



**KEYNOTE TALK**  
**Prof.dr. Maarten van Aalst**



Koninklijk Nederlands  
Meteorologisch Instituut  
Ministerie van Infrastructuur en Waterstaat

# *Health in a changing climate*

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UNIVERSITY  
OF TWENTE.





Paris,  
December 2015  
UNFCCC COP21

**Nous trouverons toujours un moyen de vous secourir.  
Mais nous préférons éviter que cela n'arrive.**

Avec le changement climatique, les catastrophes naturelles seront  
de plus en plus nombreuses. Tout comme les personnes à secourir.  
Il est encore temps de changer les choses.





Paris, June 2016



τάχ' ἄν τις εἰκὸς αὐτὸ τοῦτ' εἶναι λέγοι,  
βροτοῖσι πολλὰ τυγχάνειν οὐκ εἰκότα.

Aristotle, *Poetics*

*It is in the very nature of probability that improbable things will happen.*

*But maybe a lot of the “improbable” things that happen are not very improbable in the first place.*



# The Summer of 2023...



Juni: Unprecedented heat in the North-Atlantic Ocean



July: extreme heat from China to Europe to USA



20 July: massive hail in Italy



Northern hemisphere Summer 2023: hottest ever recorded



Violent wildfires in Canada, Greece, Hawaiï



24 July: devastation in Northern Italy, Austria, Slovenia



7 August: Code Red in Norway and Sweden due to Storm Hans



Early September: Mediane Daniël causes devastating floods in Greece and Libia



Netherlands: regional heatwaves in September

NEWS | 08 July 2021

# Climate change made North America's deadly heatwave 150 times more likely

Rising global temperatures probably contributed to a week of record-breaking heat in Canada and the United States.

Quirin Schiermeier



Screenshot

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## Climate change: US-Canada heatwave 'virtually impossible' without warming

By Matt McGrath  
Environment correspondent

8 July | Comments



The searing heat that scorched western Canada and the US at the end of June was "virtually impossible" without climate change, say scientists.

In their study, the team of researchers says that the deadly heatwave was a one-in-a-1,000-year event.



## Germany's deadly floods were up to 9 times more likely because of climate change, study estimates

By Angela Dewan, CNN  
Updated 0930 GMT (1730 HKT) August 24, 2021



Flooding in July damaged the main road leading through the Ahr river valley in Germany.

London (CNN) — Record rainfall that triggered deadly floods in Western Europe in July was made between 1.2 and 9 times more likely by human-caused climate change, according to a new study.

At least 220 people were killed between July 12 and 15 -- mostly in Germany, though dozens also died in Belgium -- and homes and other buildings were destroyed in flash flooding that followed heavy rainfall. Some parts of the region experienced more rain in a single day than they would typically expect in a whole month.

News & buzz

Meet the 17-year-old swimmer and TikTok star who just won...

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The Seattle Times

IT'S NOT YOUR TYPICAL SCHOOL YEAR. Prepare your family for the return to school.

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## Without climate change, record Pacific Northwest heat wave would have been near impossible, researchers say

July 7, 2021 at 3:00 pm | Updated July 7, 2021 at 5:28 pm



A person uses an umbrella for shade while walking near Pike Place Market on June 29. (Ted S. Warren / AP)

## In a First Study of Pakistan's Floods, Scientists See Climate Change at Work

A growing field called attribution science is helping researchers rapidly assess the links between global warming and weather disasters.



SPiegel Wissenschaft Abonnement Anmelden >

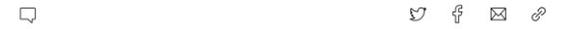
Menu | Klimakrise > Extremwetter: So hoch ist der Anteil des Klimawandels an der Flutkatastrophe

Schnellstudie zu Extremwetter

## So hoch ist der Anteil des Klimawandels an der Flutkatastrophe

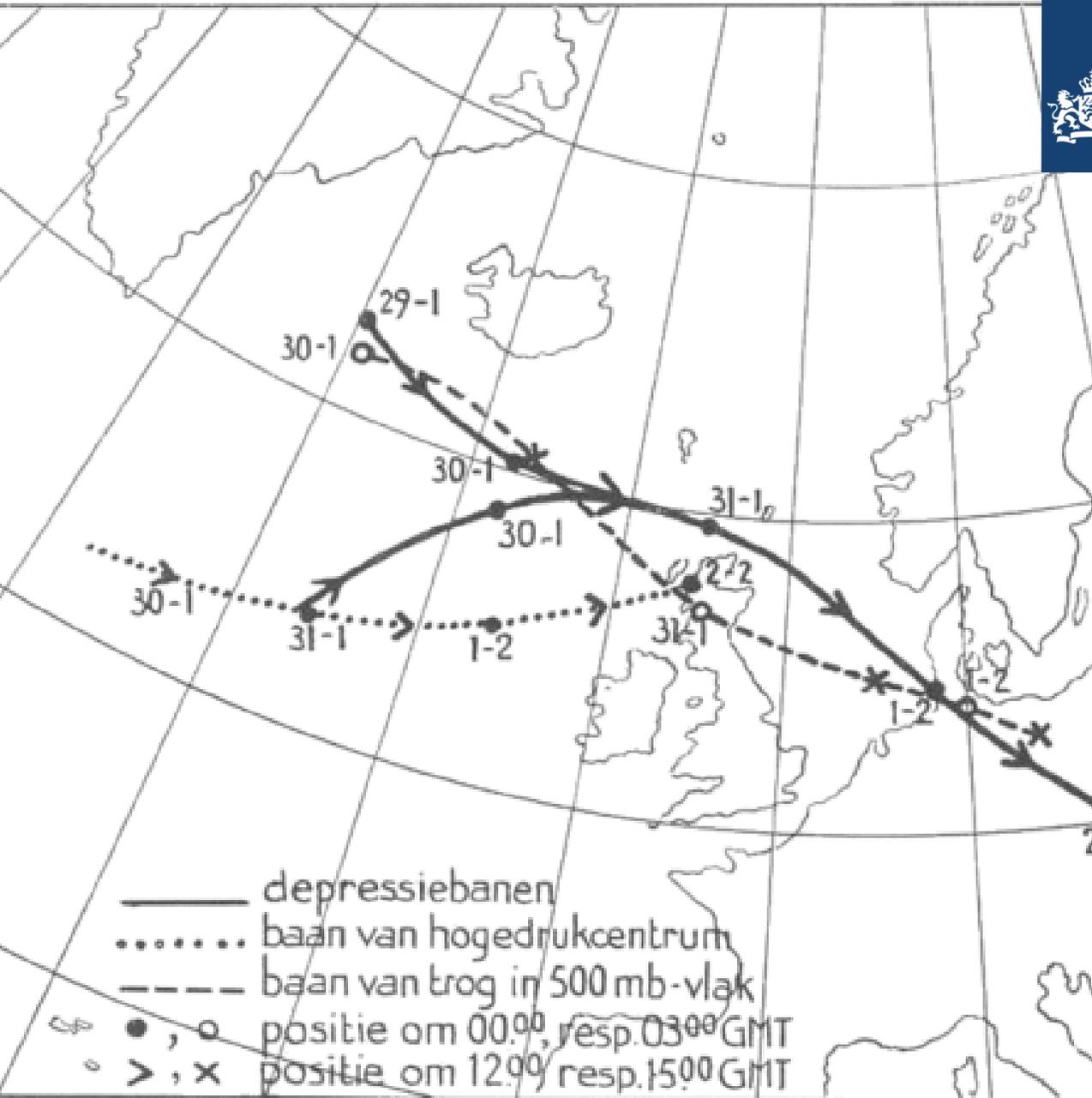
Das Hochwasser an der Ahr war mit hoher Wahrscheinlichkeit ein Klimawandel-Ereignis. Das bestätigen Forscher in einer ersten Schnellstudie. Sie räumen ein, dass der Trend eindeutig, aber die Unsicherheiten groß sind.

