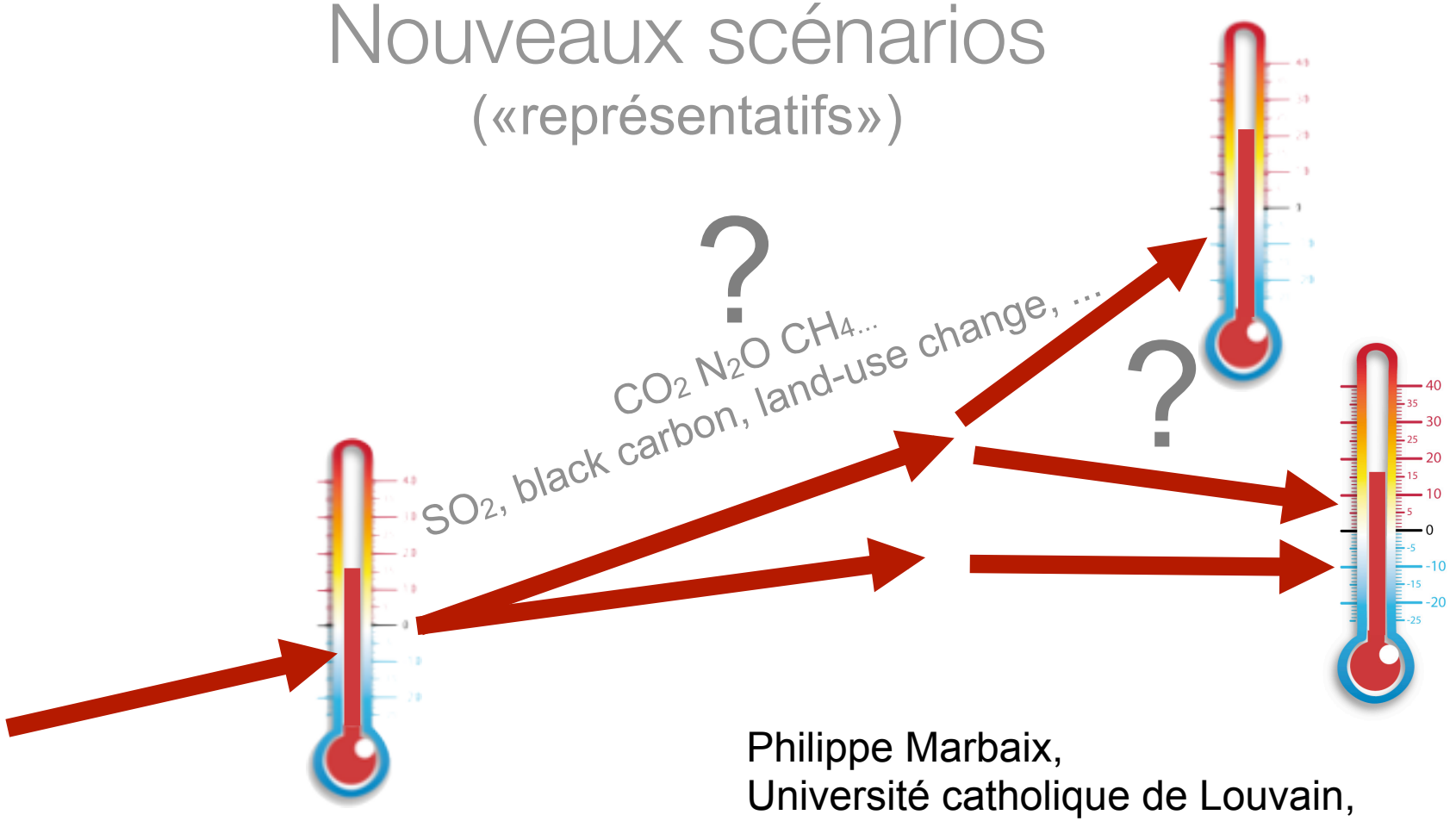
Nieuwe scenarios

(«representatief»)

Nouveaux scénarios

(«représentatifs»)



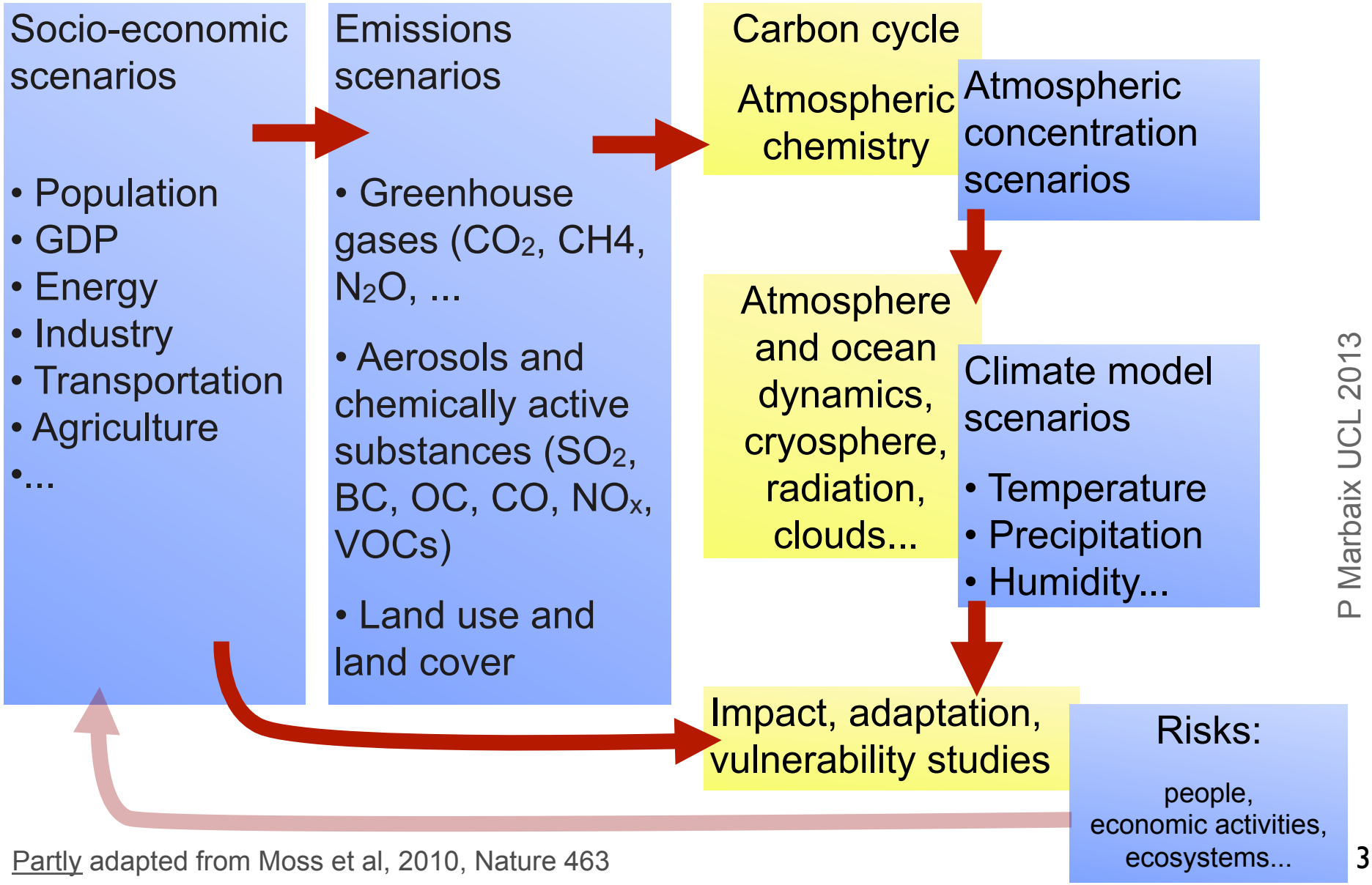
Philippe Marbaix,
Université catholique de Louvain,
Décembre 2013

