SSP/RCP-based scenarios for CMIP6

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The Parallel Process

RCPs (Complete)

CMIP5 (Complete)

Refined after community review

Socio-economic pathways
- Emissions drivers, mitigative capacity
- Exposure, sensitivity, adaptive capacity

Representative concentration pathways
- Forcing, concentrations, emissions, land use

Earth-system model simulations
- Climate change, climate variability

Integrated analyses
- Mitigation, adaptation, impacts

O’Neill & Schweizer, 2011.
Representative concentration pathways

- Grey area = literature range; colour lines = RCPs

- RCPs cover the full range of GHG emissions 😊

[Graphs showing emissions of CO₂, CH₄, and N₂O for different RCPs over time]
Scenarios for impact analysis

Indirect drivers
(Socio-Economic)

Direct drivers
(Energy)

Emissions, & land use

Carbon cycle

Climate

Impacts & adaptation

Socio-economic reference pathways
(GDP, population, governance, education, technology)
Scenarios for impact analysis

Main architecture new scenarios

Forcing level (W/m²)

Climate

Socio-economic reference pathways
IAM models now exploring these pathways

CO2 Emissions, World

Scenarios without climate policy (baselines)

- SSP5
- SSP3
- SSP2
- SSP4, SSP1

Legend:
- AIM/CGE
- GCAM
- IMAGE
- MESSAGE-GLOBIOM
- REMIND-MAGPIE
- SSP1
- SSP2
- SSP3
- SSP4
- SSP5
IAM models now exploring these pathways

Policies introduced to meet climate targets from SSP baselines

CO2 Emissions, World

2.6 W/m²
Greenhouse Gas emissions

SSP5 baseline
4.5 W/m²

SSP3

SSP2

SSP1

SSP4
Main architecture new scenarios

Socio-economic reference pathway

SSP1  SSP2  SSP3  SSP4  SSP5

Forcing level (W/m²)

8.5
6.0
4.5
2.6

Differences in land use
Research question #1: Can we explore together the influence of land use? (albedo, CO2)

Main architecture new scenarios

Socio-economic reference pathway

SSP1  SSP2  SSP3  SSP4  SSP5

Forcing level (W/m²)

Differences in short-lived forcers
Research question #2: Can we explore together the influence of short-lived forcing agents? (aerosols)
Main architecture new scenarios

Socio-economic reference pathway

SSP1  SSP2  SSP3  SSP4  SSP5

Forcing level (W/m²)

2.6
4.5
6.0
8.5

Baseline

Forcing

4.5 W/m²

2000  2100
Research question #3: We would like to explore together the influence of overshoot

Analysis of CMIP5 RCP Data by Chris Jones, Jones et al., 2013; Historical Data: Global Carbon Project, 2010; Le Quere et al., 2012
Research question #4: We would like to explore together costs and benefits of mitigation and adaptation.

Ideally, run all combinations – and look into climate, mitigation and (avoided) impacts for all cells and pairs.

→ Select the most relevant
→ Look for ways to reduce runs (pattern scaling)
Summary

- Interest in running set of scenarios to explore:
  - Land use effect (question #1)
  - Effect short-lived climate forcers / aerosols (question #2)
  - Overshoot (question #3)
  - Impacts of mitigation and adaptation policies on costs / benefits (also compared to baseline) (question #4).

- Selection of set of scenarios on the basis of the SSP architecture
Process

- Currently developing SSPs in IAM models (plan to be finished early next year) → First results already available
- We would like to discuss now (up to summer 2014?) how to best address these four questions by selecting scenarios from the framework:
  - Scenarios defined by combinations of SSP/RCP only?
  - Scenarios including deliberate different characteristics than standard SSP/RCP combination (extra S, overshoot)?
  - Choices also depend in progress in ESM models (need to run RCP ranges)
- Very strong interest in pattern scaling + questions related to “how different should scenarios be to make a difference”