

Economic implications of RCP scenarios

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Outline

- Brief introduction of GRACE model
- What we have done so far
 - Comparison of the RCP4.5 and RCP8.5 scenarios
 - Experiment: Run both scenarios with and without impacts of climate change
- Downscaling of economic impacts

Brief of GRACE model for this study

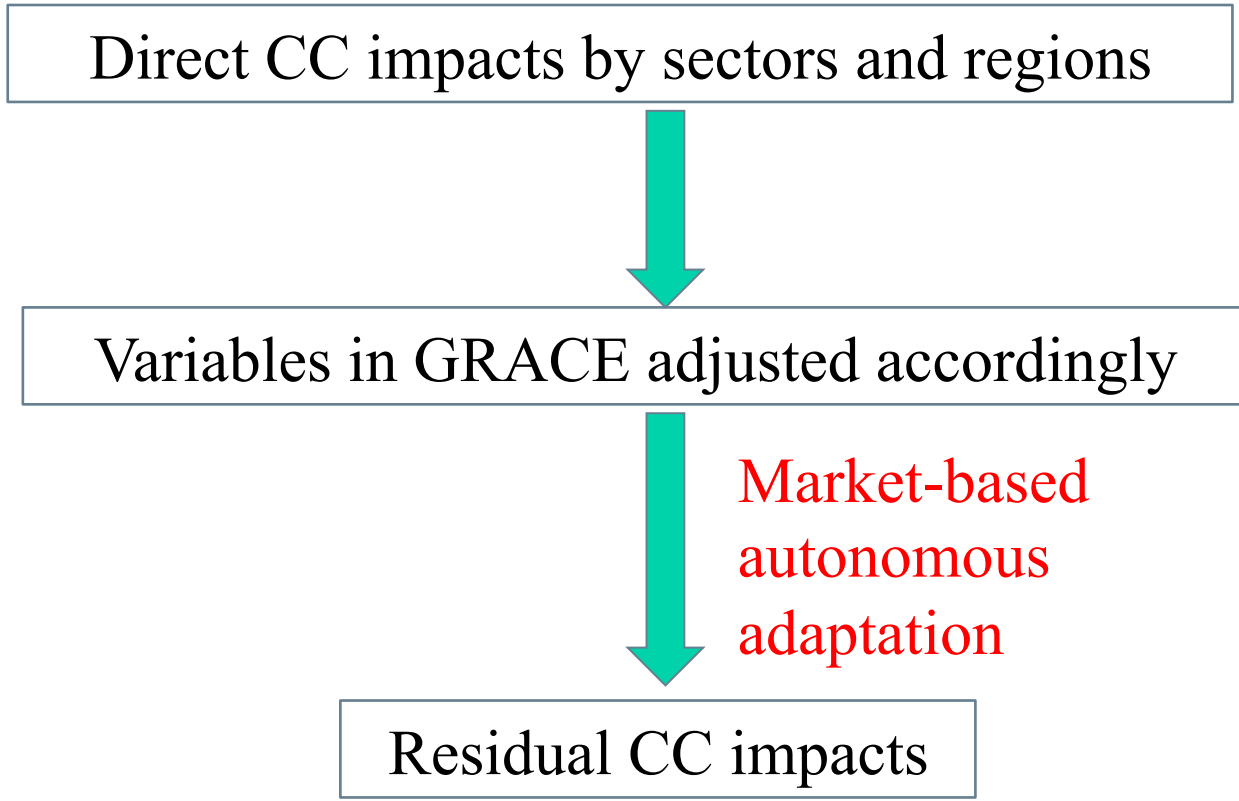
- Multi-sector, multi-regional, recursively dynamic global CGE model
- Calibrated around the GTAP v7 database (2004) (Badri and Walmsley 2008)
- Reference scenario are calibrated to RCP8.5
 - 5 regions
 - Population growth by region
 - GDP growth by region
 - CO2 emissions from fossil fuels by region

