

Applying risk analytic techniques to the integrated assessment of climate policy benefits

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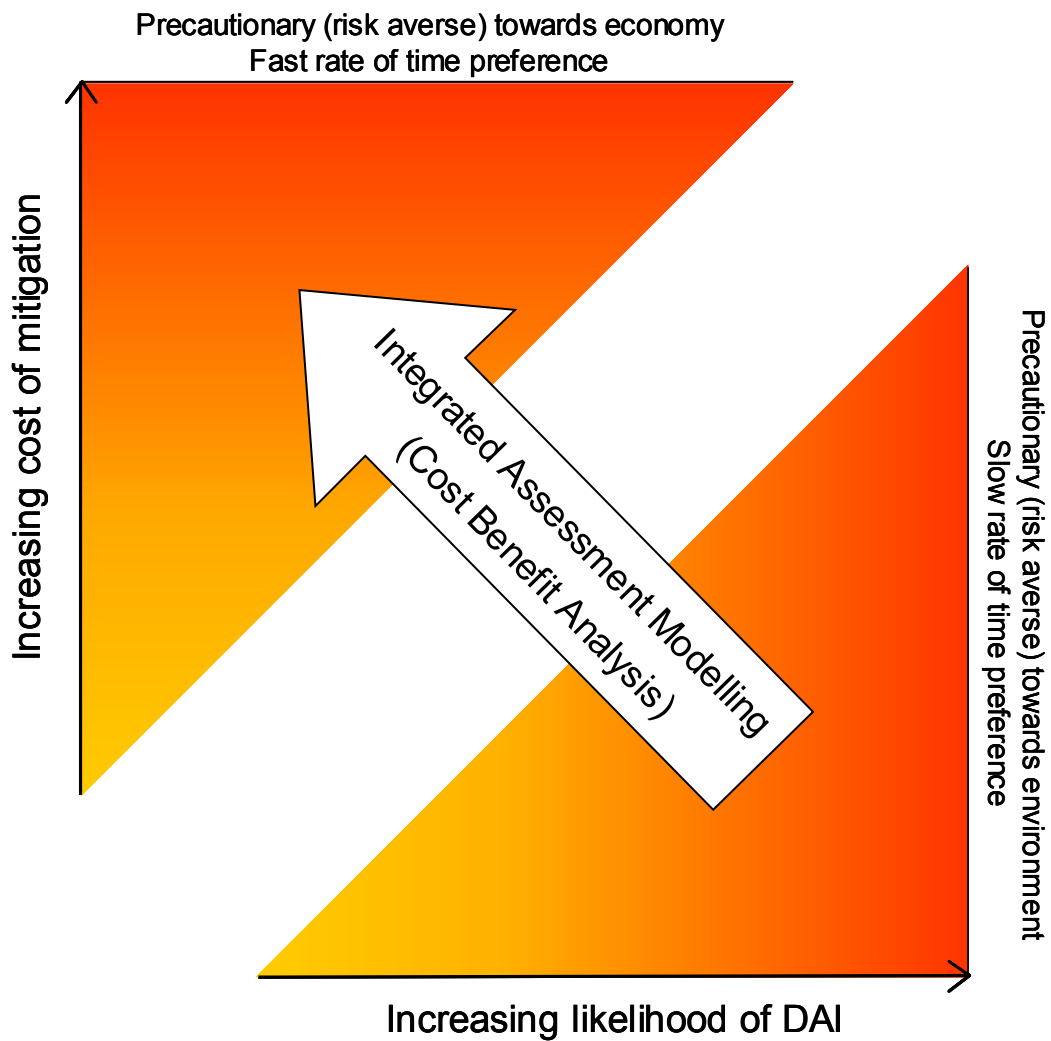
Acknowledgements Ben Preston CSIRO





Two extremes of perceived risk

Policy-related risks



Climate-related risks



Policy impasse

- Fear No.1 of the highly averse to economic risks
 - Type I Error
 - False Positive – we act on greenhouse but it turns out wrong
 - Favoured policy mix – wait and see, R&D to narrow uncertainty to predictive range, eschews targets and central controls not based on cost signals, favours market-driven tech solutions on supply
- Fear No.1 of the highly averse to environmental risks
 - Type II Error
 - False Negative – we don't act fast enough and end up with DAI
 - Favoured policy mix – set early targets and learn by doing, GHG trade/permit system, social and technological solutions on supply and demand, precautionary approach to DAI

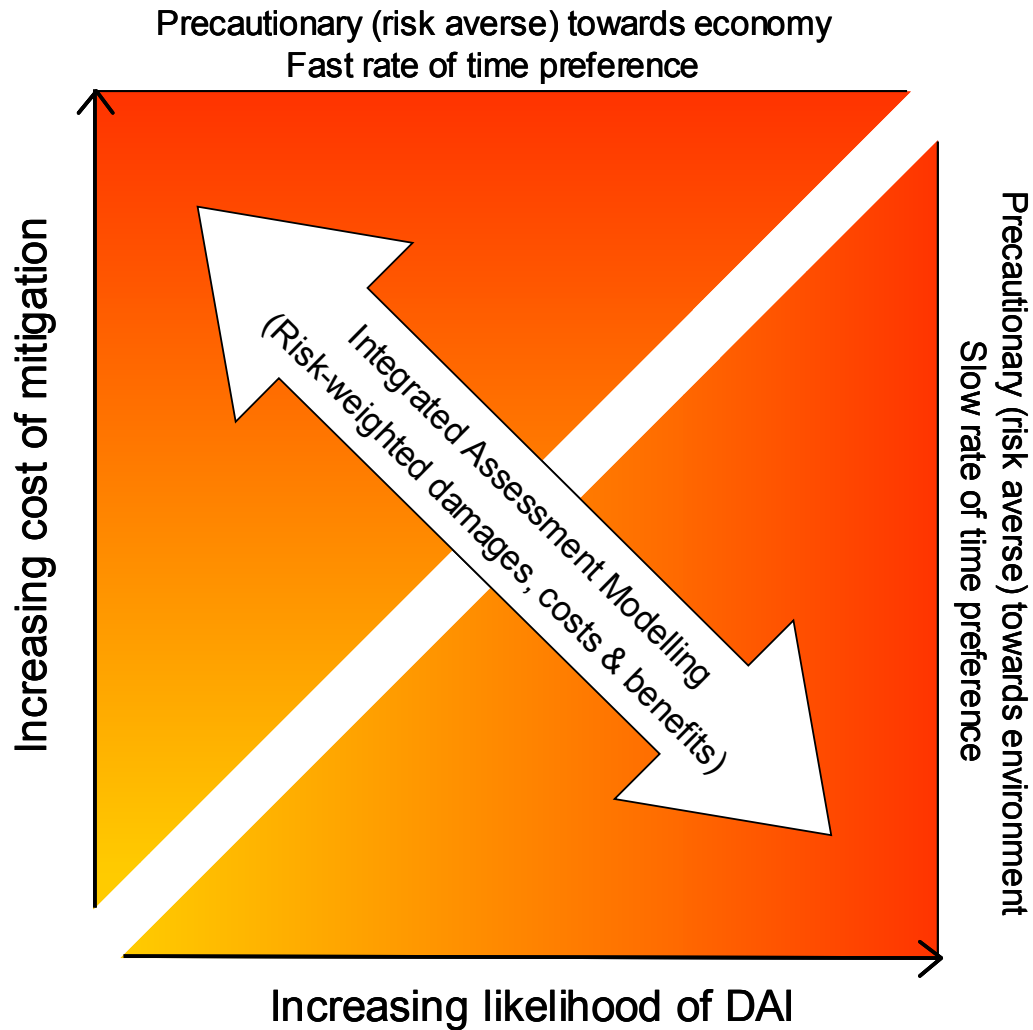


Conventional economic paradigms

- Conventional cost-benefit approaches dominate “economically rational” framing of climate issues
- These perceptions are held more strongly in political and business communities as opposed to the research community
 - Actors who are risk averse to the short-term costs of mitigating climate change want solid estimates of the benefits of avoiding damage before they will act
 - This drives climate modelling and impact assessment into a predictive framework; ill-suited to managing large uncertainties