Avec mes remerciements à la politique scientifique fédérale pour son soutien

Outline

- The scenario development process
- RCPs, SSPs and SPA (introduction)
- AR5 climate projections compared to AR4

Scenarios: socio-economic, emissions, concentrations, climate change



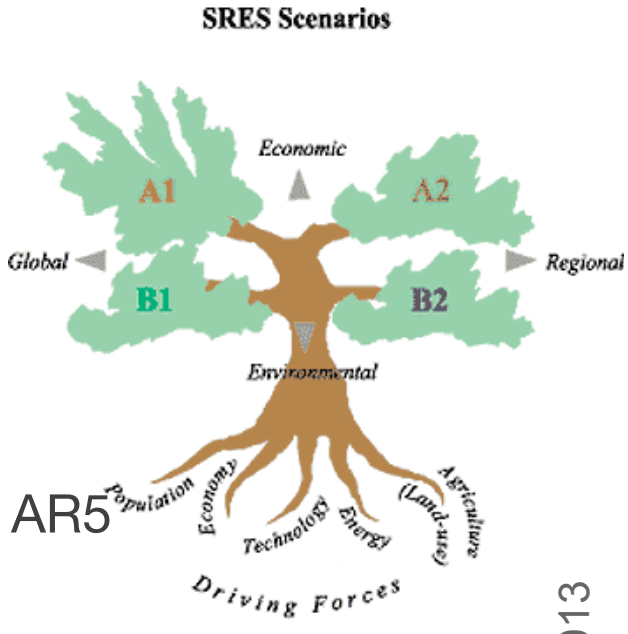
Partly adapted from Moss et al, 2010, Nature 463

P Marbaix UCL 2013

Scénarios @ IPCC : where we come from

- IPCC 1990 : SA90, baseline & mitigation policy
- IPCC 1992 : IS92, no climate policy
- IPCC 2000 : Special Report on Emission Scenarios (SRES), no climate policy, but detailed analysis of drivers, socio-economic storylines...

  → Assessment reports : TAR, AR4, still part of AR5

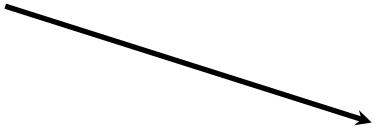


- Others outside IPCC (ex. WRE (1996) stabilisation)

Scénarios @ IPCC : the new scenario process

•IPCC 2005... 2008 :
workshop, then expert meeting on a
«process towards new scenarios» (Noordwijkerhout, 2007)

•Representative Concentration Pathways (RCPs)



