SIXTH ASSESSMENT REPORT
Working Group I – The Physical Science Basis

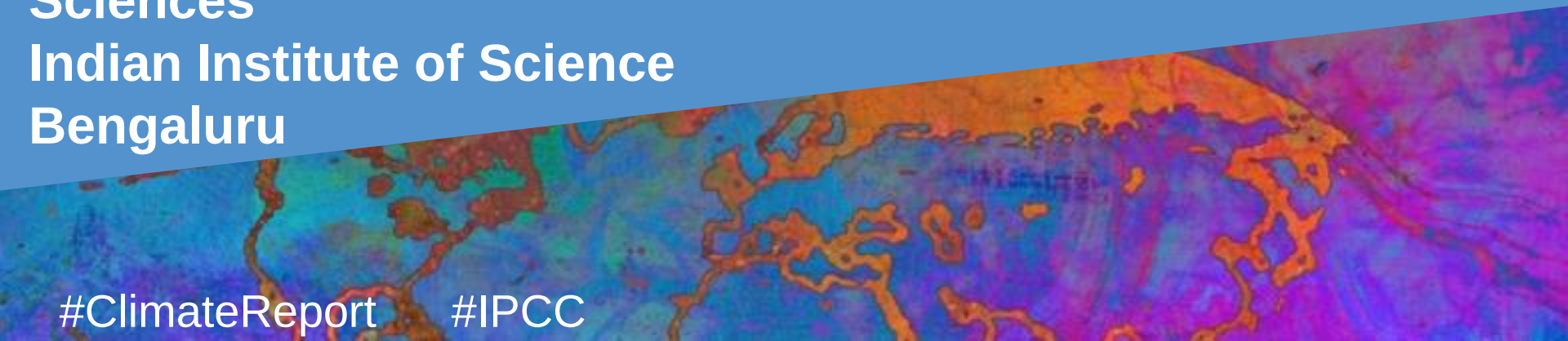
ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

15 March 2022

The physical basis of GLOBAL Climate Change

G. Bala, Professor
Center for Atmospheric & Oceanic Sciences
Indian Institute of Science
Bengaluru



#ClimateReport #IPCC

- **This talk will cover the broader global picture of global warming or climate change**
- **The latest scientific assessment by IPCC (2021) is the main source**
- **National or regional level details are not discussed in detail (…next speaker)**
- **Climate Change impacts, vulnerability, risks, adaption and mitigation are not discussed**

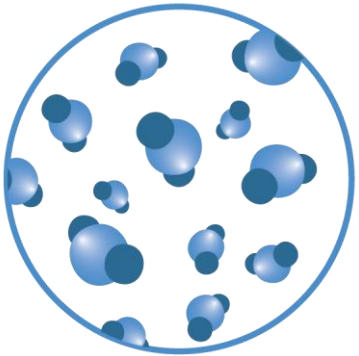
Take-Home Messages

1. Many recent changes in the climate system are unprecedented
2. Effects of global warming are felt in almost all regions
3. Human activities are the main cause for global warming
4. The regional changes we experience would increase with increased levels of global warming.
5. Every tonne of CO_2 we emit into the atmosphere would add to future global warming => we can stop global warming only if we reach net-zero emissions

- **Brief Definitions:**
  - **Global warming: Increase in global mean surface temperature of our planet (~ 1.1ºC) due to human activities in the industrial era**
  - **Human or Anthropogenic activities: Primarily Fossil fuel (coal, petroleum and natural gas) emissions and deforestation that release greenhouse gases and aerosols**
  - **Greenhouse gases: Carbon dioxide, methane, etc. which trap IR radiation and cause global warming**
  - **Industrial Era: The period after 1850**

The unprecedented nature of current climate change

CO_2
concentration



Highest

in at least

2 million years

Sea level
rise

Fastest rates

in at least

3000 years

Arctic sea ice
area

Lowest level

in at least

1000 years

Glaciers
retreat

Unprecedented

in at least

2000 years

Effects of climate change are felt in multiple ways

Extreme heat

More frequent

More intense

Heavy rainfall

More frequent

More intense

Drought

Increase in some regions

Fire weather

More frequent

Ocean

Warming

Acidifying

Losing oxygen

Photo Credits from left: 1. Luiz Guimaraes 2. Jonathan Ford 3. Peter Burdon 4. Ben Kuo 5. NOAA

