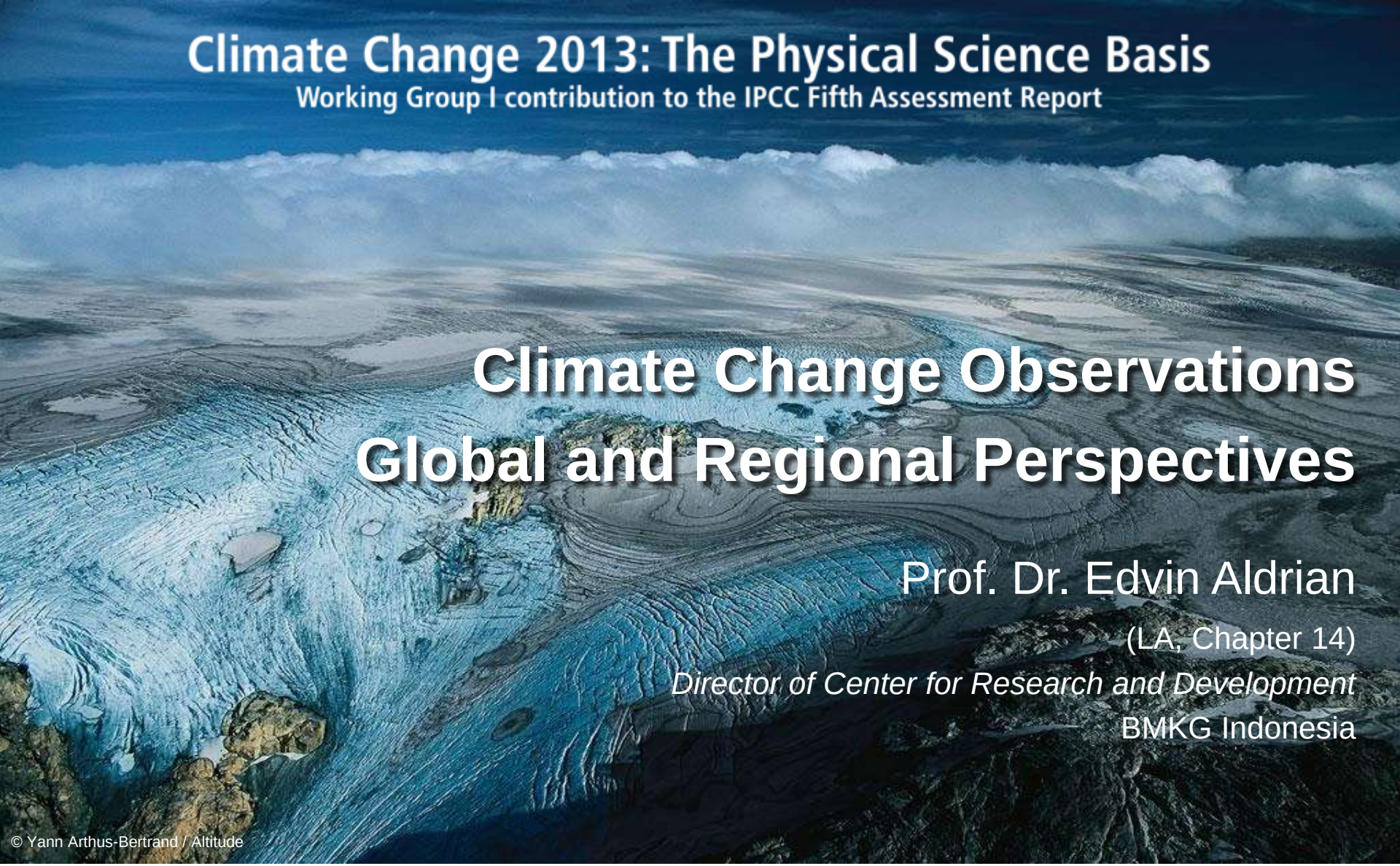


# Climate Change Observations Global and Regional Perspectives

Prof. Dr. Edvin Aldrian

(LA, Chapter 14)

*Director of Center for Research and Development*

BMKG Indonesia



Presented at the IPCC's Fifth Assessment Report Outreach Event, Bangkok, 18 August 2015

BMKG

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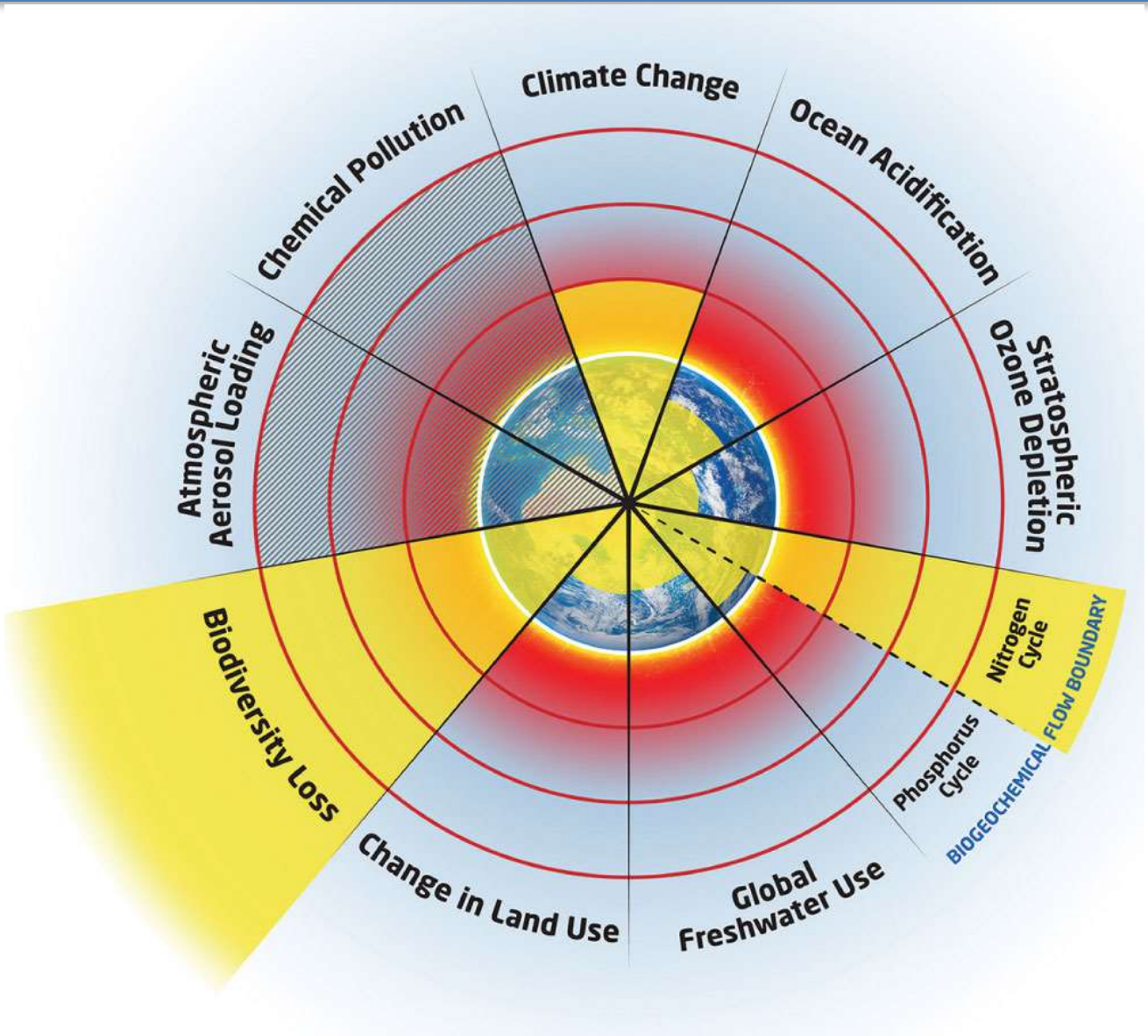
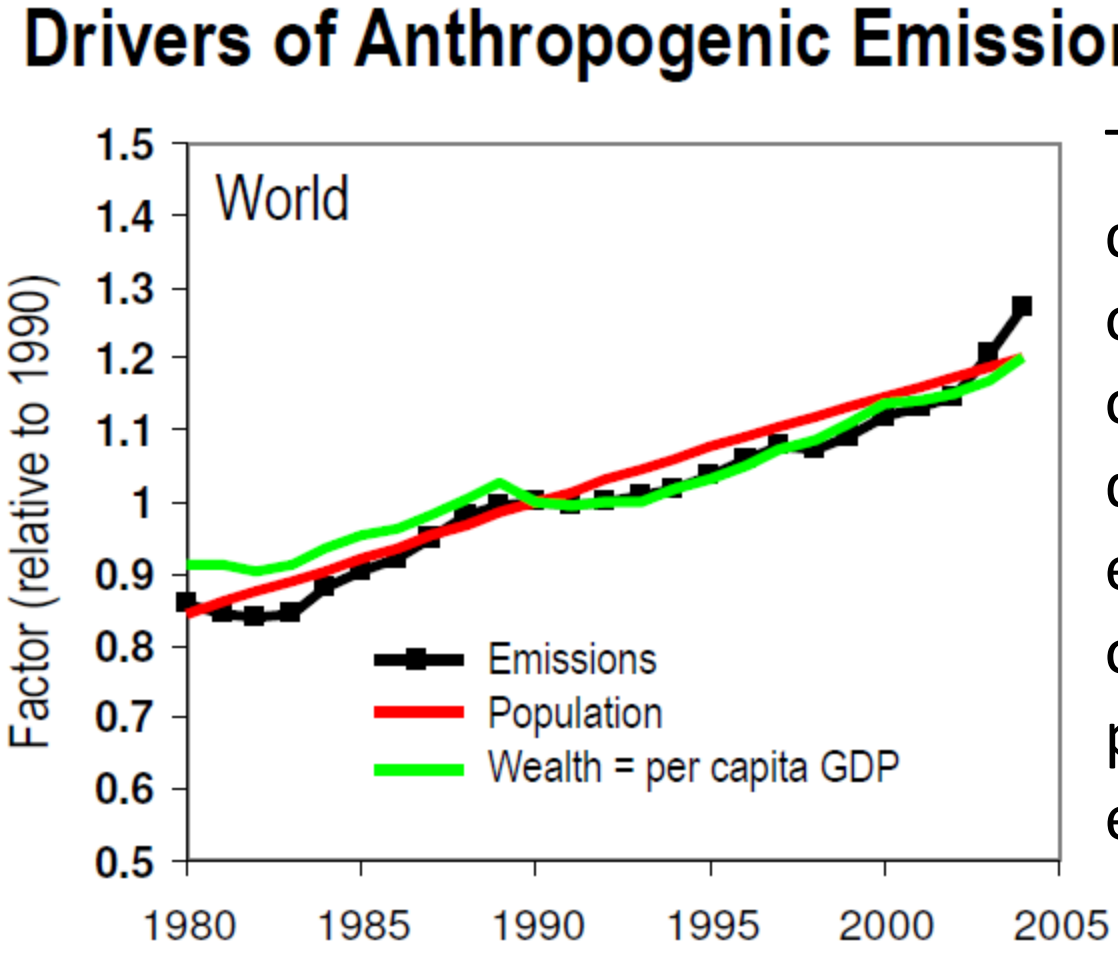
# Outline

- Global changes challanges
- Human influences on climate
- Attribution of climate change
- Global Climate parameter changes
- Regional changes of Southeast Asia




Rockström, et al. 2009. Planetary boundaries:exploring the safe operating space for humanity. *Ecology and Society* **14**(2): 32

