

Integrating socioeconomic, climate, and environmental scenarios – status update and key questions

Brian O’Neill, NCAR

Richard Moss, Jae Edmonds, Klaus Keller, Jerry
Meehl, Keywan Riahi, John Weyant

EMF Workshop on Climate Change Impacts and
Integrated Assessment, Snowmass, CO

July 30 – August 1, 2014

Scenario Process Status Update

Shared Socioeconomic Pathways (SSPs)

IAM scenarios based on SSPs

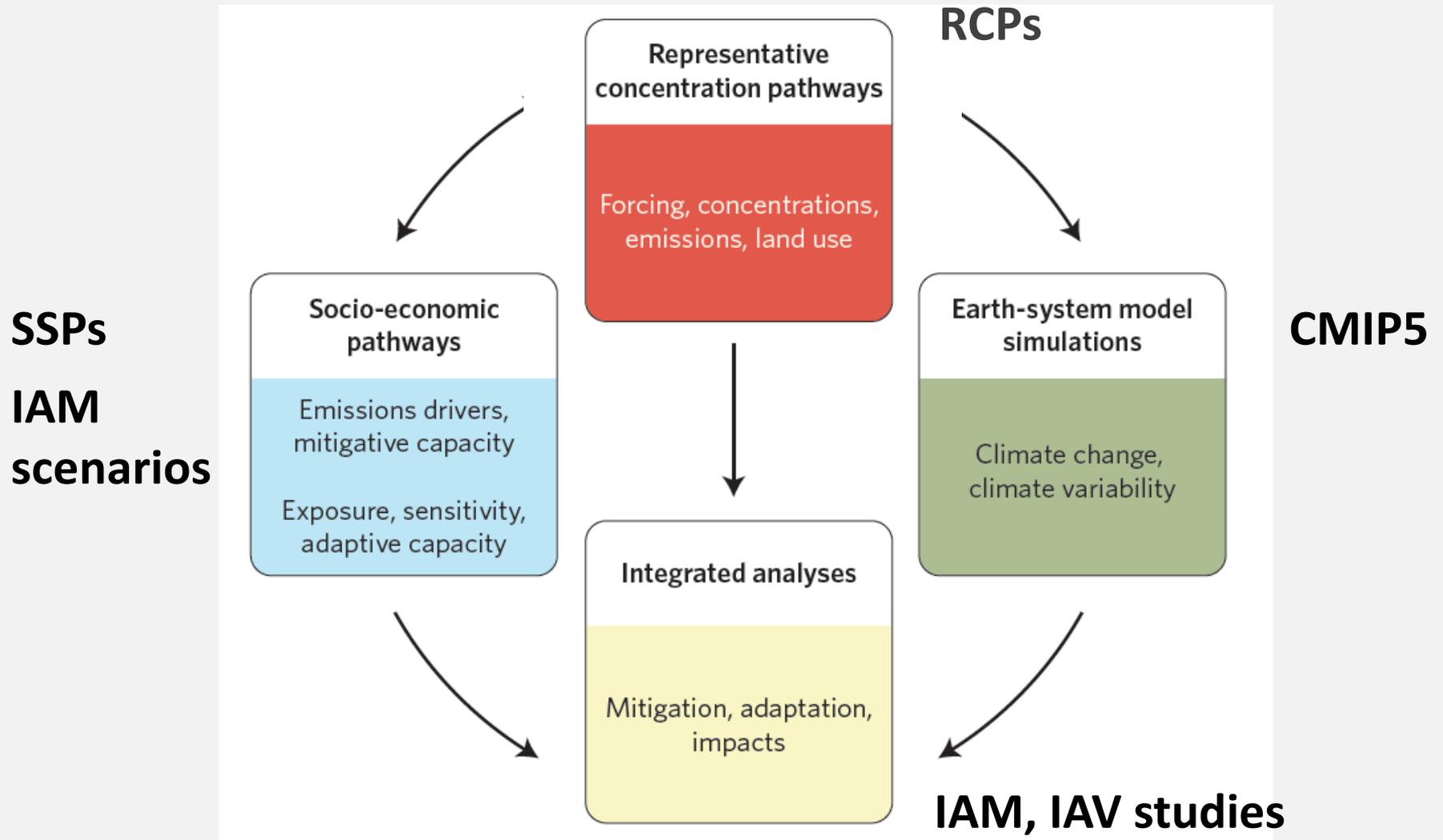
RCP-based climate information

Initial applications

Open Questions

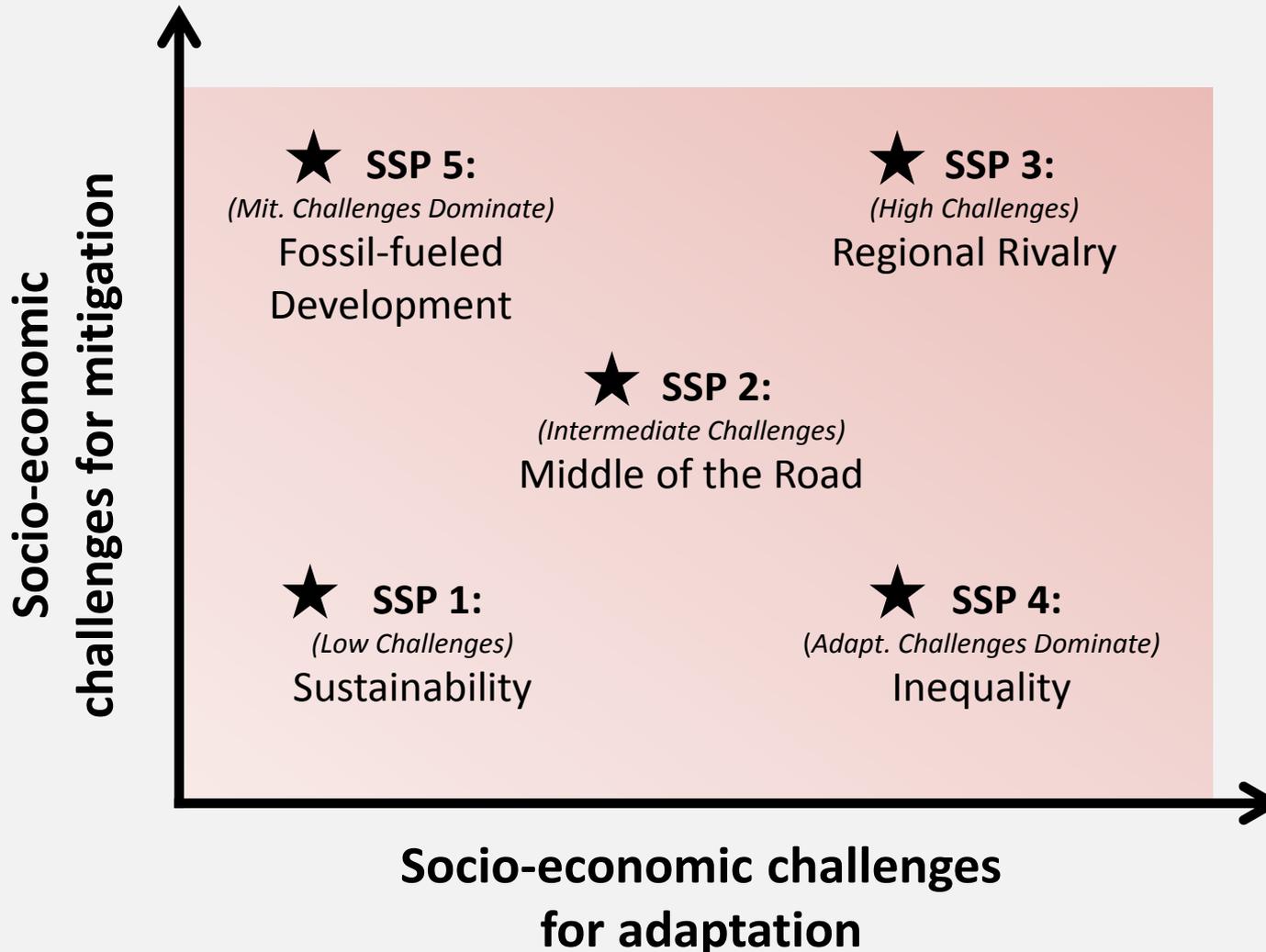
Plans for Next Steps

The Parallel Process



SSPs

SSP Logic and (Final?) Names