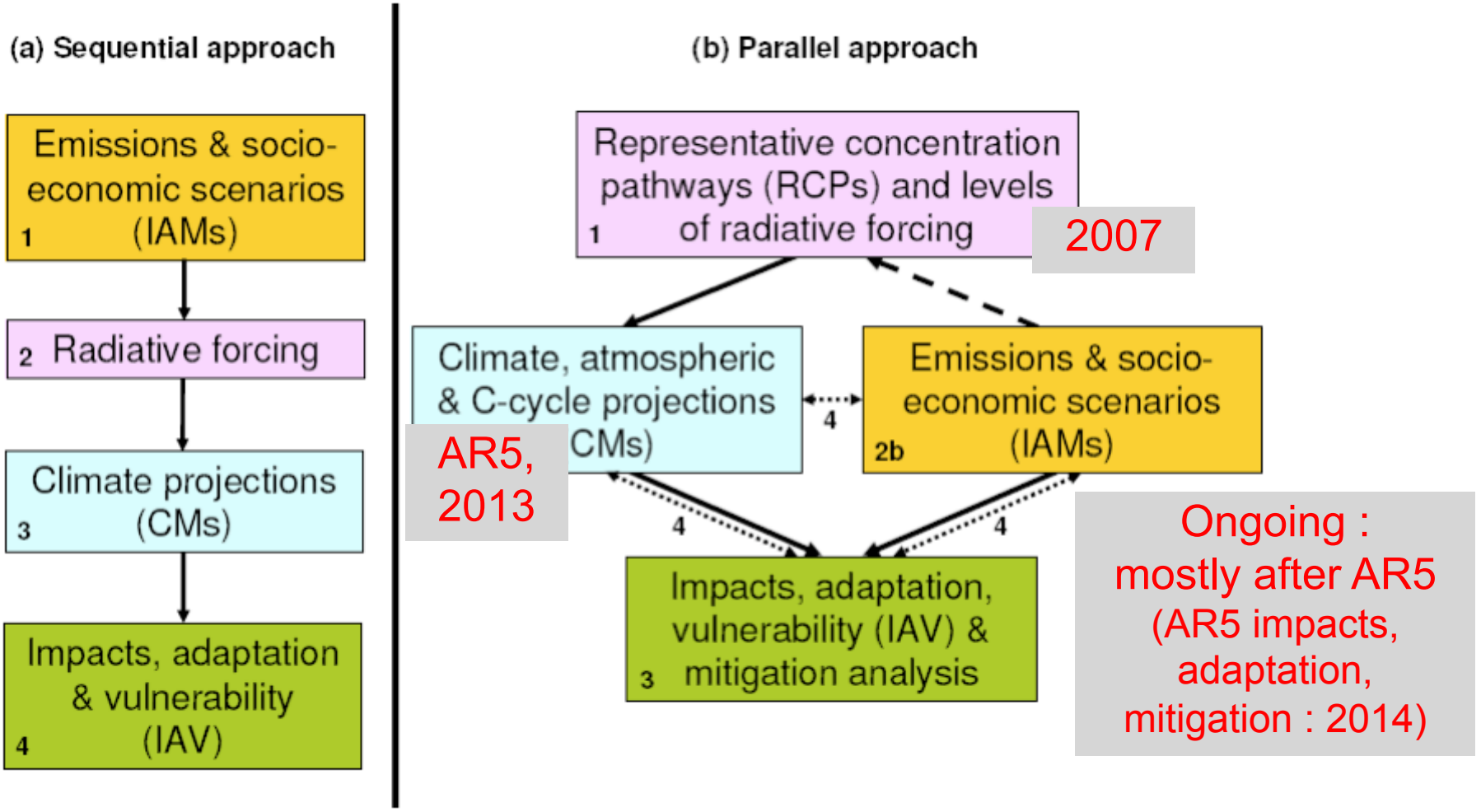
IPCC 5th assessment report

•Continuation of the process :
shared Socio-economic Pathways, ...

RCPs : «Representative Concentration Pathways» & «Parallel process» : accelerating the process -> projections

SRES > AR4

AR5



Source : IPCC expert meeting report, «Towards new scenarios...», 2008

Representative Concentration Pathways (RCPs)

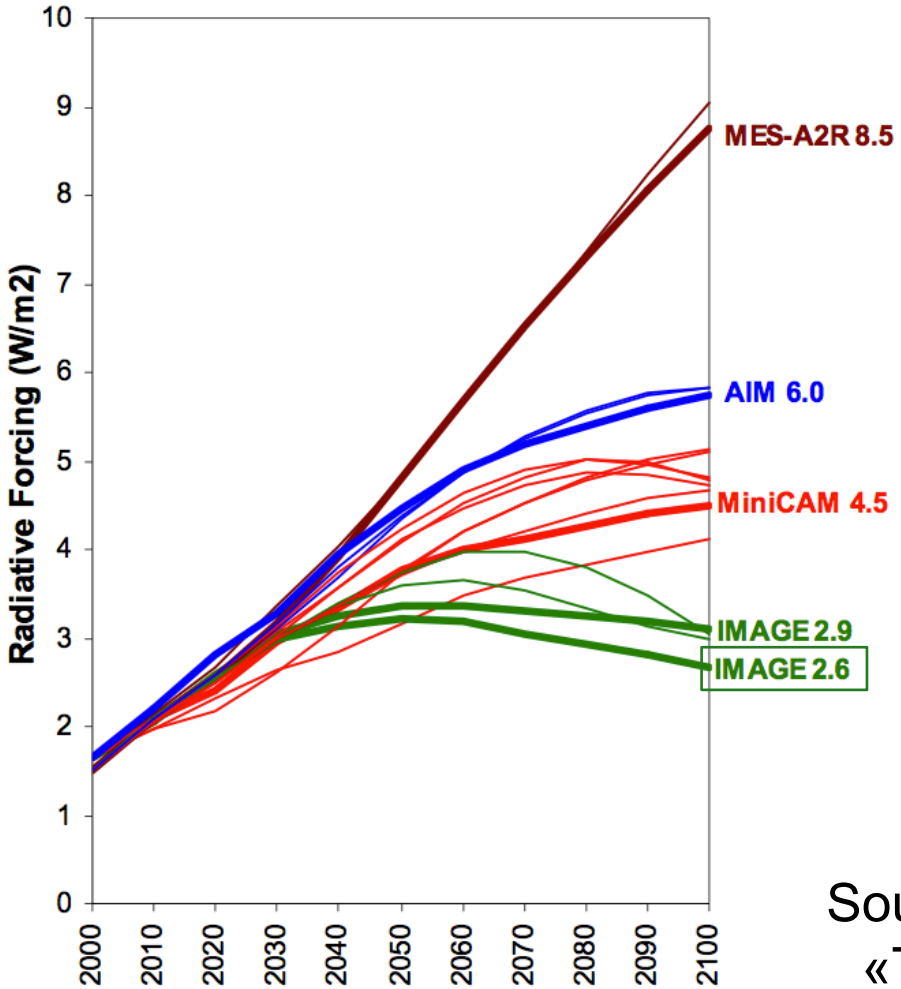
- RCPs were selected from literature
  (in 2007, hence not new / AR4 re emissions)

- Criteria:
  - compatibility with the full range of scenarios in the scientific literature (with & without mitigation and stabilisation)
  - even number of scenarios : avoid suggesting a «best estimate»
  - availability of data for all relevant forcing agents and land use
  - sufficiently different for the climate models

Representative concentration pathways

All selected from existing literature (slightly updated)