# Population, wealth and emission

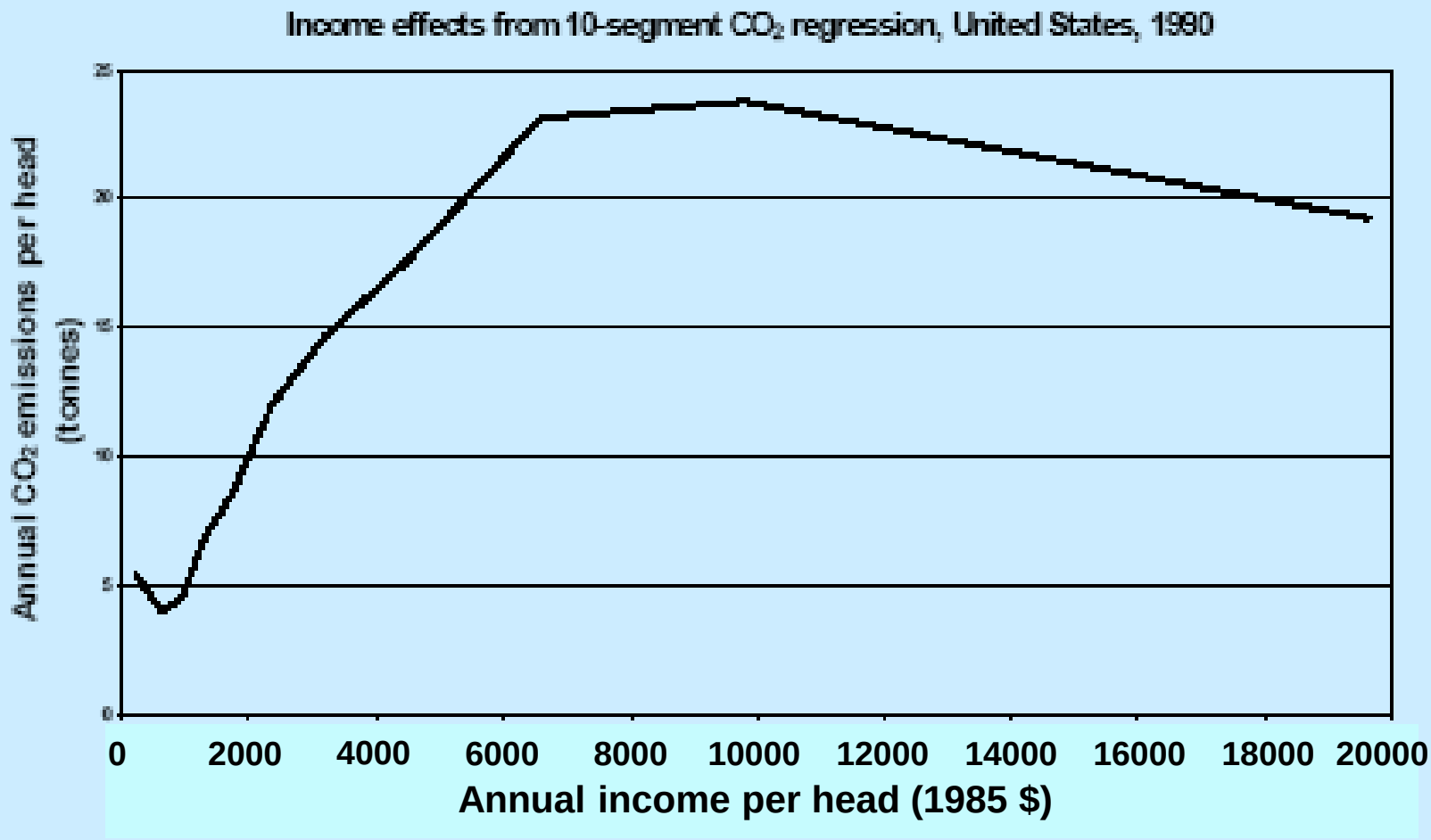



*Raupach et al. (2007, PNAS)*

The future of the climate system (and our survival) depends on our ability to decouple future emissions from the other two factors: population and economic growth

# Relationship between income and emission

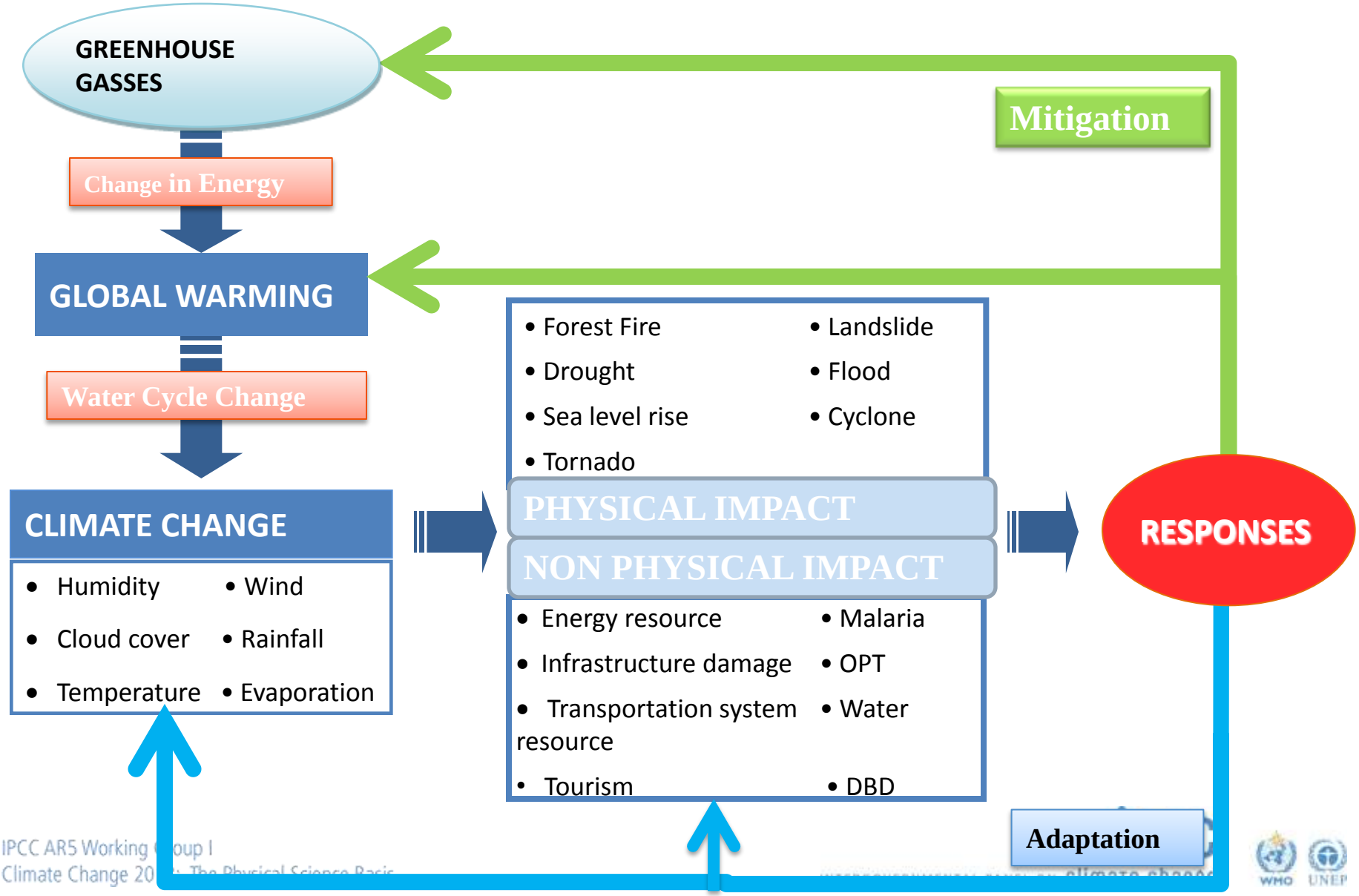
Figure 7A. 2 'Income effects from 10-segment $CO_2$ regression, USA, 1990'




Source: Schmalensee et al (1998)

Stern Report 2007

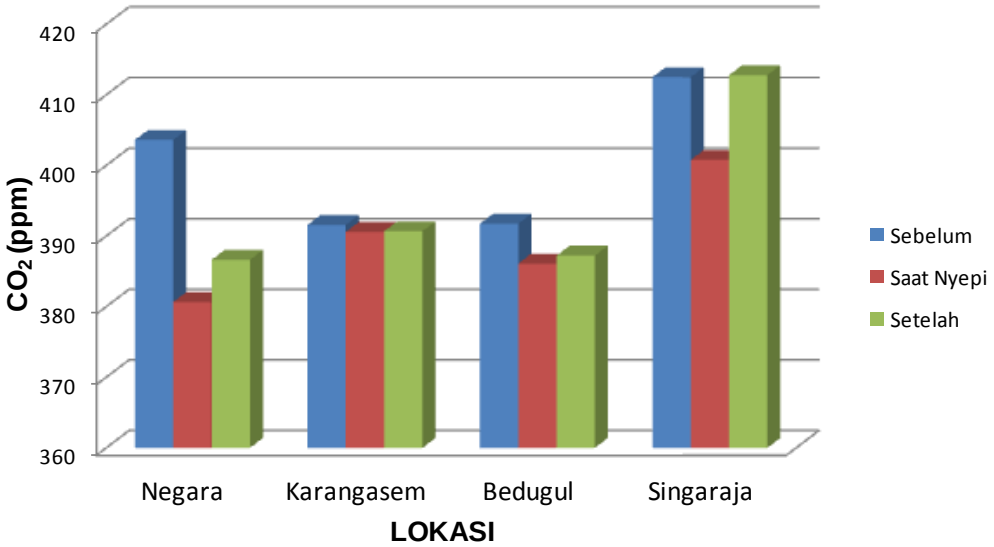
**Adaptation** : Coping the effect – managing the unavoidable
**Mitigation** : Coping the cause– avoiding the unmanagable

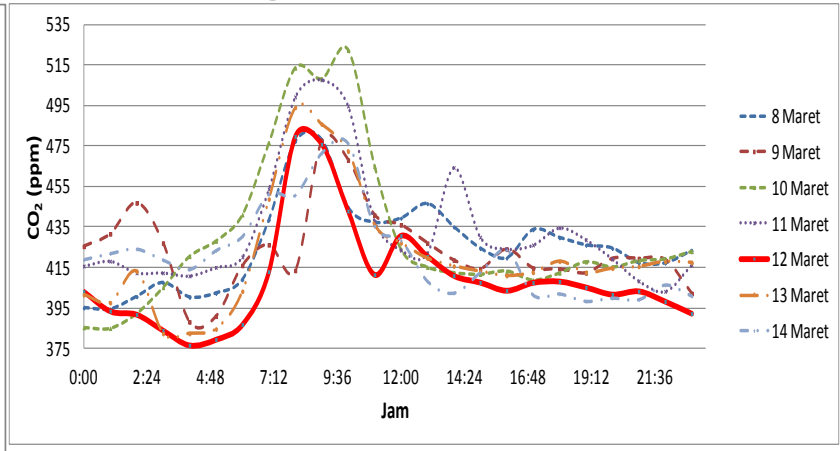


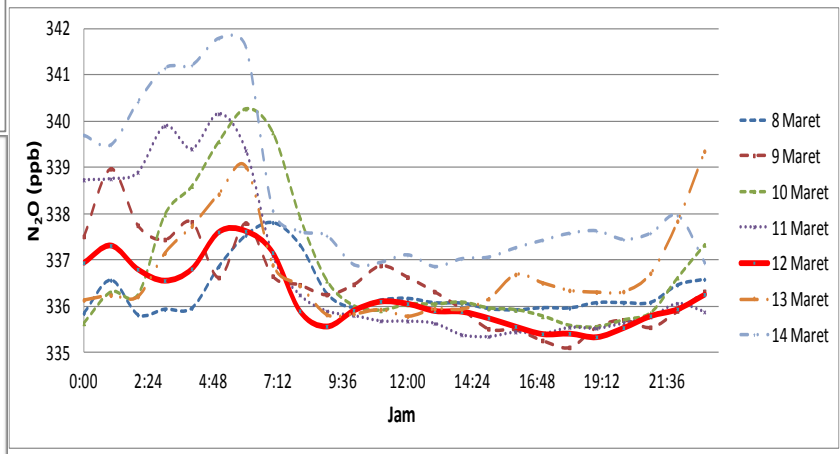
# Reduction of GHG concentration during Nyepi Hindu day

