

INDCs and pathways to different temperature targets

Hélène Benveniste for the Groupe Interdisciplinaire sur les Contributions Nationales (GICN)

Institut Pierre Simon Laplace, Paris, France
Email: helene.benveniste@ipsl.jussieu.fr

Funded by



CONTEXT

- Intended Nationally Determined Contributions (INDC) provide useful information as to what global emissions of greenhouse gases could be in 2030.
- Here we compare INDC to 2°C pathways and milestone from IPCC, as well as to 1.5 to 3°C “soft landing” pathways from the REDEM software.
- Furthermore, we analyze the drivers of uncertainty surrounding INDC implied 2030 emission level.



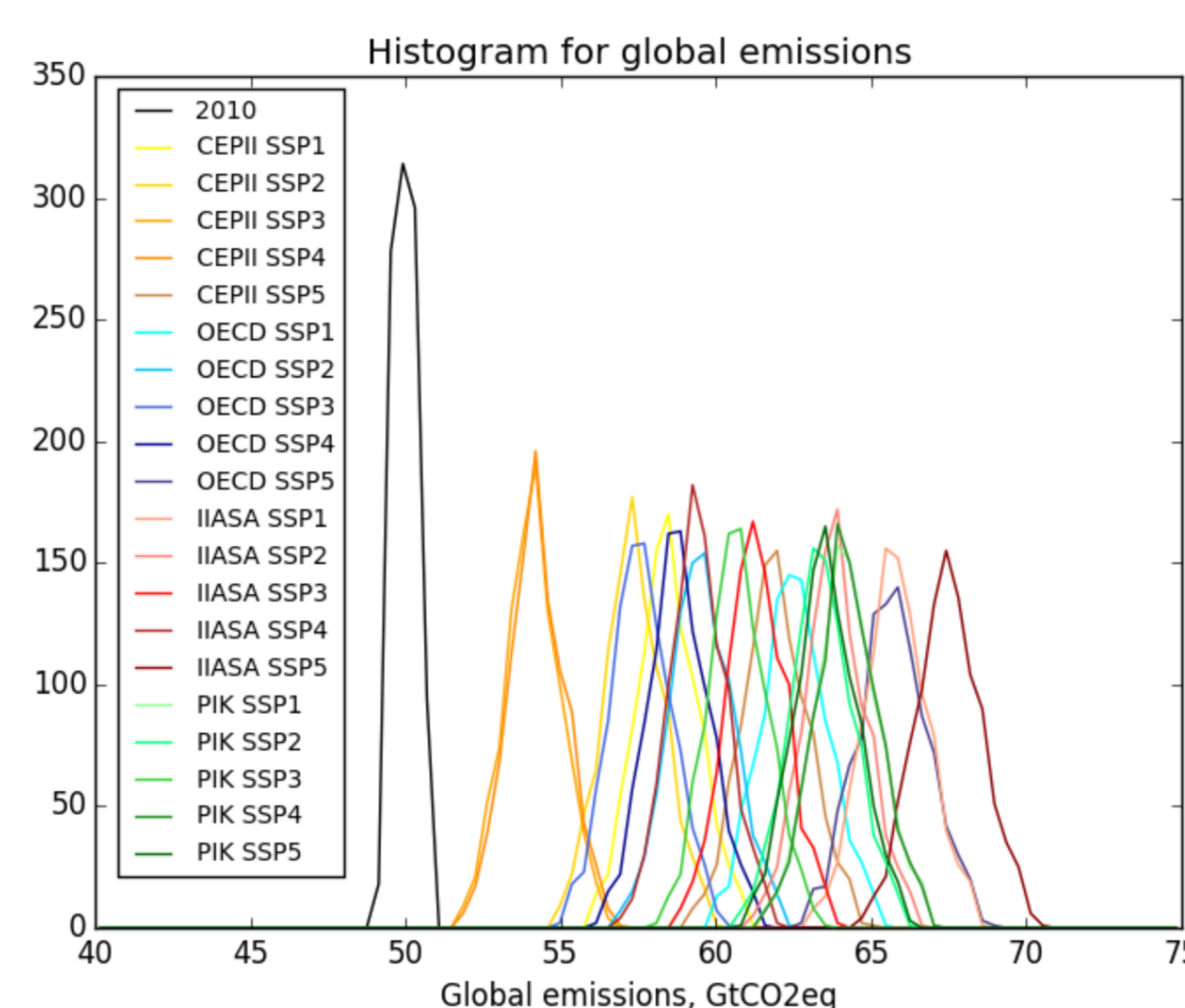
CONCLUSIONS/SUMMARY

- With our set of assumptions, INDC lead to a 2030 global emission level of 52.5 to 69.5 GtCO₂eq.
- This level implies tremendous efforts after 2030 to be on track for a 2°C goal according to IPCC pathways.
- Negative emissions, although presenting a largely uncertain potential, play a crucial role in keeping the 2°C target in reach.
- Uncertainty on the 2030 emission level makes the case for a clearer framework regarding future NDC's design: growth hypothesis, national target for LULUCF emissions.

ASSUMPTIONS FOR INDC INTERPRETATION

- Considering unconditional and conditional targets, plus assumptions when only sectoral targets.
- GDP projections: 5 Shared Socioeconomic Pathways (SSP) from 4 sources (IIASA, OECD, PIK, CEPII).
- International aviation emissions based on assumptions from SNECMA. BAU trend for international shipping.
- Varying fraction of carbon sinks considered as anthropic.
- Emission data:
 - EDGAR: all GHG except CO₂ from LULUCF
 - Correction from Liu et al. (2015) for Chinese emissions
 - BLUE: CO₂ from LULUCF
 - UNFCCC: net CO₂ from LULUCF for USA, Canada, Russia

Figure 1: Probability distribution function of the global greenhouse gas emissions (Gt CO₂eq) in 2010, and for different economic growth scenarios, in 2030.