Wide range of possible futures, including mitigation



RCP8.5: 8.5 W/m^2 in 2100, continue to increase

RCP6 : 6 W/m^2, then stabilisation

RCP4.5 : 4.5 W/m^2 in 2100, then stabilisation

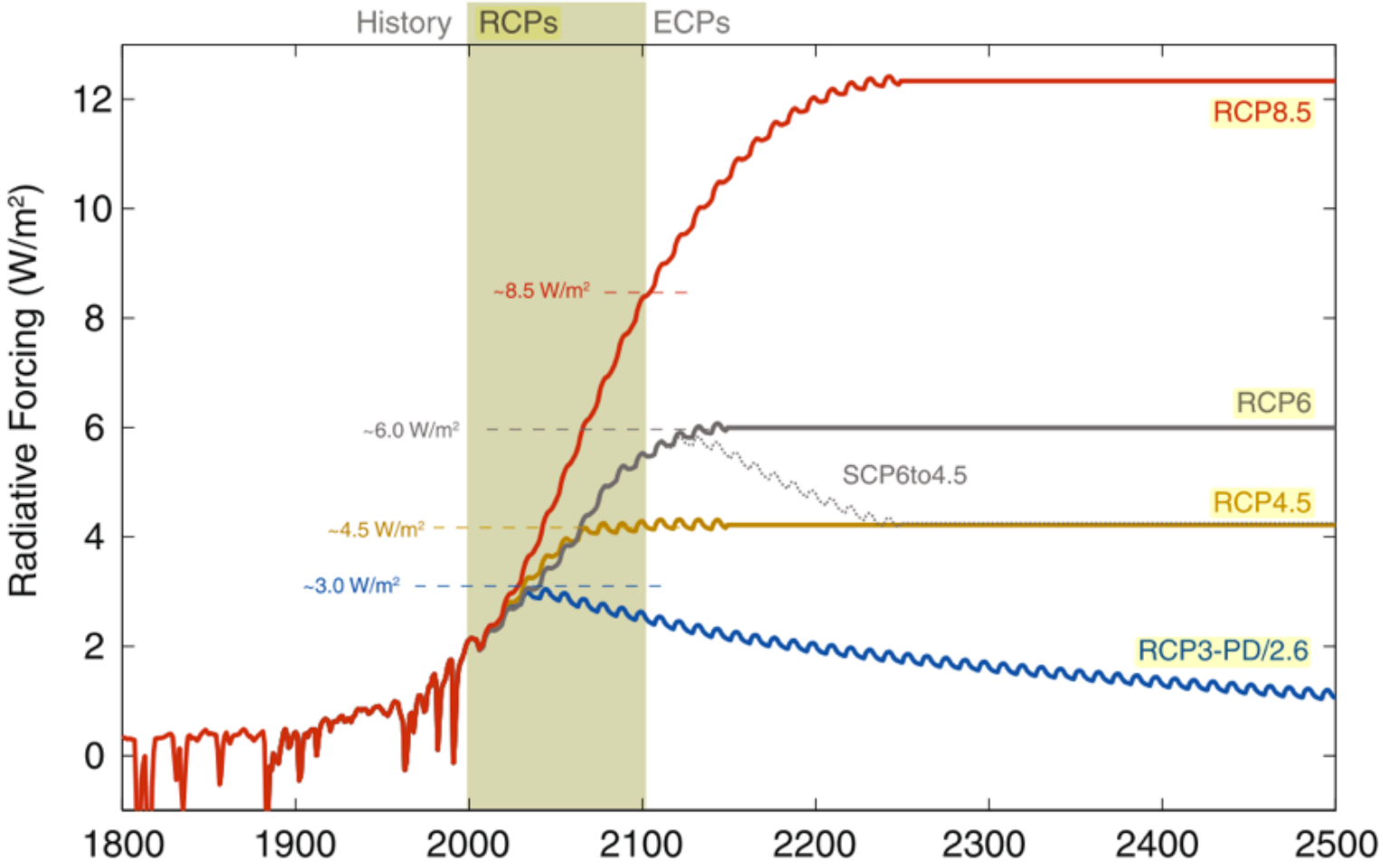
RCP3-PD : peak in radiative forcing ~3 W/m^2, then decline

Decision : use RCP 2.6

Source : IPCC expert meeting report, «Towards new scenarios...», 2008

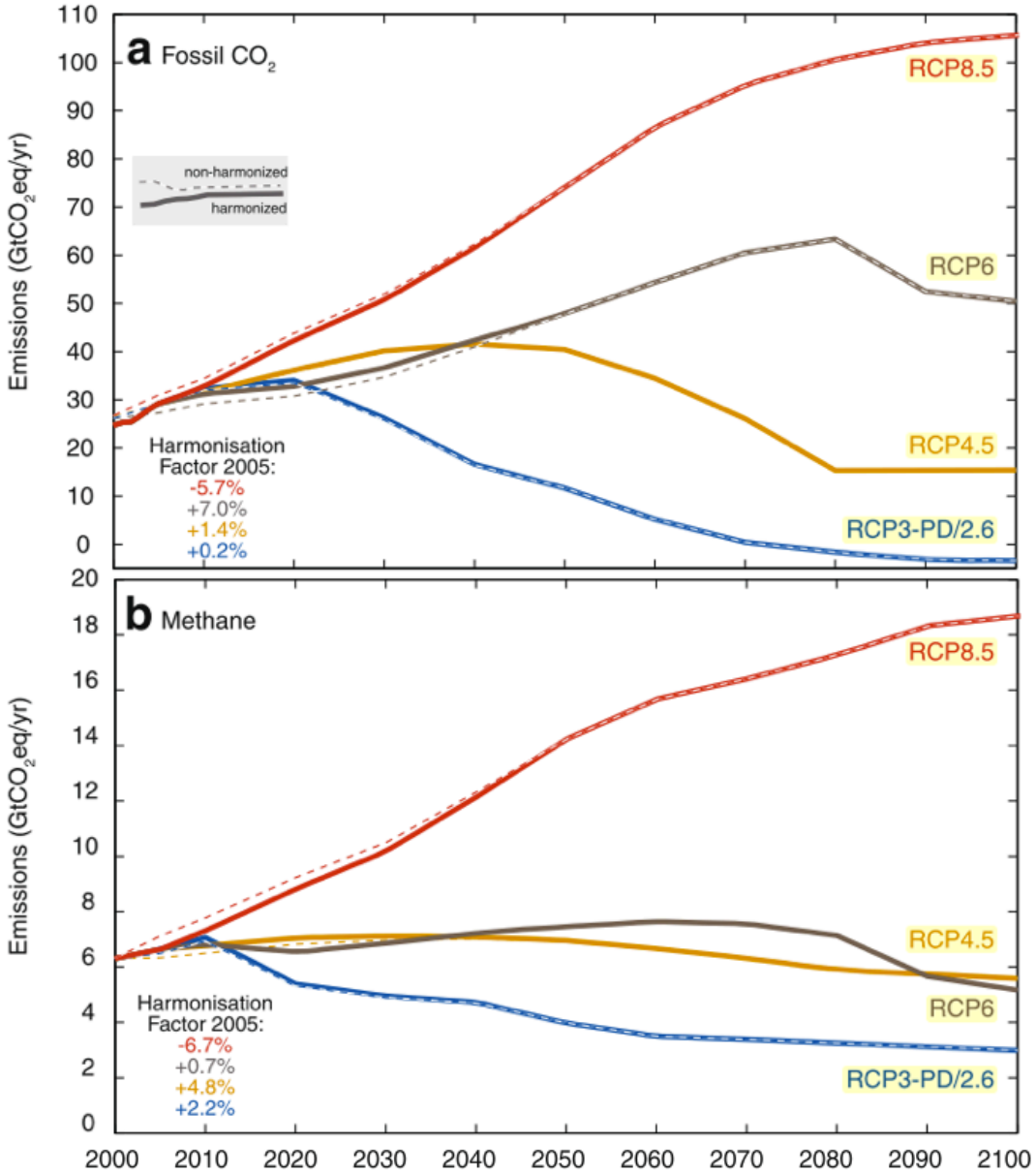
RCPs : extension beyond 2100

> 2100 : schematic extension, no soci-economic background,
important for climate projections -> long term changes



