IPCC recent findings on climate change and agriculture

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SBSTA Workshop on the current state of scientific knowledge on how to enhance the adaptation of agriculture to climate change impacts while promoting rural development

12 November 2013 - Warsaw, Poland

Thanks to the Belgian Federal Science Policy Office for their support

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Recent/Coming IPCC Products

- ***2011: Special report on Renewable Energy Sources and Climate Change Mitigation***
- ***2011: Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation***
- ***2013: AR5 WGI report (physical science)***
- ***2014: AR5 WGII (Impacts & Adaptation); WGIII (Mitigation), Synthesis Report***
- ***All available on www.ipcc.ch***

Impacts from weather and climate events depend on:

nature and severity of event

vulnerability

exposure

SREX: some key findings on extremes events and agriculture

- Extreme events will have greater impacts on sectors with closer links to climate, such as water, agriculture and food security, forestry, health, and tourism [p.16, 235]

- Agriculture is an economic sector exposed and vulnerable to climate extremes. The economies of many developing countries rely heavily on agriculture, dominated by small-scale and subsistence farming, and livelihoods in this sector are especially exposed to climate extremes. … [p.235]

IPCC, SREX, 2012

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SREX: some key findings on extremes events and agriculture

- **Food security** is linked to our ability to adapt agricultural systems to extreme events using our understanding of the complex system of production, logistics, utilization of the produce, and the socioeconomic structure of the community.

- The spatial variability and context sensitivity of each of these factors points to the value of downscaled scenarios of climate change and extreme events.

IPCC, SREX, 2012, p.259

SREX: some key findings on extremes events and agriculture in Africa (1)

Climate extremes exert a significant control on the day-to-day economic development of Africa, particularly in traditional rain-fed agriculture and pastoralism, and water resources, at all scales.

Floods and droughts can cause major human and environmental impacts on and disruptions to the economies of African countries, thus exacerbating vulnerability

IPCC, SREX, 2012, p.253

SREX: some key findings on extremes events and agriculture in Asia

Temperature Extremes → Agriculture is affected directly by temperature extremes. For example, rice, the staple food in many parts of Asia, is adversely affected by extremely high temperature, especially prior to or during critical pollination phases

IPCC, SREX, 2012, p.255

SREX: some key findings on extremes events and agriculture in North America

Inland Flooding → flooding has important negative impacts on a variety of economic sectors including transportation and agriculture.
Heavy precipitation and field flooding in agricultural systems delays spring planting, increases soil compaction, and causes crop losses through anoxia and root diseases; variation in precipitation is responsible for the majority of the crop losses

IPCC, SREX, 2012, p.259

SREX: some key findings on extremes events and agriculture in Oceania

Droughts → New Zealand has a high level of economic dependence on agriculture, and drought can cause significant disruption for this industry.
The 1997-1998 El Niño resulted in severe drought conditions across large areas of New Zealand with losses estimated at NZ$ 750 million (2006 values) or 0.9% of GDP (OCDESC, 2007).
Severe drought in two consecutive summers, 2007-2009, affected a large area of New Zealand and caused on-farm net income to drop by NZ$ 1.9 billion (Butcher and Ford, 2009).

IPCC, SREX, 2012, p.261

SREX: Extraordinary Heat Wave in Europe, Summer 2003

The extraordinarily severe heat wave over large parts of the European continent in the summer of 2003 produced record-breaking temperatures particularly during June and August.

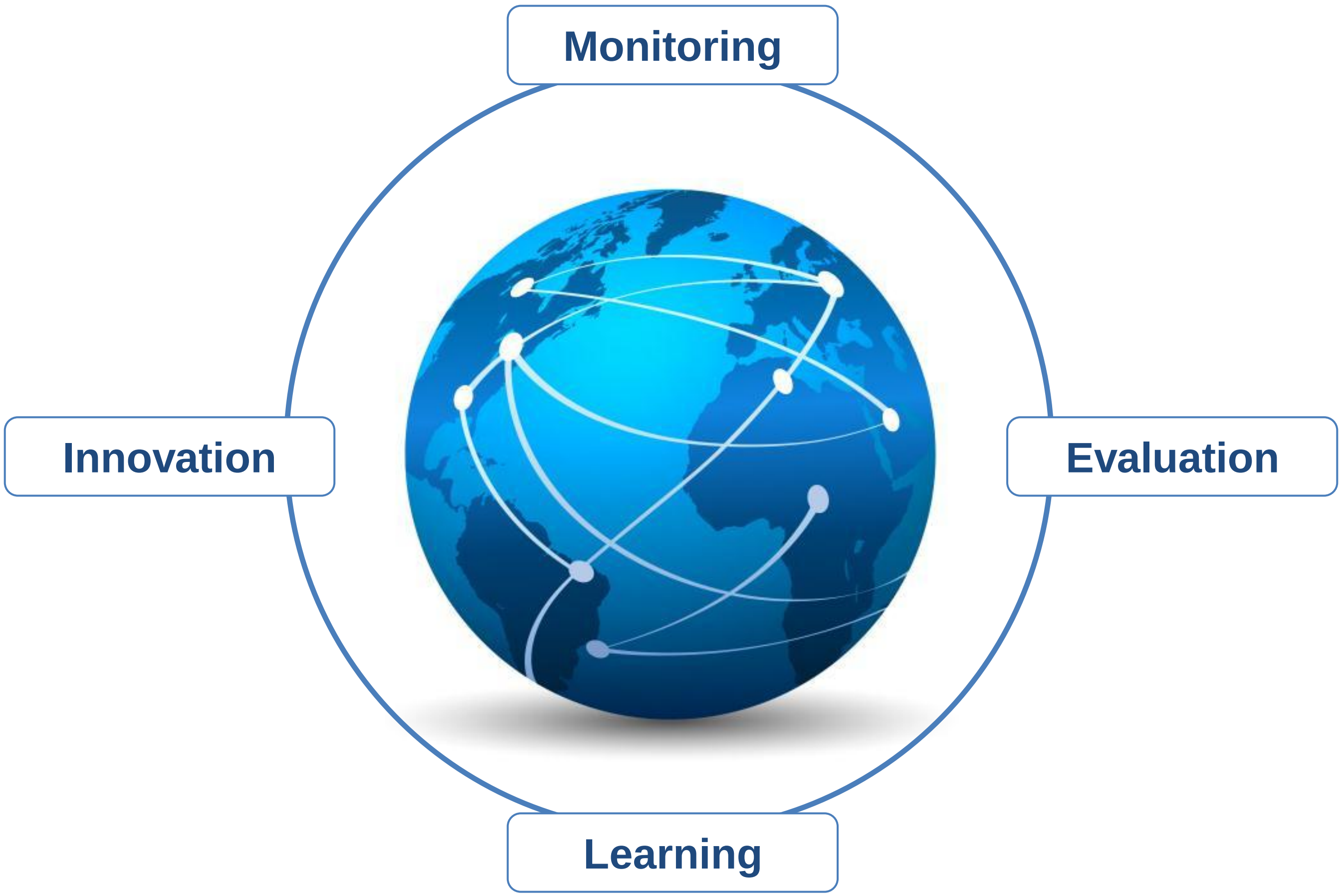
The (uninsured) economic **losses for the agriculture** sector in the European Union were estimated at € 13 billion (Sénat, 2004). A record drop in crop yield of 36% occurred in Italy for maize grown in the Po valley, where extremely high temperatures prevailed (Ciais et al., 2005)