Shared Socioeconomic Pathways (SSPs)

Narrative

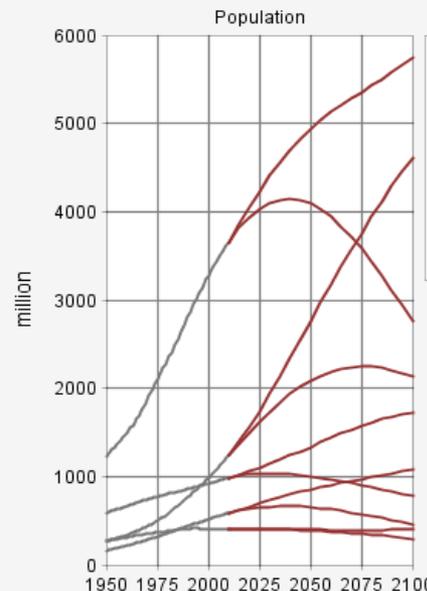
Qualitative description
of broad patterns of
development
Logic relating elements
of narrative to each
other



- SSP1** Sustainability
- SSP2** Middle of the Road
- SSP3** Regional Rivalry
- SSP4** Inequality
- SSP5** Fossil-fueled Development

Quantitative elements

Population
Education
Urbanization
Income



Country-specific data, all
SSPs, available in
database hosted by IIASA

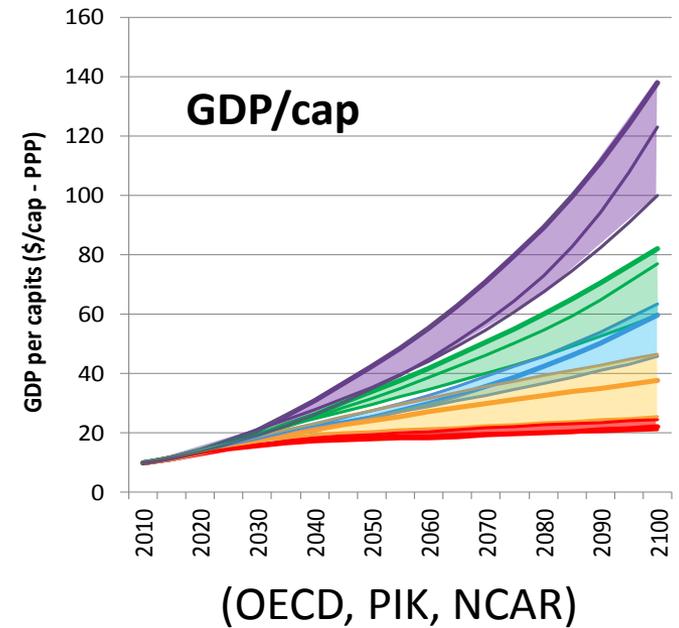
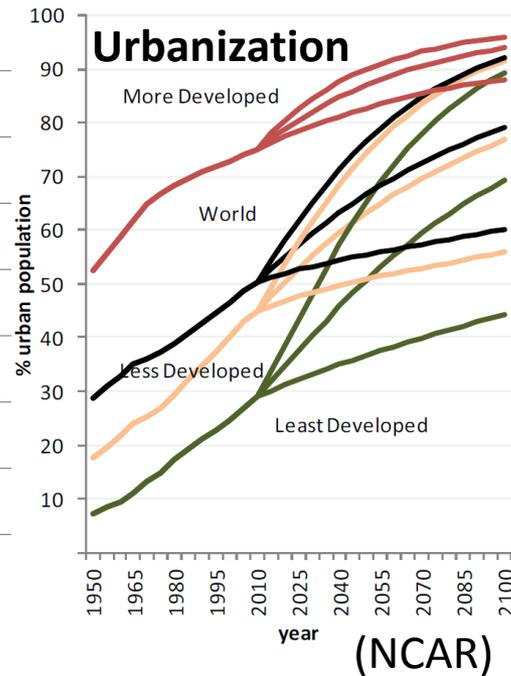
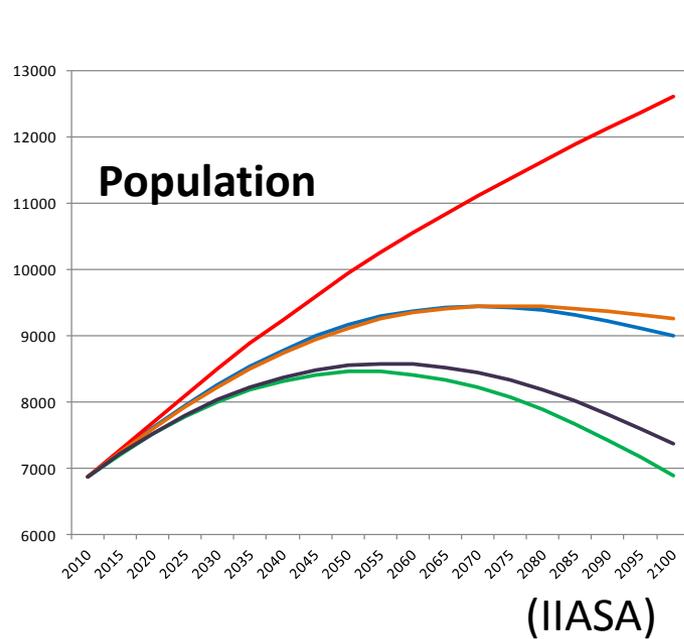
SSP Narrative Example