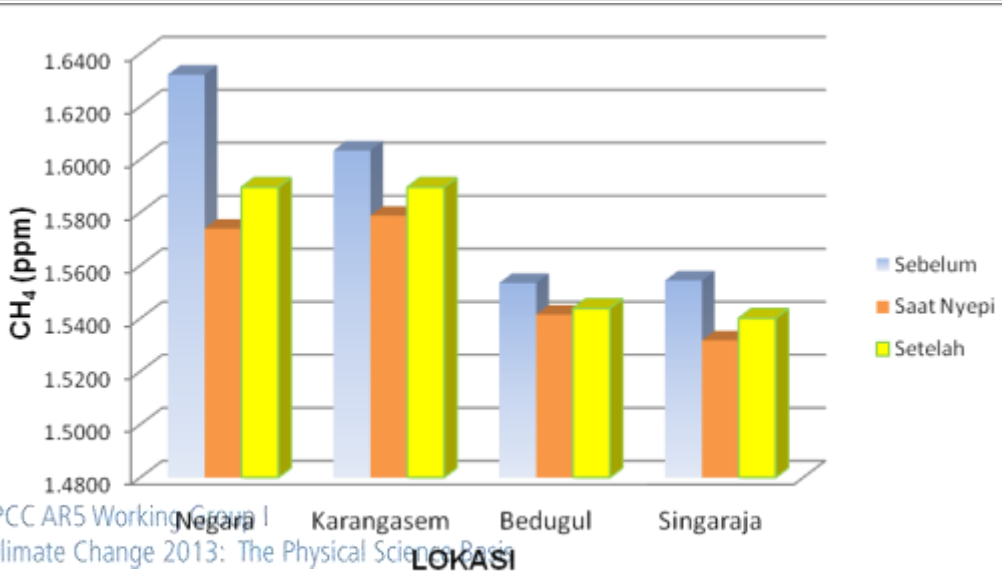

| Nama Lokasi | : | Negara | Singaraja | Karangasem | Bedugul | Denpasar |
|---|---|---|---|---|---|---|
| Koordinat | : | 8º 20' 24"S, 114º 36' 59"E | 8º 6' 57,2"S, 115º 4' 50,1"E | 8º 21' 53,4"S, 115º 36' 39,0"E | 8º 15' 1,8"S, 115º 9' 8,2"E | 8º 40' 44,2"S, 115º 13' 56,6"E |
| Metode & Frekuensi Data | : | Indirect Measurement (Sampling); Daily Data (14.00 WITA) | | | | Direct Measurement; Continuous Monitoring; (Data tiap 5 menit) |
| Alat | : | Flask Sampler | Flask Sampler | Flask Sampler | Flask Sampler | WolfPack® & IRIS 4600 |
| Data GRK | : | $CO_2$, $CH_4$ | $CO_2$, $CH_4$ | $CO_2$, $CH_4$ | $CO_2$, $CH_4$ | $CO_2$, $N_2O$ |

# Reduction of GHG concentration during Nyepi Hindu day




**Average reduction 33%**

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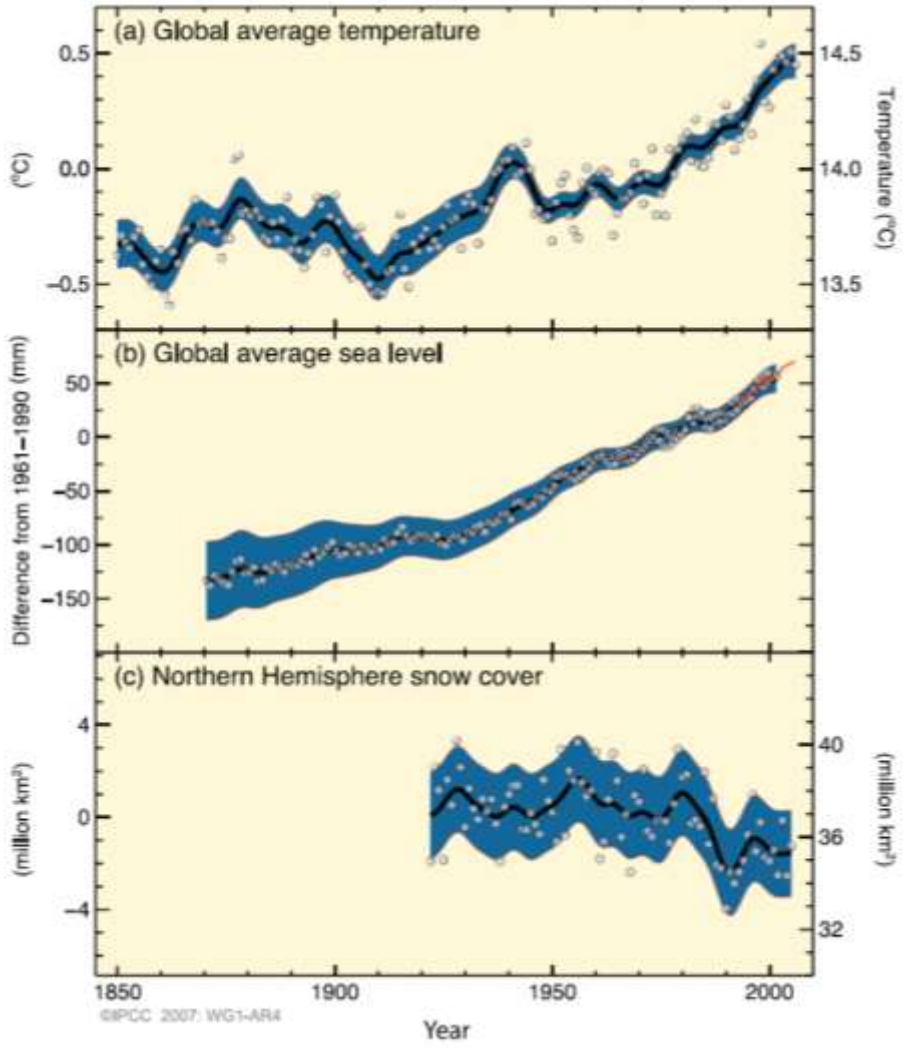
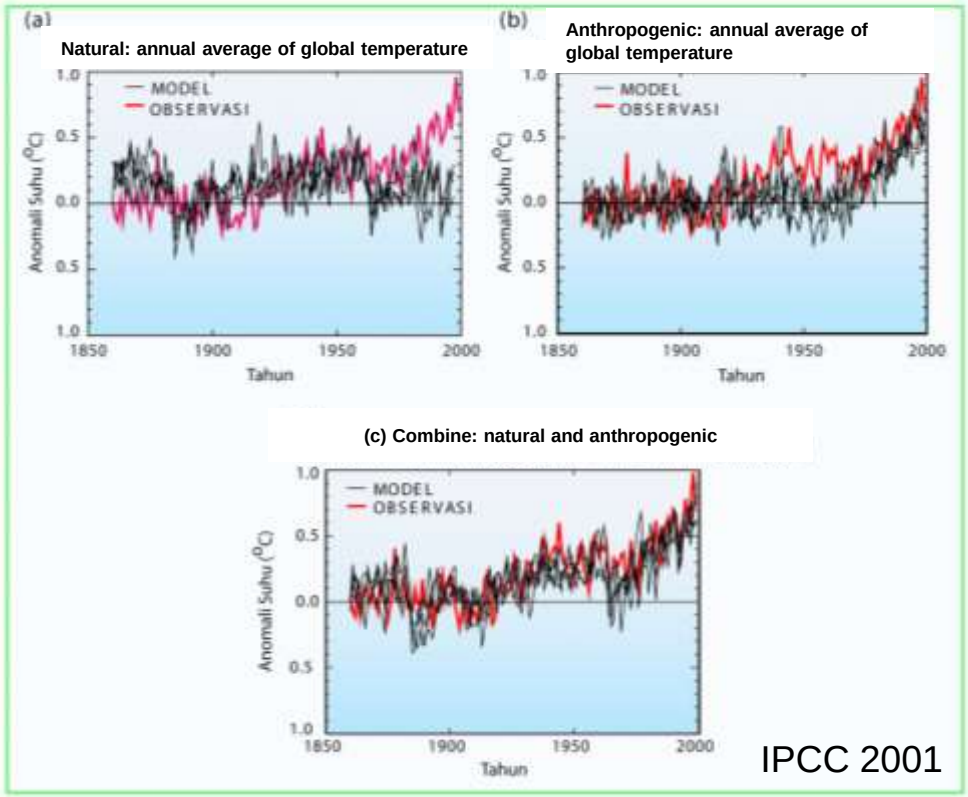
# Global Warming
# Major impacts: increase of surface temperature and sea level rise