IPCC, SREX, 2012, p.257

Effective risk management and adaptation are tailored to local and regional needs and circumstances

- **changes in climate extremes vary across regions**
- **each region has unique vulnerabilities and exposure to hazards**
- **effective risk management and adaptation address the factors contributing to exposure and vulnerability**

Managing risks of disasters in a changing climate benefits from an iterative process



Learning-by-doing and low-regrets actions can help reduce risks now and also promote future adaptation

There are strategies that can help manage disaster risk now and also help improve people's livelihoods and well-being

The most effective strategies offer development benefits in the relatively near term and reduce vulnerability over the longer term

Managing the risks: drought in the context of food security in West Africa

Risk Factors

- more variable rain
- population growth
- ecosystem degradation
- poor health and education systems

Risk Management/ Adaptation

- improved water management
- sustainable farming practice
- drought-resistant crops
- drought forecasting

Projected: *low confidence* in drought projections for West Africa

Key SPM Messages

19 Headlines

on less than 2 Pages

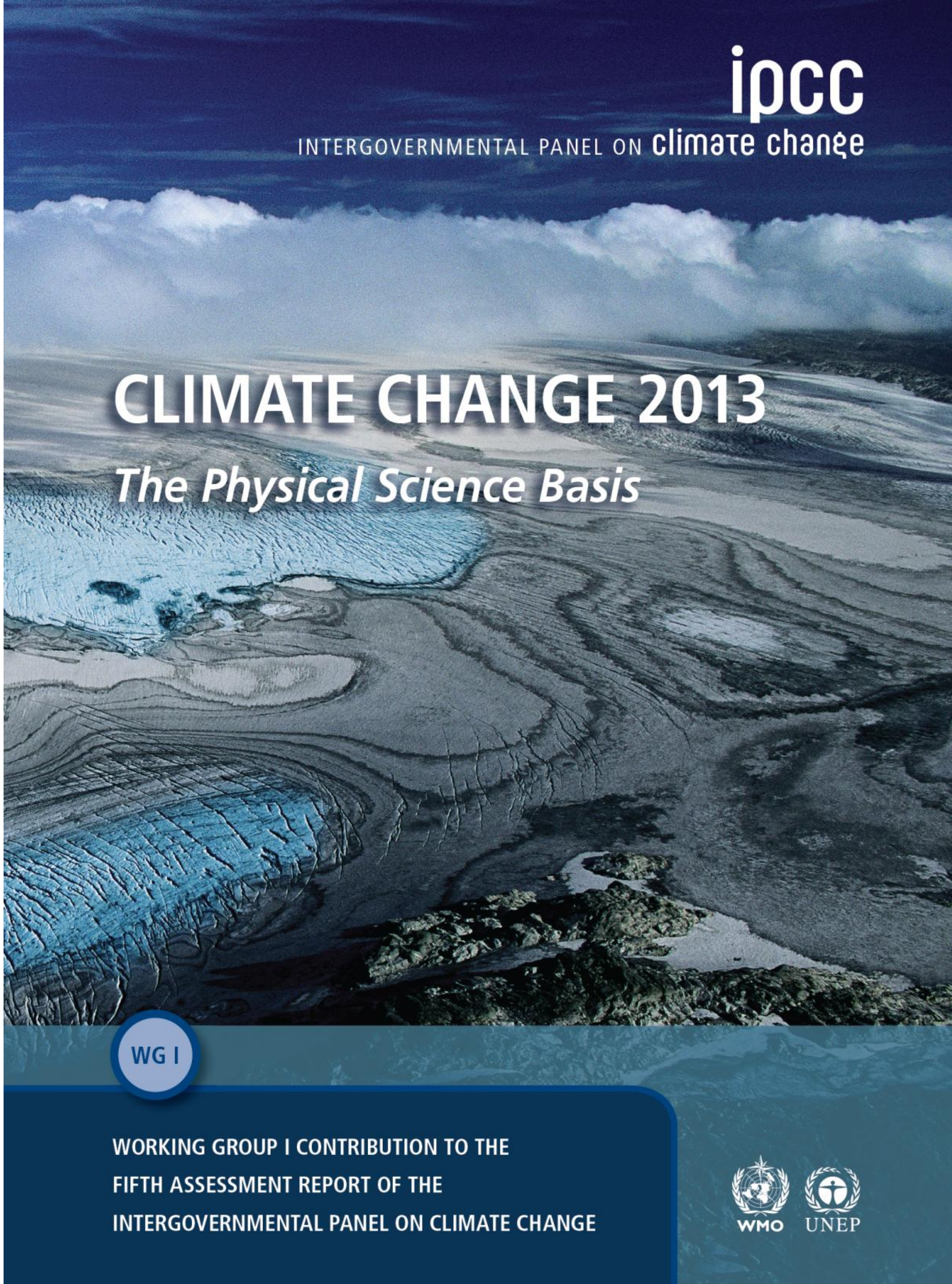
Summary for Policymakers
~14,000 Words

14 Chapters
Atlas of Regional Projections

54,677 Review Comments
by 1089 Experts

2010: 259 Authors Selected

2009: WGI Outline Approved



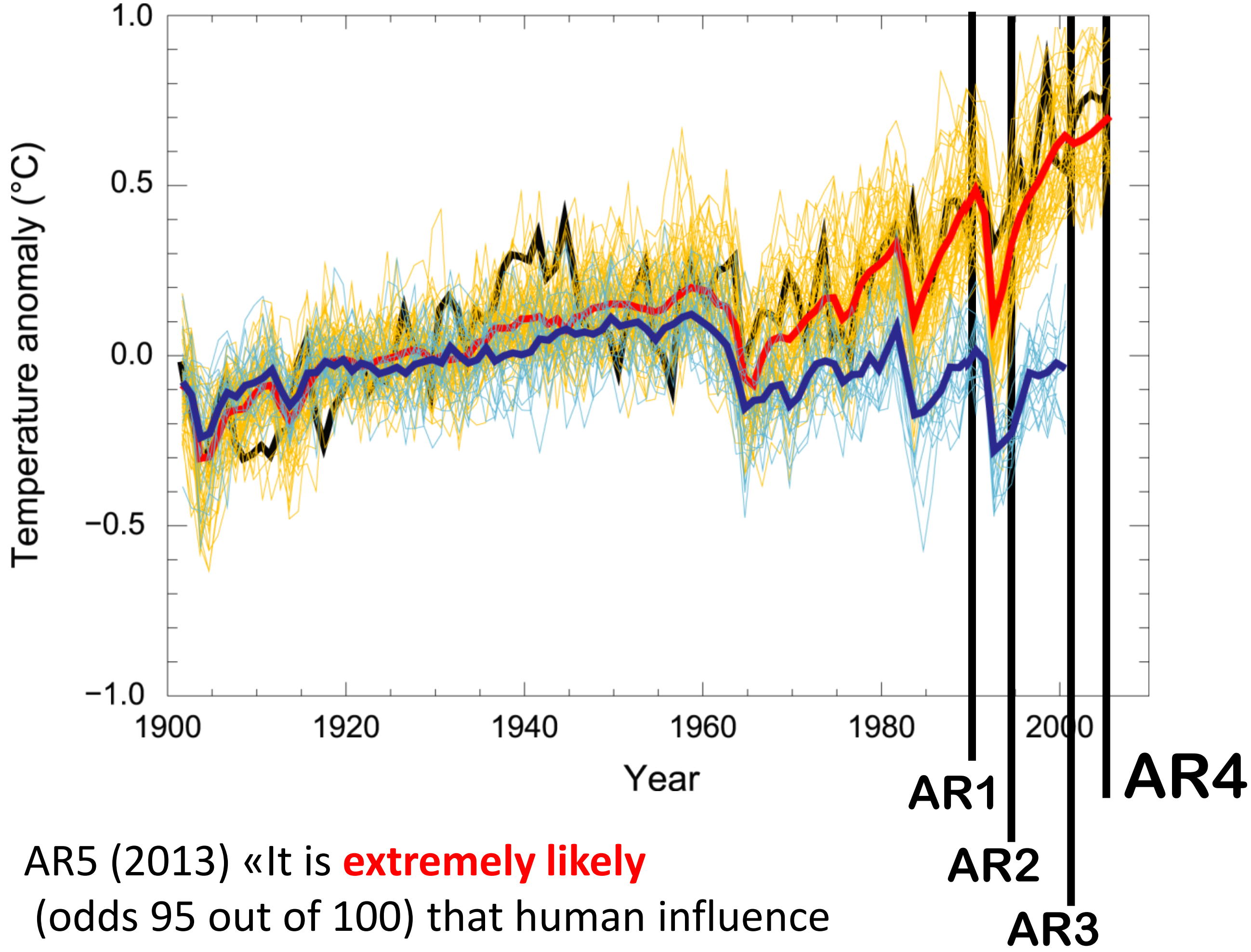
A Progression of Understanding: Greater and Greater Certainty in Attribution