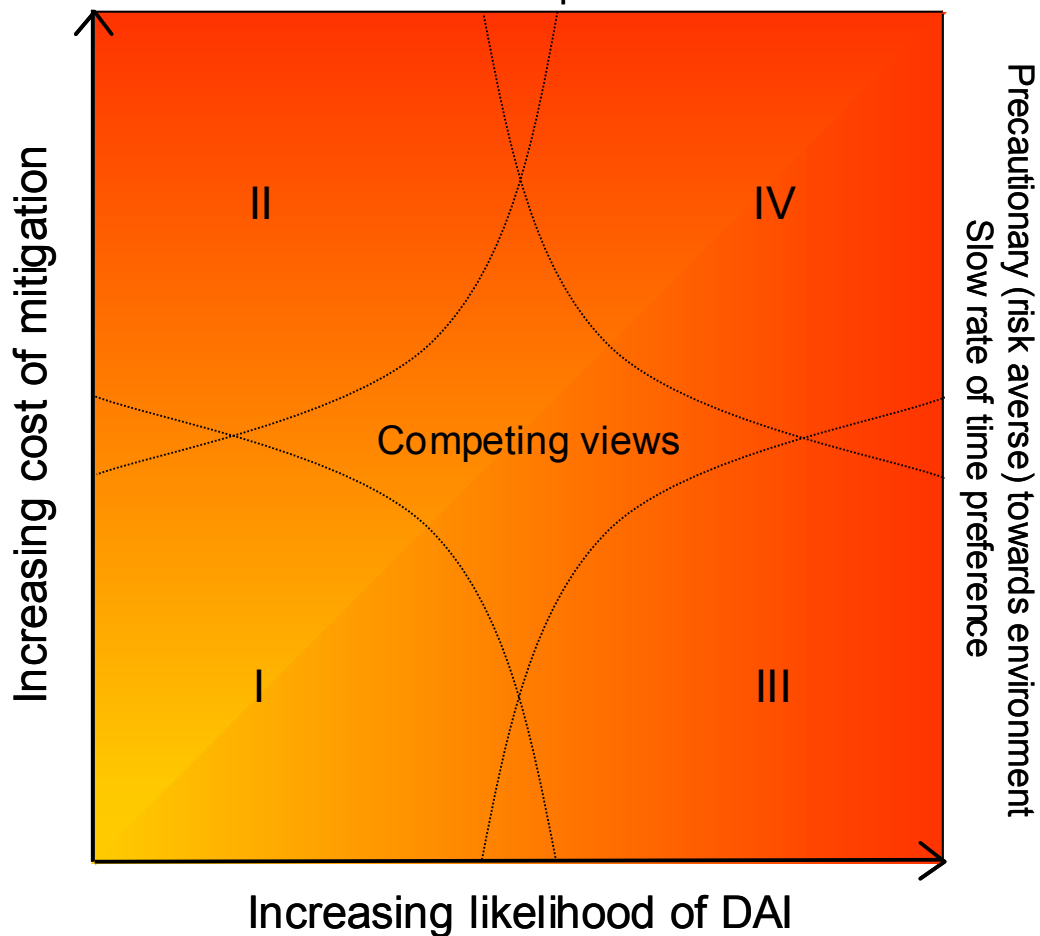


Adding risk into integrated assessment





Precautionary (risk averse) towards economy
Fast rate of time preference



Strategy I

- Wait and see on everything
- Reduce uncertainty through experience
- Reactive adaptation (min loss/max benefits)
- Modest mitigation – known low cost options

Strategy II

- Wait and see on climate and impacts
- Research economic, tech uncertainty
- Reactive adaptation (min loss/max benefits)
- Efforts to reduce mitigation costs

Strategy III

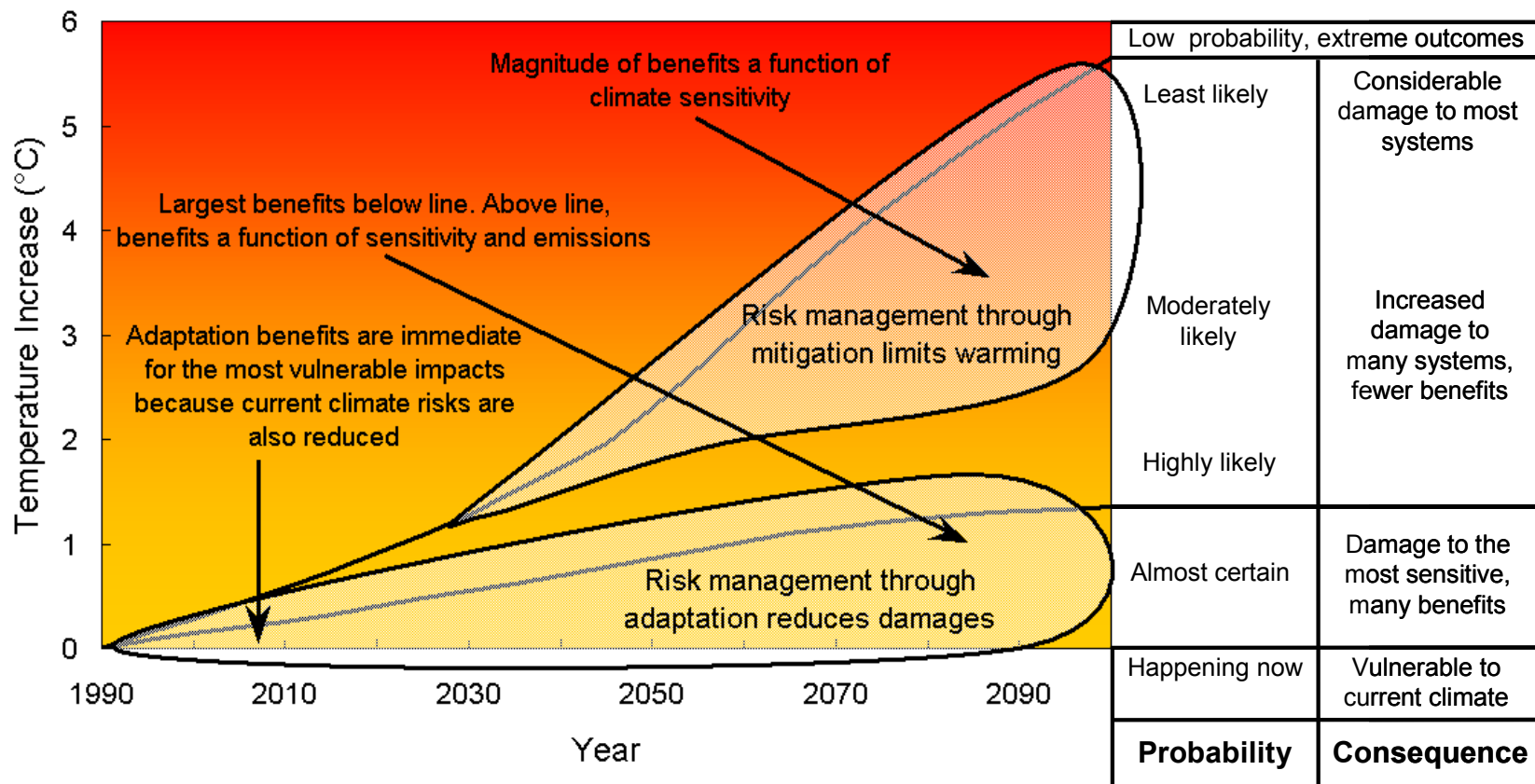
- Act early to stabilise
- Research climate & impact uncertainty
- Anticipatory adaptation
- Strong mitigation – develop low cost options


Strategy IV

- Act on everything
- Research everything
- Anticipatory adaptation and cost reduction
- Anticipatory mitigation and cost reduction



Integrated approaches to risk



 Core benefits of adaptation and mitigation
 Probability – the likelihood of reaching or exceeding a given level of global warming
 Consequence – the effect of reaching or exceeding a given level of global warming
 Risk = Probability × Consequence



