VI°CONGRESS SISC

Venice - Mestre, 17-19 October 2018

IPCC Special Report on impacts of global warming of 1.5°C: An overview of the main outcomes

Marco Bindi and Lorenzo Brilli

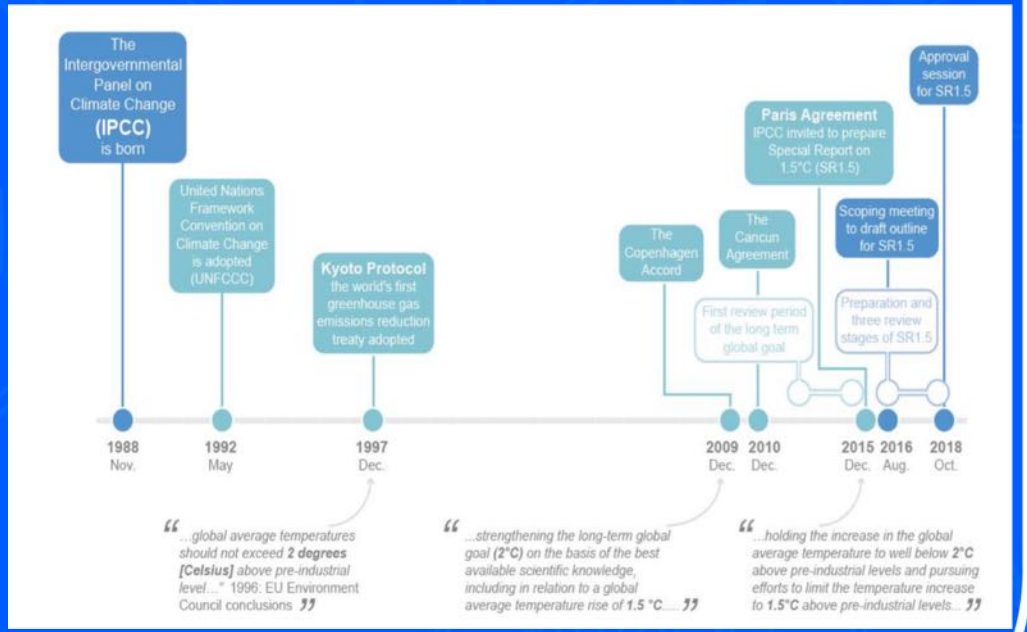
University of Florence and CNR-Ibimet

Why are we talking about 1.5°C?

2010: ***The Cancun Agreement was the first UNFCCC document to mention a limit to global warming of 1.5°C "…***strengthening the long term global goal on the basis of the best available scientific knowledge … to a global average temperature rise of 1.5 °C"

2015: The final report of the SED2 at the ***COP21 in Paris*** concluded that:

- "***in some regions and vulnerable ecosystems, high risks are projected even for warming above 1.5 °C***"
- "While ***science on the 1.5 °C warming limit is less robust, efforts should be made to push the defence line as low as possible***"



IPCC SR1.5

As part of the decision to adopt the Paris Agreement, the IPCC was invited to produce, in 2018, a Special Report on ***global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways.***

The IPCC accepted the invitation, adding that the Special Report would look at these issues in the context ***of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.***

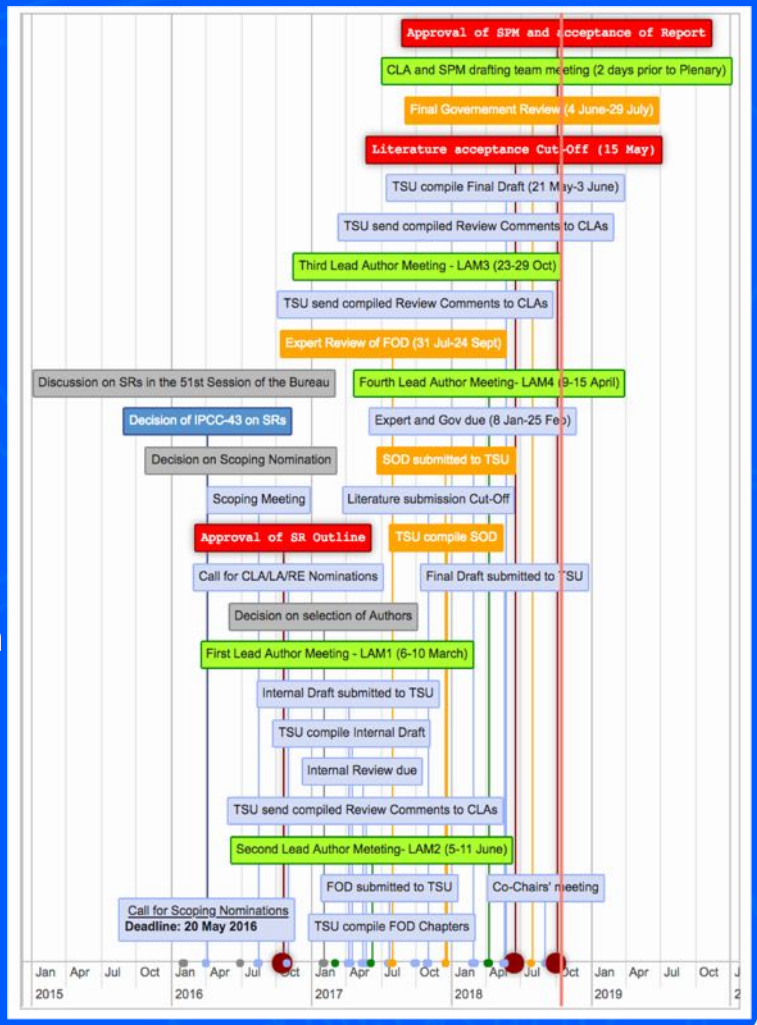
Report: numbers, timeline and outline

Numbers:

