Subject: Re: Submission on Outline Heads of the Climate Action and Low-Carbon Development Bill

From: Ray Bates

To: Eugene OCruadhlaoich

Date: 04/06/2013 00:04

Meteorology and Climate Centre,

School of Mathematical Sciences,

University College Dublin,

Belfield,

Dublin 4.

3 June 2013.

Eugene Ó Cruadhlaoich Uasal,

Cléireach don Choiste,

Oireachtas Joint Committee on Environment, Culture and the Gaeltacht,

Kildare House,

Kildare Street,

Baile Átha Cliath 2.

Re: Submission on Outline Heads of the Climate Action and Low Carbon Development Bill 2013

Dear Mr. Ó Cruadhlaoich,

Thank you for your email of 27 May. In reply, please find attached my submission, consisting of a Word Document and an accompanying Powerpoint Document containing 32 slides. Appended to my Word Document is my original covering letter of 27 May. As this letter contains the six reasons I gave as to

why I believe I should be called as a scientific witness, I request that it be considered as an integral part of my submission.

With thanks,

Yours sincerely,

J. Ray Bates (Prof.)

Email: ray.bates@ucd.ie

Mobile: 085 724 7781.

Eugene Ó Cruadhlaoich Uasal,
Cléireach don Choiste,
Oireachtas Joint Committee on Environment, Culture and the Gaeltacht,
Kildare House,
Kildare Street,
Baile Átha Cliath 2.

Telephone: 01 618 3575
E-mail: eugene.ocruadhlaoich@oireachtas.ie

This submissions notice was posted on this page on 26 March 2013.

Ray Bates ---27/05/2013 12:24:06---Meteorology and Climate Centre, School of Mathematical Sciences,

From: Ray Bates <ray.bates@ucd.ie>
To: Eugene.OCruadhlaoich@oireachtas.ie
Date: 27/05/2013 12:24
Subject: Submission on Outline Heads of the Climate Action and Low-Carbon Development Bill

Meteorology and Climate Centre,

School of Mathematical Sciences,

University College Dublin,

Belfield,

Dublin 4.

27 May 2013.

Eugene Ó Cruadhlaoich Uasal,

Cléireach don Choiste,

Oireachtas Joint Committee on Environment, Culture and the Gaeltacht,

Kildare House,

Kildare Street,

Baile Átha Cliath 2.

Re: Submission on Outline Heads of the Climate Action and Low Carbon Development Bill 2013

Dear Mr. Ó Cruadhlaoich,

Further to our telephone conversation this morning, please find attached a summary of my proposed presentation to the Oireachtas Joint Committee on Environment, Culture and the Gaeltacht in relation to the Climate Action and Low Carbon Development Bill. I request an oral presentation to the Committee. If my proposal is accepted, I will forward you a Powerpoint presentation amplifying the points made in the attached summary.

I'm sorry that my submission comes after the deadline of 30 April. As explained to you by phone, I learned only last Thursday about the Oireachtas Committee's call for submissions published on your website on 26 March. The Royal Irish Academy, which is generally recognized as representing the best in all areas of research and scholarship in Ireland, including climate science, was also not aware of the call for submissions up to that date. Any notification to the Academy of the call for submissions would immediately have been forwarded to me in my capacity as chairman of their Climate Change Sciences Committee. As that committee just reached the end of its four-year term last Thursday and no successor committee has yet been appointed, I wish to make my submission in my personal capacity as a climate scientist and member of the Academy.

The title of my submission is "Climate Change Science: An Overview of the Current Status". Since the main motivation for the Bill is to address the threat of dangerous man-made climate change, I believe it is important that the Committee should receive an overall briefing (or briefings) on the current status of climate change science from a scientist (or scientists) with solid international credentials in this area, who can present an up-to-date and objective assessment of the climate change threat. I believe such a briefing is relevant to the Bill in that it will help the Committee to consider whether the Government should aim to go beyond EU requirements in reducing Irish greenhouse gas emissions, or whether it should aim to influence EU requirements in a way that will be less demanding on Ireland.

As reasons why I, in particular, should be should be chosen to make such a presentation, I would mention the following factors:

1. I have the longest and broadest experience in climate research of any climate scientist in Ireland. I obtained a PhD in meteorology from the Massachusetts Institute of Technology (MIT) in 1969 and have been active in research in meteorology and climate at an international level since then. My PhD supervisor at MIT was Prof. Jule Charney, who was the leading meteorological scientist of the 20th century. He was the lead author of the first assessment report for policymakers on the dangers of increasing carbon dioxide in the atmosphere ("Carbon Dioxide and Climate: A Scientific Assessment", 1979, National Academy of Sciences, Washington D.C.). The breadth of my research contributions can be seen by referring to my home page at www.raybates.net.

2. I am a member of both the Royal Irish Academy (RIA, elected in1986) and the Academia Europaea (elected in 1998). I am the only Irish climate scientist to have achieved both of these distinctions. I have been chairman of the RIA's Climate Change Sciences Committee from 2009 to 2013.

3. I have been the recipient of three awards for my research work: (a) The Napier Shaw Memorial Prize of the Royal Meteorological Society (UK), 1971; (b) The Laboratory for Atmospheres Scientific Achievement Award, NASA Goddard Space Flight Center, 1994; (c) The Vilhelm Bjerknes Medal, European Geosciences Union, 2009 (http://www.egu.eu/awards-medals/awards-medals/award/vilhelm-bjerknes/j-ray-bates.html).

4. I have the broad experience of having worked at Met Eireann (where I was Head of the Research Division and was promoted to the level of Assistant Director), at NASA's Goddard Space Flight Centre (where I was a senior scientist from 1987 to 1995) and at the Niels Bohr Institute of the University of Copenhagen (where I was Professor of Meteorology from 1995 to 2004). Since 2004, I have been Adjunct Professor of Meteorology in the Meteorology and Climate Centre at UCD. I am still active in climate research, as can be seen by referring to www.raybates.net.

5. As I am a physical climate scientist, my expertise lies in the central area of climate science. In hearings on climate change held by a previous Oireachtas Committee in 2009, only a geographer and a representative of Friends of the Earth were called to give testimony, no physical climate scientist being included. (see: http://oireachtasdebates.oireachtas.ie/Debates%20Authoring/DebatesWebPack.nsf/committeetakes/CLJ2009061000003?opendocument).

6. I was a member of the Panel of Experts of the Chief Scientific Adviser to the Government of Ireland (then Prof. Patrick Cunningham) from 2009 to 2012, representing the area of climate science on the panel. I was chosen for the panel on the basis of an open, competitive selection process. I think it is relevant to point out that no such open, competitive selection process is being, or has been, used in appointing participants to represent Ireland on the Intergovernmental Panel on Climate Change (IPCC).

Further details of my credentials can be found at www.raybates.net.

Thanking you for your consideration,

Yours sincerely,

J. Ray Bates (Prof.)

Email: ray.bates@ucd.ie

Mobile: 085 724 7781

Attachment: Summary of Presentation "Climate Change Science: An Overview of the Current Status".

--
J. Ray Bates
Adjunct Professor of Meteorology,
Meteorology and Climate Centre,
School of Mathematical Sciences,
University College Dublin,
Belfield, Dublin 4, Ireland,
Telephone: +353-1-716 2421
http://www.raybates.net*(See attached file: Oireachtas presentation - Summary.doc)*

--
J. Ray Bates
Adjunct Professor of Meteorology,
Meteorology and Climate Centre,
School of Mathematical Sciences,
University College Dublin,
Belfield, Dublin 4, Ireland,
Telephone: +353-1-716 2421

http://www.raybates.net

Oireachtas Submission.doc

Oireachtas Presentation 2013.ppt

Submission on the Outline Heads of the Climate Action and Low-Carbon Development Bill

by Prof. J. Ray Bates,
Meteorology and Climate Centre,
School of Mathematical Sciences,
UCD, Belfield, Dublin 4.

1. Introduction.

In this submission an overview of the current status of the climate change science underlying the climate Bill, and justifying the necessity for its introduction, is presented. I believe it is important that the Committee receive an overall briefing on the science to enable it to make an informed judgement as to whether climate change is an immediate existential threat requiring the most drastic action, even if such action has very painful economic consequences for our society, or whether it is more gradual and long-term, allowing our society to adjust in a more measured way and possibly even to benefit economically from a well-considered transition to a low-carbon economy.

I believe such a briefing should be given by a physical climate scientist with solid international credentials and broad experience, who can give an up-to-date and objective assessment of the climate change threat. There have been some important recent developments in climate science, which I will describe, that should be taken into account in considering the Bill.

In my covering letter to the Clerk of the Committee dated 27 May 2013 (copied at the end of this submission), I gave six reasons outlining why I am well qualified to make such an overall scientific presentation; I request that that letter be referred to in deciding whether I am to be invited to address the Committee and will not repeat those reasons here.

2. Executive Summary

The topics to be covered in my overview of the science are:

i. Atmospheric Carbon Dioxide Increase
ii. Global temperature Rise
iii. Sea Level Rise
iv. Polar Sea Ice changes
v. Natural Climate Variability
vi. Irish Temperature Changes, 1900- 2012.
vii. Climate Model Projections and Some Recent Developments in Climate Sensitivity.
viii. Conclusions

The scientific conclusions are:
a. Most of the global average temperaure rise (0.8°C) and sea level rise (20 cm) of the past century is with a high degree of
certainty due to human activities. Sea level is now estimated to be rising at a rate of 3.2 mm/yr.
b. Climate models project that, if emissions continue unabated, these trends will continue. However, recent research
suggests that the future rate of increase of global average temperature may not be quite as fast as previously feared.
c. Locally, in our North Atlantic location, much of what may appear to be man-made climate change is actually natural
climate variability.

d. If model projections turn out to be even approximately true, the Mediterranean countries will become much hotter and drier in summer by the end of the century and agriculture there may be severely affected. In such circumstances, Ireland's less affected climate could become a very important European asset in terms of food security.

3. Recommendations.

The main purpose of my presentation is to summarize the present status of climate change science for the information of the Committee. I believe the following recommendations are consistent with the current state of the science.

a. I recommend that the Committee accept the gradualist and learn-as-you-go approach towards the reduction of greenhouse gas emissions advocated by the NESC Secretariat Report "Ireland and the Climate Change Challenge: Connecting 'How much' with 'How to'" (2013) as a good underlying framework for the Climate Bill.

b. The targets to which Ireland is already committed under EU agreements, i.e., a 20% reduction in non-ETS emissions relative to 2005 levels by 2020, and a possible reduction of 40% by 2030, are already very demanding. As well as being motivated by climate change projections, whose magnitude must realistically be regarded as uncertain, these stringent EU emissions reduction targets are based on considerations of gaining economic advantage by leading in the development of low-carbon energy technologies and on political considerations of EU energy independence. In considering the question of whether to urge the Government to go beyond EU targets, the Committee should weigh these three separate motivations insofar as they relate to Ireland's interests.

c. At present, agricultural emissions account for over 30% of total Irish emissions, which is to be compared with the corresponding EU average of 10% (and 8% for Germany). Given EU-mandated percentage cuts in overall emissions, it will be easier for countries whose agricultural emissions account for a small percentage of their total emissions to protect their agricultural sectors than it will be for Ireland. Given the future climate projections for the Mediterranean countries, the Committee should urge the government to explore ways in which Irish agriculture could be protected as a food-security resource within the overall EU context.