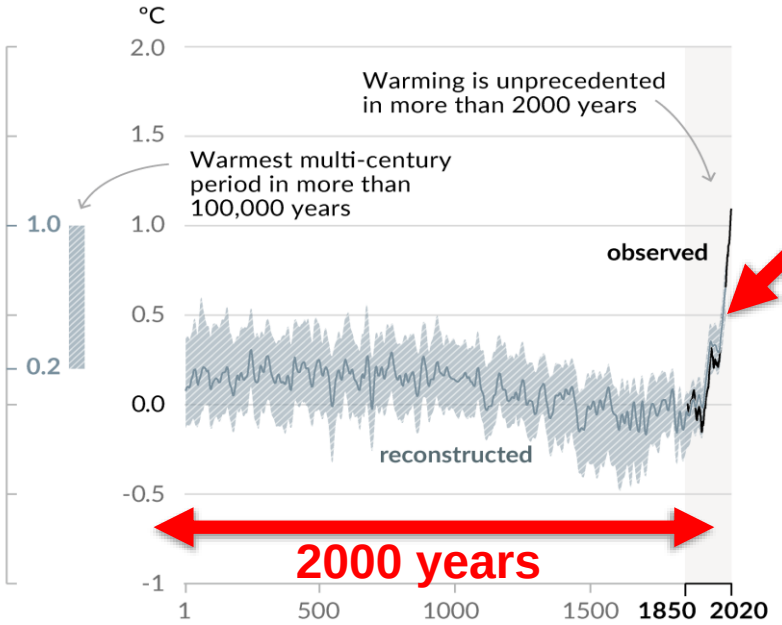
[Credit: Yoda Adaman | Unsplash]

> It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.

Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

Figure SPM.1

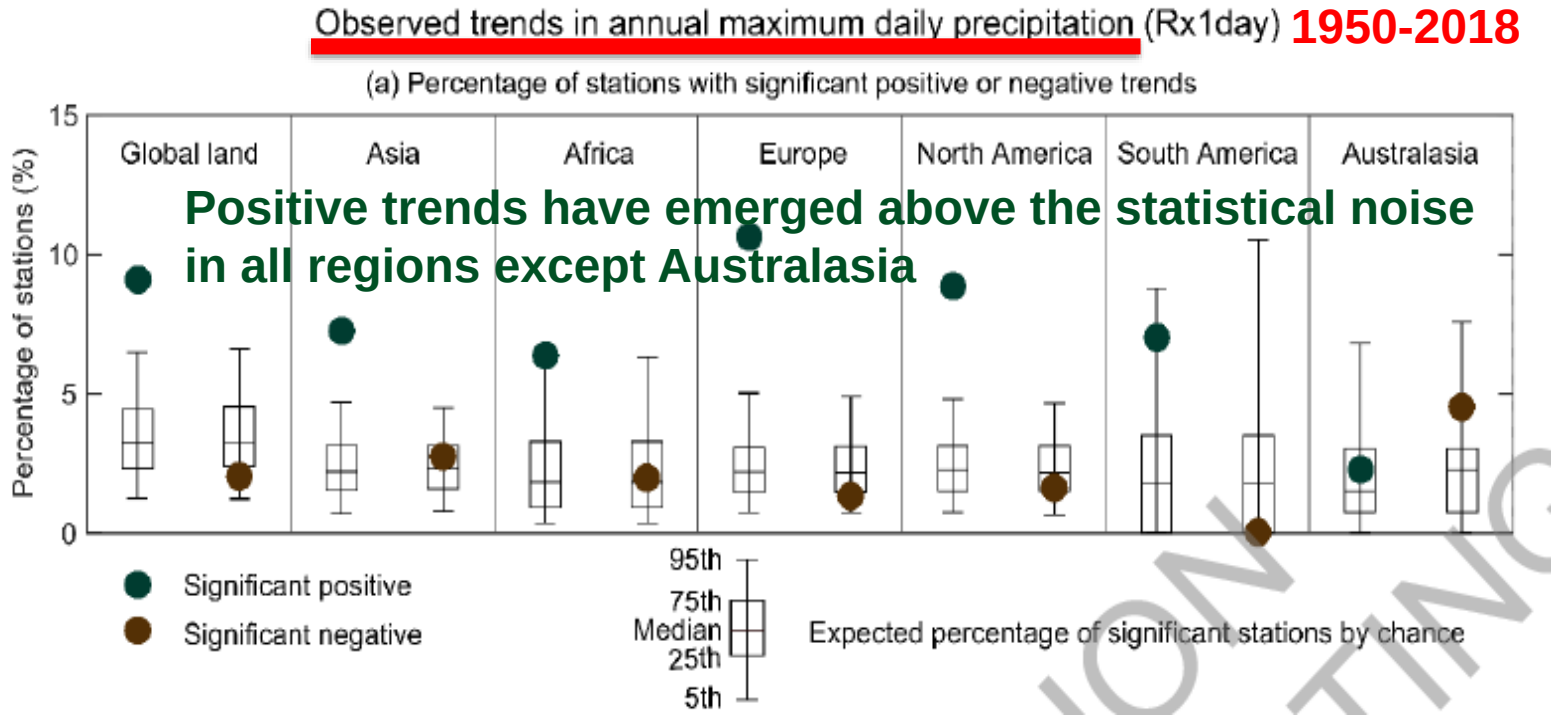
a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and **observed** (1850-2020)



Rate of recent warming is alarming and is unprecedented at least in the last 2000 years