- 91 authors from 40 countries
- 133 Contributing authors (CAs)
- Over 6,000 cited references
- A total of 42,001 expert and government review comments:
  - First Order Draft 12,895;
  - Second Order Draft 25,476;
  - Final Government Draft: 3,630

Outline:

- **Chapter 1:** *Framing and Context*
- **Chapter 2:** *Mitigation pathways* compatible with 1.5°C in the context of sustainable development
- **Chapter 3:** *Impacts of 1.5°C global warming* on natural and human systems
- **Chapter 4:** Strengthening and implementing the *global responses* to the threat of climate change
- **Chapter 5:** *Sustainable development*, *poverty* eradication, and reducing *inequalities*



Key-messages: from press release

- "…***we are already seeing the consequences of 1°C of global warming*** through more extreme weather, rising sea levels and diminishing Arctic sea ice….." Panmao Zhai, Co-Chair of IPCC Working Group I
- "…***every extra bit of warming*** matters, especially since warming of 1.5°C or higher ***increases the risk associated with long-lasting or irreversible changes*** " Hans-Otto Pörtner, Co-Chair of IPCC Working Group II
- " …***the decisions we make today are critical in ensuring a safe and sustainable world for everyone***, and ***the next few years are probably the most important in our history***…" Debra Roberts, Co-Chair of IPCC Working Group II

Key-messages: from press release (cont.)

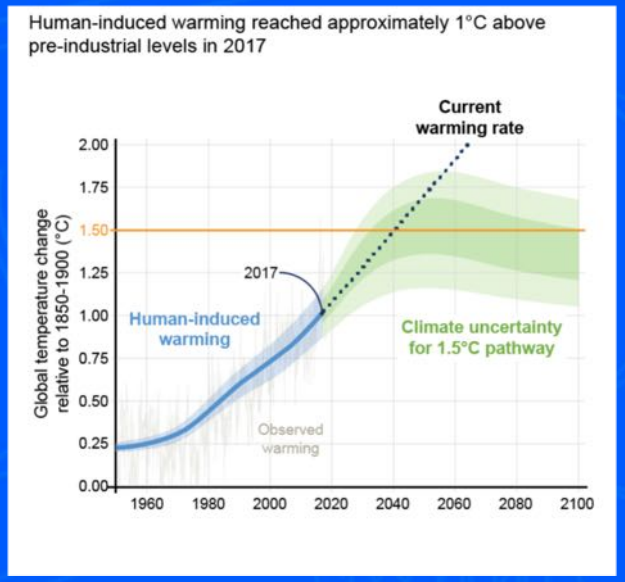
- "…***limiting warming to 1.5°C is possible within the laws of chemistry and physics but doing so would require unprecedented changes***…" Jim Skea, Co-Chair of IPCC Working Group III.
- "…***limiting global warming to 1.5°C*** compared with 2°C ***would reduce challenging impacts*** on ecosystems, human health, ***making it easier to achieve the UN-SDG*** …" Priyardarshi Shukla, Co-Chair of IPCC Working Group III.
- "…***some of the kinds of actions that would be needed to limit global warming to 1.5°C are already underway*** around the world, ***but they would need to accelerate***…" Valerie Masson-Delmotte, Co-Chair of Working Group I.
- "…***this report gives policymakers and practitioners the information they need to make decisions*** that tackle climate change while considering local context and people's needs…" Debra Roberts, Co-Chair of IPCC Working Group II.

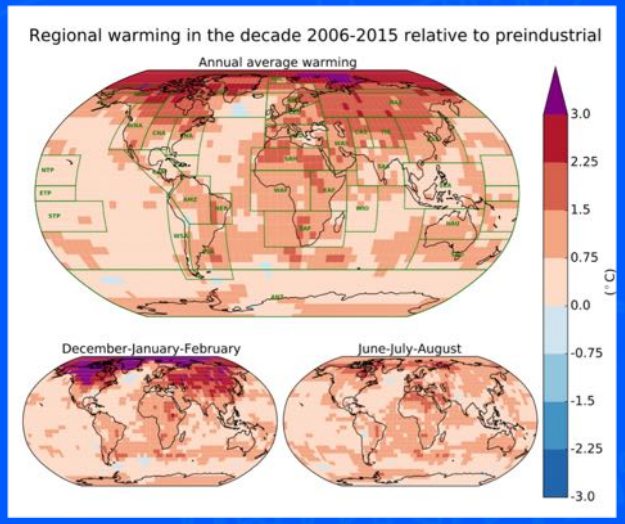
Main Chapter Key-questions ?

- ***Chapter 1:* Context**
  - How close are we to 1.5°C?
- ***Chapter 2:* Mitigation pathways**
  - What kind of pathways limit warming to 1.5°C and are we on track?
  - What do energy supply and demand have to do with limiting warming to 1.5°C?
- ***Chapter 3:* Impacts**
  - What are the impacts of 1.5°C and 2°C of warming?
- ***Chapter 4:* Global Responses**
  - What transitions could enable limiting global warming to 1.5°C?
  - Why is adaptation important in a 1.5°C warmer world?
- ***Chapter 5:* Sustainable development, poverty, inequities**
  - What are the connections between sustainable development and limiting global warming to 1.5°C?
  - What are the pathways to achieving poverty reduction and reducing inequalities while reaching the 1.5°C world?

