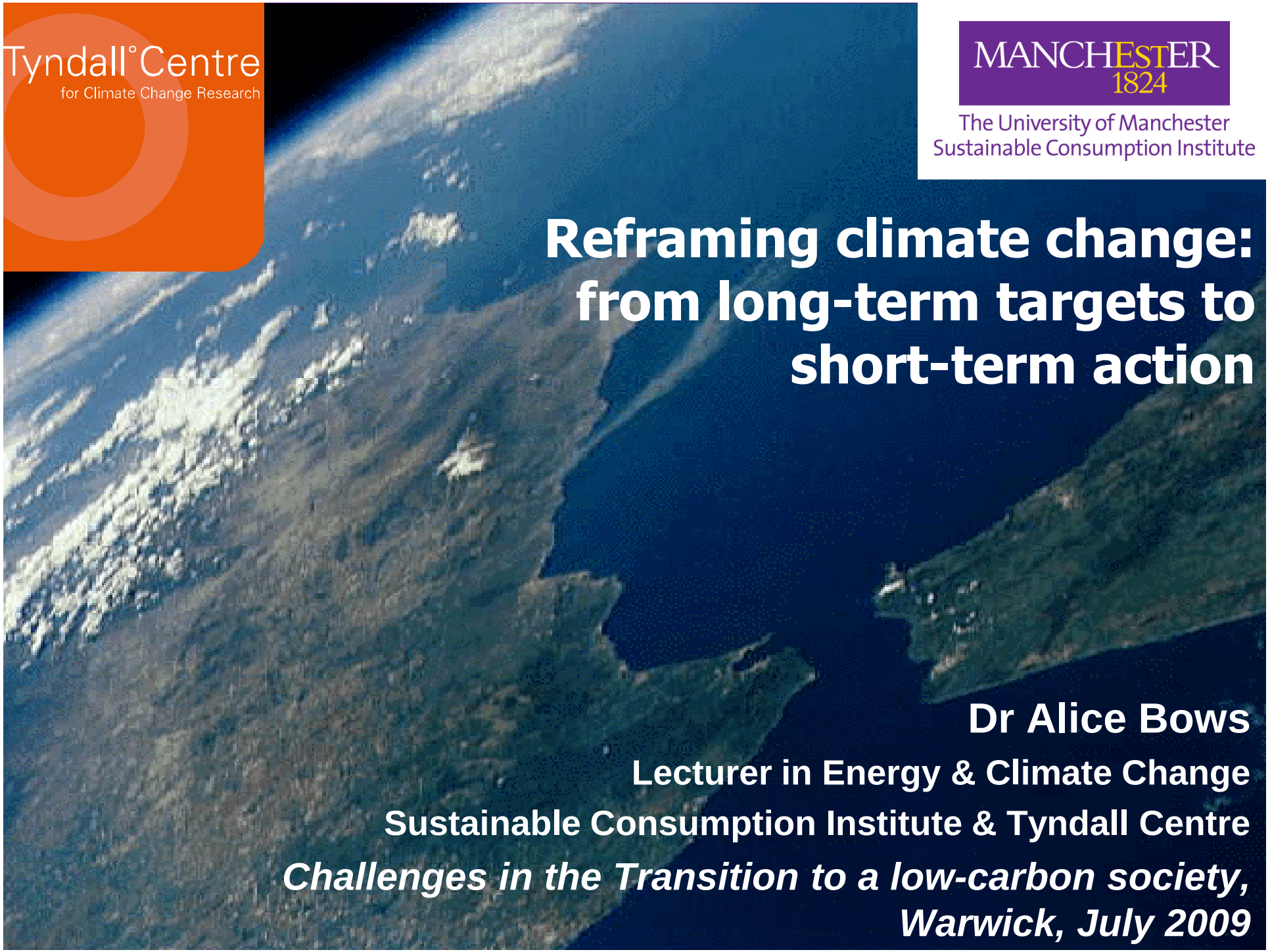

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Reframing climate change: from long-term targets to short-term action

Dr Alice Bows

Lecturer in Energy & Climate Change

Sustainable Consumption Institute & Tyndall Centre

Challenges in the Transition to a low-carbon society, Warwick, July 2009

Talk outline

What is dangerous climate change?

Reframing the debate - cumulative emissions

Global greenhouse gas emission pathways

Implications for policy

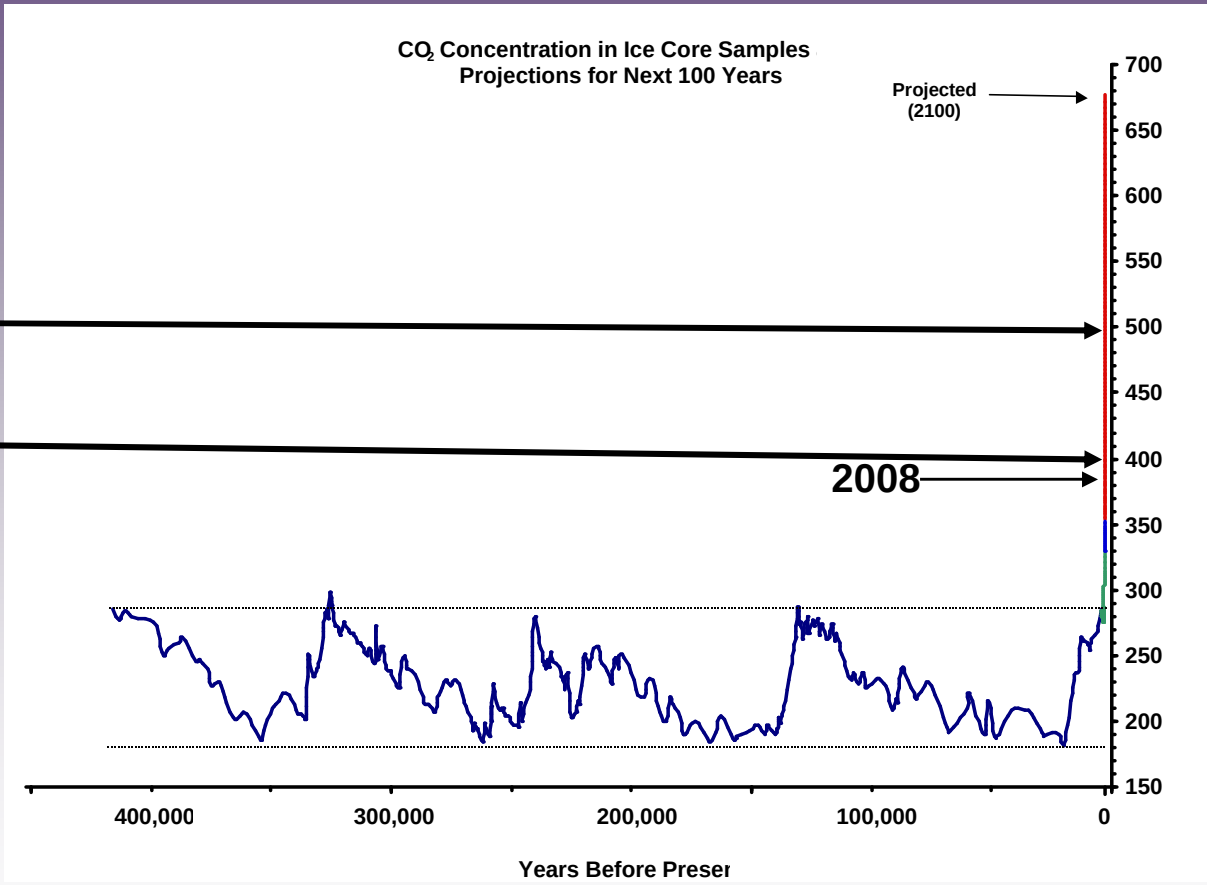
What is dangerous climate change?

- UK & EU define this as 2°C
- Links to total quantity of CO_2e in atmosphere
  - *measured in parts-per-million by volume (ppmv)*
- Currently 386ppmv (CO_2 alone) & increasing ~2ppmv each year
  - *280ppmv before industrial revolution*

The UK & EU's targets

2°C: historically, correlated with **550ppmv CO_2eq**

Now more closely linked to **450 ppmv CO_2eq**



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What are likely impacts at 2°C?

- Destruction of the vast majority of coral reefs
- Hundreds of millions of people exposed to increased water stress
- 30% of species at increasing risk of extinction
- Land moves to become a carbon source
- Cereal productivity to starts to cease in low latitudes
- Millions more people experience coastal flooding
- Tipping points?