Source: Meinshausen et al.,
Climatic Change, 2011

RCPs : Emission pathways

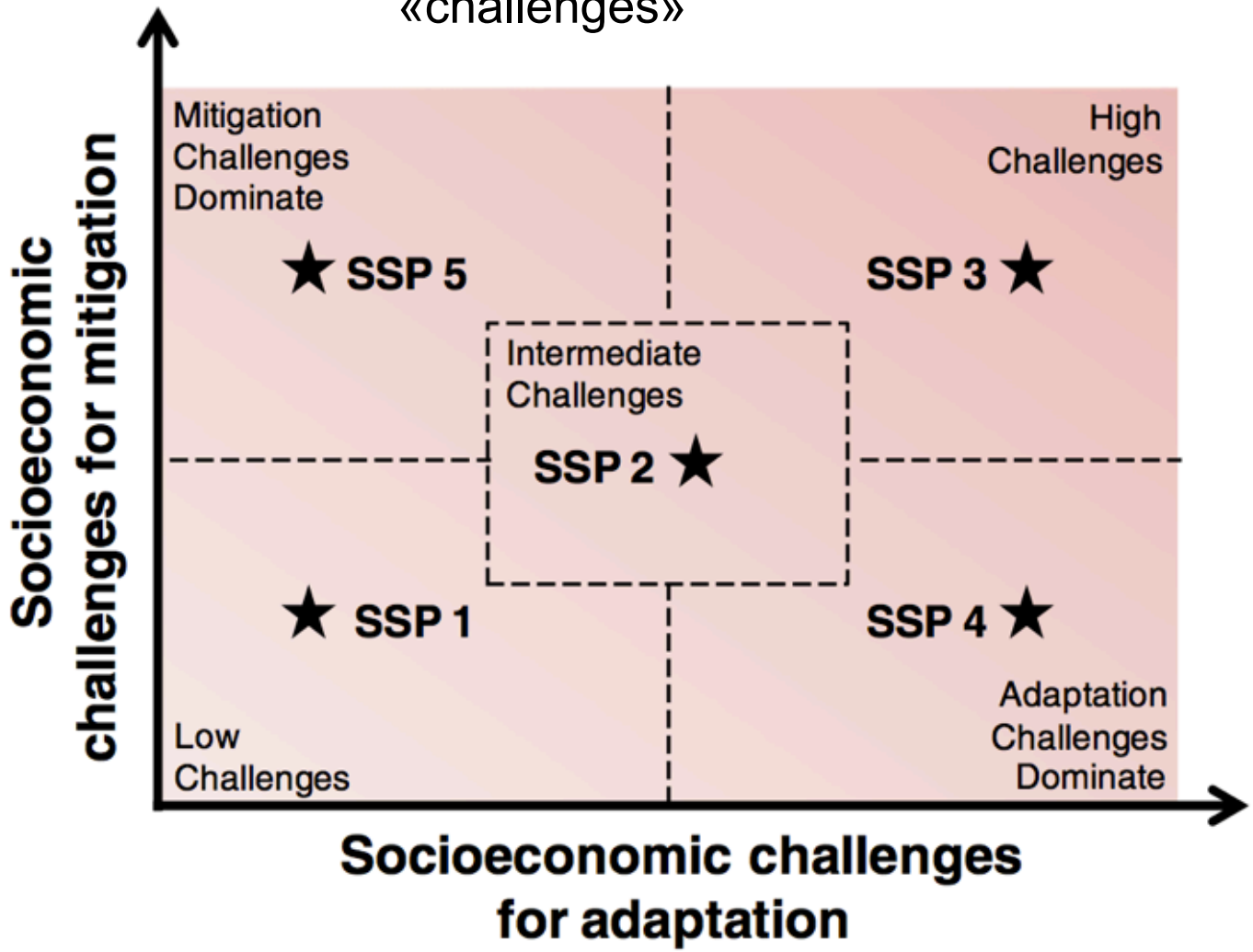


All data for emissions & concentrations publicly available

Source:
Meinshausen et al., Climatic Change, 2011

Socio-economic aspects : SSPs

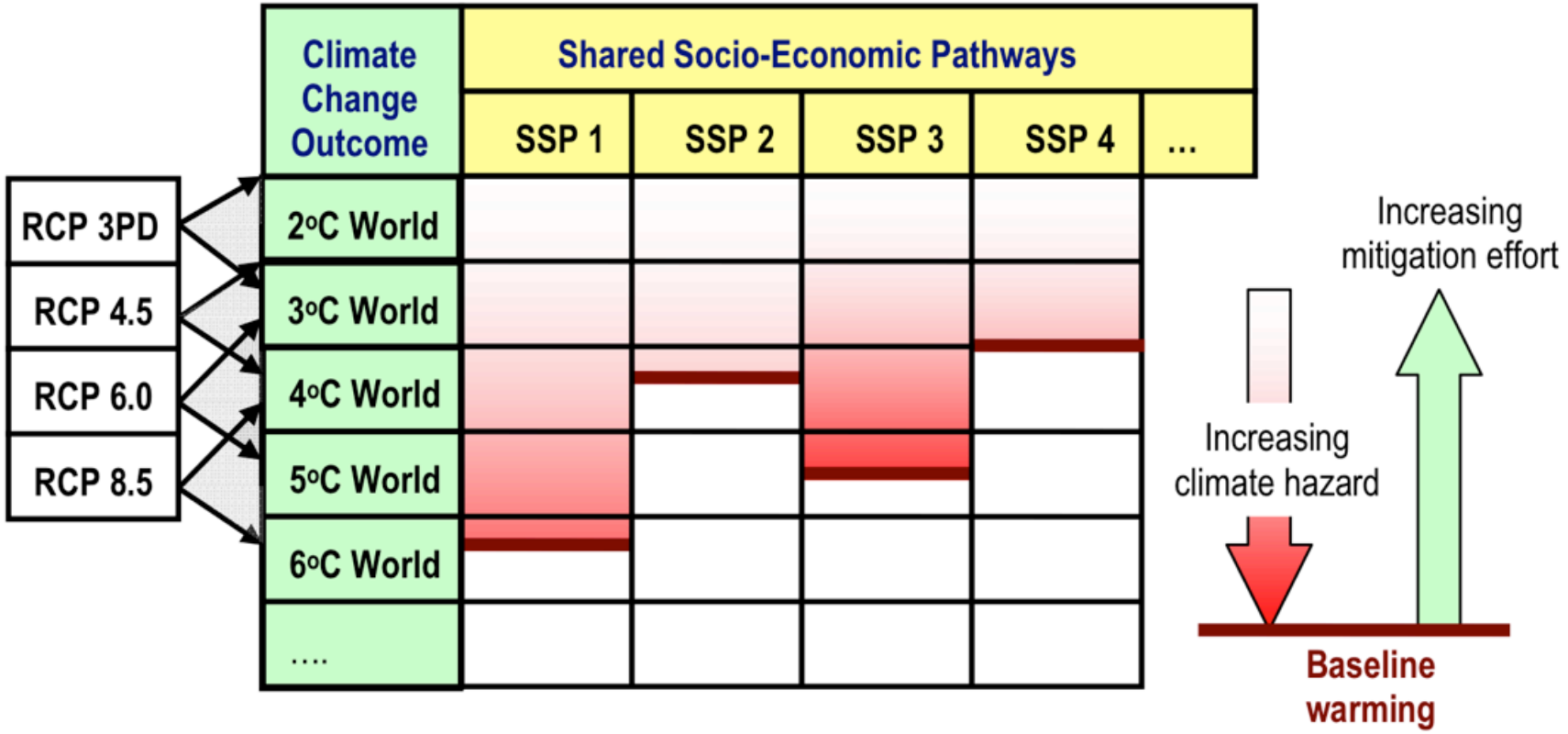
«Inverse approach», compared to SRES : starting from climate «challenges»



From O'Neill et al., Climatic Change, October 2013

