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The Climate Consequences of Paris

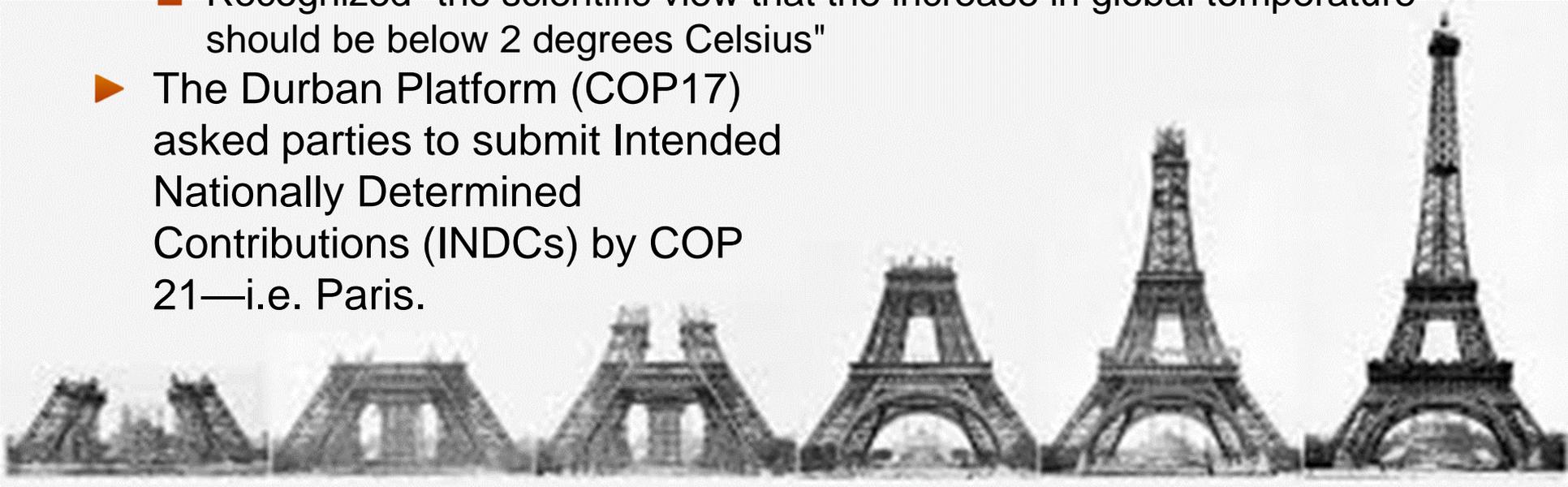
Jae Edmonds
December 9, 2016

The 22nd AIM International Workshop
Tsukuba, JAPAN

The Paris Process

COP 21 was held in Paris in December 2015

- ▶ Part of the UNFCCC, originally negotiated and opened for ratification in 1992, entered into force 1994 (196 parties).
- ▶ Set the goal of avoiding “dangerous anthropogenic interference with the climate” (Article 2),
- ▶ The Kyoto Protocol COP3 (1997) established the first international emissions limitation program.
- ▶ The 2009 Copenhagen Accord that emerged from COP15
 - Established a new international approach to emissions limitation,
 - Recognized "the scientific view that the increase in global temperature should be below 2 degrees Celsius"
- ▶ The Durban Platform (COP17) asked parties to submit Intended Nationally Determined Contributions (INDCs) by COP 21—i.e. Paris.



The Paris Agreement

- ▶ Adopted by consensus on 12 December 2015
- ▶ Opened for signature 22 April 2016 (Earth Day) in NYC
- ▶ Entered into force 4 November 2016



- ▶ The Paris Agreement is substantially different from the architecture created by the Kyoto Protocol.
- ▶ Kyoto
 - Based on cap and trade
 - Capped emissions in Annex I parties
 - Included non-Annex I parties only through CDM
- ▶ The heart of the new international emissions limitation architecture is the **INDC (Intended Nationally Determined Contribution)**.
 - Which turns into an NDC when a country joins
 - The NDCs are the contributions parties are making towards meeting the goals of the agreement in light of their national circumstances.
- ▶ Paris is also creating a durable framework for Parties' to update NDCs over time in a way that represents a progression that reflects Parties' differentiated responsibilities and commitments under the Convention.