Ch1 - How close are we to 1.5°C?

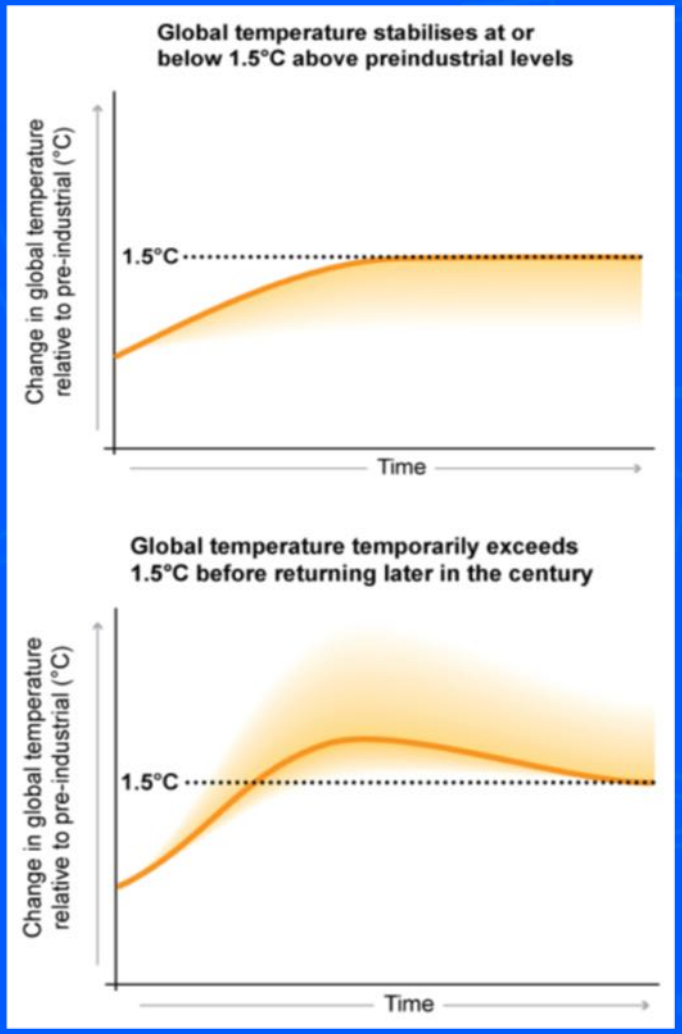
- Human–induced ***warming has already reached about 1°C above pre-industrial levels*** *(high confidence)*.
- ***If the current warming rate continues*** (+0.2°C per decade), the world would reach human–induced ***global warming of 1.5°C around 2040*** *(high confidence)*.
- Since the 1970s, most land regions have been warming faster than the global average, so ***warming in many regions has already exceeded 1.5°C above pre-industrial levels*** *(high confidence)*.
- ***Over a fifth of the global population live in regions that have already experienced warming in at least one season that is greater than 1.5°C*** above pre-industrial levels *(high confidence)*





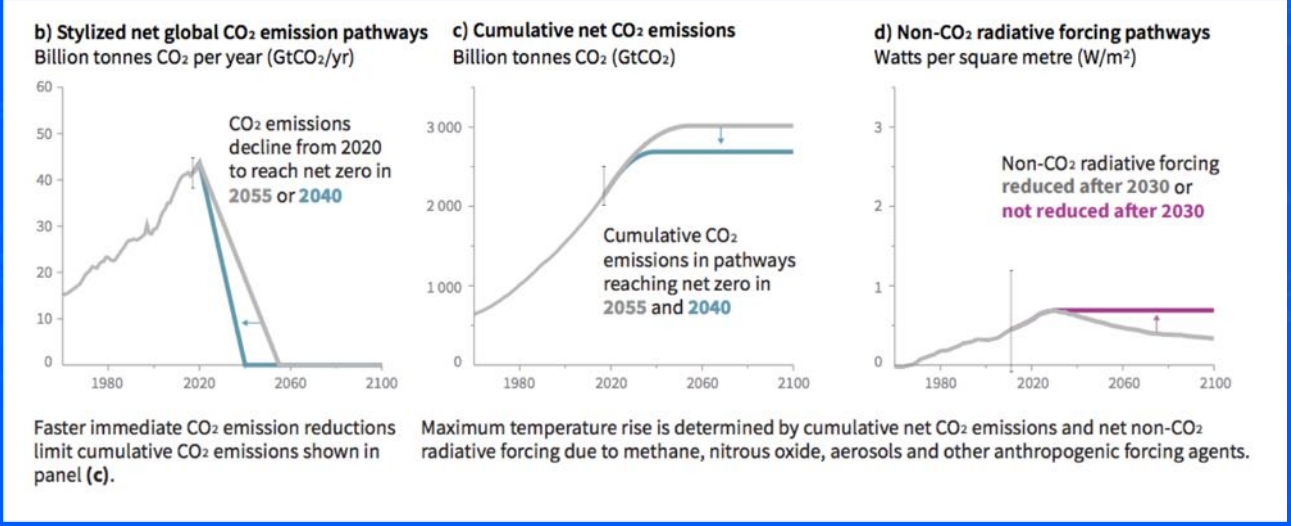
Ch2 - What kind of pathways limit warming to 1.5°C and are we on track?