IPCC 2007

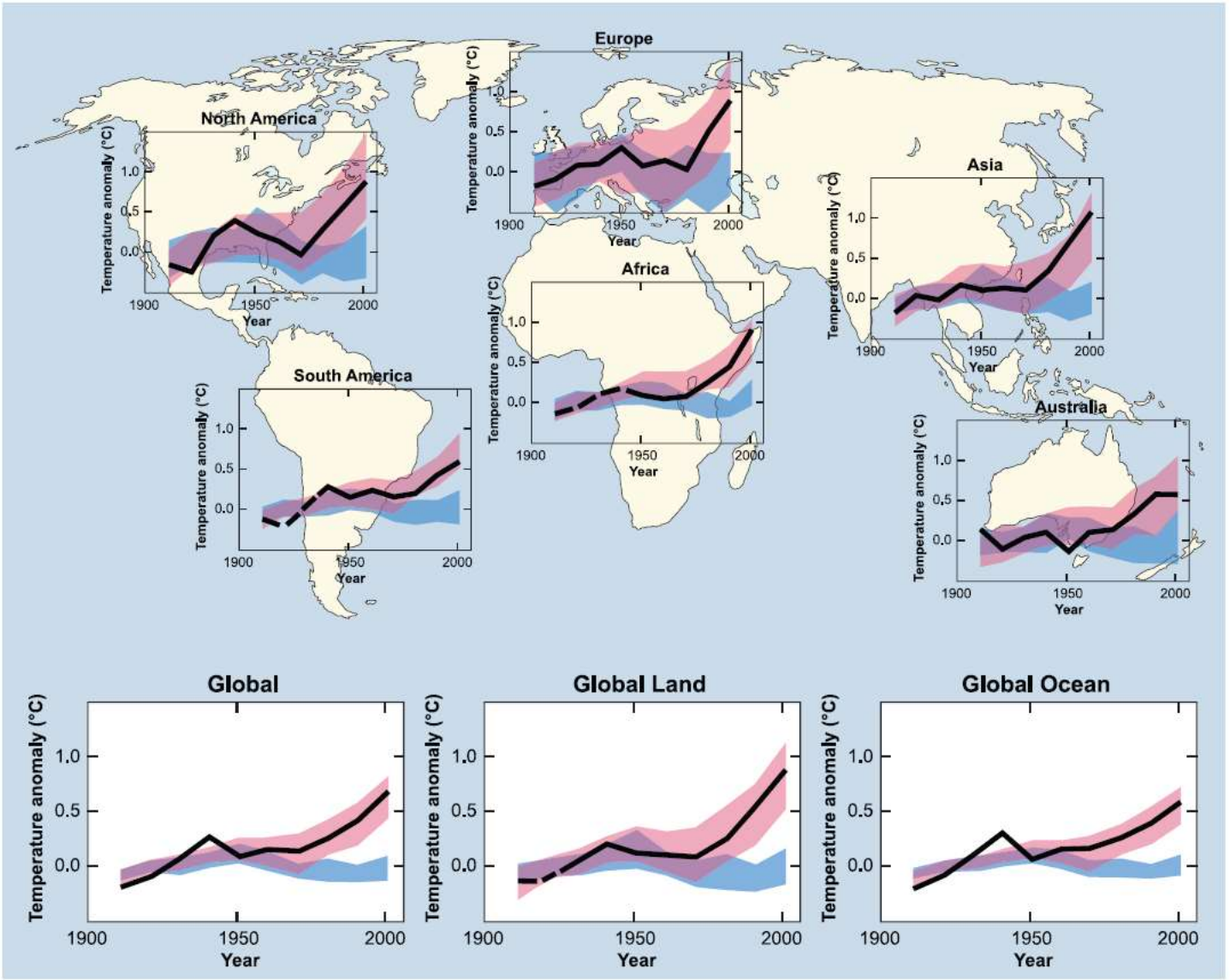



Human vs nature



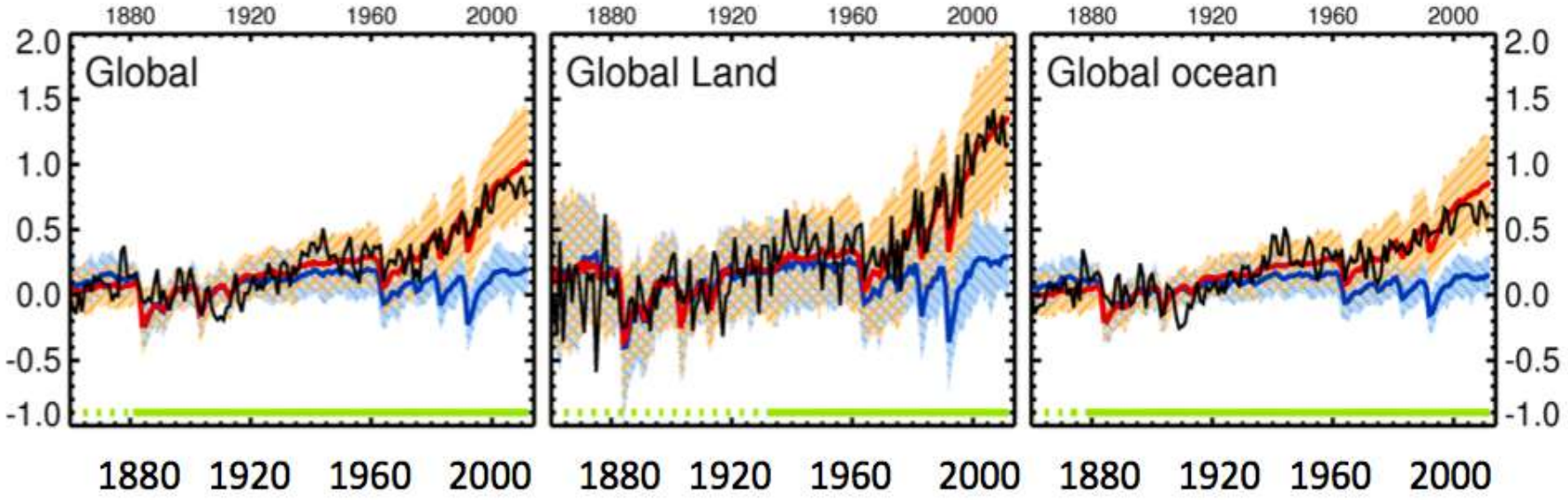

IPCC 2001

# Earth temperature with and without human influences

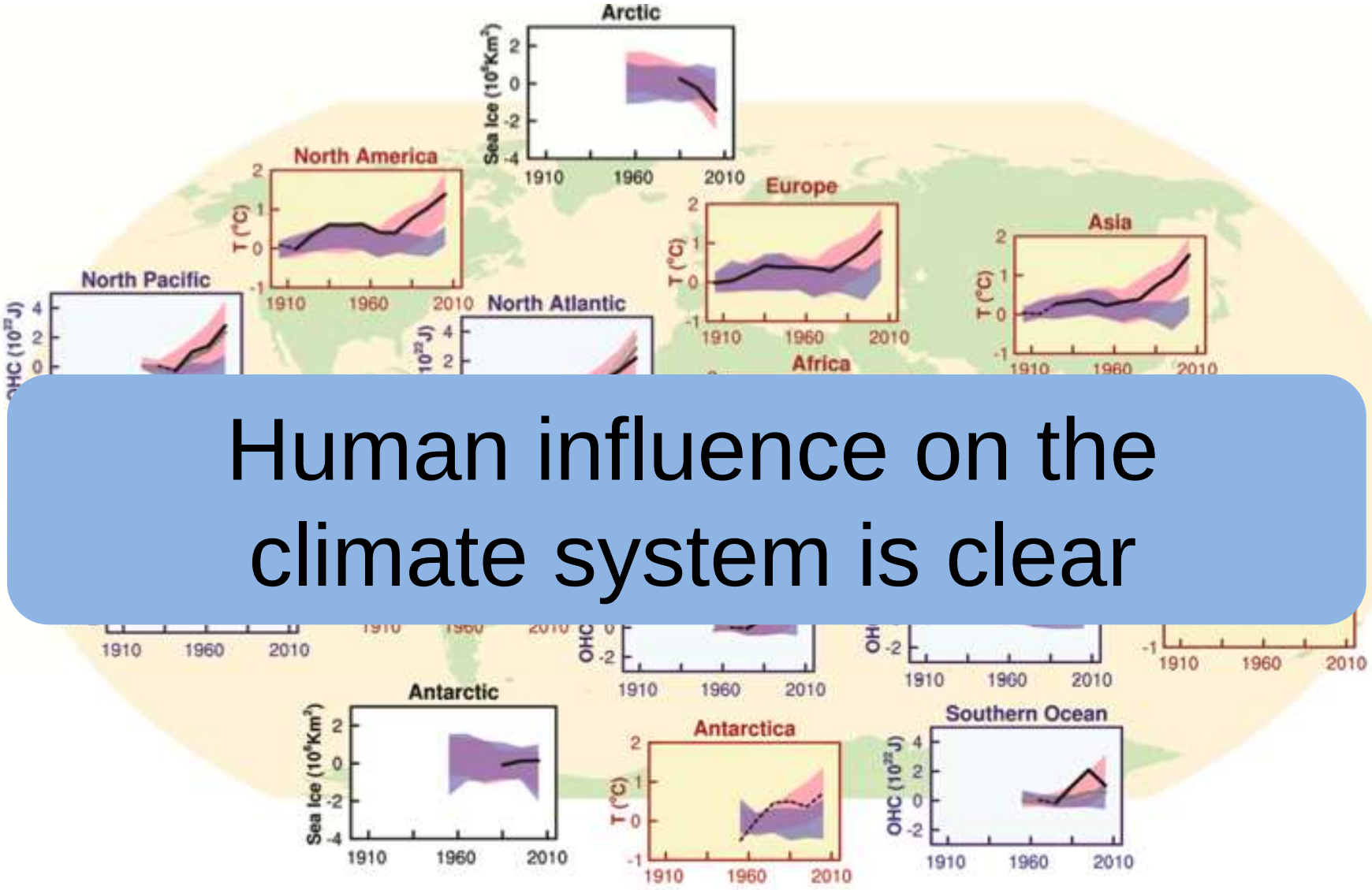



IPCC 2001

# Observed warming consistent with that expected from anthropogenic factors and inconsistent with that expected from natural factors

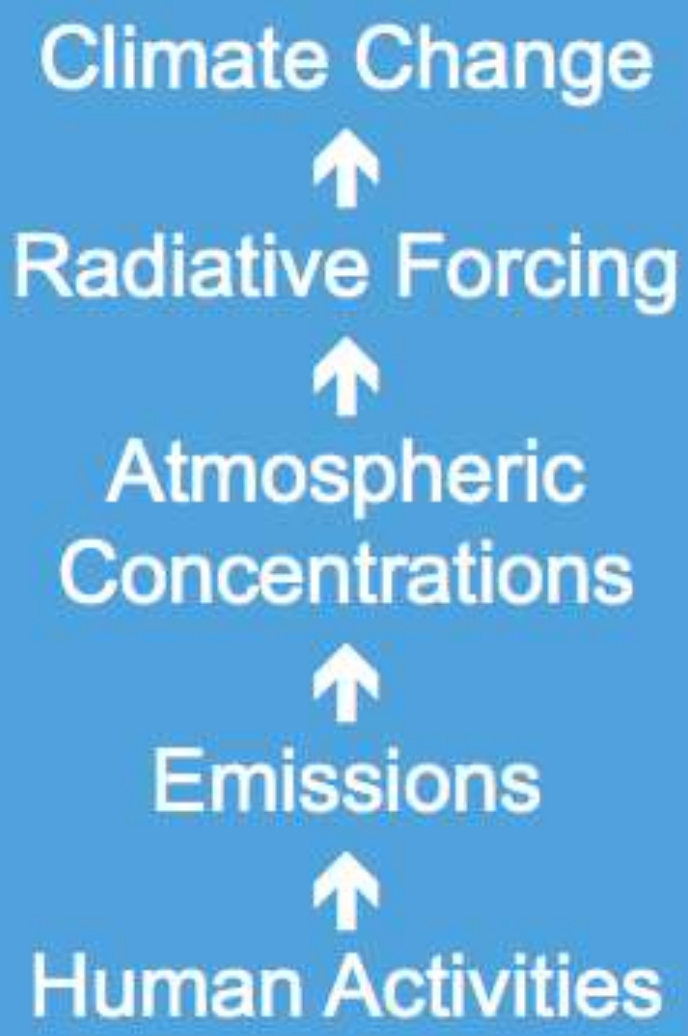



(IPCC 2013. Fig 10.7)

