8th International Conference on BIG DATA & Data Science for Official Statistics

BILBAO 2024

Informing Climate Change and Sustainable Development Policies with Integrated Data

BILBAO. SPAIN | 10-14 JUNE 2024 | #UNBigData2024

Estimating impacts of climate change on people: HUMAN CLIMATE HORIZONS DATA PLATFORM

ADMIR JAHIC

On behalf of UNDP/HDRO and Climate Impact Lab teams

1990: Concept and Measurement
1991: Financing
1992: Global Dimensions
1993: People's Participation
1994: Human Security
1995: Gender
1996: Economic Growth
1997: Poverty
1998: Consumption
1999: Globalization
2000: Human Rights
2001: New technologies
2002: Democracy
2003: MDGs
2004: Cultural Liberty
2005: Aid, trade and security
2006: Water
2007-8: Climate Change
2009: Human Mobility
2010: Pathways to Human Development
2011: Sustainability and Equity: A Better Future for all
2013: The Rise of the South: Human Progress in a Diverse World
2014: Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience
2015: Work for Human Development
2016: Human Development for Everyone
2018: Human Development Indices and Indicators: Statistical Update
2019: Beyond income, beyond averages, beyond today: inequalities in human development in the 21st Century
2020: The next frontier: Human development and the Anthropocene
2021-2: Uncertain Times, Unsettled Lives: Shaping our Future in Transforming World
2023-4: Breaking the gridlock: Reimagining cooperation in a polarized world

Human Climate Horizons objective:

Providing multidimensional climate risk information of **projected impacts of climate change on people** and human development worldwide.

What could be our potential futures in scenarios of +1.8, +2.7 or higher temperature change?

About Human Climate Horizons

Partnership between UNDP and Climate Impact Lab

A living, modular, open digital public good

Global coverage with over 24,000 subnational regions

3 emission scenarios

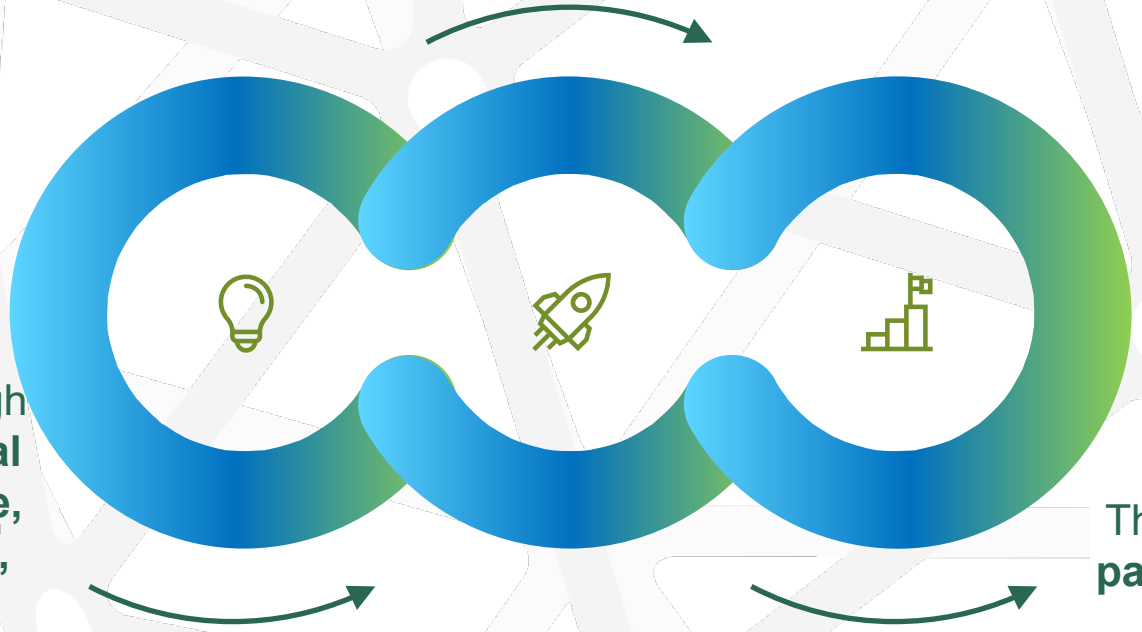
3 time horizons over the entire 21st century

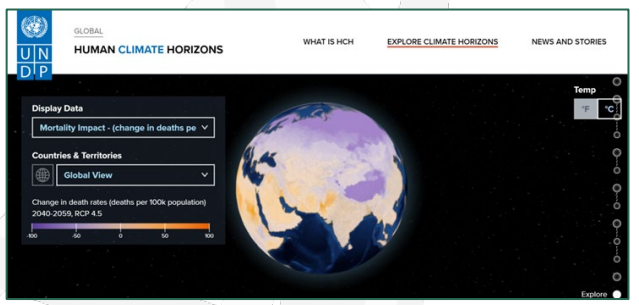
- Expands our understanding of impacts of climate change on human welfare worldwide.
- Shows how our present choices on climate change can shape human development over the century.
- Equips policymakers with the means to understand the potential costs, and gather efforts around mitigation strategies, both locally and globally.
- Enhances agency and empowers individuals and communities to play a role in shaping the path forward.

About HCH data

Using big data analytical tools, they **look for empirical evidence of how climatic conditions–such as abnormally warm summers–affect people and economies** - harm human health; reduce economic activity and labor productivity; and have other effects.

Climate Impact Lab





Scientists comb through **terabytes of historical weather (temperature, tidal gauges), social, population, and economic data** from around the world.

They use these estimates to **quantify the cost of past changes in the climate—and simulate how those impacts are set to grow over time.** With adjustments for projected growth in income and population, future greenhouse gas emissions.

Note: The Shared Socioeconomic Pathways (SSPs) are part of a scenario framework established by the climate change research community to help researchers study plausible pathways for global development. Each of the five SSPs envisions a different baseline scenario for the economic future of the planet over the 21st century in the absence of climate impacts. The Human Climate Horizons platform presents information based on SSP3, which shows the highest population growth and the lowest global Gross Domestic Product (GDP) growth of the five scenarios, and tracks most closely with recent historical observations. The population and income projections are based on data from the International Institute for Applied Systems Analysis SSP Database.

Available indicators

HAZARDS
(from publicly available data including from IPCC)

IMPACT INDICATORS
(modeled using methodologies available at HCH)

DATA RELEASES

2022 RELEASE:

- **Temperature change**
- **Mortality**
  (projected additional deaths due to future climate change per 100k population)
- **Energy demand**
  (mean projected per capita change in electricity or other fuels use)
- **Labour productivity**
  (mean projected change in time spent working due to climate change, expressed in number of hours per worker per year

2023 RELEASE:

- **Sea level rise**

2024 RELEASE:

- Agriculture (crops)

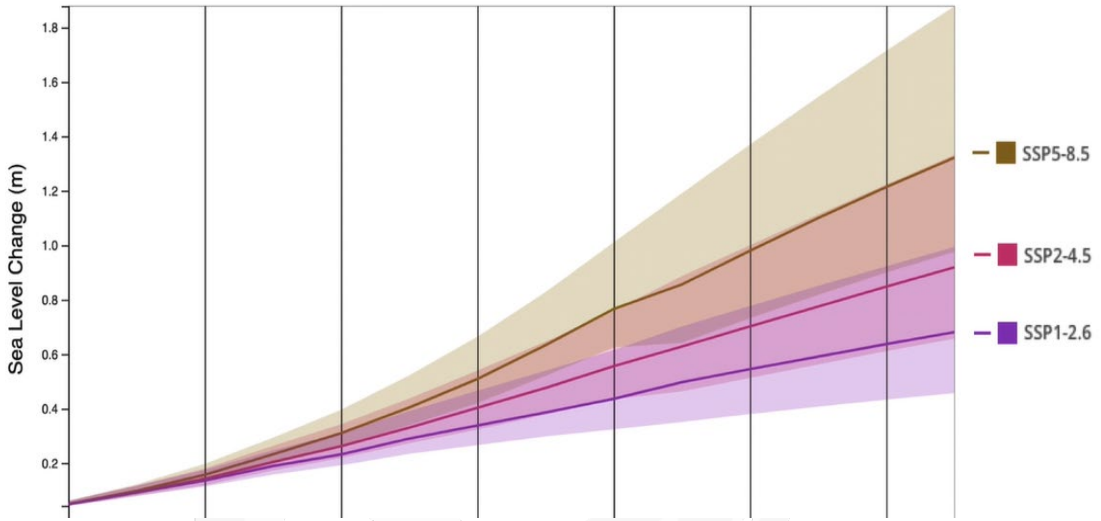
IN ~2 YEARS:

