

Economics of Climate Change

FMI – PSMW2010

GEORGE FOOTE

June 15, 2010

Fig. 2. (A) Earthrise (24 December 1968)



J. J. McCarthy Science 326, 1646-1655 (2009)

A Brief History of Climate Science

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- **Sir James Tyndall 1859**

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- **Svante Arrhenius – 1890s**

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- **Guy Callendar – 1930s**

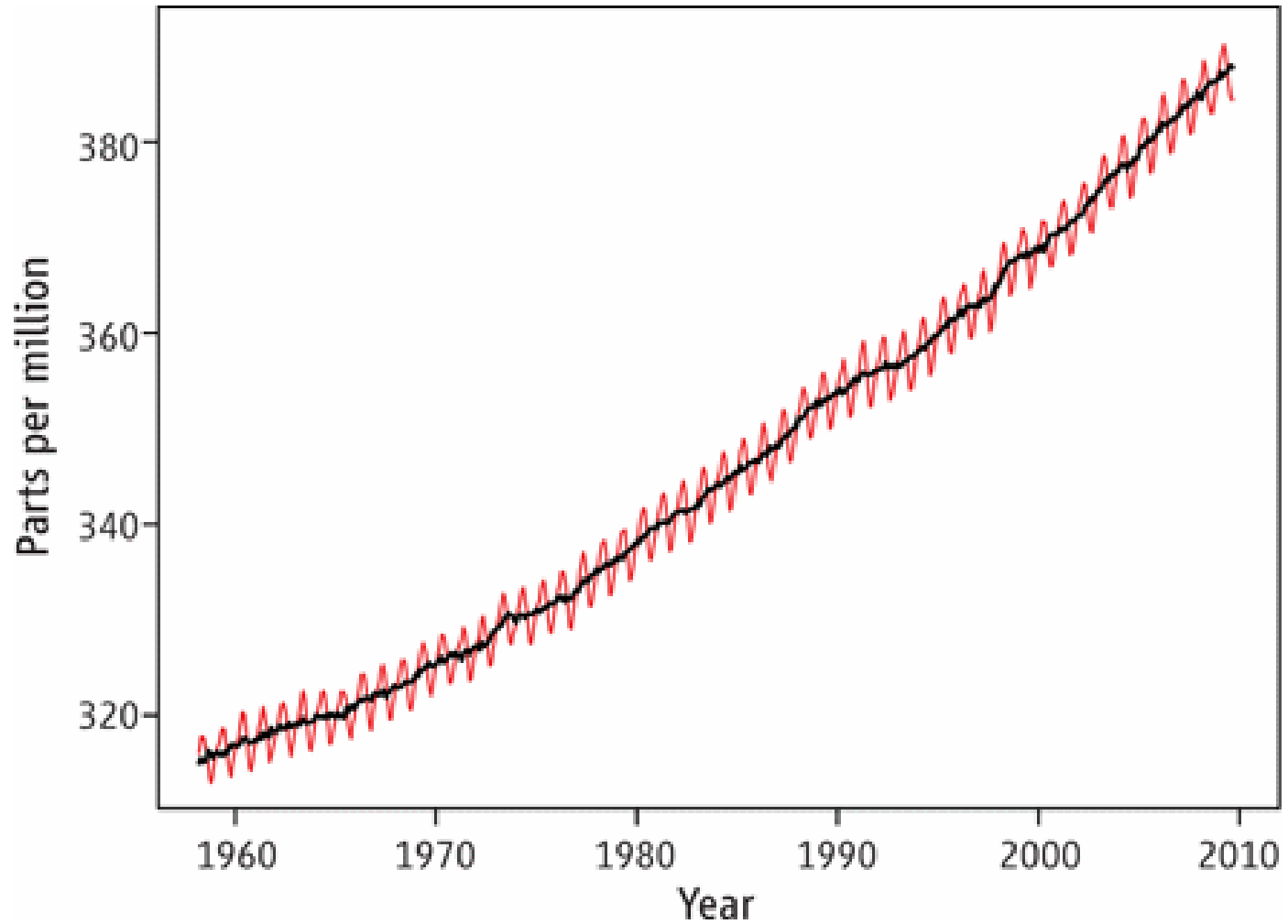
History of Climate Science

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- **Roger Revelle - 1957**

Fig. 1. Keeling curve for atmospheric CO₂



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Climate Change Science

- Climate predictions becoming more alarming
- Need for reductions becoming more urgent
- Preparing for a changing climate essential



Stephen Schneider (Stanford University)

- "Don't be poor in a hot country, don't live in hurricane alley, watch out about being on the coasts or in the Arctic, and it's a bad idea to be on high mountains with glaciers melting."
- (*Associated Press*, 07/04/08)