(IPCC Fourth Assessment Report, 2008. 'Impacts, adaptation & vulnerability')

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Emission-reduction targets for 2°C

- UK, EU & Global - long term reduction targets
  - *UK's **80%** reduction in CO_2e by 2050*
  - *EU **60%-80%** reduction in CO_2e by 2050*
  - *Bali **50%** global reduction in CO_2e by 2050*

- But CO_2 stays in atmosphere for approx. 100years

- Hence, today's emissions add to yesterdays &
  will be added to by tomorrows

- Focus on long-term targets is very misleading

Put bluntly …

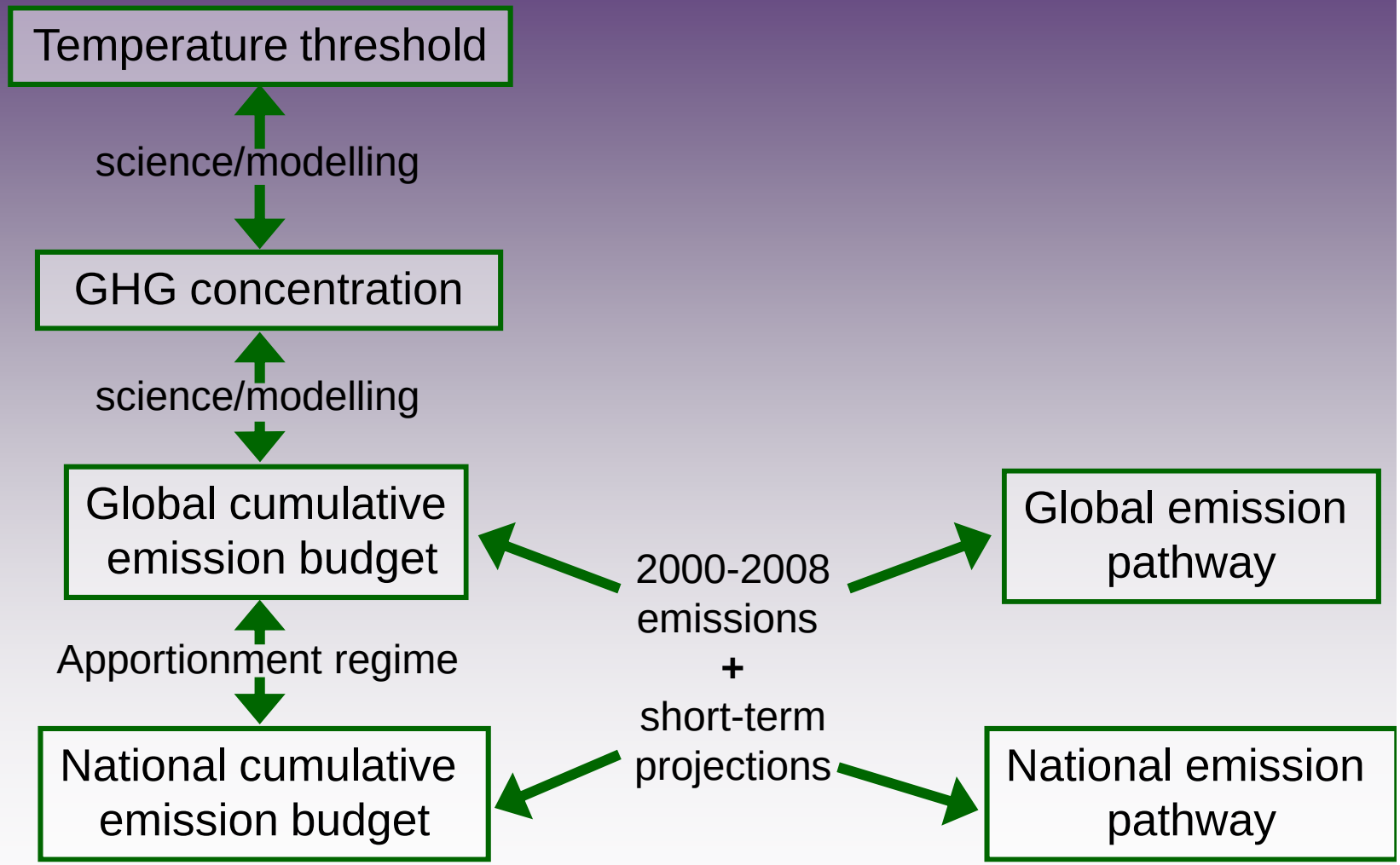
the final % reduction in carbon has little relevance to avoiding dangerous climate change *(e.g. 2°C)*

What is important are the **cumulative** emissions of carbon & other greenhouse gases (*i.e. the carbon budget*)

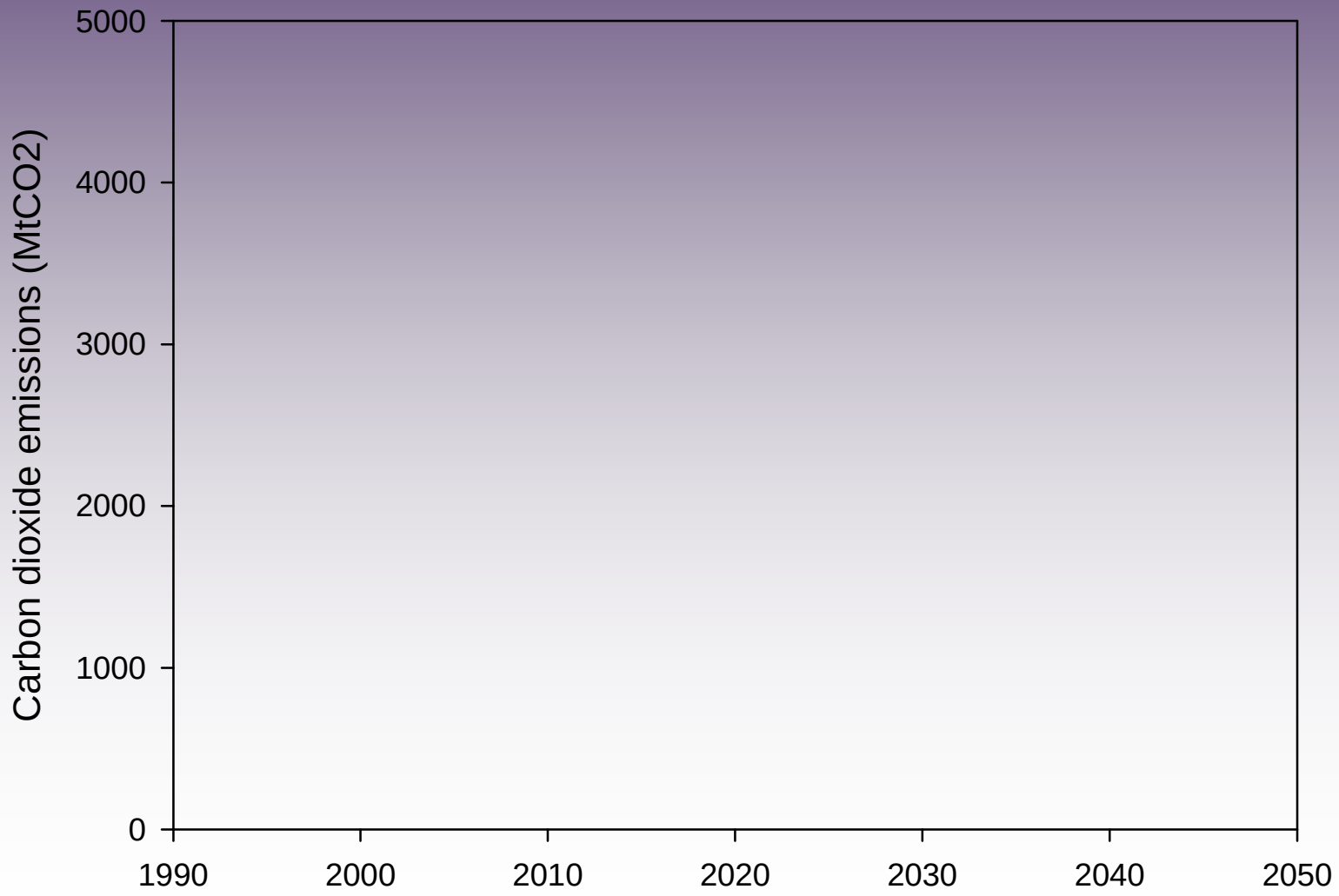
Linking science to policy

How do global temperatures link to global and national carbon budgets & from there to emission-reduction pathways?