AR1 (1990): "unequivocal detection not likely for a decade"

AR2 (1995): "balance of evidence suggests **discernible** human influence"

AR3 (2001): "most of the warming of the past 50 years is **likely** (odds 2 out of 3) due to human activities"

AR4 (2007): "most of the warming is **very likely** (odds 9 out of 10) due to greenhouse gases"



AR5 (2013) «It is **extremely likely** (odds 95 out of 100) that human influence has been the dominant cause… »

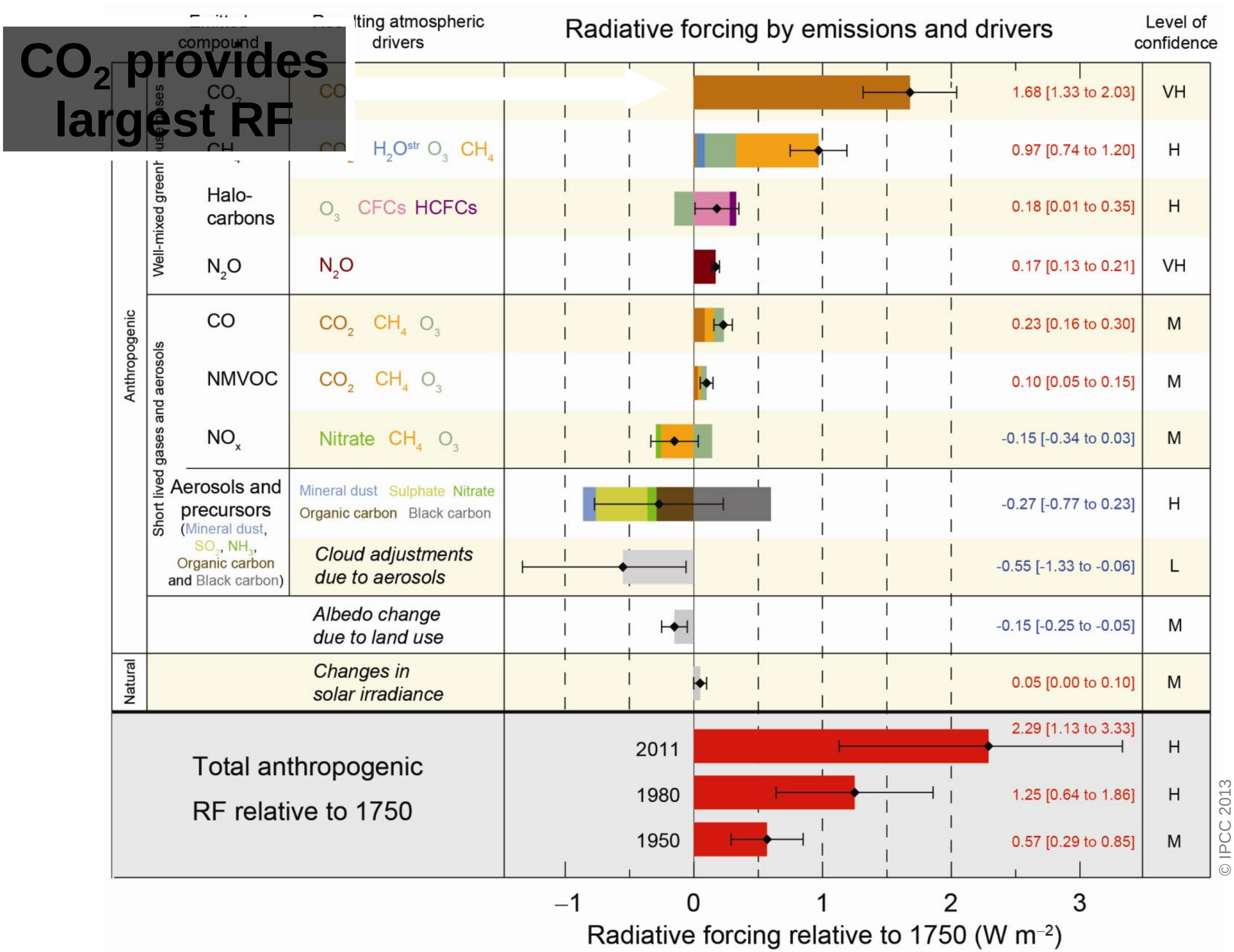
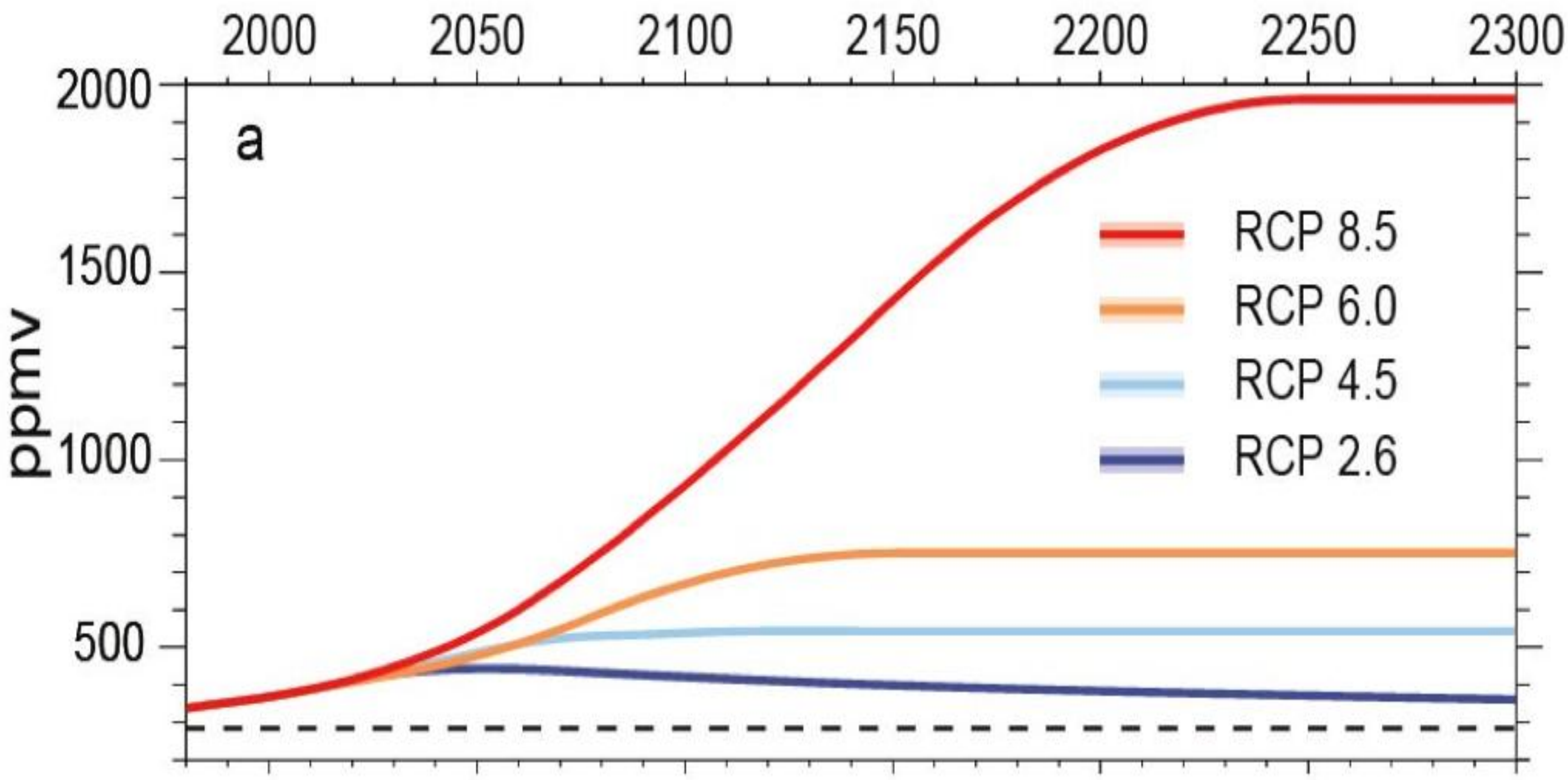
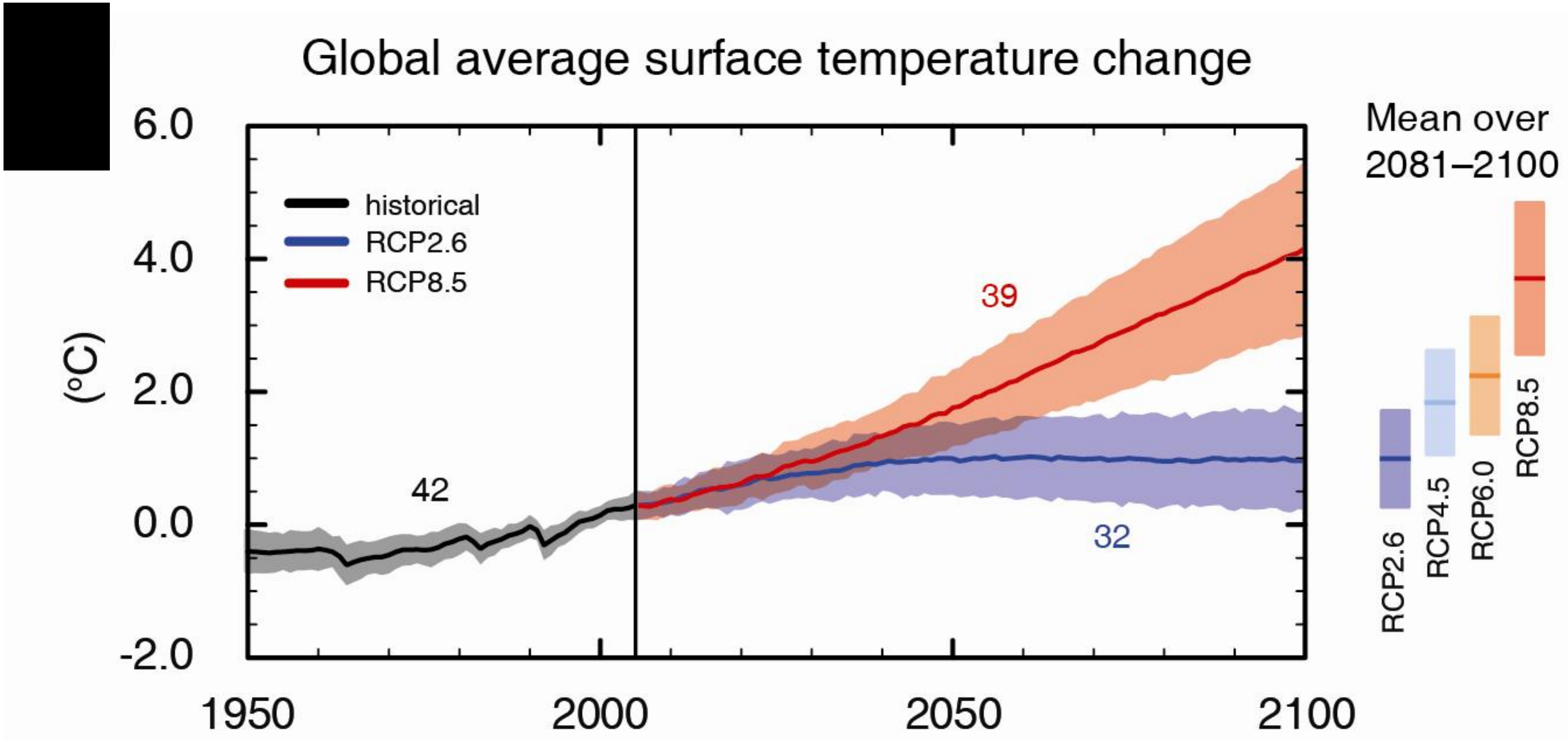

CO2 provides largest RF
Emitted compound
Resulting atmospheric drivers
Radiative forcing by emissions and drivers
Level of confidence
Well-mixed greenhouse gases
CO2
CH4
H2Ostr O3 CH4
Halo-carbons
O3 CFCs HCFCs
N2O
N2O
Short lived gases and aerosols
CO
CO2 CH4 O3
NMVOC
CO2 CH4 O3
NOx
Nitrate CH4 O3
Aerosols and precursors (Mineral dust, SO2, NH3, Organic carbon and Black carbon)
Mineral dust Sulphate Nitrate Organic carbon Black carbon
Cloud adjustments due to aerosols
Albedo change due to land use
Anthropogenic
Natural
Changes in solar irradiance
1.68 [1.33 to 2.03] VH
0.97 [0.74 to 1.20] H
0.18 [0.01 to 0.35] H
0.17 [0.13 to 0.21] VH
0.23 [0.16 to 0.30] M
0.10 [0.05 to 0.15] M
-0.15 [-0.34 to 0.03] M
-0.27 [-0.77 to 0.23] H
-0.55 [-1.33 to -0.06] L
-0.15 [-0.25 to -0.05] M
0.05 [0.00 to 0.10] M
Total anthropogenic RF relative to 1750
2011 2.29 [1.13 to 3.33] H
1980 1.25 [0.64 to 1.86] H
1950 0.57 [0.29 to 0.85] M
−1 0 1 2 3
Radiative forcing relative to 1750 (W m−2)
© IPCC 2013