Von Susanne Götze  
24.08.2021, 00:24 Uhr





*What were the three most deadly "natural" disasters of the past Century in the Netherlands?*



# Never again?

Maarten van Aalst



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Fig. 1.1.22. Banen der verschillende druksystemen

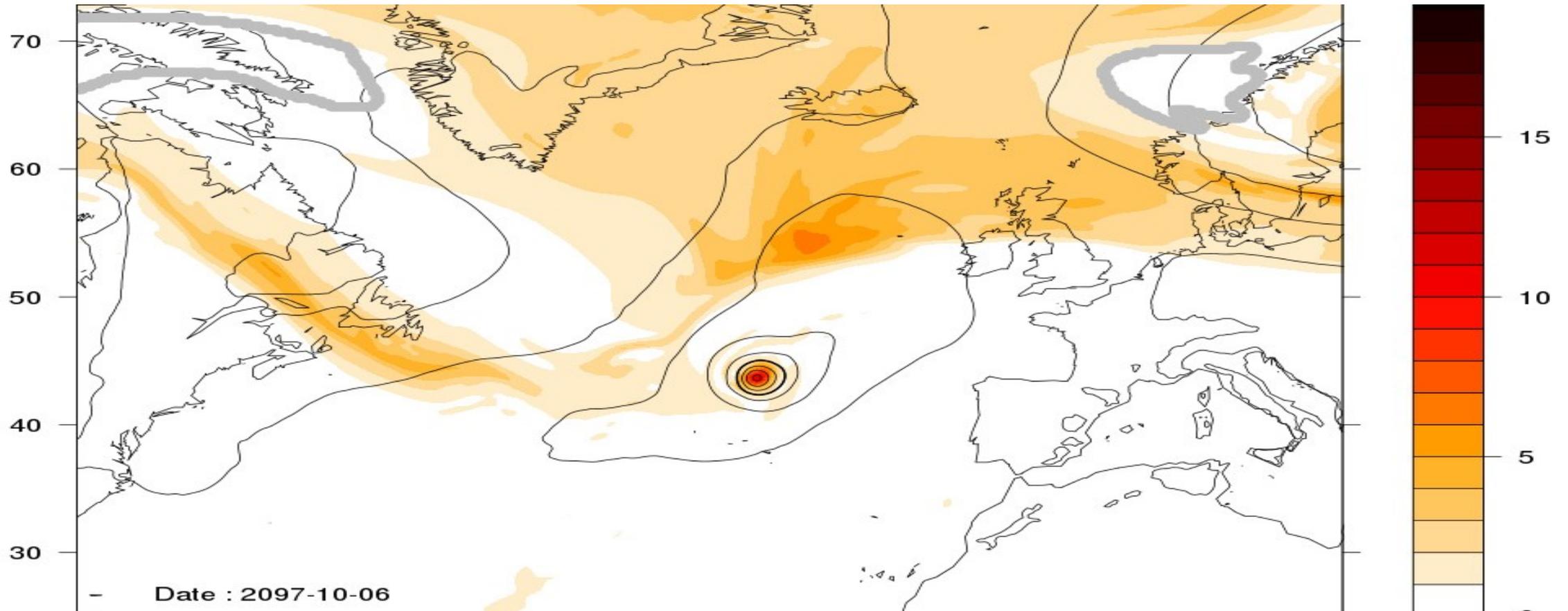


# Storm Ophelia, October 2017





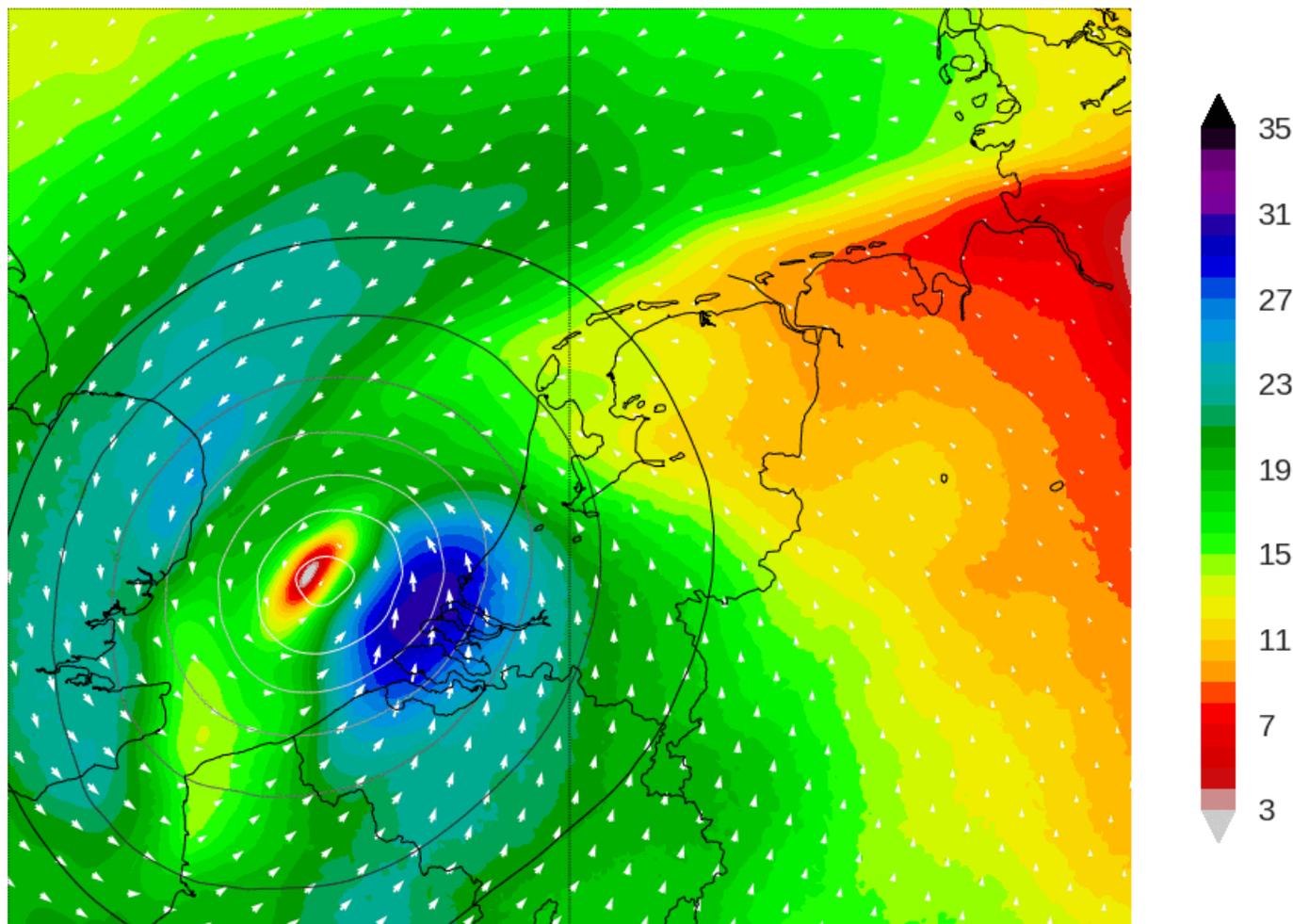