- ***There is no definitive way to limit global temperature rise to 1.5°C above pre-industrial levels***.
- This Special Report identifies ***two main conceptual pathways***:
  - *Without overshooting*: stabilises global temperature at, or just below, 1.5°C.
  - *With overshooting*: sees global temperature temporarily exceed 1.5°C before coming back down.



Ch2 - What kind of pathways limit warming to 1.5°C and are we on track? (cont.)

- ***Countries' pledges agreed in Paris*** to reduce their ***emissions are currently not in line with limiting global warming to 1.5°C*** (NDCs)
- A world that is consistent with holding warming to 1.5°C would see ***greenhouse gas emissions rapidly decline in the coming decade beyond current NDCs*** (e.g. global net anthropogenic CO_2 emissions decline by about 45% from 2010 levels by 2030 reaching net zero around 2050).



Ch2 - What do energy supply and demand have to do with limiting warming to 1.5°C?

Energy supply

- ***A major reduction in greenhouse gas emissions in all sectors*** (e.g. buildings, industry, transport, energy, and agriculture, forestry and other land use) ***would be required*** *(high confidence)*.
- ***Different sectors are not independent*** of each other and making changes in one can have implications for another.

Energy demand

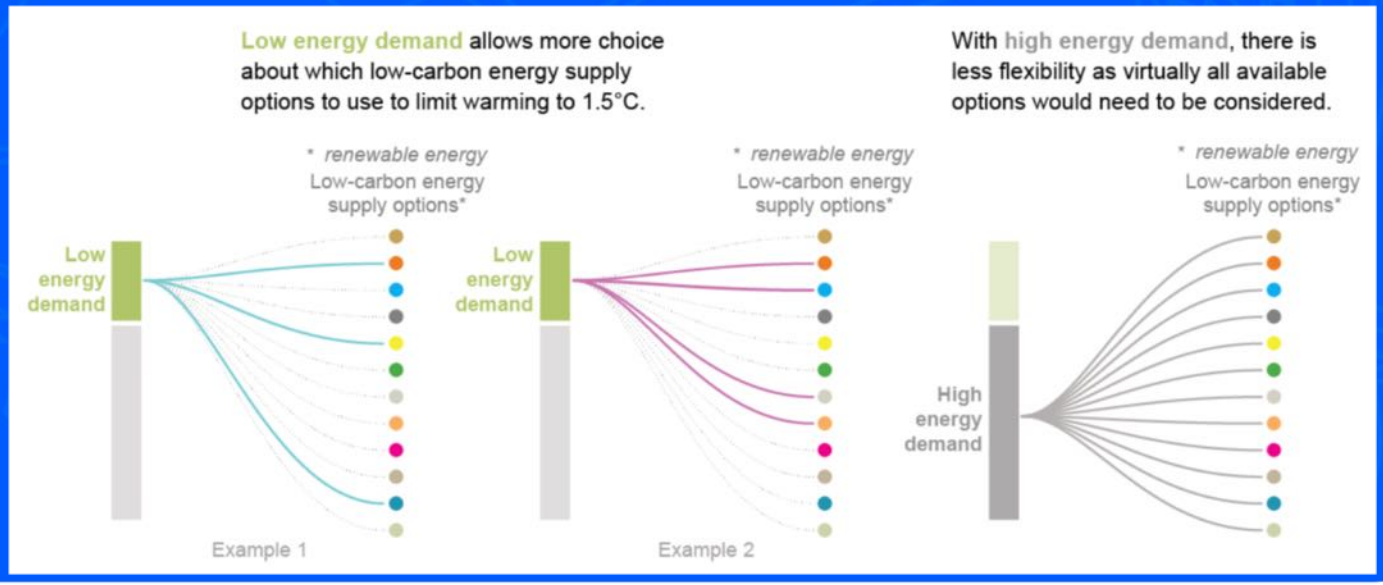
- This category includes ***improving energy efficiency*** in buildings and ***reducing consumption*** of energy and greenhouse-gas intensive products ***through behavioural and lifestyle changes.***

Demand and supply-side measures have to work in parallel with each other

Ch2 - What do energy supply and demand have to do with limiting warming to 1.5°C ? (cont.)

The ***amount of the energy demand will have strong effects on the options to reduce emissions*** *(high confidence):*

- ***high energy demand will determine less flexibility in the choice of mitigation*** options available to limit warming to 1.5°C *(high confidence),*
- ***with lower energy demand, the choice of possible actions will be greater*** and the reliance on practices and technologies that remove CO_2 from the atmosphere will be lower *(high confidence).*