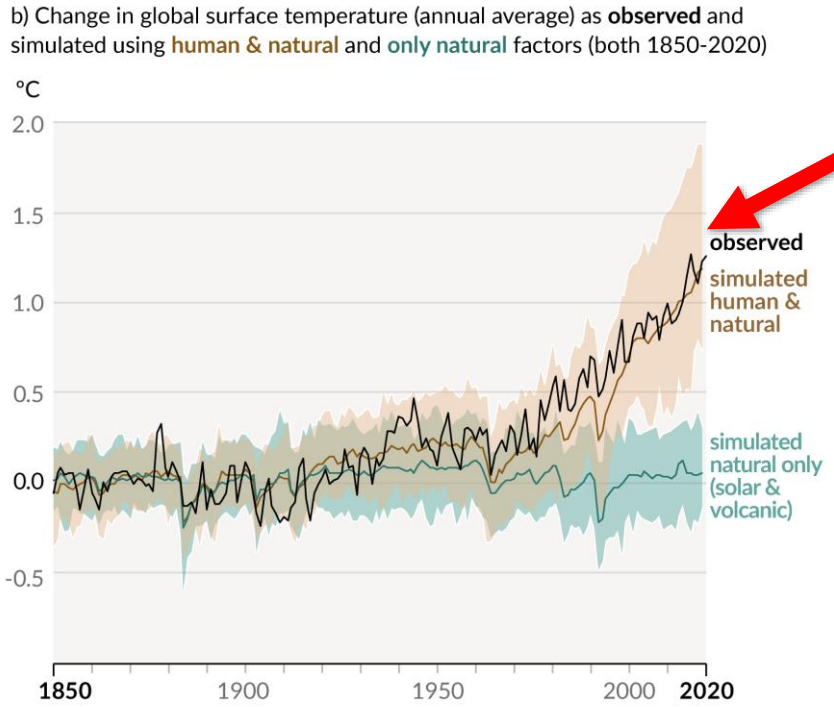
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

Chapter 11



Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

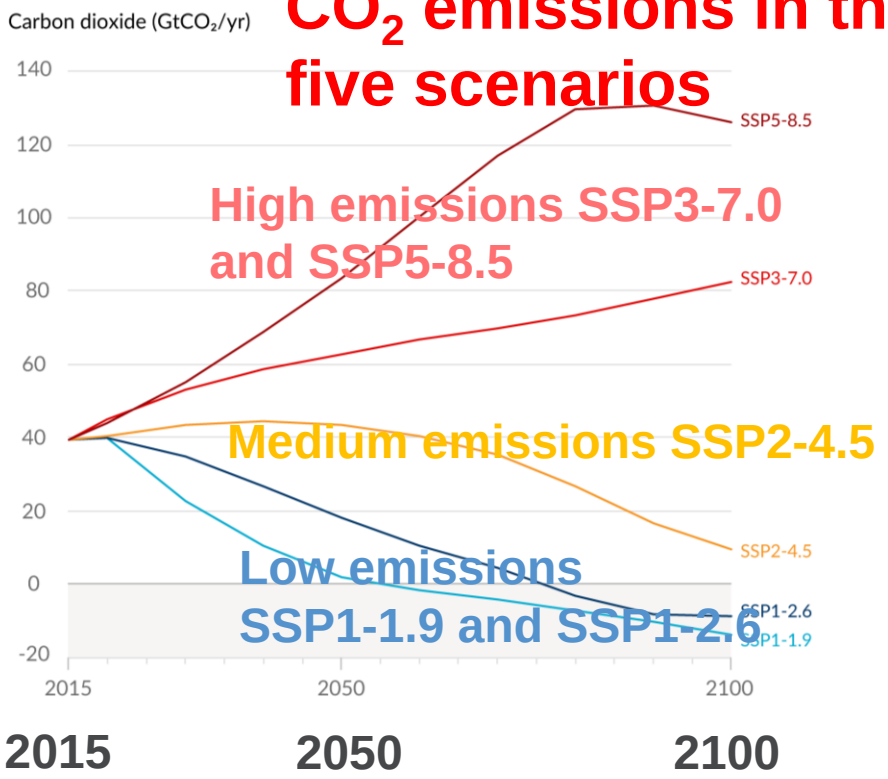
Figure SPM.1



Human Activities (fossil fuel emissions and deforestation) are the main cause for global warming in the industrial era

Future emissions cause future additional warming, with total warming dominated by past and future CO_2 emissions