4. Main body of submission.

The main body of my submission is attached as a Powerpoint presentation of 32 slides, with the title "Climate Change Science: An Overview of the Current Status". (The number of slides to be used in my presentation can be reduced if this is considered necessary.) My presentation is directly influenced and informed by my own scientific publications (as described in www.raybates.net), but, being an overview, draws on many different sources in the current scientific literature, all of which receive acknowledgement.

Copy of my covering letter of 27 May 2013.

Meteorology and Climate Centre,
School of Mathematical Sciences,
University College Dublin,
Belfield,
Dublin 4.

27 May 2013.

Eugene Ó Cruadhlaoich Uasal,
Cléireach don Choiste,
Oireachtas Joint Committee on Environment, Culture and the Gaeltacht,
Kildare House,
Kildare Street,
Baile Átha Cliath 2.

Re: Submission on Outline Heads of the Climate Action and Low Carbon Development Bill 2013

Dear Mr. Ó Cruadhlaoich,

Further to our telephone conversation this morning, please find attached a summary of my proposed presentation to the Oireachtas Joint Committee on Environment, Culture and the Gaeltacht in relation to the Climate Action and Low Carbon Development Bill. I request an oral presentation to the Committee. If my proposal is accepted, I will forward you a Powerpoint presentation amplifying the points made in the attached summary.

I'm sorry that my submission comes after the deadline of 30 April. As explained to you by phone, I learned only last Thursday about the Oireachtas Committee's call for submissions published on your website on 26 March. The Royal Irish Academy, which is generally recognized as representing the best in all areas of research and scholarship in Ireland, including climate science, was also not aware of the call for submissions up to that date. Any notification to the Academy of the call for submissions would immediately have been forwarded to me in my capacity as chairman of their Climate Change Sciences Committee. As that committee just reached the end of its four-year term last Thursday and no successor committee has yet been appointed, I wish to make my submission in my personal capacity as a climate scientist and member of the Academy.

The title of my submission is "Climate Change Science: An Overview of the Current Status". Since the main motivation for the Bill is to address the threat of dangerous man-made climate change, I believe it is important that the Committee should receive an overall briefing (or briefings) on the current status of climate change science from a scientist (or scientists) with solid international credentials in this area, who can present an up-to-date and objective assessment of the climate change threat. I believe such a briefing is relevant to the Bill in that it will help the Committee to consider whether the Government should aim to go beyond EU requirements in reducing Irish greenhouse gas emissions, or whether it should aim to influence EU requirements in a way that will be less demanding on Ireland.

As reasons why I, in particular, should be should be chosen to make such a presentation, I would mention the following factors:

1. I have the longest and broadest experience in climate research of any climate scientist in Ireland. I obtained a PhD in meteorology from the Massachusetts Institute of Technology (MIT) in 1969 and have been active in research in meteorology and climate at an international level since then. My PhD supervisor at MIT was Prof. Jule Charney, who was the leading meteorological scientist of the 20th century. He was the lead author of the first assessment report for policymakers on the dangers of increasing carbon dioxide in the atmosphere ("Carbon Dioxide and Climate: A Scientific Assessment", 1979, National Academy of Sciences, Washington D.C.). The breadth of my research contributions can be seen by referring to my home page at www.raybates.net.

2. I am a member of both the Royal Irish Academy (RIA, elected in1986) and the Academia Europaea (elected in 1998). I am the only Irish climate scientist to have achieved both of these distinctions. I have been chairman of the RIA's Climate Change Sciences Committee from 2009 to 2013.

3. I have been the recipient of three awards for my research work: (a) The Napier Shaw Memorial Prize of the Royal Meteorological Society (UK), 1971; (b) The Laboratory for Atmospheres Scientific Achievement Award, NASA Goddard Space Flight Center, 1994; (c) The Vilhelm Bjerknes Medal, European Geosciences Union, 2009 (http://www.egu.eu/awards-medals/awards-medals/award/vilhelm-bjerknes/j-ray-bates.html).

4. I have the broad experience of having worked at Met Eireann (where I was Head of the Research Division and was promoted to the level of Assistant Director), at NASA's Goddard Space Flight Centre (where I was a senior scientist from 1987 to 1995) and at the Niels Bohr Institute of the University of Copenhagen (where I was Professor of Meteorology from 1995 to 2004). Since 2004, I have been Adjunct Professor of Meteorology in the Meteorology and Climate Centre at UCD. I am still active in climate research, as can be seen by referring to www.raybates.net.

5. As I am a physical climate scientist, my expertise lies in the central area of climate science. In hearings on climate change held by a previous Oireachtas Committee in 2009, only a geographer and a representative of Friends of the Earth were called to give testimony, no physical climate scientist being included. (see: http://oireachtasdebates.oireachtas.ie/Debates%20Authoring/DebatesWebPack.nsf/committeetakes/CLJ2009061000003?opendocument).

6. I was a member of the Panel of Experts of the Chief Scientific Adviser to the Government of Ireland (then Prof. Patrick Cunningham) from 2009 to 2012, representing the area of climate science on the panel. I was chosen for the panel on the basis of an open, competitive selection process. I think it is relevant to point out that no such open, competitive selection process is being, or has been, used in appointing participants to represent Ireland on the Intergovernmental Panel on Climate Change (IPCC).

Further details of my credentials can be found at www.raybates.net.

Thanking you for your consideration,

Yours sincerely,

J. Ray Bates (Prof.)
Email: ray.bates@ucd.ie
Mobile: 085 724 7781

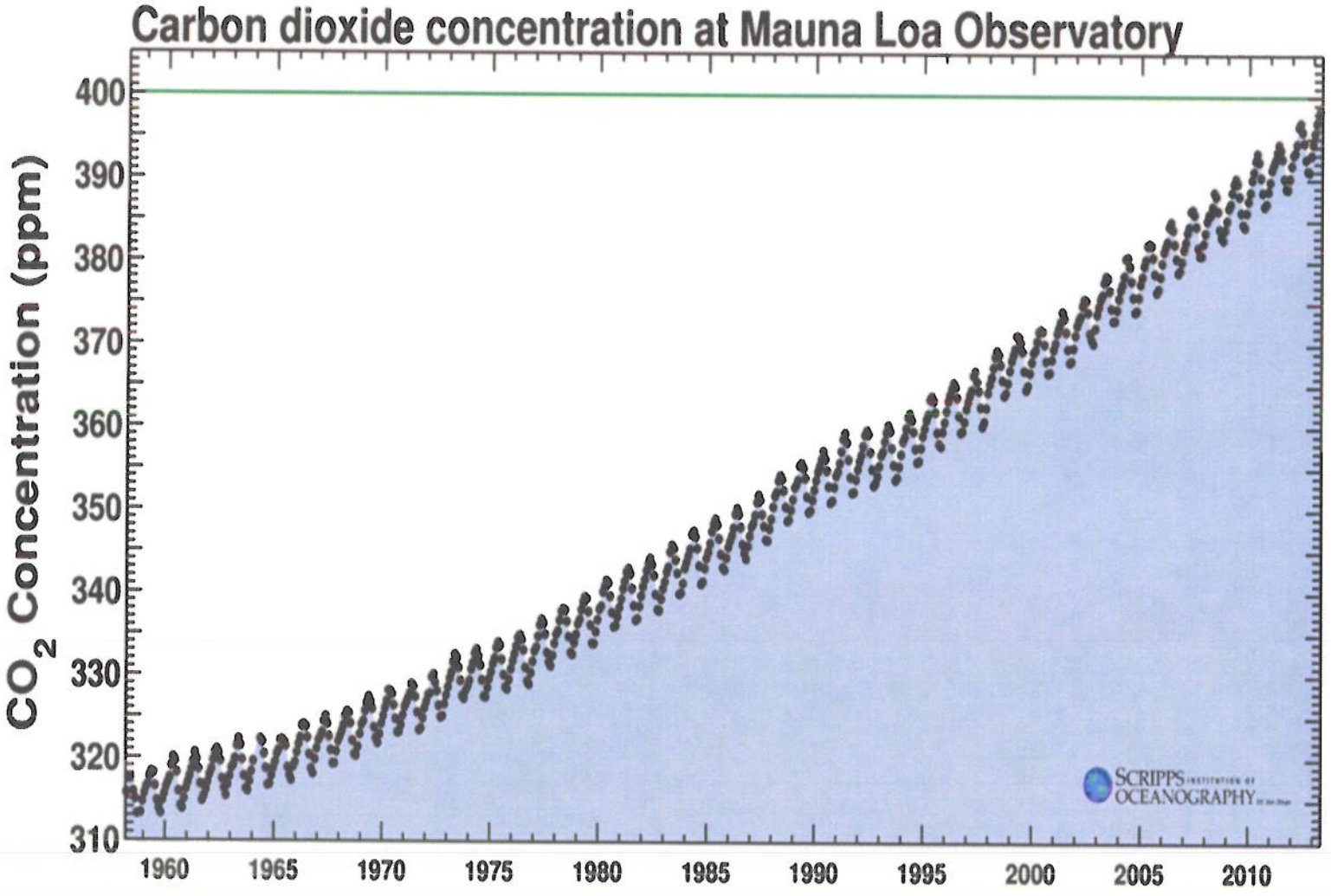
--

Climate Change Science:
An Overview of the Current Status

Prof. J. Ray Bates
Meteorology and Climate Centre,
School of Mathematical Sciences,
UCD, Belfield, Dublin 4.