Adaptation and mitigation

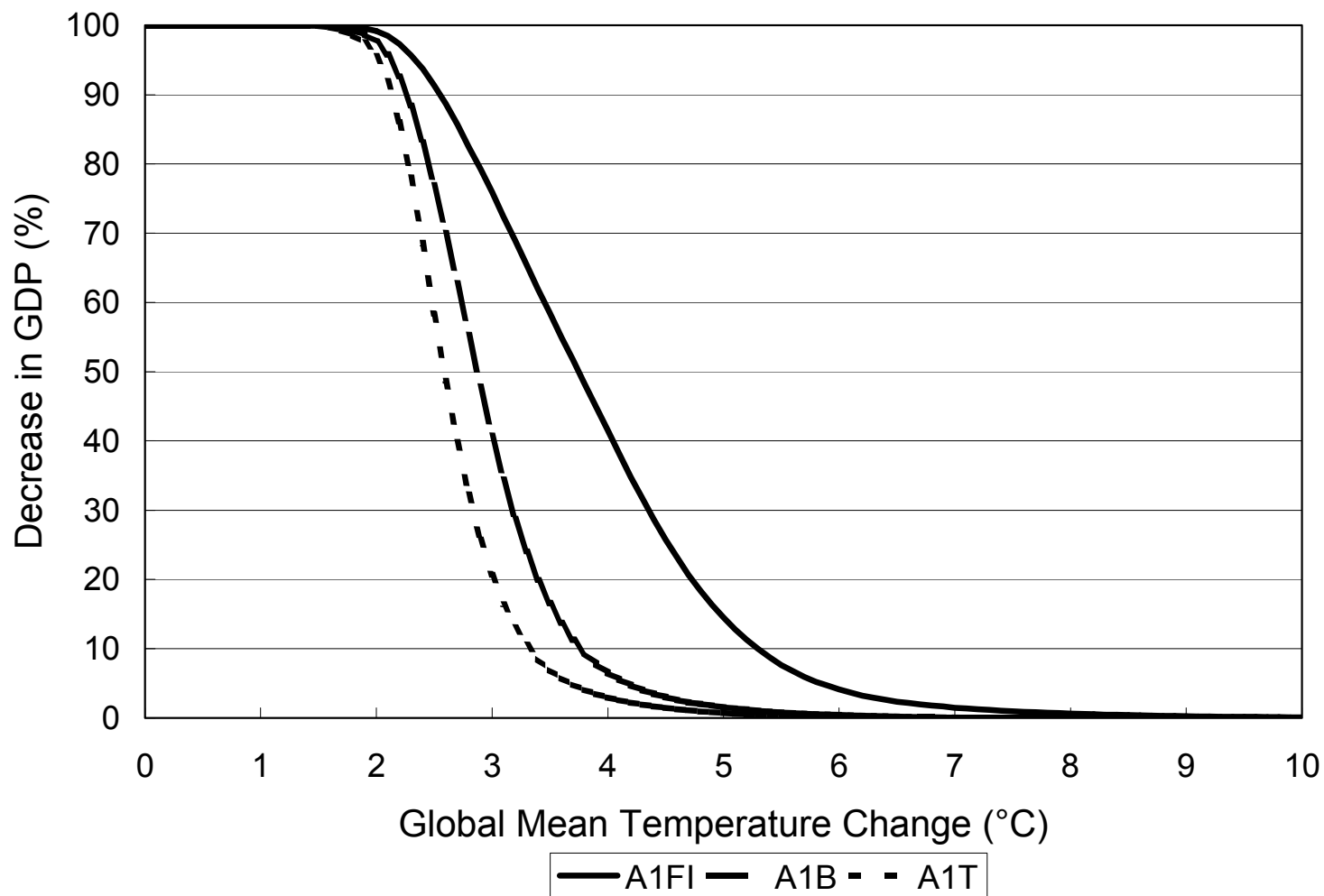
- Adaptation increases the coping range through biological and social means
- Mitigation reduces the magnitude and frequency of greenhouse-related climate hazards

At the policy scale they are complementary, not interchangeable.