# Future weather – October 2098





# Storm Ophelia heading towards the Netherlands?

Wind speed (t=20171016-00)  
HCLIM38h1\_OPH\_an2017101600\_expb



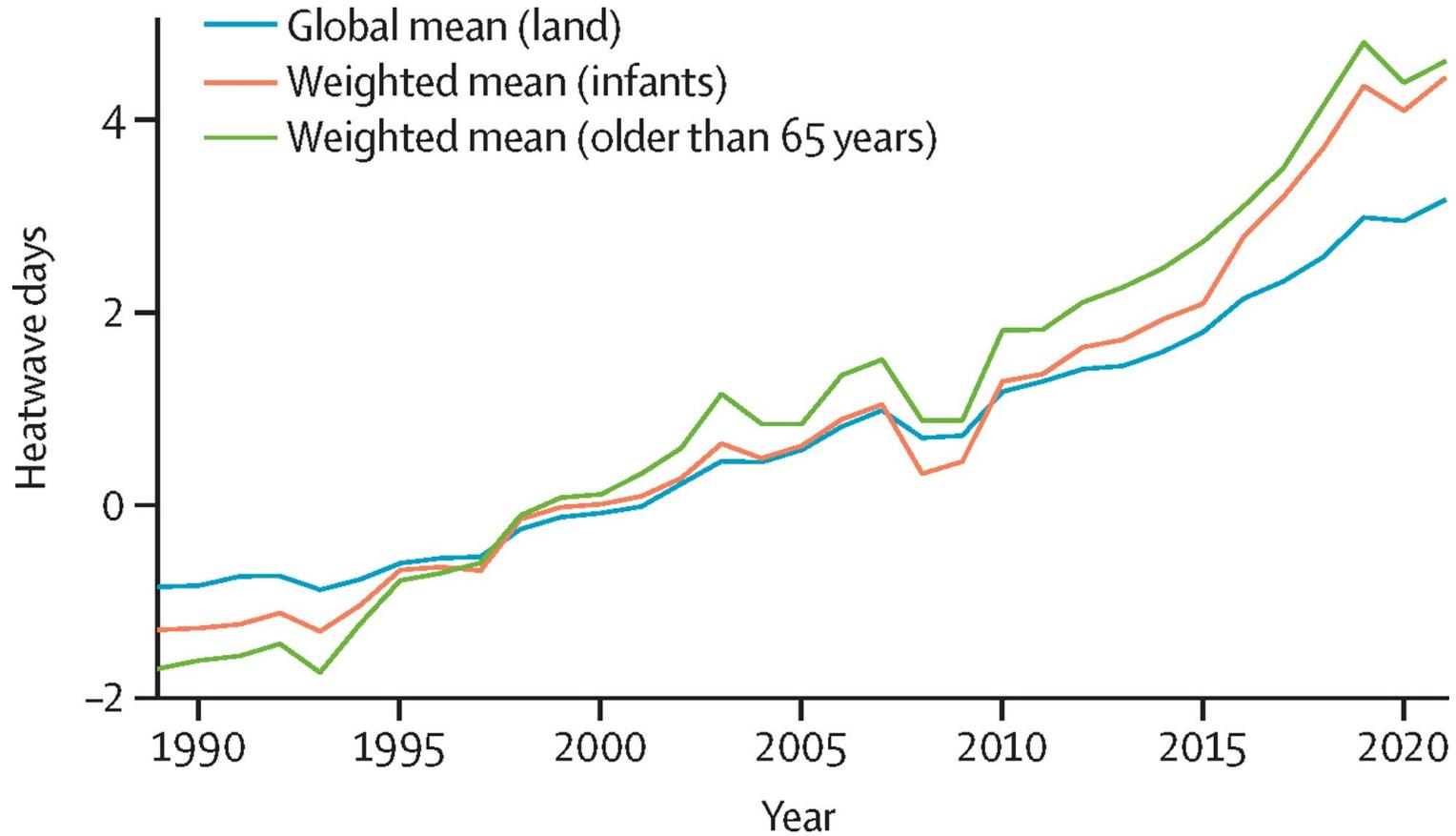


*What were the three most deadly "natural" disasters of the past Century in the Netherlands?*



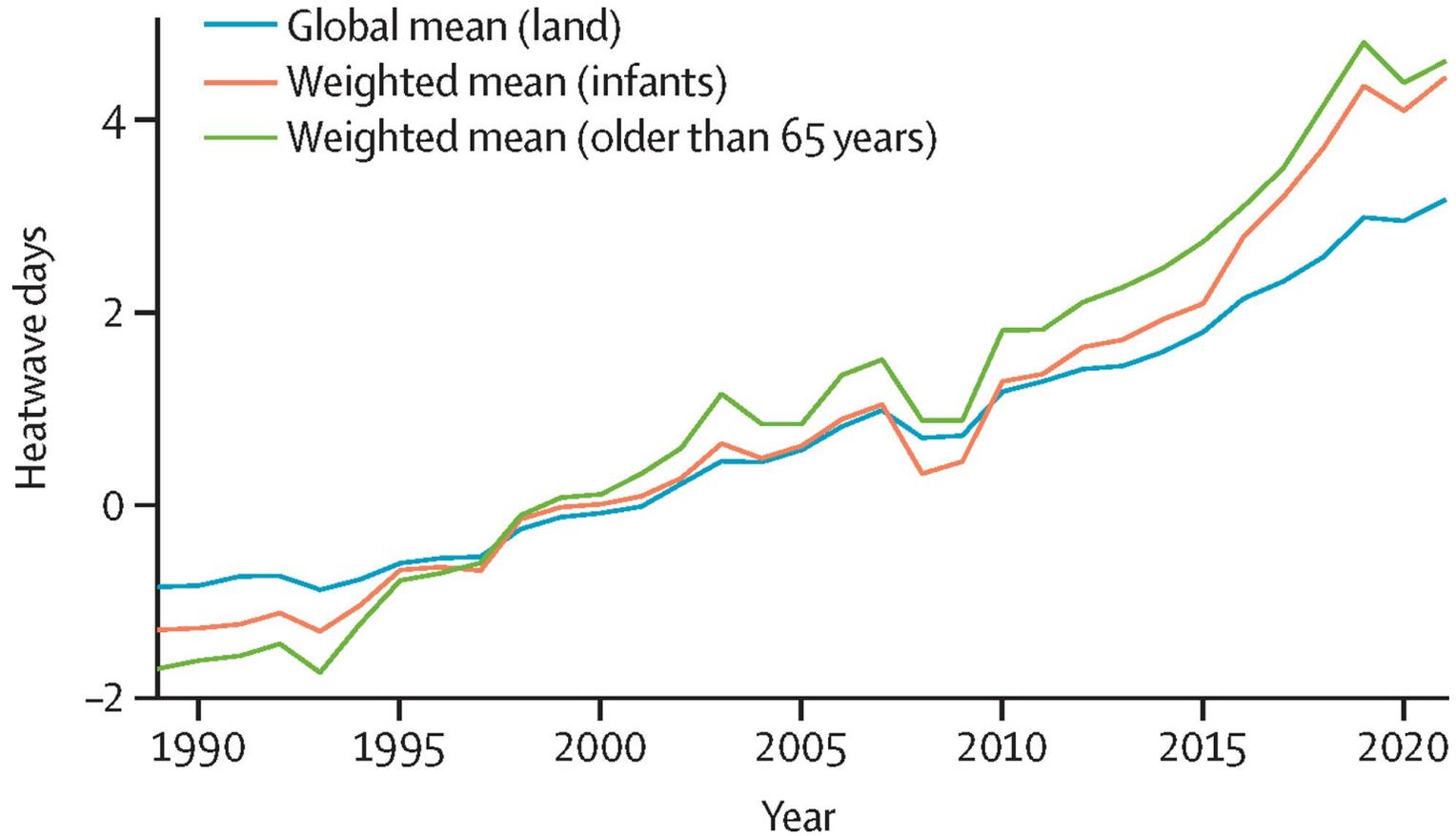
Heat!





