations of CO_2 in '2016 4% Low' in Parts Per Million by Volume [ppmv] and in Gigatonnes Carbon [Gt C]: -

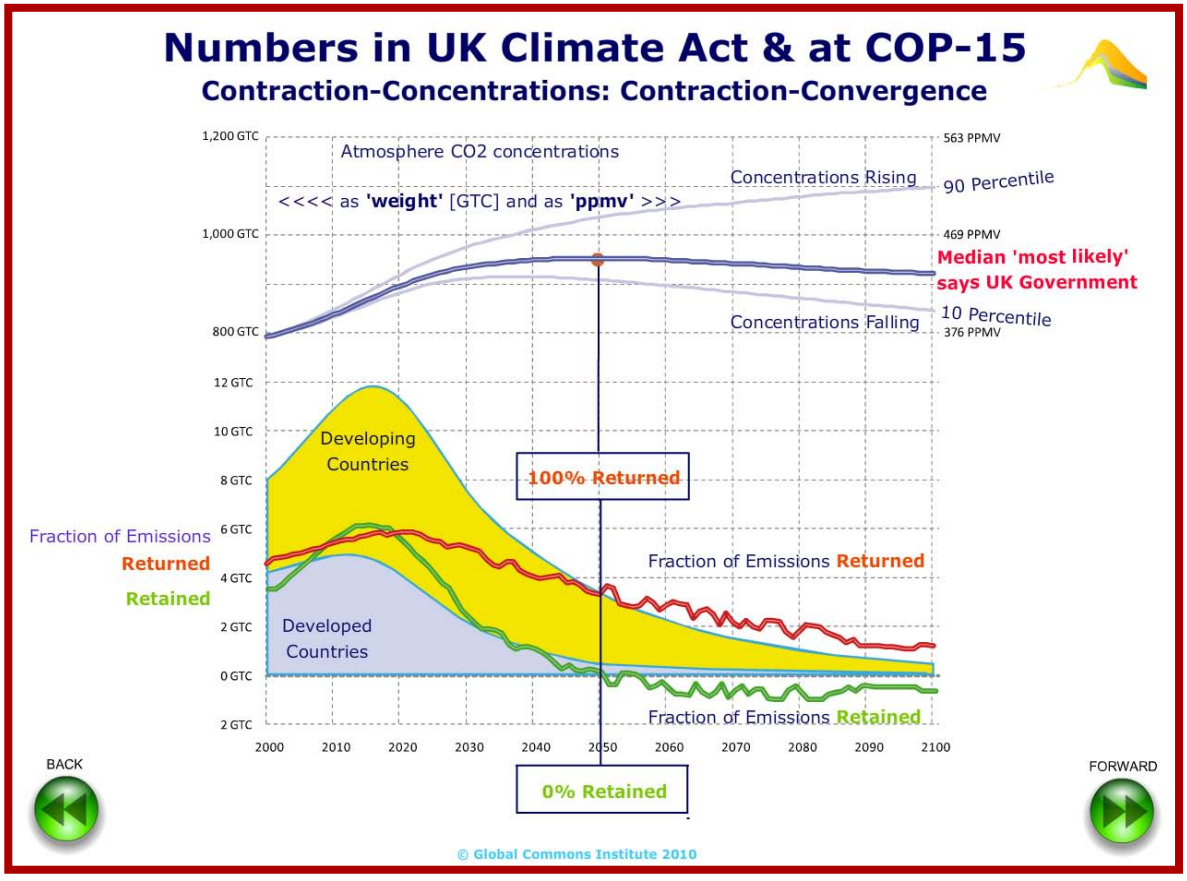
'10 Percentile',
'90 Percentile'
'Median' case, their preferred and 'most likely' outcome

It transpires that the 'Median' case requires achieving more than 100% 'sink-efficiency' by 2050. This is remarkable as it overturns everything published by the IPCC until that point.