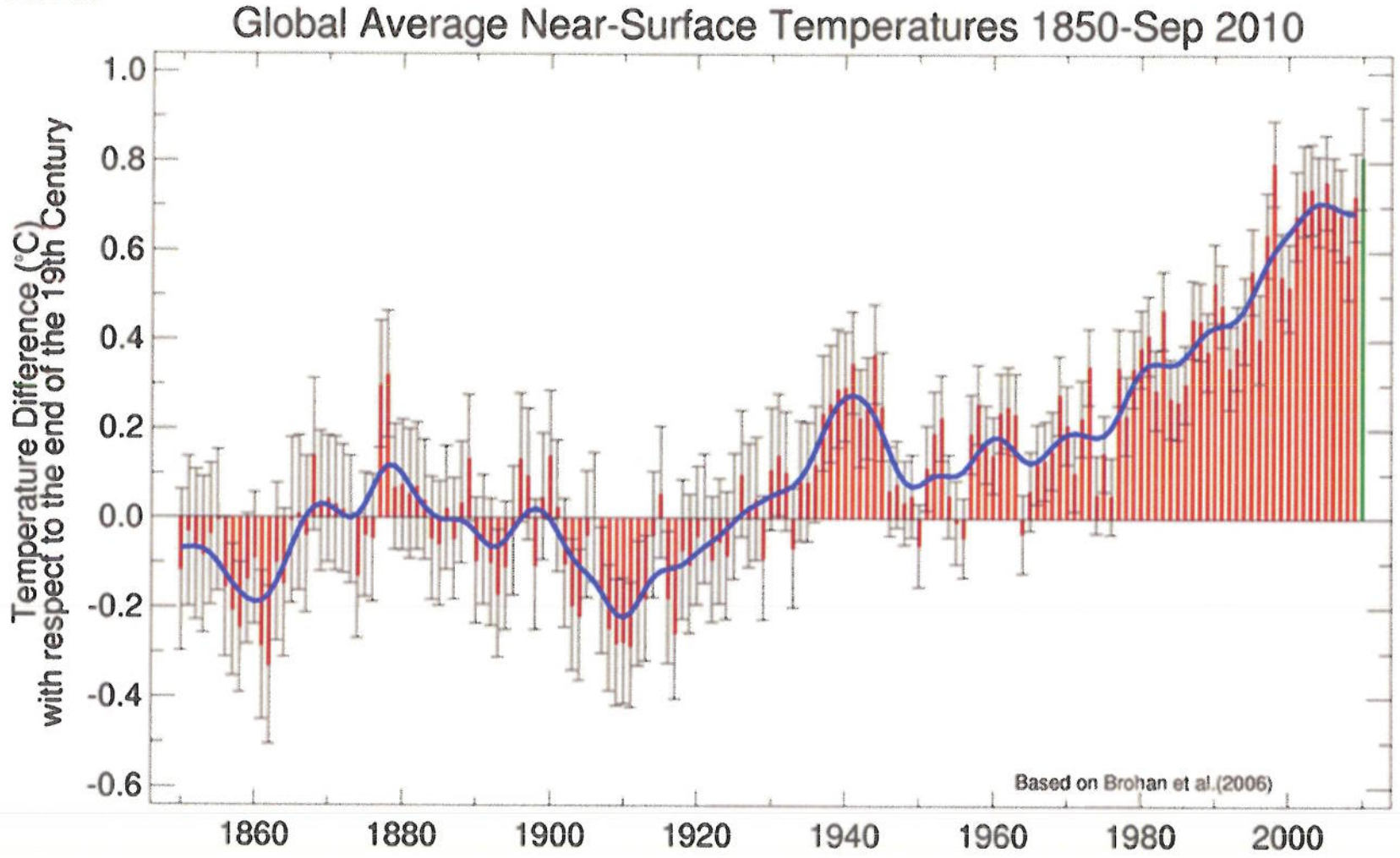
1. Carbon Dioxide Increase
2. Global temperature Rise
3. Sea Level Rise
4. Polar Sea Ice changes
5. Natural Climate Variability
6. Irish Temperature Changes, 1900- 2012.
7. Climate Model Projections and Some Recent Developments in Climate Sensitivity.
8. Conclusions

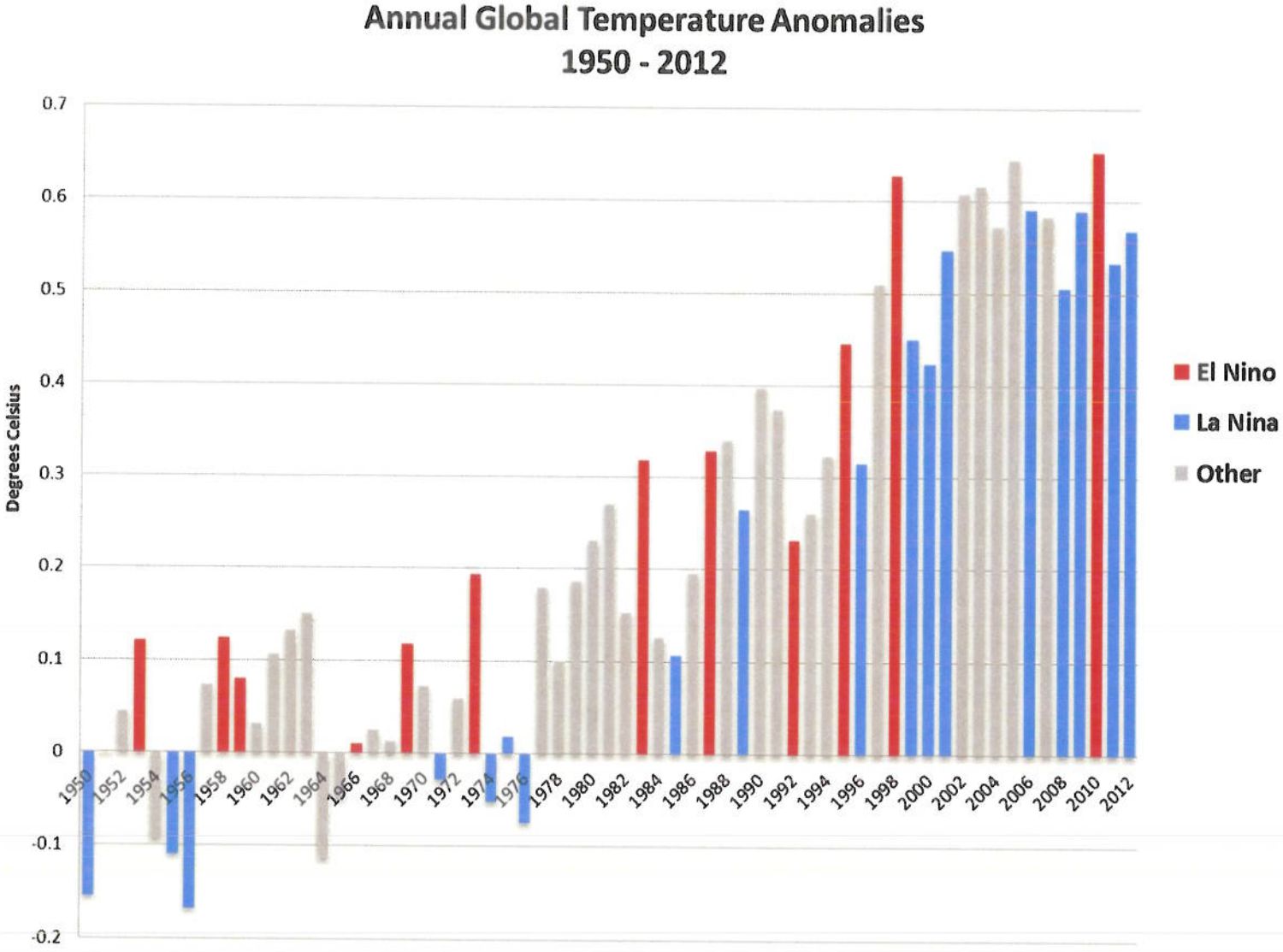
Carbon Dioxide Increase

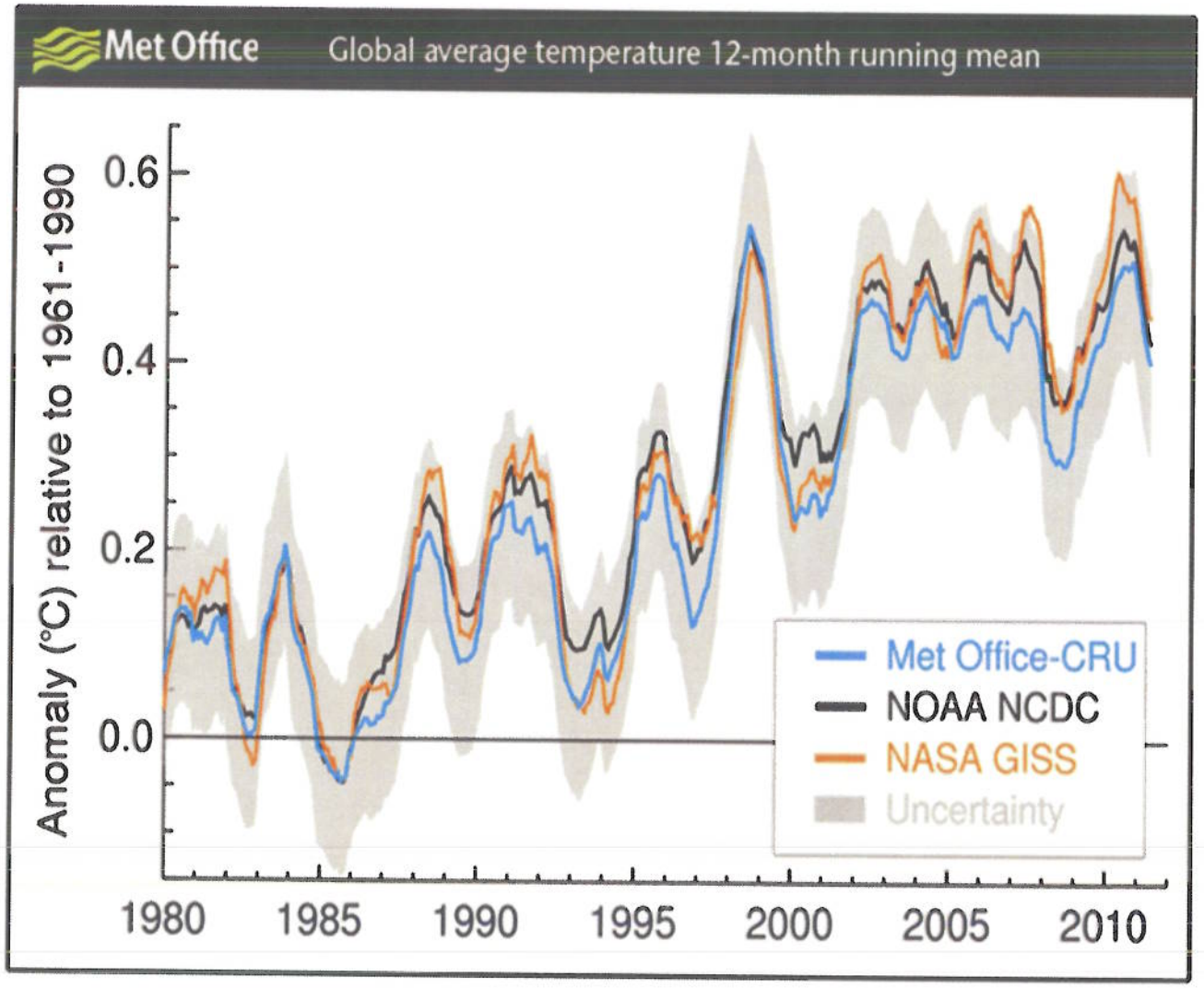

Carbon dioxide concentration at Mauna Loa Observatory
CO_2 Concentration (ppm)
400
390
380
370
360
350
340
330
320
310
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
SCRIPPS INSTITUTION OF OCEANOGRAPHY