SSP3: Regional Rivalry

Growing **interest in regional identity** and **concerns about competitiveness and security** push countries to increasingly focus on domestic or, at most, regional issues. This trend is reinforced by the **limited number of comparatively weak global institutions**, with uneven coordination and cooperation for addressing environmental concerns. Policies are oriented towards security, including **barriers to trade**, particularly in the energy resource and agricultural markets. Countries focus on achieving **energy and food security goals** within their own region, **at the expense of broader-based development**. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions. The combination of impeded development and limited environmental concern results in **poor progress towards sustainability. ... etc.**

SSP Quantitative Drivers



Additional SSP Quantitative Information

Within-country income distribution

Beginnings of coordination between World Bank, IIASA, University of Denver, NCAR, SEI. Need for targeted meeting.

Global spatial population distribution

NCAR version of SSP5 complete, other SSPs by early fall

Useful to coordinate this field: MIT, US EPA, NCAR, CUNY, etc.

Interest in additional spatial variables

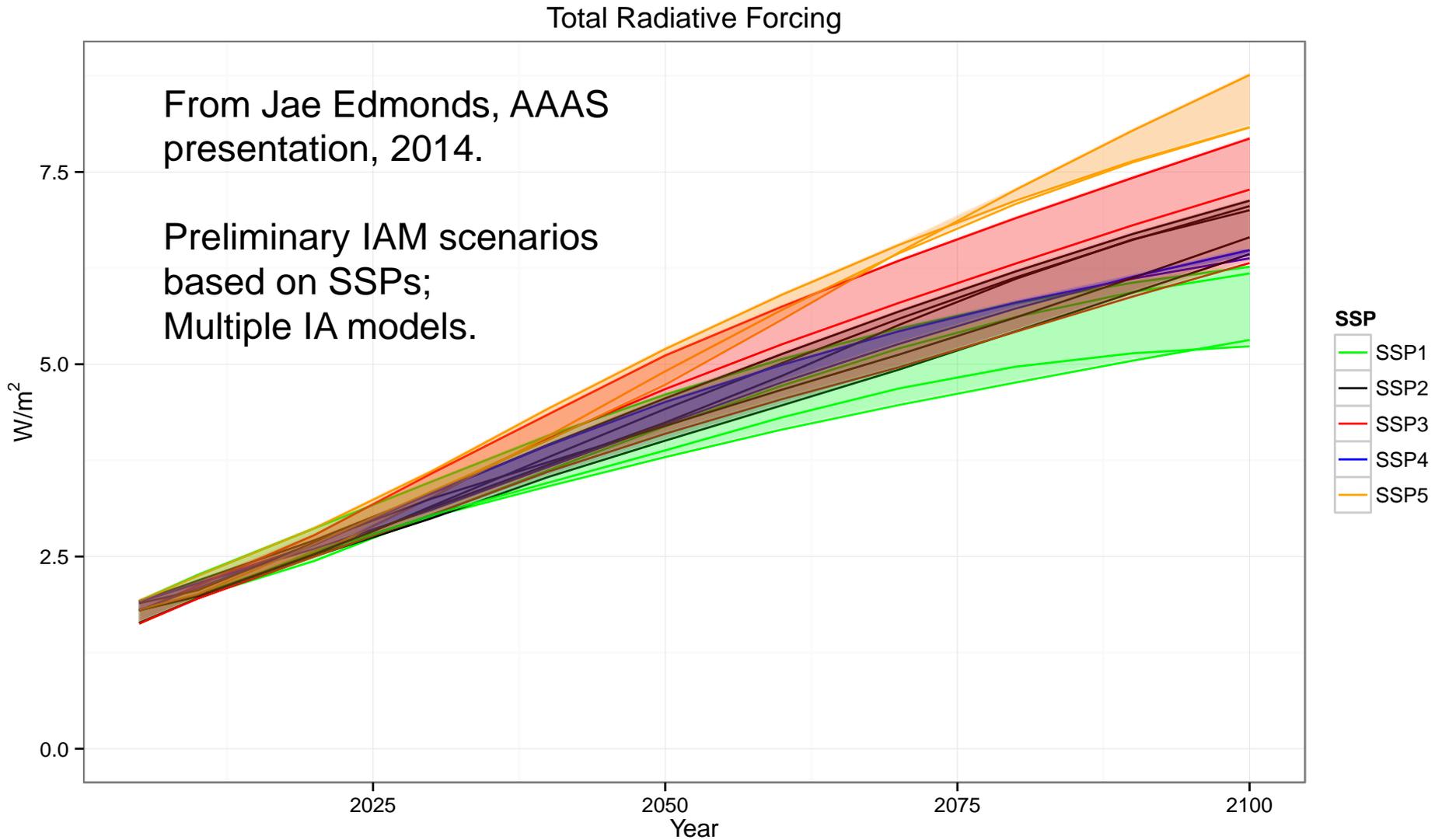
Urban land cover (NCAR)

Energy/emissions (IIASA)

Population characteristics (urban/rural, age, income, education; NCAR, IIASA)