- Migration

Available scenarios

Users can explore median projections along 2 RCPs for temperature (4.5 and 8.5) and 3 SSP pathways for SLR:

- **SSP1-2.6:** where global CO2 emissions are cut severely, reaching net-zero after 2050, and **the average global temperature rise1.8°C by the end of the century.**
- **SSP2-4.5:** where emissions hover around current levels before starting to fall mid-century but do not reach net-zero by 2100, and **temperatures rise 2.7°C by the end of the century.**
- **SSP5-8.5:** where current CO2 emissions levels roughly double by 2050; **temperatures rise 4.4°C by the end of the century.**



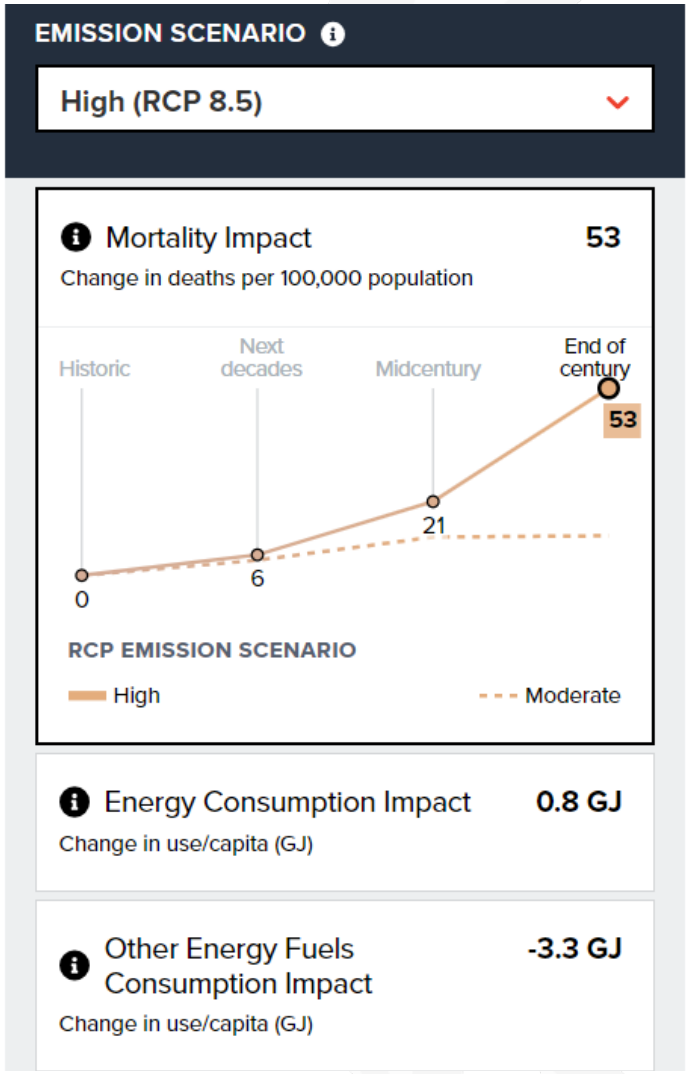
HCH 1.0

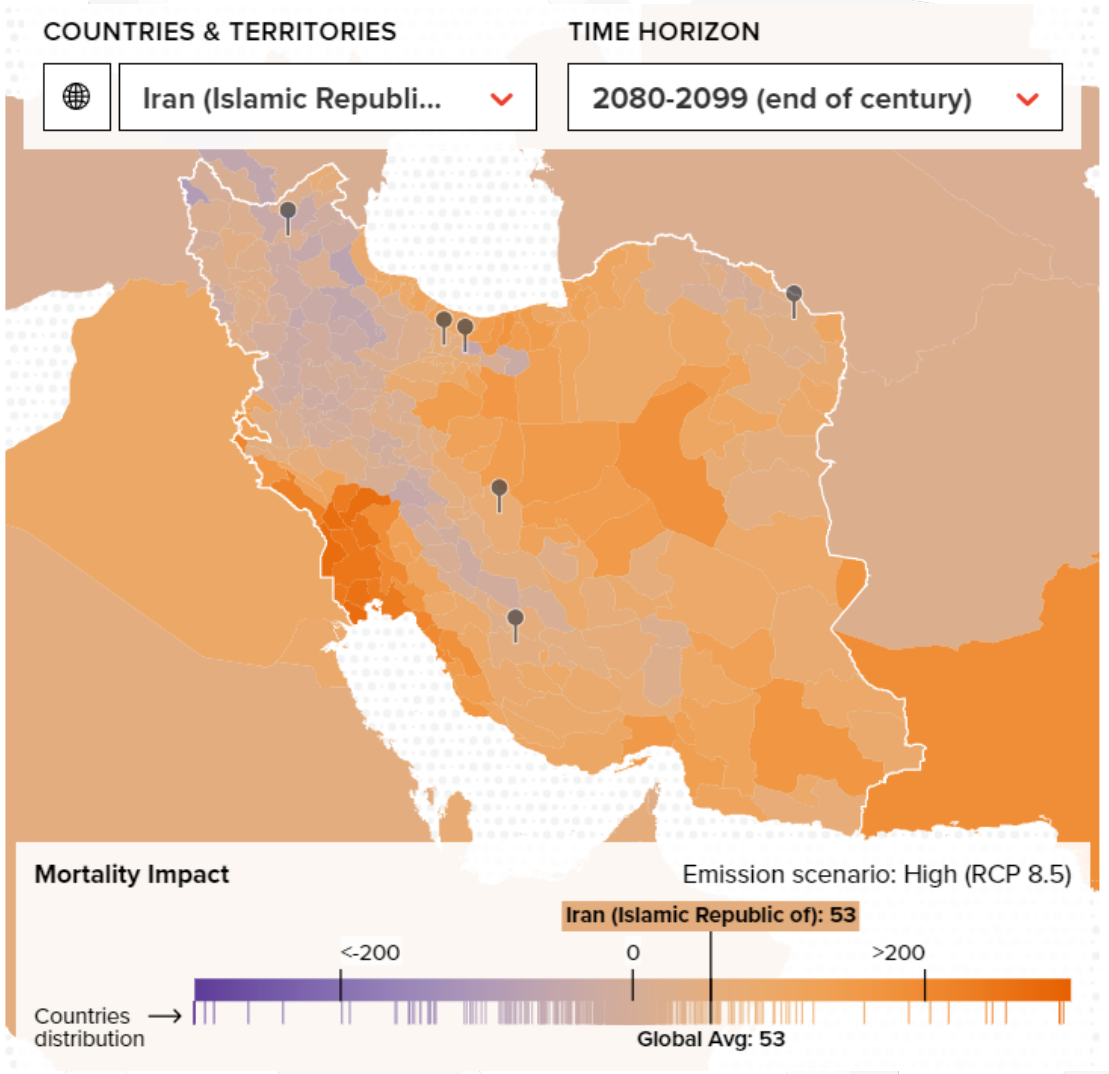
Temperature impacts

Mortality impact

Definition: projected additional deaths due to future climate change per 100k population