The Hadley Centre eventually agreed with the calculating procedure GCI had used to demonstrate this result for rates of 'sink-efficiency'. But on the result of more than 100% sink-efficiency after 2050, citing historic sink dependency their response was, *"it is not unreasonable."*

GCI does not share that view and a full animation showing what the Hadley Centre's results with "2016 4% Low" are, is here: -

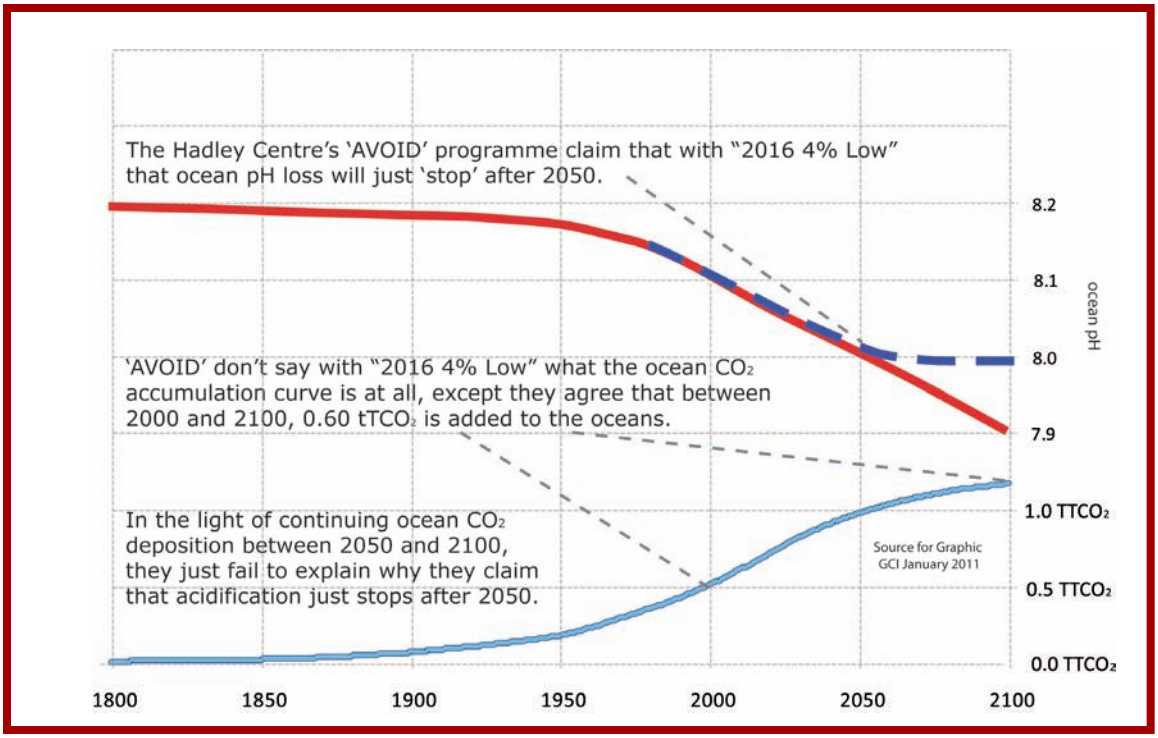
http://www.gci.org.uk/animations/Sources_and_Sinks_UK_Climate_Act.exe



10. 2010 GCI asked why rising CO_2 acidification of the oceans would just cease after 2050 in the "2016 4% Low" scenario

In 2010 GCI produced an analysis of the claim made in the 'AVOID' Report from the Hadley Centre where with "2016 4% Low", CO_2 acidification of the oceans was projected to cease after 2050.

GCI wrote to the Minister at DECC asking, *"how is it possible for CO_2 acidification of the oceans to just cease, when with the median case of '2016 4% Low', CO_2 concentration in the oceans continues on a rising curve until 2100?"*