They also reduce different areas of climate uncertainty

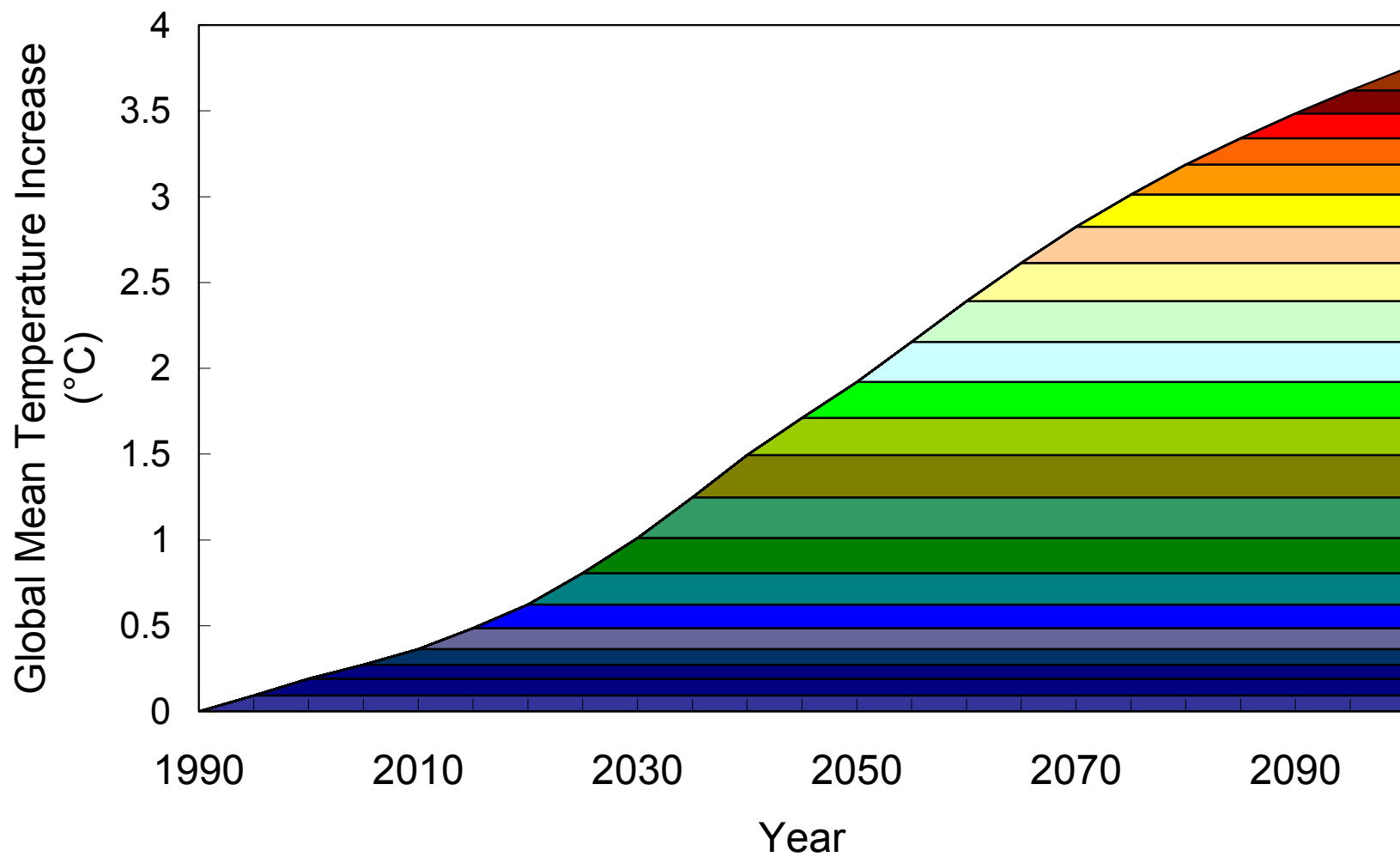


Global mean warming probabilities 2100





Incremental damages

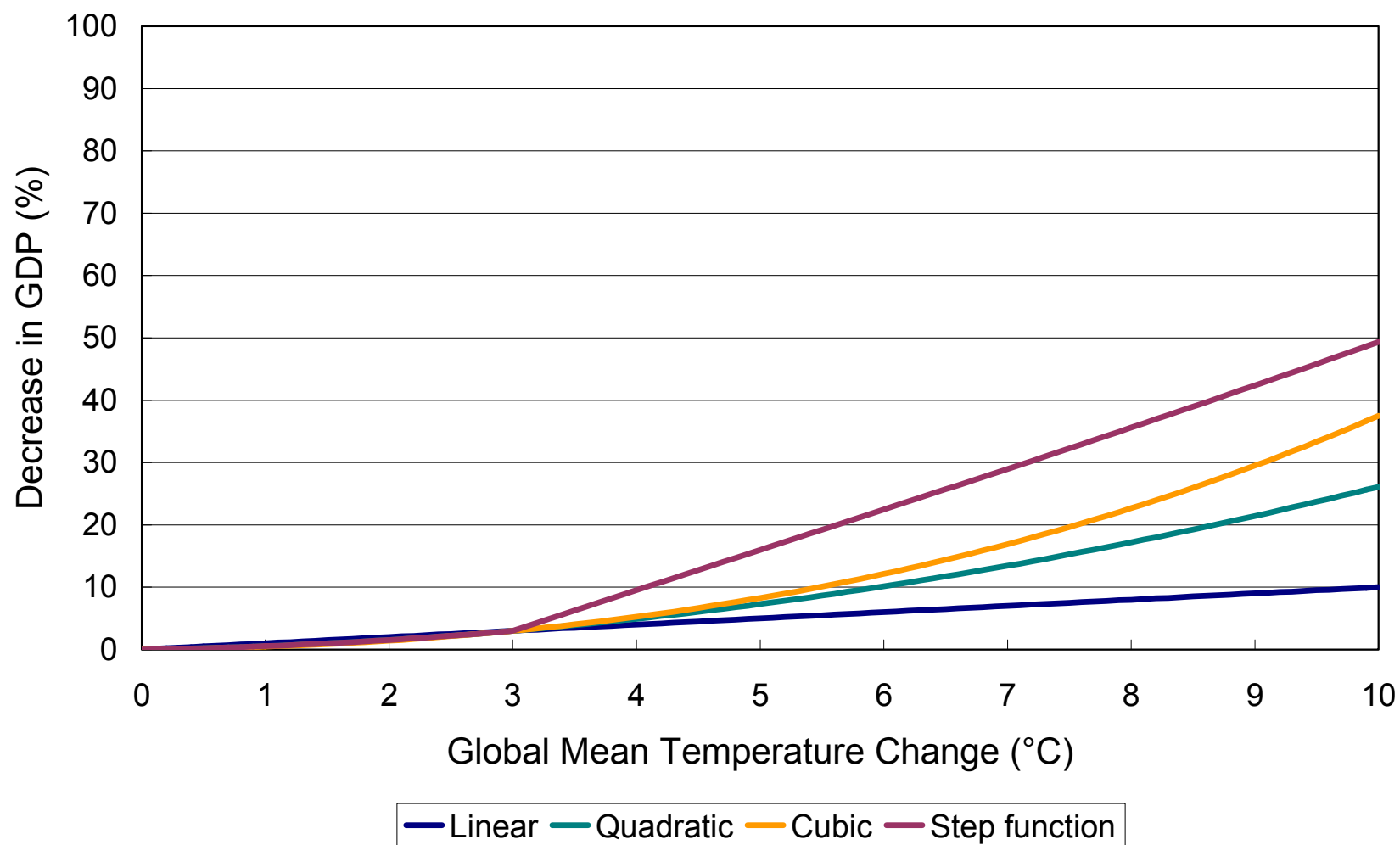




Assessing market damages