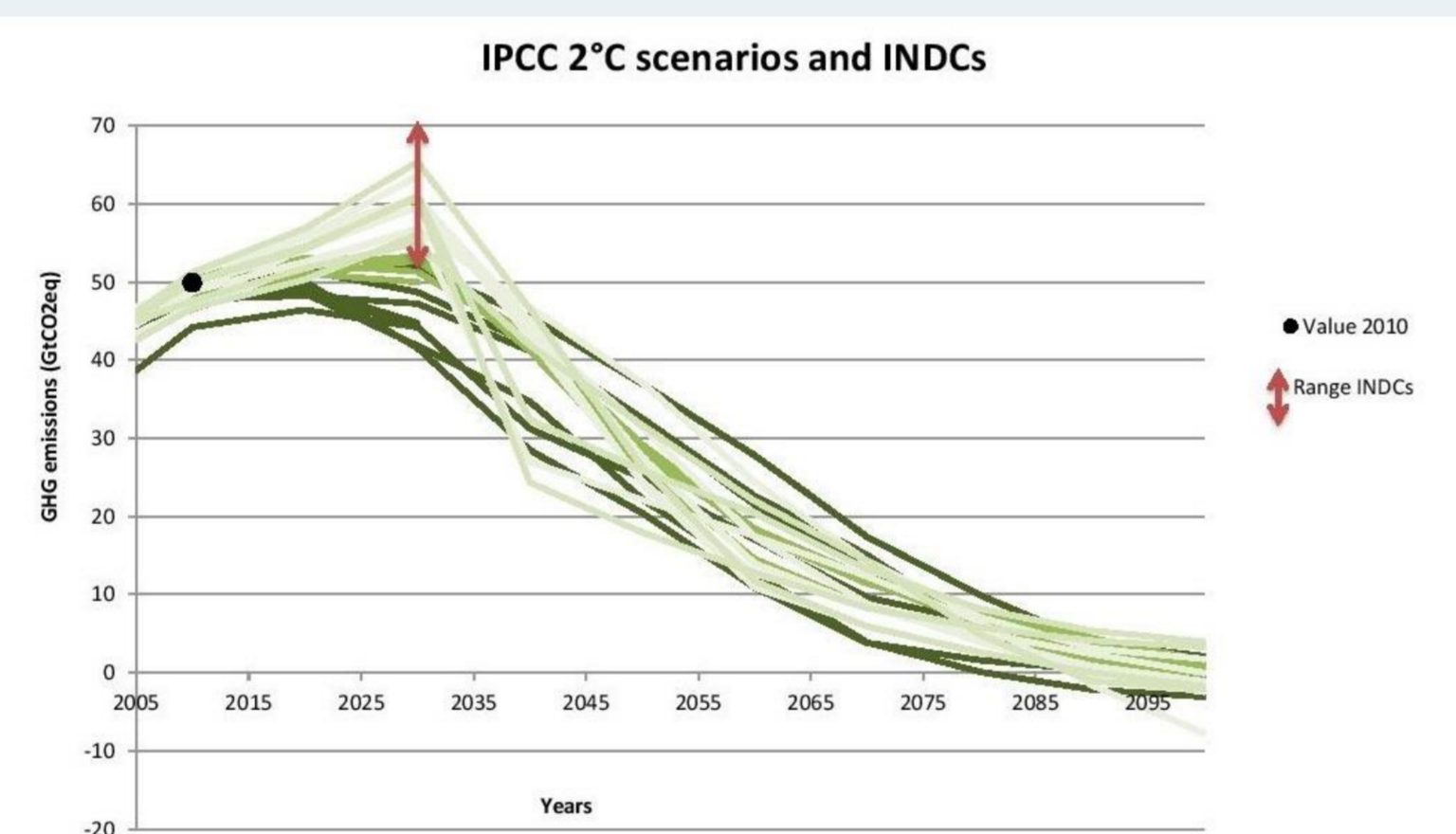
MAIN FEATURES OF THE REDEM SOFTWARE

- Based on the concept of “soft landing in emissions”
- Computes national or world CO₂ emission trajectories:
 - observed CO₂ emissions until 2014
 - exogenous cumulative CO₂ emissions to 2100
- REDEM main parameters: curvature factor + date of the peak in emission declining rate
- Optional pool of negative CO₂ emissions
- Non CO₂ gases based on IPCC RCP2.6 scenarios' median
- Trajectories for varying:
 - probabilities of reaching a given temperature target
 - timings of action (early-mid-late)