A three-way correspondence ensued: -

http://www.gci.org.uk/correspondence/Huhne_Letter_to_Aubrey_31-10-10_.pdf

http://www.gci.org.uk/correspondence/GCI_Letter_to_Chris_Huhne_22_11_2010.pdf

http://www.gci.org.uk/correspondence/Lowe_et_al_Hadley_Reply_to_GCI_06_01_11.pdf

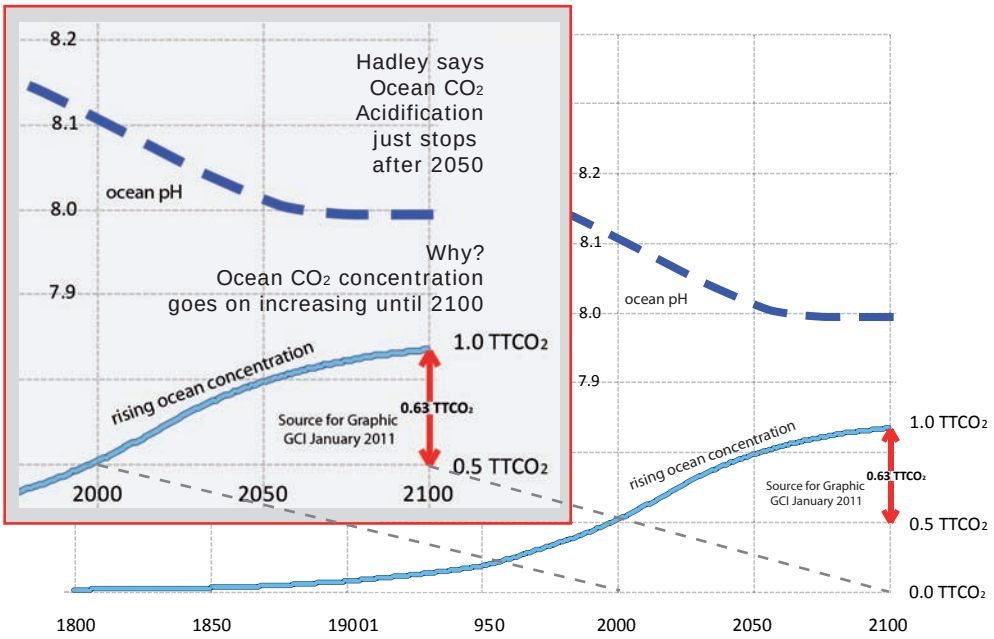
http://www.gci.org.uk/correspondence/Huhne_Letter_to_Aubrey_10_01_2011.pdf

http://www.gci.org.uk/correspondence/GCI_Letter_to_Chris_Huhne_15_01_2011_.pdf

This included a challenge from experts in DECC and at the Hadley Centre over GCI's 'numbers' and that GCI's its model that was 'too simple'. GCI pointed out when DECC's misquoting of the numbers provided by GCI was corrected, we had in fact agreed on the 'the numbers' and differed only on interpretation of the numbers. This point in the debate awaits resolution at this time.

11. GCI asked the question again: - How does DECC explain that rising CO_2 acidification of the oceans would just cease after 2050 even though rising ocean CO_2 deposition continues until 2100?

In fact, we agreed that under "2016 4% Low" as an 'integral', around 0.63 Terra Tonnes of CO_2 would be added to the oceans from the falling CO_2 concentrations in the atmosphere between 2000 and 2100, as shown in this chart: -



GCI pointed out to DECC that as a '*path*-integral', this weight would accumulate *on a rising curve throughout the period 2000 - 2100.*

Comparing GCI's 'simple' model and Hadley's complex model we get:

[a] results with the same 'integral' but
[b] GCI's simple model also giving the '*path*-integral' for this with
[c] DECC's complex model inexplicably failing to provide this.

So the question remains: - how does DECC explain that rising CO_2 acidification stops in 2050 when CO_2 concentrations in the ocean keep rising until 2100? Their flag the 'biological pump' and deep ocean transfer of carbon, but this mechanism has always operated and there is no reason to forecast a sudden increase of this mechanism after 2050.