Country-level Example: Iran

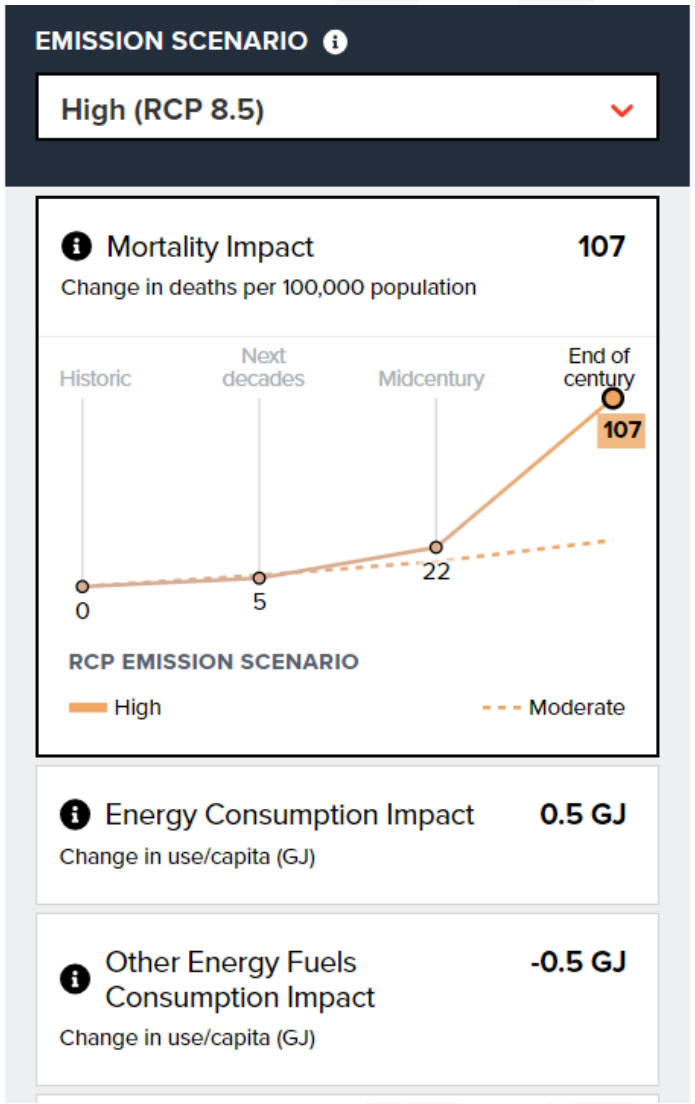


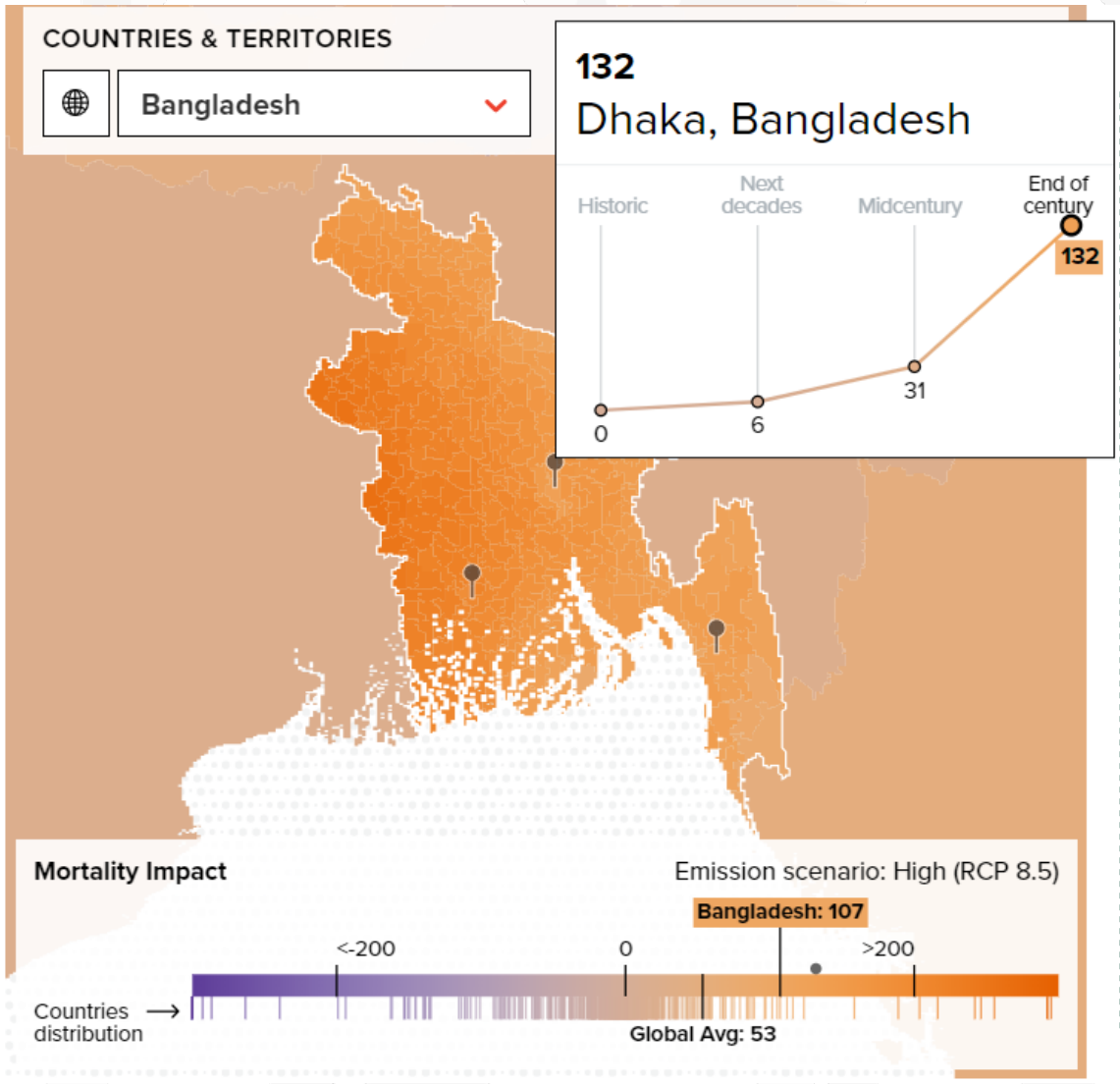


Horizon: mid-century outlook
Scenario: RCP 8.5 scenario
Projected outcome: 21 more deaths per 100,000 people.

Can also be observed: different realities within the country with some parts of the country experiencing sharp rise in mortality rates while others may see a decline.

Country-level Example: Bangladesh/Dhaka





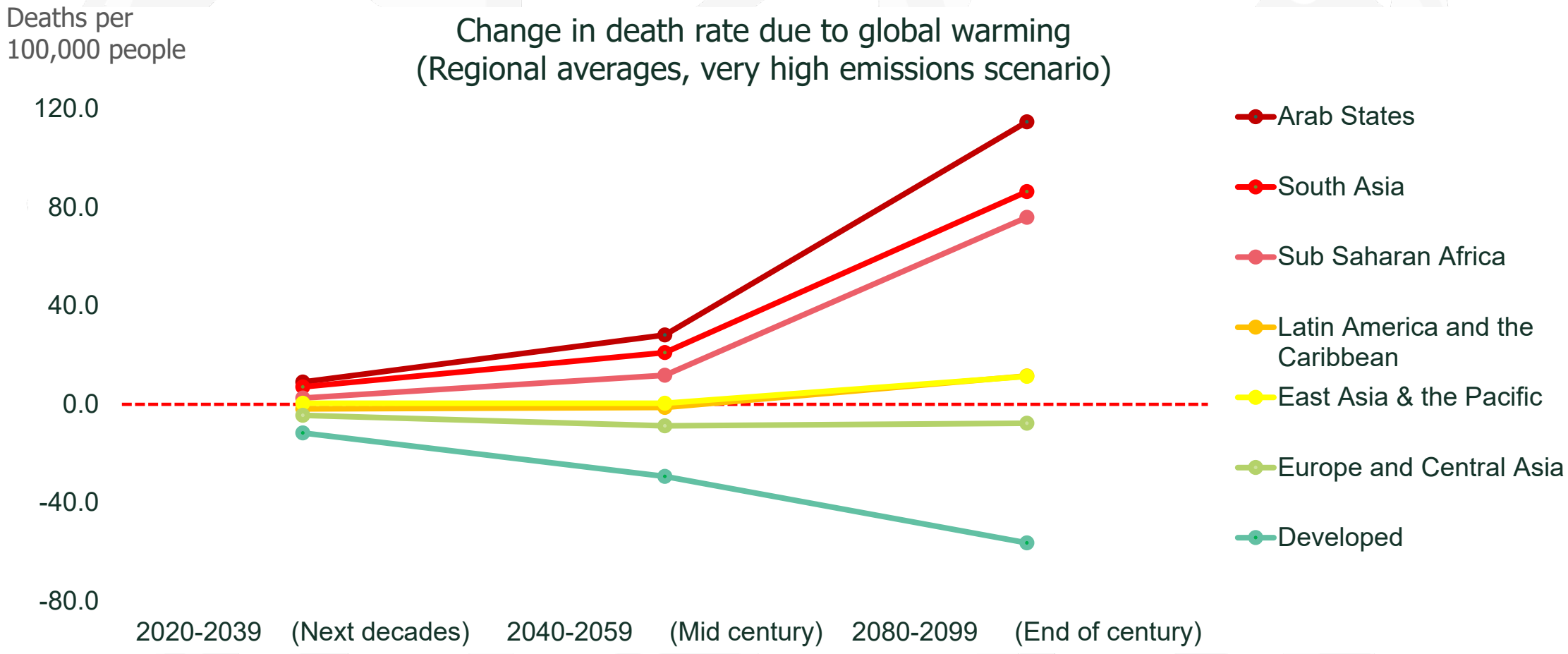
Horizon: End of century

Scenario: RCP 8.5 (very high emissions)

Outcome: Projected additional 132 deaths each year by 2100 compared to a future with no climate change.