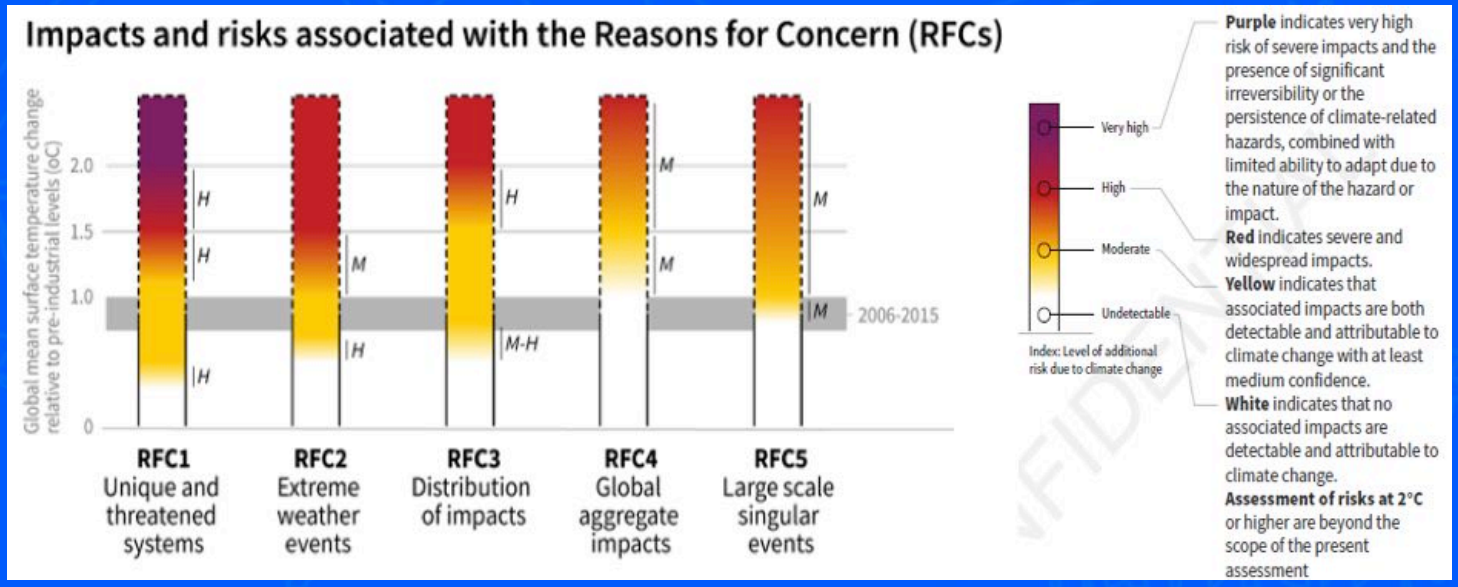
Ch3 - What are the impacts of 1.5°C and 2°C of warming?

- The ***impacts of climate change are not spread uniformly across the globe***, and different parts of the world experience impacts differently *(high confidence)*.
- An average ***warming of 1.5°C across the whole globe raises the risk of*** heatwaves and heavy rainfall events, amongst many other ***potential impacts*** *(high confidence)*.
- ***Limiting warming to 1.5°C rather than 2°C can help reduce these risks***, but ***the impacts will depend on the specific greenhouse gas emission 'pathway'*** taken:
  - ***The impacts of temporarily overshooting 1.5°C*** and returning later in the century ***could be larger*** than if temperature stabilizes below 1.5°C *(high confidence)*.
  - The ***size and duration of an overshoot will also affect future impacts*** *(high confidence)*.

Ch 3 - What are the impacts of 1.5°C and 2°C of warming? (cont.)

At 1.5°C compared to 2°C:

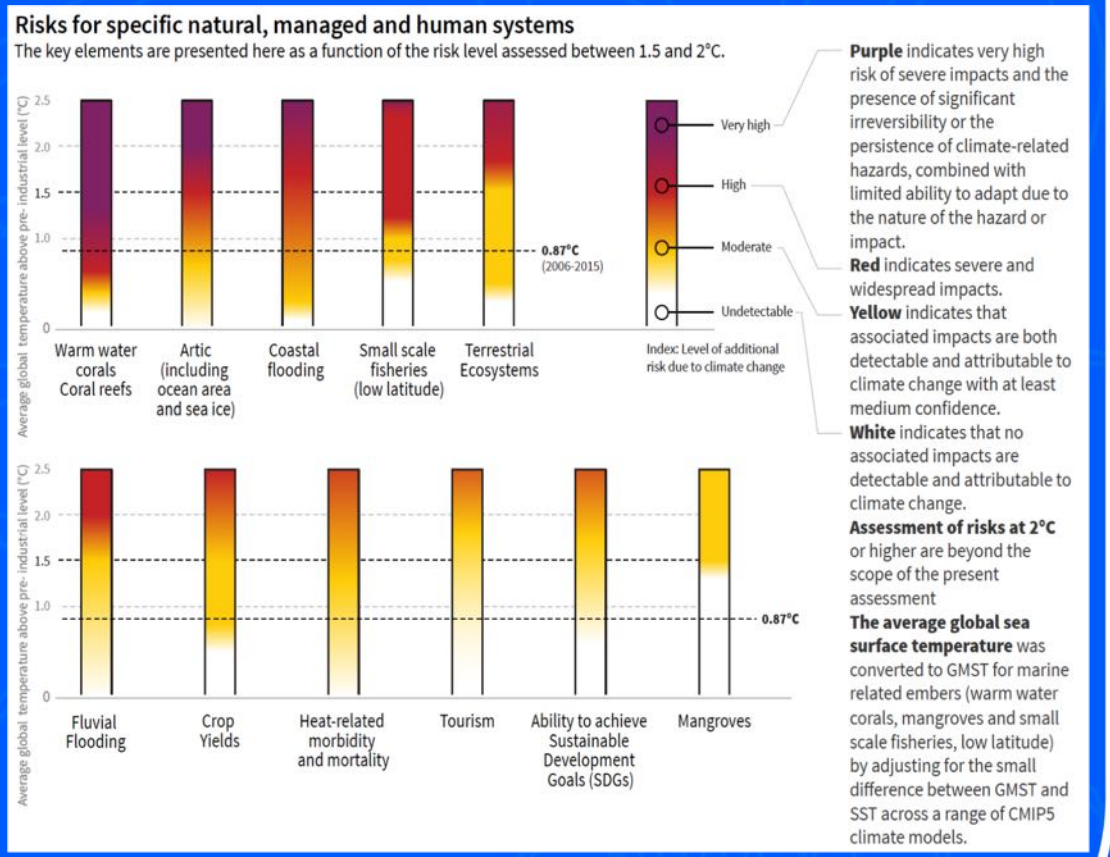
- ***Less extreme weather where people live***, including extreme heat and rainfall *(high confidence)*
- By 2100, ***global mean sea level rise will be around 10 cm lower*** *(medium confidence)* but may continue to rise for centuries *(high confidence)*
- ***10 million fewer people exposed to risk of rising seas*** *(medium confidence)*



