Engineering the Global Thermostat!

Part A - Humanitys' Dilemma

Blueprints for Sustainable Infrastructure Conference
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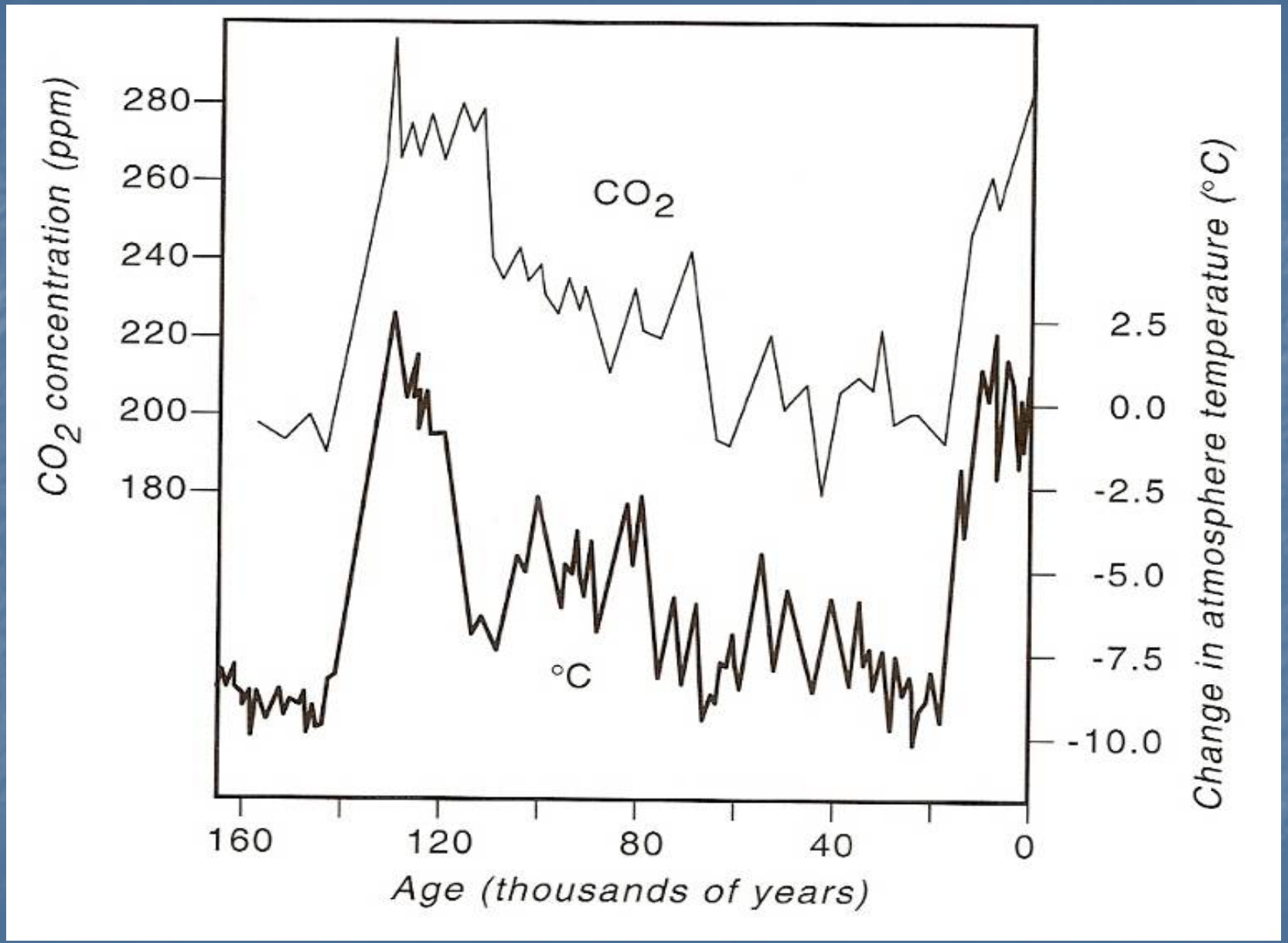
Dr John Russell
La Trobe University Bundoora Australia

a short history of progress

ronald wright

'Rarely have I read a book that is so gripping, so immediate and so important to our times. Jared Diamond will be jealous!'
ROBYN WILLIAMS, ABC