Linking science to policy



Illustrative carbon budget & pathway



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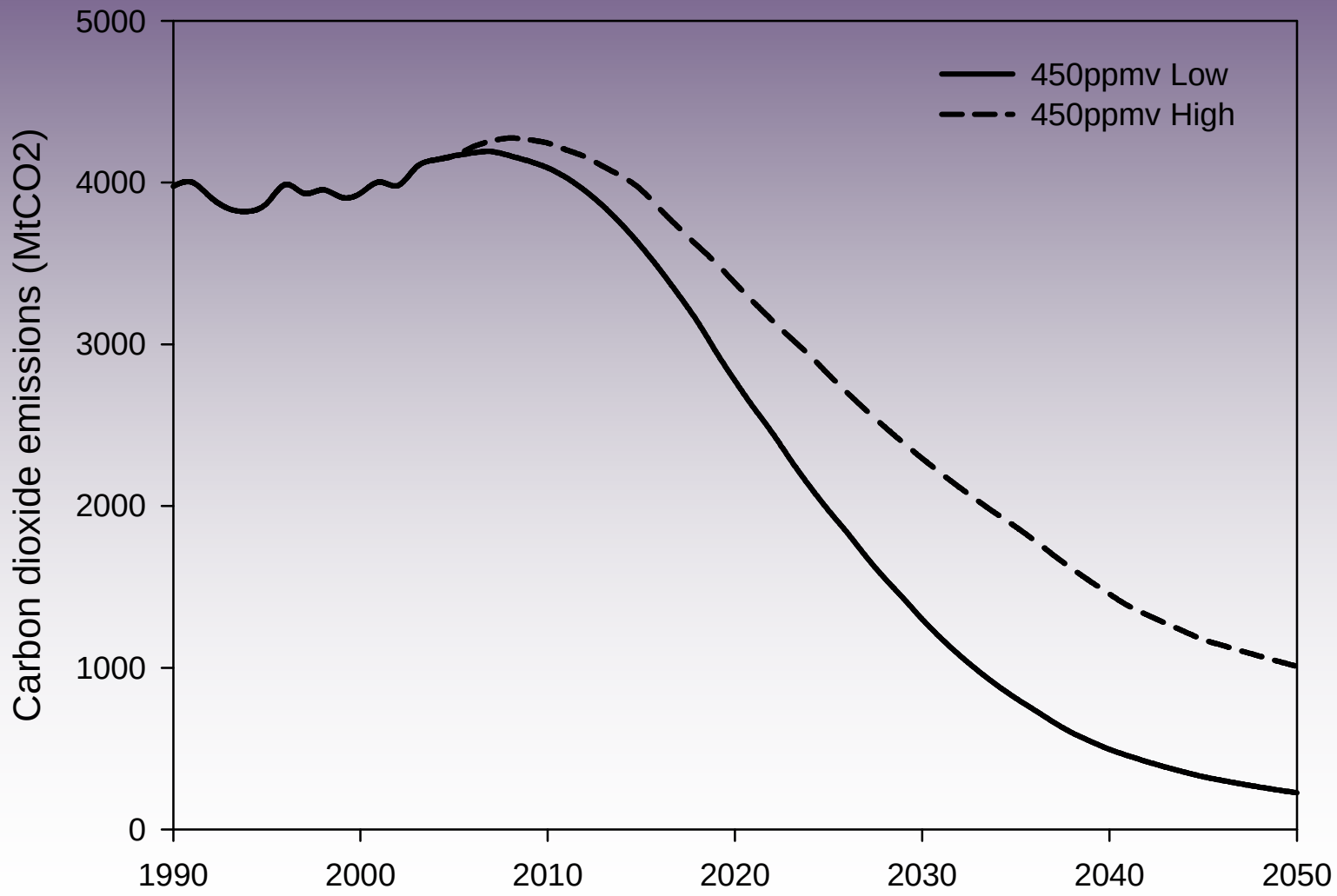

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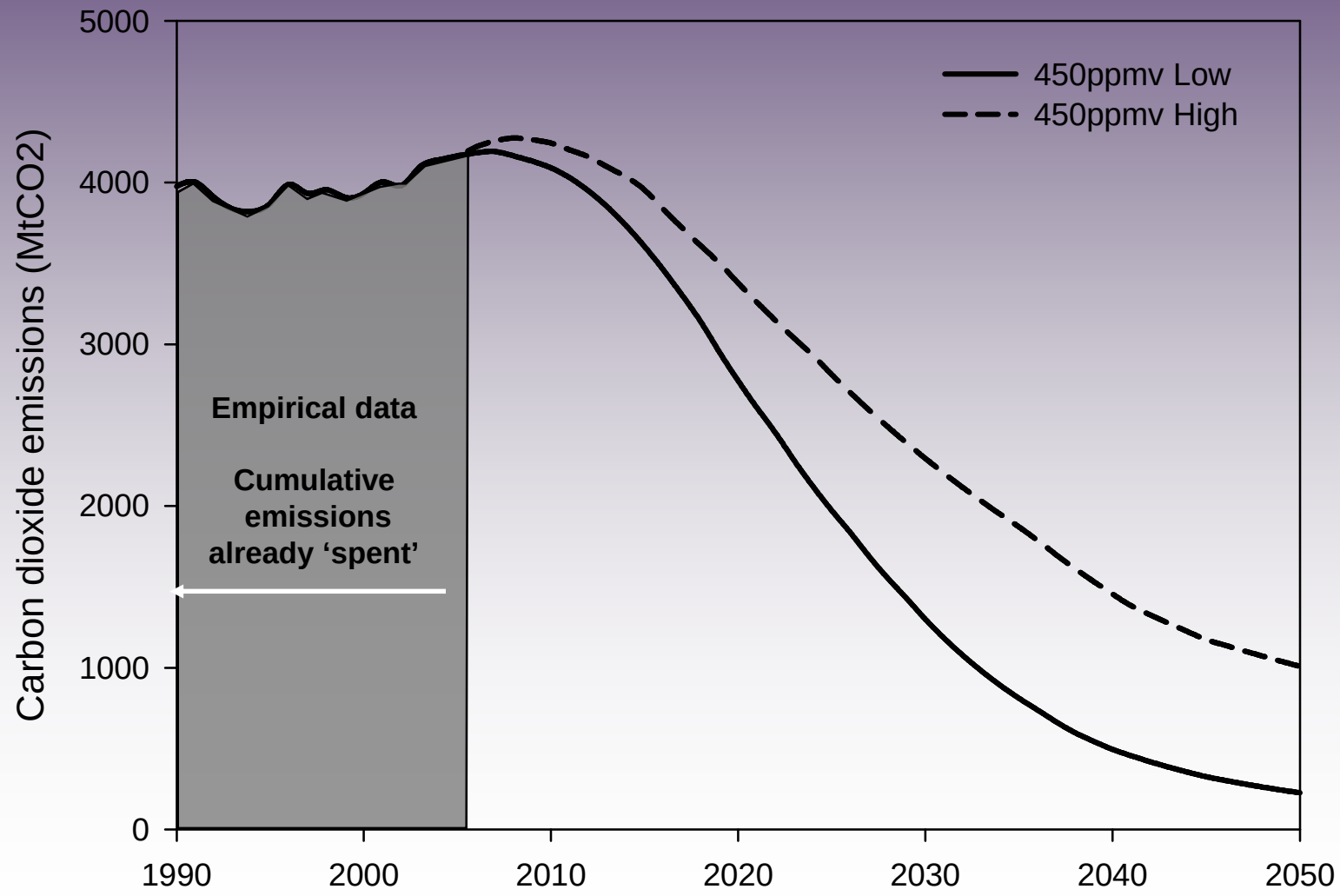