Fig. SPM.5

Atmospheric CO_2 concentration



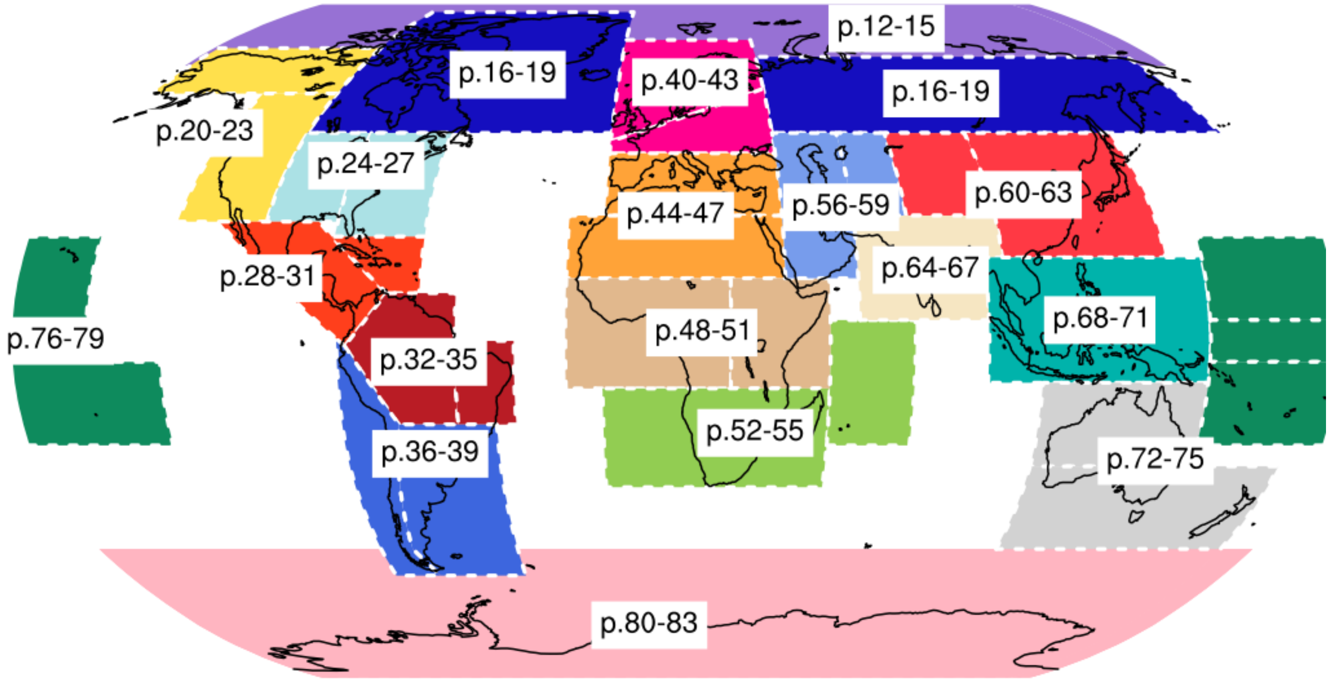
Most CMIP5 runs are based on the concentrations, but emissions-driven runs are available for RCP 8.5



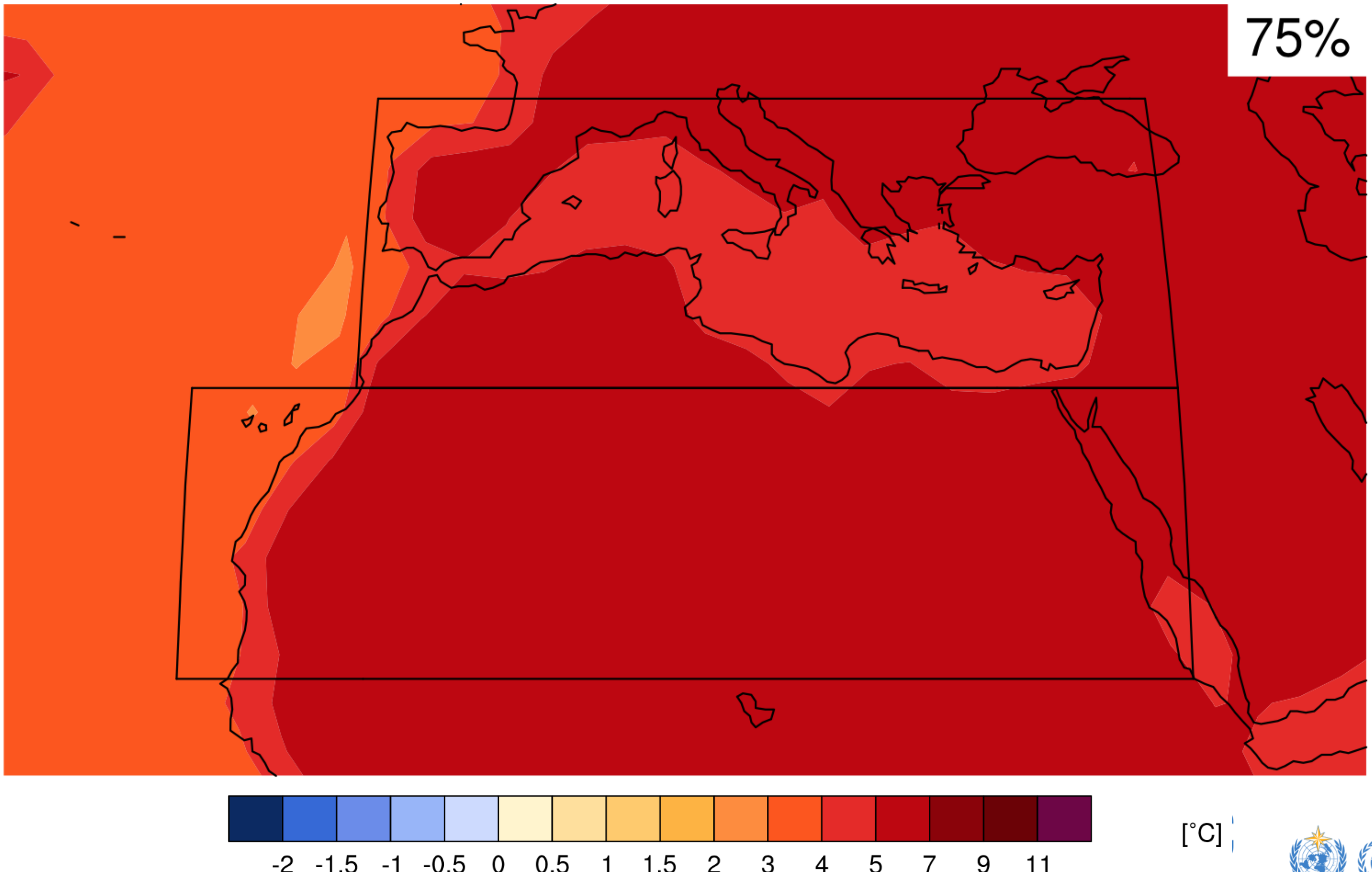
Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850 for all scenarios

AR5 WGI Regional Atlas

- Addition to previous reports
- > 70 pages of maps, for RCP4.5 only:
  temperature and precipitation changes
  (winter & summer average climate, including model uncertainties)
- Other RCPs & seasons will be available as suppl. material later