Global Temperature Rise

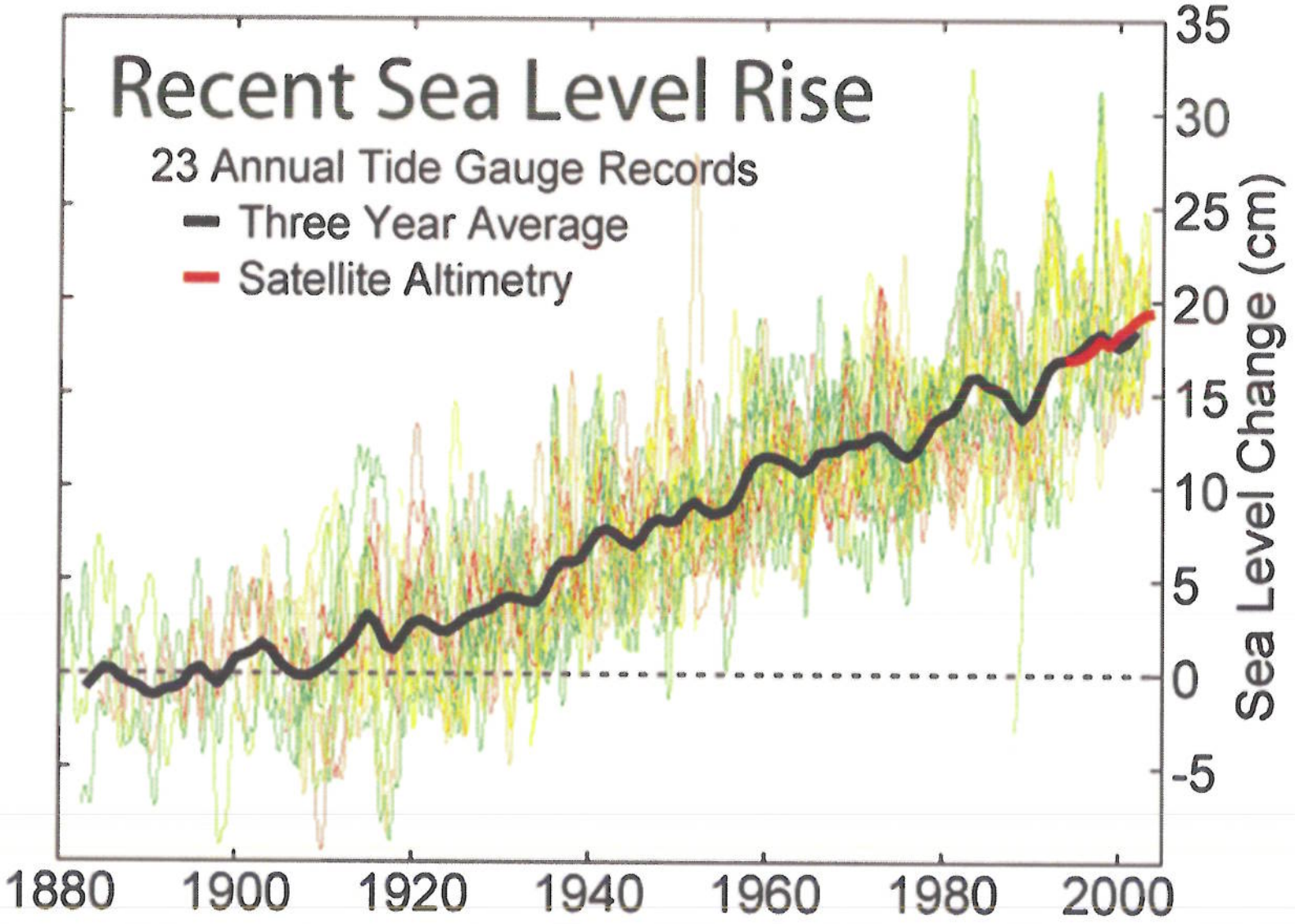
Met Office

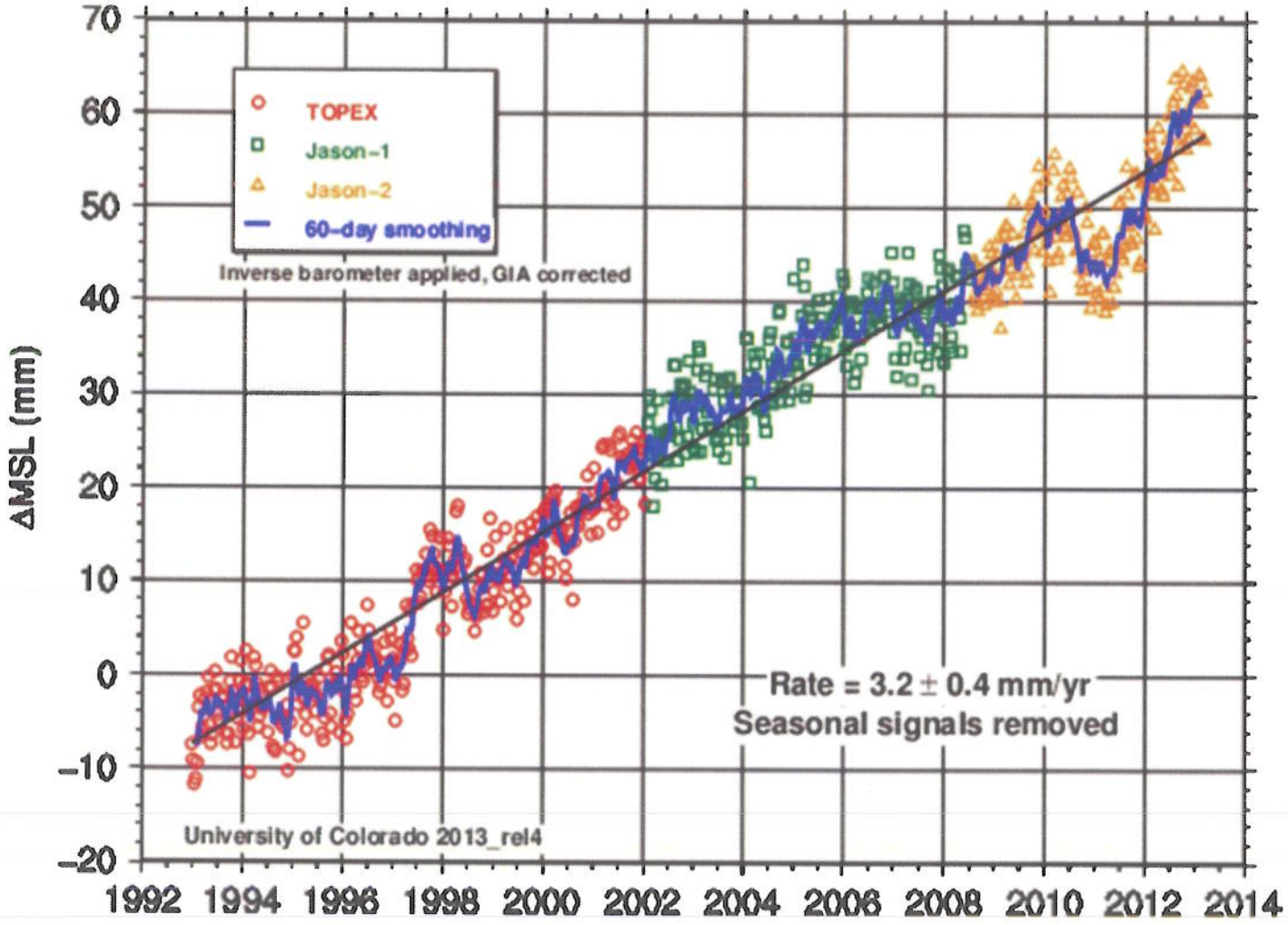

Global Average Near-Surface Temperatures 1850-Sep 2010
Temperature Difference (°C)
with respect to the end of the 19th Century
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1860
1880
1900
1920
1940
1960
1980
2000
Based on Brohan et al.(2006)


Annual Global Temperature Anomalies
1950 - 2012
Degrees Celsius
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
El Nino
La Nina
Other

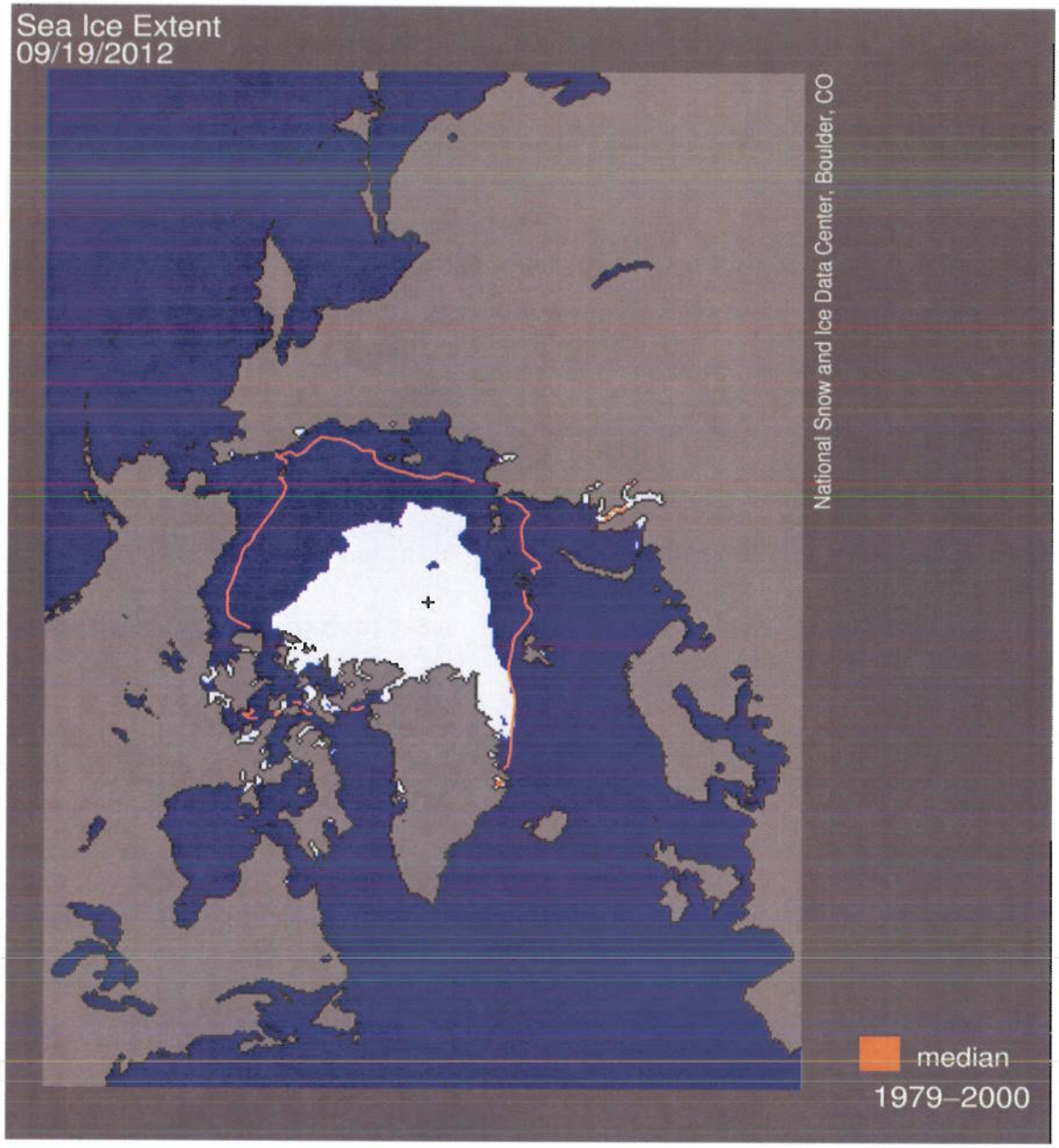

Met Office
Global average temperature 12-month running mean
Anomaly (°C) relative to 1961-1990
0.6
0.4
0.2
0.0
1980
1985
1990
1995
2000
2005
2010
Met Office-CRU
NOAA NCDC
NASA GISS
Uncertainty