Ch3 - What are the impacts of 1.5°C and 2°C of warming? (cont.)

At 1.5°C compared to 2°C:

- ***Lower impact on biodiversity and species*** *(high confidence)*
- ***Smaller reductions in yields of maize, rice, wheat*** *(medium confidence)*
- ***Global population exposed to increased water shortages is up to 50% less*** *(medium confidence)*



Ch4 - What transitions could enable limiting global warming to 1.5°C?

- The ***world would need to transform in a number of complex and connected ways***.
- ***Transitions towards lower greenhouse gas emissions are already underway*** in some cities, regions, countries, businesses and communities, ***but there are few that are currently consistent with limiting warming to 1.5°C***.
- ***Meeting this challenge would require a rapid escalation in the current scale and pace of change***, particularly in the coming decades.
- ***The 'feasibility' of transitions*** (i.e. adaptation and mitigation options or actions) ***requires careful consideration of multiple different factors***.

Ch4 - What transitions could enable limiting global warming to 1.5°C? (cont.)

These factors include:

i. whether natural systems and resources are available to support the various options for transitioning (***environmental feasibility***);

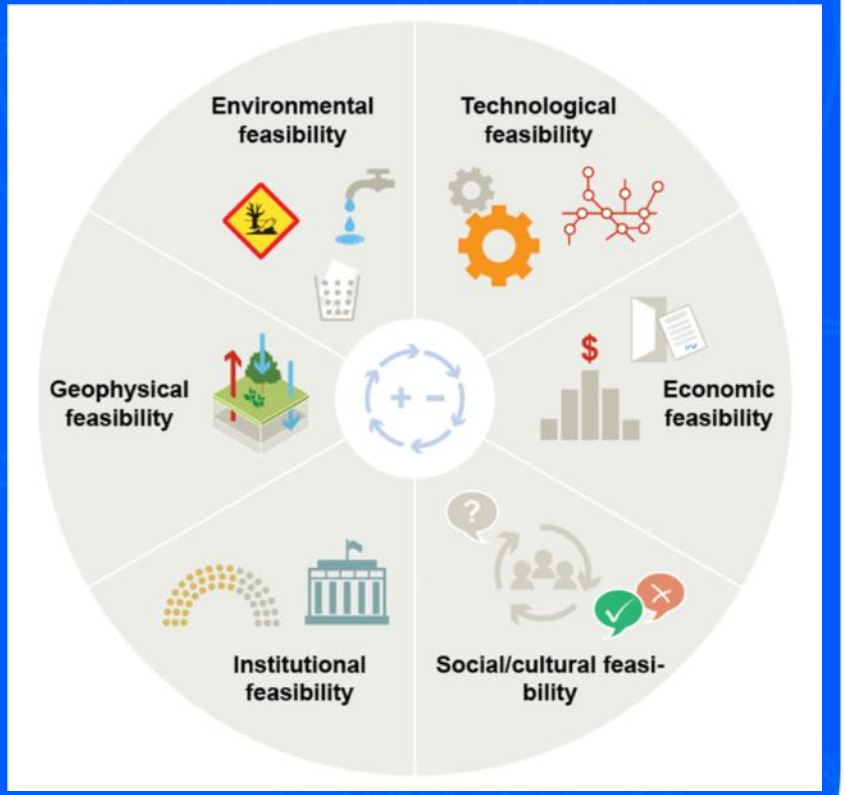
ii. the degree to which the required technologies are developed and available (***technological feasibility***);

iii. the economic conditions and implications (***economic feasibility***);

iv. what are the implications for human behavior and health (***social/cultural feasibility***);

v. governance, institutional capacity and political support (***institutional feasibility***);

vi. capacity of physical systems to carry the option at large-scale (***geophysical feasibility***)