Figure SPM.4

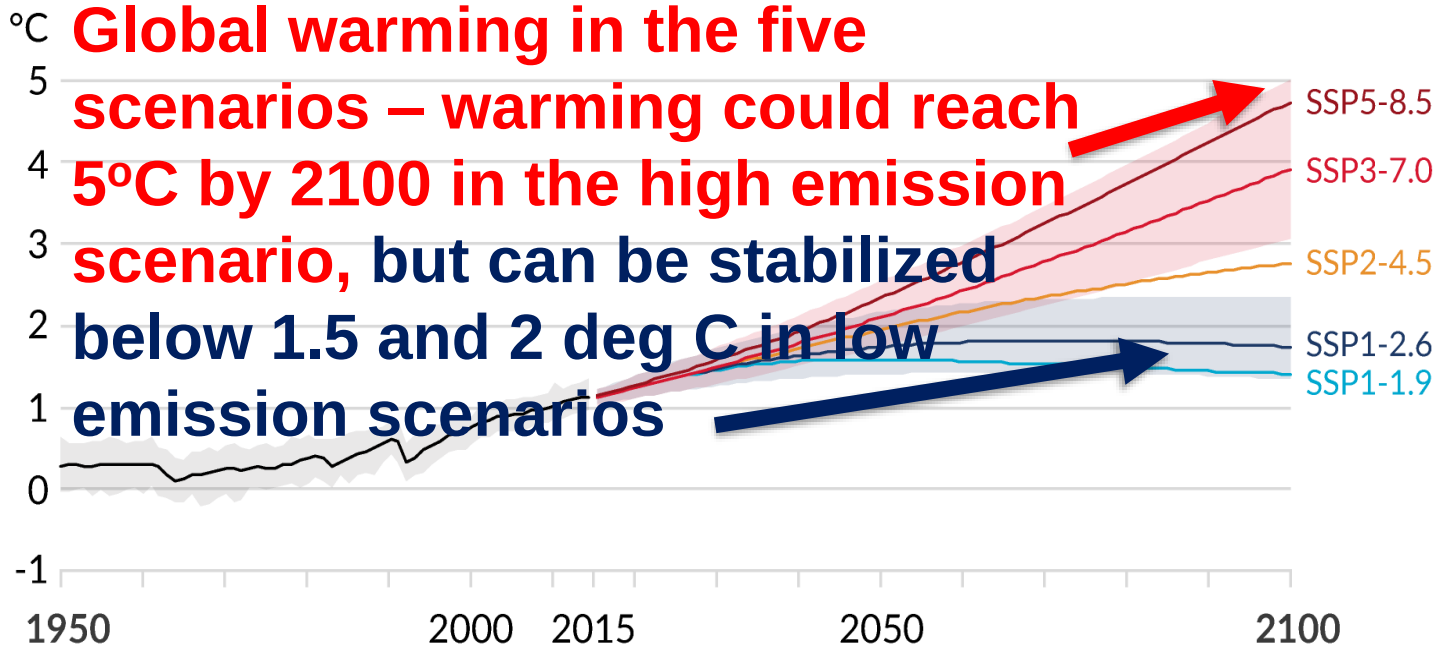


Future climate change is projected for a range scenarios spanning "business-as-usual high emissions and low carbon emissions from 2015 to 2100

Human activities affect all the major climate system components, with some responding over decades and others over centuries