Scenarios

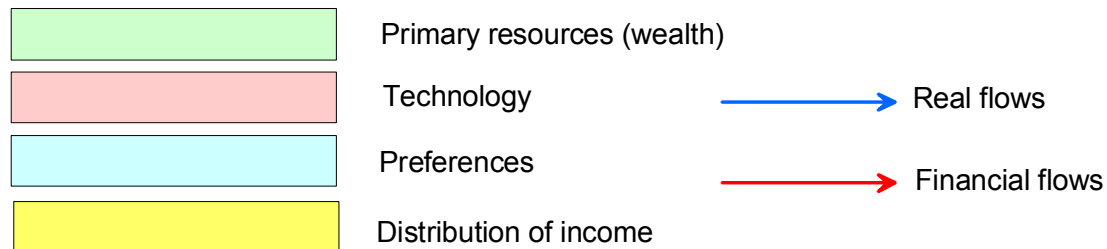
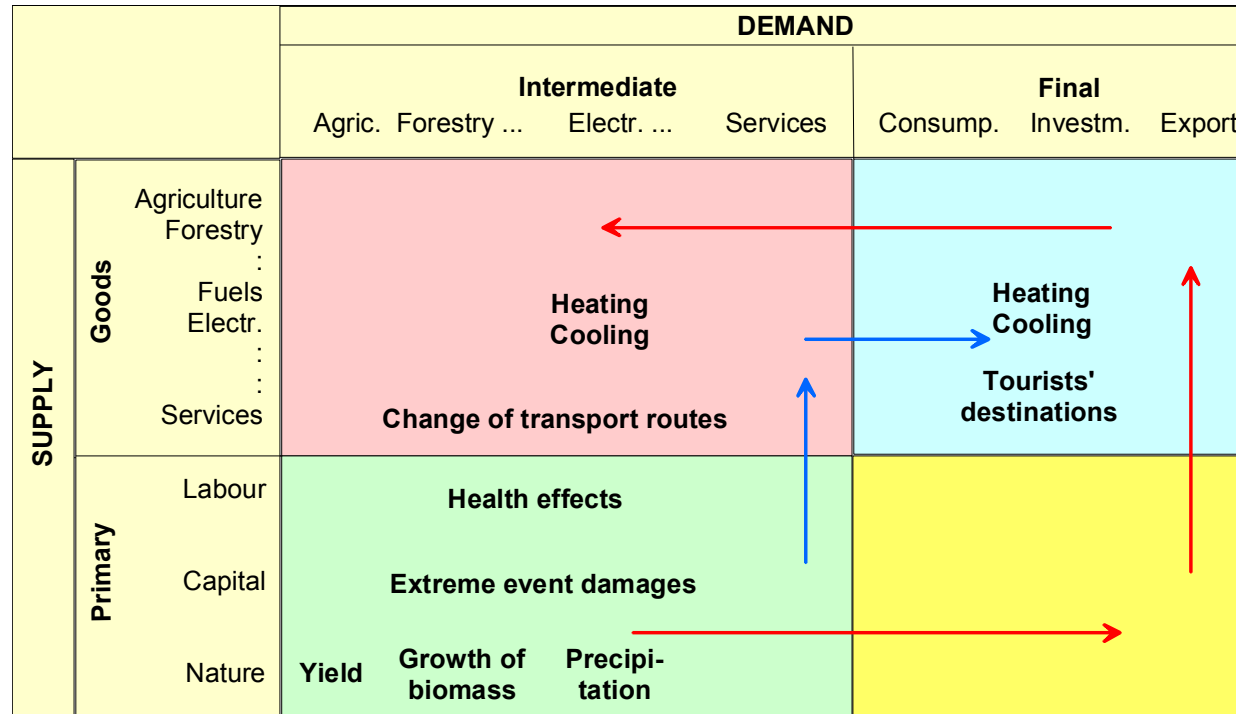
- Assume **the same SSP** for all scenarios
- 4 scenarios:

		Climate change impacts	
		No	Yes
Emissions control: regional	No	RCP8.5 (Ref)	RCP8.5_CC
	Yes	RCP4.5	RCP4.5_CC

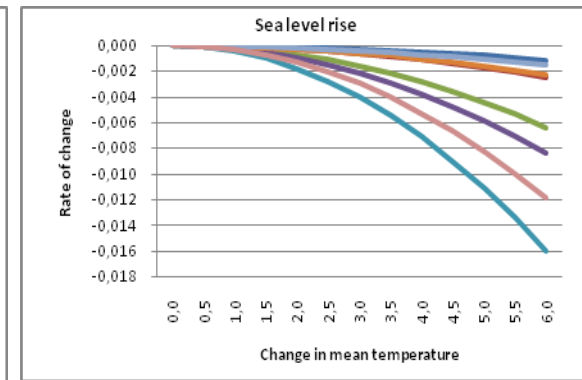
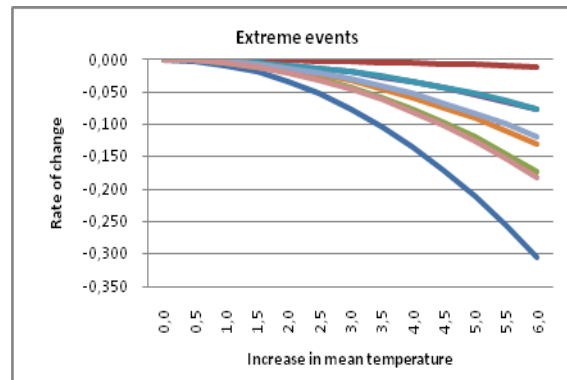