INDC Commitments



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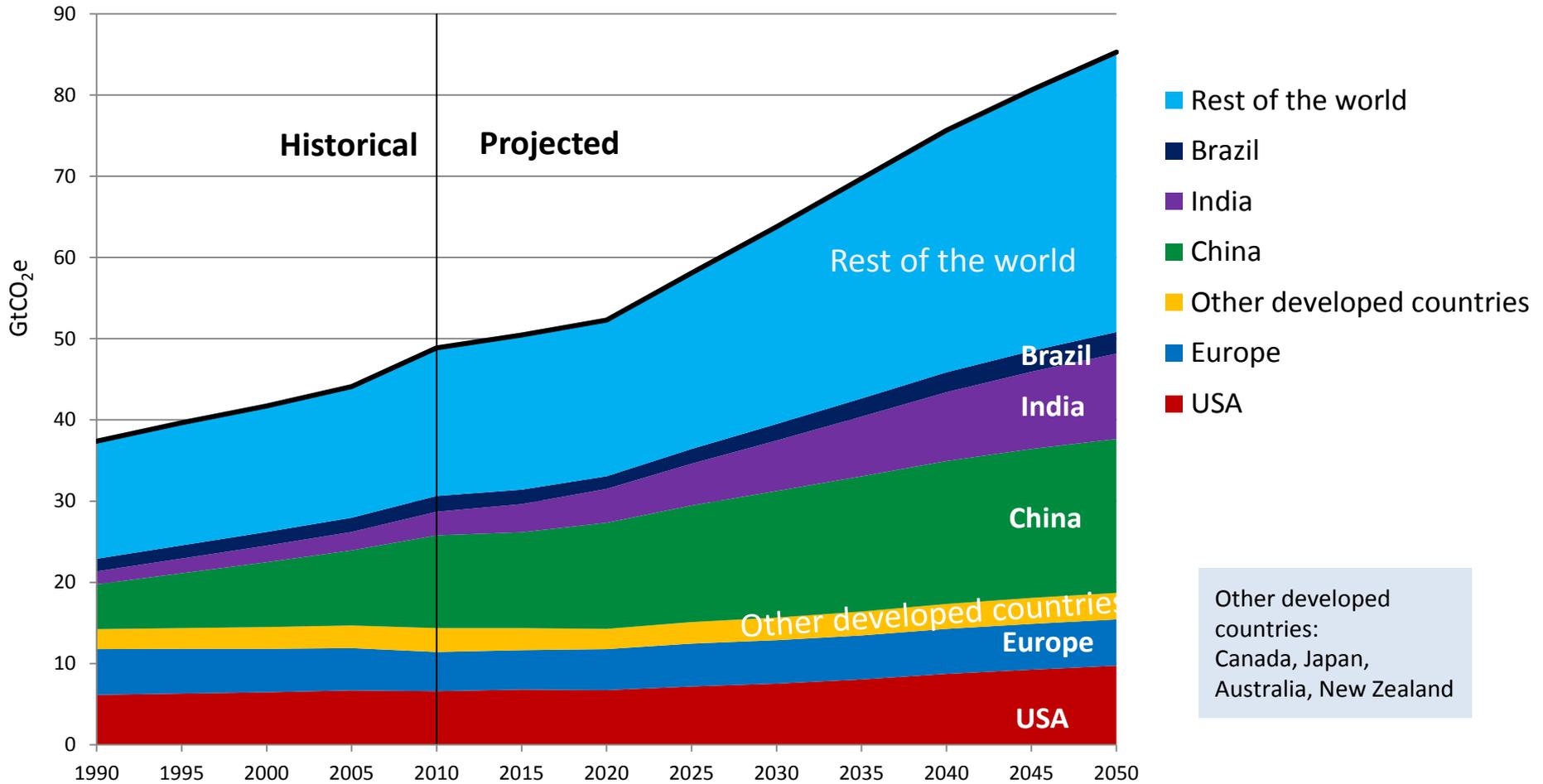
- ▶ As of mid-November 2016 163 INDCs representing 190 countries covering ~98.9% of current global GHG emissions have been submitted.