CO_2 concentration (ppm)
280
260
240
220
200
180
CO_2
°C
2.5
0.0
-2.5
-5.0
-7.5
-10.0
Change in atmosphere temperature (°C)
160
120
80
40
0
Age (thousands of years)

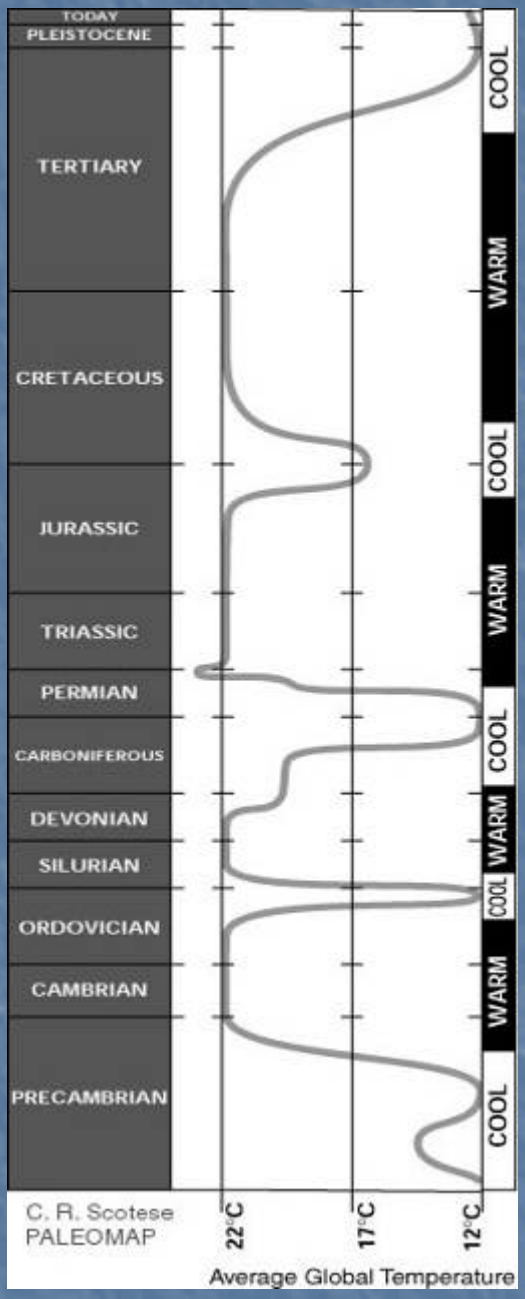

TODAY
PLEISTOCENE
TERTIARY
CRETACEOUS
JURASSIC
TRIASSIC
PERMIAN
CARBONIFEROUS
DEVONIAN
SILURIAN
ORDOVICIAN
CAMBRIAN
PRECAMBRIAN
COOL
WARM
COOL
WARM
COOL
WARM
COOL
WARM
COOL
C. R. Scotese
PALEOMAP
22°C
17°C
12°C
Average Global Temperature

Figure 1 1000 years of Northern Hemisphere Temperatures in a Degrees Centigrade. (Gore, 2006) Note. The last 160 years of temperature records have been measured not inferred.