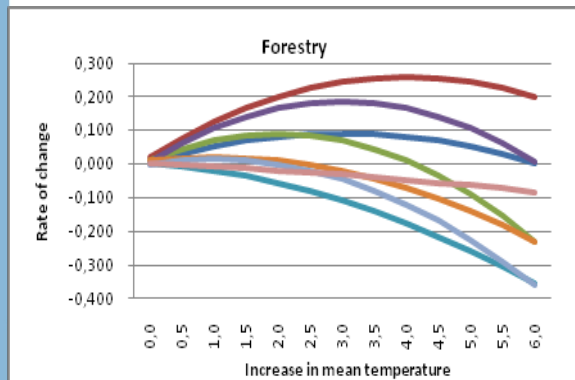
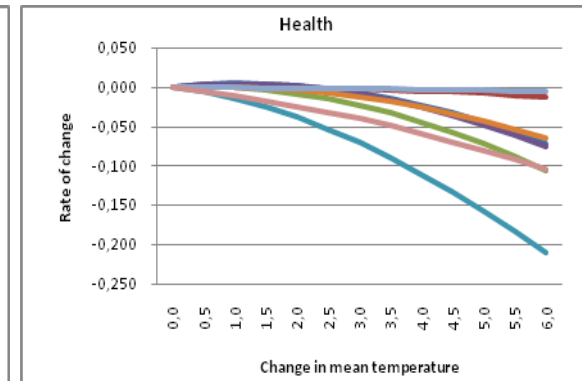
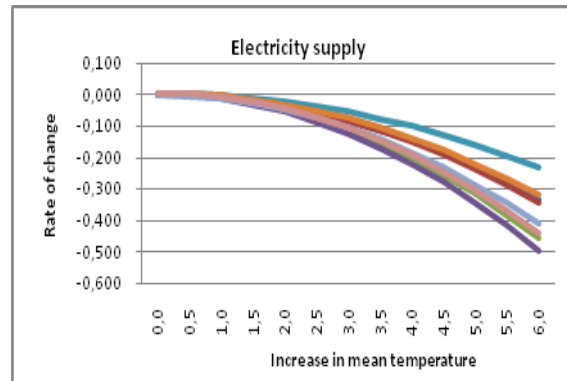
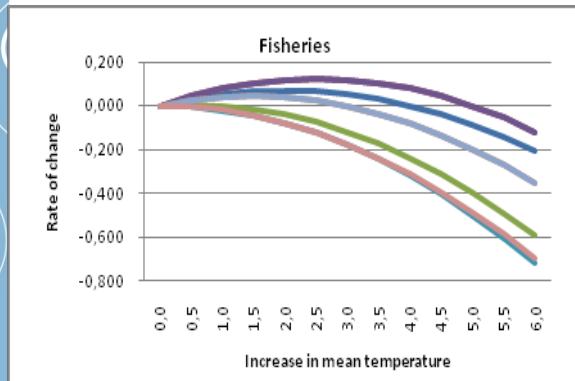
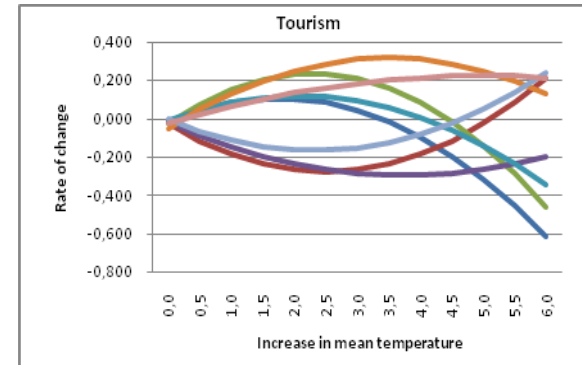
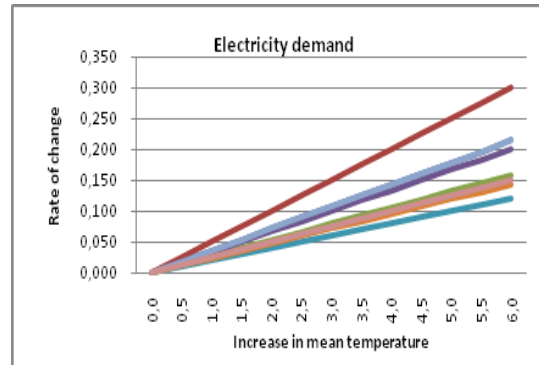
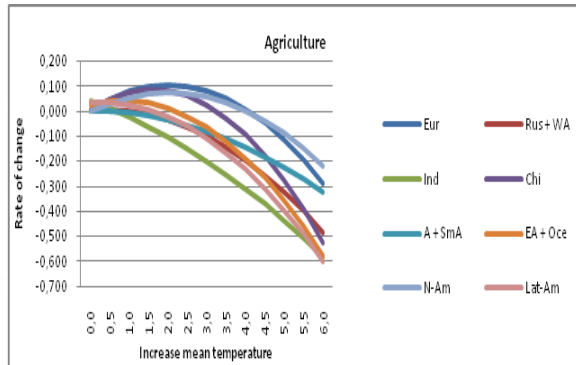
Climate change impacts in GRACE