Major Commitments

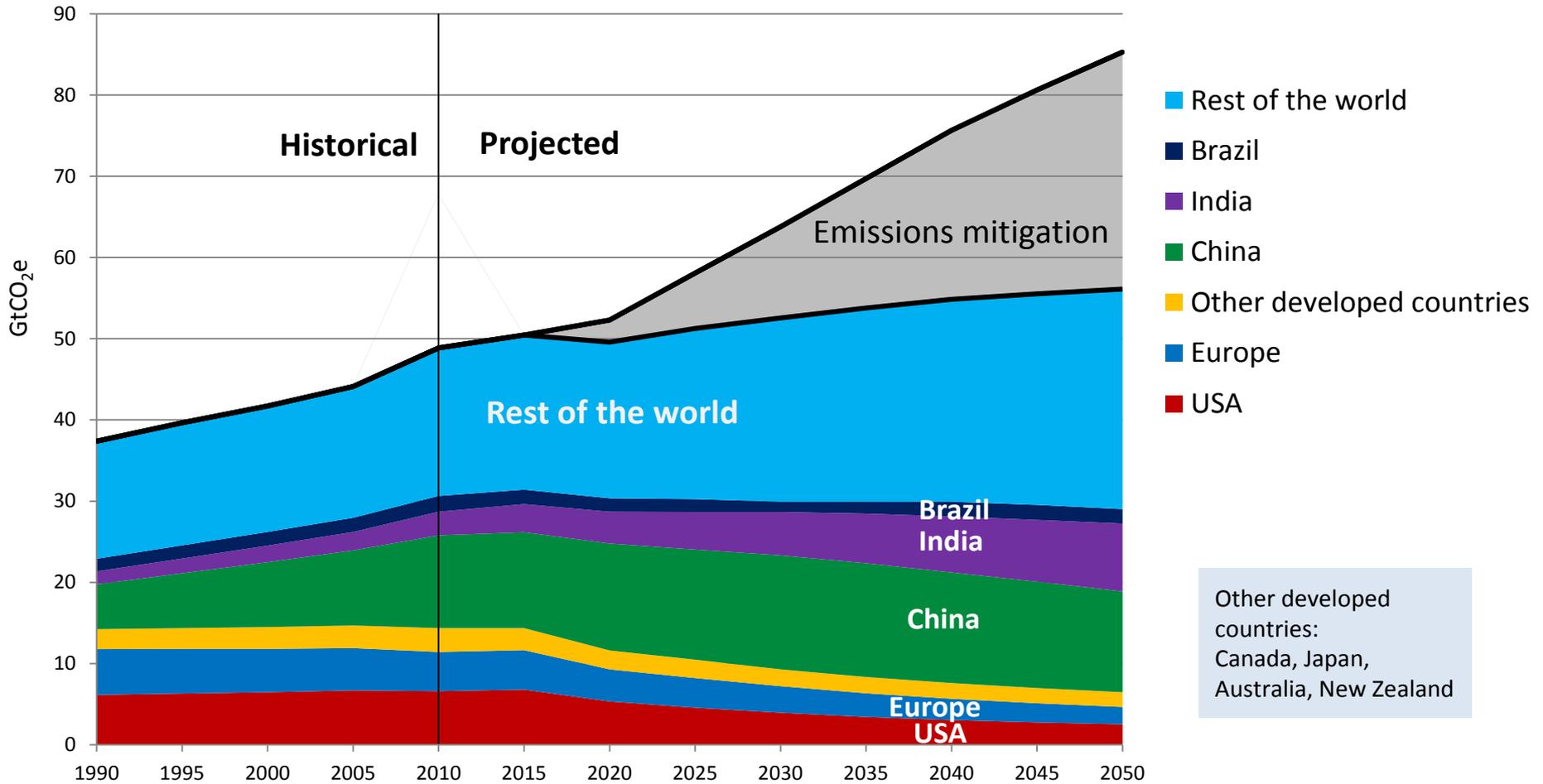


- ▶ **China** will achieve the
 - Peaking of carbon dioxide emissions around 2030 with best efforts to peak early;
 - Lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level;
 - Increase the share of non-fossil fuels in primary energy consumption to around 20%; and
 - Increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level.
- ▶ **United States** will reduce its net greenhouse gas emissions by 26-28 percent below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28 percent.
- ▶ **EU** will impose a binding target of a 40 percent domestic reduction in greenhouse gas emissions by 2030 compared to 1990 to be fulfilled jointly.
- ▶ **Japan** will reduce GHG emissions in 2030 to 26.0% emission in 2013