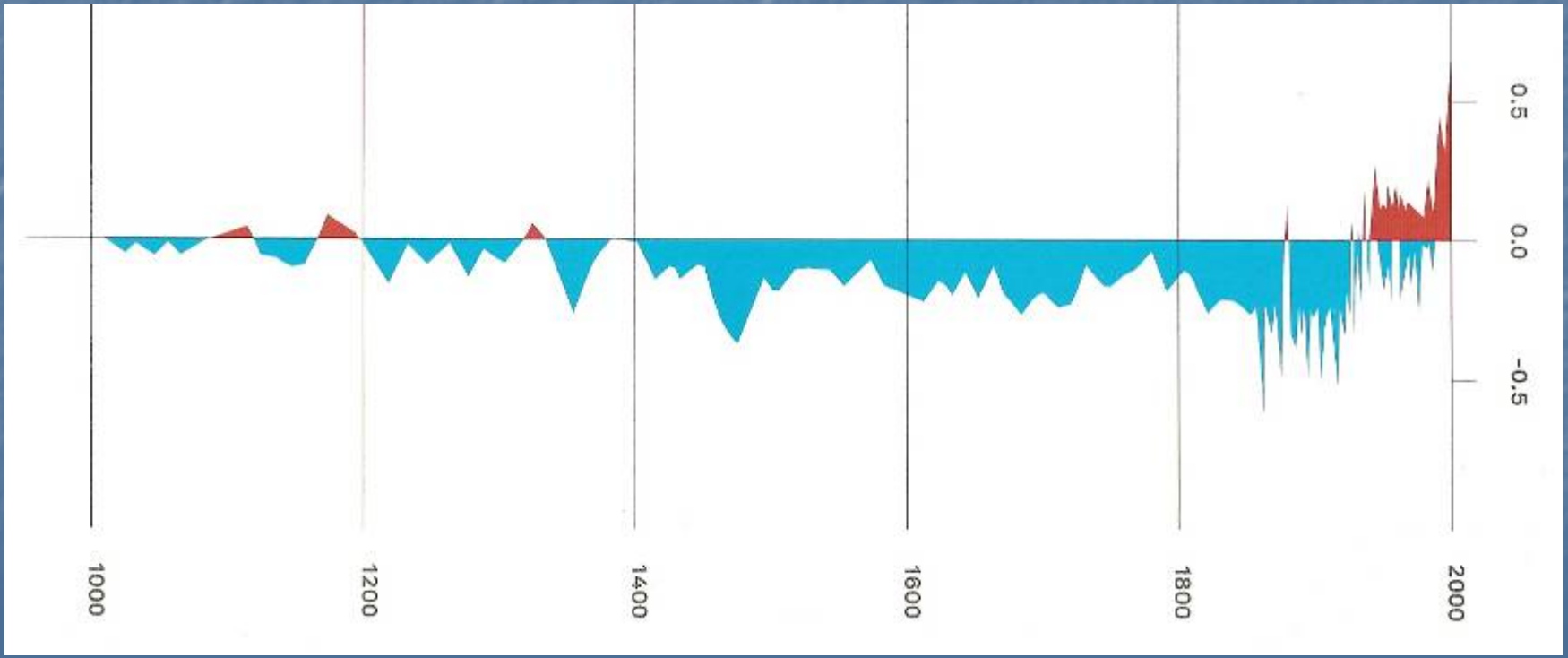
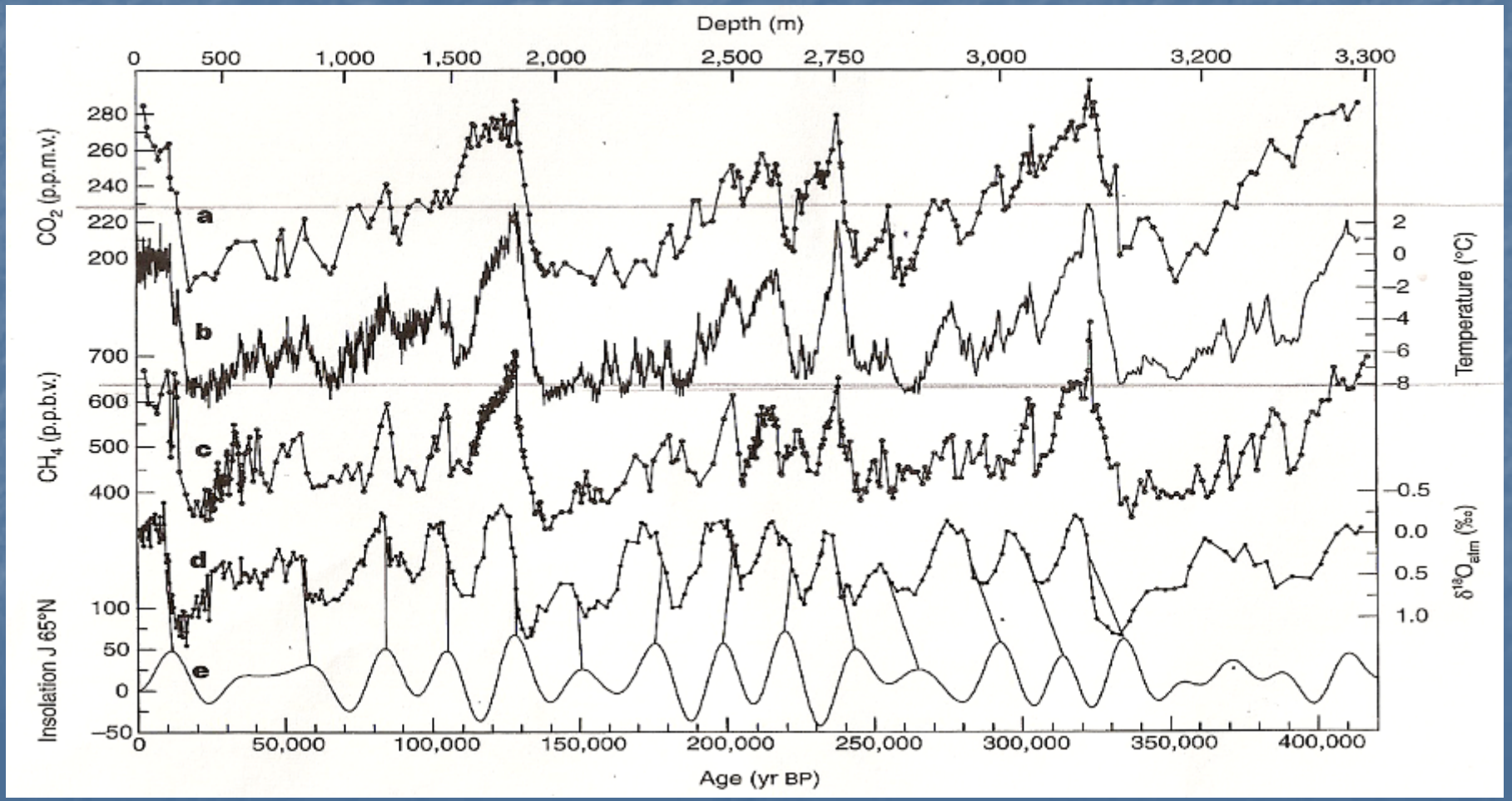