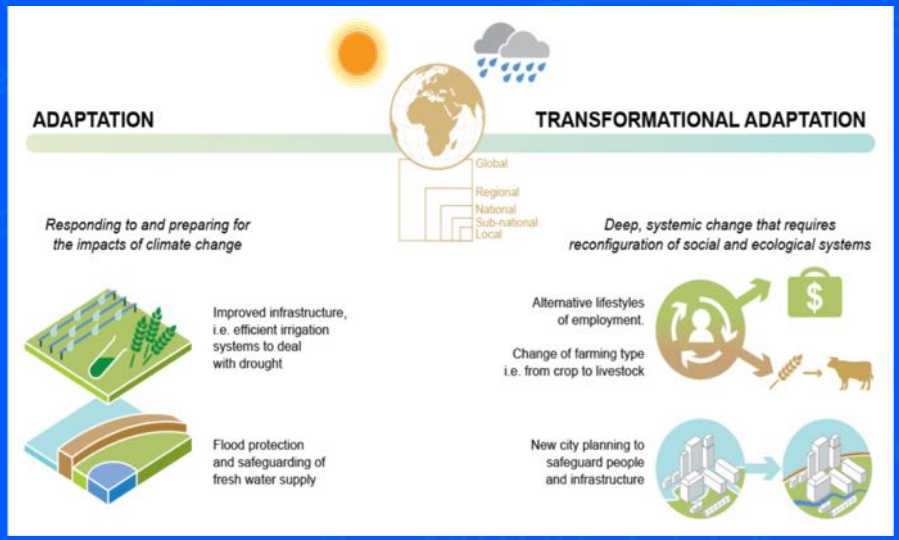


Ch4 - Why is adaptation important in a 1.5°C warmer world?

- Climate change impacts are different across the world, so ***people in different regions are adapting in different ways*** *(high confidence)*.
- ***A rise in global temperature from 1°C to 1.5°C, and beyond, increases the need for adaptation***, but stabilising global temperatures at 1.5°C above pre-industrial levels would require a ***smaller adaptation effort than for 2°C*** *(high confidence)*.
- Despite many successful examples around the world, ***progress in adaptation is, in many regions, in its infancy and unevenly distributed globally***.
- Adaptation is important to reduce the negative impacts from climate change, but ***adaptation measures on their own are not enough to prevent climate change impacts entirely*** *(high confidence).*

Ch4 - Why is adaptation important in a 1.5°C warmer world? (cont.)

- The ***world is already experiencing the impacts of +1°C of global warming and there are many examples of adaptation***: e.g. flood defences, modified crops, new types of insurance.
- An ***increase in global temperature from present day to 1.5°C would increase the need for adaptation***, with:
  - ***individual adaptations*** minimising negative consequences (e.g. switch drought-tolerant crops to deal with increasing risk of heat waves).
  - ***transformational adaptation*** requiring significantly more institutional, structural, and financial support (e.g. moving to a new agricultural system in areas no longer suitable for current practices)

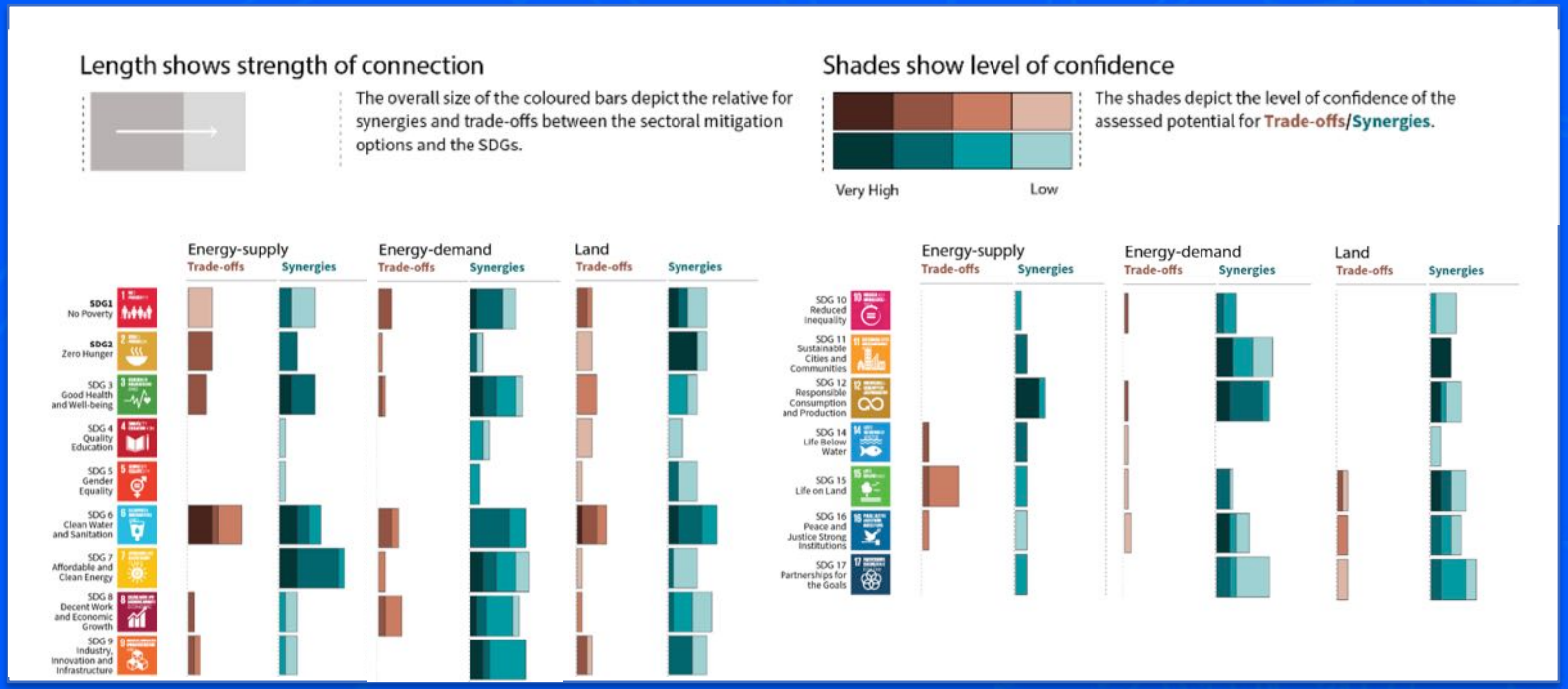


Ch5 - What are the connections between sustainable development and limiting global warming to 1.5°C?