GRACE: Impacts of climate change in a macroeconomic modelling perspective

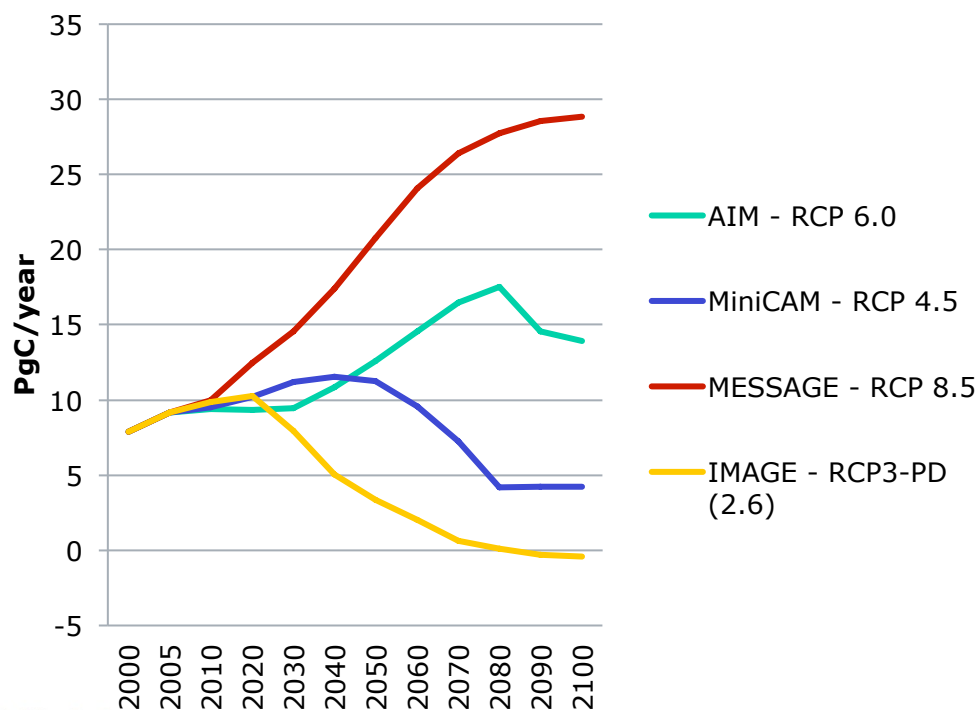


Impacts of climate change in GRACE



Representative Concentrations Pathways (RCP)