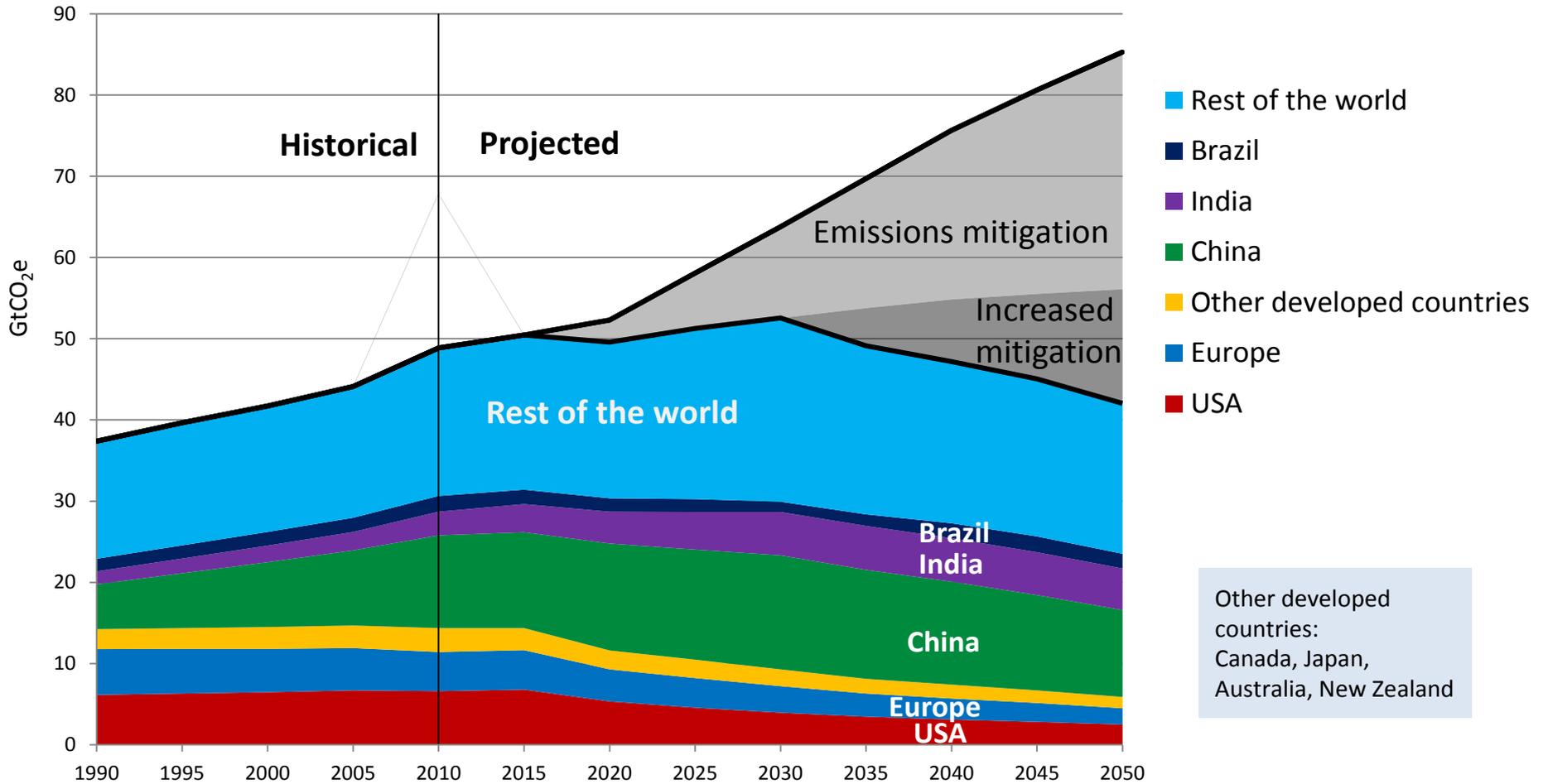
Global GHG Emissions: BAU



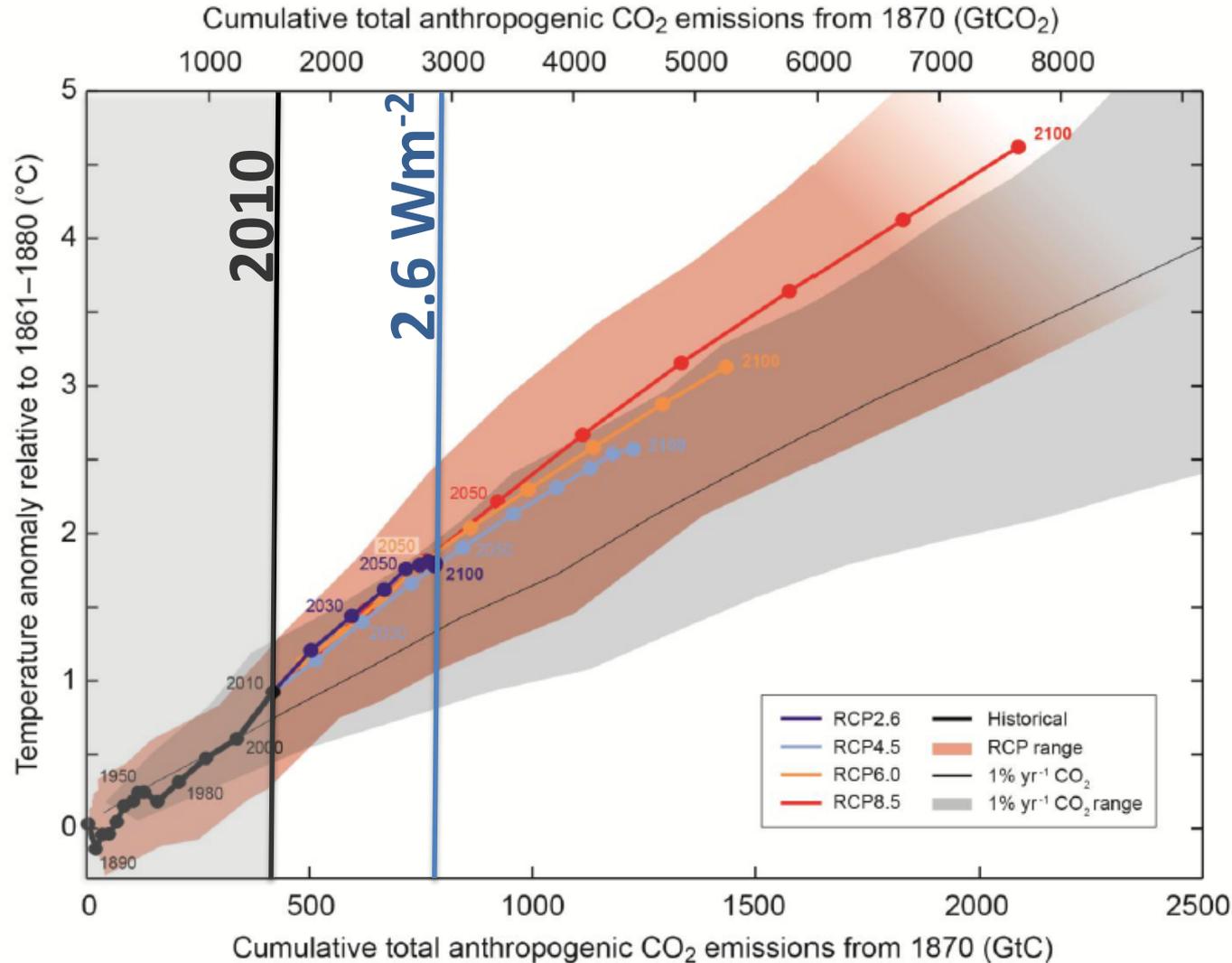
Global GHG: remaining emissions



Global GHG: increased ambition



Cumulative carbon determines warming



SPM.10

CLIMATE POLICY

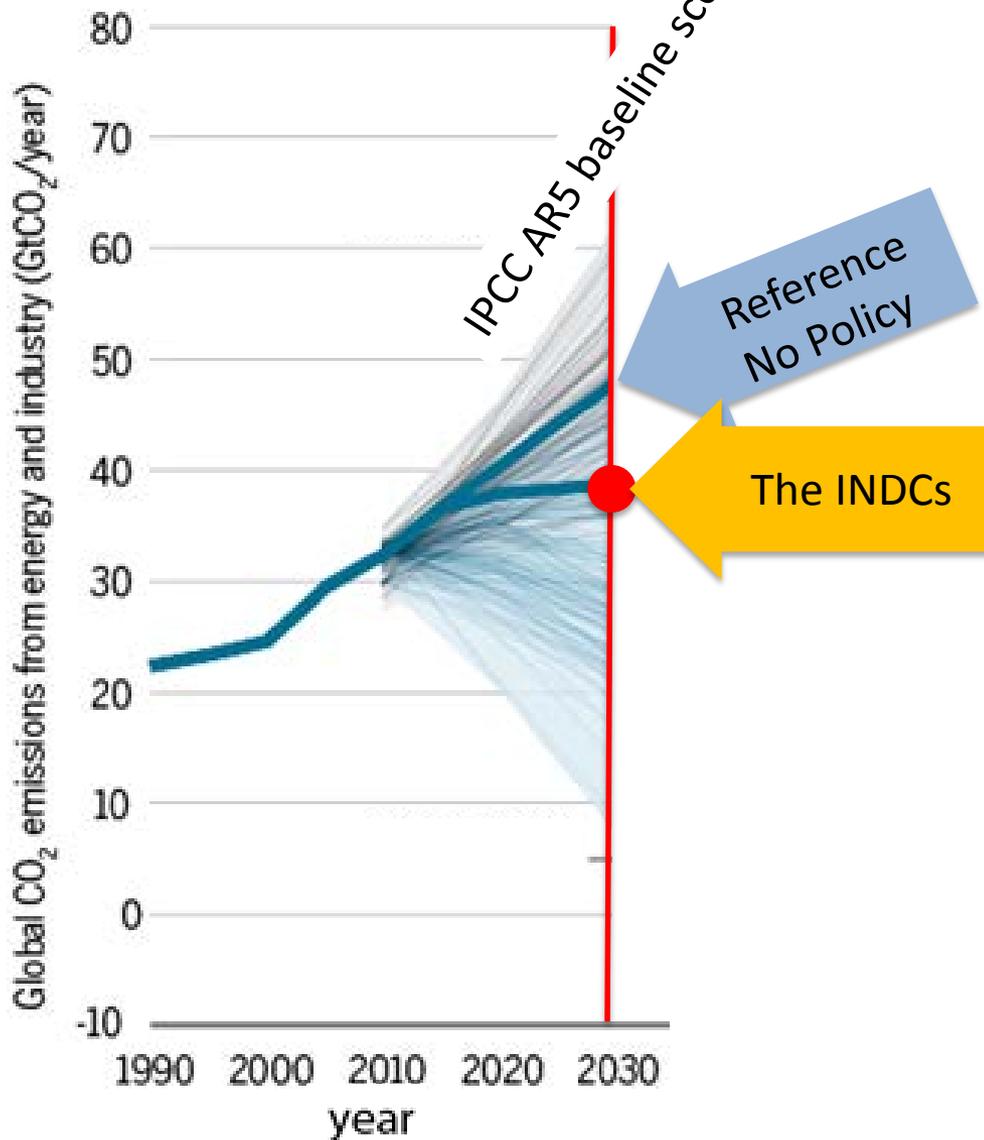
Can Paris pledges avert severe climate change?