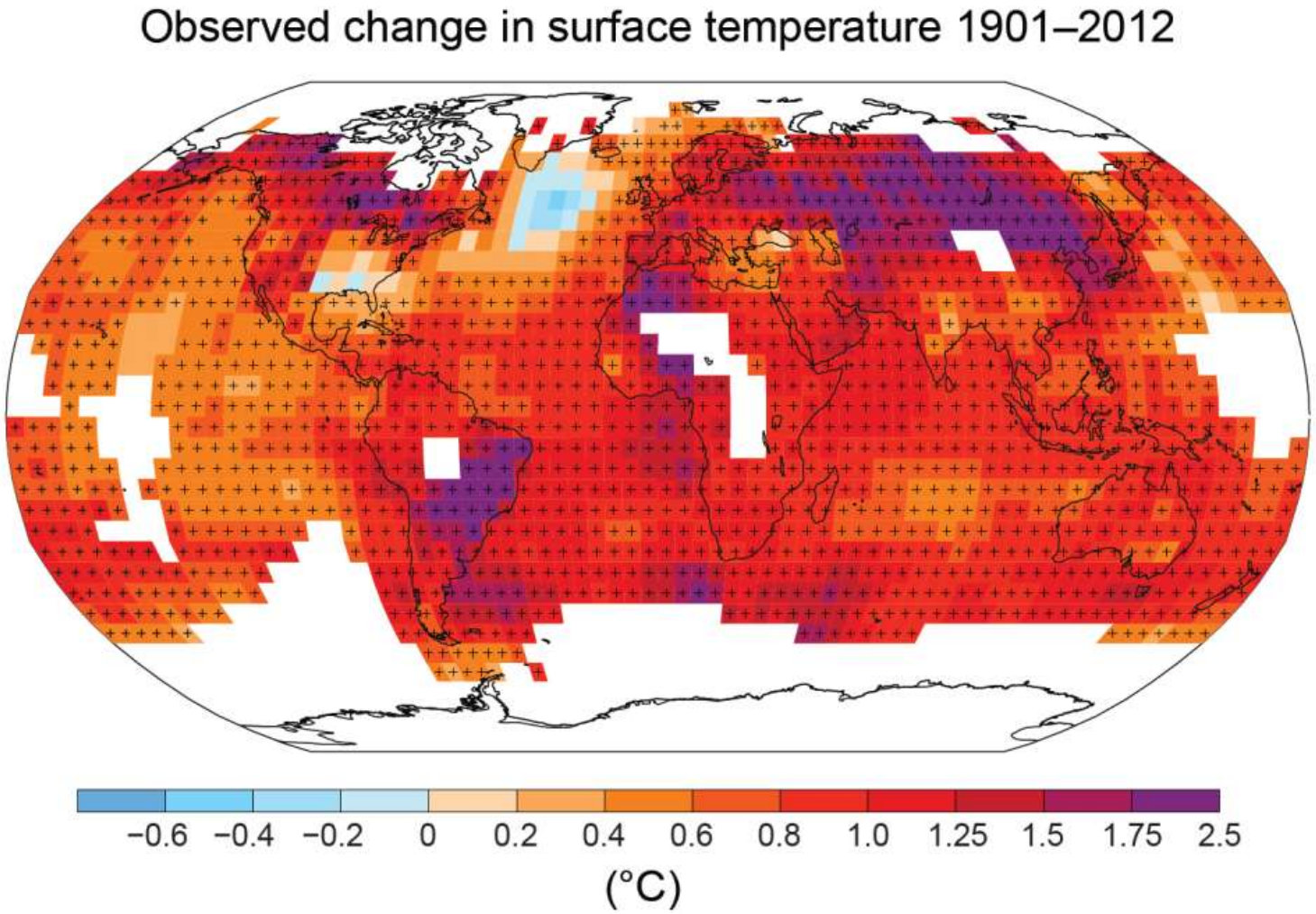



# Human influence on the climate system is clear

(IPCC 2013. Fig SPM.6)

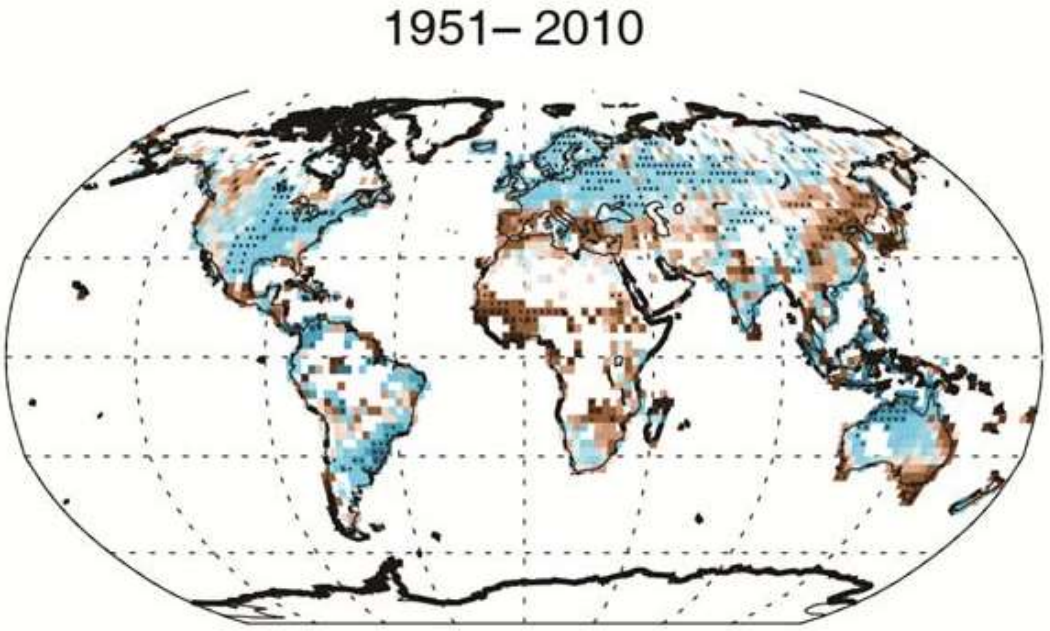

Climate Change
Radiative Forcing
Atmospheric Concentrations
Emissions
Human Activities

# Temperature



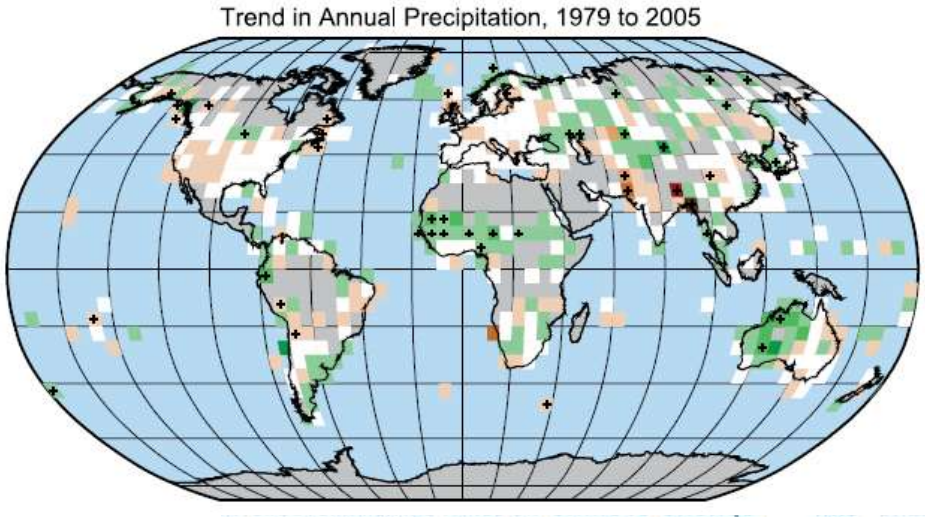
Observed Changes

# Observed changes in Precipitation – AR4 vs. AR5




AR5

AR4

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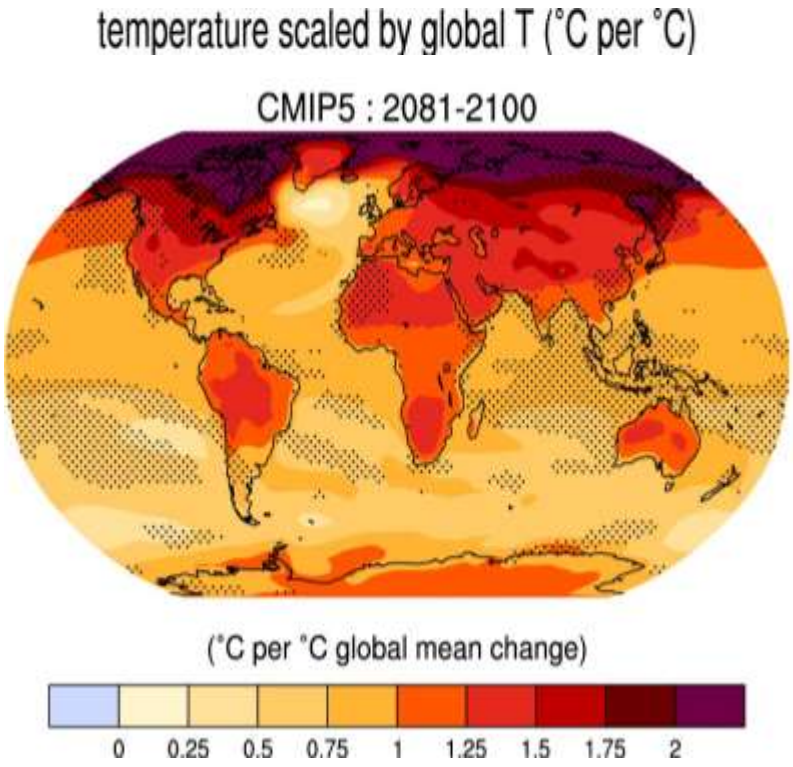
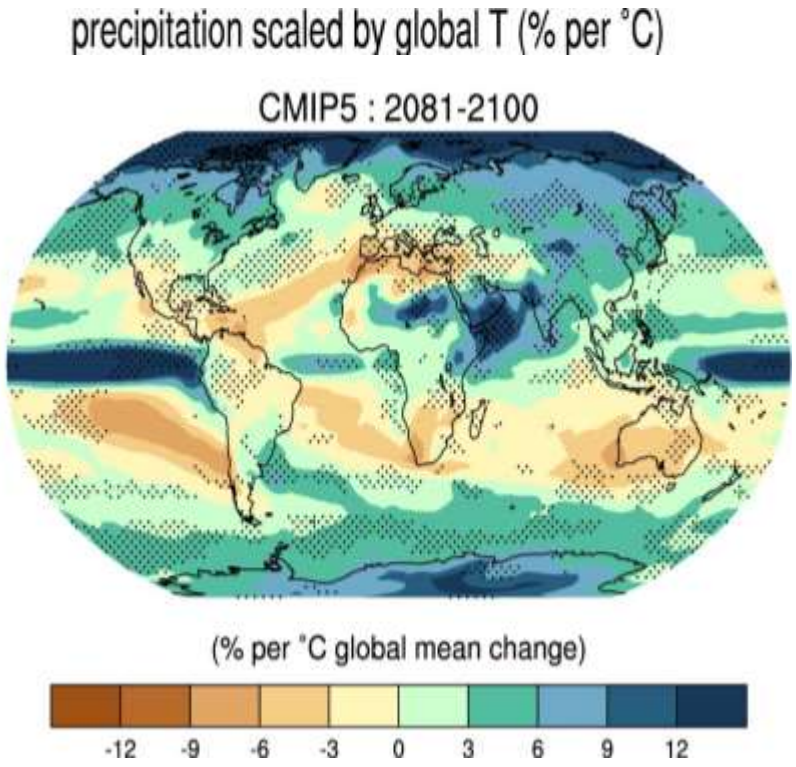
Projected Changes