Sea Level Rise

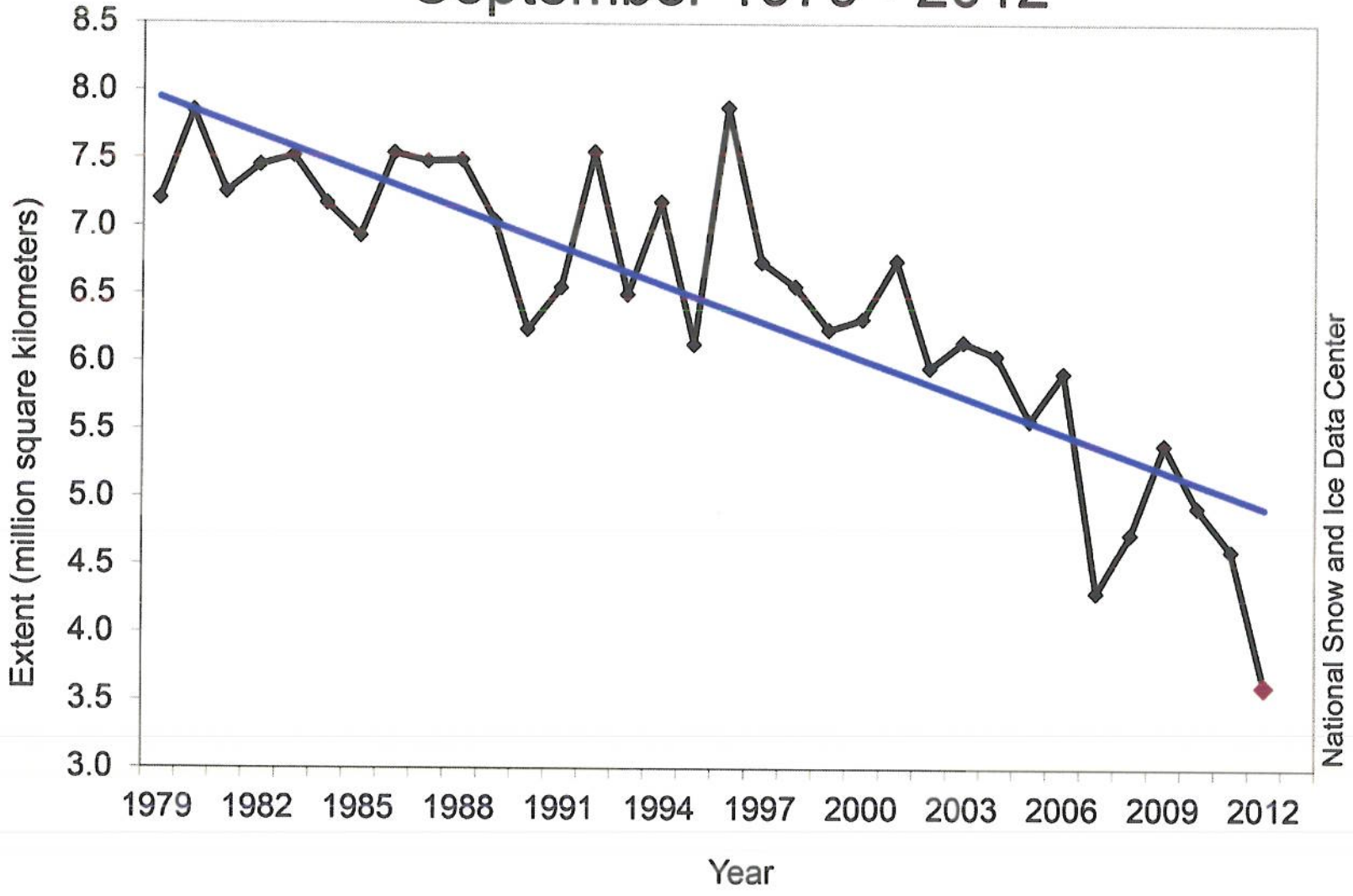

Recent Sea Level Rise
23 Annual Tide Gauge Records
Three Year Average
Satellite Altimetry
35
30
25
20
15
10
5
0
-5
Sea Level Change (cm)
1880
1900
1920
1940
1960
1980
2000

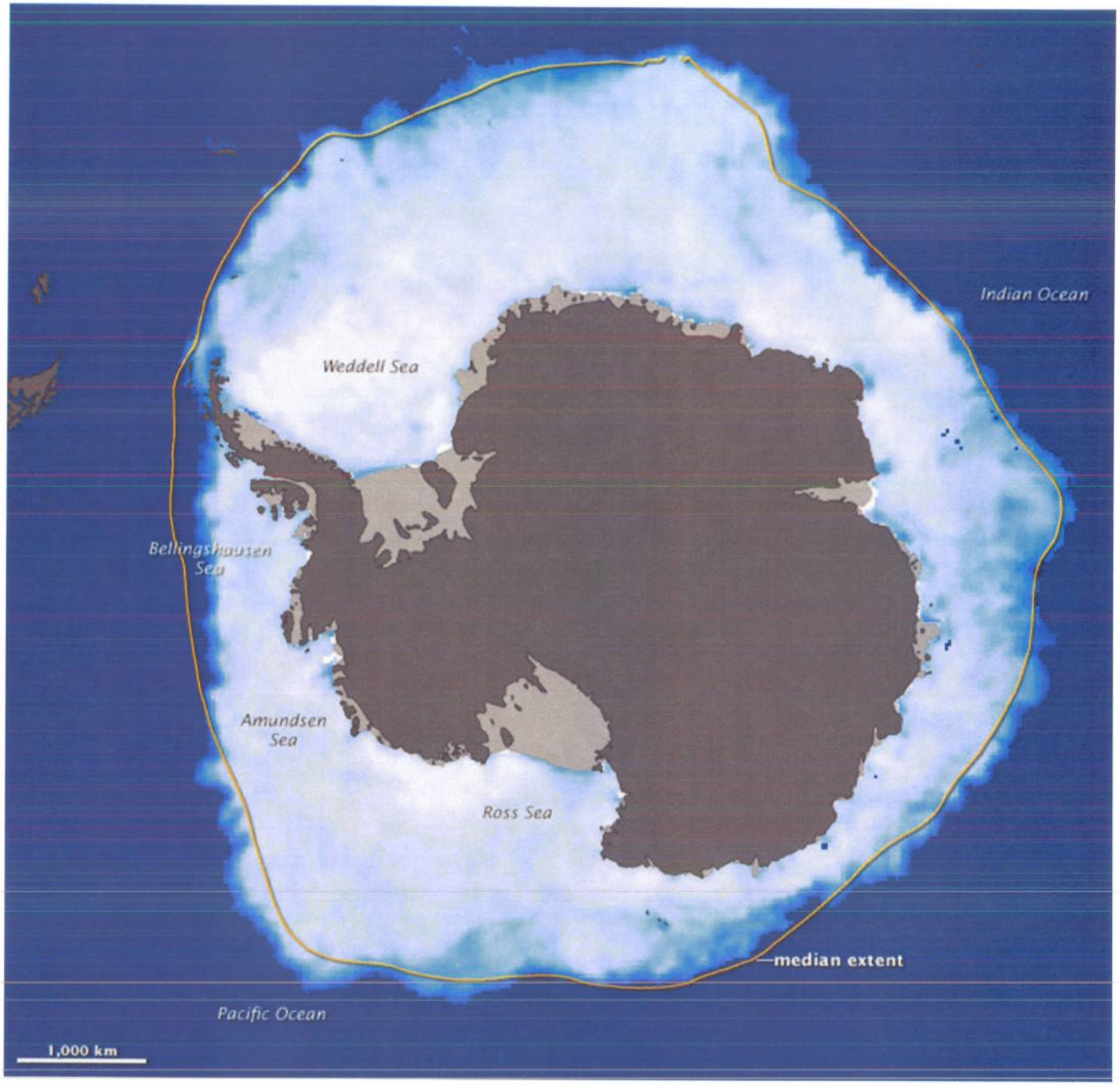

TOPEX
Jason-1
Jason-2
60-day smoothing
Inverse barometer applied, GIA corrected
Rate = 3.2 ± 0.4 mm/yr
Seasonal signals removed
University of Colorado 2013_rel4
ΔMSL (mm)
70
60
50
40
30
20
10
0
-10
-20
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

Polar sea ice changes


Sea Ice Extent
09/19/2012
National Snow and Ice Data Center, Boulder, CO
median
1979–2000

Average Monthly Arctic Sea Ice Extent
September 1979 - 2012



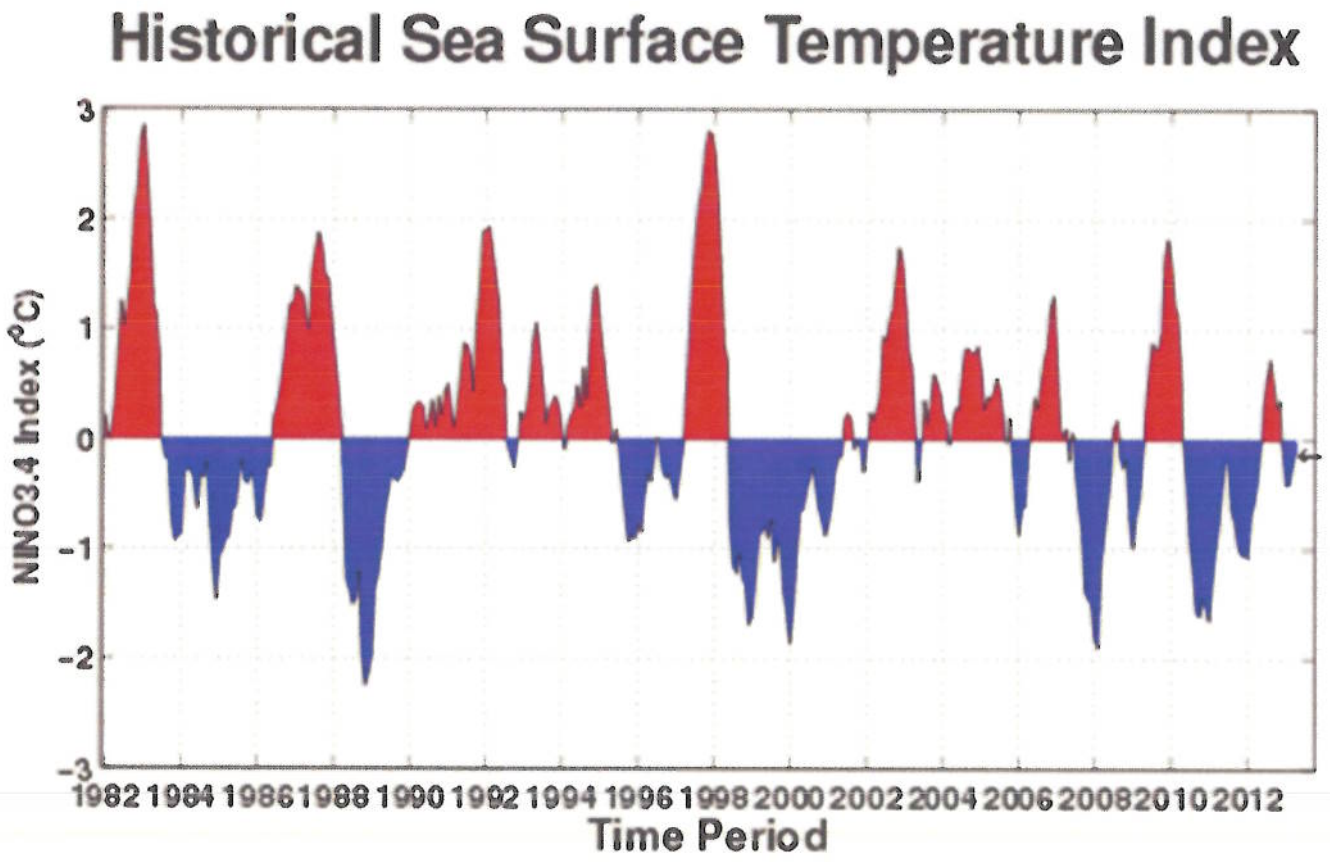

Indian Ocean
Weddell Sea
Bellingshausen Sea
Amundsen Sea
Ross Sea
median extent
Pacific Ocean
1,000 km