Comparison: This figure is 2x Bangladesh's death rate from all cancers each year and 9x greater than the rate of road traffic fatalities.

Climate change will be a significant driver of inequalities worldwide

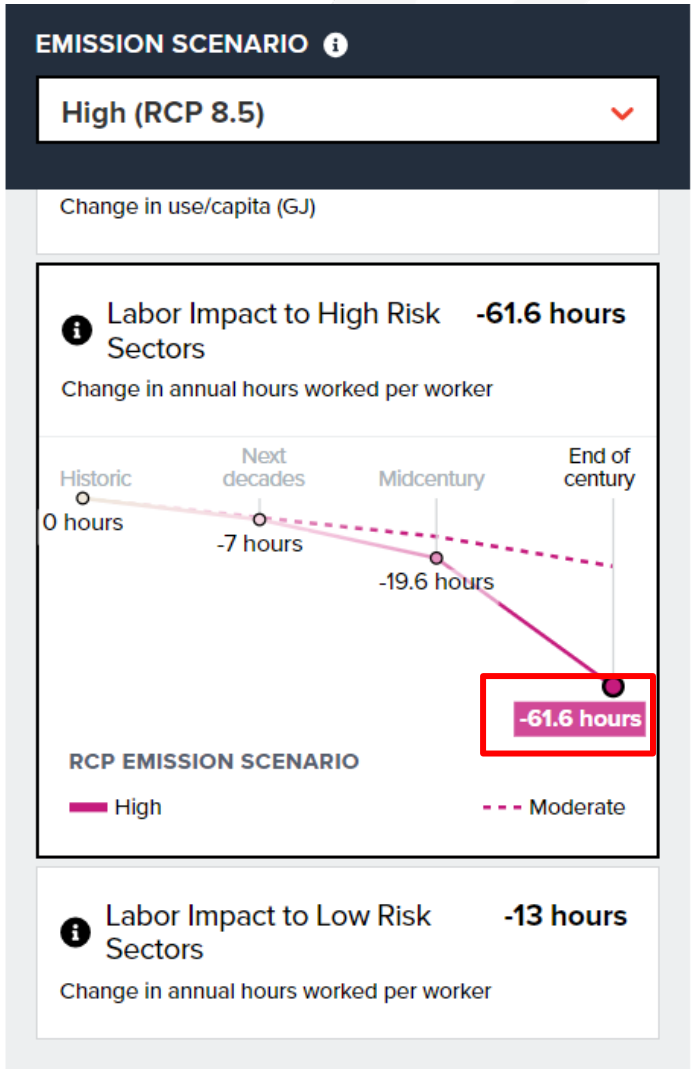


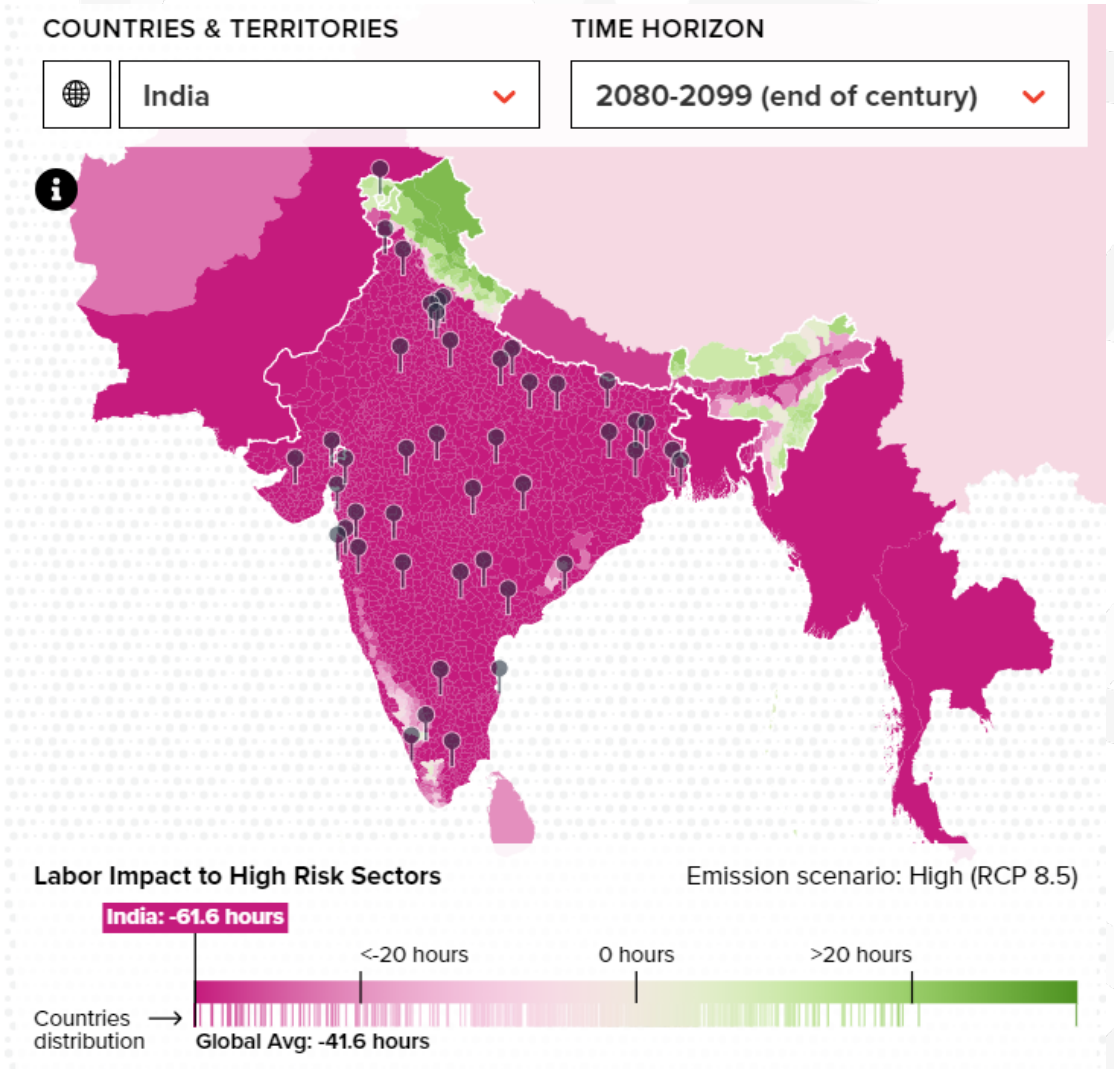
Labour productivity impact

Definition: change in annual hours worked per worker in high and low risk sectors

Note: High risk sectors include agriculture, construction, mining, manufacturing.

Country-level Example: India





Horizon: End of century

Scenario: RCP 8.5 (very high emissions)

Outcome: India is projected to witness 118 days each year with temperatures surpassing 35 degrees Celsius.

This could lead to a significant reduction in productive working hours **(-61.6 per worker per year)**, with exposure to extreme heat.

HCH 2.0

Sea level rise impacts

Impacts on coastal communities include the threat of permanent inundation of low lying land adjacent to the ocean. The data here maps those sea level rise projections to a satellite-based elevation dataset to explore which places may be submerged in the absence of shoreline defenses.

Sea level rise hazard

Definition: change in cm in projected SLR

Note: The sea level rise projections are sourced directly from the IPCC, then aggregated to more than 5000 subnational coastal regions worldwide.