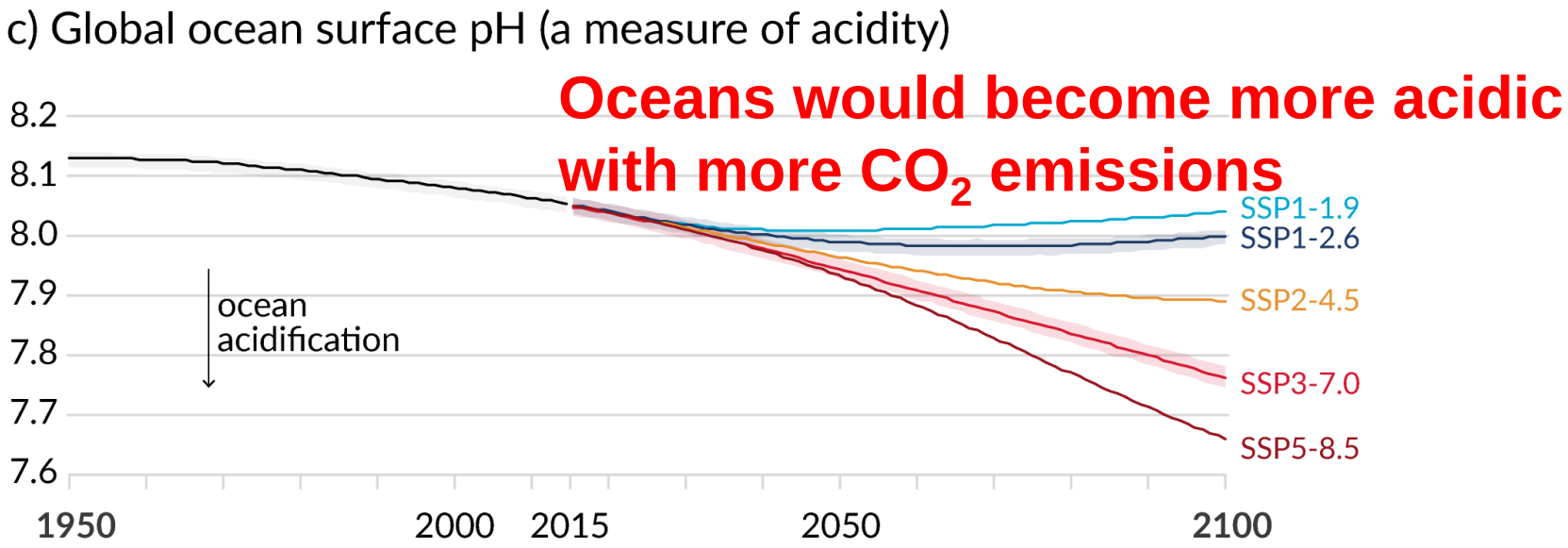
Figure SPM.8

a) Global surface temperature change relative to 1850-1900



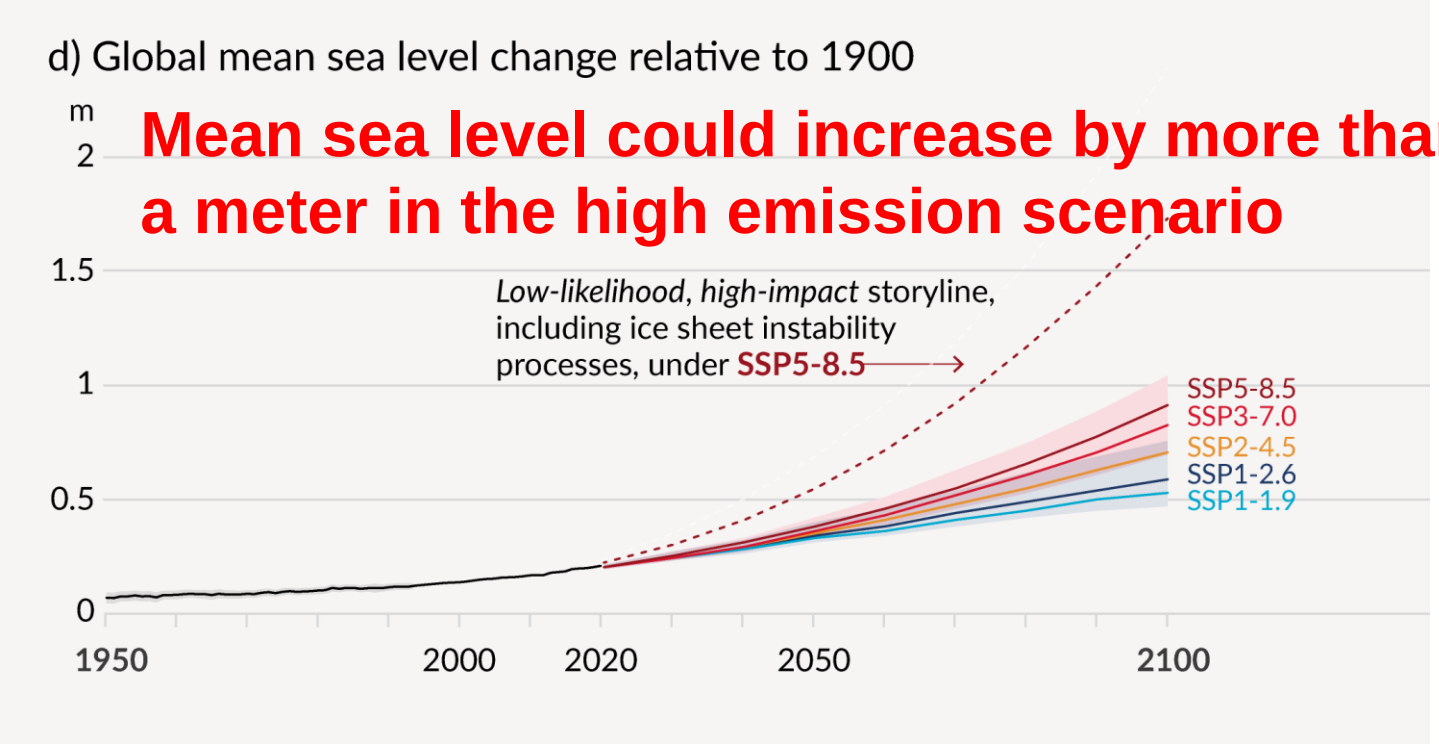
Human activities affect all the major climate system components, with some responding over decades and others over centuries