INDC AND IPCC PATHWAYS AND MILESTONES TO 2°C

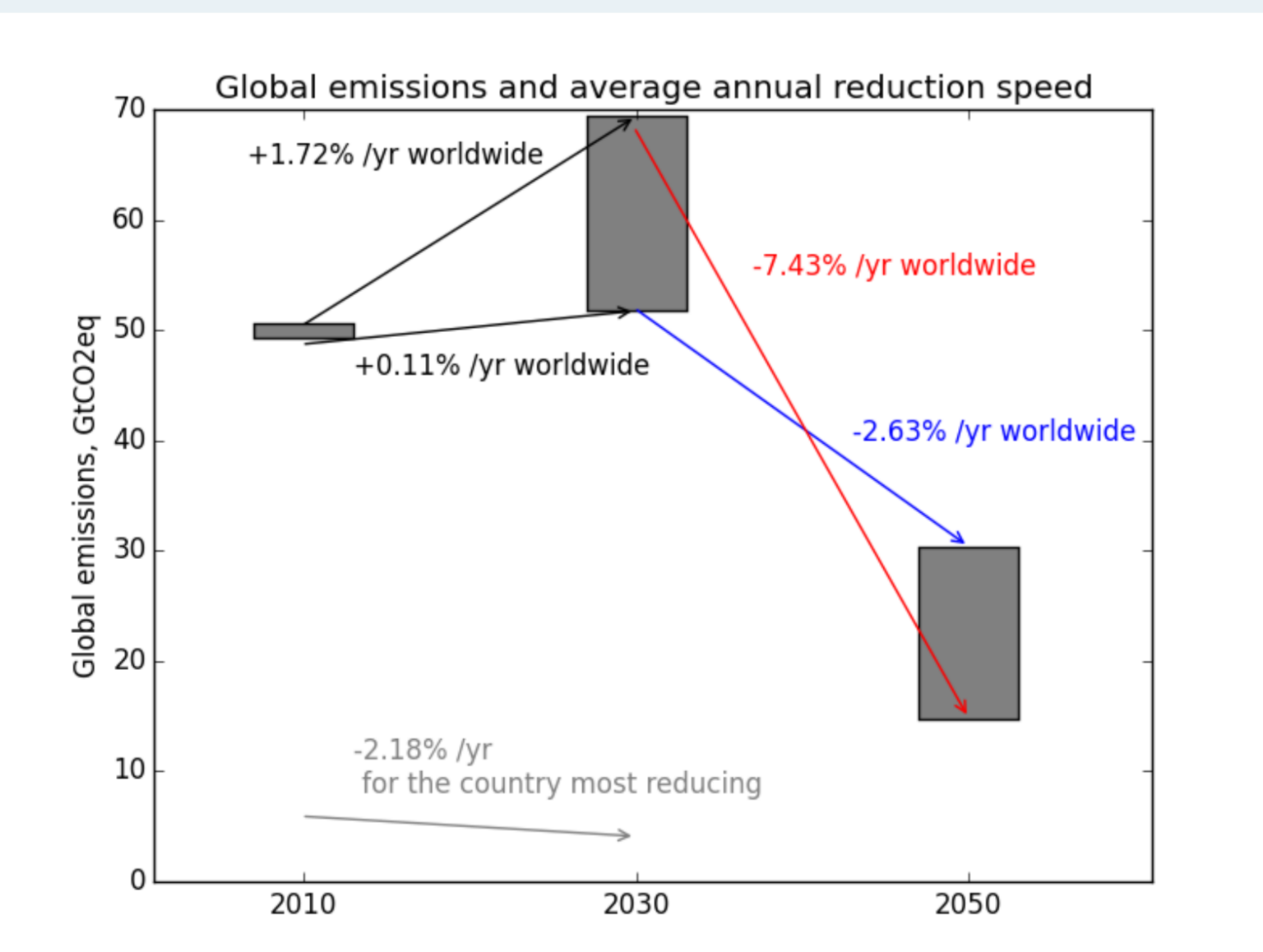
- There are 2°C scenarios passing through the 2030 INDC emission level.
- However they show a **strong and unrealistic break in slope in 2030**.

Figure 2: Non-obsolete IPCC 2°C scenarios and INDC. Source: IPCC, AR5, SPM, 2014 and GICN, 2015.



- 2050 IPCC milestone: reducing global emissions from 40% to 70% compared to 2010
- With current INDC: implies **staggering annual emission reduction rates for 2030-2050**.

Figure 3: Global emissions and uncertainty ranges in 2010, 2030 with INDC, and 2050 the IPCC milestone; minimal and maximal annual reduction speeds.



UNCERTAINTY ANALYSIS ON 2030 EMISSION LEVEL

- Uncertainty largely (~60%) due to **economic growth scenarios**.
- INDC's lack of precision (~27%):
 - Ranges
 - No target in emission reduction
 - No differentiation per sector
- Uncertainty from LULUCF partly contained in the INDC.
- Substantial driver not shown here: **will countries achieve or not, or exceed the announced INDC?**