GLOBAL

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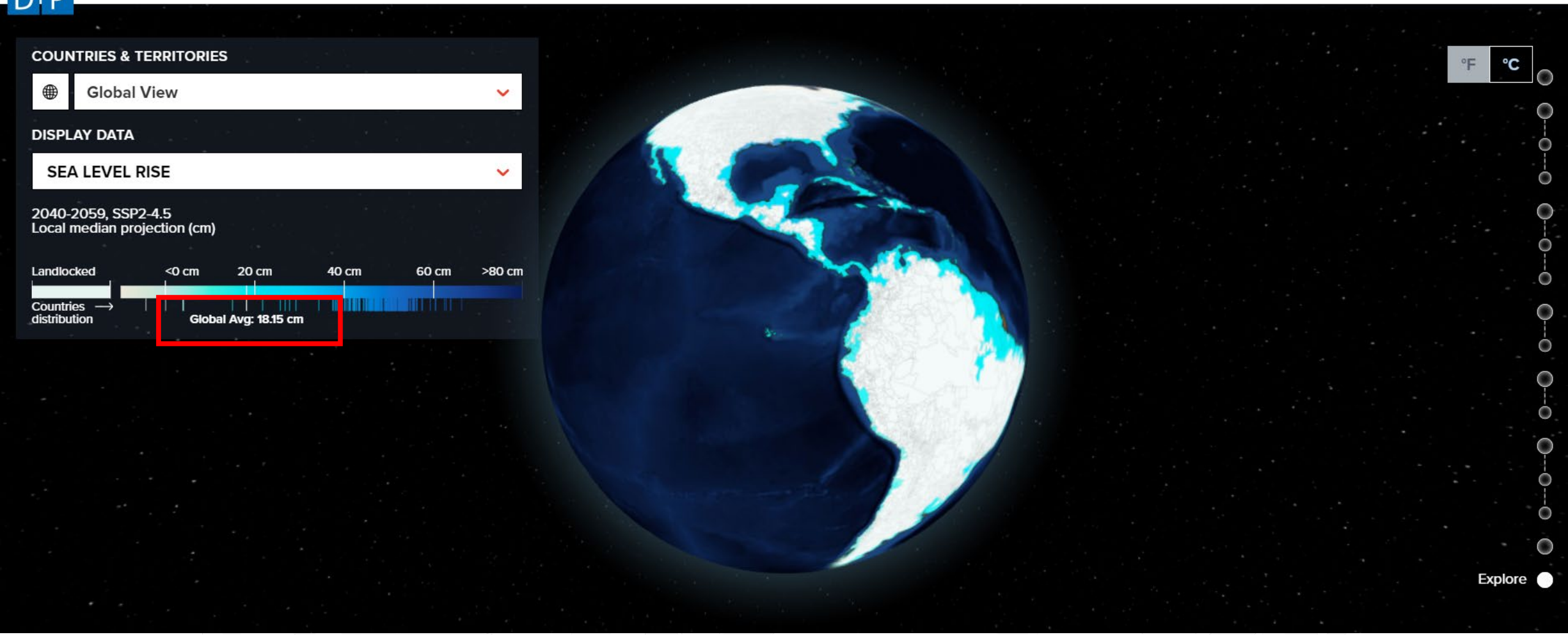

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COUNTRIES & TERRITORIES

Mexico

DISPLAY DATA

SEA LEVEL RISE

2040-2059, SSP2-4.5
Local median projection (cm)

°F °C

26.74 cm
Mexico

close-tooltip

COUNTRY INSIGHTS

COUNTRY COMPARISON

Explore

EMISSION SCENARIO

Intermediate Emissions (SSP2-4.5)

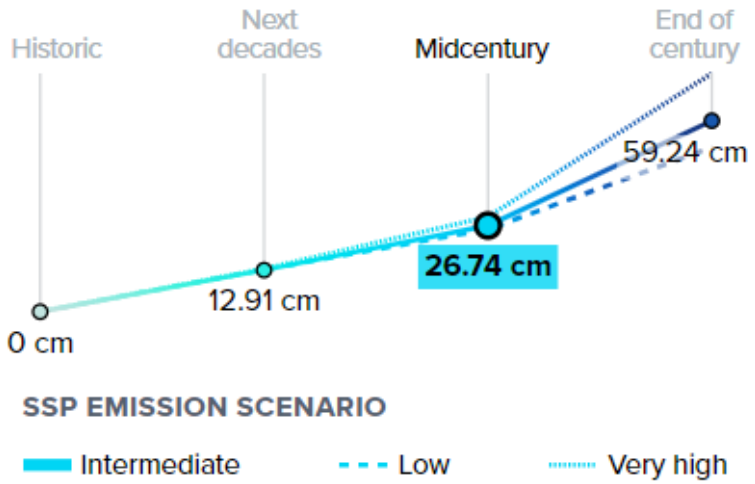
Sea Level Rise

Line shows average for all the coastlines bordering the country

Hazard Data

Sea Level Rise — 26.74 cm

Local median projection (cm)



Impact Data

Land Inundation Impact — 0.09%

Show borders

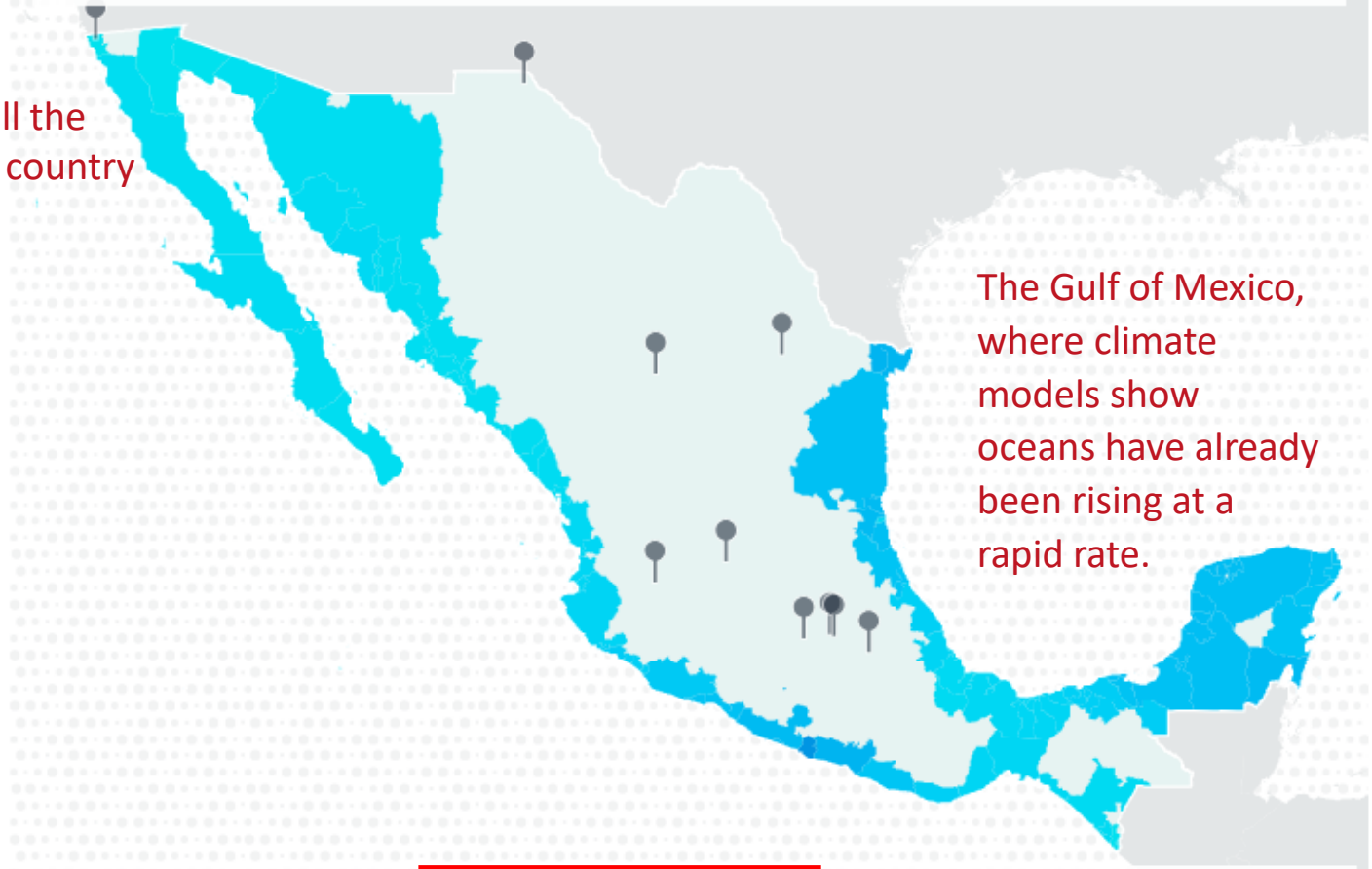
COMPARE COUNTRIES

COUNTRIES & TERRITORIES

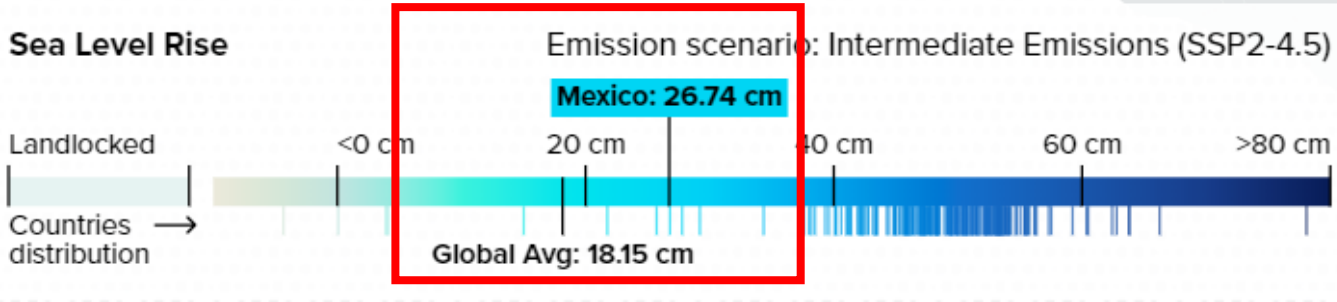
Mexico

TIME HORIZON

2040-2059 (midcentury)



The Gulf of Mexico, where climate models show oceans have already been rising at a rapid rate.