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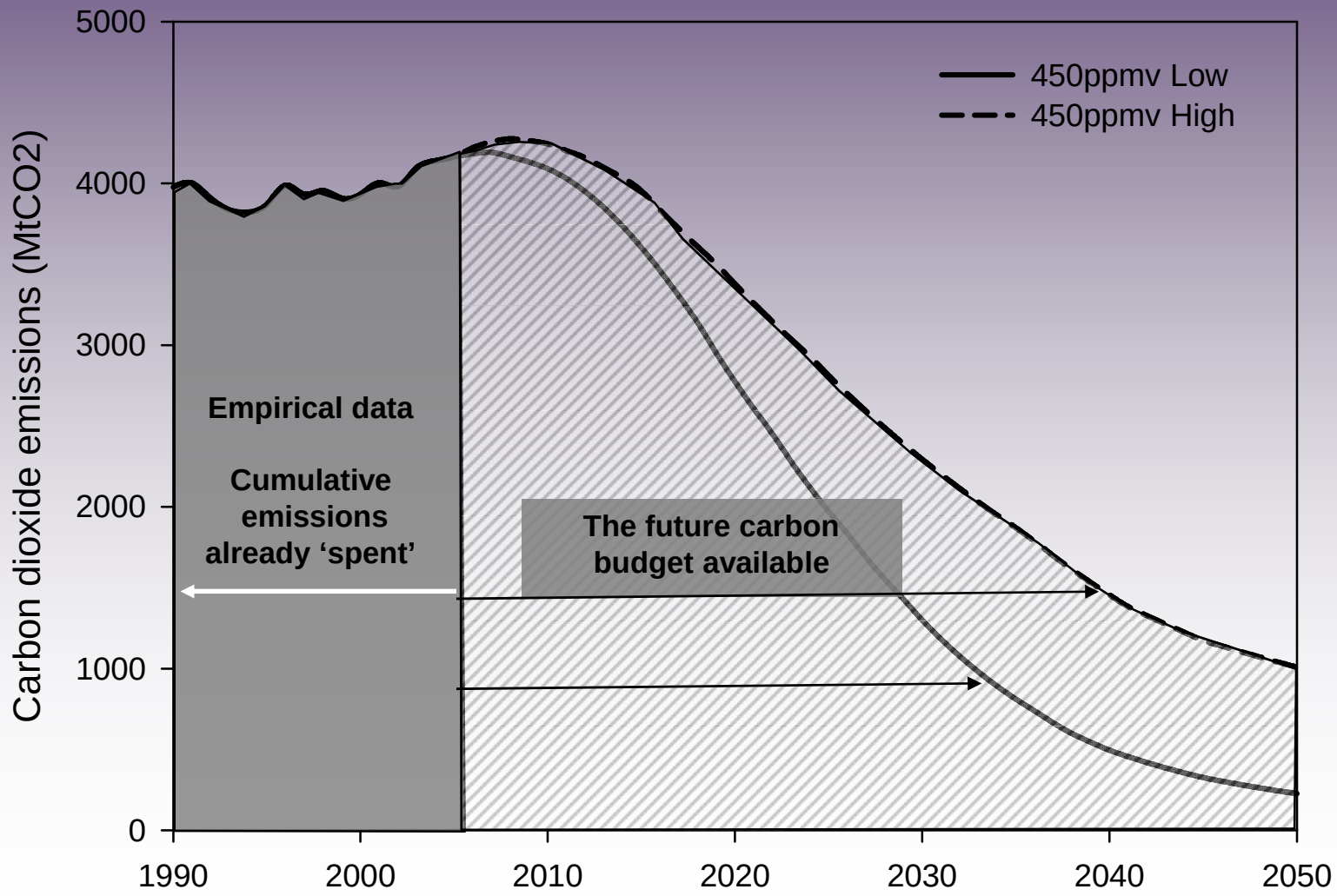
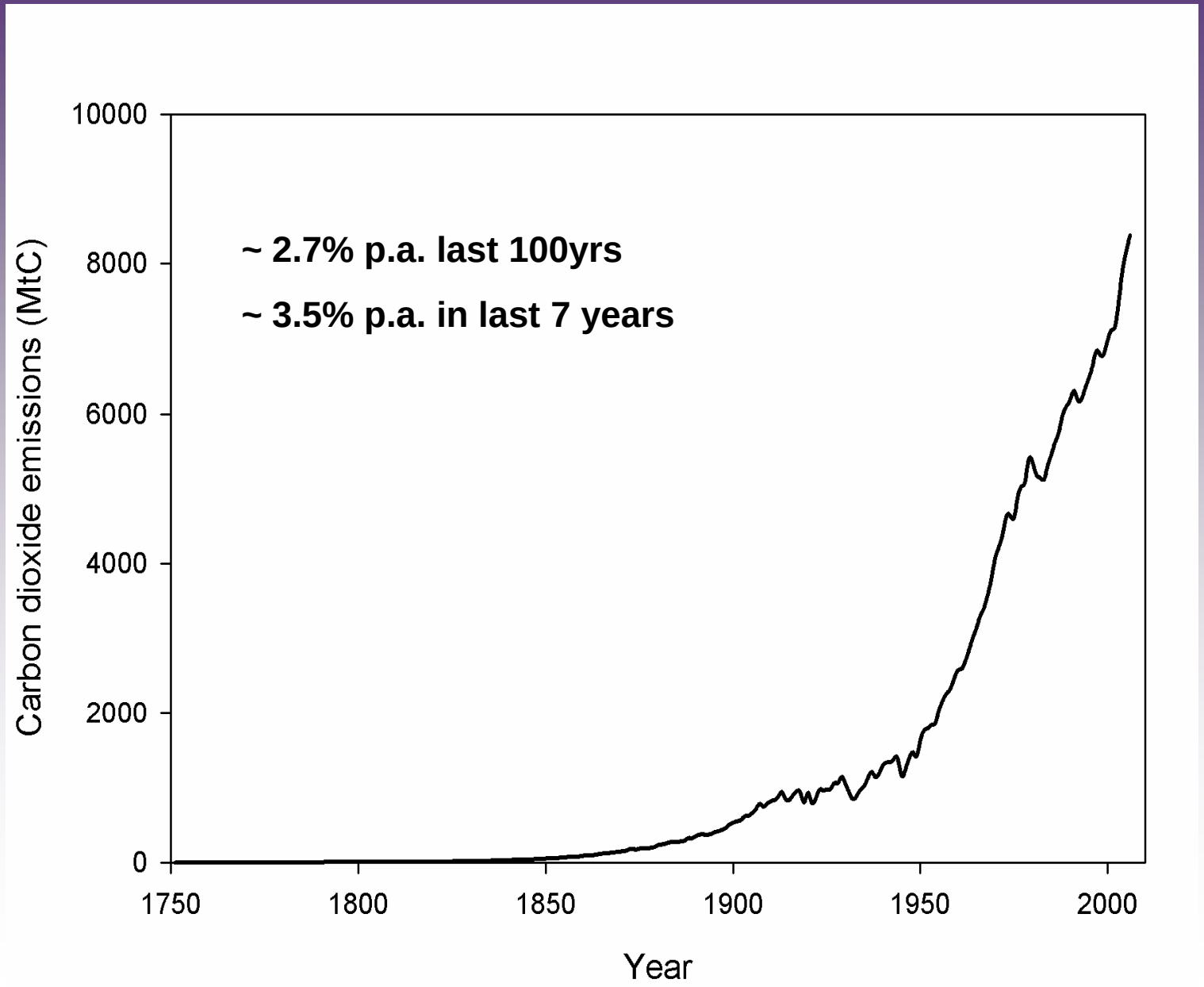


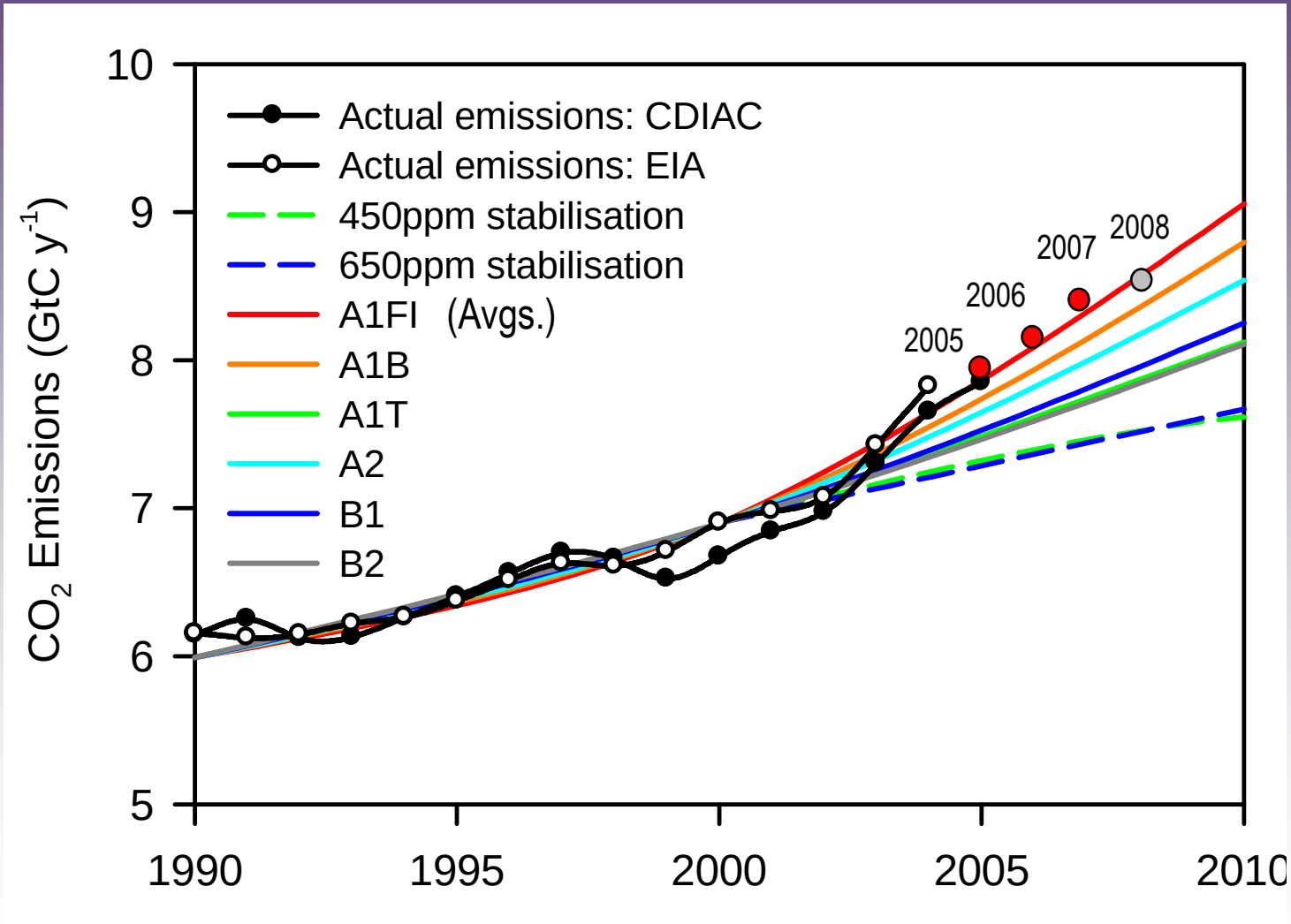
Global emission scenarios (CO_2e)