South Europe - Map of temperature changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



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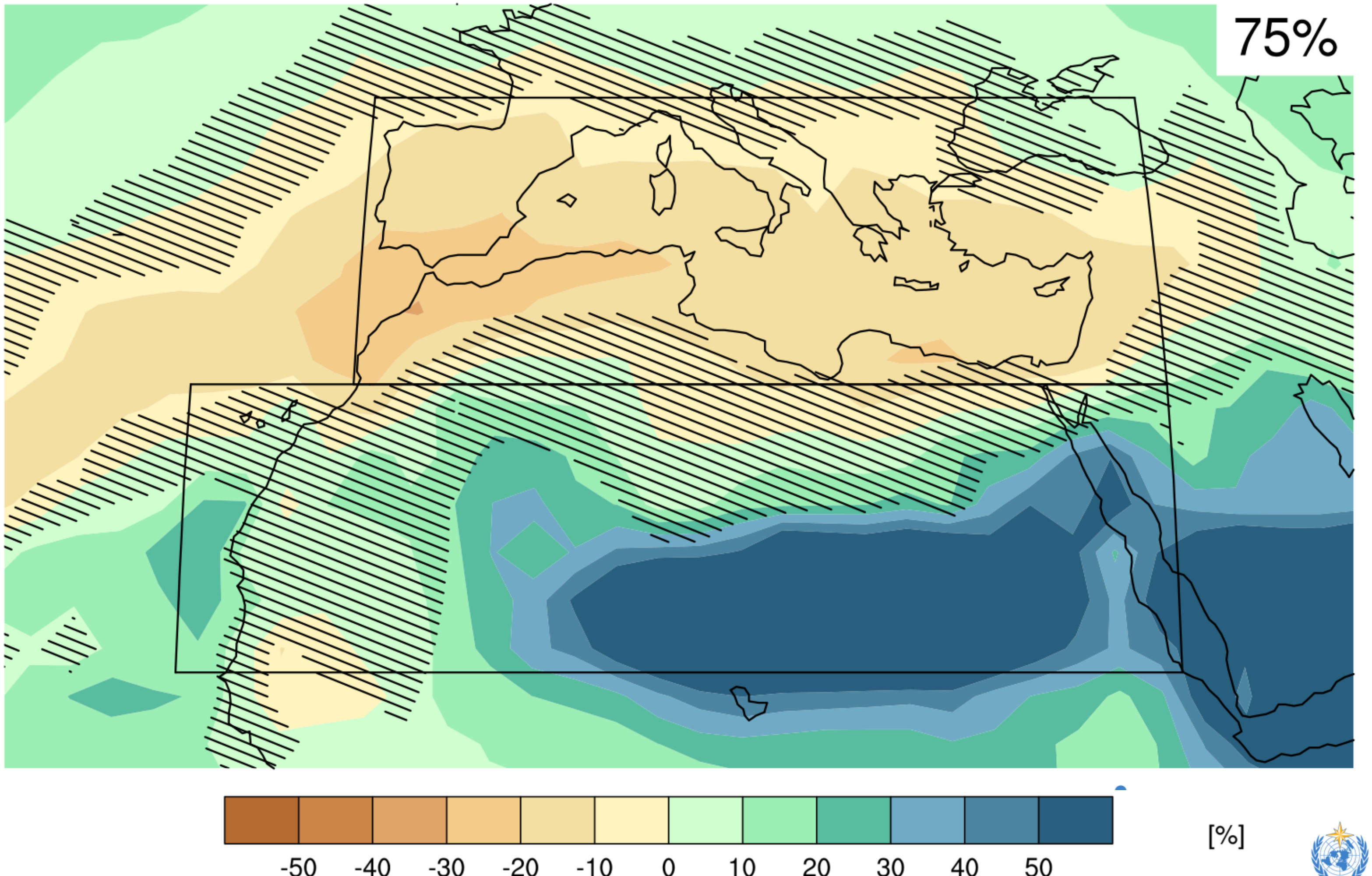
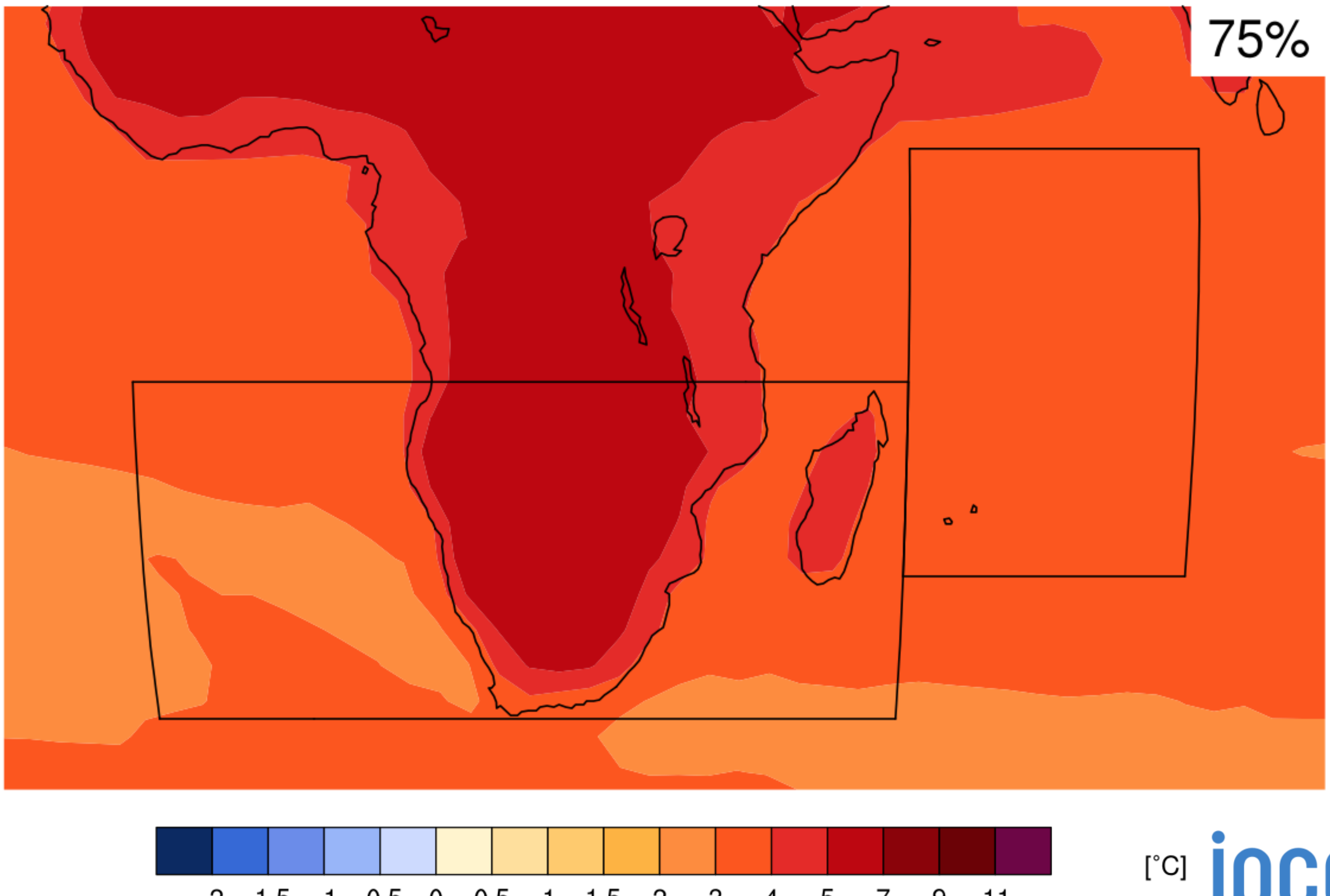
South Europe - Map of precipitation changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