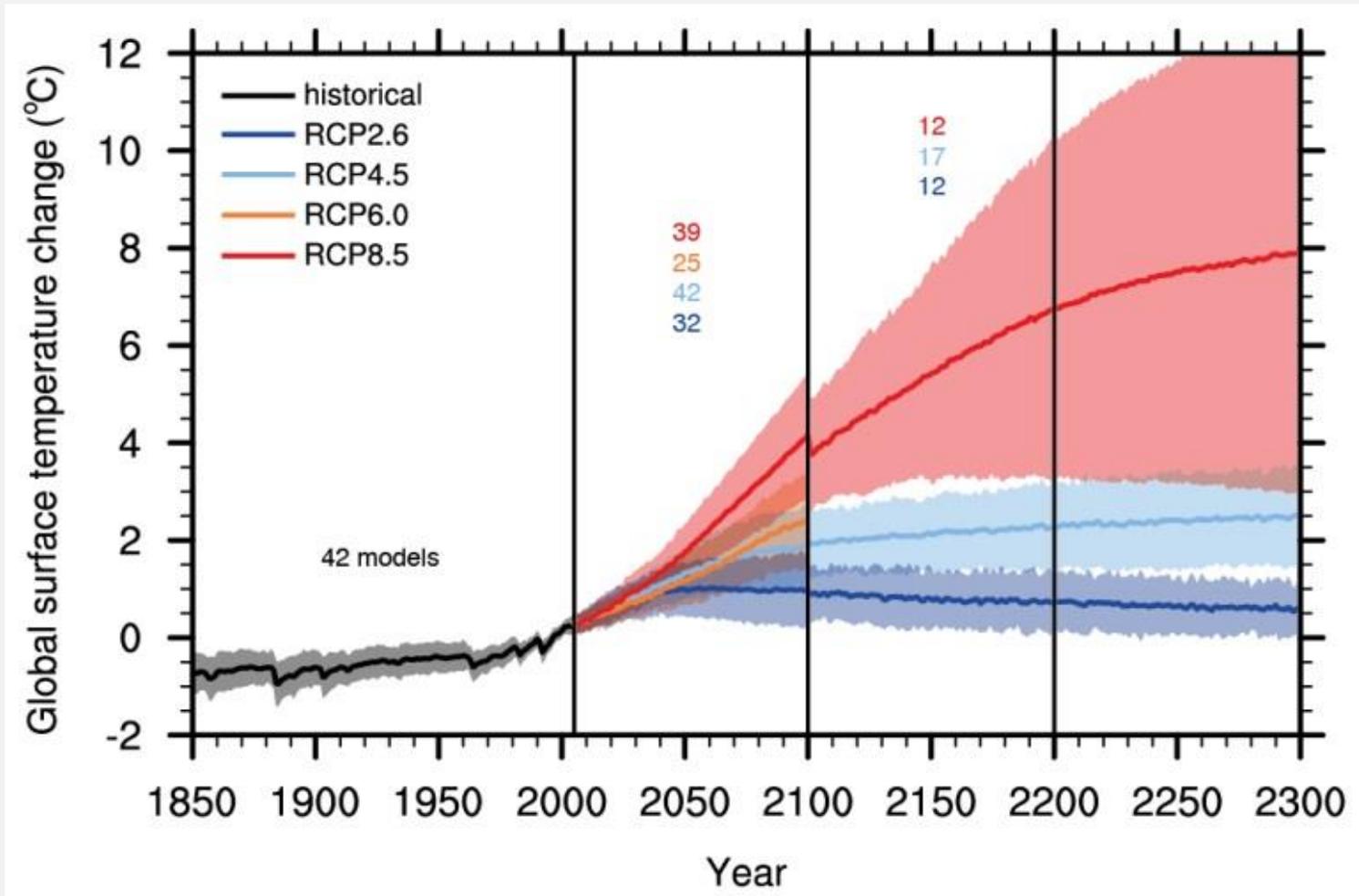
IAM Scenarios

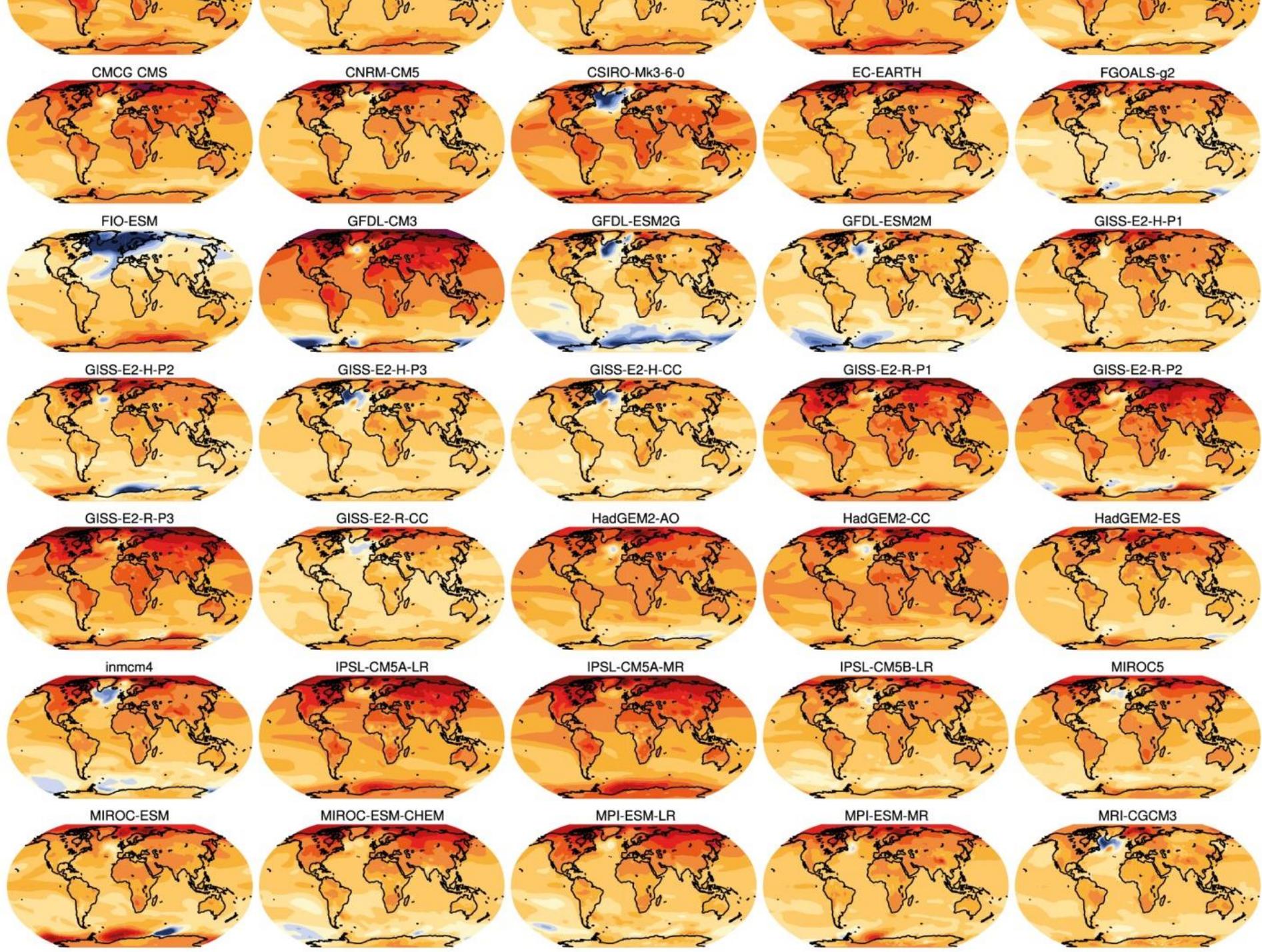
Total Radiative Forcing *without Mitigation*