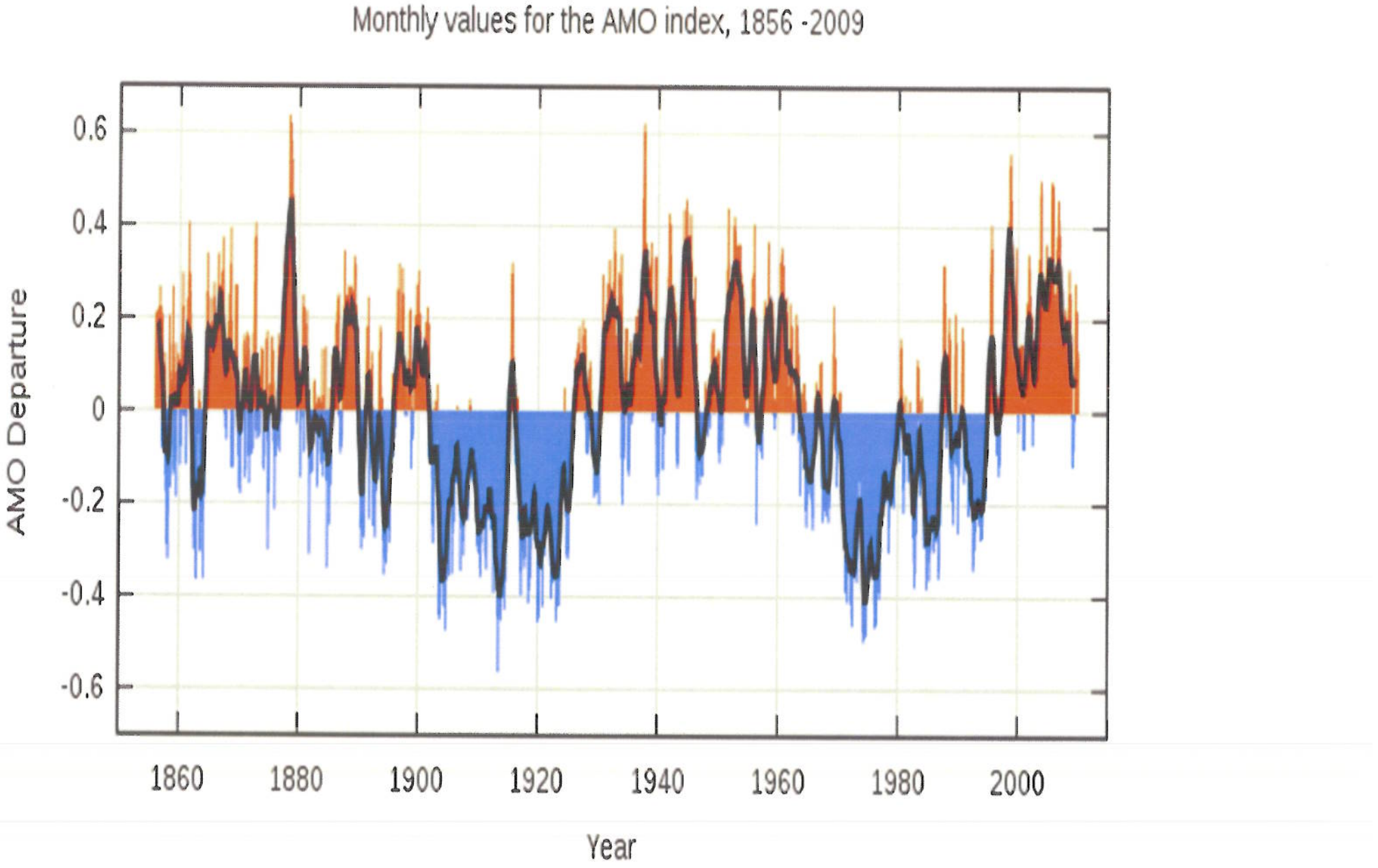
At the time of end-of-summer sea ice minimum (September in the Arctic, March in the Antarctic):

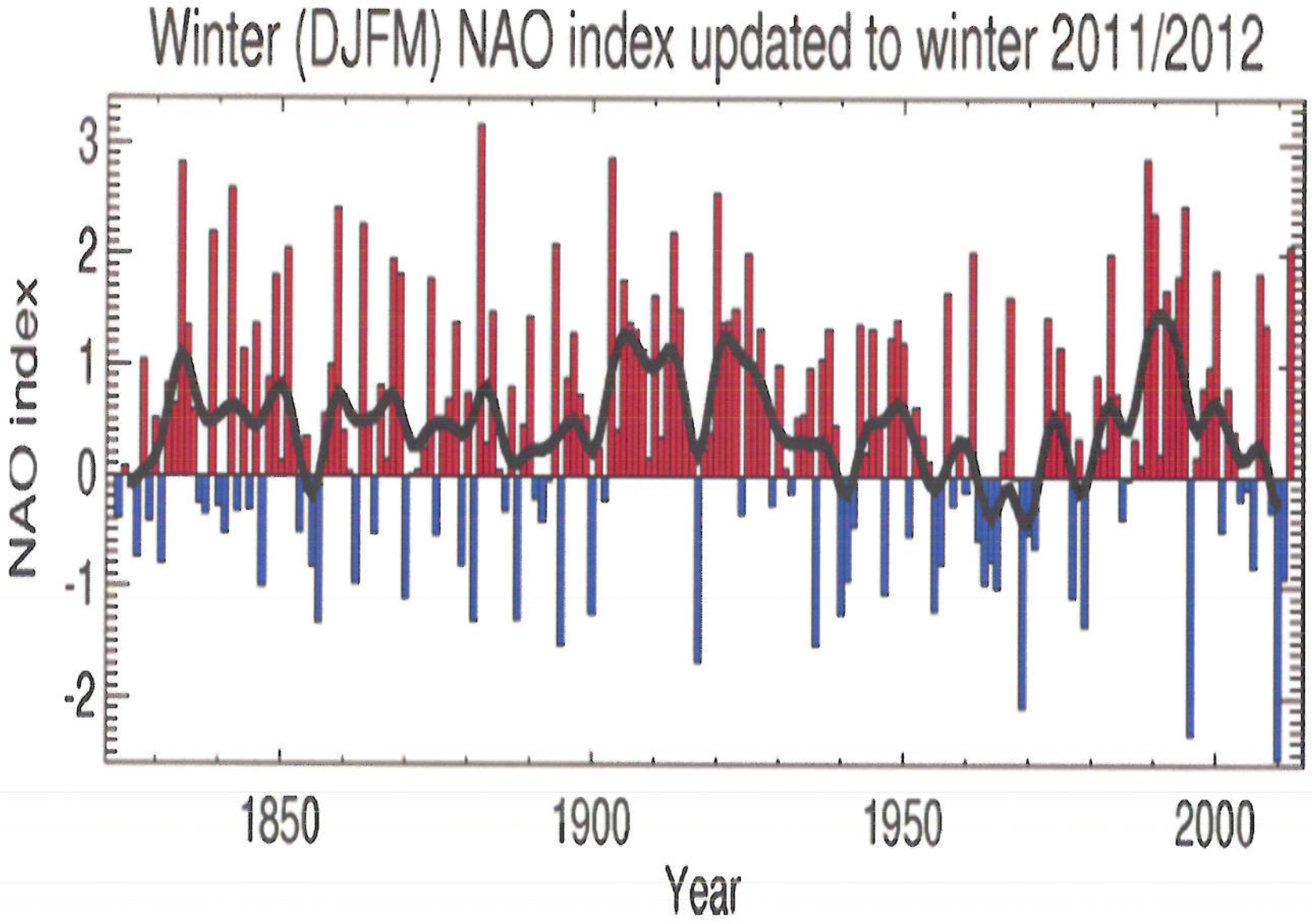
The Arctic sea ice extent is decreasing at a rate of 13% per decade, but the Antarctic sea ice extent is increasing at a rate of 5% per decade, relative to the 1979 to 2000 average.

[Turner et al., 2013, Journal of Climate, Vol. 26, 1473-1484]

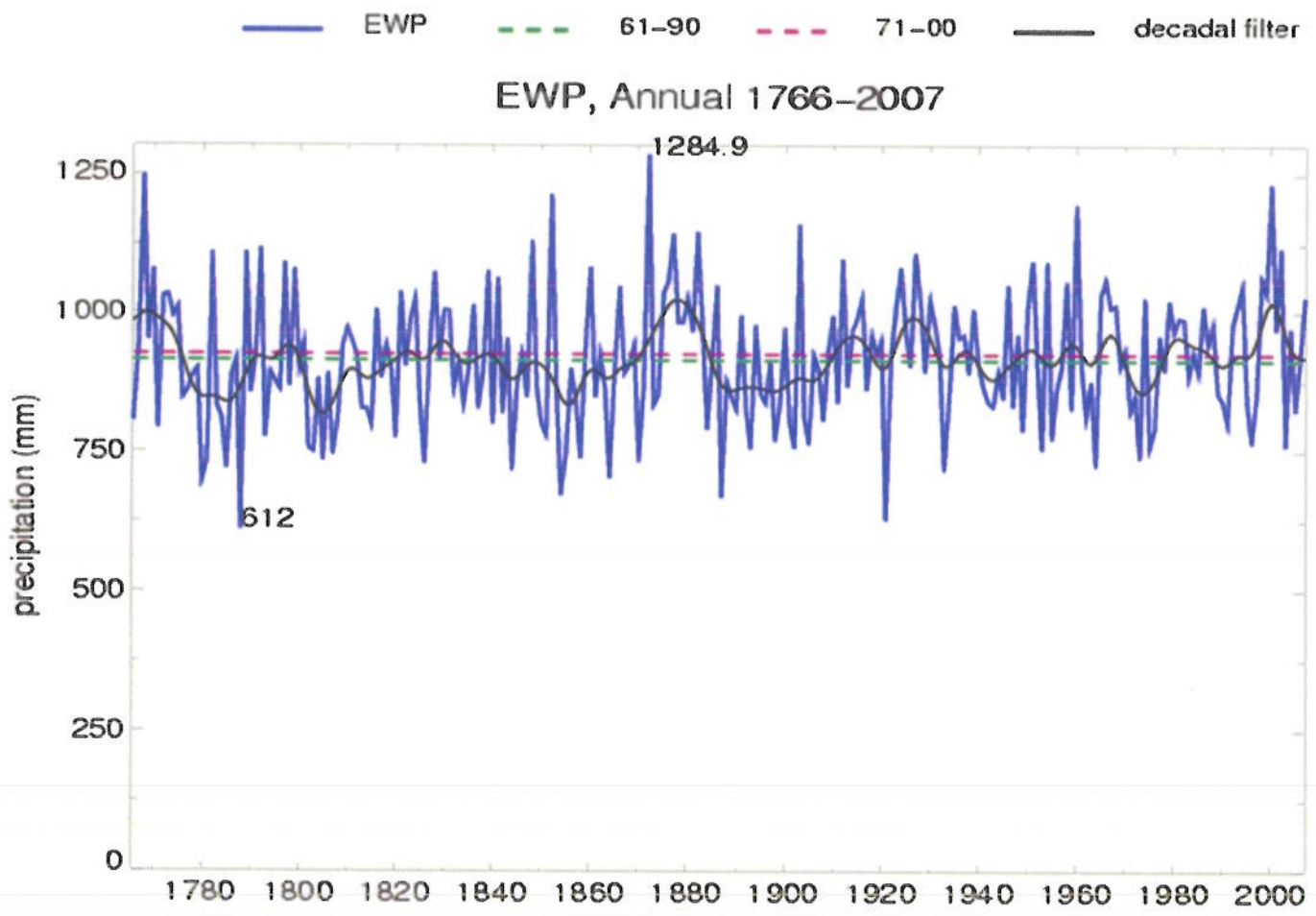
Natural Climate Variability


Historical Sea Surface Temperature Index
NINO3.4 Index (°C)
3
2
1
0
-1
-2
-3
1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Time Period


