Transformation, Adaptation and Mitigation for a 1.5 degree Global Warming: Current challenges in climate science and policy

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10TH EDITION OF THE BC3-UPV/EHU SUMMER SCHOOL!
10th Edition of the BC3-UPV/EHU Summer School!

1. IPCC 1.5 Report: background and process
2. SR1.5: Where are we now?
3. What does 1.5C mean compared to 2C?
4. The magnitude of the challenge
1. IPCC 1.5 REPORT: BACKGROUND AND PROCESS

• 2C Climate target

- 1988: the IPCC is created
- 1990: SEI suggests a 2C limit
- 1992: UNFCCC is adopted
- 1996: EU Council of Environmental Ministers declared the 2C as the limit
- 1997: Kyoto Protocol is adopted
- 2010: Cancun Agreements: countries commit to limit temperatures to 2C

Source: Nordhaus (1977)
1. IPCC 1.5 REPORT: BACKGROUND AND PROCESS

- What about the 1.5°C target?
  - First mentioned in the COP16 Cancun Agreements (2010)
- Review of the long-term global goal (LTGG)
  - From 2013 to 2015
  - Process: Structured expert dialogue
  - Report presented in Bonn in May 2015

1. “In some regions and vulnerable ecosystems, high risks are projected even for warming above 1.5°C”
2. “Buffer zone” instead of “guardrail”.
3. “‘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’”
1. IPCC 1.5°C REPORT: BACKGROUND AND PROCESS
1. This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
1. IPCC 1.5C REPORT: BACKGROUND AND PROCESS

• Paris Agreement: UNFCCC invites the IPCC to prepare a Special Report on 1.5C (known as SR1.5):
  ▪ Impacts of climate change above 1.5C compared to pre-industrial levels
  ▪ Related emission pathways to limit global temperatures to 1.5C
  ▪ IPCC outline (2016) includes links to sustainable development and poverty eradication.
• IPCC team: 91 authors from 44 countries
• IPCC SR1.5 published in October 2018
2. SR15: WHERE ARE WE NOW?

Before going ahead...

1. How much has the temperature increased since the pre-industrial era?

2. What is the current concentration of CO2 in the atmosphere?

3. At current warming rates, temperatures are expected to reach 1.5°C by...?
Go to **www.menti.com** and use the code 33 90 96

1. **Grab your phone**
2. **Go to www.menti.com**
3. **Enter the code 33 90 96 and vote!**
2. SR15: WHERE ARE WE NOW?

2014 ha sido el año más caluroso desde que empezaron los registros. 2015 fue el año más cálido desde que arrancaron los registros.

2016 fue el año más caluroso del que se tiene constancia. 2017 ha sido el segundo año más caluroso desde que empezaron los registros. 2018 es el cuarto año más cálido en la historia moderna de la Tierra.

- El balance de la Organización Meteorológica Mundial destaca que en los últimos 22 años se han batido 20 récords de temperaturas elevadas.

Source: El País, La Vanguardia
1. OBSERVED CHANGES
In the last 650,000 years, CO2 concentration has not exceeded 300 ppm.

~411 ppm (May 2019)
2. SR15: WHERE ARE WE NOW?

Source: FAQ 1.2, Figure 1. Chapter 1, IPCC SR15 (2018)
"Climate models project robust differences in regional climate between present-day and global warming up to 1.5°C, and between 1.5°C and 2°C (high confidence)." (Ch. 3, pp. 177).

### 3. WHAT DOES 1.5°C MEAN COMPARED TO 2°C?

<table>
<thead>
<tr>
<th></th>
<th>1.5°C</th>
<th>2°C</th>
<th>2°C IMPACTS</th>
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</thead>
<tbody>
<tr>
<td><strong>EXTREME HEAT</strong></td>
<td>14%</td>
<td>37%</td>
<td>2.6x WORSE</td>
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<tr>
<td>Global population exposed to severe heat at least once every five years</td>
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<tr>
<td><strong>SEA-ICE-FREE ARCTIC</strong></td>
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<tr>
<td>Number of ice-free summers</td>
<td>At least 1 every 100 years</td>
<td>At least 1 every 10 years</td>
<td>10x WORSE</td>
</tr>
<tr>
<td><strong>SEA LEVEL RISE</strong></td>
<td>0.40m</td>
<td>0.46m</td>
<td>.06m MORE</td>
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<tr>
<td>Amount of sea level rise by 2100</td>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>SPECIES LOSS: VERTEBRATES</strong></td>
<td>4%</td>
<td>8%</td>
<td>2x WORSE</td>
</tr>
<tr>
<td>Vertebrates that lose at least half of their range</td>
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<tr>
<td><strong>SPECIES LOSS: PLANTS</strong></td>
<td>8%</td>
<td>16%</td>
<td>2x WORSE</td>
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<tr>
<td>Plants that lose at least half of their range</td>
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<tr>
<td><strong>SPECIES LOSS: INSECTS</strong></td>
<td>6%</td>
<td>18%</td>
<td>3x WORSE</td>
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<tr>
<td>Insects that lose at least half of their range</td>
<td></td>
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</tbody>
</table>