Projections of Future Changes in Climate

- *Very likely* that **hot extremes, heat waves, and heavy precipitation events** will continue to become more frequent
- *Likely* that future **tropical cyclones** will become more intense, with larger peak wind speeds and more heavy precipitation
 - less confidence in total numbers
- **Extra-tropical storm tracks** to move poleward with resulting changes in wind, precipitation, and temperature patterns

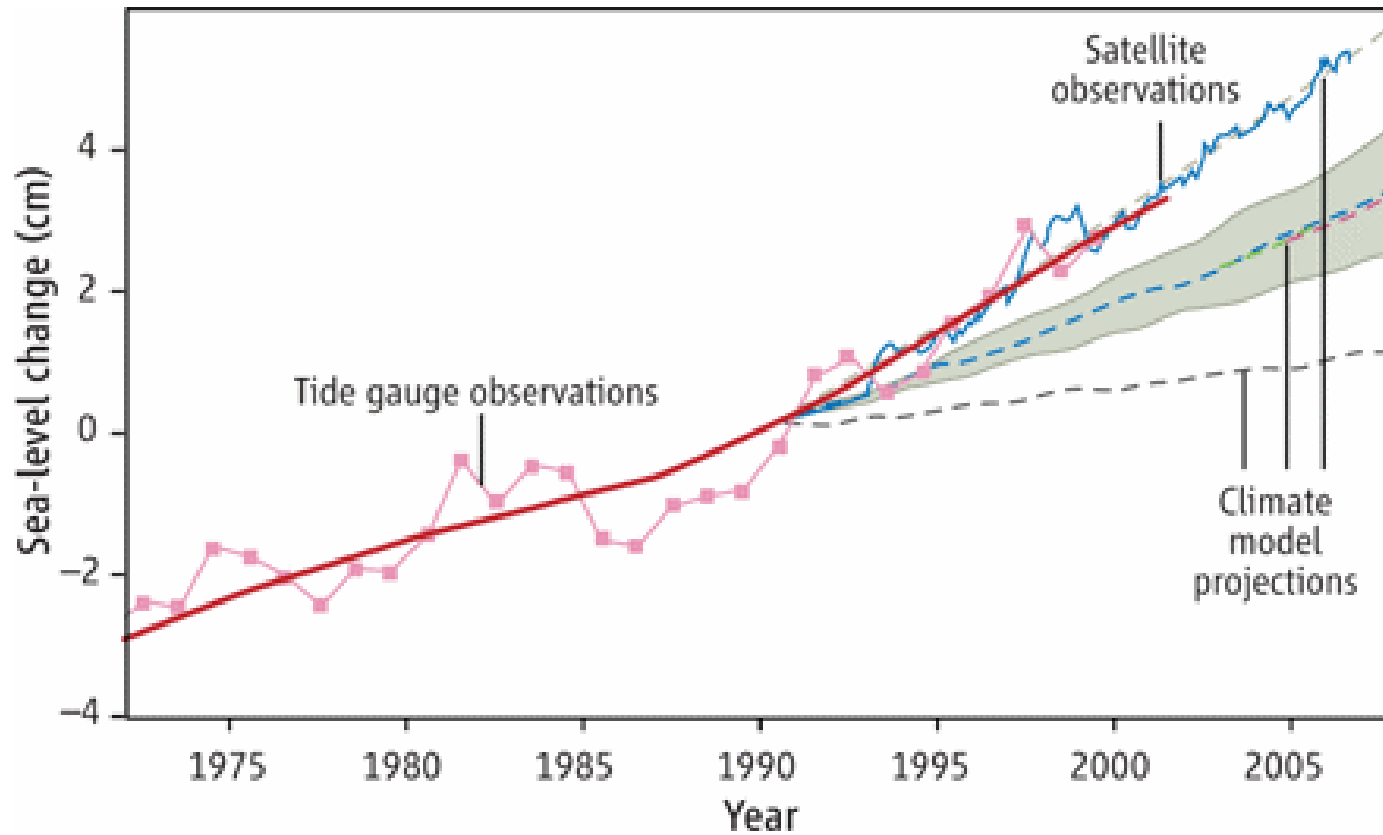
Key message / Message-clef

- ***The research has shown that the current 100-year storm-surge return level (the record flooding event of January 21, 2000) is expected to occur, on average, every 10 years with a 60-cm sea-level rise scenario.***