# Projected Changes in Temperature and Precipitation

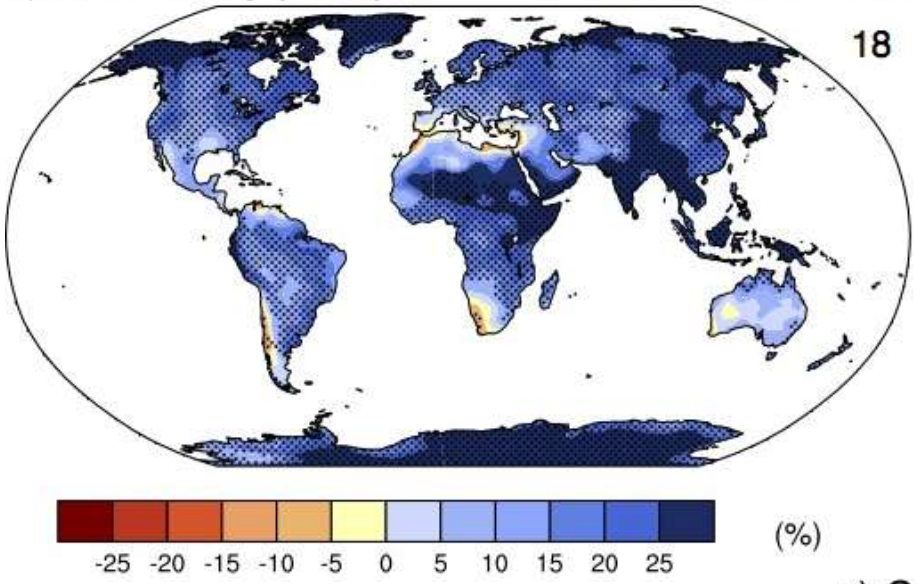


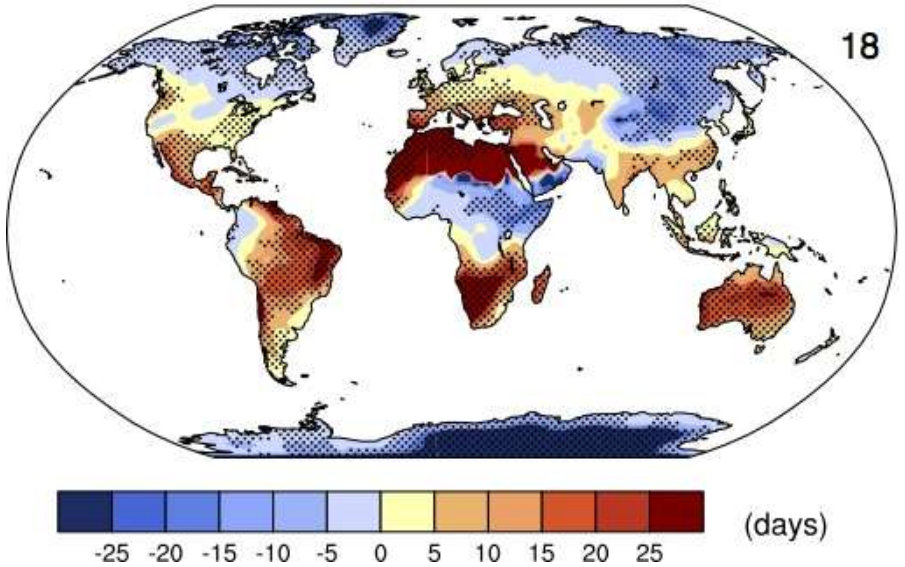
Projected Changes

# Changes in Extremes

b) max. 5 day precip RCP8.5: 2081-2100




c) Consecutive Dry Days RCP8.5: 2081-2100

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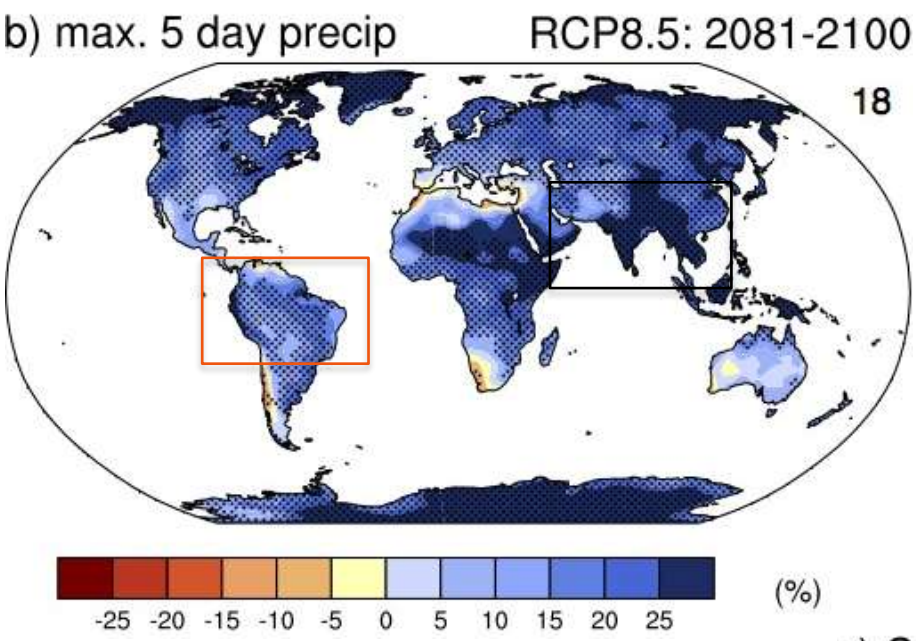
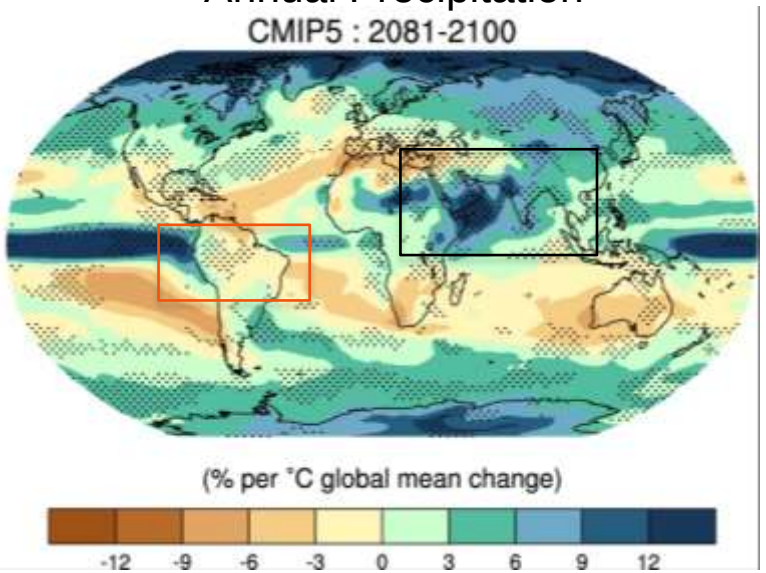
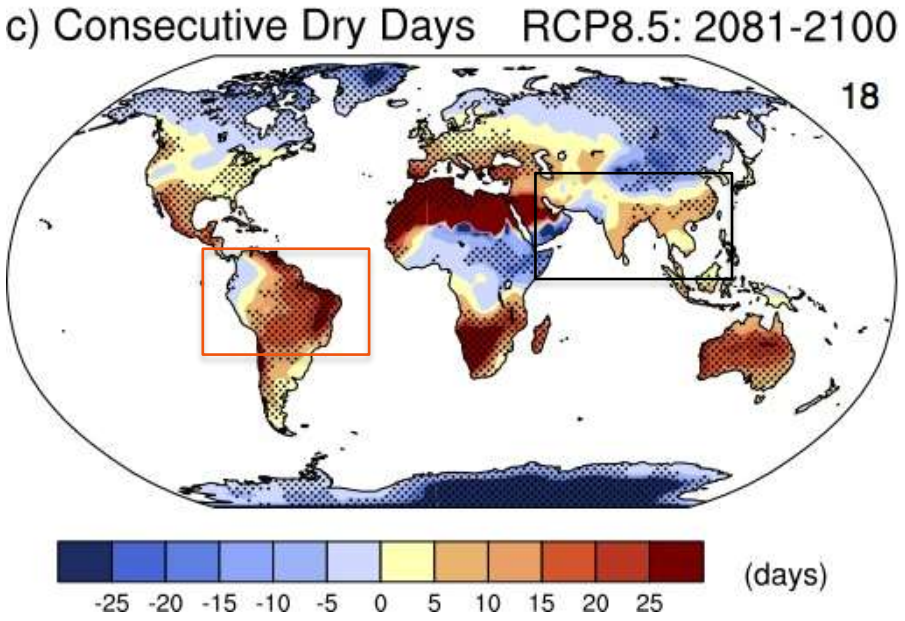
Projected Changes

# Changes in Extremes




Annual Precipitation

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# Tropical phenomena: Convergence Zones

**Rainfall Change**
**(*medium confidence*)**

"wet-get-wetter" over CZ regions

"warmer-get-wetter" over oceans

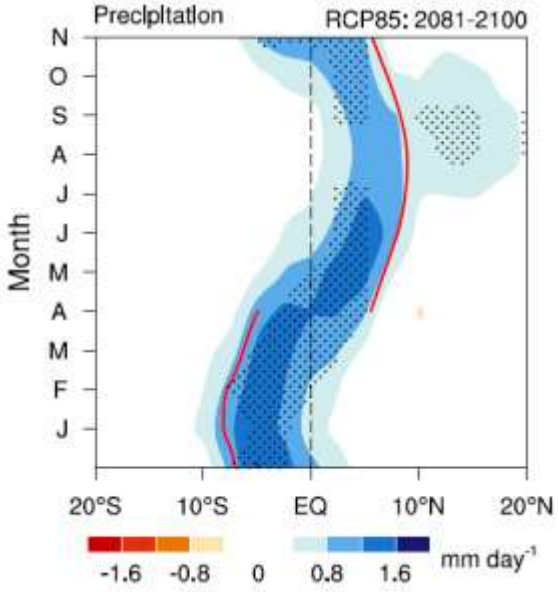



**Figure 14.9:** Seasonal cycle of zonal-mean tropical precipitation change (2081–2100 in RCP8.5 minus 1986–2005) in CMIP5 multimodel ensemble mean. Eighteen CMIP5 models were used. Stippling indicates that more than 90% models agree on the sign of MME change. The red curve represents the meridional maximum of the climatological rainfall. Adapted from Huang et al. (2013).