- What are the latest CO_2 emission trends?
- What are implications of factoring in:
  - land-use & forestry?
  - non-CO_2 greenhouse gas emissions?
- When will global CO_2e emissions peak?
- How much 'CO_2 space' left for energy & process emissions?

The latest global CO_2 emission trends



Fossil Fuel Emissions: Actual vs. IPCC Scenarios



SRES (2000) aver. growth rates in % y^{-1} for 2000-2010:

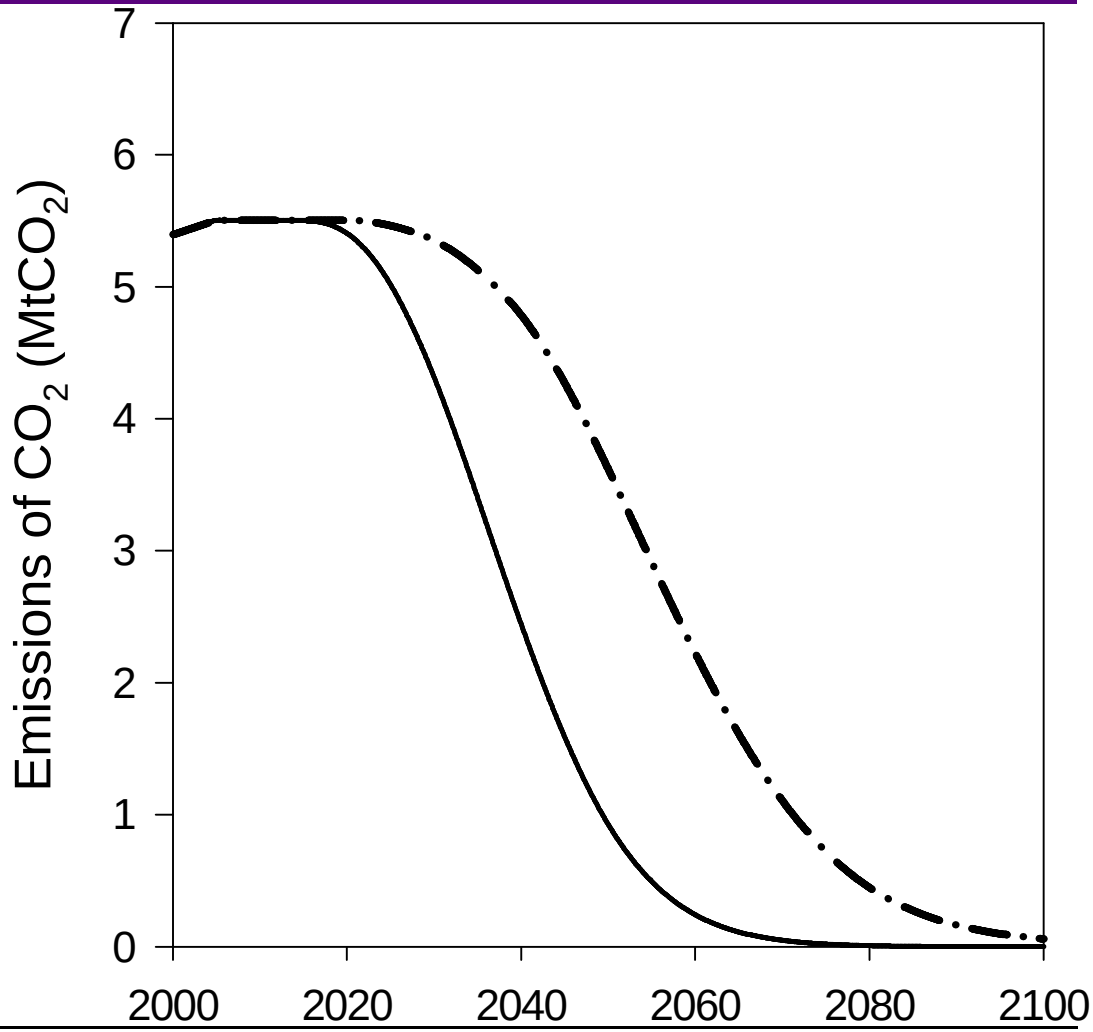
A1B: 2.42
A1FI: 2.71
A1T: 1.63
A2: 2.13
B1: 1.79
B2: 1.61

Observed 2000-2007 3.5%

Raupach et al 2007, PNAS; Global Carbon Project 2009

Emissions of CO_2 from land-use change

- Characterised by high uncertainty *(principally driven by deforestation)*
- Represents 12%-25% of total global greenhouse gas emissions in 2000
- Two Tyndall scenarios with different carbon-stock levels remaining: *70% & 80%*
- Optimistic compared with Forest Resource Assessment



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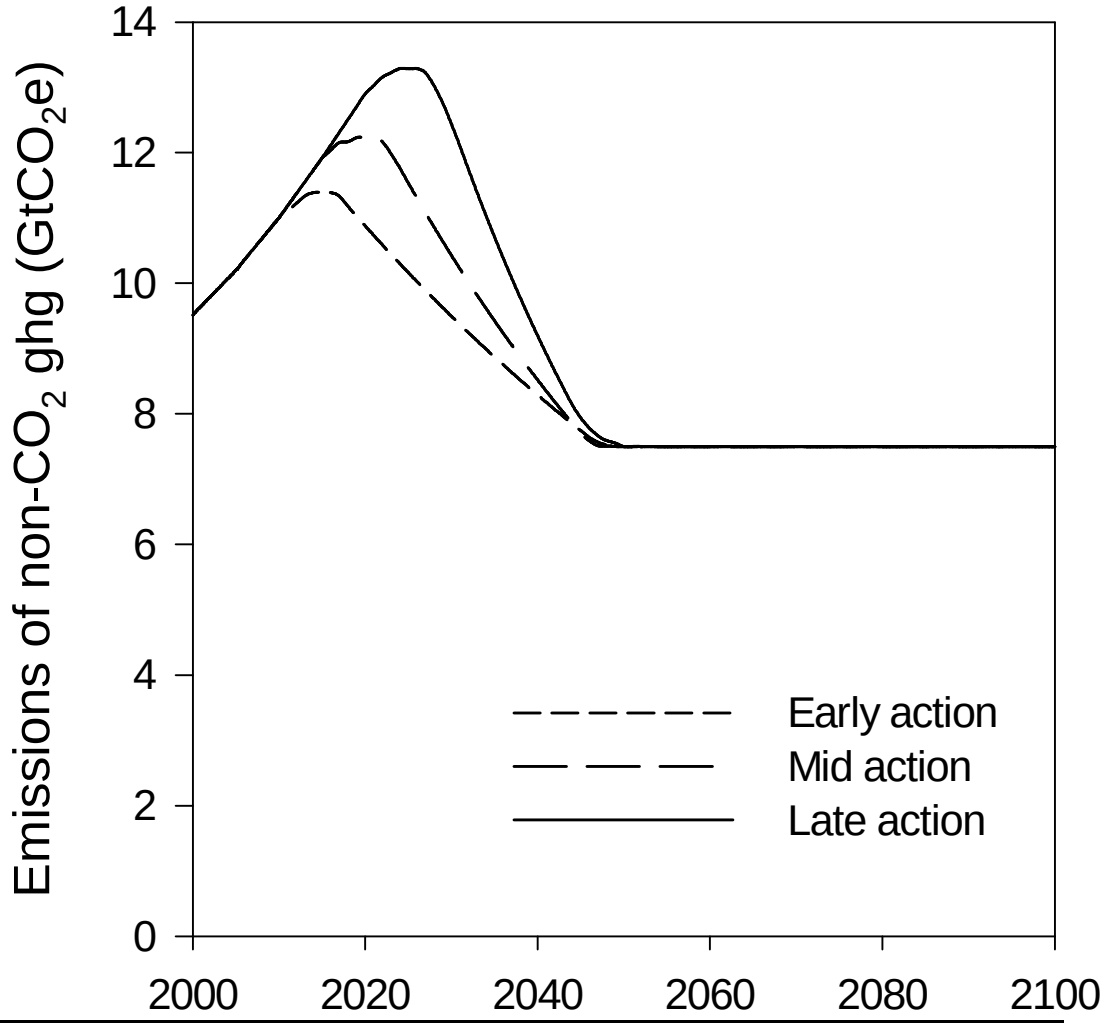
Emissions of non-CO_2 greenhouse gases