IPCC WG1 Fifth Assessment Report (Final Draft)

Southern Africa: Map of temperature changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



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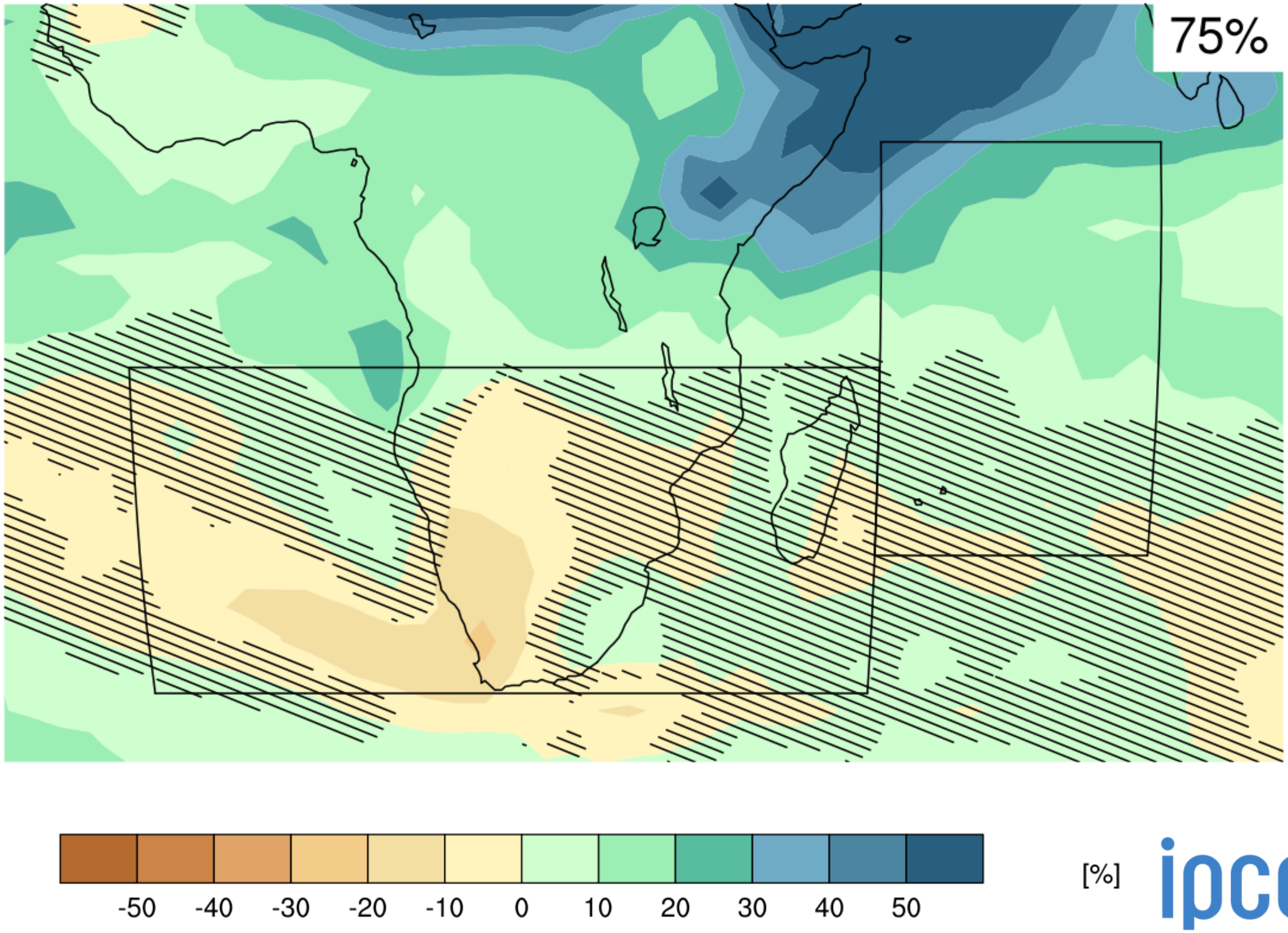
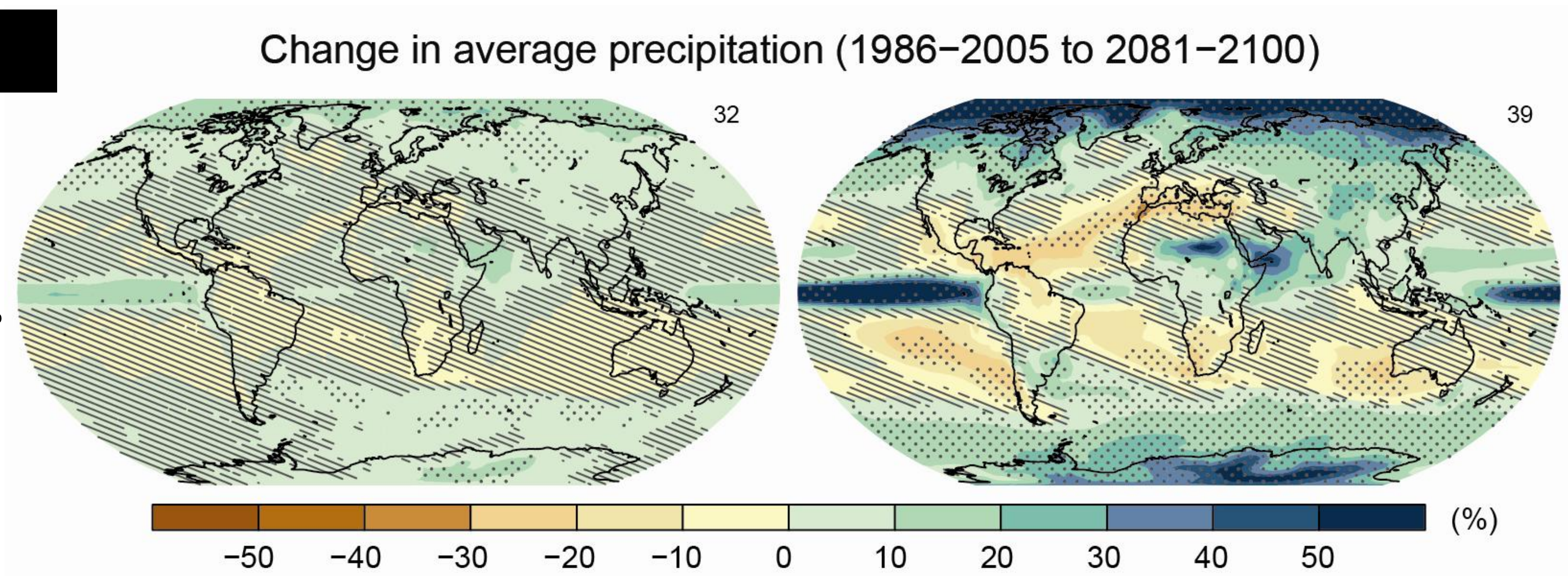


RCP2.6 **RCP8.5**

Fig. SPM.8



We have a choice.