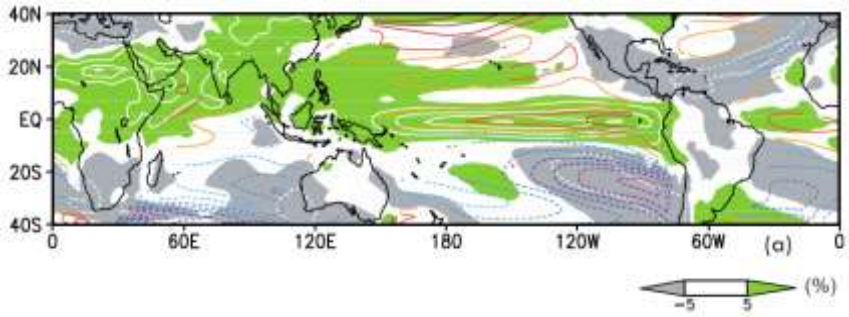


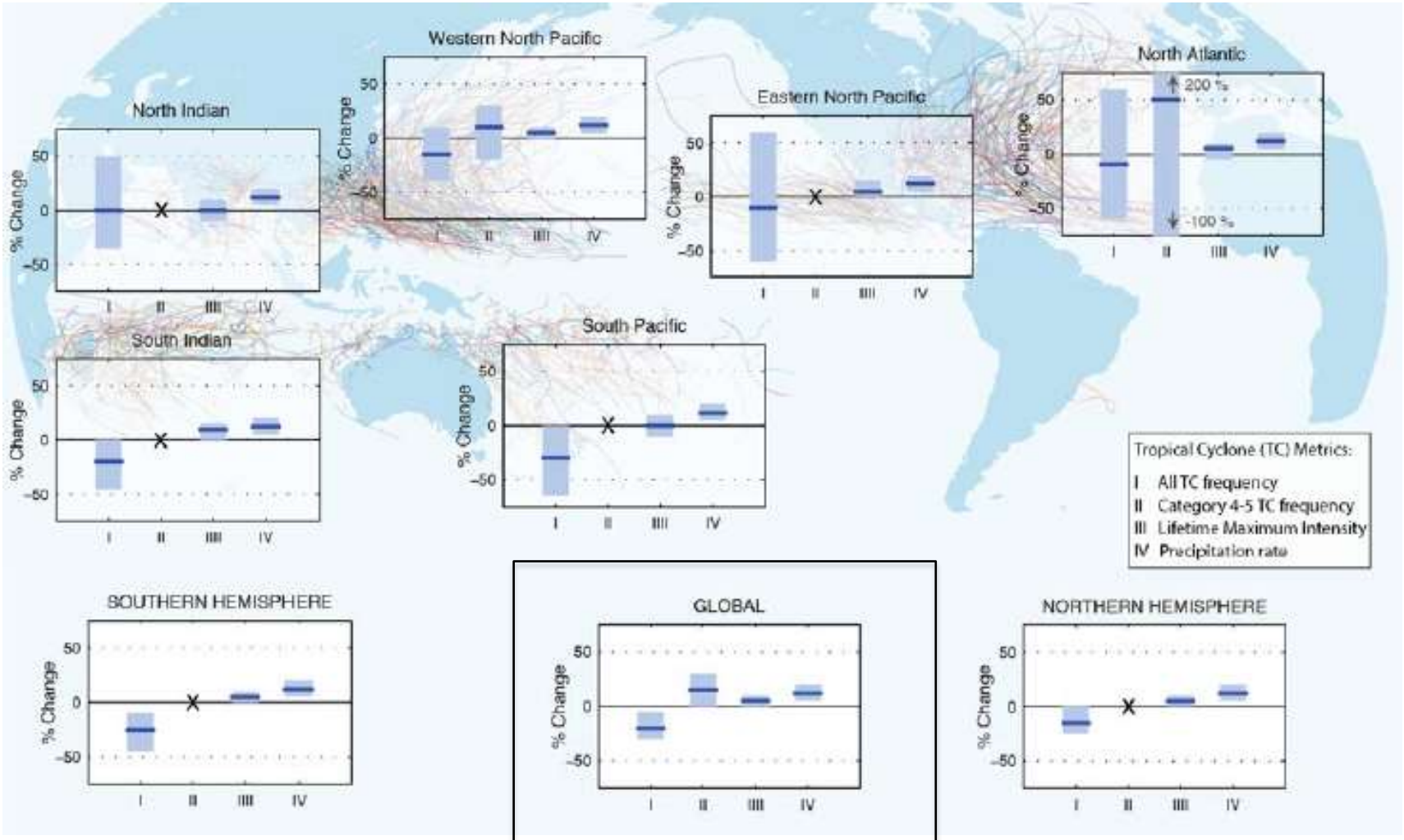

**Figure 14.8:** Upper panel: Annual-mean precipitation percentage change (ΔP/P in green/gray shade and white contours at 20% intervals), and relative SST change (colour contours at intervals of 0.2°C; negative shaded) to the tropical (20S–20N) mean warming in RCP8.5 projections, shown as 23 CMIP5 model ensemble mean.

The seasonal-mean rainfall is projected to increase on the ITCZ equatorward flank

More warming and rainfall at north of the equator. Less zonal SST gradient across the equatorial Pacific that contribute to the weakened Walker cells.

Regional Changes

# Tropical cyclones



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# Annex I: Atlas of Global and Regional Climate Projections

- **35 regions**
- **42 global climate models**
- **2 variables**

  Temperature, Precipitation

- **4 scenarios**

  RCPs 2.6, 4.5, 6.0, 8.5

- **2 seasons**

  temp: DJF, JJA (for temp)
  precip: AMJJAS, ONDJFM

- **Maps for 3 time horizons**

  2016-35, 2046-65, 2081-2100
  reference period 1986-2005

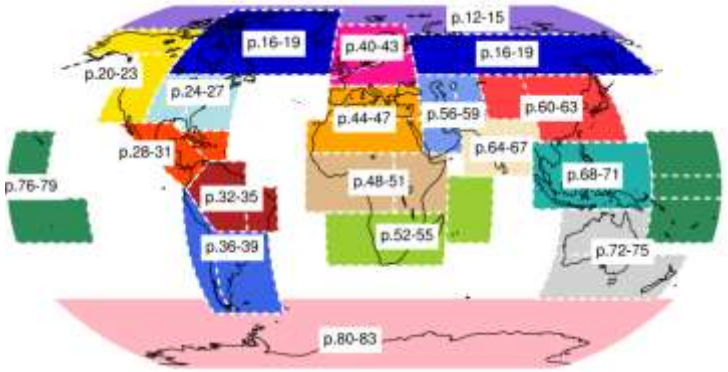
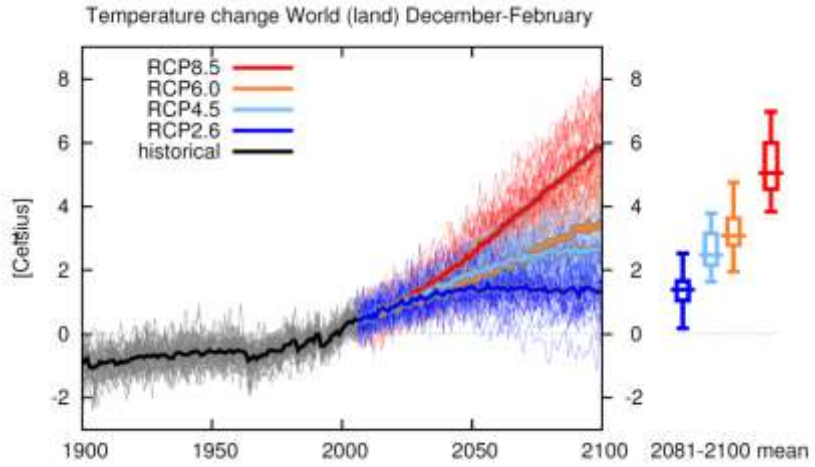



Fig. AI.3



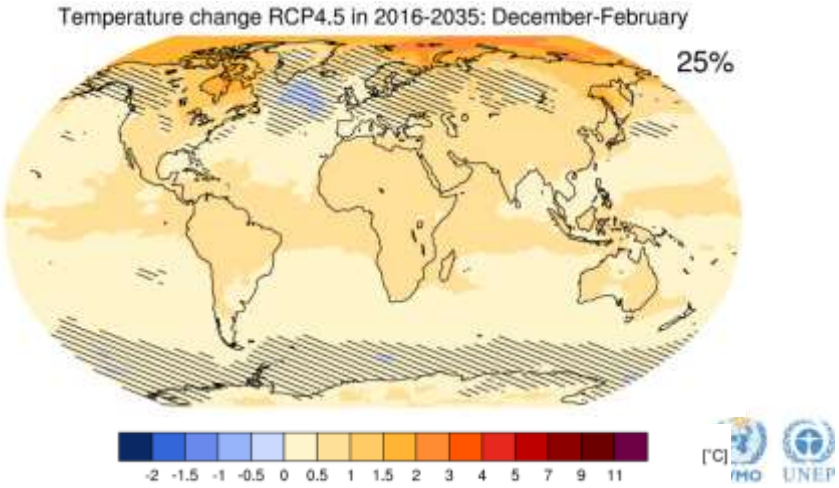
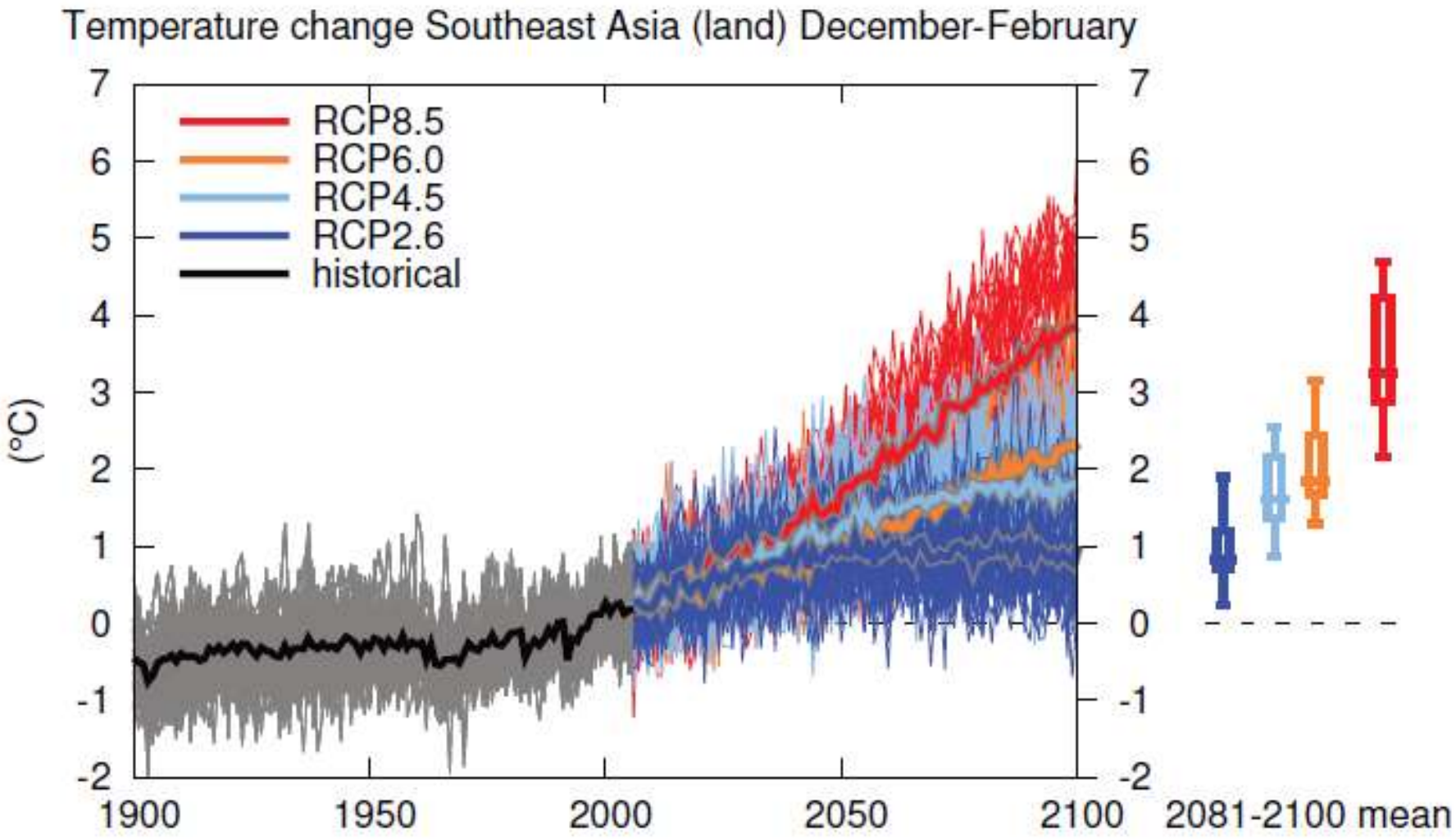
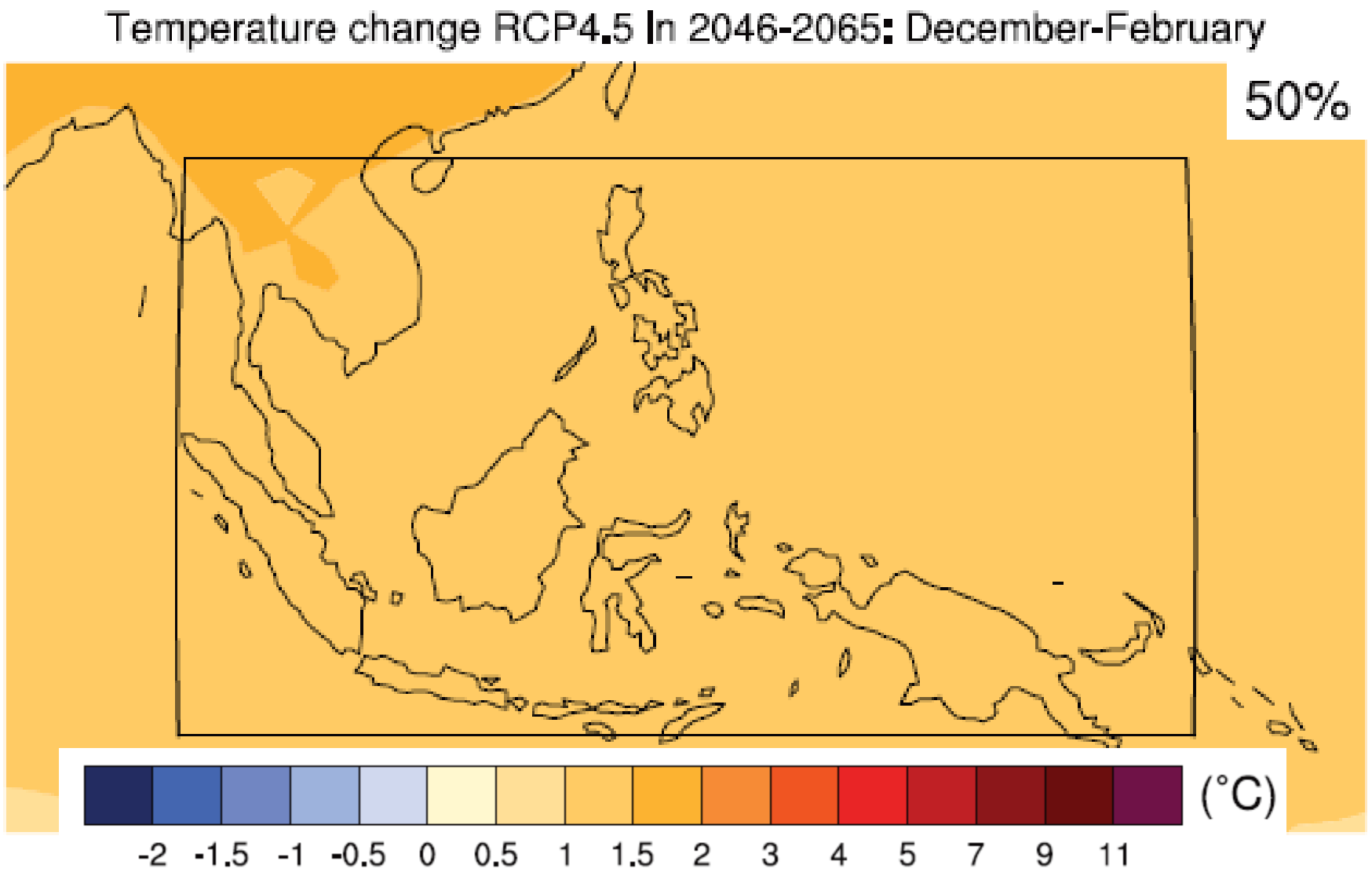