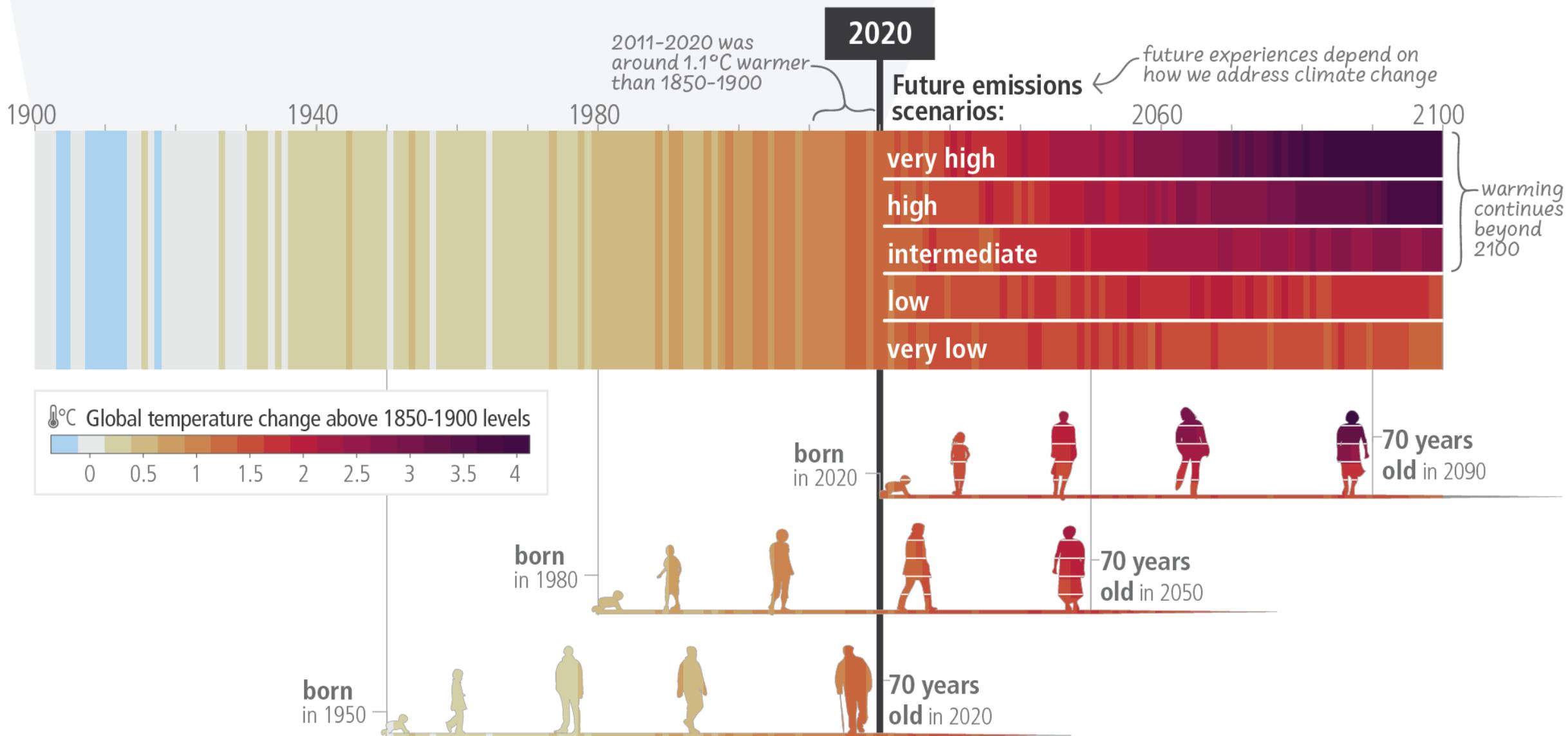
During the period 2012–21, children younger than 1 year experienced 600 million more person-days of heatwaves (4.4 more days per child) annually compared with the average in 1986–2005

Adults older than 65 years experienced 3.1 billion more days (3.2 more days per person) (*Lancet*, 2022)



Exposure to extreme heat is associated with acute kidney injury, heatstroke, adverse pregnancy outcomes, worsened sleep patterns, impacts on mental health, worsening of underlying cardiovascular and respiratory disease, and increases in non-accidental and injury-related deaths (*Lancet*, 2022)

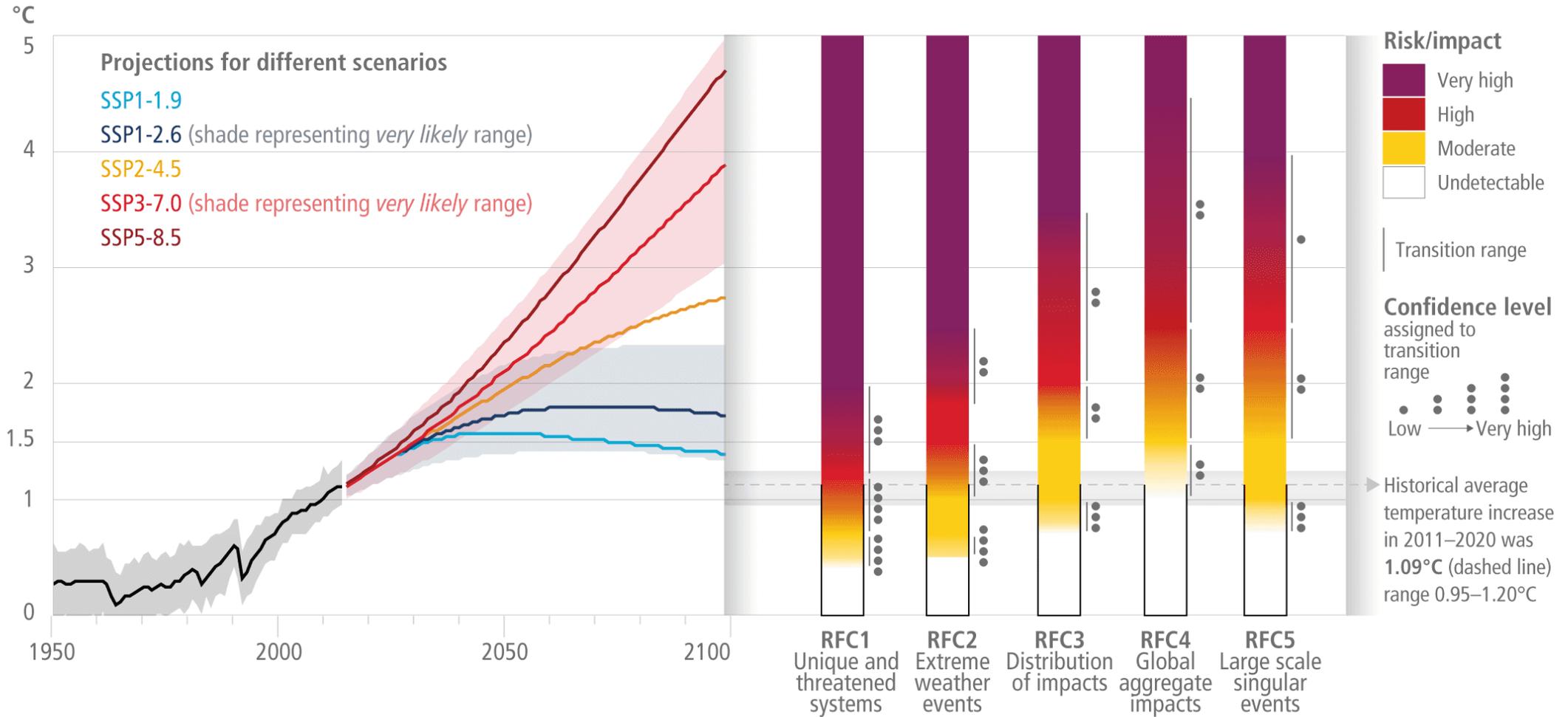
### c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term