- Short-term EPA estimates
- Characterised by considerable tail due to emissions associated with food production
- Represents ~20-23% of total global greenhouse gas emissions in 2000
- Three scenarios with different peak dates



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Suggested CO_2e emissions peak

Bush - USA	-	2025
Stern – Global aim	-	2015
Tyndall	-	2015, 2020, 2025

450ppmv

greenhouse gas emission pathways

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450ppmv CO_2e budget

We know from the science how much CO_2e we can emit between 2000-2100 (the emission budget)

Global budget

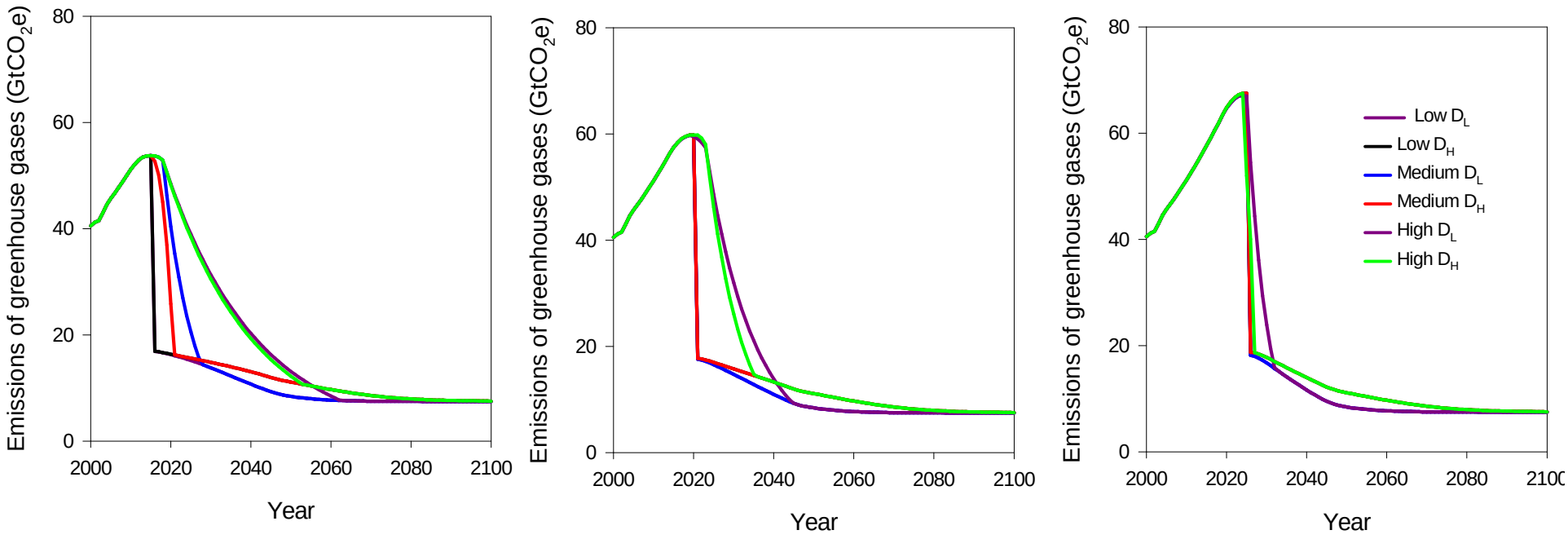
For a 50% (450ppmvCO_2e) chance of *"avoiding dangerous climate change"*