Reducing risks of severe outcomes and improving chances of limiting warming to 2°C

By Allen A. Fawcett,¹ Gokul C. Iyer,^{2*} Leon E. Clarke,² James A. Edmonds,² Nathan E. Hultman,³ Haewon C. McJeon,² Joeri Rogelj,⁴ Reed Schuler,⁵ Jameel Alsalam,¹ Ghassem R. Asrar,² Jared Creason,¹ Minji Jeong,² James McFarland,¹ Anupriya Mundra,² Wenjing Shi²

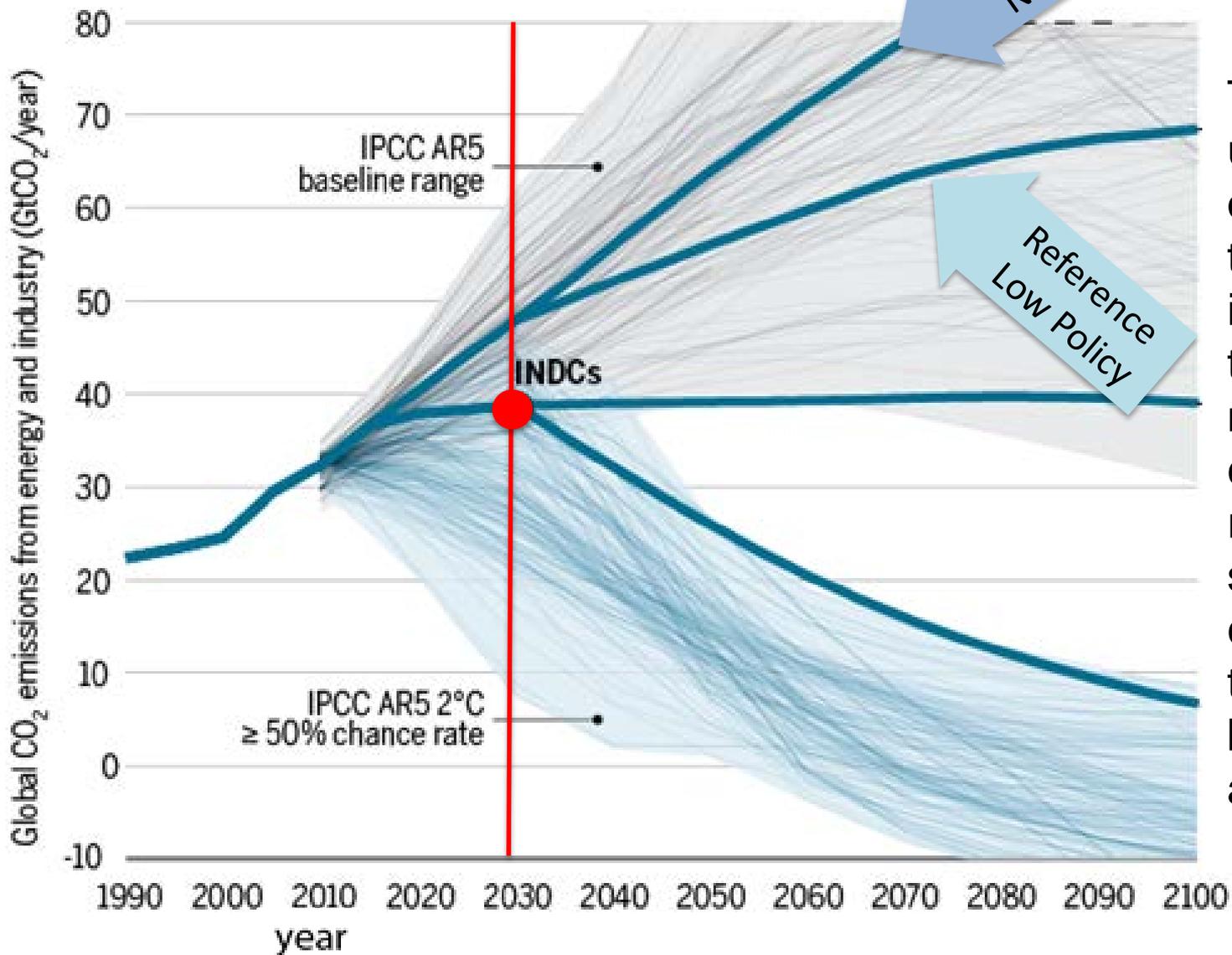
- ▶ A multi-year effort by a team from PNNL, EPA, UMD, State, and IIASA supporting the INDC process in the lead up to Paris.
- ▶ We analyze Paris from a risk management perspective and pose two key questions:
 - How much does Paris and the INDCs reduce the probability of the highest levels of temperature change?
 - How much do they improve the odds of achieving the international goal of limiting temperature change to 2°C?
- ▶ In order to answer these questions we need to:
 - Estimate what emissions would look like without Paris
 - Assess the emissions reductions that would be driven by the INDCs
 - Project a range of futures that are enabled by Paris and the INDCs
 - Estimate probabilistic temperature outcomes over the 21st century for this range of scenarios with and without Paris and the INDCs