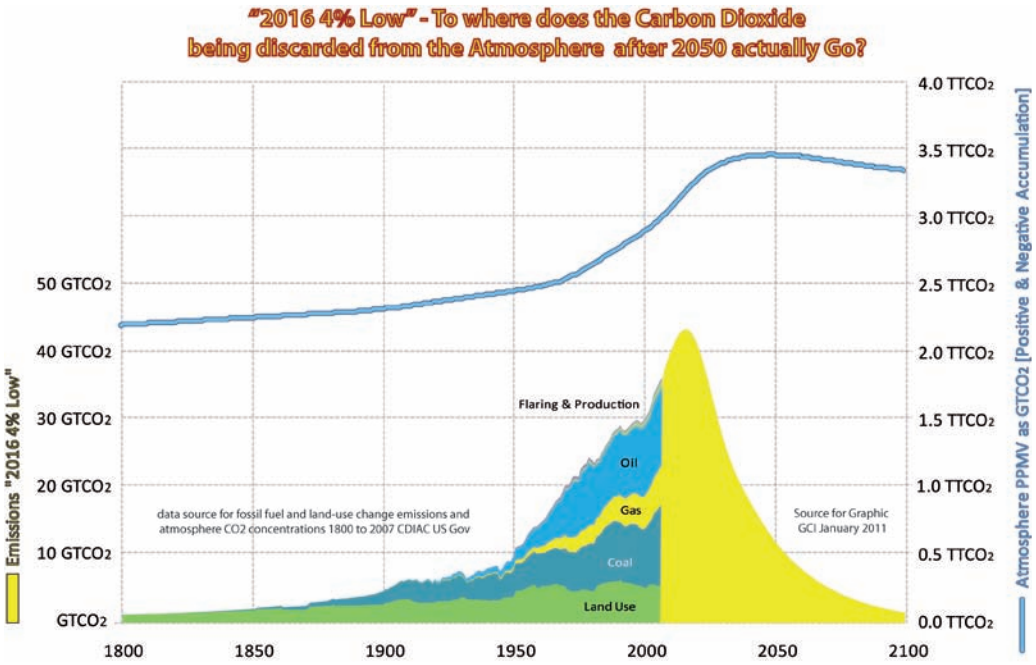
Moreover, DECC informed us a large 'consortium' of experts were all involved in giving this advice so GCI asked for evidence that they had all agreed with the result. No evidence has yet been provided for that.

That said, the question is not 'remote' as it covers five decades starting only in fifty years time. The question is here and of relevance now as it addresses generally the reliability or otherwise of the climate models and the mitigation advice being given to Government by these experts.

12. Essential note about fossil fuels

Fossil fuels - oil, coal and gas - were stored as ‘carbon’ in ‘reservoirs’ that have been stable over paleontological time spans - millions of years. In other words this carbon was completely removed from the biosphere and from flows of ‘biological carbon’ and CO_2 fluxes between the oceans, the forests and the atmosphere. In these ‘fluxes’, ‘biological carbon’ in trees for example ebbs and flows between autumn and spring as CO_2 [carbon dioxide] is released with the fall of leaves in winter and recaptured by growing leaves in spring.

The release of CO_2 from fossil fuel burning has no such cycle. Once CO_2 has been released to the atmosphere from this burning, it has to go somewhere and accumulate somewhere. For the last two hundred years this has been in the atmosphere and in the ‘land-sinks’ [mainly forests] and the ‘ocean-sink’ [coral reef, shell fish and foramanifera]. *The key-point here is it doesn’t go back down the coal-mines and oil and gas wells and reconvert to fossil carbon.*



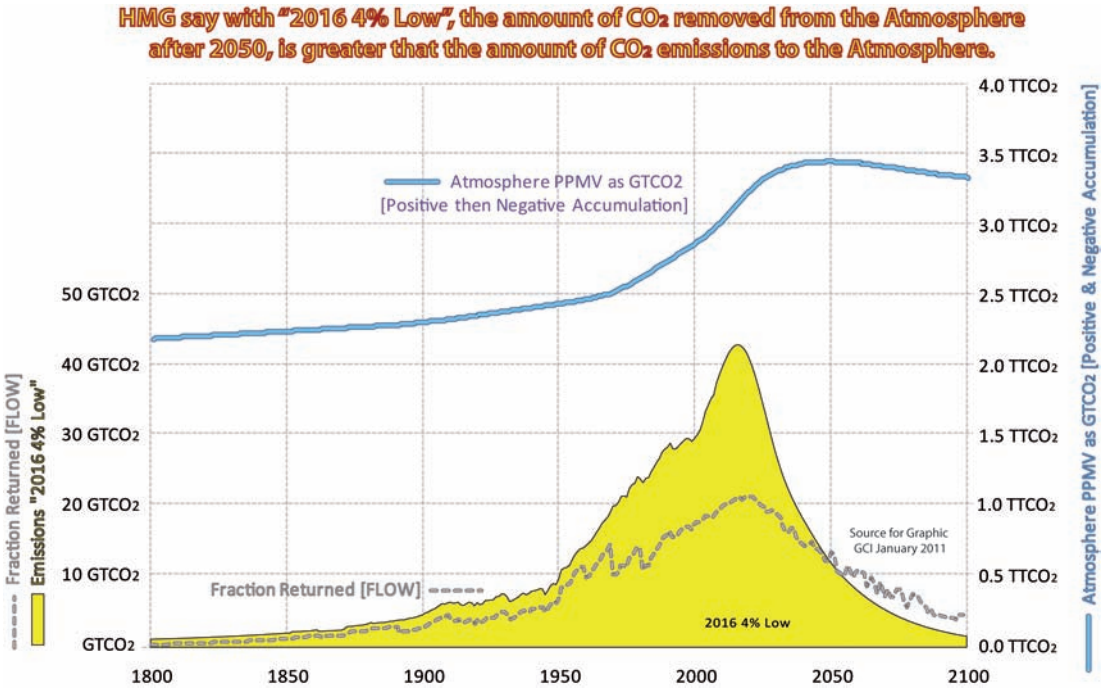
Data charted above for fossil fuels and land-use changes [1800 - 2007] are from CDIAC. The emissions profile [2008 - 2100] is the “2016 4% Low” scenario underpinning the UK Climate-Act and is from Hadley. Data for the CO_2 concentrations in the atmosphere come from the same two sources.