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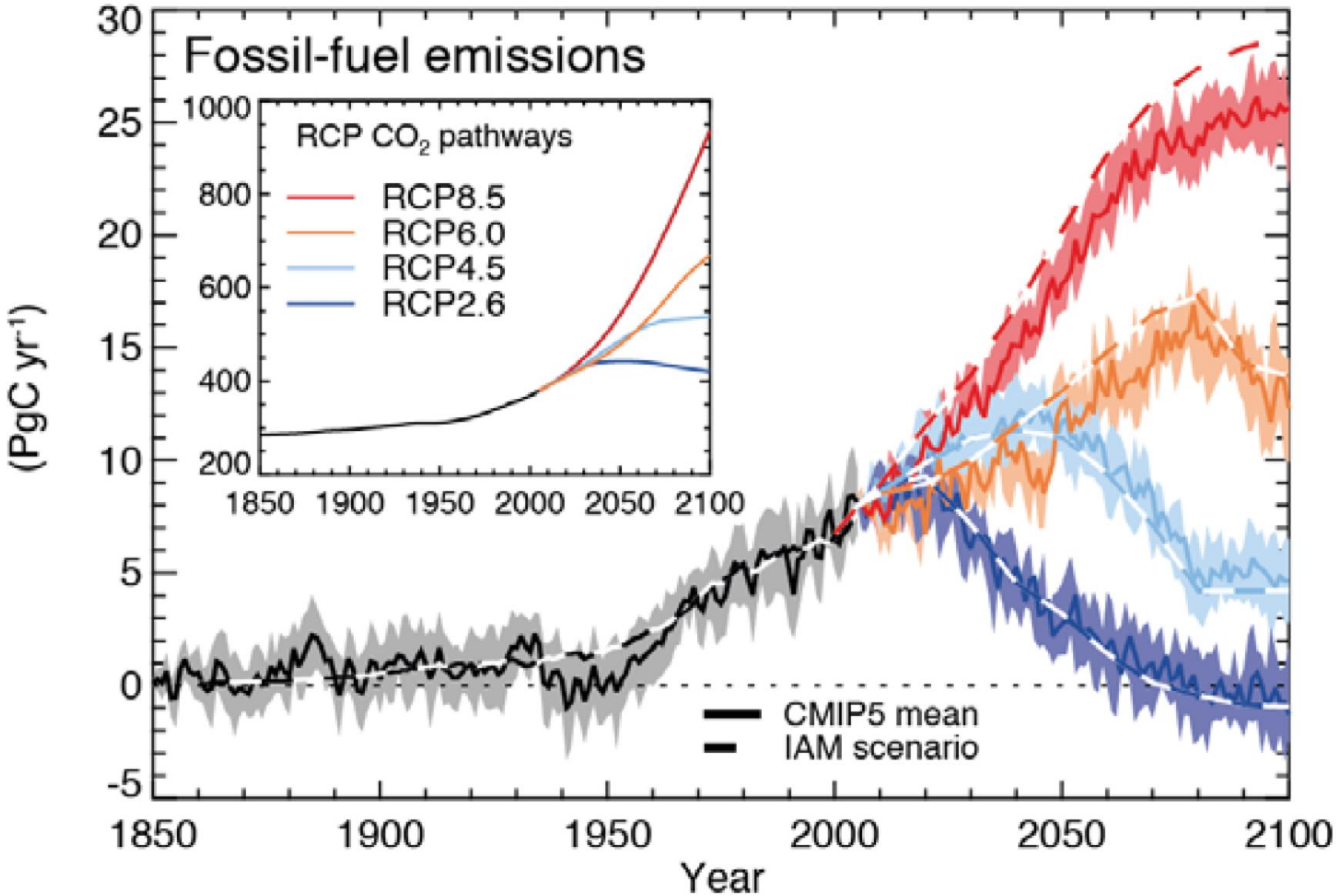
Compatible fossil fuel emissions simulated by the CMIP5 models for the four RCP scenarios



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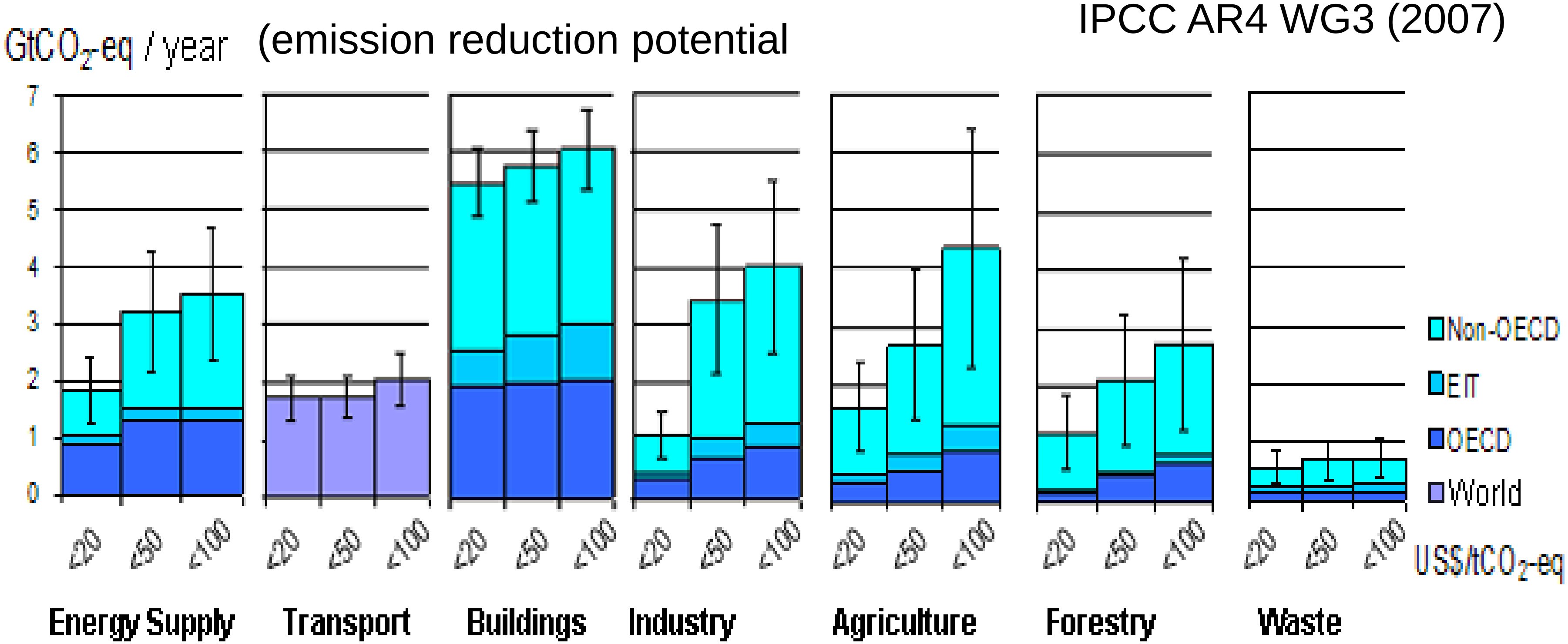
All sectors and regions have the potential to contribute by 2030

IPCC AR4 WG3 (2007)



Note: estimates do not include non-technical options, such as lifestyle changes.

Useful links:

- www.ipcc.ch : IPCC
- www.climatechange2013.org: IPCC WGI AR5