“The Judgement of Paris” a New Analysis



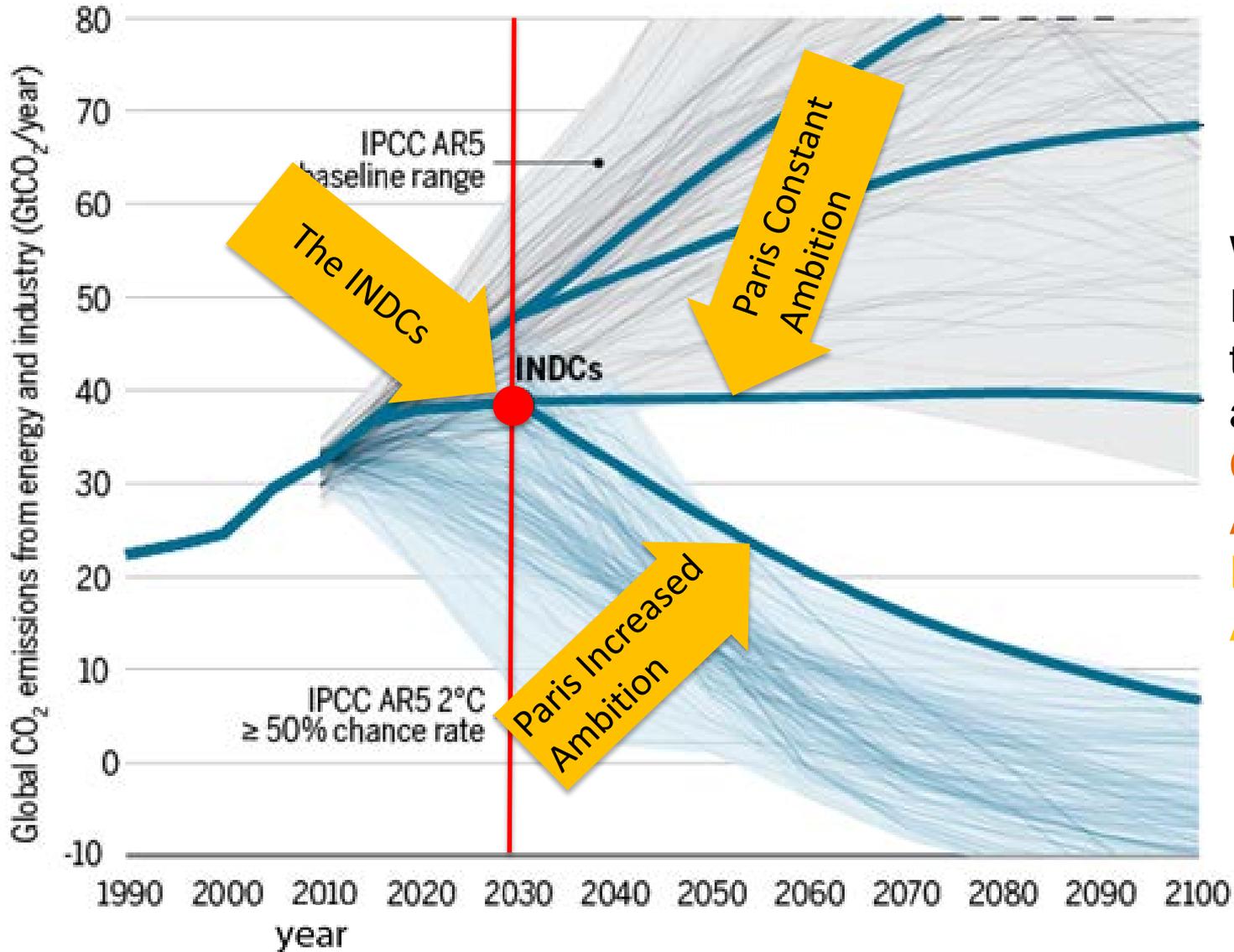
- ▶ The INDCs are defined no further than the year 2030 (e.g. U.S. INDC goes to 2025)
- ▶ Yet, a major question that is being asked is, what are the climate implications of the INDCs?
- ▶ That answer depends on the next 70 or more years.