RCP-based Climate Information

CMIP5 Simulations of RCPs Available





New RCP Simulations of Interest

CESM RCP8.5 Large Ensemble

1920-2080

30 members, different initial conditions

See

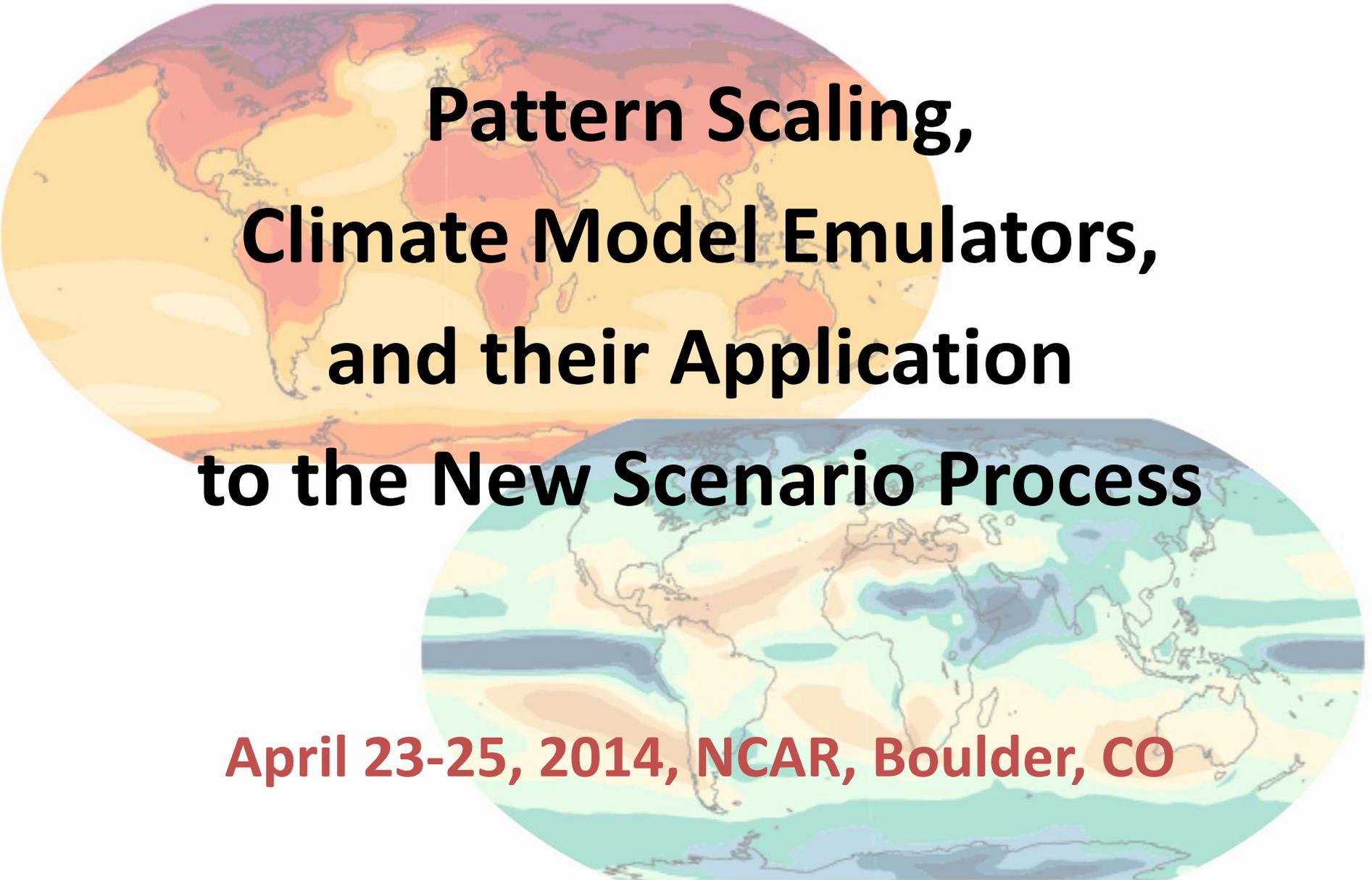
<http://www2.cesm.ucar.edu/models/experiments/LENS>

CESM RCP4.5 Medium Ensemble

Same protocol as Large Ensemble

~15 members

Still in production, tentatively available in fall or winter



**Pattern Scaling,
Climate Model Emulators,
and their Application
to the New Scenario Process**

April 23-25, 2014, NCAR, Boulder, CO

Sponsors: IMAGE and CGD, NCAR

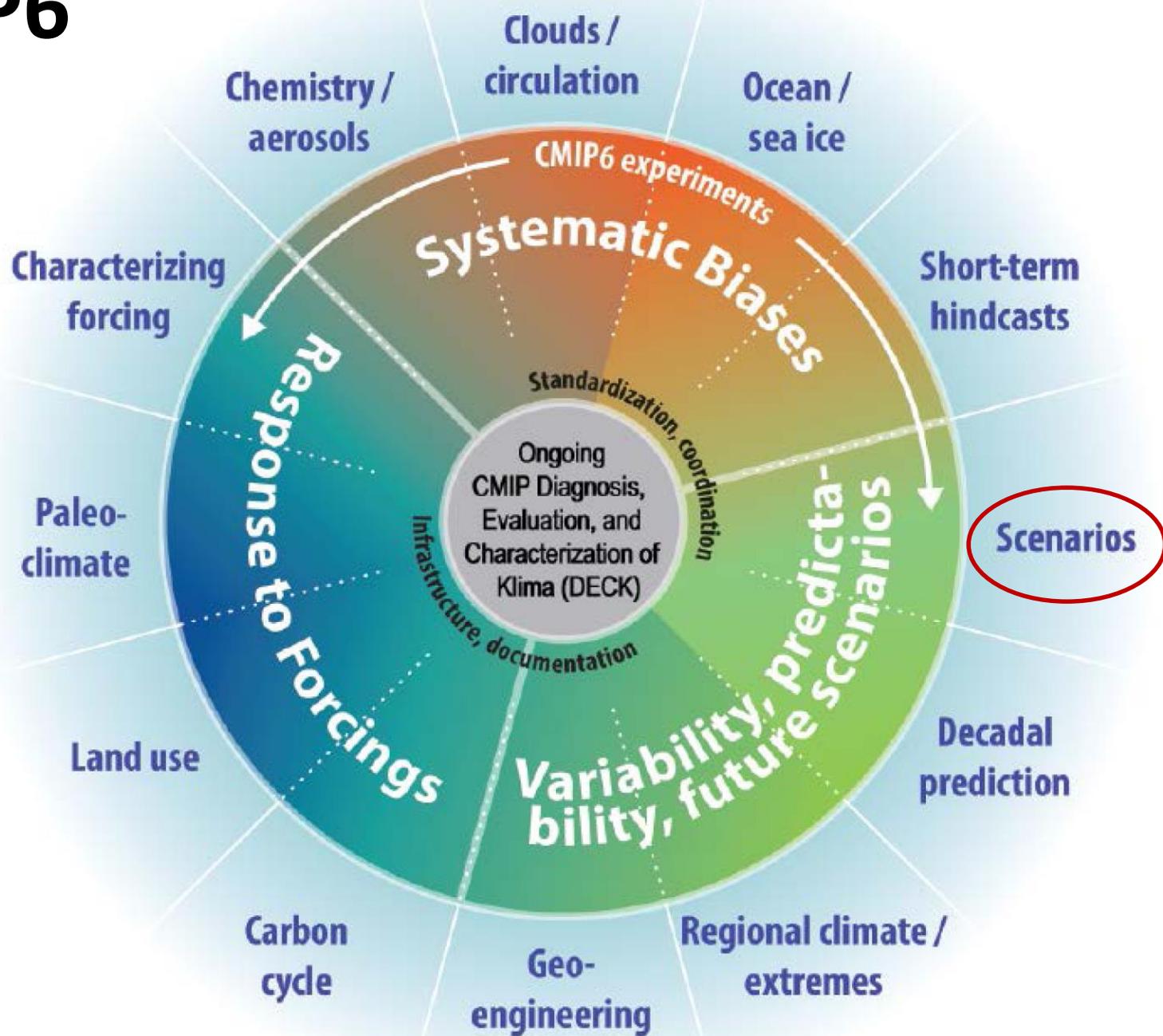
Organizing committee: Claudia Tebaldi, Brian O'Neill, Tim Carter and James Murphy