Figure 4 Vostok time series and Insolation (trace 'e') relationships to temperature methane (CH4) and carbon dioxide (CO2). (Showing Milanokovitch 100,000 year cycles)



INSOLATION

- IN coming SOL ar radiATION = INSOLATION

Predicting the Global Climate

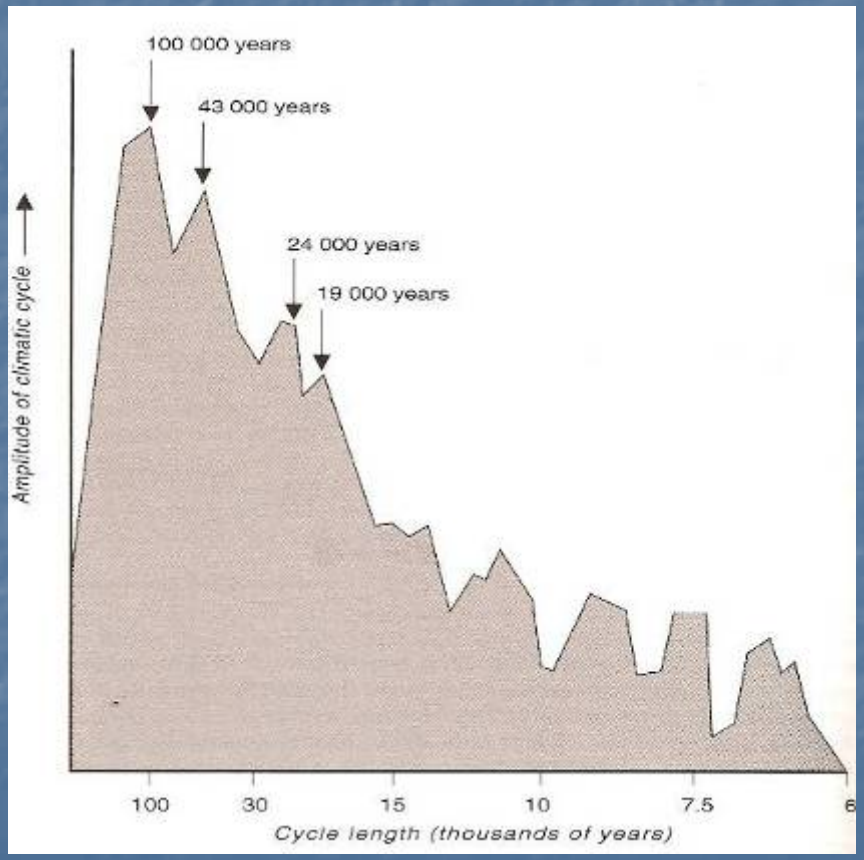
Milutin Milanovitch and James Croll

1. Variations in Earth's orbital eccentricity – The shape of the elliptical orbit around the Sun
2. Changes in Obliquity – Changes in the angle of the Earth's axis to the plane of orbit
3. Precession – The change in direction of the Earth's rotation

Spectral Analysis

- Peaks of periods 23,000; 42,000 & 100,000 year cycles
- These peaks correspond to 10; 25 and 50% of climate variance respectively
- At maximum eccentricity Earth experiences a reduction of about 30% of solar energy