Monthly values for the AMO index, 1856 -2009
AMO Departure
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1860
1880
1900
1920
1940
1960
1980
2000
Year

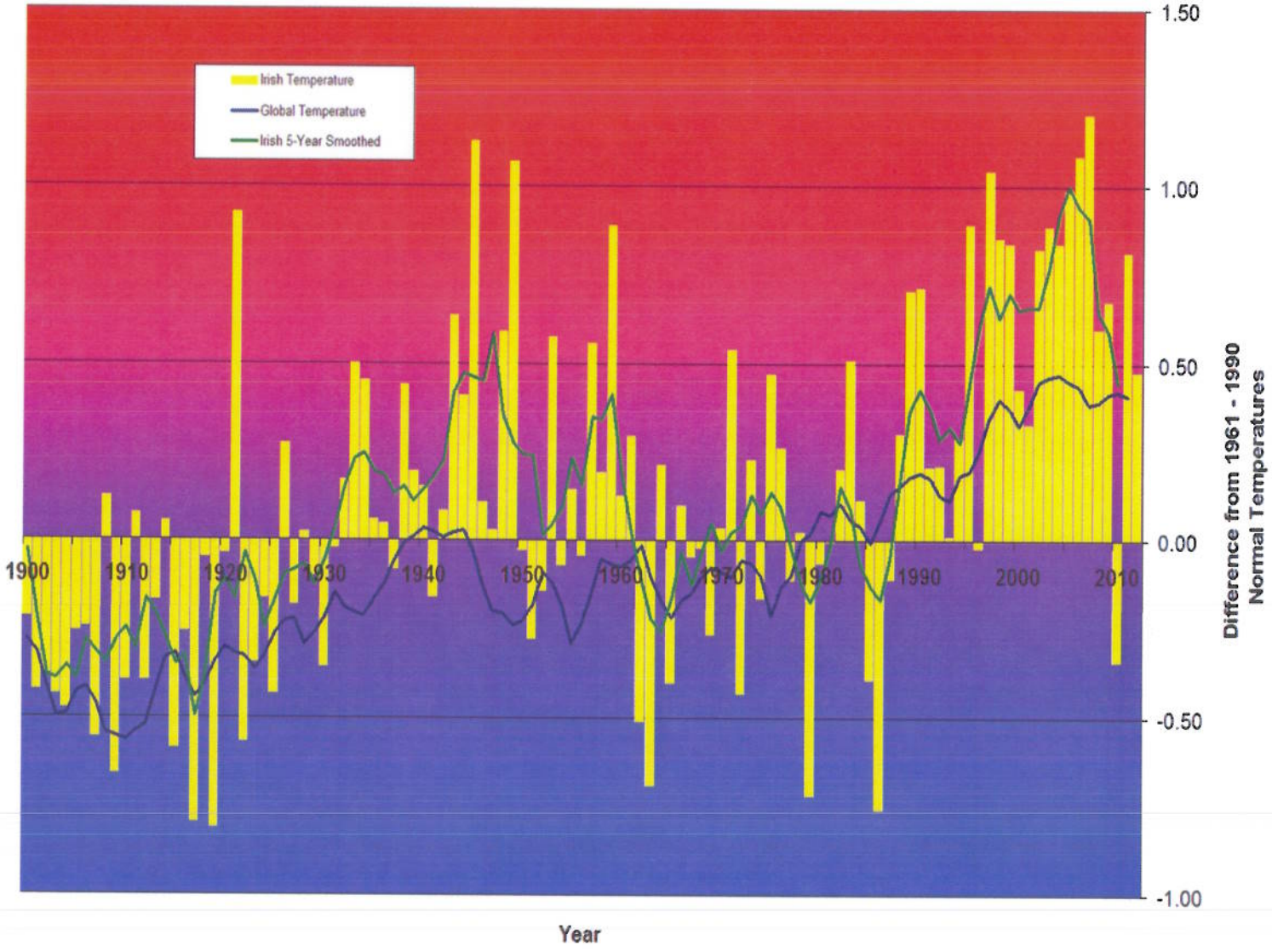

Winter (DJFM) NAO index updated to winter 2011/2012
NAO index
3
2
1
0
-1
-2
1850
1900
1950
2000
Year

England and Wales Annual Precipitation 1766-2007



Irish Temperature Changes 1900-2012

1900-2012 Air Temperature Difference from 1961-1990 Normal Values



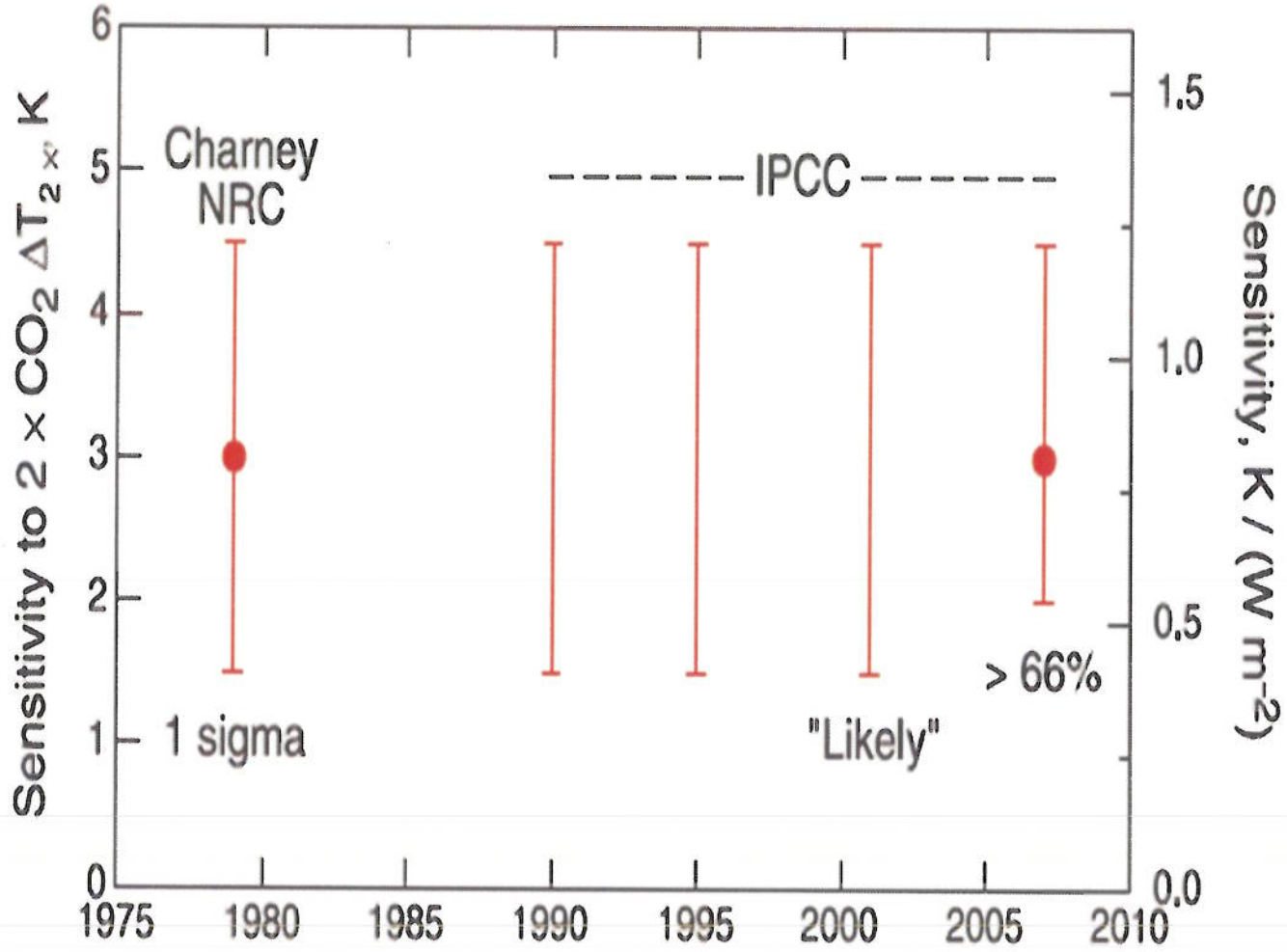
- In the 22-year period 1986-2007, annual average Irish temperatures were increasing at more than twice the global average rate.

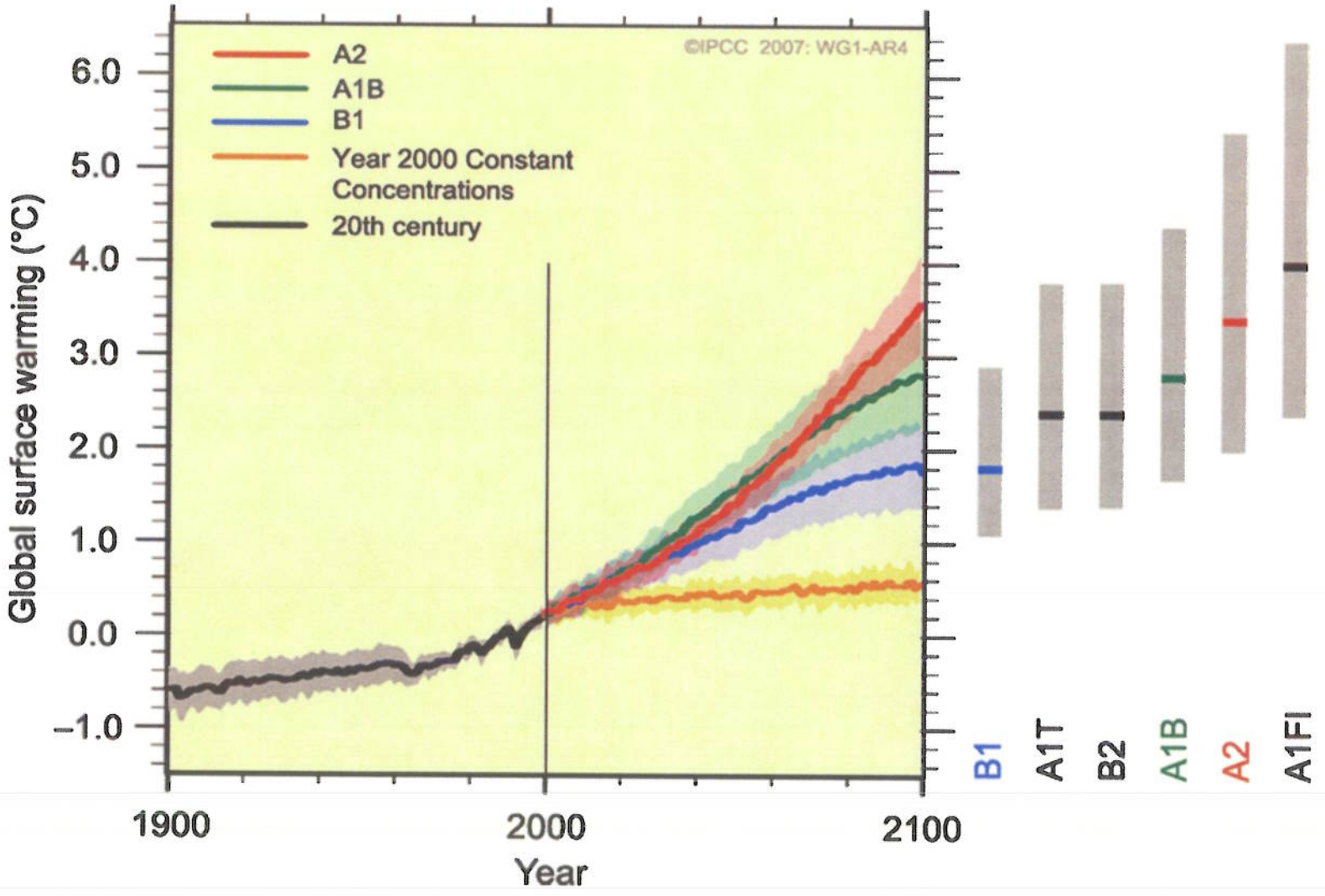
- It is virtually impossible that this high rate of increase could be have been due mainly to anthropogenic causes, since Ireland has a maritime climate (strongly influenced by the Atlantic) and ocean temperatures increase more slowly under anthropogenic forcing than the global average.