	Unit	2000	2100				
			RCP3	RCP4.5	RCP6	RCP8.5	SRES range
Population	bill	6.0	9.0	8.5	9.8	12.6	7.0 – 15.1
World GDP	10 ¹² US\$	30	363	365	218	191	235 - 529
Primary energy	EJ	475	855	1150	830	1750	449 - 1746

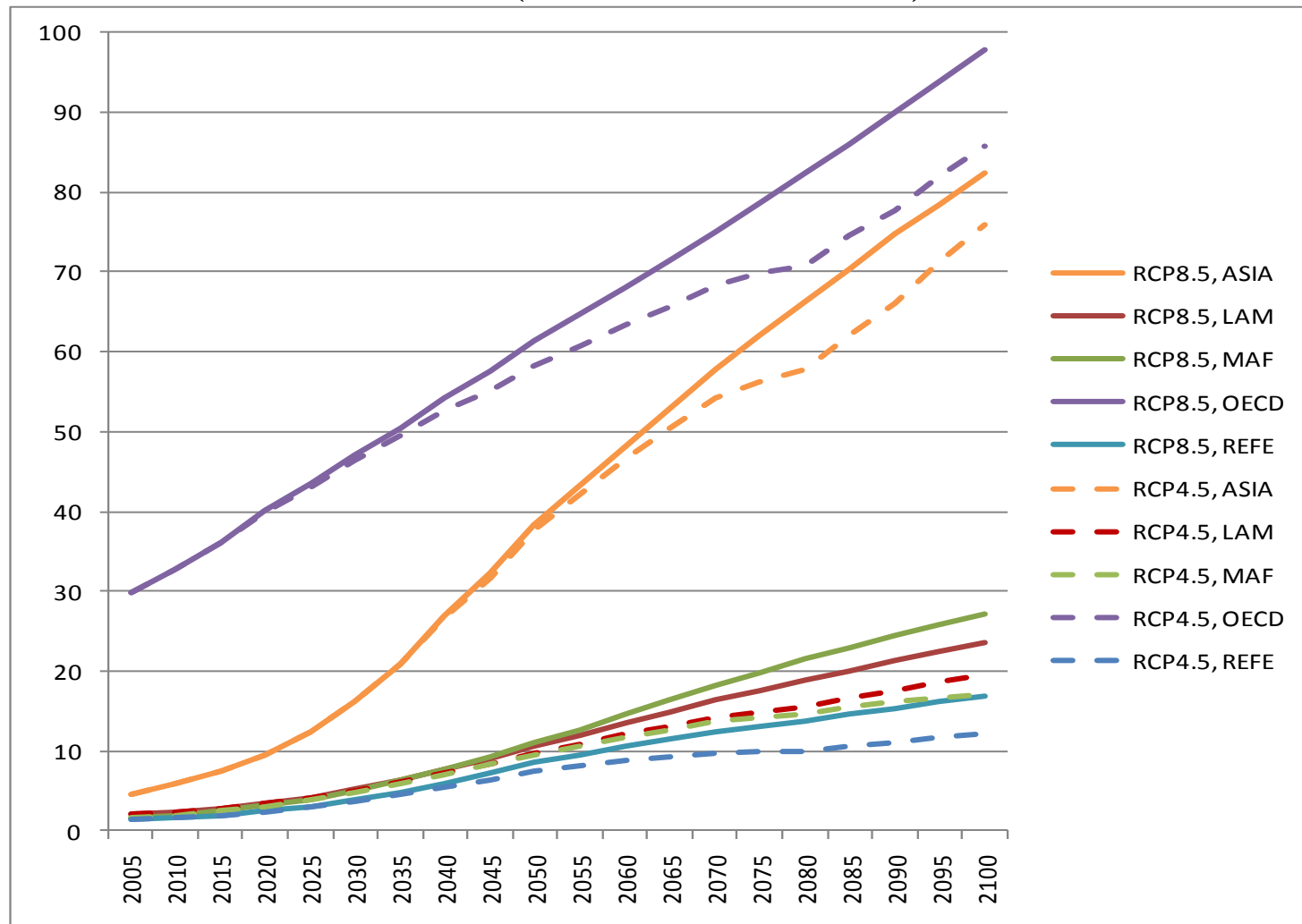


Scenarios

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Emissions control: GDP by region under RCP8.5 and RCP4.5 **without** climate change (trillion 2004US\$)