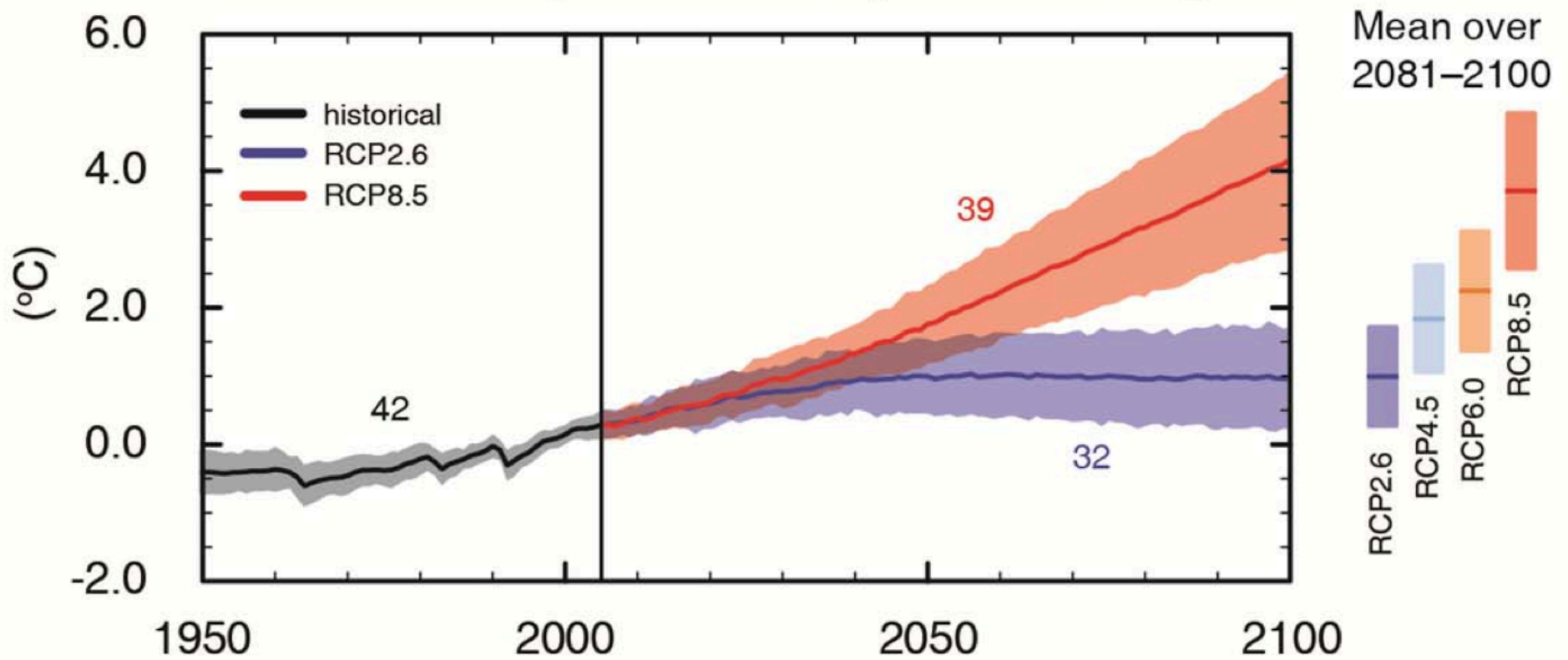
Socio-economic aspects : SSP and SPA

«Shared climate Policy Assumptions» (SPA),
to supplement the non-climate policy SSPs.
Combination of SSP + SPA links to a RCP



From Kriegler et al., Glob. Env. Change, 2012

Global average surface temperature change



AR5 WGI - Approved version / subject to final copyedit

Global mean surface temperature change

With a small oversimplification...