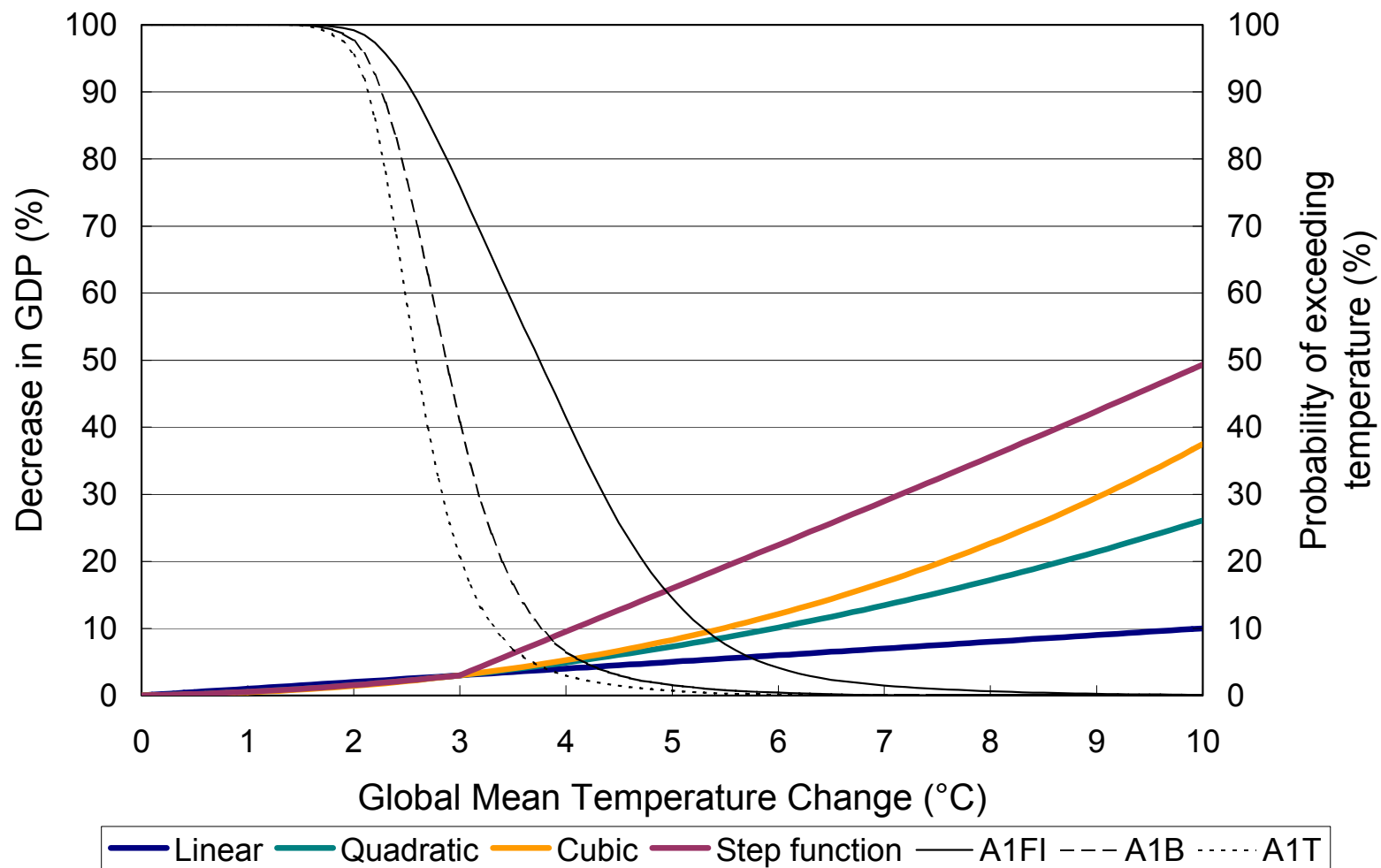


Testing cost curve sensitivity





Risk under different emissions limits – market

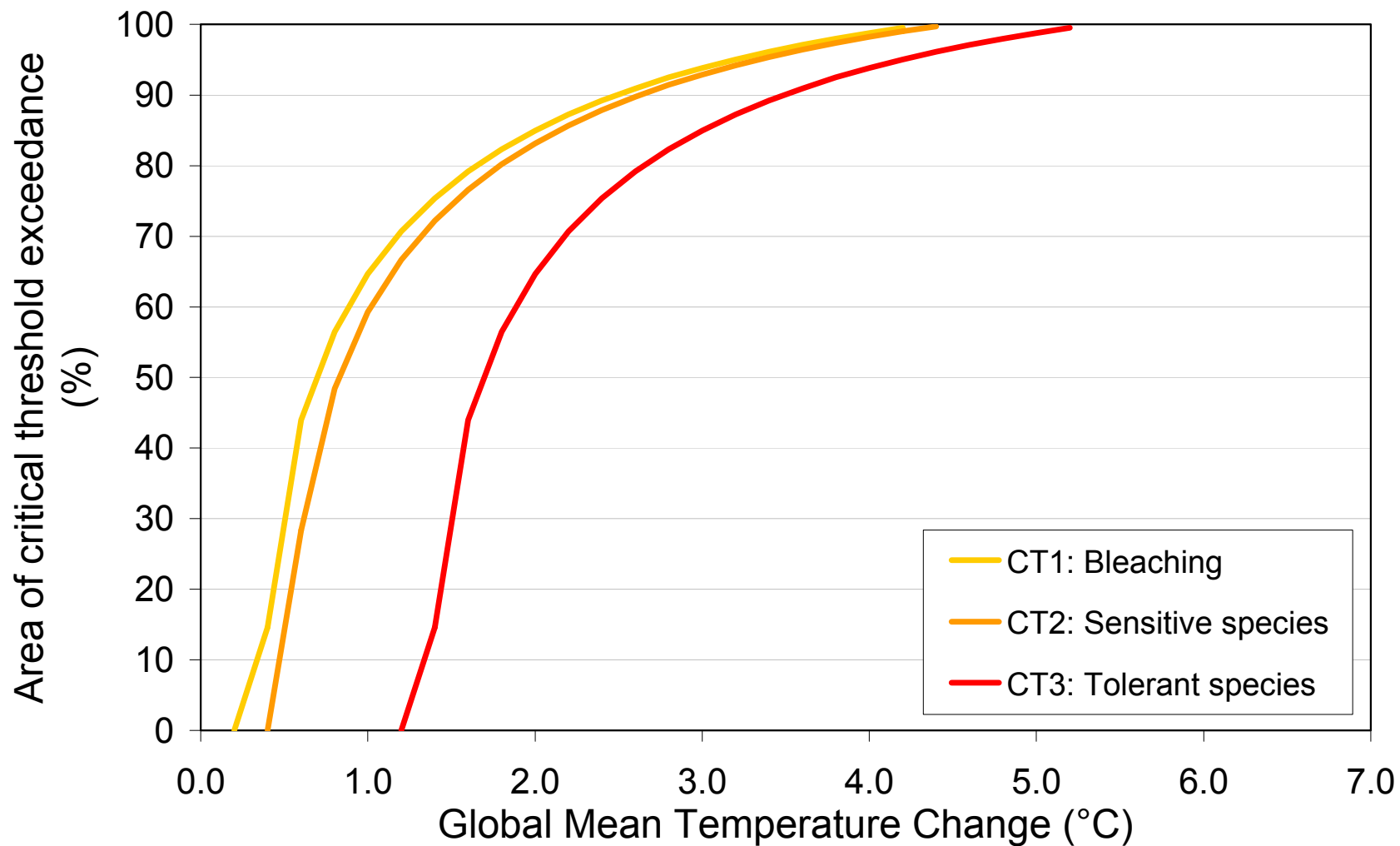




Assessing non-market damages

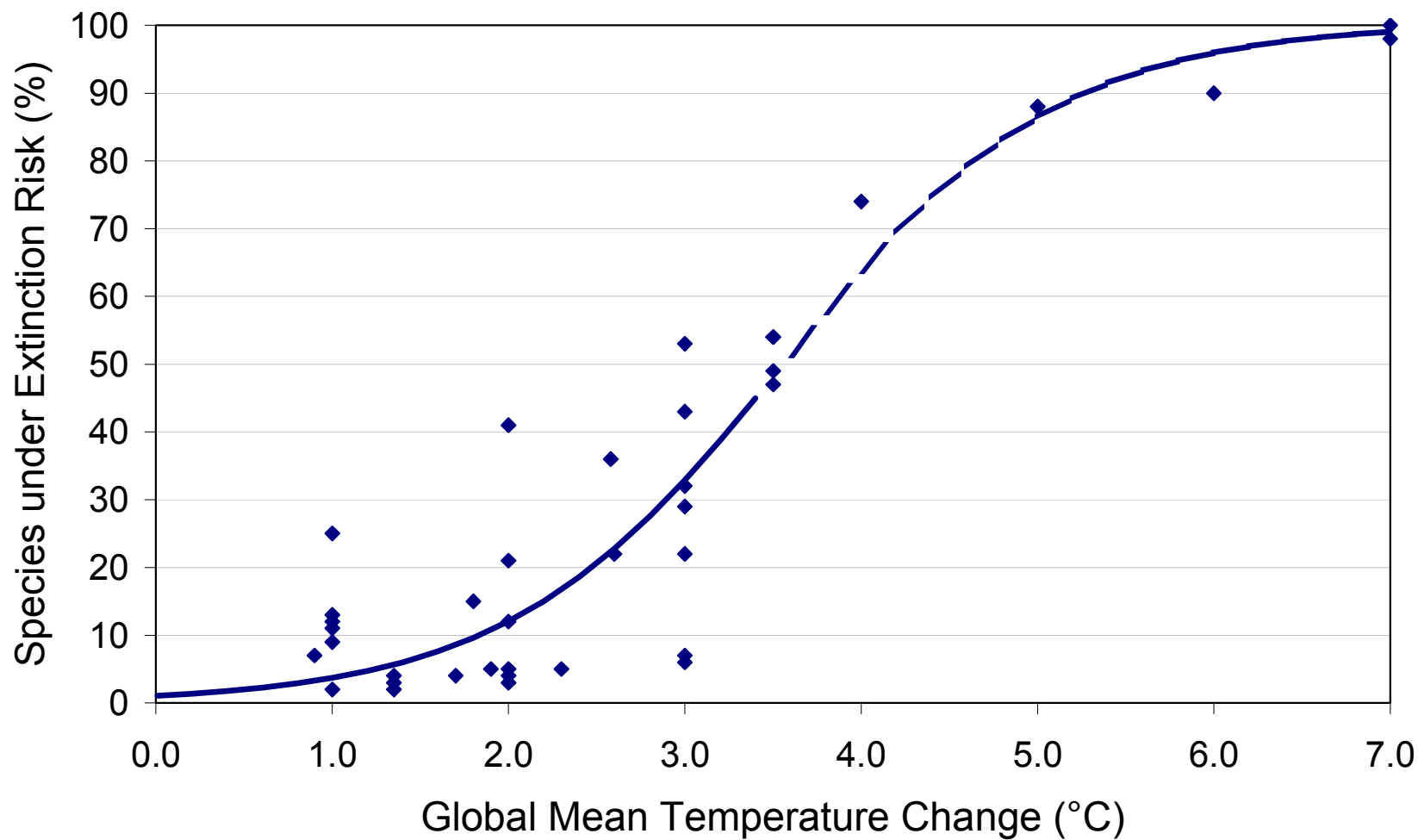