Spectral Analysis and Holocene Temperature



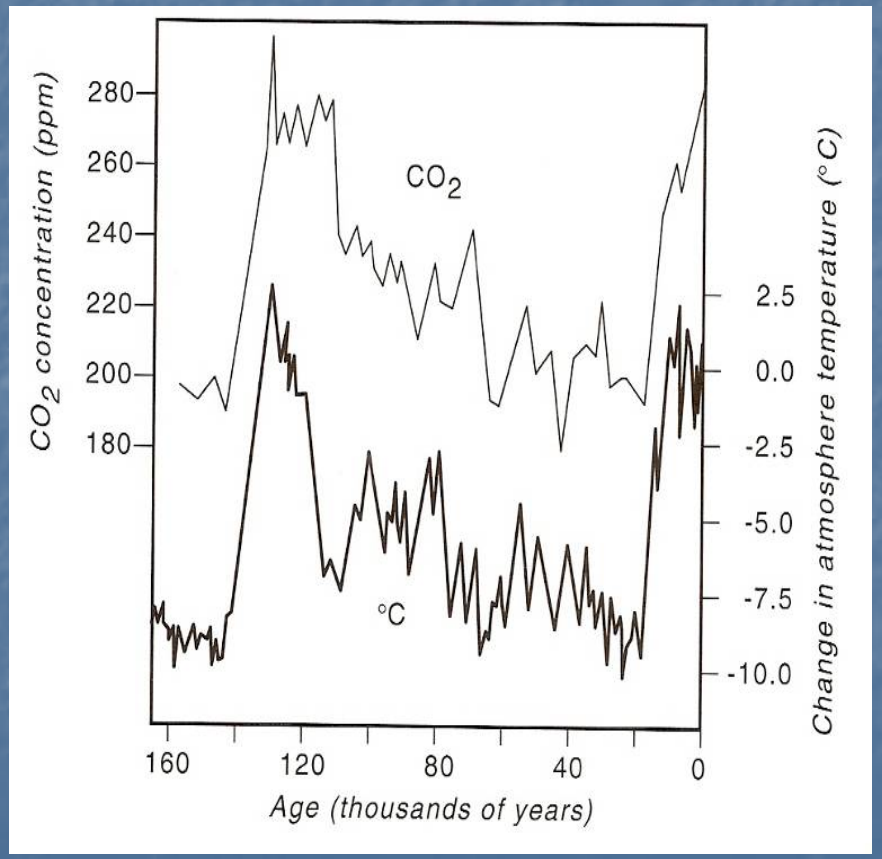


Figure 6. Orbiting the Sun. Long term variations of eccentricity (top), June insolation at 65° N (middle), and simulated Northern Hemisphere ice volume (increasing downward) (bottom) for 200,000 years before the present time to 130,000 from now.

Heavenly Bodies at Work!