GCI has requested that the Hadley Centre provide information for the period 2008 - 2100 in the “2016 4% Low” for the quantification assumptions made about the future breakdown between fossil fuels and land-use changes during this future. The relative future performance of oceanic and land sinks are obviously relevant to this and, perhaps because doing this is difficult, so far they have not done it.

11. Sequence showing arithmetic of the atmospheric and oceanic CO_2 deposition and acidification under "2016 4% Low"

The **'Fraction Returned Curve'** for the entire carbon budget [1800 - 2100] in tonnes of carbon dioxide data is charted below.

It was calculated converting atmospheric ppmv to a weight of CO_2 and then weighing off and comparing year-on-year changes between emissions and concentrations. From this the curve for the emissions 'Fraction Returned' to sinks can be calculated and this has been added to the chart below in the dotted grey line.

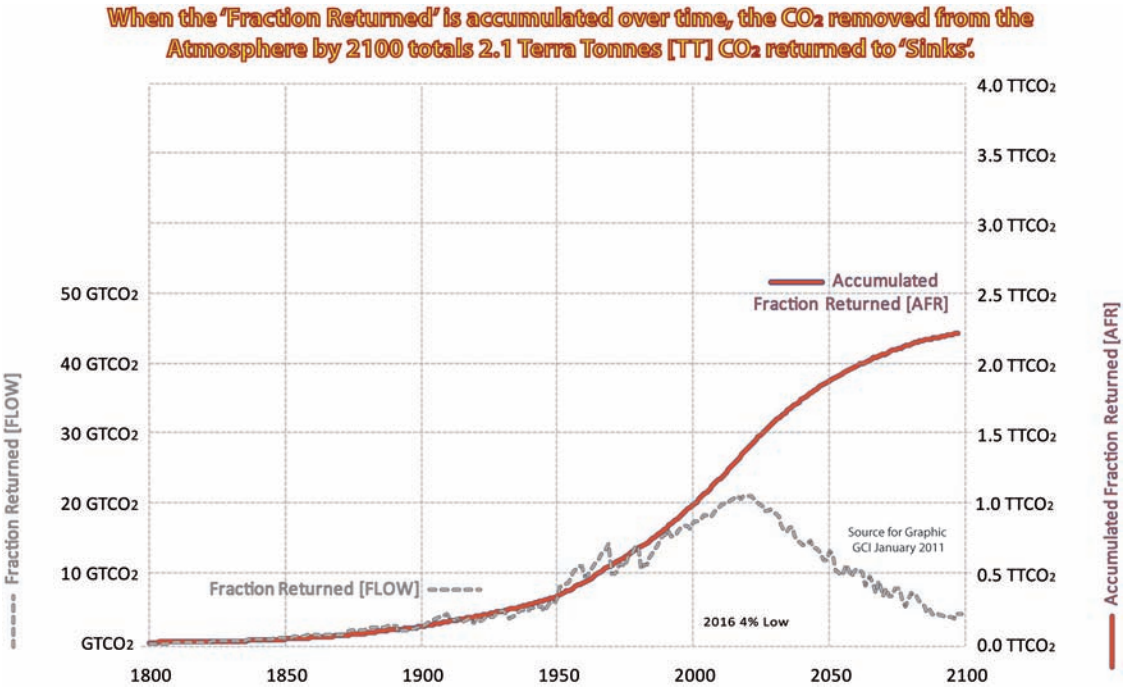


Atmospheric ppmv as a weight of CO_2 is shown here as terra tonnes of carbon dioxide [TT CO_2] on the right-hand axis. Emissions and the emissions 'Fraction Returned' to sinks are on the left-hand axis.