EMISSION SCENARIO

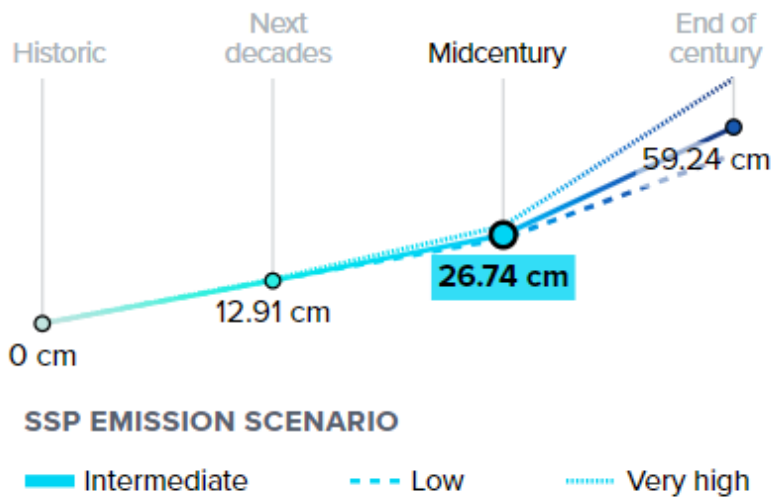
Intermediate Emissions (SSP2-4.5)

Sea Level Rise

Hazard Data

Sea Level Rise **26.74 cm**

Local median projection (cm)



Impact Data

Land Inundation Impact **0.09%**

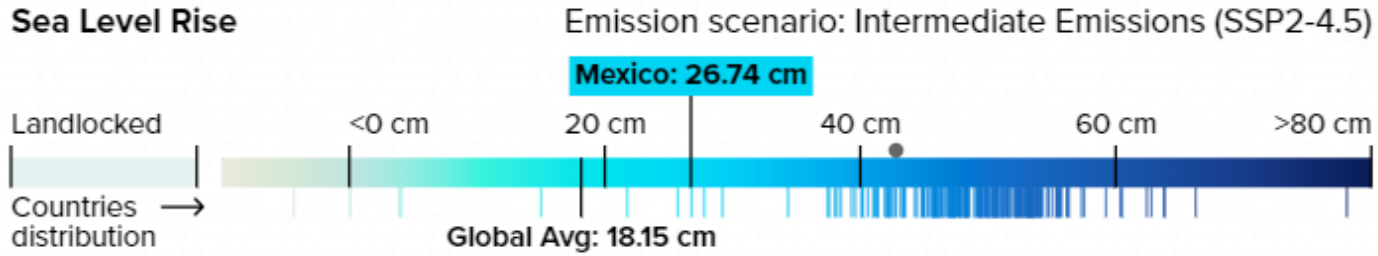
Share of region under mean sea level (%)

COUNTRIES & TERRITORIES

Mexico

TIME HORIZON

2040-2059 (midcentury)



Land inundation impact

- **Share of region under mean sea level (%)**
- **Area under mean sea level (km2)**

Definition: percent of region's land or total square kilometers of land projected to be permanently inundated by rising seas, relative to future of no climate change. From this modeling, we can see the places most at risk of disappearing due to long-term sea level rise.

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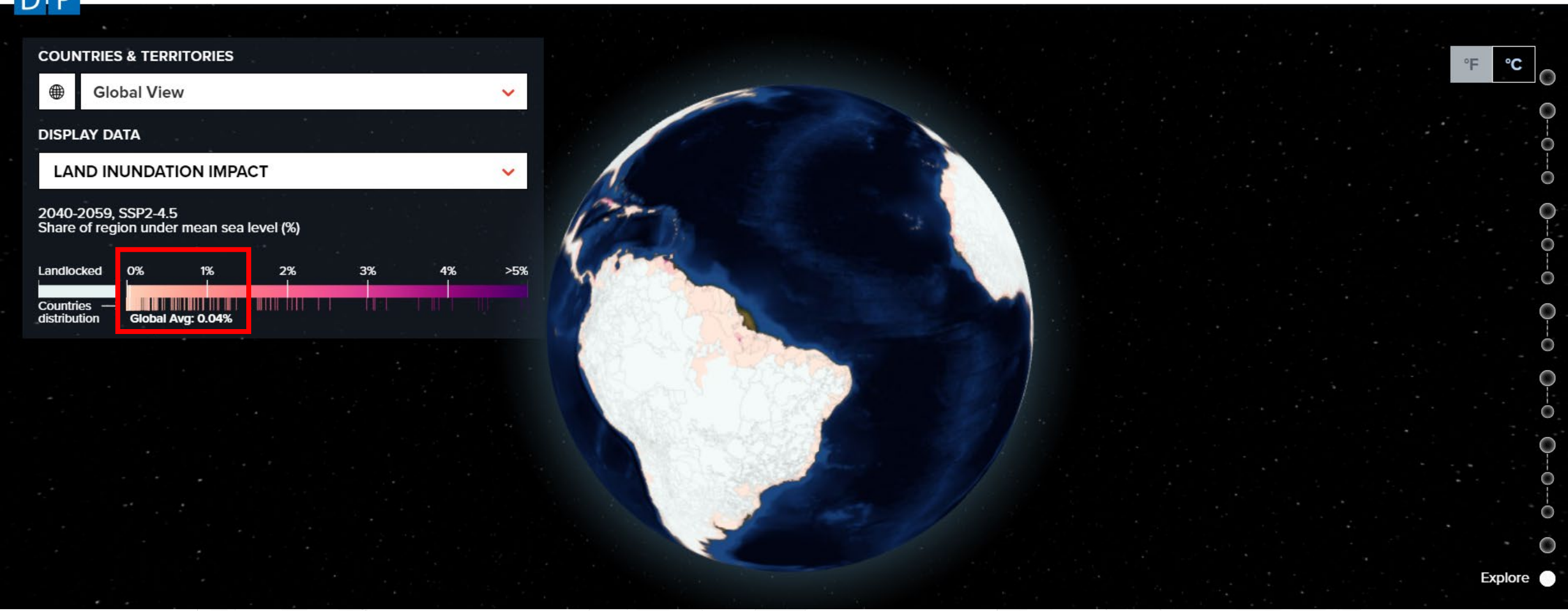


COUNTRIES & TERRITORIES

Maldives

EMISSION SCENARIO

Intermediate Emissions (SSP2-4.5)

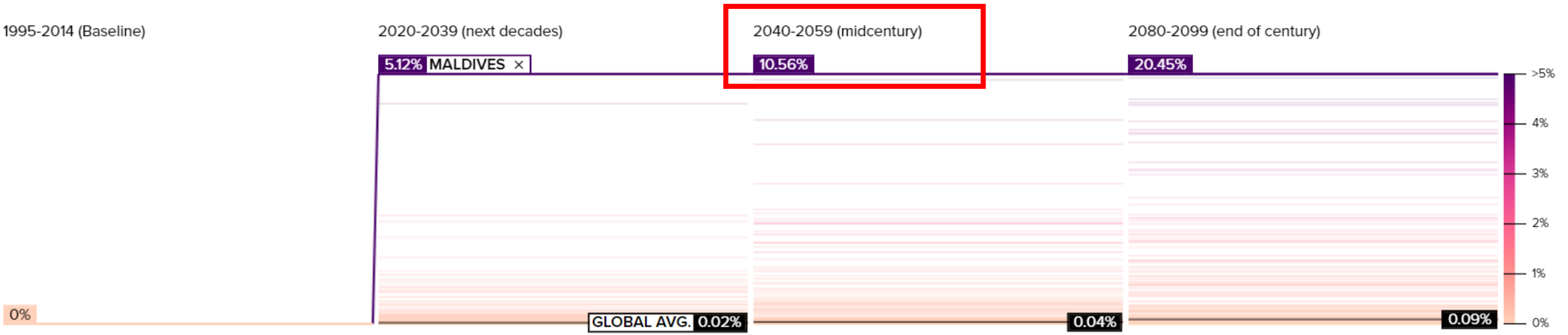
TEMPERATURE

°F °C

Impact Data

Land Inundation Impact

COUNTRY INSIGHTS



Impact Data

Plot graphs on HCH compare impacts to each of coastal countries and territories - Comparing impacts to each of these coastal countries and territories highlights those at highest risks of permanent inundation.