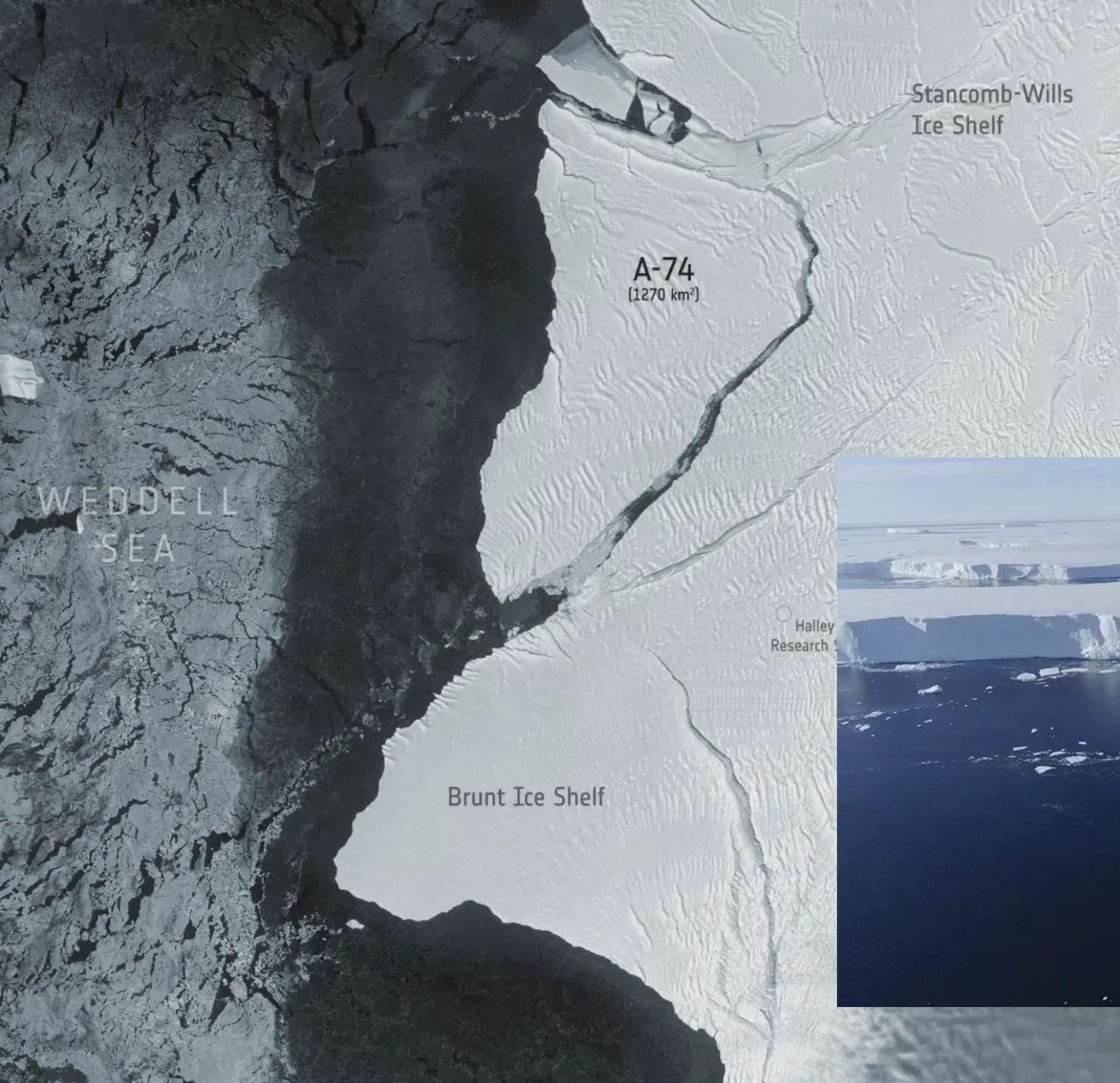


# Global and regional risks for increasing levels of global warming

(a) Global surface temperature change  
Increase relative to the period 1850–1900

(b) Reasons for Concern (RFC)  
Impact and risk assessments assuming low to no adaptation





- > **Thwaites**
- > “the Doomsday glacier”





## IPCC (AR6 WGII ch7)

**Climate-related illnesses, premature deaths, malnutrition in all its forms, and threats to mental health and well-being are increasing (*very high confidence*).**