Fig. AI.4

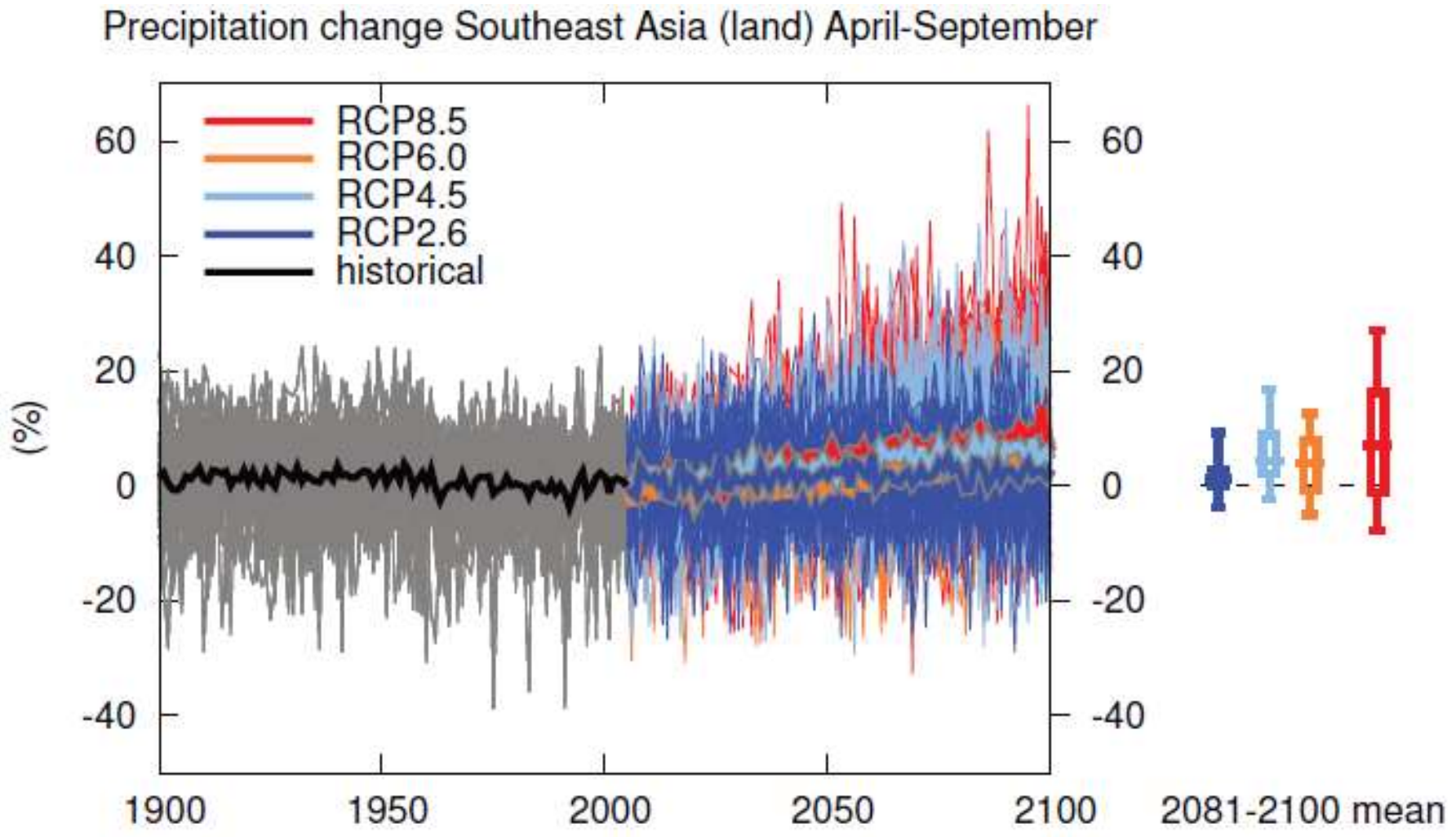
# Temperature Change Graph – South Asia



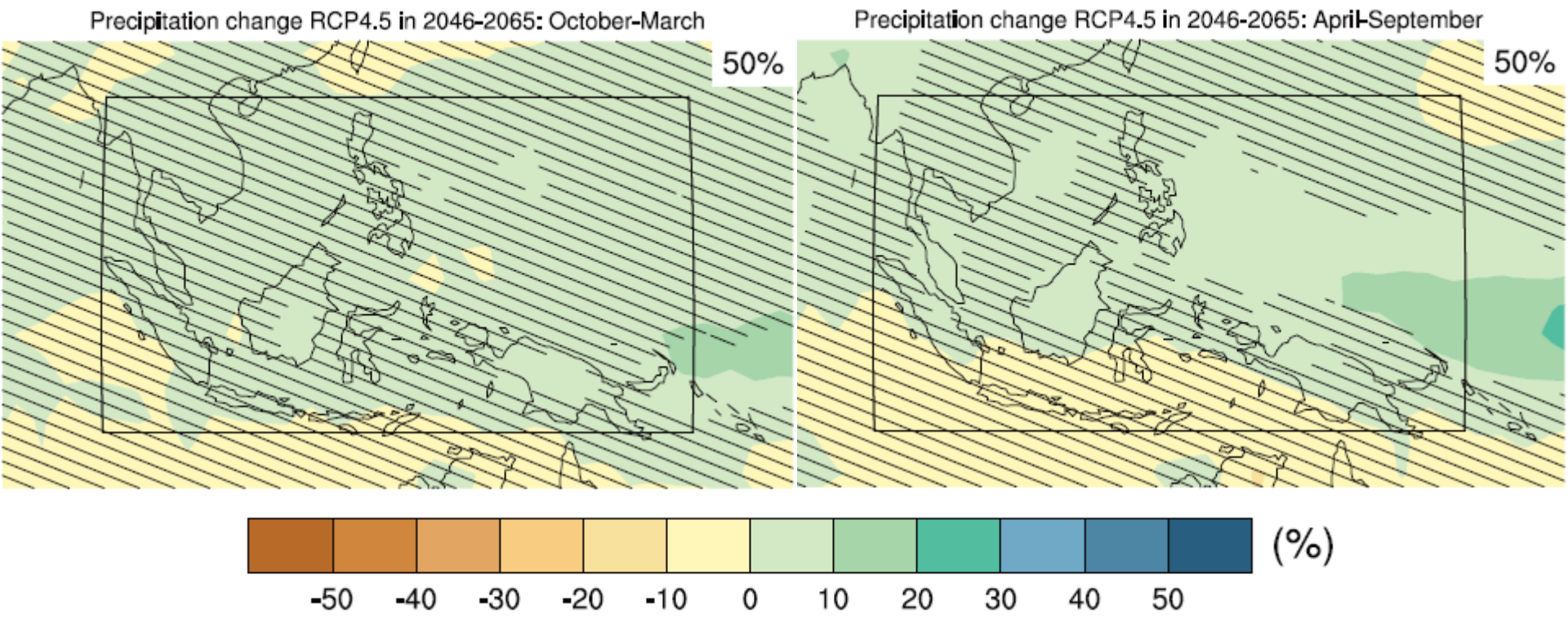
# Temperature Change Map South Asia – RCP4.5



# Rainfall Change Graph – South Asia



# Rainfall Change Maps South Asia - RCP4.5



# Climate Change 2013: The Physical Science Basis

## Working Group I contribution to the IPCC Fifth Assessment Report

Further Information

**www.climatechange2013.org**