The 1.5°C Temperature Limit

A Better Climate for Growth, Development and Food Security

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1.5°C Science update

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The Climate Spiral

Global temperature change (1850–2016)

2016

HadCRUT4 Baseline: 1850–1900

http://www.climate-lab-book.ac.uk
2016 – A truly extreme year in terms of temperature records

- 2015 was about 1°C warmer than pre-industrial levels
- According to NASA, August 2016 was the 11th monthly temperature record in a row
- It seems very likely that 2016 will be a new record year
Long term temperature limits vs short term natural variability

Source: http://data.giss.nasa.gov/gistemp/
Long term temperature limits vs short term natural variability

- Long-term temperature limits are understood as **annual averages of at least 20 years** to account for natural variability.
- Natural variability can lead to individual years (or month) well above the long term average.

Source: http://data.giss.nasa.gov/gistemp/
Individual years in a long term 1.5°C pathway may temporarily exceed 1.5°C.

1.5°C scenarios

°C above pre-industrial

- 1.5°C scenario long-term mean
- Additional natural variability

Own Analysis based on [http://data.giss.nasa.gov/gistemp/](http://data.giss.nasa.gov/gistemp/)
2016 estimates well within the range of natural variability projected by IPCC models
Observed 2016 record temperatures and the 1.5°C warming limit

• 2016 temperature records in line with our scientific understanding of long term warming trends and natural variability

• Observed 2016 temperatures do not question the feasibility of the 1.5°C long term warming limit
Energy system transformations required for limiting warming to below 1.5°C by 2100...

- Requires the same technologies and transformations in the energy system as holding warming to below 2°C during the 21st century
- Decarbonisation of the energy system needs to be faster and more pronounced.
Characteristics of 1.5°C pathways compared to 2°C

- Substantial increase in near term action (until 2030)
- Coal phase-out over the next decades
- Needs to tackle also difficult sectors such as transportation and buildings

The long-term global temperature goal in the Paris Agreement (Article 2)

“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”
New Science on the Paris Agreement temperature goal including the 1.5°C limit

Science and policy characteristics of the Paris Agreement temperature goal

• Perspective piece in Nature Climate Change by Climate Analytics scientists out in July 2016 provides overview of on scientific implications of Paris Agreement, 1.5°C vs. 2°C impacts, mitigation pathways
1.5°C vs 2°C – Steep rise in occurrence of hot temperature extremes

- Near doubling between occurrence probability of 1-in-1000 day temperature extremes
- Unusual heat waves would become the new normal in tropical regions at 2°C (Russo et al. 2016)
1.5°C vs 2°C – Robust increase in extreme precipitation on the global level

- Intensity increase by about 5% compared to 1986-2005 under 1.5°C compared to 7% under 2°C
- Above global average in South Asia, where extreme precipitation may intensify by 10% under 2°C

Schleussner et al. (2016)
**1.5°C vs 2°C – Mediterranean ‘Hot Spot’ of drying trend**

Mediterranean annual water availability

- Near doubling in annual water availability reduction relative to 1986-2005 from about 9% under 1.5°C to 17% under 2°C

Schleussner et al. (2016)
1.5°C vs 2°C – Difference decisive for survival of tropical coral reefs

• The majority of coral reefs will be at risk at 1.5°C, but some window for ecosystem adaptation may still exist.

• Loss or fundamental changes to these systems will have profound consequences for ecosystem services and livelihoods depending on them.

Schleussner et al. (2016)
There are discernible differences between climate impacts at 1.5°C and 2°C with tropical regions bearing the brunt of the additional impacts.
Outlook on 1.5°C science for the upcoming IPCC special report

• More science expected to emerge for the IPCC 1.5°C special report in 2018

• Scientific scoping meeting in August 2016, IPCC Plenary in October 2016 will decide on content

• Major scientific efforts under way to improve understanding on differential climate impacts: ‘Half a degree Additional warming, Prognosis and Projected Impacts’ (www.happimip.org)