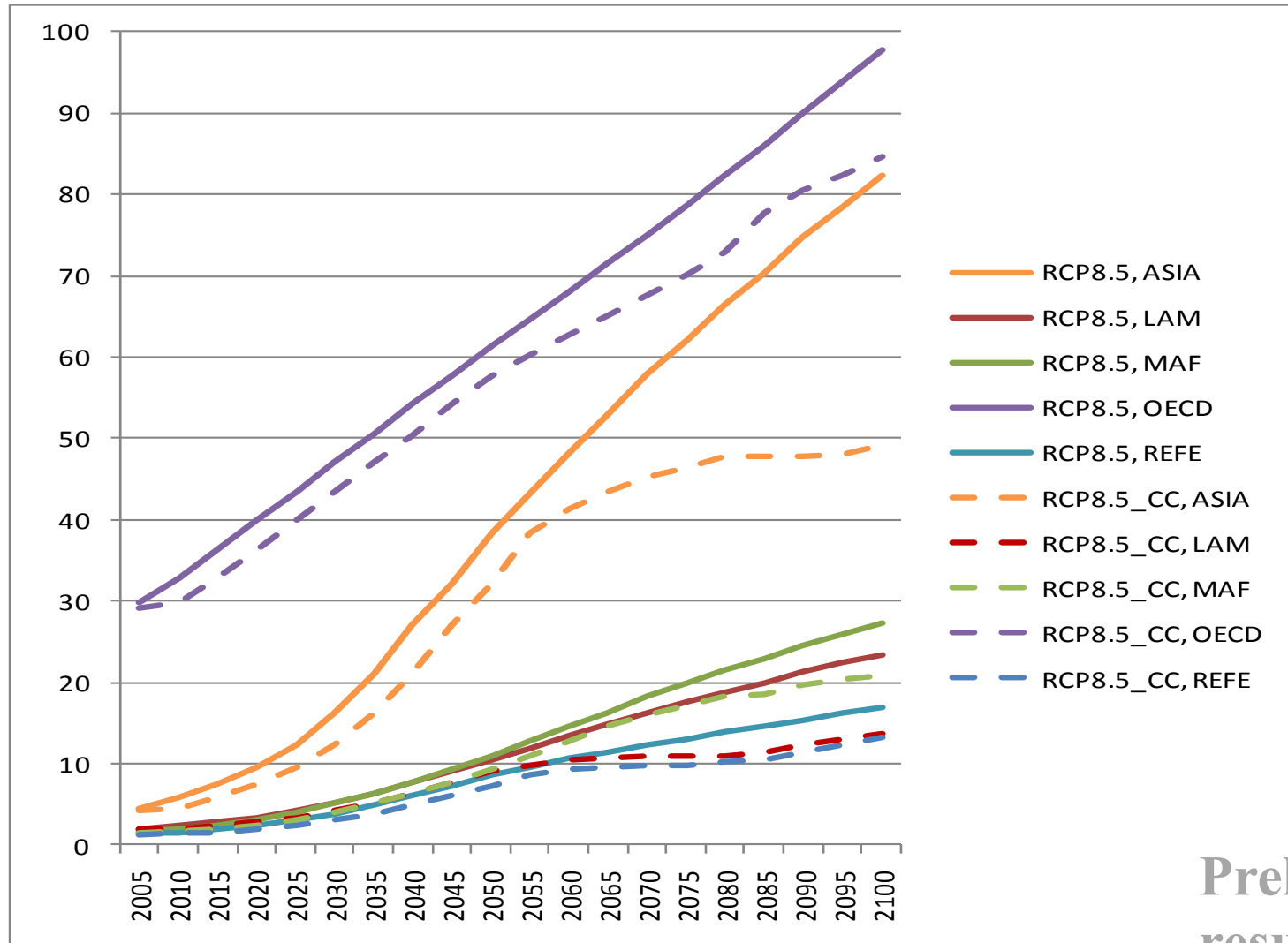
Preliminary
Results

Scenarios

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Estimated GDP in RCP8.5 with and without climate change (trillion 2004US\$)



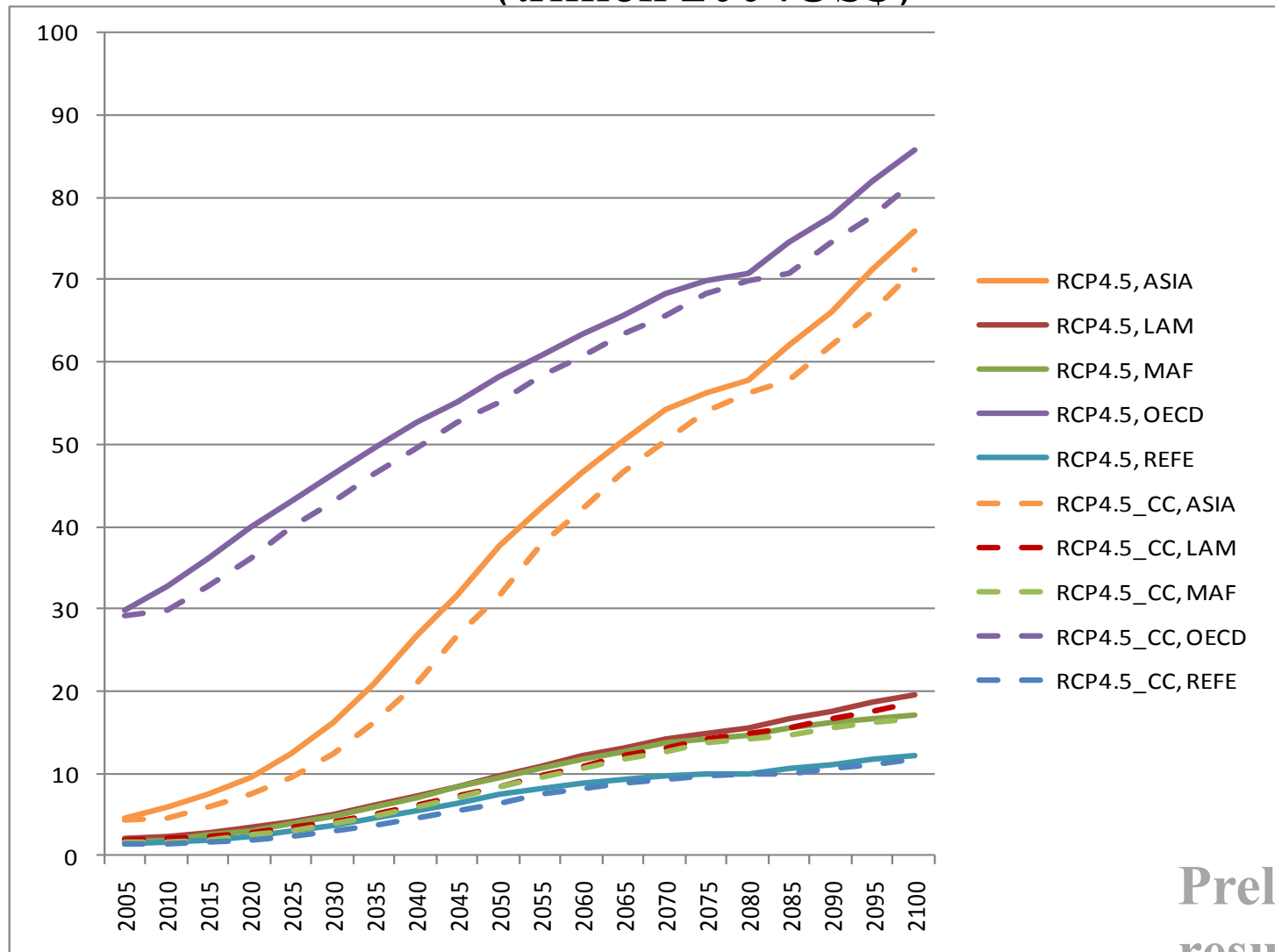
Preliminary
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Estimated GDP in RCP4.5 with and without climate change (trillion 2004US\$)