Source: World Resources Institute
### 3. WHAT DOES 1.5°C MEAN COMPARED TO 2°C?

#### ECOSYSTEMS
- Amount of Earth’s land area where ecosystems will shift to a new biome
  - **1.5°C**: 7%
  - **2°C**: 13%
  - **2°C IMPACTS**: 1.86x WORSE

#### PERMAFROST
- Amount of Arctic permafrost that will thaw
  - **1.5°C**: 4.8 MILLION KM²
  - **2°C**: 6.6 MILLION KM²
  - **2°C IMPACTS**: 38% WORSE

#### CROP YIELDS
- Reduction in maize harvests in tropics
  - **1.5°C**: 3%
  - **2°C**: 7%
  - **2°C IMPACTS**: 2.3x WORSE

#### CORAL REEFS
- Further decline in coral reefs
  - **1.5°C**: 70–90%
  - **2°C**: 99%
  - **2°C IMPACTS**: UP TO 29% WORSE

#### FISHERIES
- Decline in marine fisheries
  - **1.5°C**: 1.5 MILLION TONNES
  - **2°C**: 3 MILLION TONNES
  - **2°C IMPACTS**: 2x WORSE

Source: World Resources Institute
3. WHAT DOES 1.5C MEAN COMPARED TO 2C?

Economic impacts of 1.5C and 2C
(Change in annual per capita GDP growth)

Source: Pretis et al., 2018. Uncertain impacts on economic growth when stabilizing global temperatures at 1.5°C or 2°C warming. Philosophical Transactions of the Royal Society A 376, 20160460; Infographic from Carbon Brief.
3. WHAT DOES 1.5°C MEAN COMPARED TO 2°C?

In other words...

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, such as the loss of the Greenland ice sheet or warm water coral reefs.

Hans-Otto Pörtner
Co-Chair, WGII
Incheon, 8 October 2018
4. THE MAGNITUDE OF THE CHALLENGE

“Limiting warming to 1.5°C is possibly within the laws of chemistry and physics but doing so would require unprecedented changes.”

Jim Skea, Co-Chair of IPCC Working Group III

Source: FAQ 2.1, Figure 1. Chapter 2, IPCC SR15 (2018)
4. THE MAGNITUDE OF THE CHALLENGE

In pathways limiting global warming to 1.5°C with no or limited overshoot as well as in pathways with a high overshoot, CO₂ emissions are reduced to net zero globally around 2050.
4. THE MAGNITUDE OF THE CHALLENGE

2100 WARMING PROJECTIONS
Emissions and expected warming based on pledges and current policies

Warming projected by 2100

- Baseline: 4.1 – 4.8°C
- Current policies: 3.1 – 3.5°C
- Optimistic policies: 3.0°C
- Pledges & Targets: 2.7 – 3.0°C
- 2°C consistent: 1.6 – 1.7°C
- 1.5°C consistent: 1.3°C
4. THE MAGNITUDE OF THE CHALLENGE

In summary, if we want to avoid higher risks...

"Urgent and far-reaching" action is needed:

• Global carbon emissions need to decrease by 45% by 2030; in 2050 emissions need to be net zero.

• We need transitions that are ethical and just, that align with the SDGs and poverty eradication policies.

• Achieving a 1.5C scenario is not impossible, but it “would require transformative systemic change, integrated with sustainable development” (IPCC SR1.5, p. 315).

• The required systemic change needs to go hand by hand with adaptation, including transformational adaptation (especially with overshooting).
• Every bit of warming matters
• Every year matters
• Every choice matters
ESKERRIK ASKO!
Climate is Changing