Preliminary pattern scaling/emulation
conclusion:

“Pattern scaling has not yet been shown to be sufficiently accurate to comprehensively meet the needs of users, such that it could substitute for GCM simulations.”

[However, things may not be quite as bad as they seem.]

CMIP6



Initial Applications

Applications completed or underway

(ICONICS database under construction)

Individual studies

Several individual papers

Projects: BRACE on avoided impacts

Large scale impact studies

AgMIP

ISIMIP

Regional studies

LAMP (Latin America)

IMPRESSIONS (Europe)

LUC4C (Europe)

Arctic Assessment

National studies

USGCRP, population and land use scenarios

Open Questions

Open Questions: SSPs

Do the current SSPs represent well the domains of the challenges space they are intended to represent?

How can challenges to mitigation and adaptation best be measured?

Are all the storylines and quantitative information plausible and internally consistent?

Are there important variations or new pathways that need to be explored?

How best can global SSPs be used to inform societal pathways at smaller scales?

Open Questions: IAM scenarios

- Do the IAM scenarios cover a sufficient range of forcing?
- Do the IAM scenarios include a useful variety of outcomes for land use and emissions of SLCFs, particularly aerosols and precursors?
- Are there any issues of consistency between IAM scenarios and the SSPs they are based on?

Open Questions: Climate Information

What climate variables are impacts most sensitive to?
(for pattern scaling, for model selection)

What variables can be successfully pattern scaled/emulated, at what resolution (and what does “successfully” mean)? How best can we make progress in this area, and will it be in time to influence ScenarioMIP design?

Do inconsistencies between land use and SLCF emissions in RCPs and new IAM scenarios matter? For what impacts and/or regions?

What new scenarios should be run as part of CMIP6?

Next Steps

Selected scenario process milestones

RCPs

Special issue, *Climatic Change*, 2011

RCP-SSP Conceptual framework

Special issue, *Climatic Change*, 2013

SSPs and IAM scenarios

Special issue, *Global Environmental Change*, 2015

ScenarioMIP/CMIP6

Aspen multi-MIP meeting next week

CMIP6 scenarios begin to be run early 2017

} IAM/IAV
influence!

Upcoming Scenarios Meetings

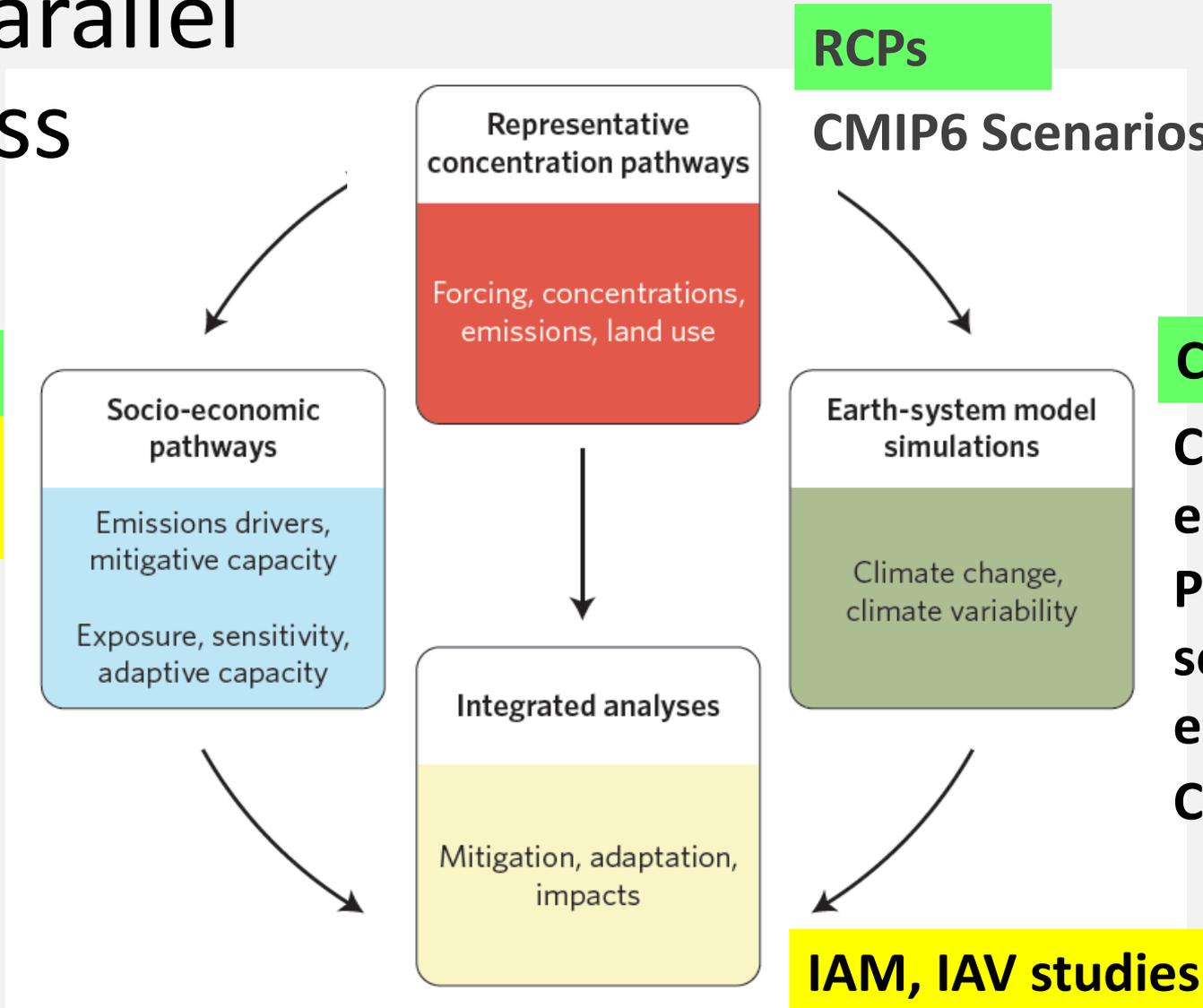
IPCC meeting at IIASA, tentatively February 2015