Figure SPM.8



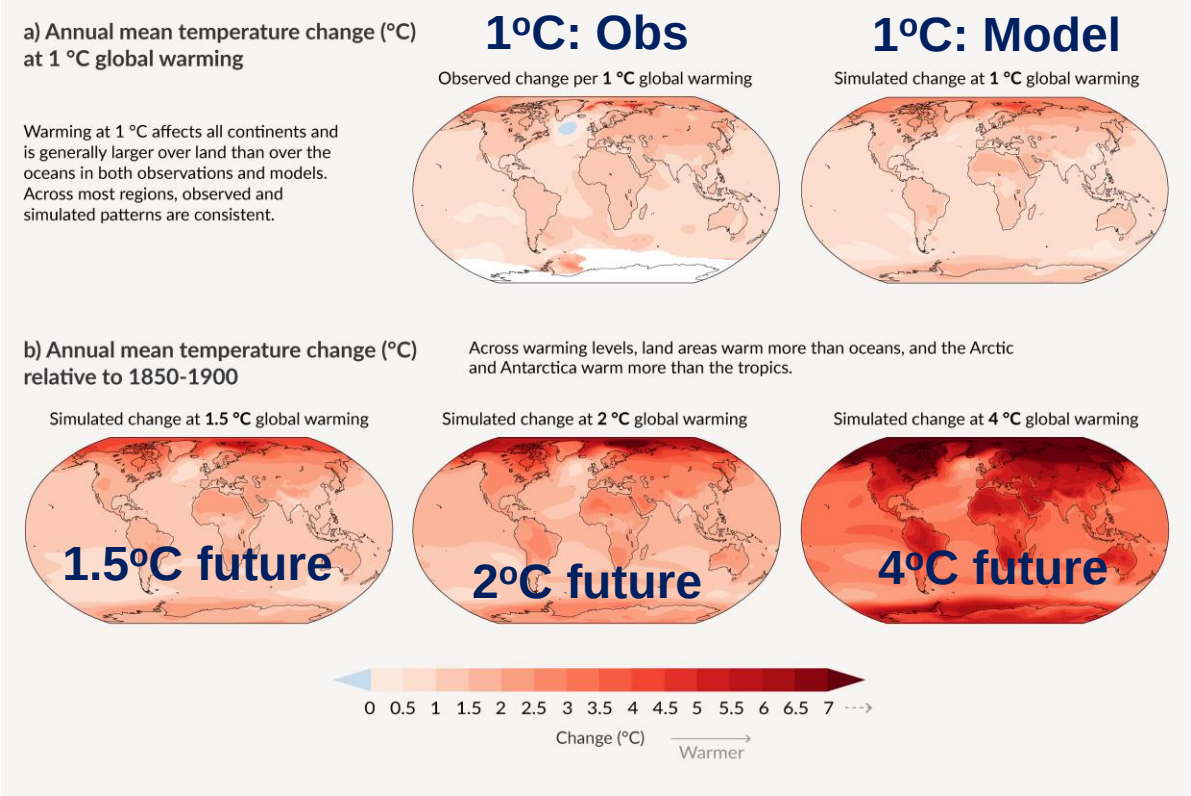
Human activities affect all the major climate system components, with some responding over decades and others over centuries

Figure SPM.8



With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

Figure SPM.5

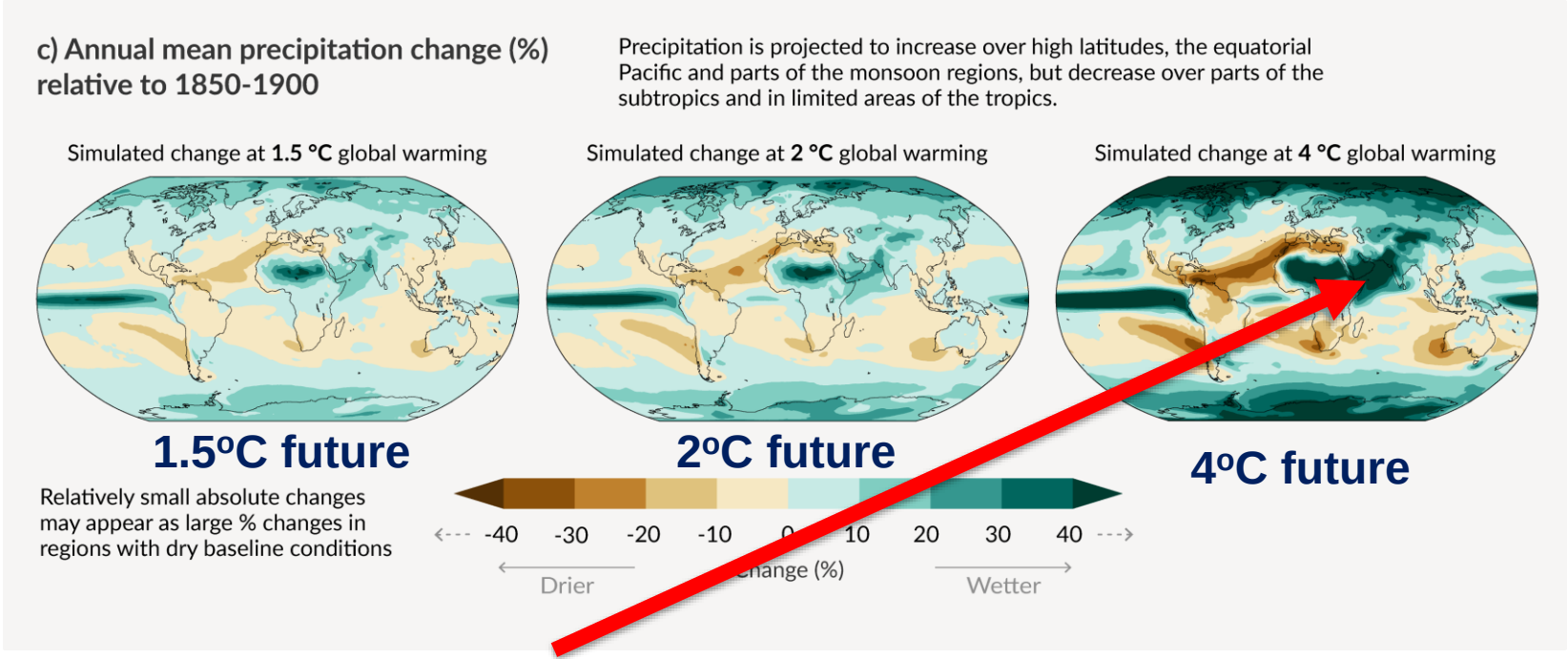


Larger the global mean warming, larger the warming everywhere

Pattern remains the same for all global warming levels but intensifies with global warming