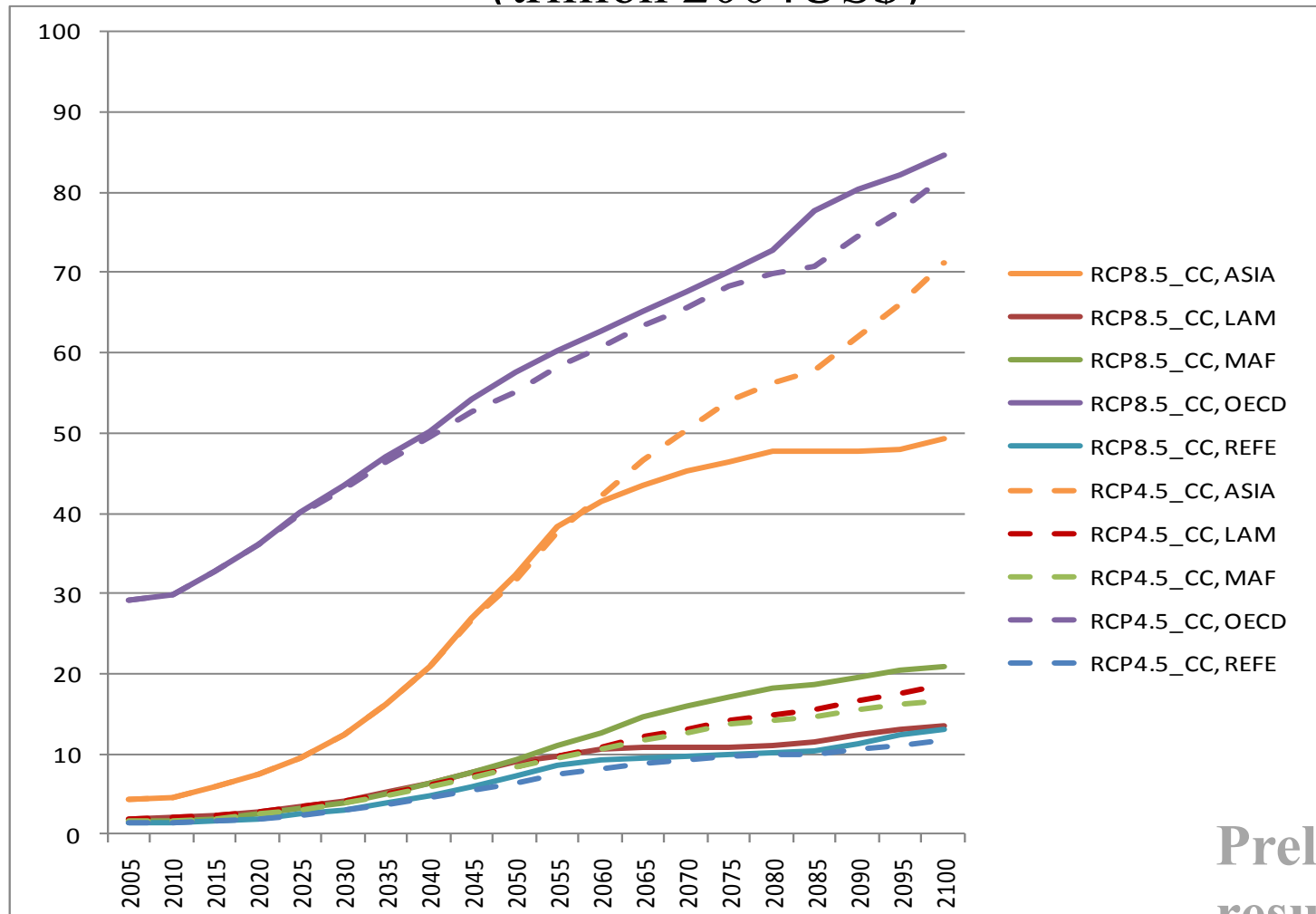
Preliminary
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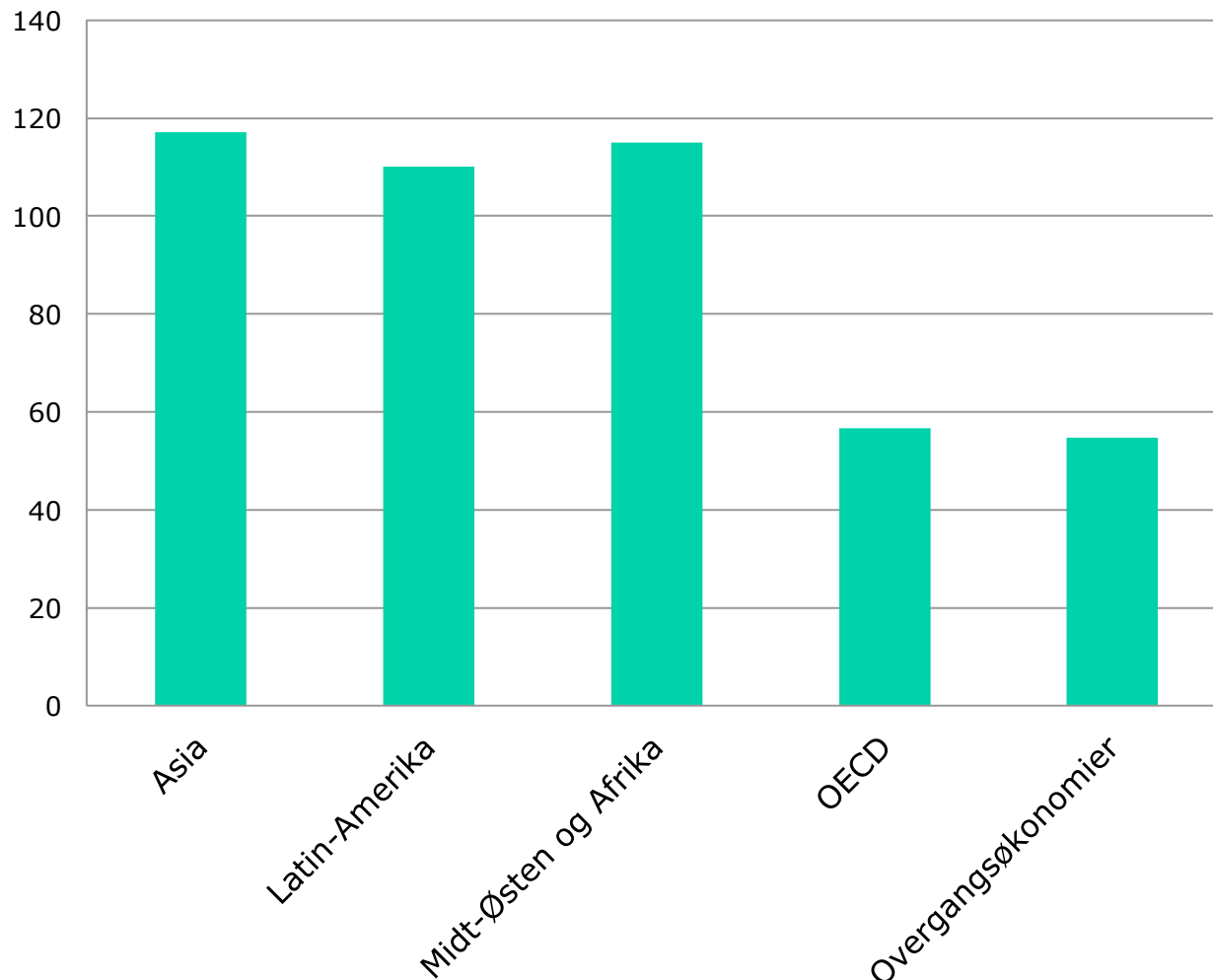
Estimated GDP paths by region under RCP8.5 and RCP4.5 WITH climate change (trillion 2004US\$)