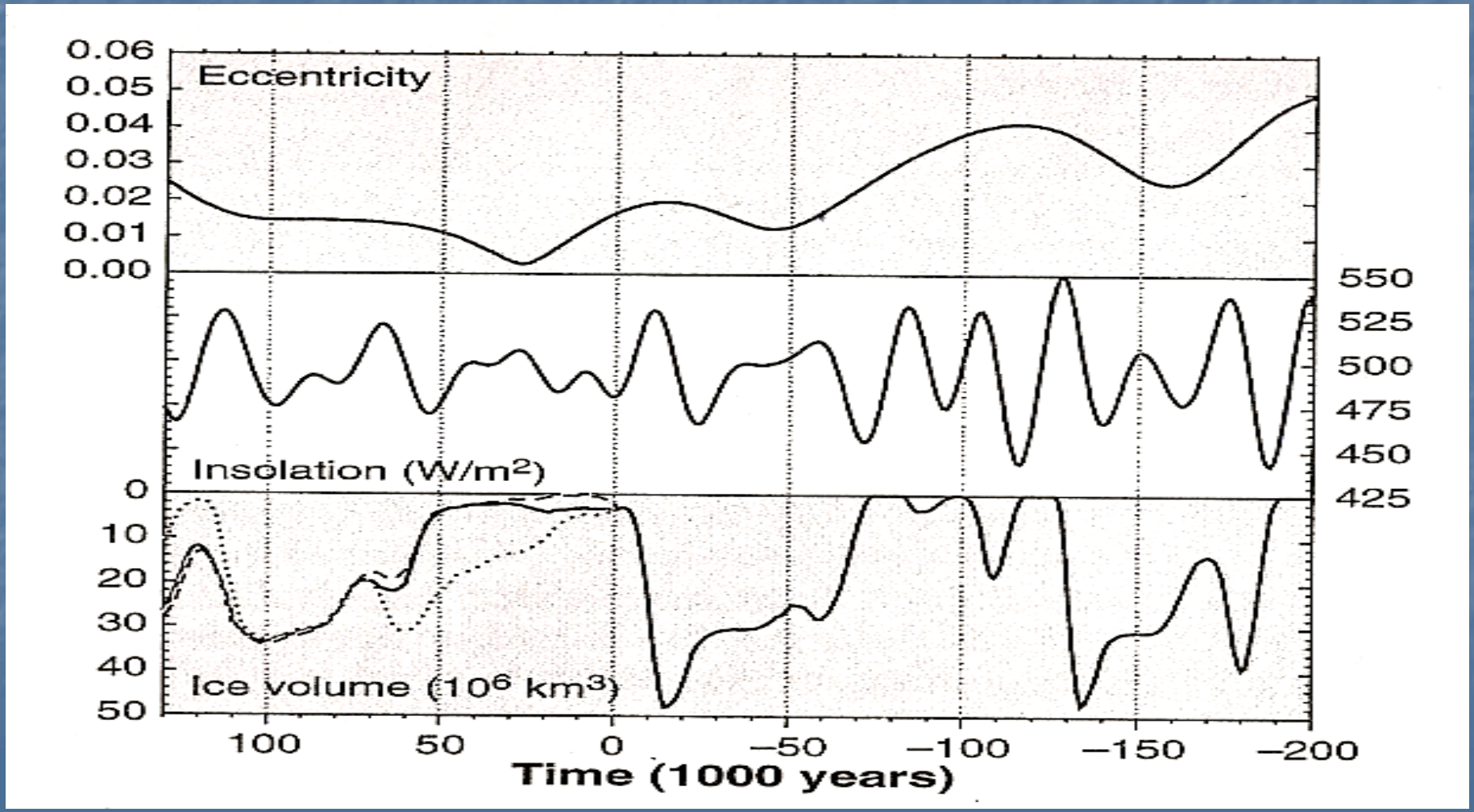


Table 1 IPCC Summary table showing mitigation categories, temperature rise, sea level rise and corresponding CO2 – equivalents.

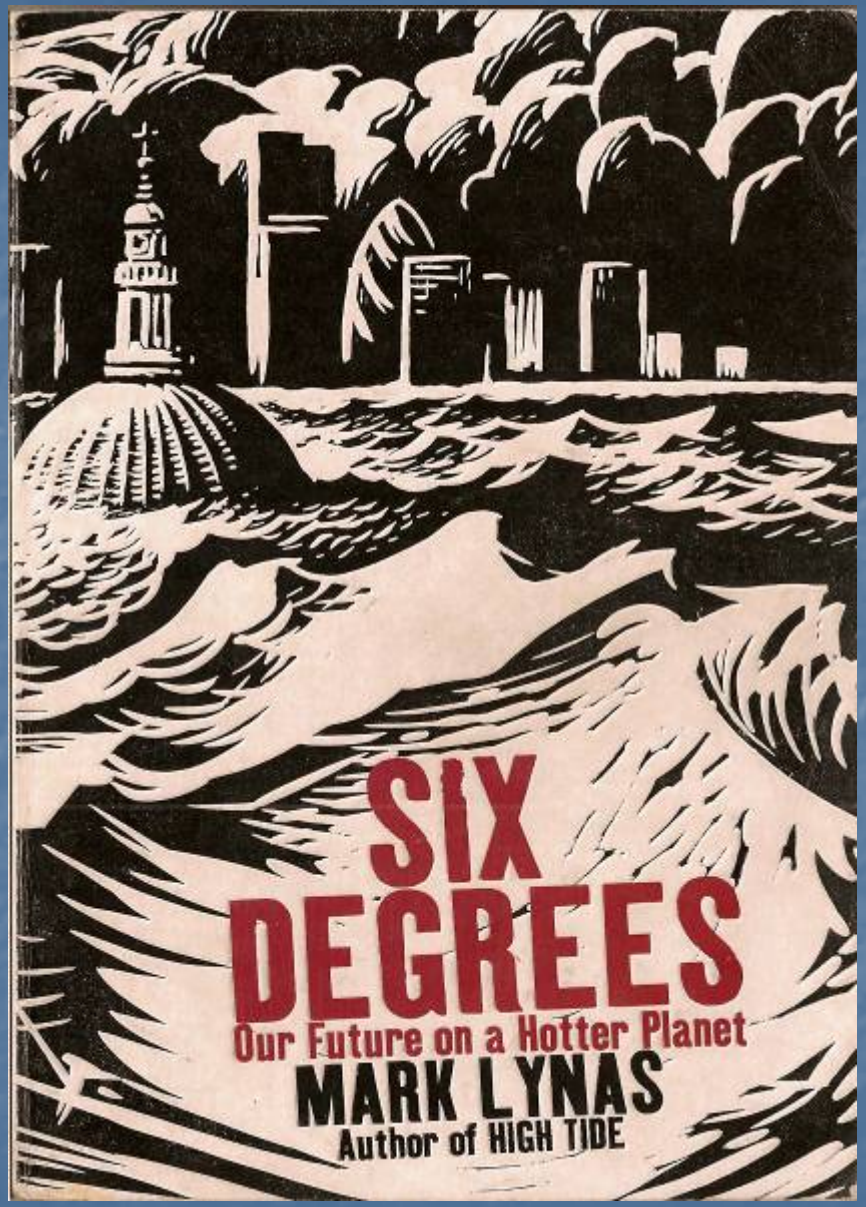
Category	CO_2 concentration at stabilization (2005 = 379 ppm) [b]	CO_2-equivalent Concentration at stabilization including GHGs and aerosols (2005 = 375 ppm) [b]	Peaking year for CO_2 emissions [a, c]	Change in global CO_2 emissions in 2050 (% of 2000 emissions) [a, c]	Global average temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity [d], [e]	**Global average sea level rise above pre-industrial at equilibrium from thermal expansion only** [f]	Number of assessed scenarios
	ppm	ppm	Year	Percent	°C	**metres**	
I	350 – 400	445 – 490	2000 – 2015	-85 to -50	2.0 – 2.4	**0.4 – 1.4**	6
II	400 – 440	490 – 535	2000 – 2020	-60 to -30	2.4 – 2.8	**0.5 – 1.7**	18
III	440 – 485	535 – 590	2010 – 2030	-30 to +5	2.8 – 3.2	**0.6 – 1.9**	21
IV	485 – 570	590 – 710	2020 – 2060	+10 to +60	3.2 – 4.0	**0.6 – 2.4**	118
V	570 – 660	710 – 855	2050 – 2080	+25 to +85	4.0 – 4.9	**0.8 – 2.9**	9
VI	660 – 790	855 – 1130	2060 – 2090	+90 to +140	4.9 – 6.1	**1.0 – 3.7**	5