With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

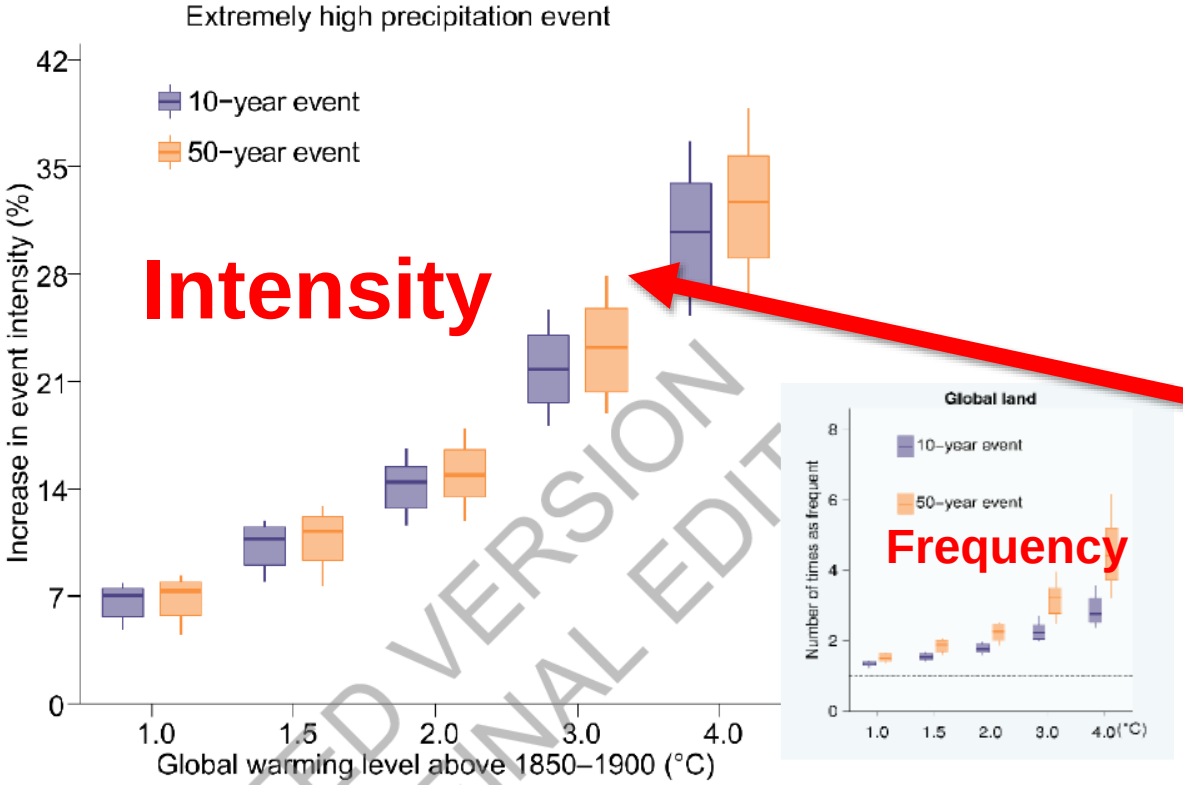
Figure SPM.5



Rainfall changes (%): SA is projected to be become wetter

Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming

Chapter 11

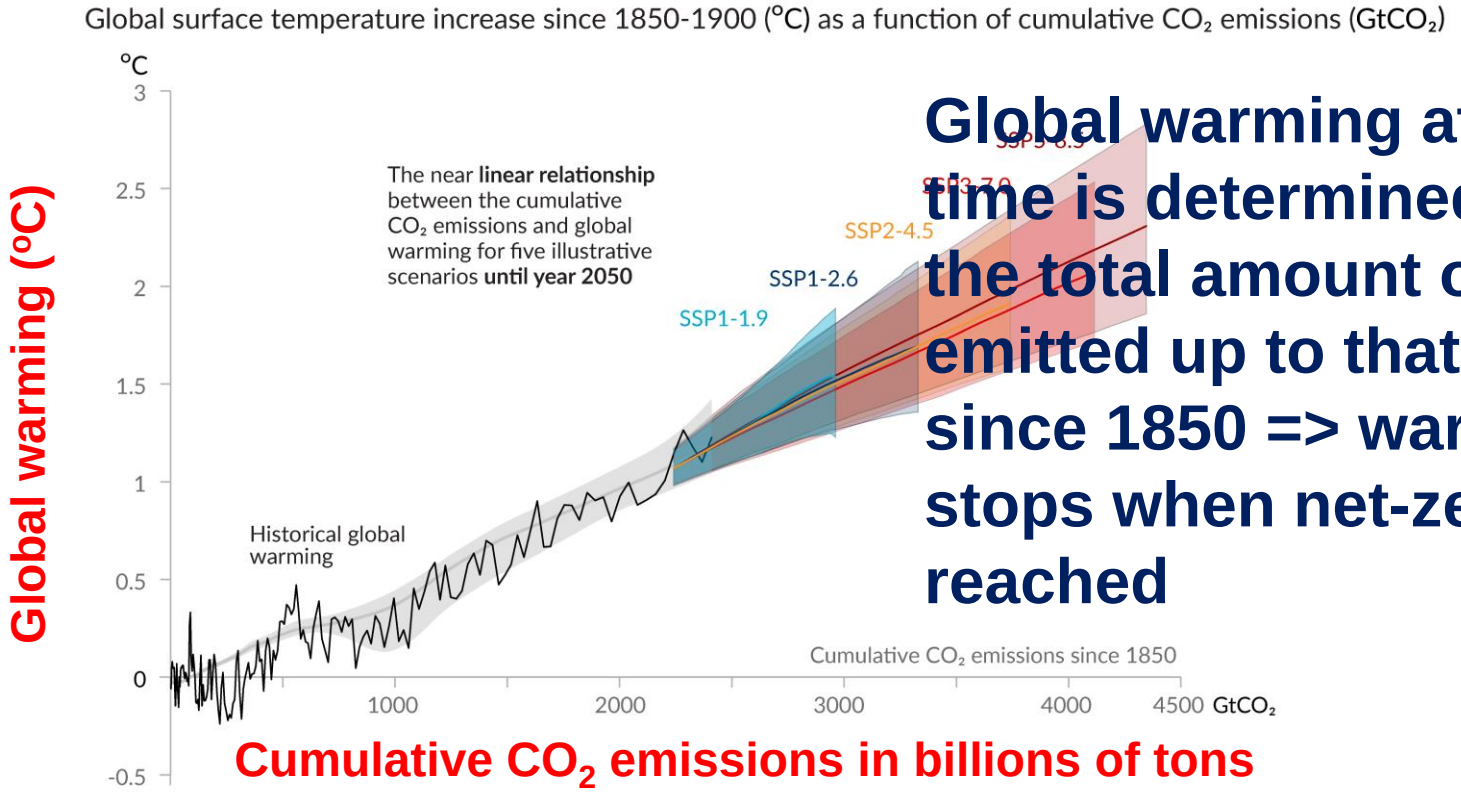


Intensity and frequency of extremes scale with global warming.

The intensity of 1-in-10-year and 1-in-50-year extreme precipitation would increase at ~7% per deg C of global warming

Every tonne of CO_2 emissions adds to global warming

Figure SPM.10



Global warming at any time is determined by the total amount of CO_2 emitted up to that time since 1850 => warming stops when net-zero is reached