Critical thresholds – coral reefs



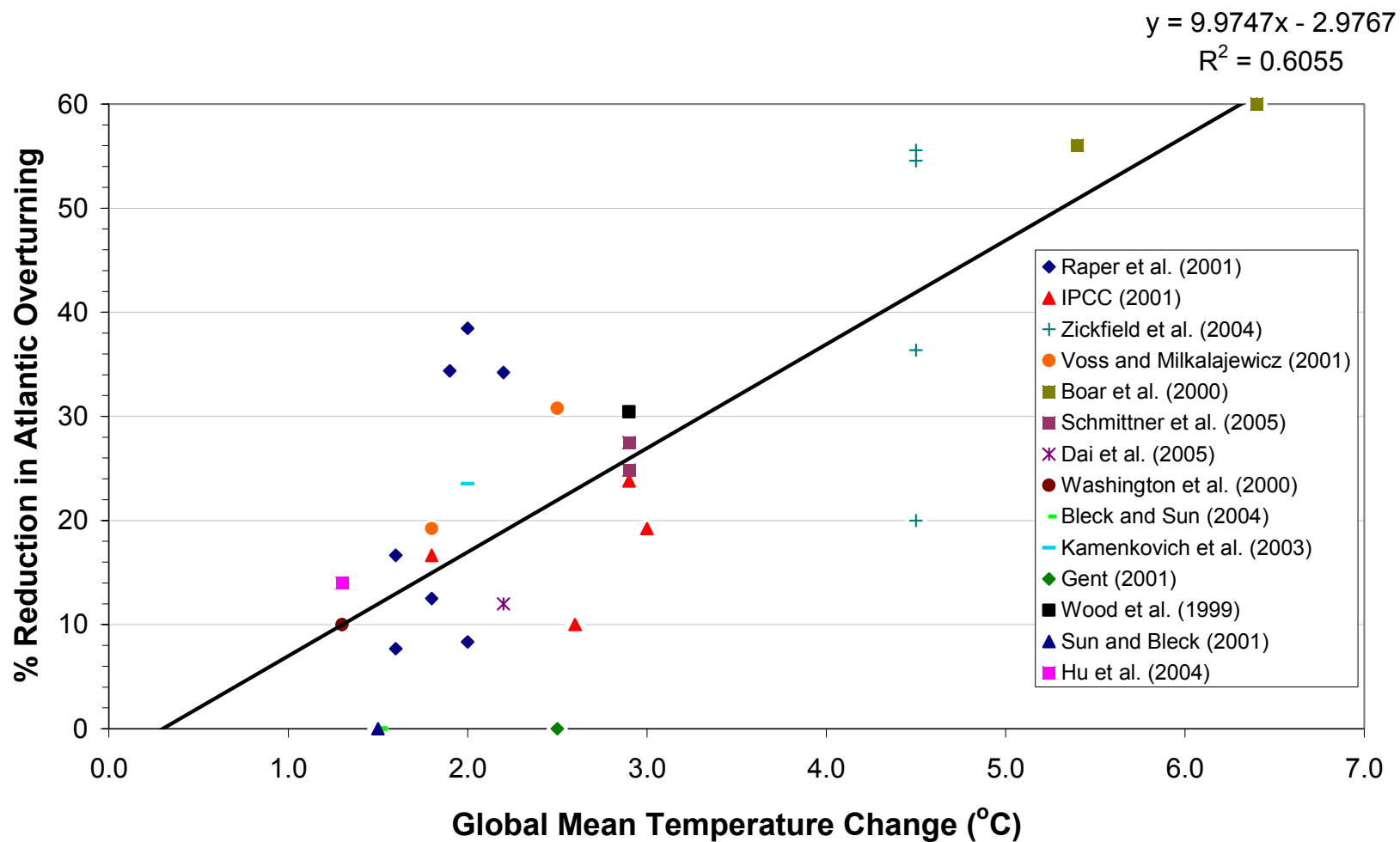


Critical thresholds – extinction risk



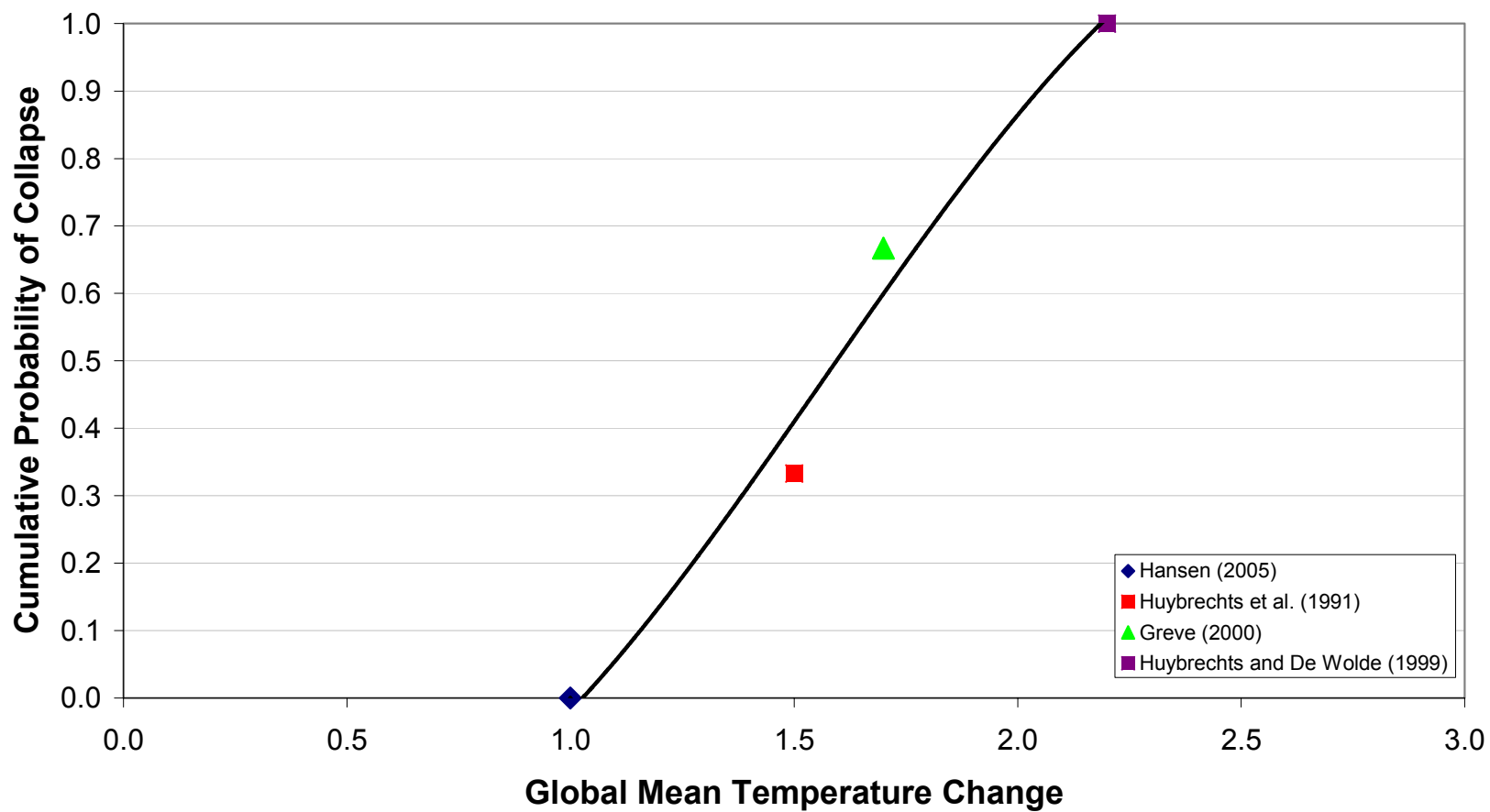


Critical thresholds – thermohaline circulation