the global budget is

~ 490 billion tonnes of carbon

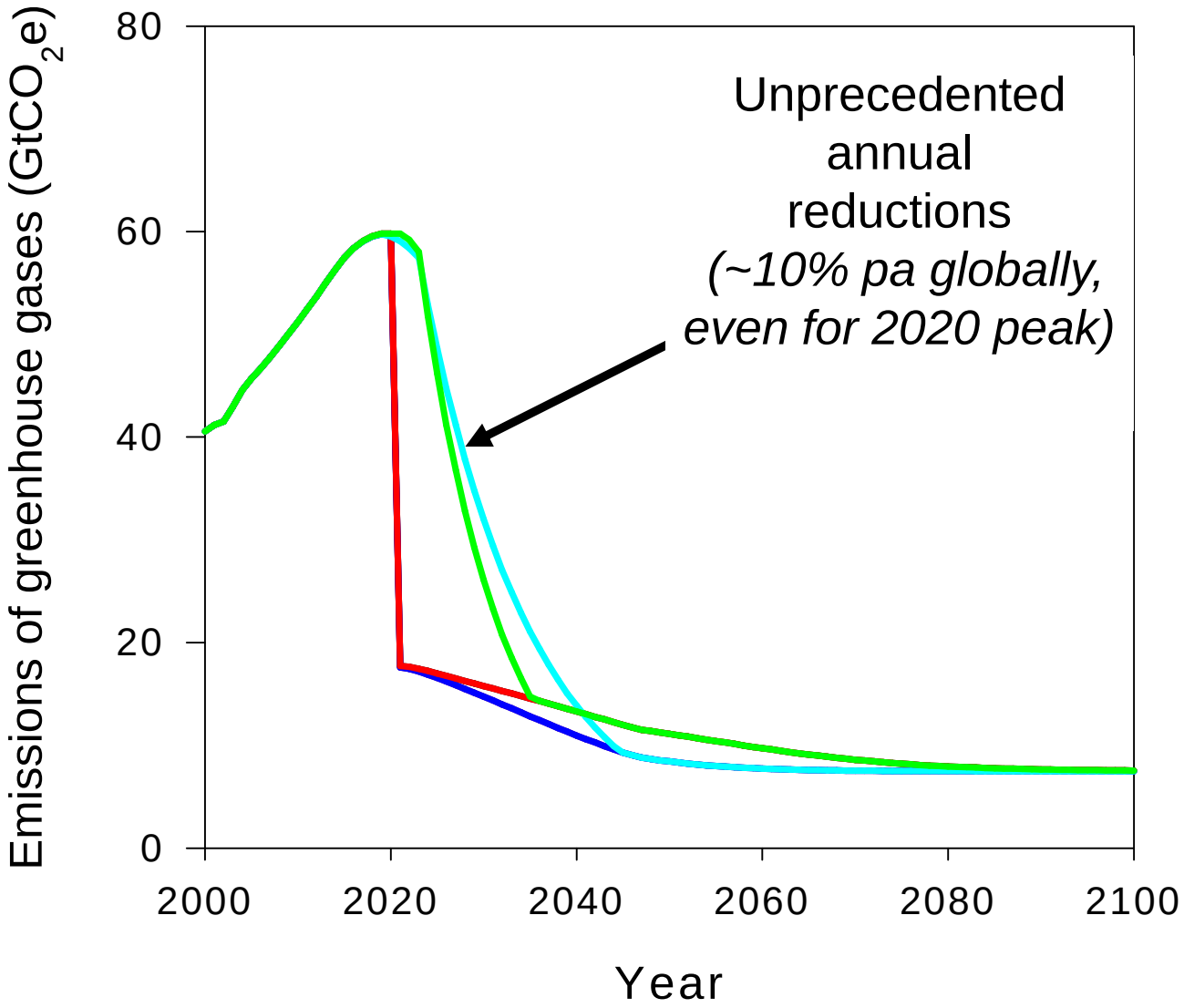
equivalent *between 2000-2100*

Total greenhouse gas emission pathways



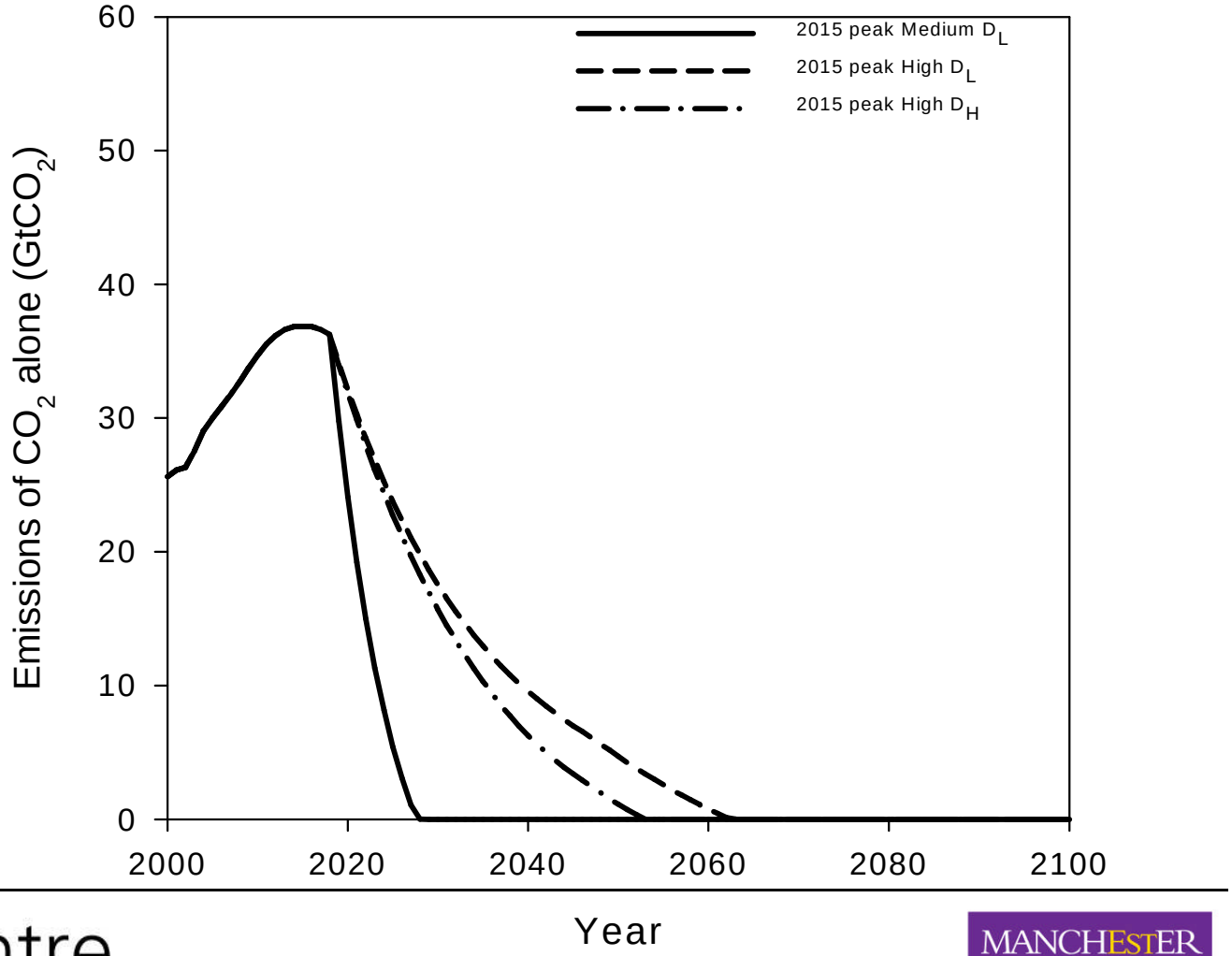
Anderson, K., and Bows, A., 2008, *Philosphical Transactions of the Royal Society A*, 366, 3863-3882

What does all this imply for a 450ppmvCO_2e future?



Emission-space remaining for energy CO_2

- Removed impossible pathways



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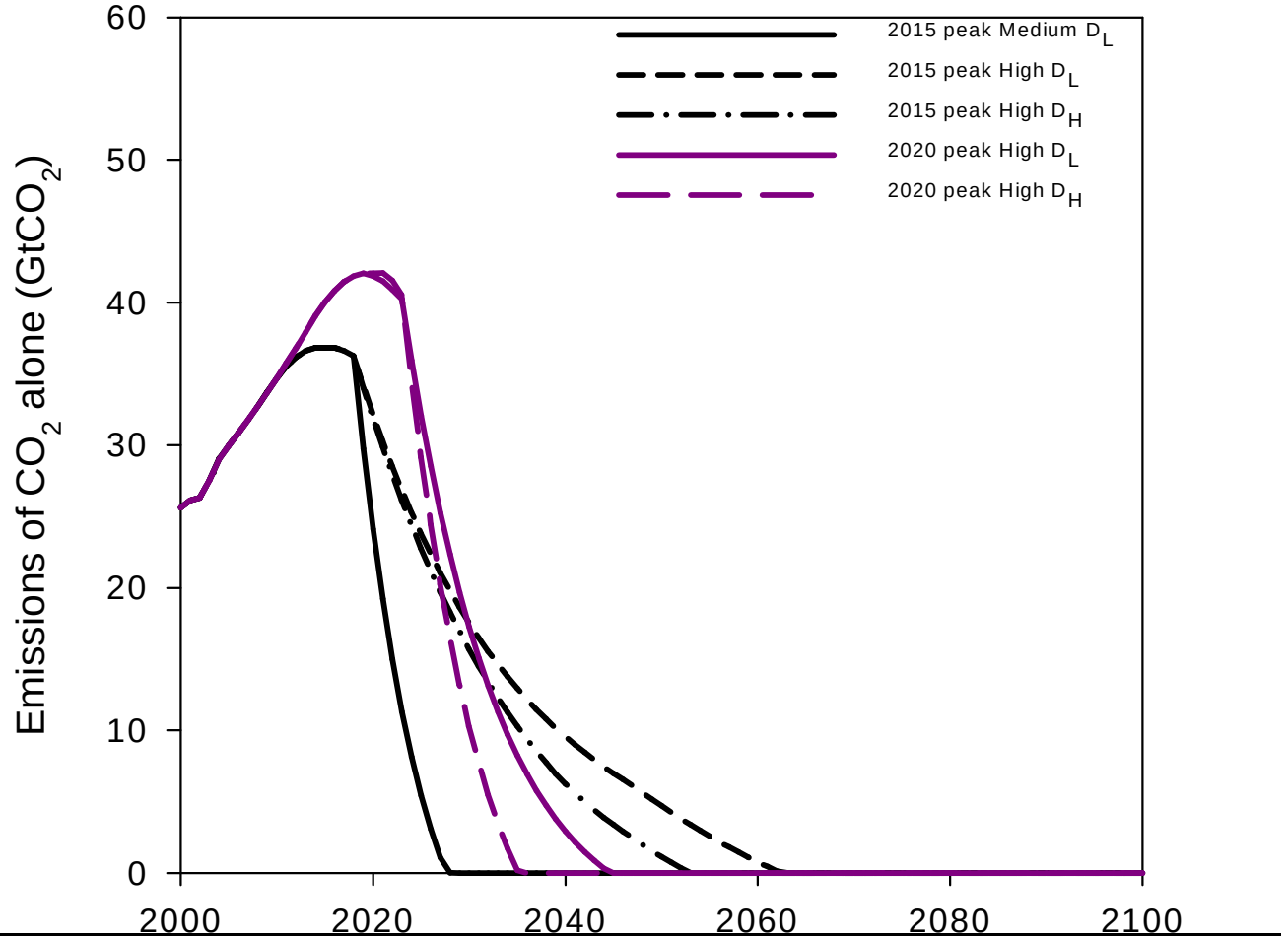
Emission-space remaining for energy CO_2

- Removed impossible pathways

- Complete global decarbonisation 2027 - 2062



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For 450ppmv CO_2e (50:50 of 2°C)

Only possible with IPCC upper cumulative emission estimate

70-80% of current forestry carbon stock must remain

Peak in GHG emissions in 2015

- *4% reduction p.a. in CO_2e*
- *7% reduction in CO_2 from energy*
- *Halving carbon intensity of food production between 2015 & 2050*

550 & 650 ppmv

greenhouse gas emission pathways

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Suggested CO_2e emissions peak?

Bush - USA	-	2025
Stern – Global aim	-	2015
Tyndall	-	2015, **2020**, 2025

550 & 650 ppmv

For 550ppmv CO_2e with emissions peaking by 2020:

- *6% annual reductions in CO_2e*
- *9% annual reductions in CO_2 from energy*

For 650ppmv CO_2e with emissions peaking by 2020:

- *3% annual reductions in CO_2e*
- *3.5% annual reductions in CO_2 from energy*

What are the precedents for such reductions?