Minisky Moments and Black Swans

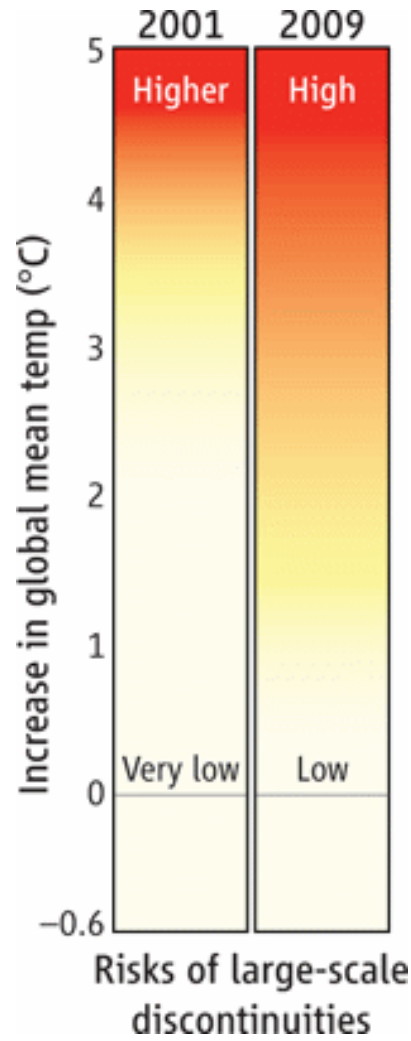
- Are we borrowing against the environment to the point where we will be unable to pay it back?
- Black Swan Event: the disproportionate role of high-impact, hard-to-predict, and rare events that are beyond the realm of normal expectations in history, science, and technology,.
- Is there a climate equivalent of Bear Sterns, Lehrman Brothers, Greece?

Fig. 8. Sea-level rise



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Fig. 9. IPCC RFCs



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New Thinking Needed

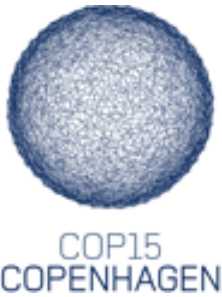
“Climate change represents a unique challenge for economics.

It is the greatest and widest-ranging market failure ever seen.”

– Sir Nicholas Stern

Doing nothing has a cost

- “ Still time to avoid worst impacts if we take strong action now” – Stern Review
- Overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever.



15th session of the Conference of the Parties to the Climate Change Convention (COP 15) *and* 5th meeting of the Parties to the Kyoto Protocol

Copenhagen, 7-19 December 2009

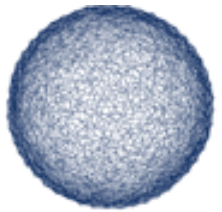
The “Copenhagen Accord”

(for those Parties that “sign onto” the Accord)

- Economy-wide emission reduction targets for developed countries
- Mitigation actions by developing countries
- “Pledges” to be recorded by 1st February 2010
- Fast-start and longer term financing
- Monitoring, reporting and verification
- Mechanisms for REDD and technology
- Recognition of the 2 C objective

There is:

- no legal standing within the process
- limited guidance for the next steps, particularly a route to the Accord becoming a legally binding agreement



COP15
COPENHAGEN

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A Few Thoughts

There was a “deal”

- but what does it really mean?
- how can it go forward to become legally binding?
- how will the EU treat it?

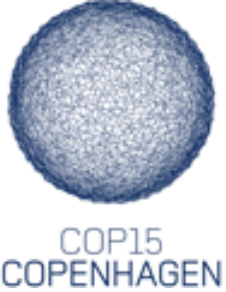
The re-integration of the USA was an important step forward

A change in stance of emerging economies

- offering national commitments

The UN process proved to be unwieldy to achieve a global comprehensive agreement

None of the “real issues” (targets, timetables etc.) have been solved and will re-emerge during the forthcoming negotiations



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A Few More Thoughts

Moving from a top down approach to a bottoms up approach

Country led rather than internationally led – many rules will be set domestically (e.g. US on international offsets)

We now have a pledge and review system with less international oversight

China got what it wanted – access to markets and technology and gave up requests for financing via mechanisms

Large gap between 2 C goal and pledges to reduce emissions – “Greater ambition is required to meet the scale of the challenge.” – Yvo de Boer

What have we got so far?

- Pledges by 55 countries representing 78% of emissions
- US – in the range of 17% (below 2005 levels by 2020)
- Canada now the same as US – we have reduced commitment
- EU – 20% below 1990 and will
 - reduce emissions by 30% if other industrialized and developing countries contribute with comparable reductions according to their responsibility and capability.
- Australia - 5% (below 2000 levels by 2020) and will only go higher if
 - the level of global ambition becomes sufficiently clear and there is a robust global agreement
- China – 40-45% drop in intensity from 2005 by 2020
- India- 20-25% in intensity
- South Korea – 30% in intensity

Other Economic Modeling Studies

Industry Study for WWF by *Climate Risk*, Oct. 2009

“....world’s governments, businesses and investors have five years to shift low-carbon industries into a high growth phase to avoid runaway warming.