The atmospheric concentrations of CO_2 shown come from CDIAC [1800 - 1960], Mauna Loa [1960 - 2010] and "2016 4% Low" median case [2010 - 2100]. Together with the "2016" 4% median case as a continuum, they are shown here as terra [or trillions of] tonnes of Carbon Dioxide [TT CO_2] on the right-hand axis.

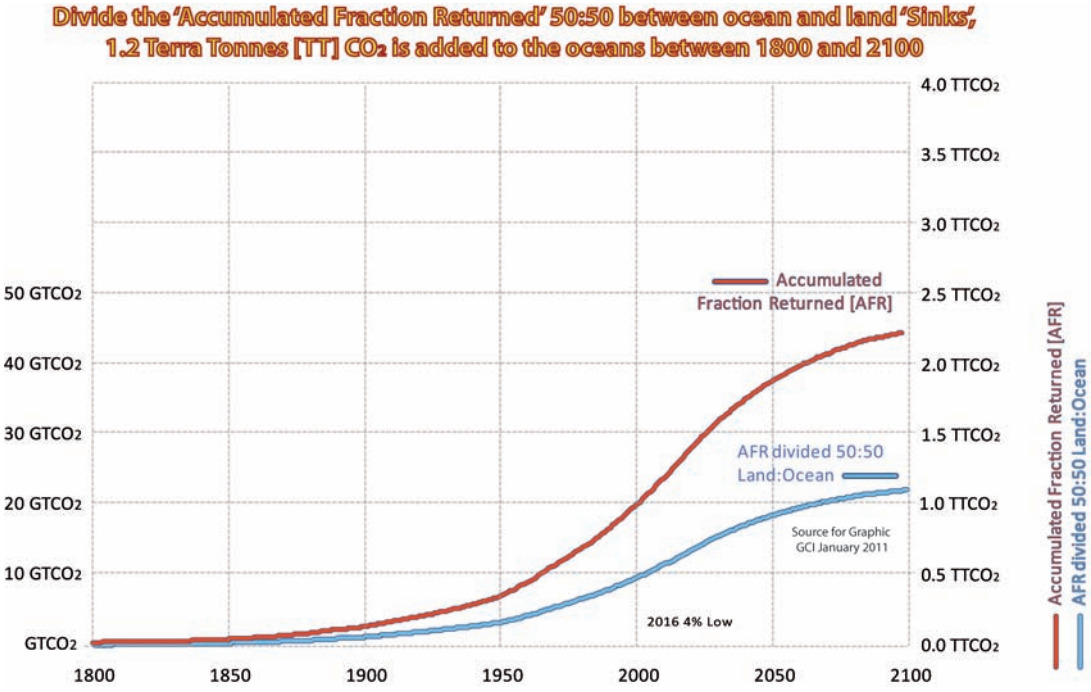
The **‘Accumulated Fraction Returned Curve**’ for the entire carbon budget [1800 - 2100] in tonnes of carbon dioxide is charter below. This tells you the total of emissions returned to the sinks over the past 200 years and the future 100 years under “2016 4% Low”.

It was calculated simply adding up the ‘Fraction Returned’ year-on-year over time and it is shown as a weight of CO_2 in terra tonnes of carbon dioxide [TT CO_2] on the right-hand axis. Emissions that just are the ‘Fraction Returned’ to sinks are still on the left-hand axis.