Some Key Take-Home Messages

1. The rate of warming in recent decades is unprecedented in at least the last 2000 years
2. Effects of global warming are felt in almost all regions
3. Human activities are the main cause for global warming
4. The changes we experience would increase with further global warming.
5. Every tonne of CO_2 we emit into the atmosphere would add to future global warming
6. The climate we experience in the future would depend on our decisons now

Thank you

More Information:

IPCC: www.ipcc.ch

IPCC Secretariat: ipcc-sec@wmo.int

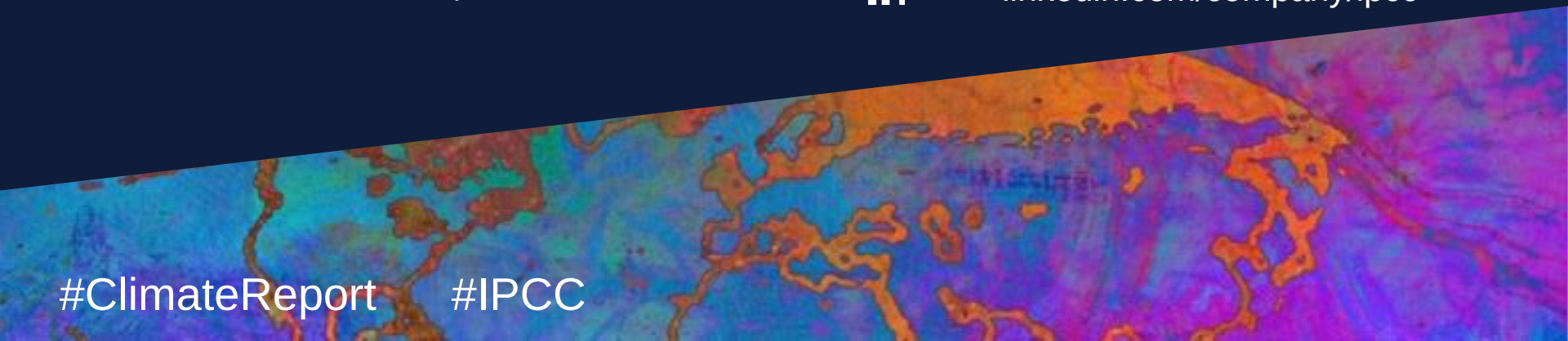
IPCC Press Office: ipcc-media@wmo.int

Follow Us:

@IPCC

@IPCC_CH

linkedin.com/company/ipcc



#ClimateReport #IPCC