Table 2 Shows the 'Key Finding' on the Pathways towards Stabilisation (IPCC, 2007b)

Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilisation level. (IPCC, 2007b)

Characteristics of stabilization scenarios

Stabilization level (ppm CO_2-eq)	Global mean temp. increase at equilibrium (°C)	Year CO_2 needs to peak	Year CO_2 emissions back at 2000 level	Reduction in 2050 CO_2 emissions compared to 2000
445 – 490	2.0 – 2.4	2000 - 2015	2000- 2030	-85 to -50
490 – 535	2.4 – 2.8	2000 - 2020	2000- 2040	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	2020- 2060	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	2050- 2100	+10 to +60
710 – 855	4.0 – 4.9	2050 - 2080		+25 to +85
855 – 1130	4.9 – 6.1	2060 - 2090		+90 to +140



- What does 1 degree mean?

Each chapter represents a specific degree of heat. i.e.

chapter 1 = 1 degree

....

chapter 6 = 6 degrees

Chancellor Merkel's advisor –

Dr Hans Joachim Schellnhuber Director Potsdam Climate Impact Research

- Germany aims to confine Global warming to 2^0C
- Official European Union goal 2^0C to avoid 'dangerous' climate change
- We cannot be sure but must avoid tipping points which could be unmanageable
- 2^0C a different World but keep chaos at bay
- Germany & UK to reduce emissions by 80% by 2050 and US by 90% to 1990 values
- i.e. Germany 40% by 2020

CONCLUSION

That unless there is a demonstrated WILL by the nations of the world to drastically reduce carbon dioxide emissions within a very short time-frame the world community will have to consider desperate measures if billions of people are not to perish and the species is to survive.

A two pronged approach will be essential to avoid this latter scenario. Both the carbon dioxide emissions must be reduced as quickly as possible and measures taken to reduce the Insolation particularly in the next 20 to 30 years.