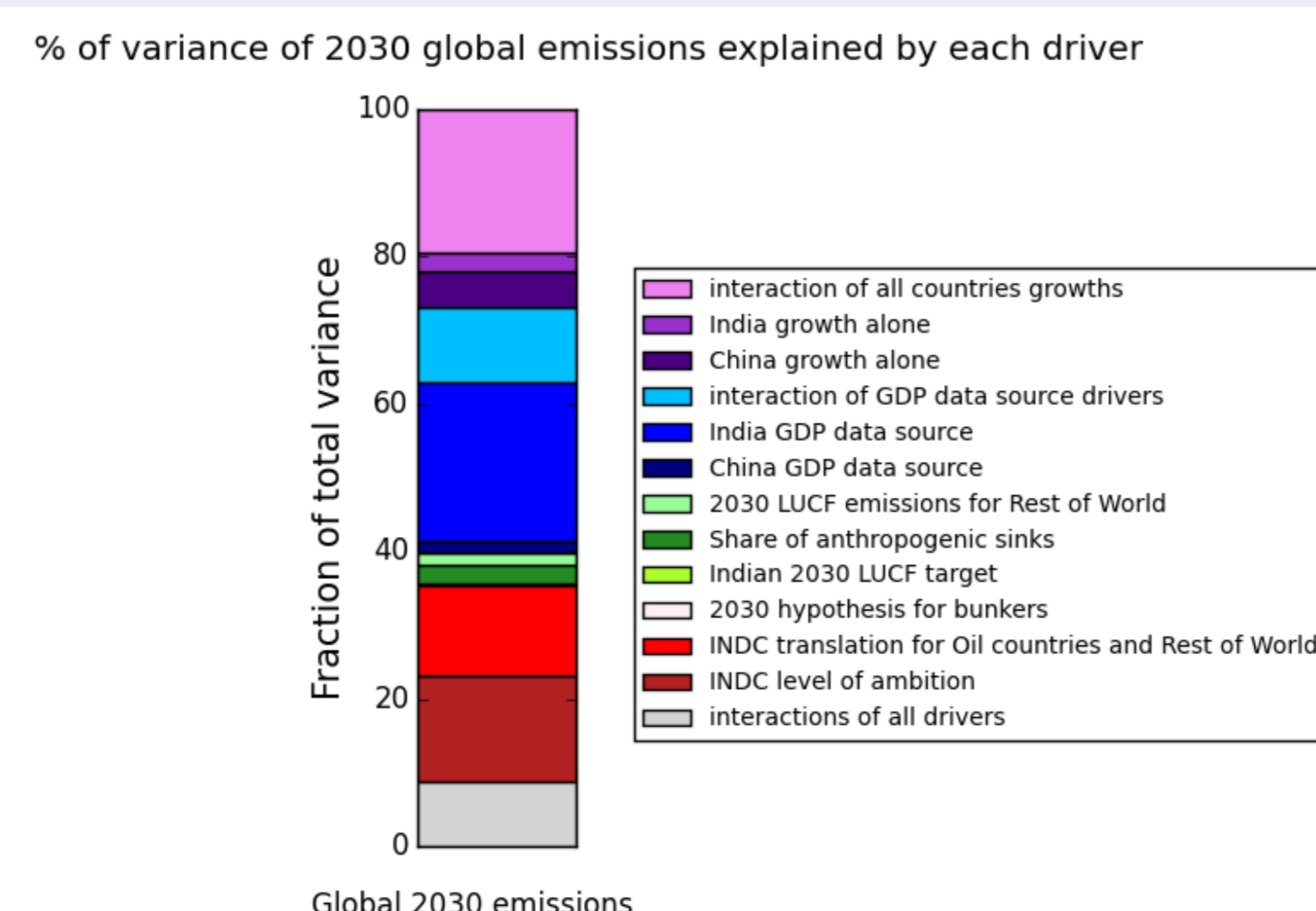


Figure 5: Respective contributions to the uncertainty in 2030 global emissions from various drivers. The interaction terms represent the covariances between drivers.

REDEM SOFT LANDING EMISSION PATHWAYS TO VARIOUS TEMPERATURE TARGETS

- When taking into account the inertia of socio-economic systems, INDC only match with 3°C scenarios and 2.5°C scenarios with negative emissions for a reasonable probability of success.
- 2.5°C scenarios without and 2°C scenarios with negative emissions are reached with a low probability of success.
- 2°C scenarios without negative emissions and any 1.5°C scenarios are out of reach in this modelization of the inertia of socio-economic systems.**