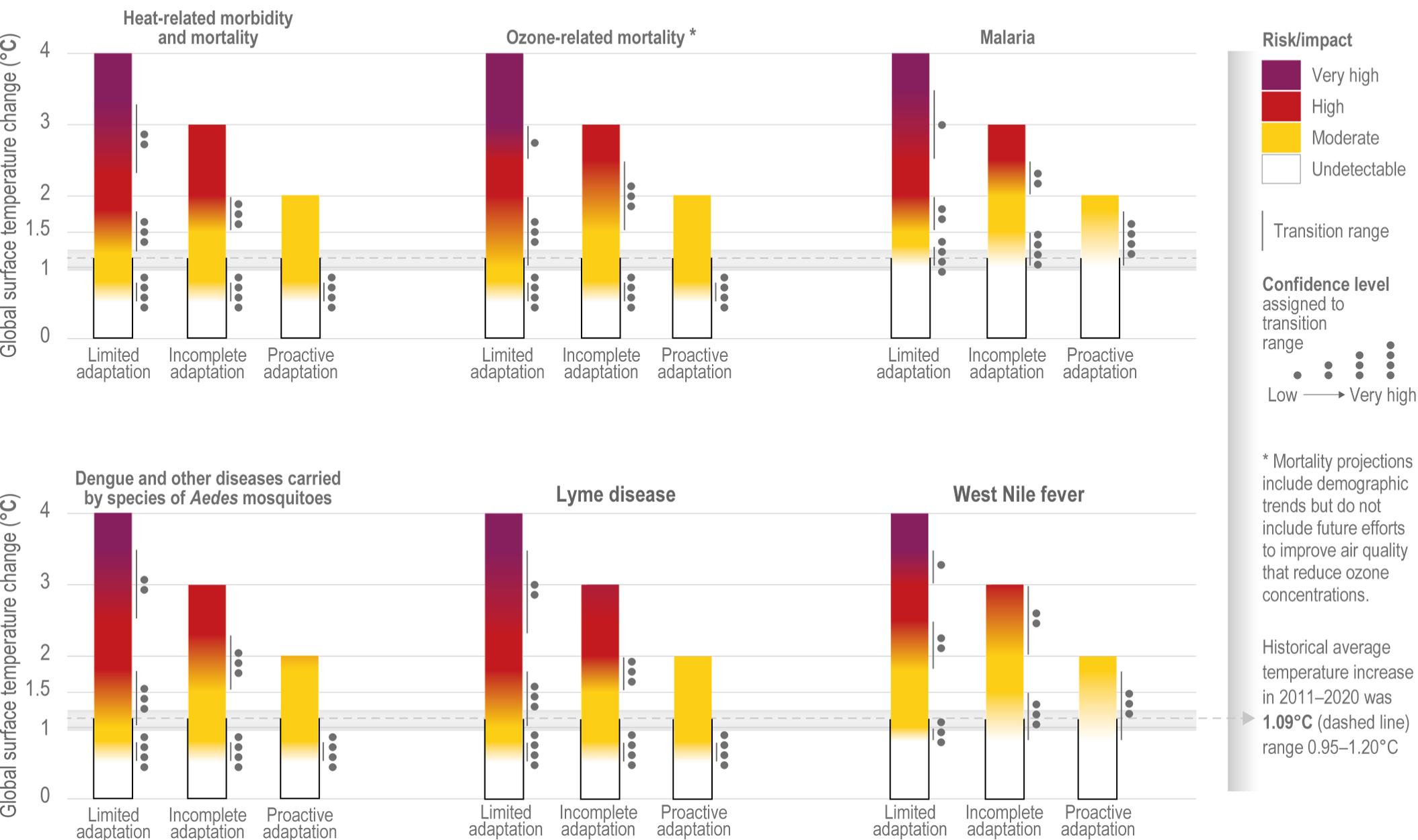
These impacts are often inter-connected, are unevenly distributed across and within societies, and will continue to be experienced inequitably due to differences in exposure and vulnerability (*very high confidence*).

Cascading and compounding risks affecting health due to extreme weather events have been observed in all inhabited regions, and risks are expected to increase with further warming (*very high confidence*)

# Climate sensitive health outcomes under three adaptation scenarios

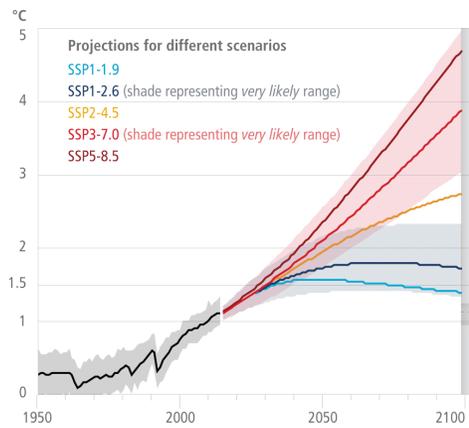
**Scenario narratives**

- Limited adaptation:** Failure to proactively adapt; low investment in health systems.
- Incomplete adaptation:** Incomplete adaptation planning; moderate investment in health systems.
- Proactive adaptation:** Proactive adaptive management; higher investment in health systems

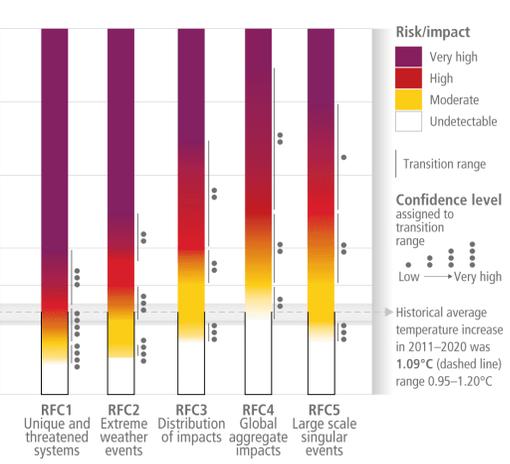


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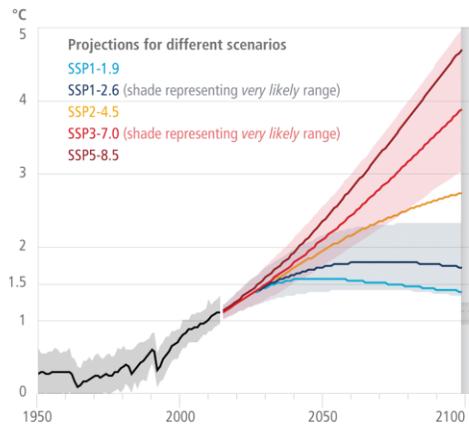


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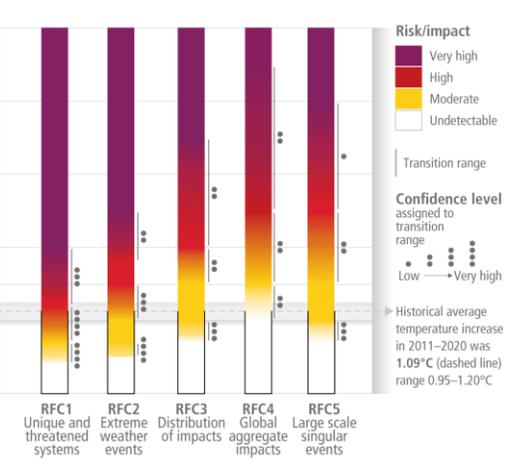


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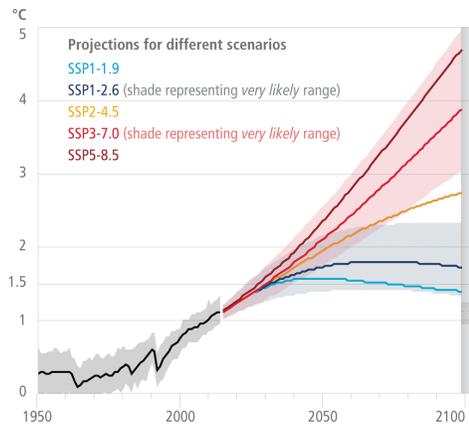


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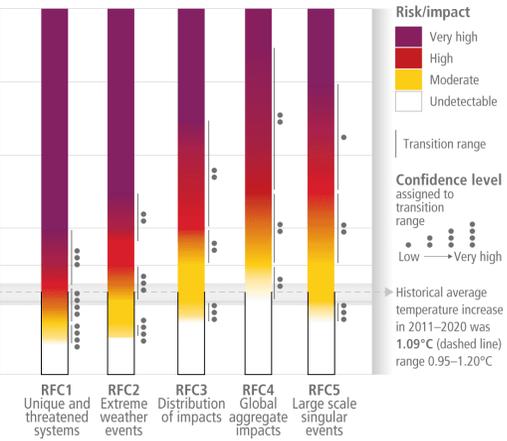