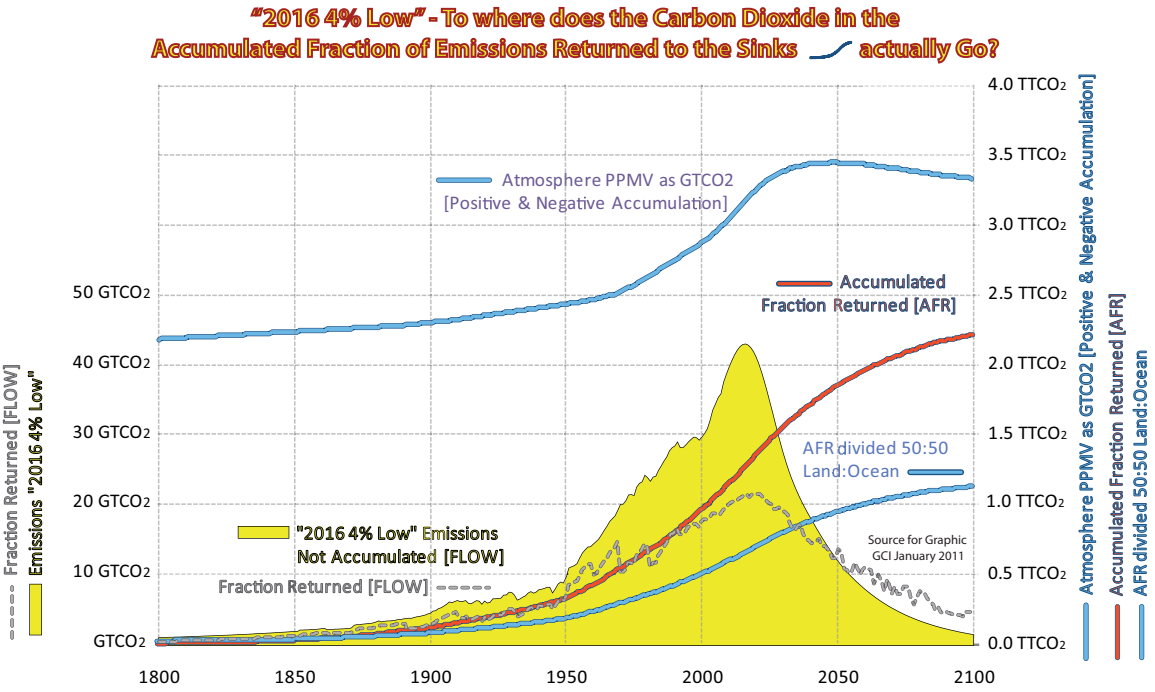


The **'Accumulated Fraction Returned Curve' for the entire carbon budget [1800 - 2100] in tonnes of carbon dioxide, but split 50:50 between the land-sinks and the ocean sinks** is charted below.

In the past when atmospheric CO_2 was rising, it is inferred that the split was around 40% of emissions stayed in the atmosphere while the other 60% was split 30:30 between the ocean and the land sinks. In 2050 under "2016 4% Low" when atmospheric CO_2 concentrations apparently start to fall, Hadley say the split of the Fraction Returned becomes 50:50 between the land and the ocean sinks. It is the weight of CO_2 in terra tonnes of carbon dioxide [TT CO_2] on the right-hand axis.