ICONICS open forum at NCAR, ~September 2015

The Parallel Process

SSPs
IAM
scenarios

Add'l SSP
quant.
info.
SSP/IAM
changes



CMIP5
CMIP5
ensembles
Pattern
scaling/
emulation
CMIP6

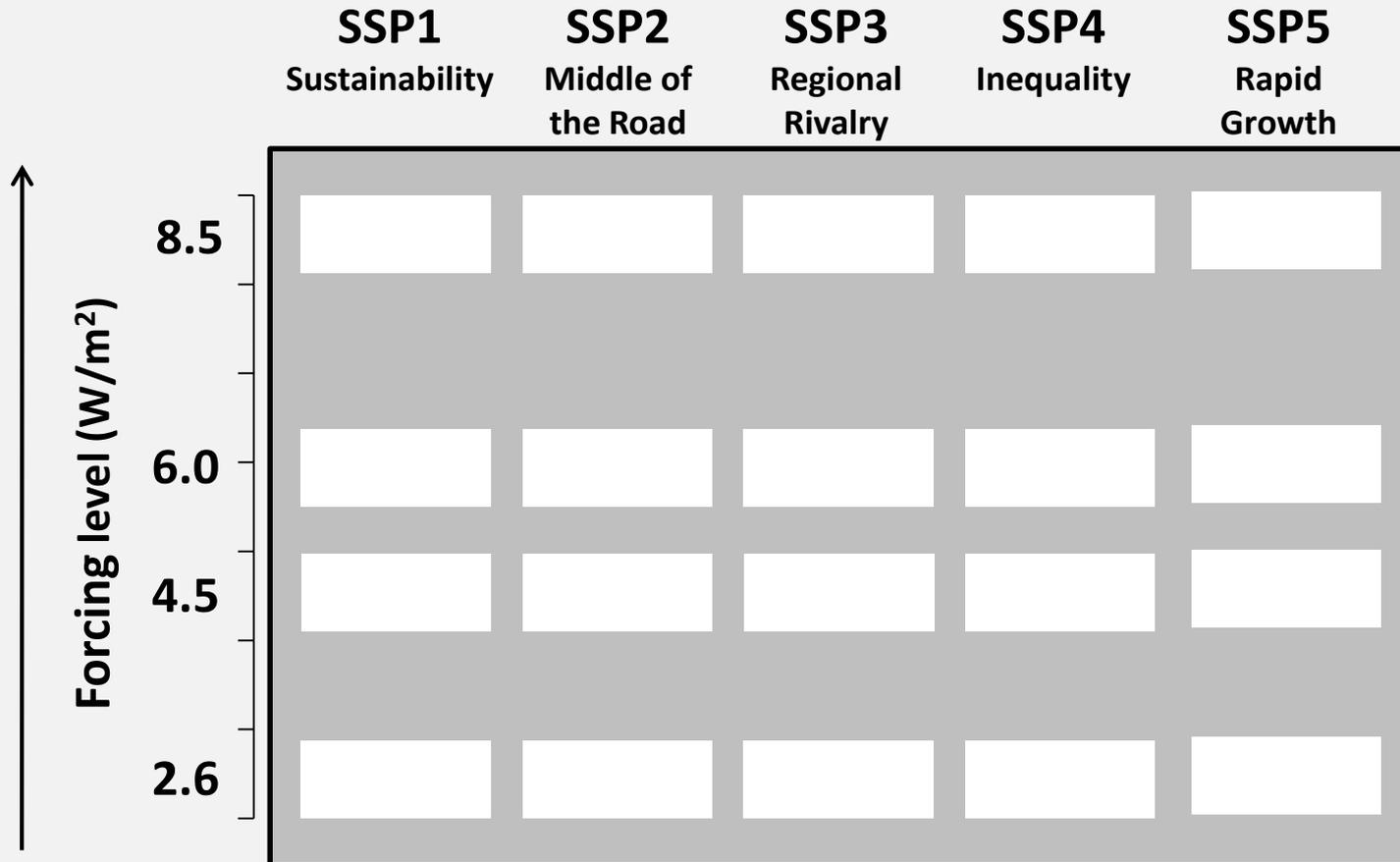
IAM, IAV studies

More IAM, IAV studies

Extra Slides

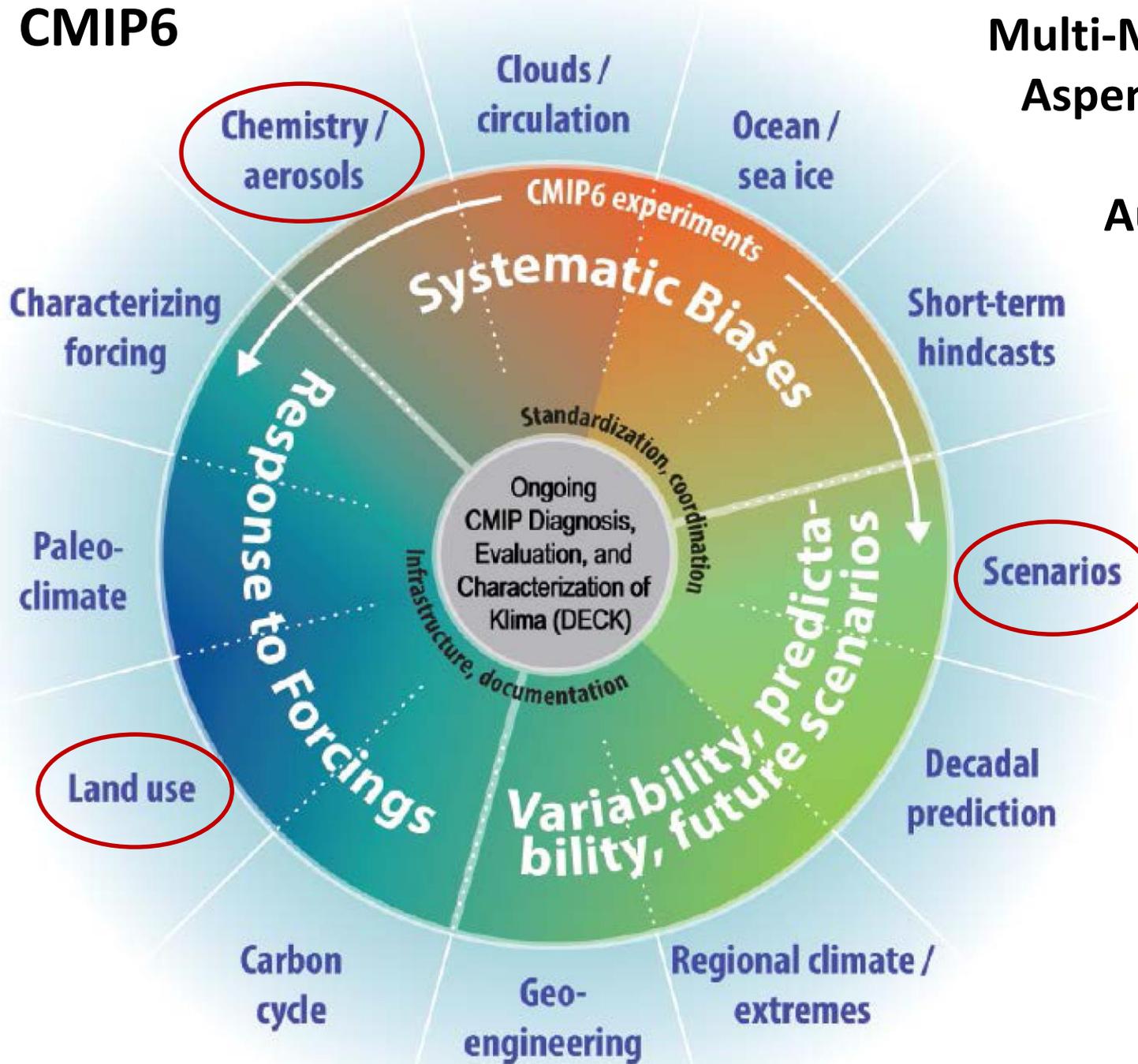
The Scenario Matrix Architecture