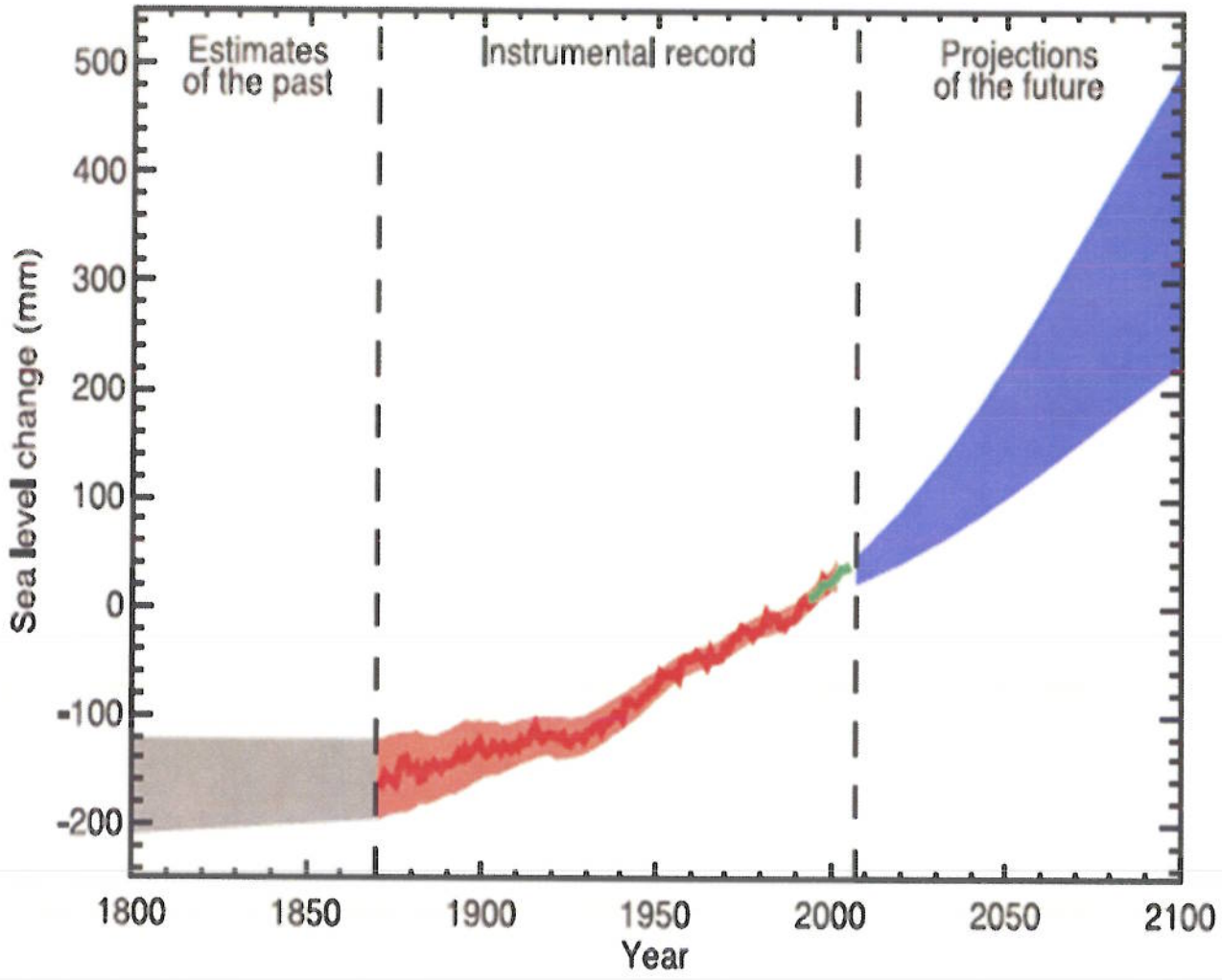
- It is very likely that the high rate of increase of Irish temperatures in the period 1986-2007 was due mainly to aspects of natural variability such as the Atlantic Multidecadal Oscillation (AMO), which was in a phase of increasing temperature during this period, and the North Atlantic Oscillation (NAO), which was becoming increasingly positive for most of that period.

- Since 2007, annual average Irish temperatures have been in rapid decline.

Climate Model Projections and Some Recent Developments in Climate Sensitivity.

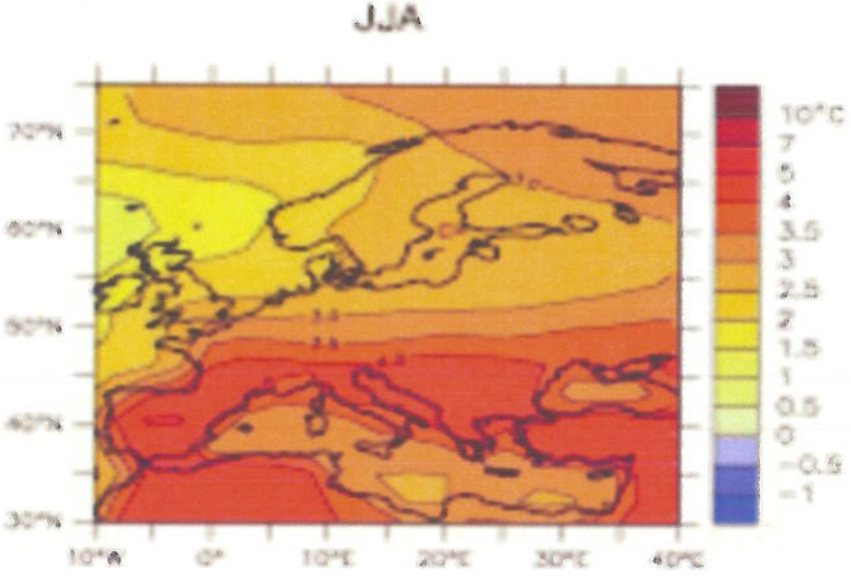

Sensitivity to 2 × CO2 ΔT2×, K
Sensitivity, K / (W m-2)
Charney
NRC
IPCC
1 sigma
"Likely"
> 66%
0
1
2
3
4
5
6
0.0
0.5
1.0
1.5
1975
1980
1985
1990
1995
2000
2005
2010


©IPCC 2007: WG1-AR4
A2
A1B
B1
Year 2000 Constant Concentrations
20th century
Global surface warming (°C)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
1900
2000
2100
Year
B1
A1T
B2
A1B
A2
A1FI


Estimates of the past
Instrumental record
Projections of the future
Sea level change (mm)
500
400
300
200
100
0
-100
-200
1800
1850
1900
1950
2000
2050
2100
Year

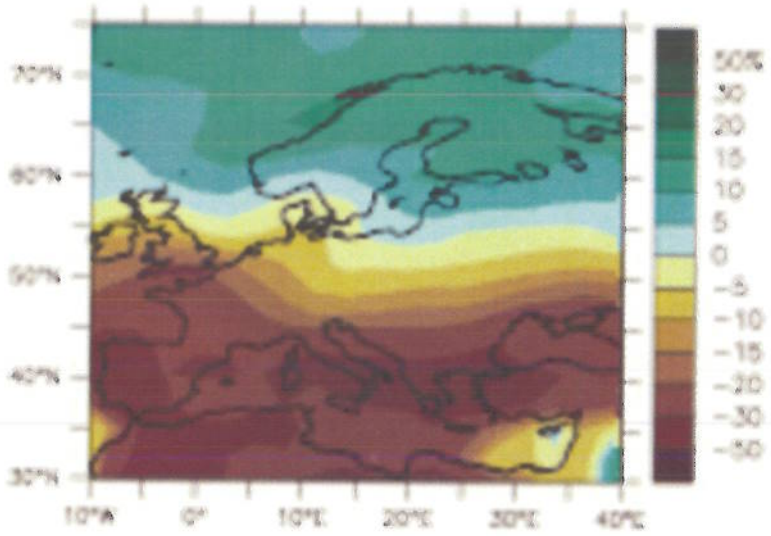
IPCC Fourth Assessment Report (2007).

Projected temperature changes over Europe in summer, period (2080-2099) minus period (1980-1999).



IPCC Fourth Assessment Report (2007).

Projected precipitation changes (%) over Europe in summer, period (2080-2099) minus period (1980-1999).



Recent studies suggesting that the climate may be less sensitive to CO_2 increase than previously believed:

- Lindzen, R. S. and Y.-S. Choi, 2011. On the Observational Determination of Climate Sensitivity and Its Implications. *Asia-Pacific J. Atmos. Sci.*, 47(4), 377-390.
- Bates, J.R., 2012. Climate stability and sensitivity in some simple conceptual models. *Climate Dynamics*, 38, 455-473.
- Tung, K.-K. and J. Zhou, 2013: "Using Data to Attribute Episodes of Warming and Cooling in Instrumental Records", *Proc. of National Academy of Sciences*, 110.
- J. Zhou and K. K. Tung, 2013: "Deducing Multidecadal Anthropogenic Global Warming Trends Using Multiple Regression Analysis", *J. Atmospheric Sciences*, 70, 3-8.

Conclusions

1. Most of the global average temperaure rise (0.8˚C) and sea level rise (20 cm) of the past century is with a high degree of certainty due to human activities. Sea level is now estimated to be rising at a rate of 3.2 mm/yr.

2. Climate models project that, if emissions continue unabated, these trends will continue. However, recent research suggests that the future rate of increase of global average temperature may not be quite as fast as previously feared.

3. Locally, in our North Atlantic location, much of what may appear to be man-made climate change is actually natural variability.

4. If model projections turn out to be even approximately true, the Mediterranean countries will become so hot and dry in summer by the end of the century that agriculture there will be seriously affected. In such circumstances, Ireland's less affected climate will become a very important asset in terms of European food security.