"The Judgement of Paris" a New Analysis



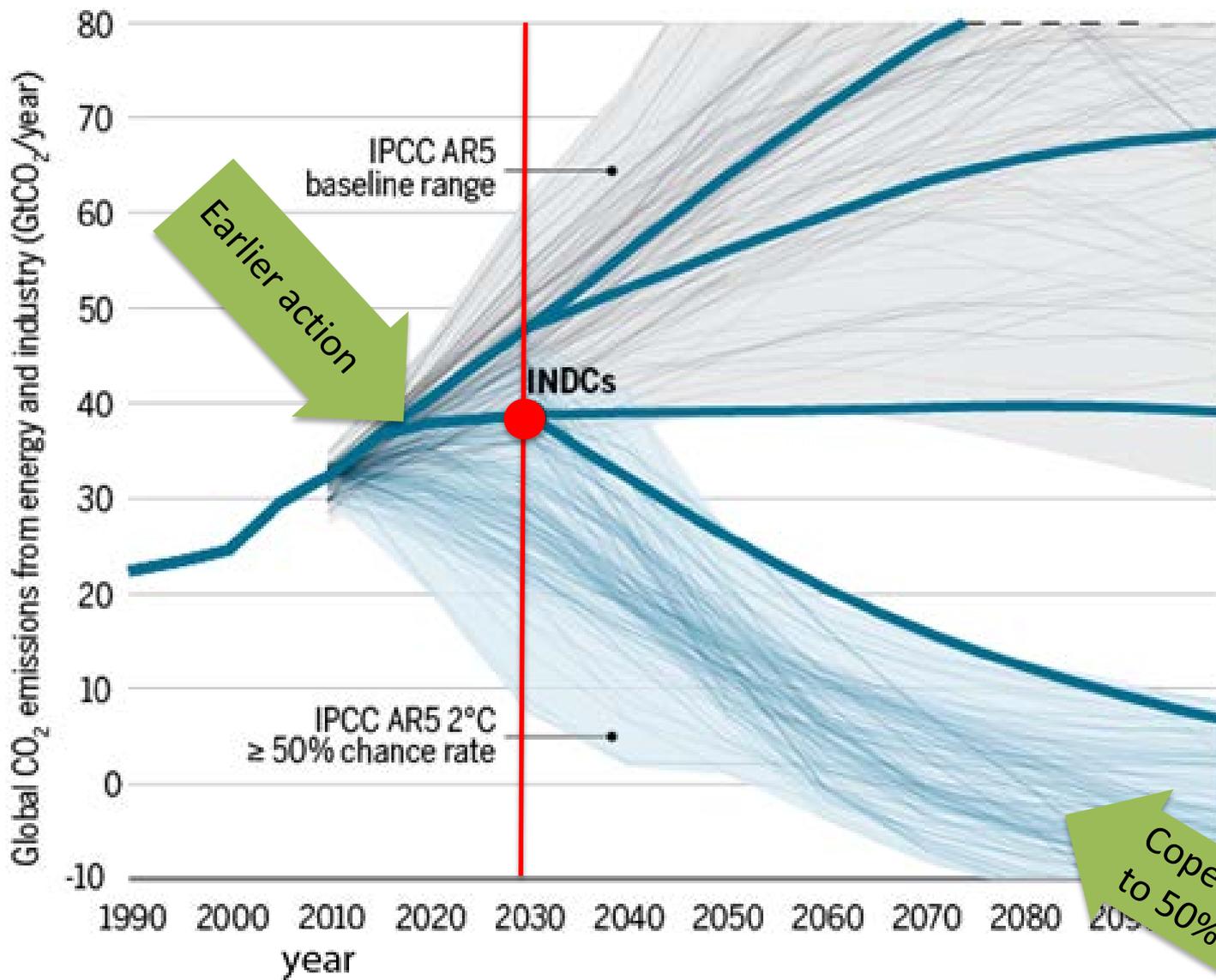
To get a better understanding of the long term implications of the INDCs we need to consider a range of scenarios that could occur in the period between 2030 and 2100.

“The Judgement of Paris” a New Analysis



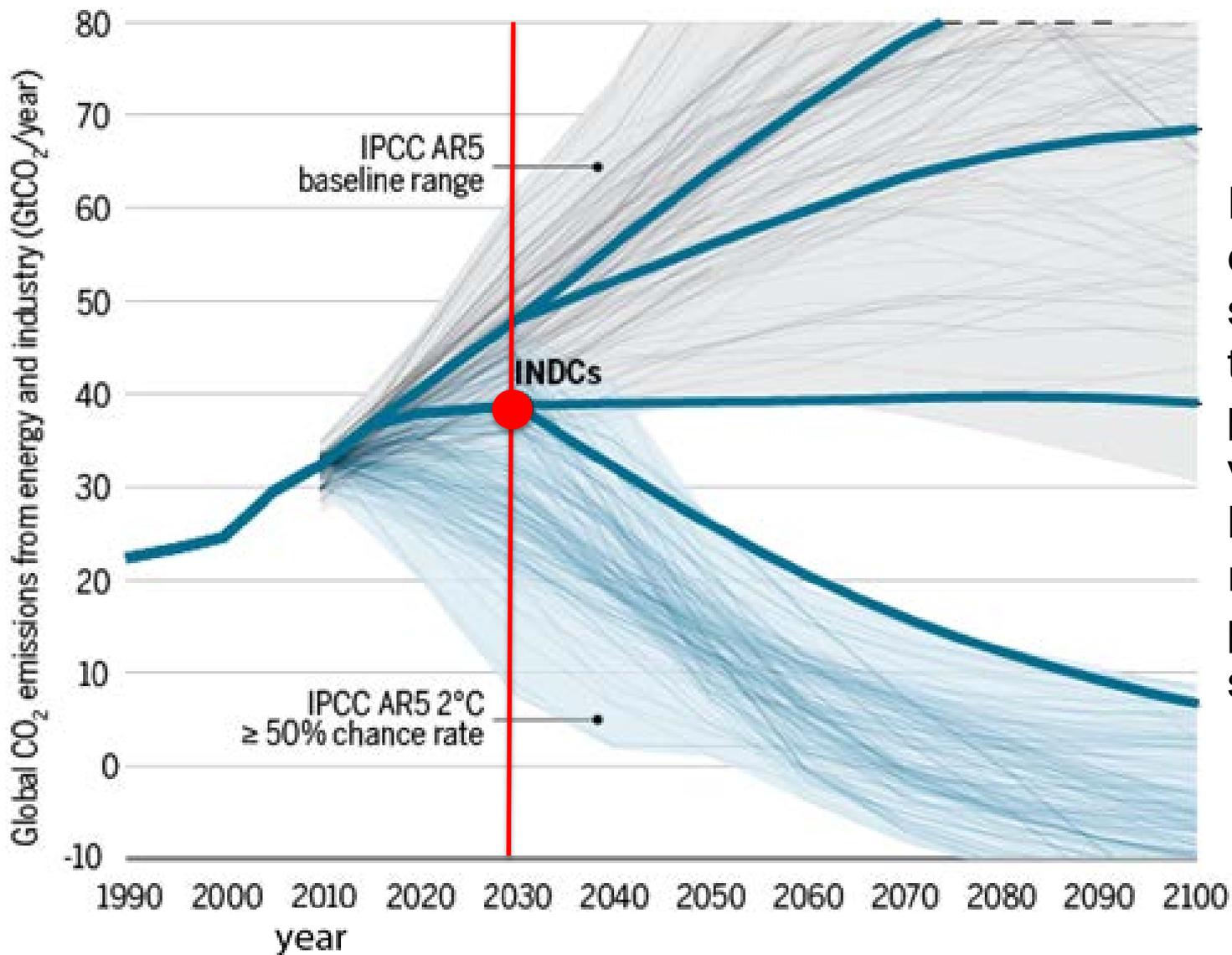
We extend the INDCs under two alternative assumptions, **Constant Ambition** and **Increased Ambition**

“The Judgement of Paris” a New Analysis



We contrast those scenarios with a scenario that implements the Copenhagen commitments and then reduces emissions so as to produce a 50-50 chance of limiting climate change to 2 degrees

“The Judgement of Paris” a New Analysis



Finally, we run each of our 5 scenarios through a probabilistic version of MAGICC, a reduced form physical Earth system model.