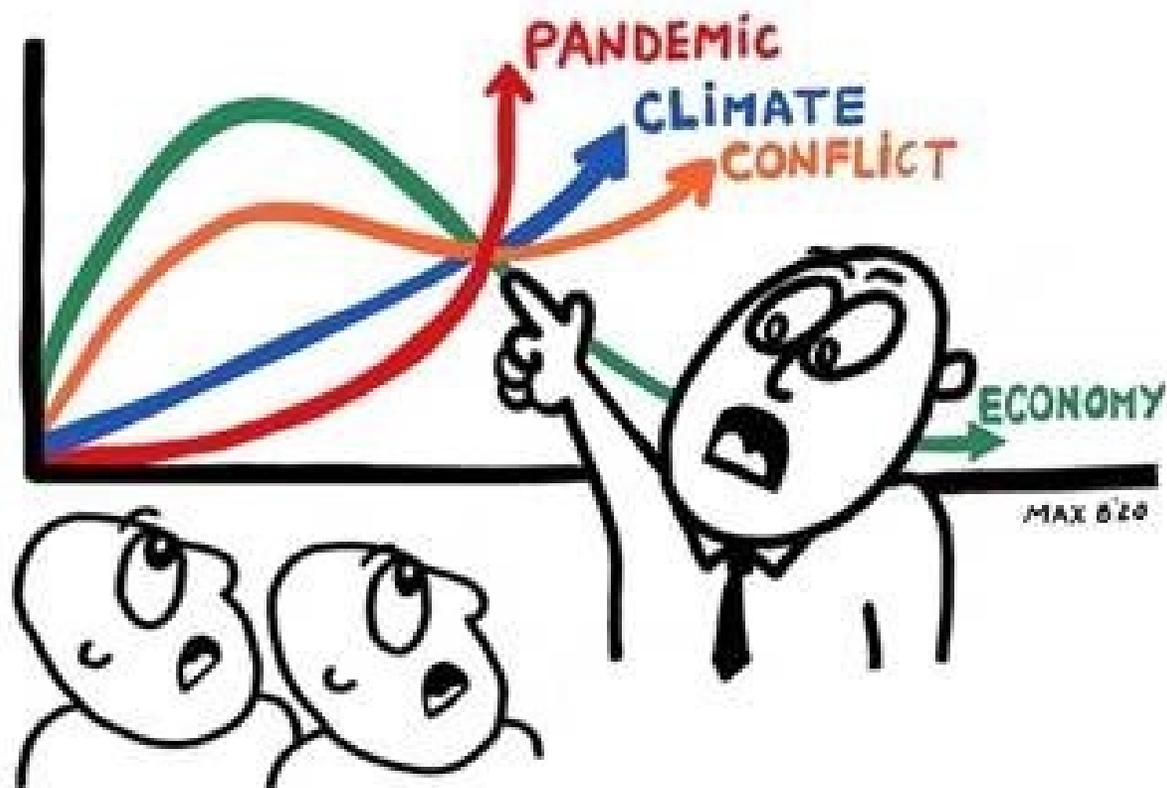
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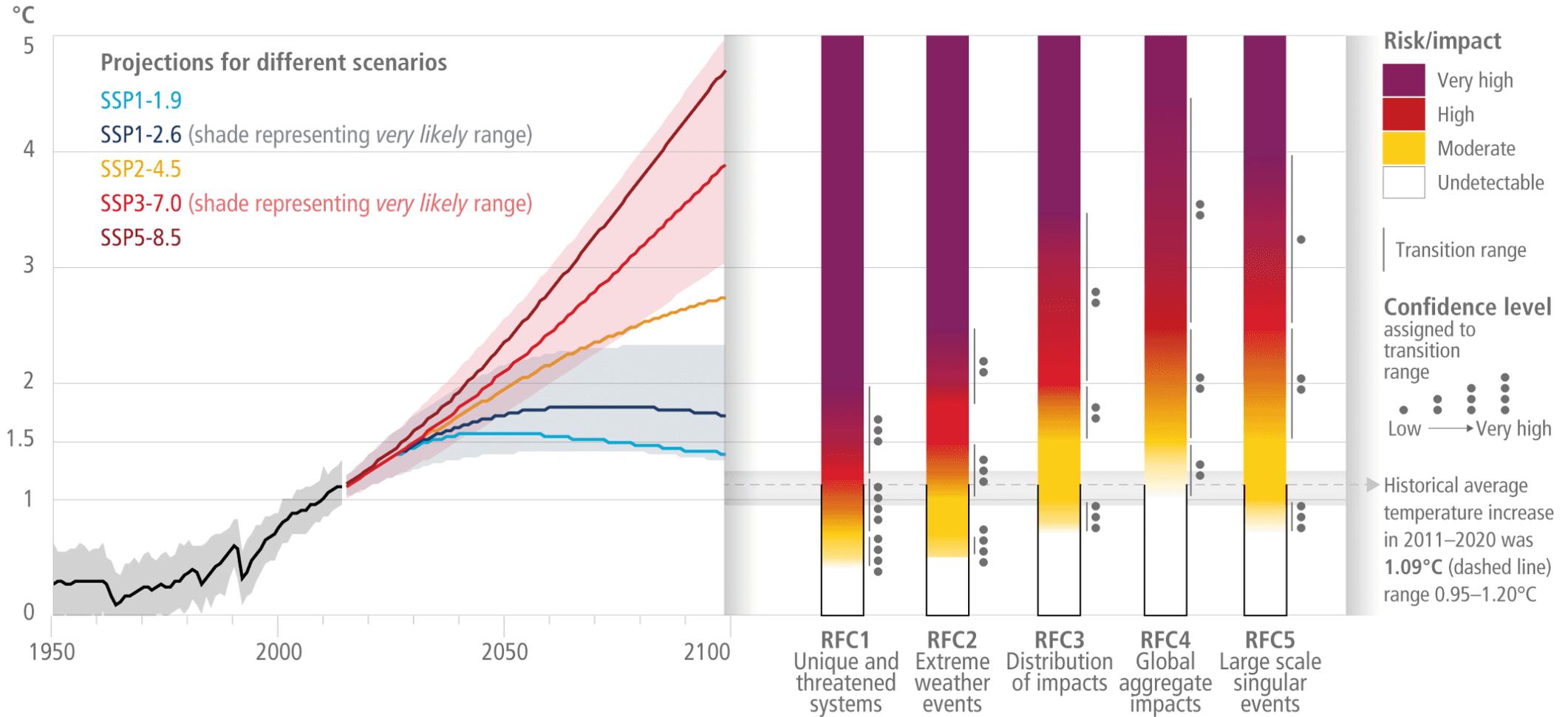


- The disasters are collaborating better than we are!