Projections for the end of the 21th century, all scenarios

AR4

1.1 to 6.4

AR5

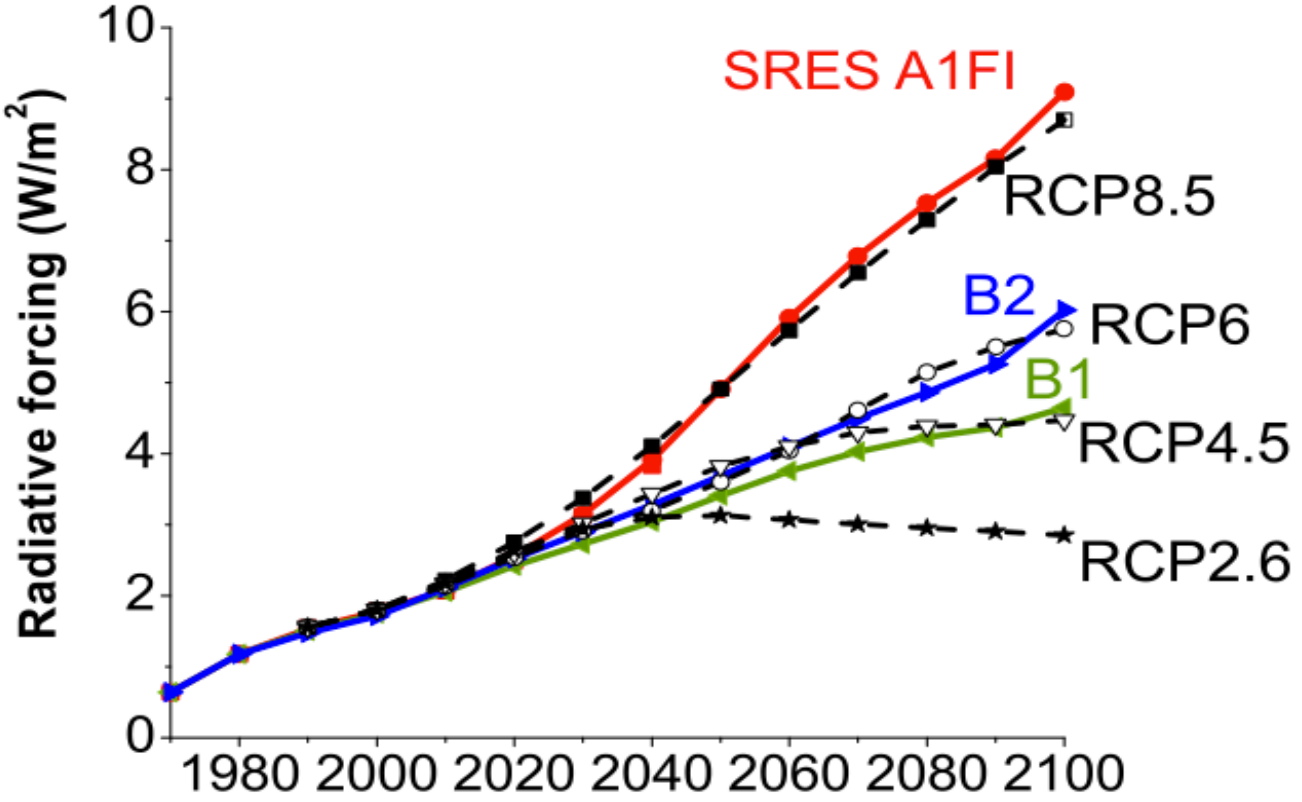
0.3 to 4.8

↓

Looks smaller...
Good news ?

RCPs vs SRES : radiative forcing

- Radiative forcing = change in net energy flux due to GHGs & others
- Some SRES (AR4) marker scenarios are close to RCPs (AR5) :



Source: van Vuuren and Carter, Climatic Change, 2013
(adapted layout, see also AR5 fig 12.3)

Global mean surface temperature change projections

AR4

	mean	likely range
«Climate policy SC»	(none in SRES)	
B1	1.8	1.1 to 2.9
B2	2.4	1.4 to 3.8
A1FI	4.0	2.4 to 6.4

AR5

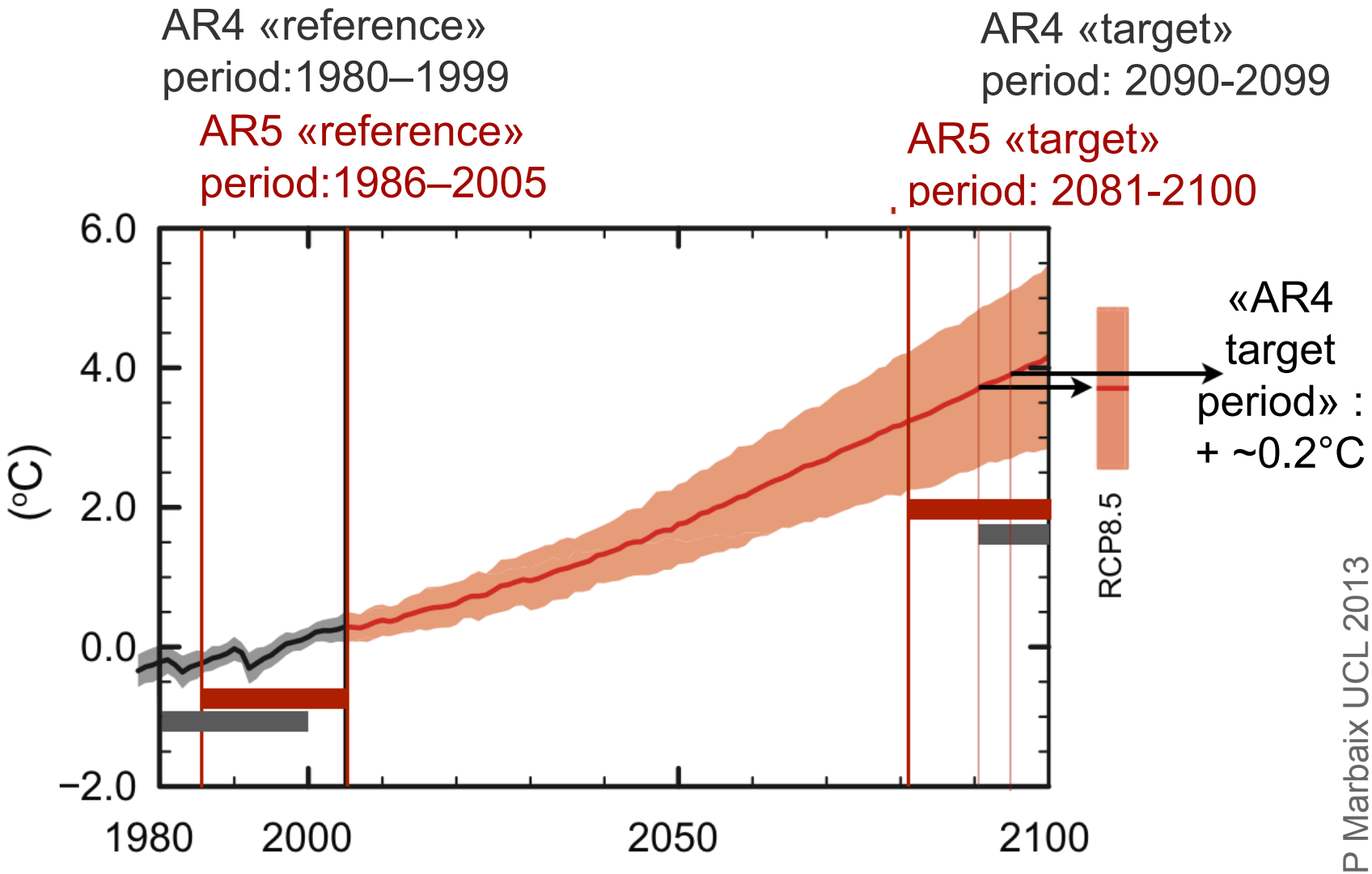
	mean	likely range
RCP2.6	1.0	0.3 to 1.7
RCP4.5	1.8	1.1 to 2.6
RCP6	2.2	1.4 to 3.1
RCP8.5	3.7	2.6 to 4.8