Our approach to uncertainty

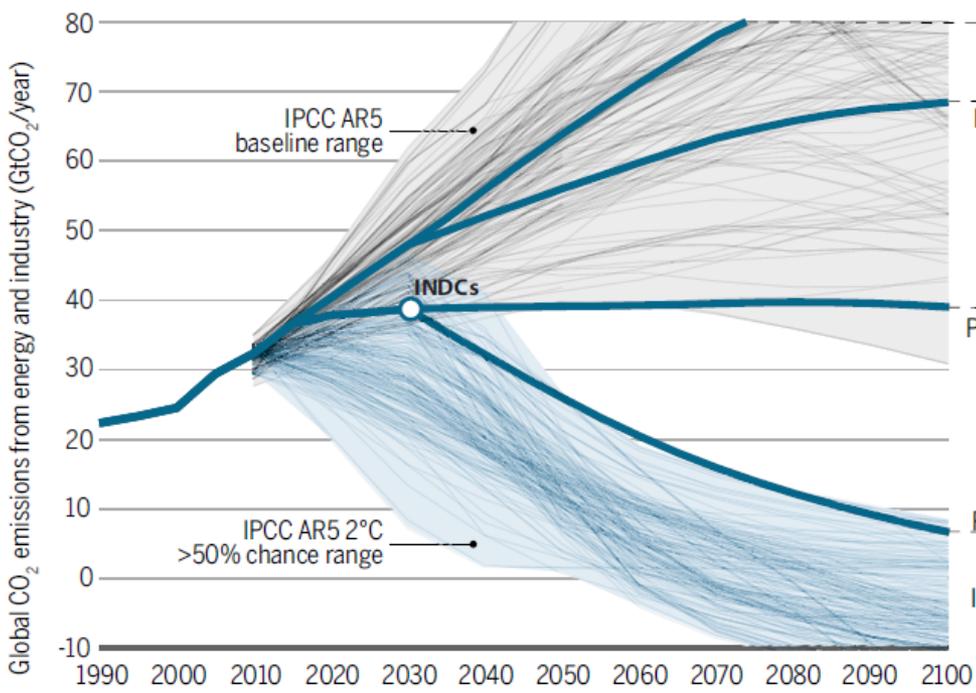
- ▶ Run 5 deterministic scenarios
 - Full GHG representation

- ▶ Pass the scenario on to MAGICC
 - Run MAGICC using a Monte Carlo simulation to get the distribution

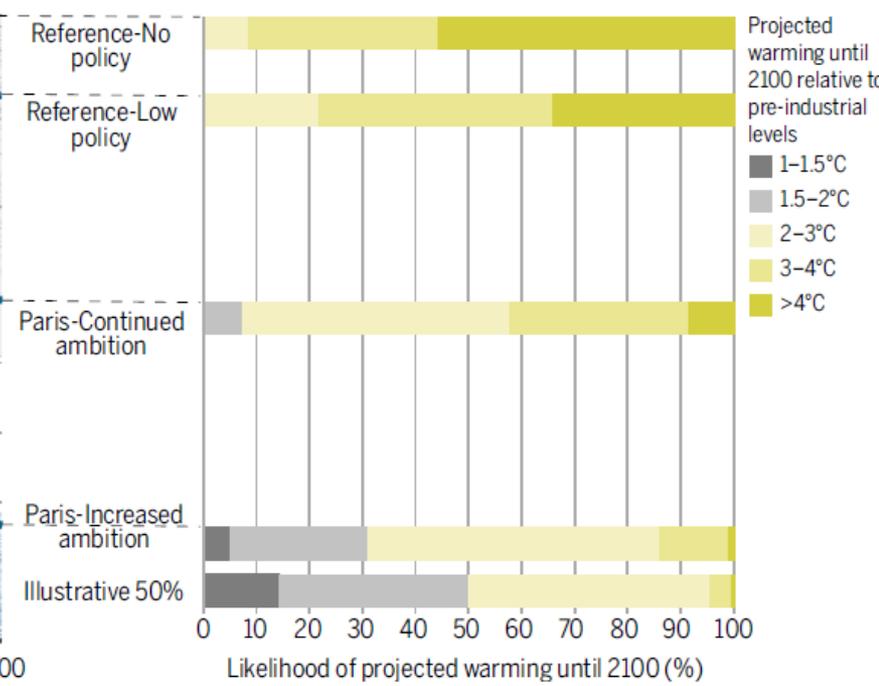
- ▶ The role of GCAM
 - Create a particular no-policy reference scenario
 - Fill in non-fossil fuel CO₂ emissions

Climate implications of our scenarios

A Emissions pathways



B Temperature Probabilities



- ▶ While the INDCs are defined no further into the future than 2030, they nonetheless reshape the range of options available to future decision makers.
- ▶ A useful way to think about the climate implications of policy is to consider it as a risk management problem under uncertainty.
- ▶ If the INDCs are followed by similar increases in ambition after 2030, then they could lead to substantial reductions in the likelihood of global average temperature change greater than 4°C.
- ▶ The INDCs also leave the door open to increased ambition which would increase the likelihood climate less than 2°C.



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DISCUSSION