- ***Climate change affects the ability to achieve sustainable development goals*** but ***limiting warming to 1.5°C will help to meet some sustainable development targets*** *(high confidence)*.
- ***Pursuing sustainable development will influence emissions, impacts and vulnerabilities*** *(high confidence)*.
- Responses to climate change in the form of ***adaptation and mitigation will also interact with sustainable development*** with positive effects, known as ***synergies***, or negative effects, known as ***trade-offs*** *(high confidence)*.
- ***Responses to climate change can be planned to maximize synergies and limit trade-offs with sustainable development***.

Ch5 - What are the connections between sustainable development and limiting global warming to 1.5°C? (cont.)

Indicative ***linkages between mitigation and sustainable development*** using SDGs (sustainable development goals)

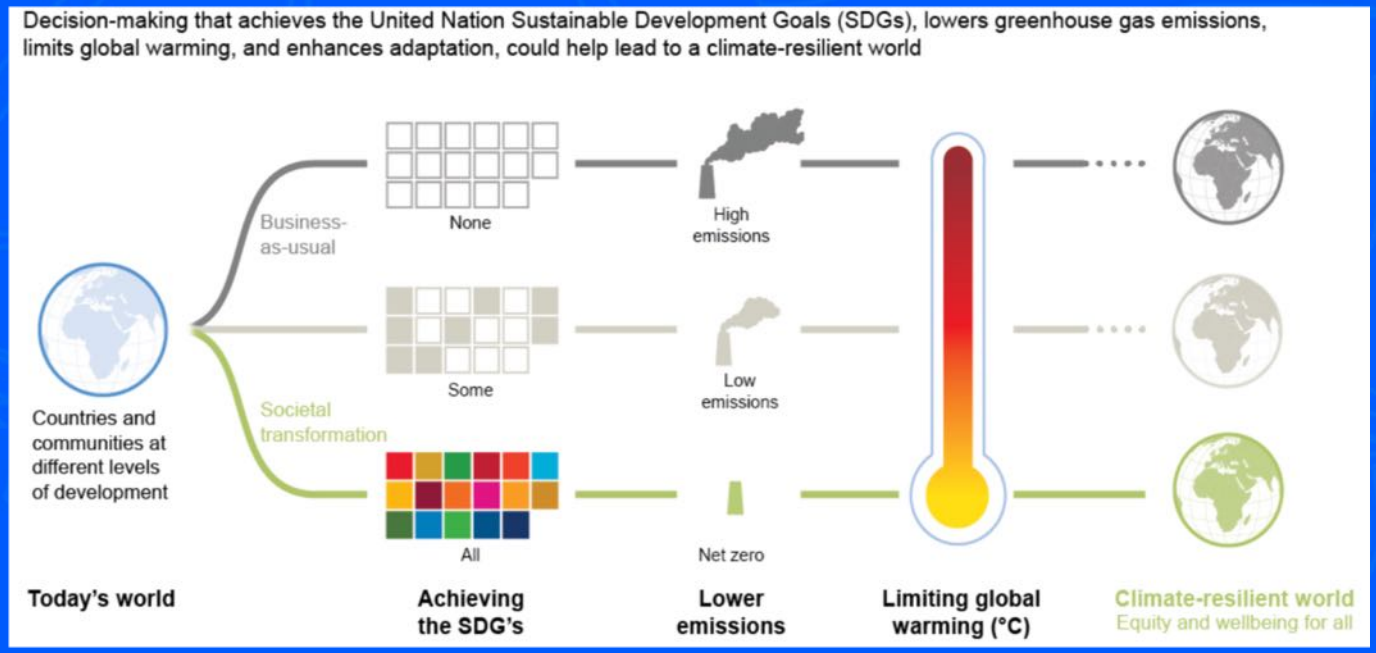


Ch5 - What are the pathways to achieving poverty reduction and reducing inequalities while reaching the 1.5°C world?

- Which ***pathways*** are possible and desirable ***will differ between and within regions and nations***.
- This is due to the fact that ***development progress to date has been uneven and climate-related risks are unevenly distributed***.
- ***Flexible governance would be needed*** to ensure that such pathways are inclusive, fair, and equitable to avoid poor and disadvantaged populations becoming worse off.
- ***'Climate-Resilient Development Pathways' (CRDPs) offer possibilities to achieve both equitable and low-carbon futures***.

Ch5 - What are the pathways to achieving poverty reduction and reducing inequalities while reaching the 1.5°C world? (cont.)

Climate-resilient development pathways (CRDPs) goals are ***to meet SDGs in the short-term***, ***reduce emissions toward net zero*** around the middle of the century, ***limiting global warming*** and ***for leading to a climate resilient world*** paying close attention to equity and well-being for all.



Next steps

- **IPCC's Sixth Assessment Cycle**
  - ***Special Reports:***
    - Global Warming of 1.5ºC (2016-2018)
    - Ocean and Cryosphere in a Changing Climate (2017-2019),
    - Climate Change and Land (2017-2019)
  - ***Assessment Report***
    - AR6 (2018-2022)

SPM word analysis