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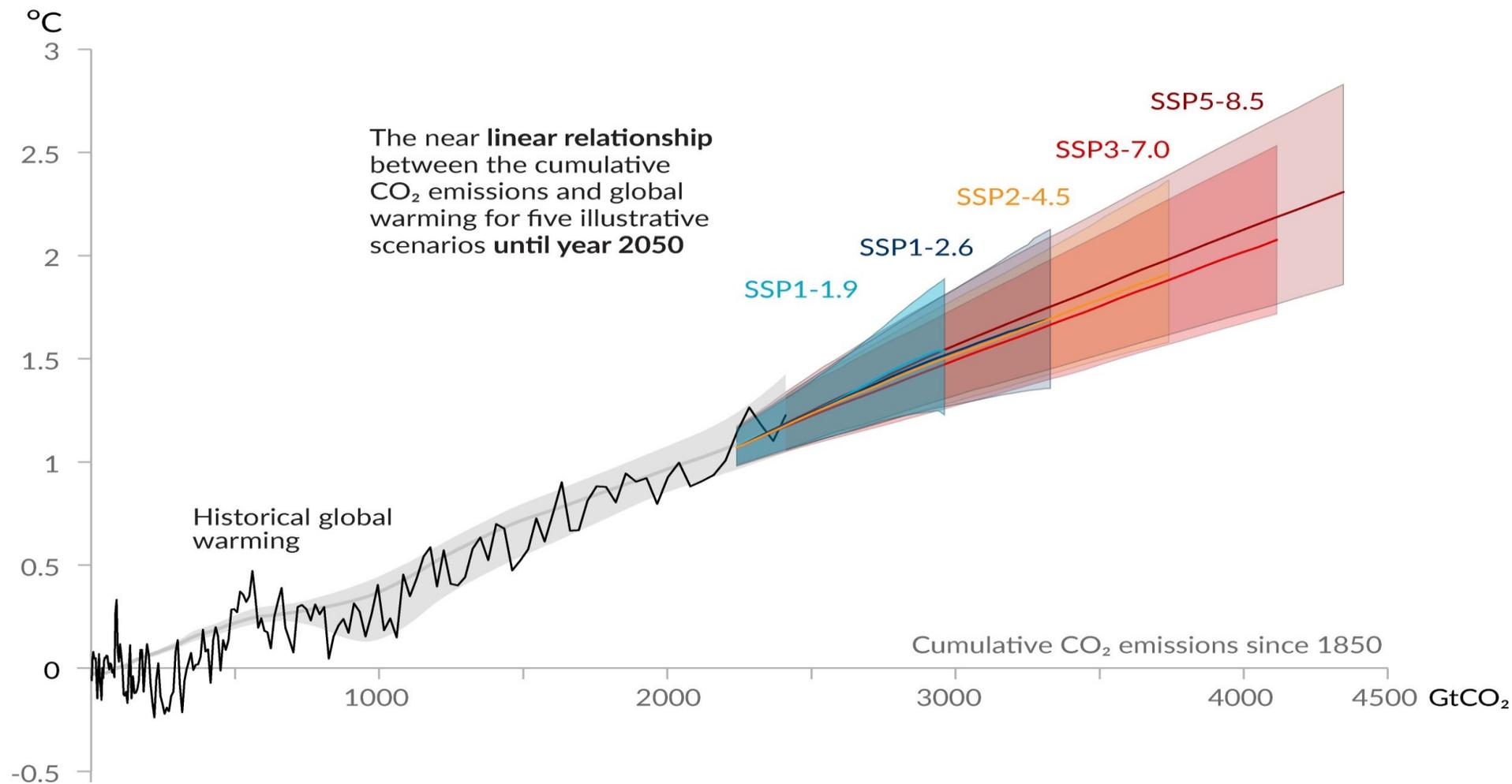
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# Every tonne of CO<sub>2</sub> emissions adds to global warming

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative CO<sub>2</sub> emissions (GtCO<sub>2</sub>)

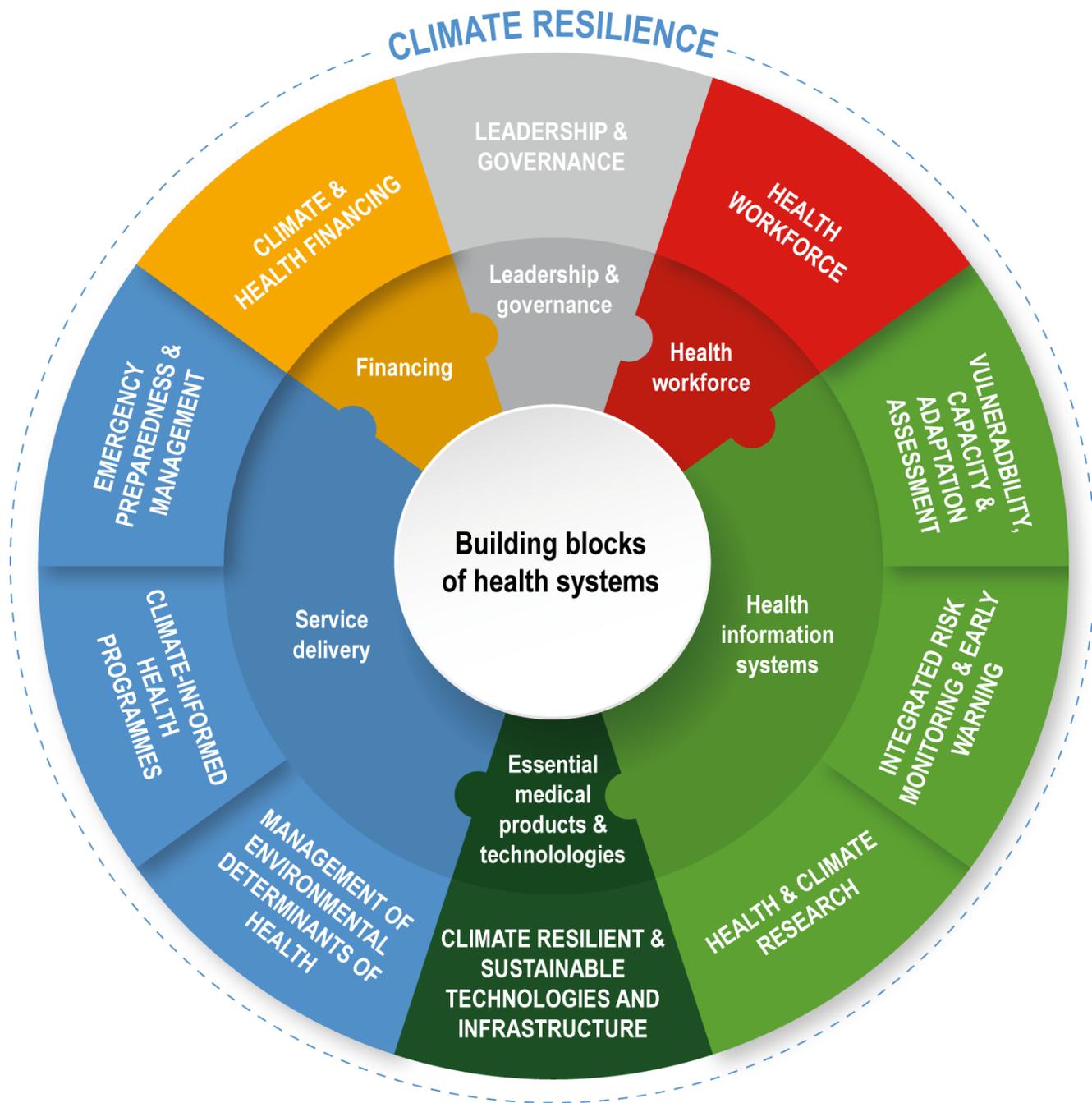




# The global response



- 1 GHG mitigation
- 2 Adaptation
- 3 Loss and Damage
- 4 ?





# Mitigation (greenhouse gases)





What percentage does healthcare contribute to green house gas emissions?



The healthcare sector is responsible for **7 percent** of total GHG emissions in the Netherlands (RIVM, 2022)



# Adaptation





# Loss and Damage





# EARLY WARNINGS FOR ALL

The UN Global Early Warning Initiative for the Implementation of Climate Adaptation



WORLD  
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