Annual reductions of greater than 1% p.a. have only

"been associated with economic recession or upheaval"… Stern 2006

- *UK gas & French 40x nuclear ~1% p.a. reductions*

  (ex. aviation & shipping)

- *Collapse Soviet Union economy ~5% p.a. reductions*

So where does this leave us?

Even assuming:

… an unprecedented step change in mitigating emissions

… stabilising at **650ppmv CO_2e** appears increasingly to be the best we can expect

*i.e. human-induced climate change of **~4°C*** or more

Reframe the debate

We need to urgently reframe the climate change debate:

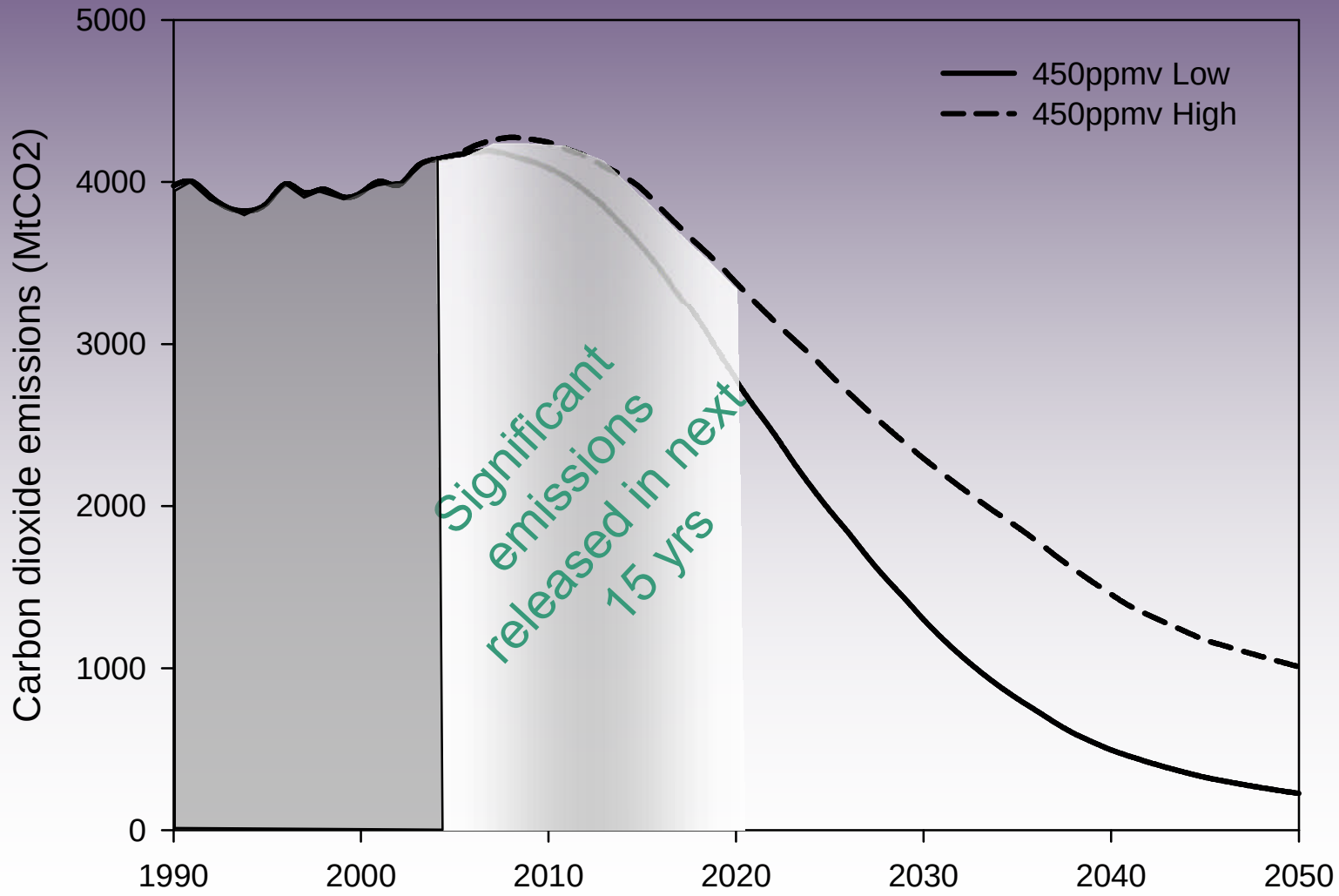
- For mitigation

  2°C should remain the driver of policy

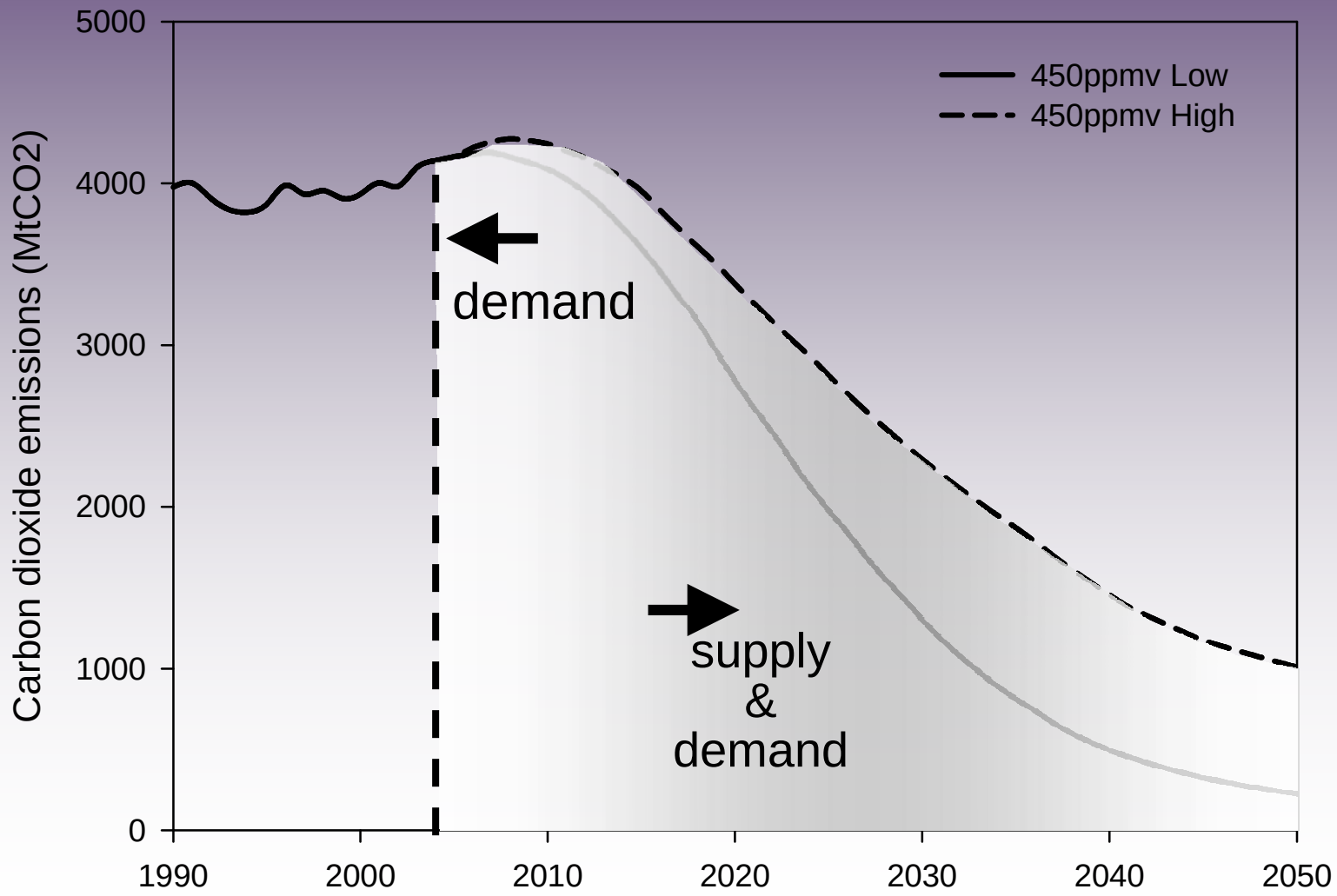
- For adaptation

  4°C should become the driver of policy

Where does this leave us?



Where does this leave us?



The example of domestic lighting

Light	Electricity Consumption	Transmission	Powerstation	Fuel Production, Extraction &Transport
10	→ 50	→ 54	→ 120	→ 133

… carbon reductions from reducing demand could dwarf reductions from low-carbon supply in all but the long term!

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Conclusions

Can not afford for emissions to remain high

Must seek solutions that deliver radical emission reductions in the short-term

Not currently on track to avoid ‘dangerous climate change’

UK Climate Change Act put is a welcome a starting point