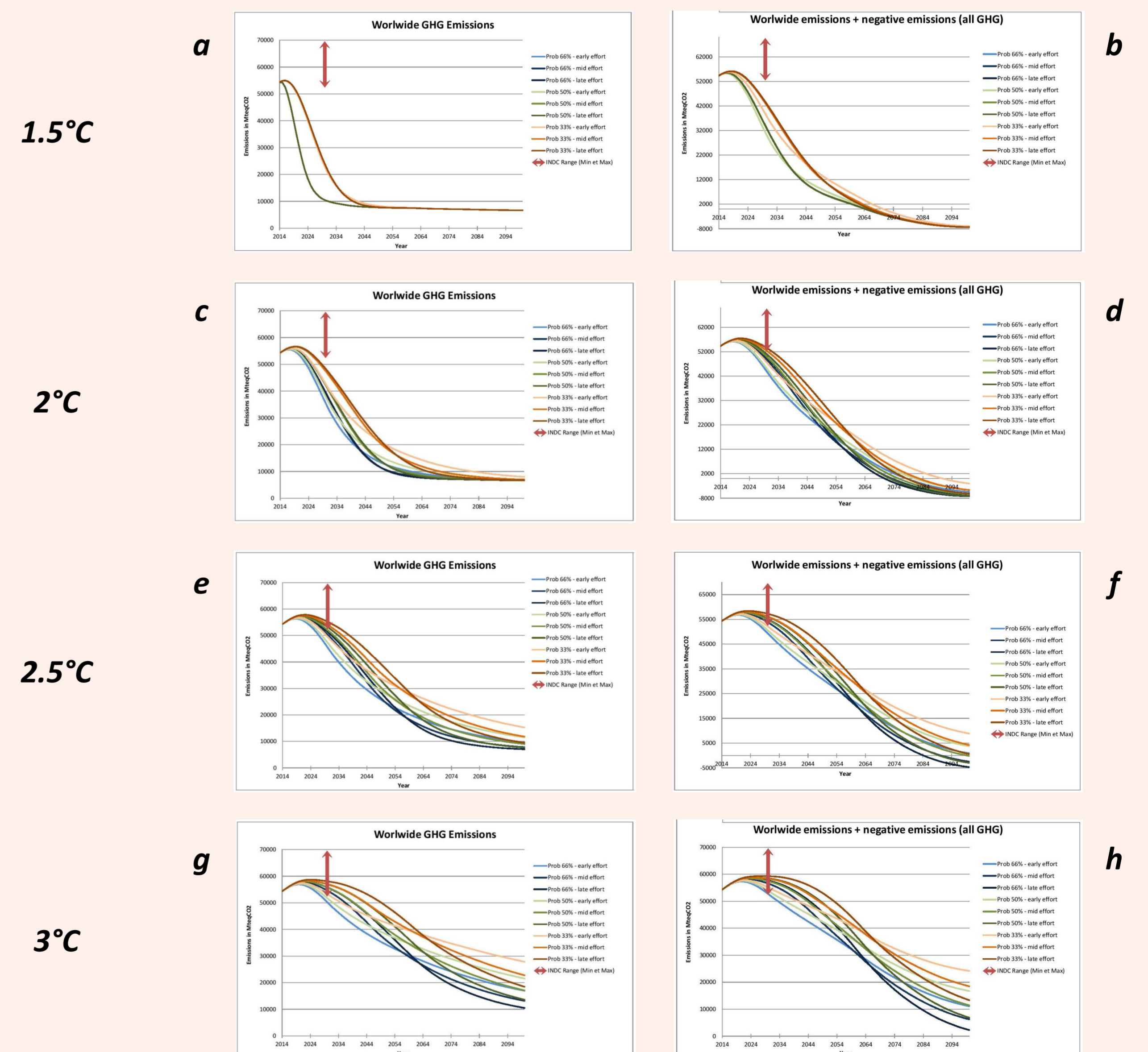


Figure 4: Soft landing global emission pathways and INDC range for temperature targets of 1.5°C (a, b), 2°C (c, d), 2.5°C (e, f) and 3°C (g, h), without negative emissions (a, c, e, g) and with a 500 GtCO₂ negative emission budget over the century (b, d, f, h).

REDEM-world freely available on <http://redem.gforge.inria.fr/> (Emmanuel Prados)

OTHER FINDINGS

- A new worldwide distribution of emissions:
 - China catches up with EU and potentially US in emissions per capita
 - Inequalities related to emissions per capita decrease
 - Emerging countries share increases