SIDS like the Maldives, are projected to lose more than 10% of its territory by mid-century (current emissions trajectory, SSP2-4.5).

COUNTRIES & TERRITORIES

Tuvalu

EMISSION SCENARIO

Intermediate Emissions (SSP2-4.5)

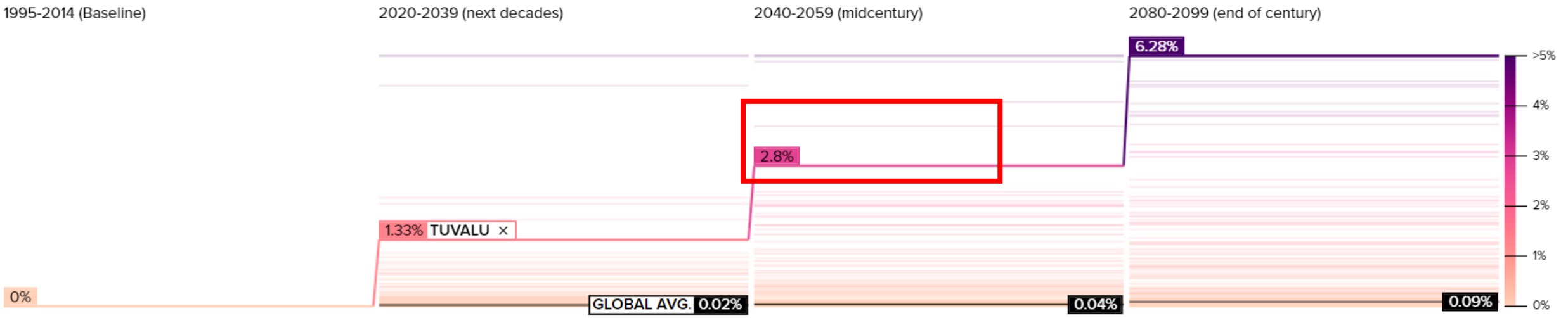
TEMPERATURE

°F °C

Impact Data

Land Inundation Impact

COUNTRY INSIGHTS



Show borders

COMPARE COUNTRIES

EMISSION SCENARIO

Intermediate Emissions (SSP2-4.5)

COUNTRIES & TERRITORIES

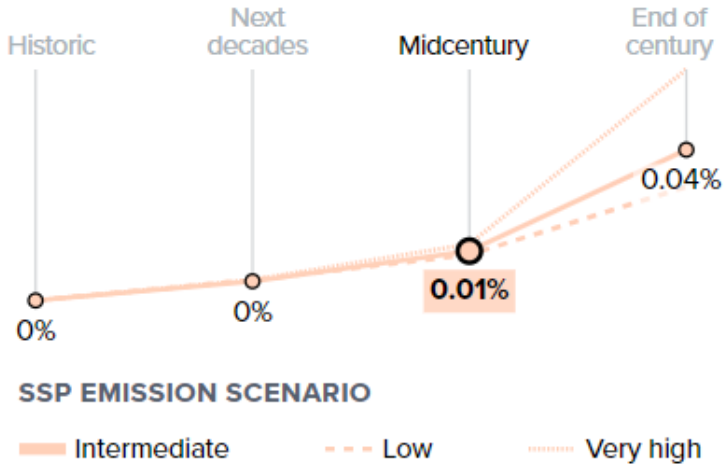
Brazil

TIME HORIZON

2040-2059 (midcentury)

Land Inundation Impact **0.01%**

Share of region under mean sea level (%)



SSP EMISSION SCENARIO

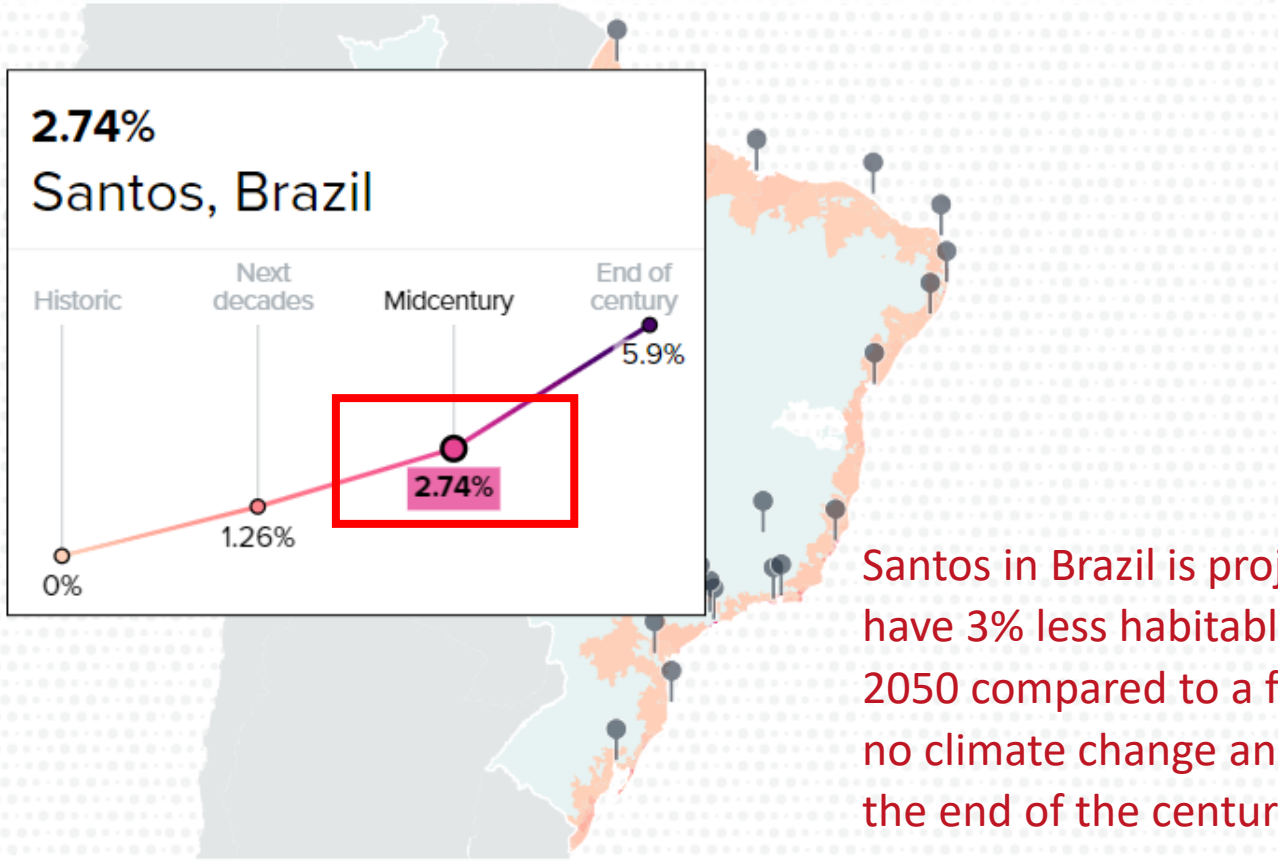
Intermediate Low Very high

Land Inundation Impact **987.8 km²**

Area under mean sea level (km²)

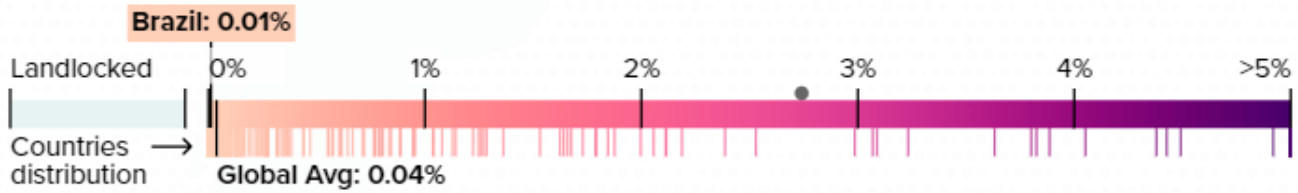
Population Flood Exposure Impact **0.3%**

Share of population living in 1-in-20-year floodplain



Santos in Brazil is projected to have 3% less habitable land in 2050 compared to a future with no climate change and 6% less by the end of the century.