(°C)

Nice, but still
AR4 warming > AR5 ?

AR4 vs AR5 : closer look at highest scenario

Global mean surface temperature change, RCP 8.5



Source : adapted from AR5 WGI SPM

AR4 vs AR5 : closer look at highest scenario

AR4

	mean	likely range
A1FI	4.0	2.4 to 6.4

AR5

	mean	likely range
RCP8.5	3.7	2.6 to 4.8

(°C)

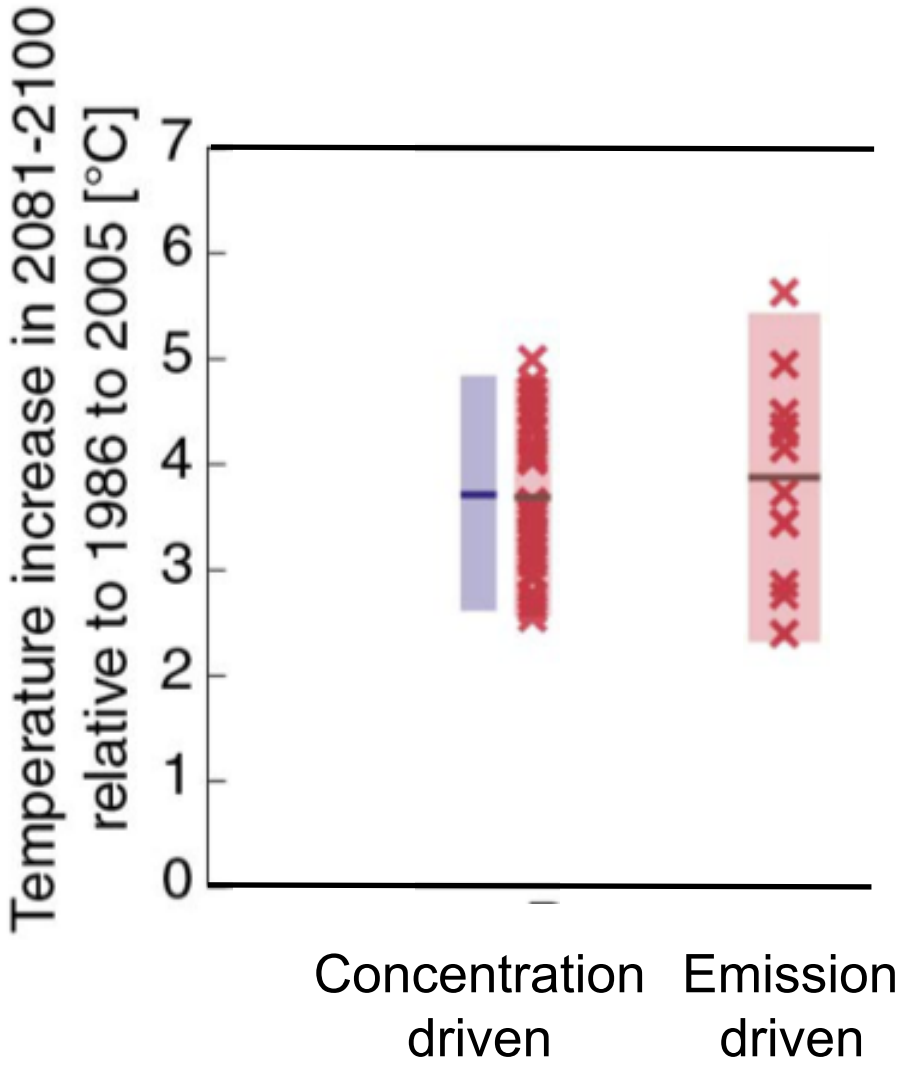
with same time period as AR4 : ~3.9 °C

with same time period as AR4 : ~2.7 to ~5.1

less uncertainty ? (no....)

AR4 vs AR5: closer look at the uncertainty assessment

AR5, RCP 8.5 only (figure 12.8)



AR4 vs AR5: closer look at the uncertainty assessment

The majority of AOGCM (= 3D) used concentrations as input, in both AR4 and AR5 : those specific model results do not include carbon cycle uncertainties (including climate - carbon feedbacks)

AR4 and AR5 ranges = separate assessments (not just model output)
= different hypotheses

AR4

	mean	likely range	
A1FI	4.0	- 40 %	2.4 °C
		+ 60 %	6.4 °C

Ranges take into account some information on carbon uncertainty, as available

AR5

	mean		likely range	
RCP8.5	3.7 °C	Gaussian / CMIP5 : 5 to 95%	(-30%)	2.6 °C
			(+30%)	4.8 °C

Ranges take into account uncertainties not in CMIP5 by assessing the result as «likely», i.e. ≥ 66% chances (not 90%)

For more information, see AR5 figure 12.8

AR4 vs AR5 projections : climate sensitivity ?

- Conclusion: taking into account
  - need to compare similar scenarios
  - reference time period changes
  - differences in uncertainty assessment, inc. carbon cycle,

    → very very similar global-mean temperature projections (end century)

    → models do not project less climate change...
- But the equilibrium climate sensitivity range changed ?

AR4 : likely range 2.0 - 4.5 °C (best estimate 3°C)

AR5 : likely range 1.5 - 4.5 °C

... but ranges similar to the AR5 used before AR4,

«...in my view, it will take decades to pin down the climate sensitivity to even a factor of two» Stephen Schneider

- See you later (in 10 years ?)