Preliminary
results

Admissible quotas for CO₂ emissions per year 2010 -2100 needed to achieve RCP4.5.

Percent of regional emissions in 2010.



Summary so far

- All regions lose under emissions control **without** climate change impacts (from RCP8.5 to RCP4.5)
- All regions lose under climate change impacts (for both RCP8.5 and RCP4.5), relatively moderate for RCP4.5 since emissions are controlled.

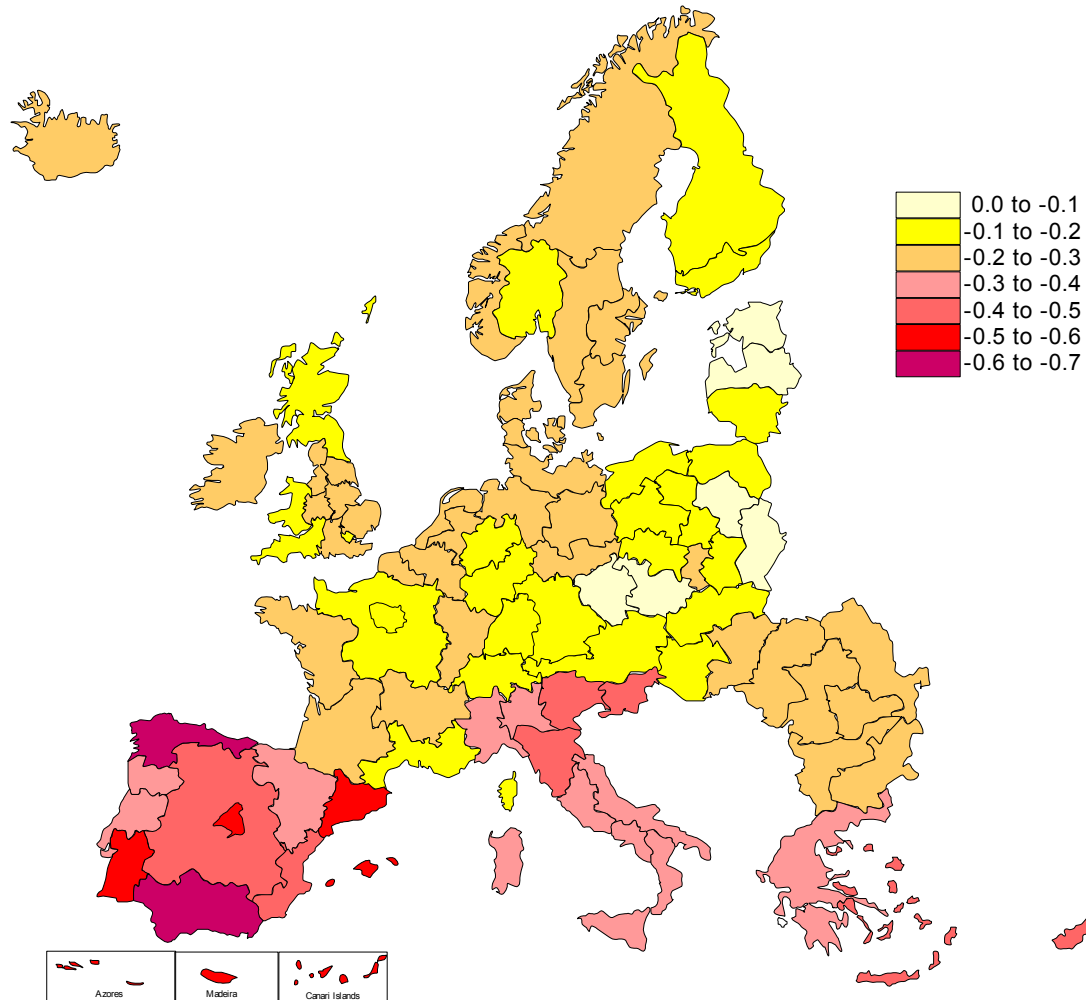
However,

- Regional differences are huge
- Asia and Latin American (LAM) benefit while the other 3 regions lose under emissions control after climate change impacts introduced (from RCP8.5_CC to RCP4.5_CC)
 - **Mitigation measure matters for estimation of CC impacts**
 - **Asia and LAM may support emissions control (RCP4.5) if climate change impacts are taken into account**

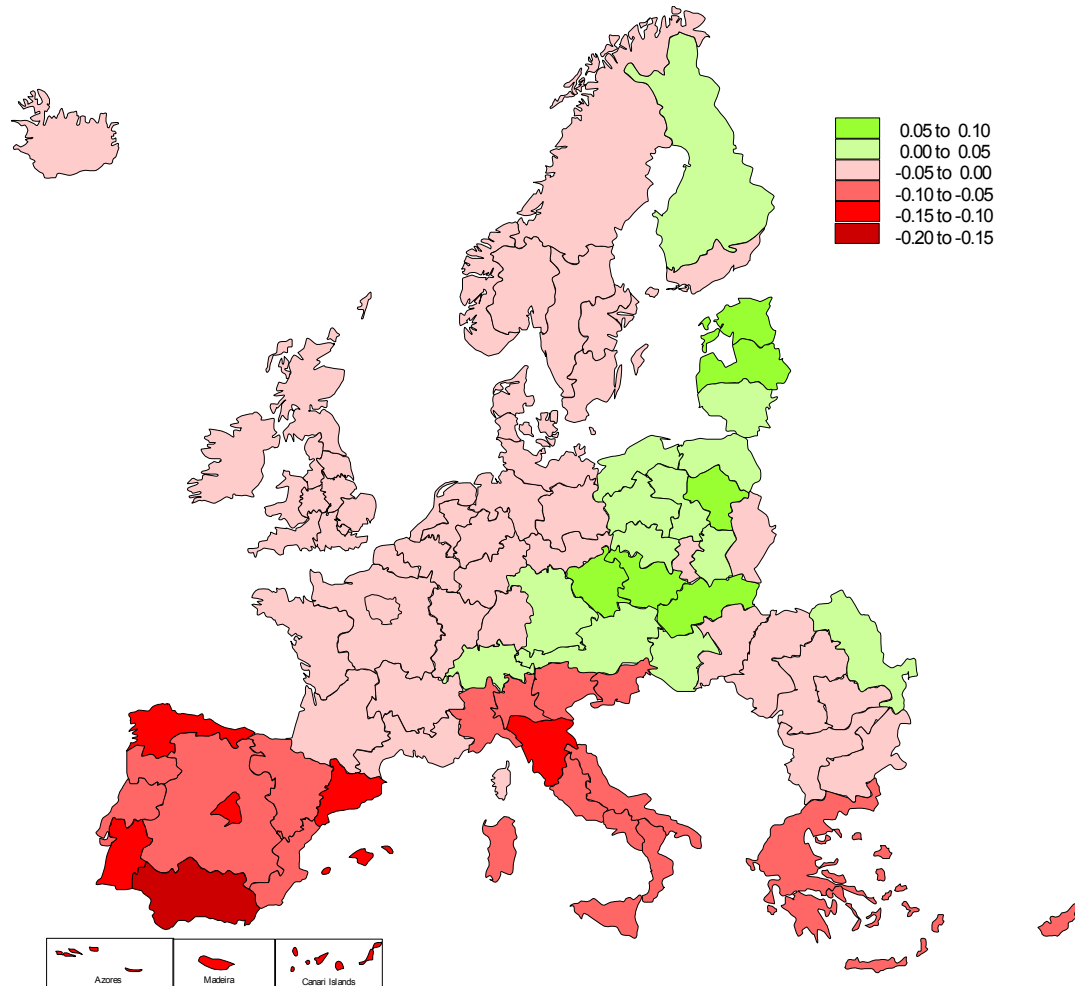
Cautions

- The uncertainties are huge (to put it mildly)
 - Estimates of impacts are based on "best guesses"
 - Impacts at 2.5 °C (RCP4.5) may become serious
 - Geoengineering may be a "safety valve"
- Information demand from SMA/SSP
 - Population and economic growth (GDP)
 - Technology and policy by sectors and regions
 - Key CC variables by regions
 - Possible direct CC impacts by sectors and regions
 - Variations within regions, e.g., degree of urbanization

Downscaling of economic impacts (% of GDP): The results from Europe with +4°C increase in global mean temperature



Downscaling of economic impacts (% of GDP): The results from Europe with +2°C increase in global mean temperature



UNCERTAINTY

- Sum of best guesses
- Expected outcome