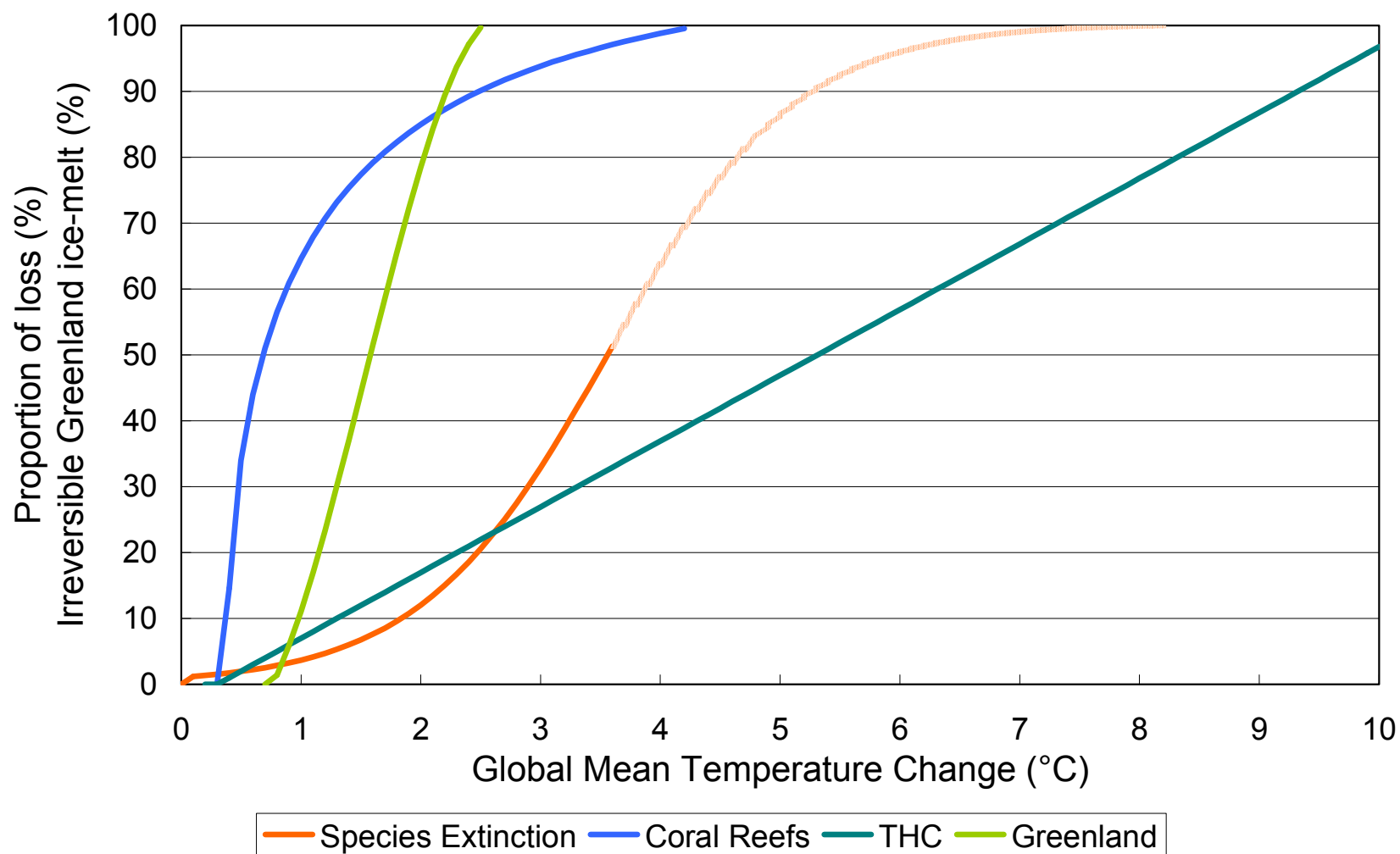


Critical thresholds – Greenland ice-sheet



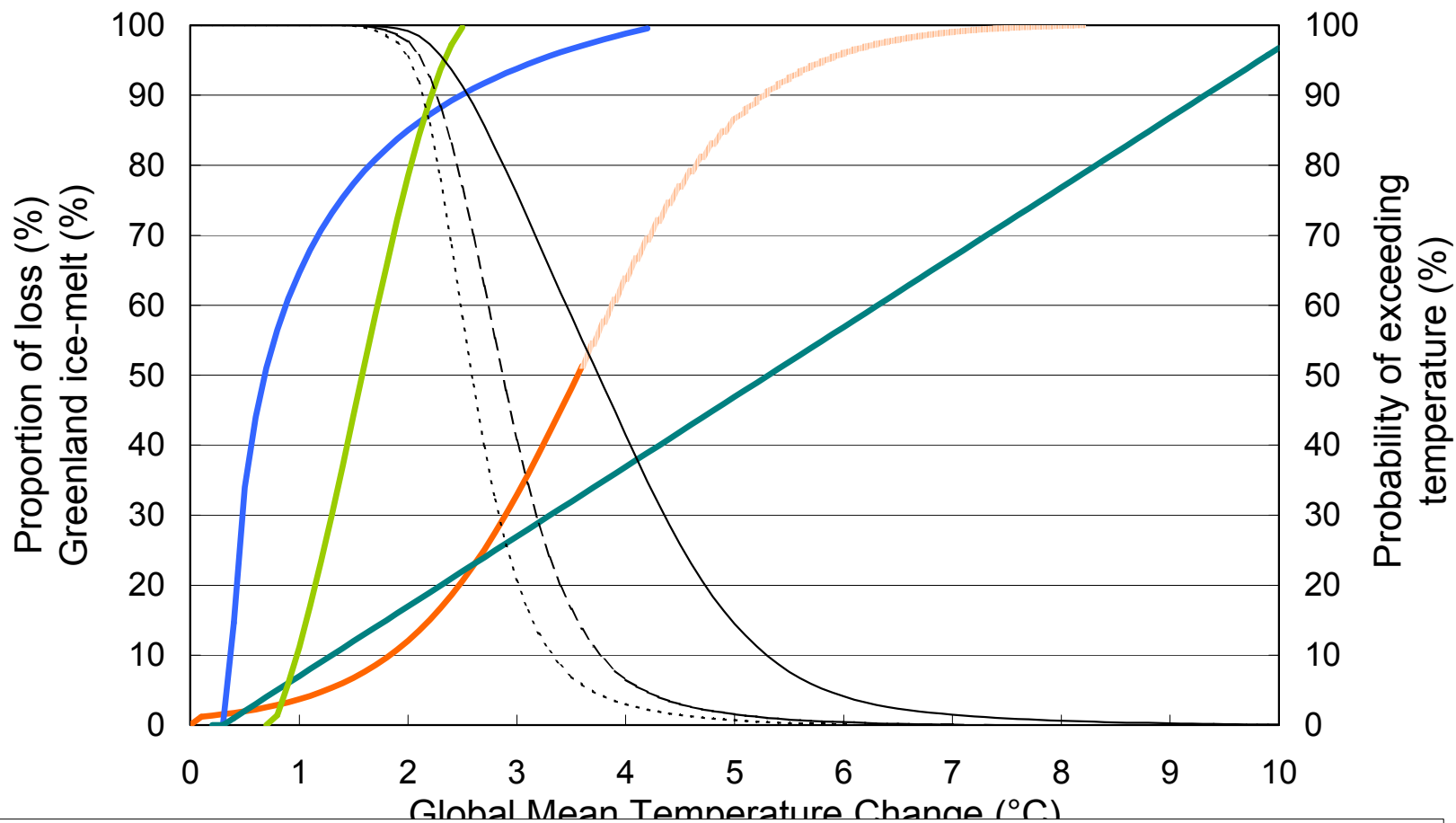


Critical thresholds – all





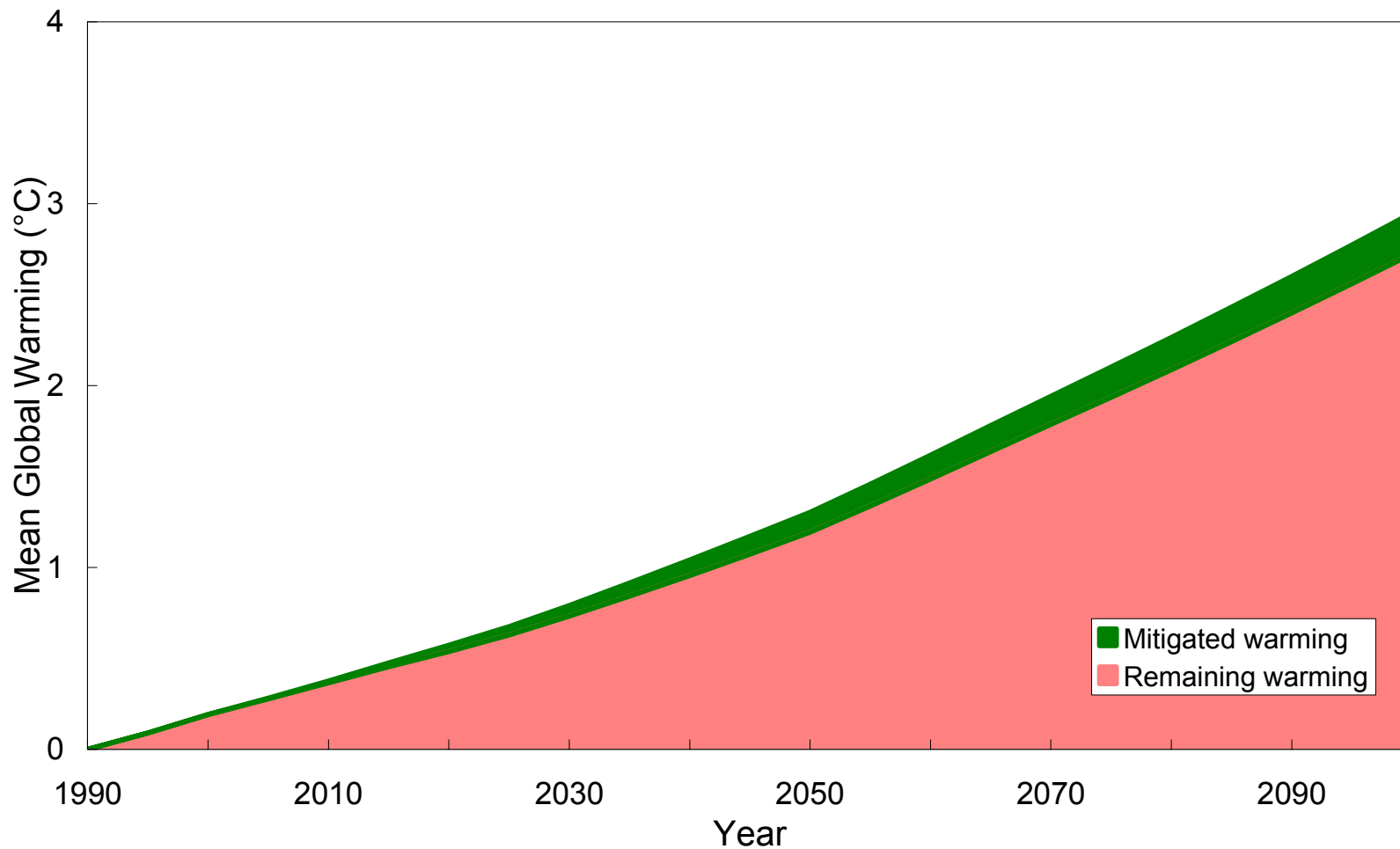
Risk under different emissions limits – non-market