Shared Socioeconomic Pathways

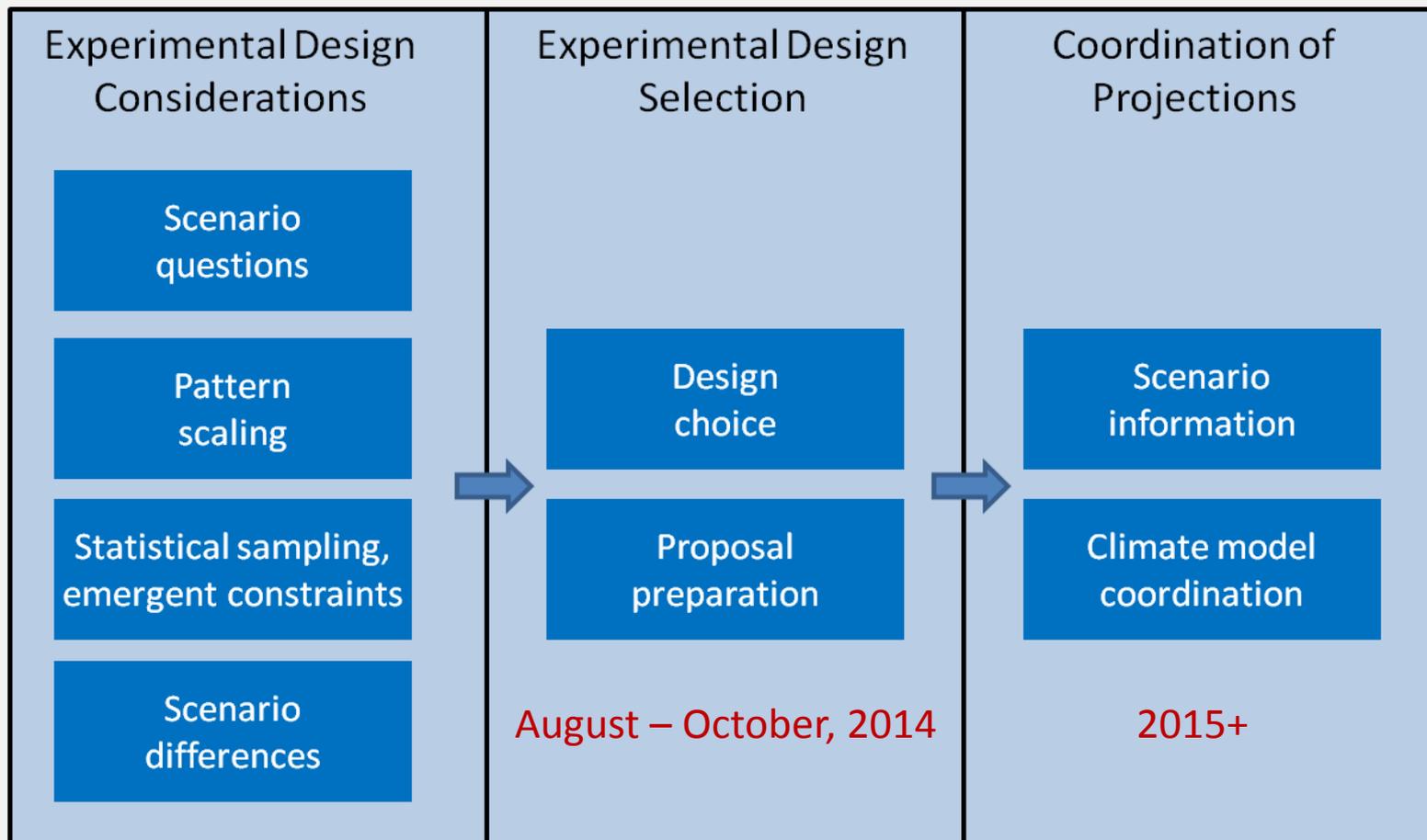


CMIP6

Multi-MIP meeting (?):
Aspen Global Change
Institute
August 4-8, 2014



ScenarioMIP



Co-chairs: Claudia Tebaldi, Brian O'Neill, Detlef van Vuuren

Members: Veronika Eyring, Pierre Friedlingstein, Reto Knutti, Jason Lowe, Jerry Meehl, Richard Moss, Jean-Francois Lamarque, Ben Sanderson