The industries of energy efficiency, clean energy and sustainable forestry need to grow around 25% a year from 2010.”–

Who is Investing

- China
 - In 2009, China alone invested substantially more money in clean energy technologies (\$400 billion over 10 years) than North America. Ninety percent of today's market for new clean energy technologies is outside of the United States, primarily in Asia and Europe.
 - China now boasts the world's largest solar panel manufacturing industry which exports about 95 percent of its production.
- Europe
 - Europe led the world in clean energy investments in 2008, spending nearly \$50 billion
 - Denmark – a small country - produce close to 40 percent of annual global installed wind capacity.
 - Germany's energy policies have made it a leader in clean energy manufacturing; German companies could capture 15-20 percent of several global clean energy markets worth \$18-\$30 billion a year in revenues by 2020.

What about the recession?

- Spending on renewable energy to reach \$200 billion in 2010 – Bloomberg
- China passes US in 2009 as biggest investor in renewables at \$34.5 billion to \$18.6 billion.
- “Rise of China as an investor in clean energy ... reflects Beijing’s desire to be at the forefront of manufacturing key technologies such as wind turbines and solar PV modules” - Bloomberg

Modelling Economic Effects

- Carbon ubiquitous – affects all aspects of life
- Many players and many sources and many opportunities – complicates modelling as most of economy in play
- Modelling behaviour a challenge
- Technology evolution and future costs unknowable
- BUT...

Key Findings- Nova Scotia

2) Economic Impact?

<u>Output (GDP)</u>	<u>BAU</u>	<u>Our Target</u>
• 2005-2020	25%	22.6 - 24.6%
• 2005-2050	94%	92 - 93 %

- 1% less Demand by 2020.
- 1% decrease in Export / Import volume

What did we learn

- There will be winners and losers
- Energy prices will rise but costs not so much as people use less
- More options on the table the better – costs lower with offsets, especially international ones
- Investment may increase in some areas and is up slightly overall.

NRTEE - Achieving 2050

- Macroeconomic impacts generally small and manageable over time
- Competitiveness impacts primarily sector specific so focus is known
- Technology impacts mostly positive but targeted assistance still needed
- Distributional impacts for some households

NRTREE – Achieving 2050

- Uncertainty about future carbon pricing results in higher emission
- Options for pricing instruments offer greater price certainty versus greater reduction uncertainty
- Full trading between large emitters and rest of economy
- Need to get reductions from all sectors to keep price down

NRTEE - Achieving 2050

- Need both cap and trade and complimentary policies to achieve goal
- International offsets can substantially reduce carbon price
- Carbon pricing policy must be complemented by regulations to
 - expand coverage to more emissions, and
 - target support for technology innovation, adoption and deployment

CC and Economic Development

- Allocation of burden and costs can favour some industries/activities over others
- Offsets and credits provide opportunity to favour some industries/sectors
- These can reflect local circumstances and opportunities
- Must be consistent with overall economic policy direction

British Columbia

- Carbon tax of \$10 per tonne (2.4 cents/litre gas) rising to \$30 in 2012;
- Over \$1.1 billion in programs to reduce GHGs
- Establishment of a Cap and Trade System as part of the WCI – regulations on offsets and allocations due in 2010;
- Establishment of the Pacific Carbon Trust (\$24 million) to procure BC offsets on behalf of public sector

Quebec

- Implemented Canada's first carbon tax (under 1 cent per litre) to raise \$200 million annually for Quebec's Green Fund,
- \$4.5 billion for public transit
- \$280 million for green industry and technology development
- Ethanol production facilities aimed at a 5% ethanol in gasoline sales in Quebec and 0.78 Mt of GHG reductions

Alberta

- \$2 billion for Carbon Capture and Storage
 - Alberta is relying on CCS to deliver 70% of its required emissions reductions
- \$520 million over three years for GreenTRIP, a project to improve public transit
- 2010 Budget committed \$43 million to biofuel initiatives

Ontario

- Regulations for phase out of coal fired power production by 2014
- \$11.5 billion to the MoveOntario 2020 rapid transit plan;
- Cap and trade system as part of WCI
- \$112 million for home energy audits and associated retrofits
- Building code changes (1.53 Mt by 2020)

Nova Scotia

- Only province with hard GHG caps
- 25% renewable electricity by 2015 and 40 per cent goal by 2020
- Creation of Efficiency Nova Scotia to administer rate-payer funded efficiency
- \$20 million for 2010 and \$40 million for 2011 for electricity
- Continuation of Conserve NS funding for non-electricity efficiency and renewable energy

A few predictions

- “ We are going to be negotiating on climate change for the next 50 years” .
- Investment in clean tech to grow faster than other sectors
- Carbon will find its way into price of more good and services
- Carbon markets to grow and link
- Carbon disclosure with become commonplace and mandatory

Conclusion

- Climate change, other air issues, energy security and fossil fuel price volatility driving investment in new and growing markets
- Most obvious areas are energy efficiency and renewable energy
- Nova Scotia on track – achievements being recognized
- Investment can build future growth as markets will continue to expand