— Species Extinction — Coral Reefs — THC — Greenland
— A1FI - - - A1B · · · A1T

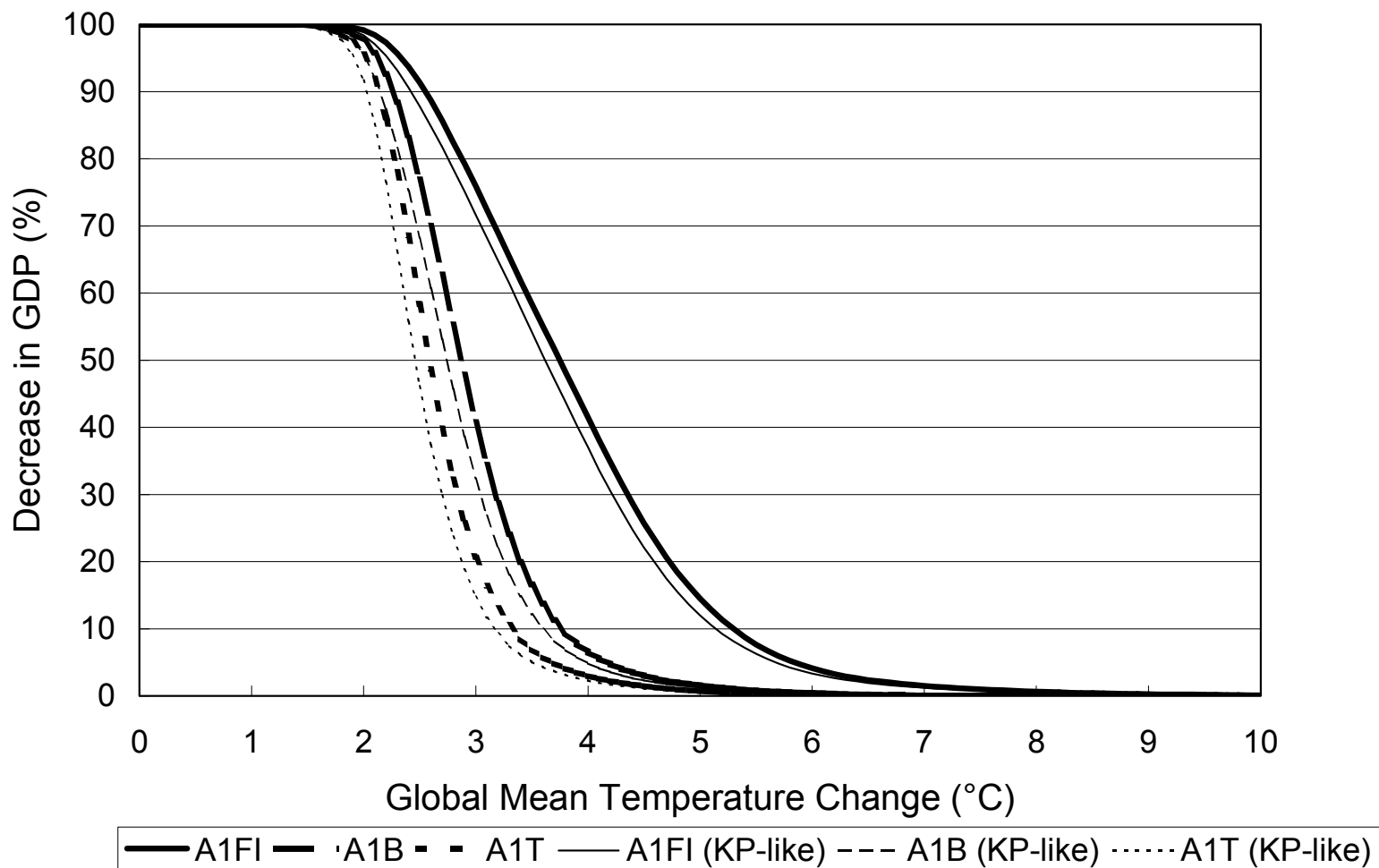


Testing a Kyoto-like mitigation





Changed temp risk with Kyoto-like mitigation





Risk-weighted damages – non-monetary

Scenario upper limit	Species	Coral Reefs	THC slow-down	Green-land ice sheet
	(% damage)			Chance of loss (%)
A1FI	54.6	97.3	36.1	99.3
A1B	31.2	94.5	27.2	98.3
A1T	25.1	92.3	24.3	96.7



Risk-weighted damages – monetary

Scenario upper limit	Linear	Squared	Cubic	Step change
	(% decrease in GDP)			
A1FI	3.9	5.1	5.5	9.4
A1B	3.0	3.1	3.2	4.3
A1T	2.4	2.6	2.6	3.2
	(NPV \$Trillion 1990)			
A1FI	68.3	53.1	74.2	131.6
A1B	49.2	35.1	46.2	57.1
A1T	43.6	30.1	38.8	44.8



Risk-weighted benefits – non-monetary

Scenario upper limit	Species	Coral Reefs	THC slow-down	Green-land ice sheet
	(% damage)			Chance of loss (%)
A1FI	-3.0	-0.4	-1.3	-0.4
A1B	-3.3	-0.8	-1.4	-1.1
A1T	-2.8	-0.9	-1.3	-2.0



Risk-weighted benefits – monetary

Scenario upper limit	Linear	Squared	Cubic	Step change
	(% decrease in GDP)			
A1FI	-0.1	-0.3	-0.4	-0.7
A1B	-0.1	-0.2	-0.3	-0.5
A1T	-0.1	-0.2	-0.2	-0.4
	(NPV \$Trillion 1990)			
A1FI	-2.8	-2.7	-4.2	-11.6
A1B	-2.7	-2.3	-3.5	-5.6
A1T	-2.7	-2.3	-3.5	-5.6



Damages and benefits

- Damages build from bottom up
- Benefits of mitigation come from top down (highest temperatures, worst plausible risks developed from a comprehensive set of reference scenarios)
- Benefits of adaptation work from bottom-up, reducing damages
- Knowledge of costs and benefits of adaptation remains poor
- It is possible to assess near to mid-term adaptation needs (adapting to the inevitable) by using risk analysis based on changes already committed to



Conclusion

- Risk can be used to compare policy and climate risks
- Frameworks for assessing the benefits of climate policy within probabilistic “risk” frameworks provide insights into where policy benefits may lie
- Benefits could be expressed in familiar terms (e.g. cost effectiveness) but expanded to include monetary and non-monetary benefits of risk management
- New knowledge and actions will both alter risk profile – learn by research, learn by doing