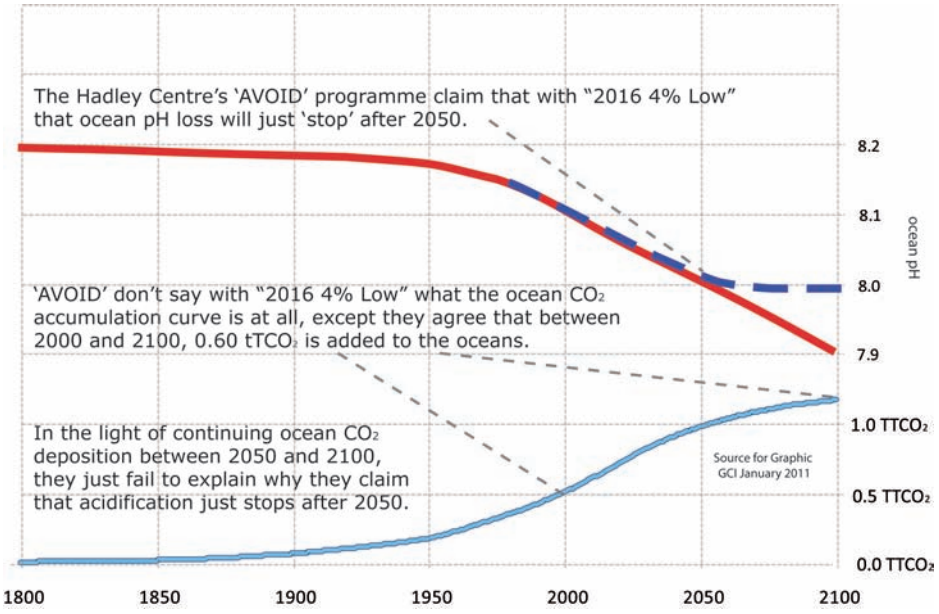


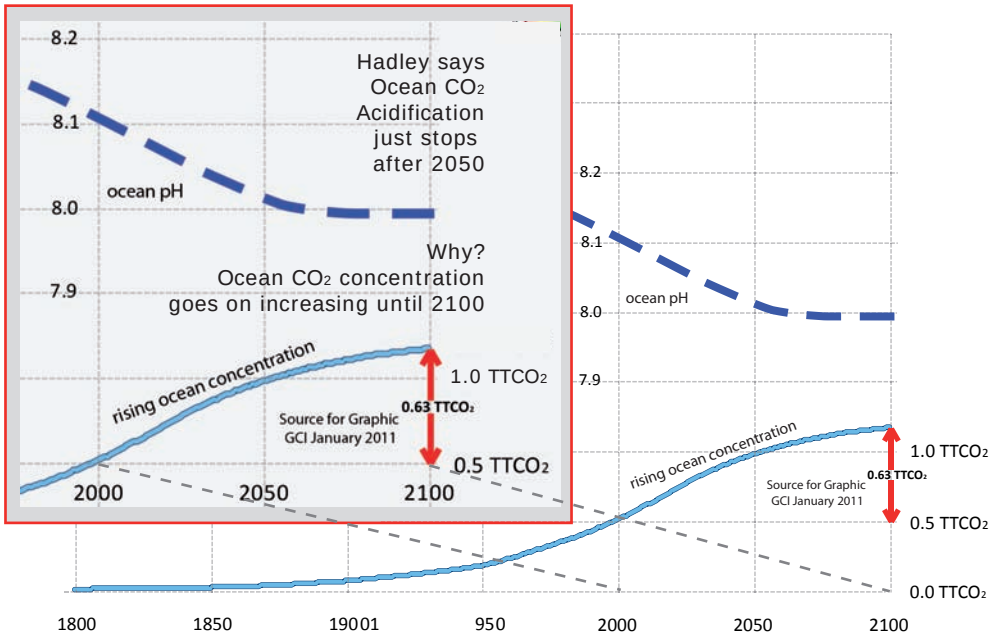
All this is integrated in the chart below.



However, the point demonstrated is that ocean CO_2 concentration is increasing until 2100. So it is from this curve that GCI still asks the Hadley Centre and DECC the question at the heart of this stage of the enquiry: -

On what basis of trend-evidence or futures-modelling do the Hadley Centre and DECC claim that ocean CO2 acidification just stops in 2050, when under their "2016 4% Low" scenario behind the UK Climate Act, this is obviously countervailed by ocean CO_2 concentrations increasing until at least 2100?





DECC and Hadley said GCI's numbers regarding the amount of CO_2 added to the oceans between 2000 and 2100 were wrong. GCI pointed out that the amount we specified was for *1800* to 2100 and when this was examined for the period 2000 to 2100, the amount we'd indicated was 0.63 TT CO_2 as shown in the chart on page 21.

In fact GCI had stated that under "2016 4% Low", around 0.63 Terra Tonnes of CO_2 would be added to the oceans from the falling CO_2 concentrations in the atmosphere between 2000 and 2100 as an 'integral'.

However, GCI also pointed that as a '*path*-integral', this weight would accumulate *on a rising curve throughout* the period between 2000 and 2100. DECC informed GCI that its model was 'too simple'.

To recap: - GCI's 'simple' model and their 'complex' model both get:
[a] the same 'integral' [2000 - 2100 0.63 Tt CO_2] but
[b] GCI's simple model also gives the '*path*-integral' with
[c] *DECC's complex model inexplicably failing to provide this*.

So can DECC yet explain why rising CO2 acidification stops in 2050 though ocean CO_2 concentrations keep rising until 2100?

Being counter intuitive in this is counterproductive as it nurses an optimism bias. Nor is the question 'remote' as it covers 5 decades starting in fifty years time. It is here now and of present relevance as it addresses directly the reliability, or otherwise, of the climate models being used by the mitigation advisors to the Government supported by more experts operating in DECC's multi-agency consortium of expertise.

Notwithstanding, GCI's says observing the precautionary principle is paramount and that faster rates of C&C are needed for UNFCCC-compliance at 2 degrees than are on offer with "2016 4% Low." As said on page three, the Hadley Centre has already agreed with us on this.