Land Inundation Impact Emission scenario: Intermediate Emissions (SSP2-4.5)



Population flood exposure impact

- **Share of population living in the 1-in-20 floodplain**

Definition: percent of region's population living in the median projected 1-in-20 floodplain to be permanently flooded by rising seas, relative to modeled future with no climate change.

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Higher sea levels => giving the storm surge caused by hurricanes and cyclones a higher starting point.

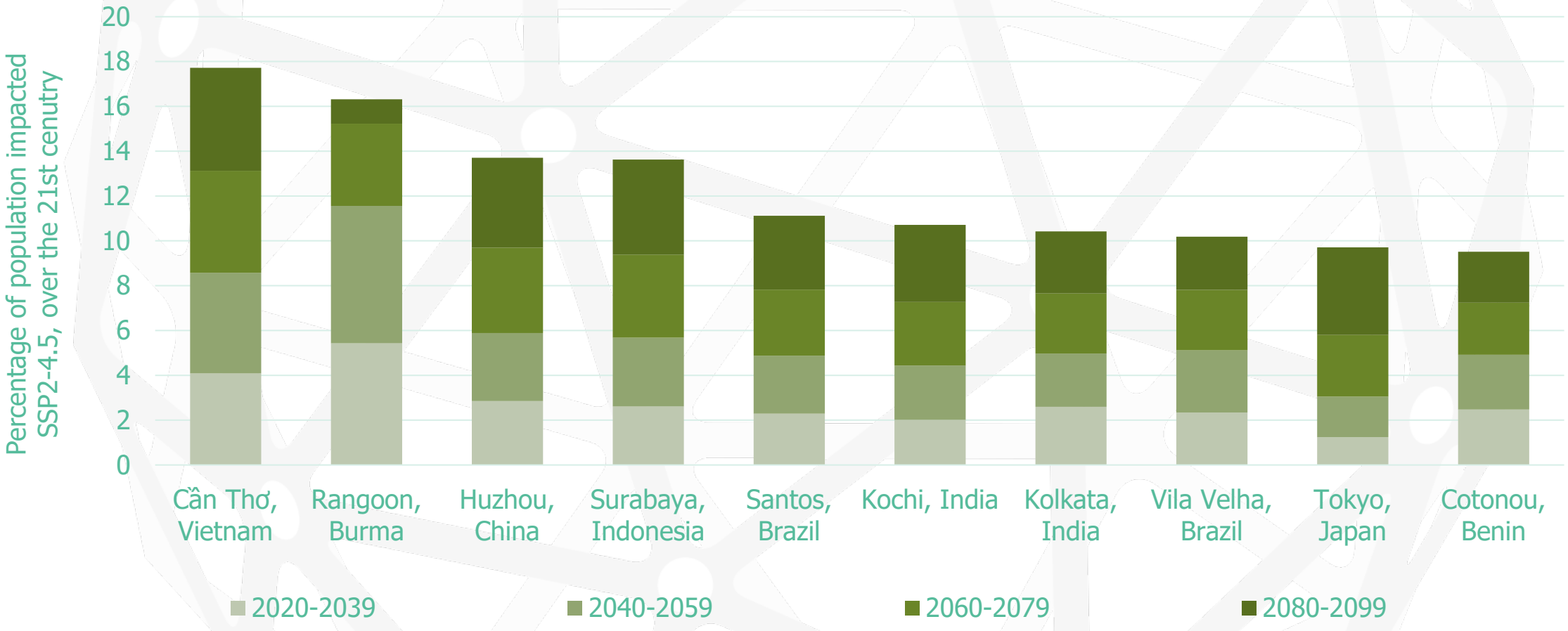
This allows that surge to push further inland.

The 20 year floodplain is modeled on top of the current mapping of where people live to enable us to see how much more of the population is exposed to flood risk.

Key findings: Local

the top 10 cities most severely affected by the percentage increase in population exposed to expanding flood areas (intermediate scenario, SSP2-4.5)

Hundreds of highly populated cities will be exposed to increased flood risk



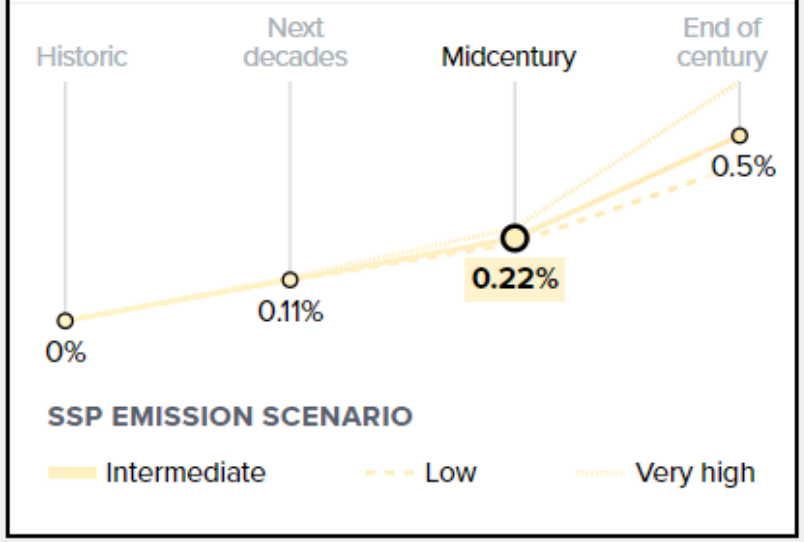
Show borders

COMPARE COUNTRIES

EMISSION SCENARIO

Intermediate Emissions (SSP2-4.5)

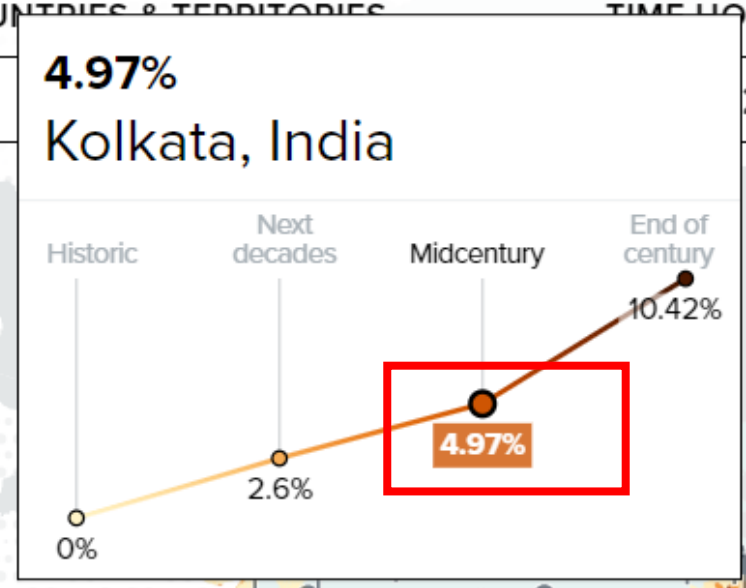
Share of population living in 1-in-20-year floodplain



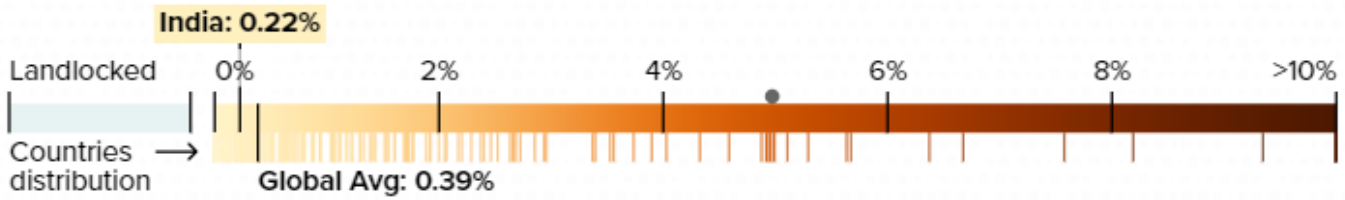
COUNTRIES & TERRITORIES

TIME HORIZON

2059 (midcentury)



Population Flood Exposure Impact Emission scenario: Intermediate Emissions (SSP2-4.5)



Temperature

°F °C

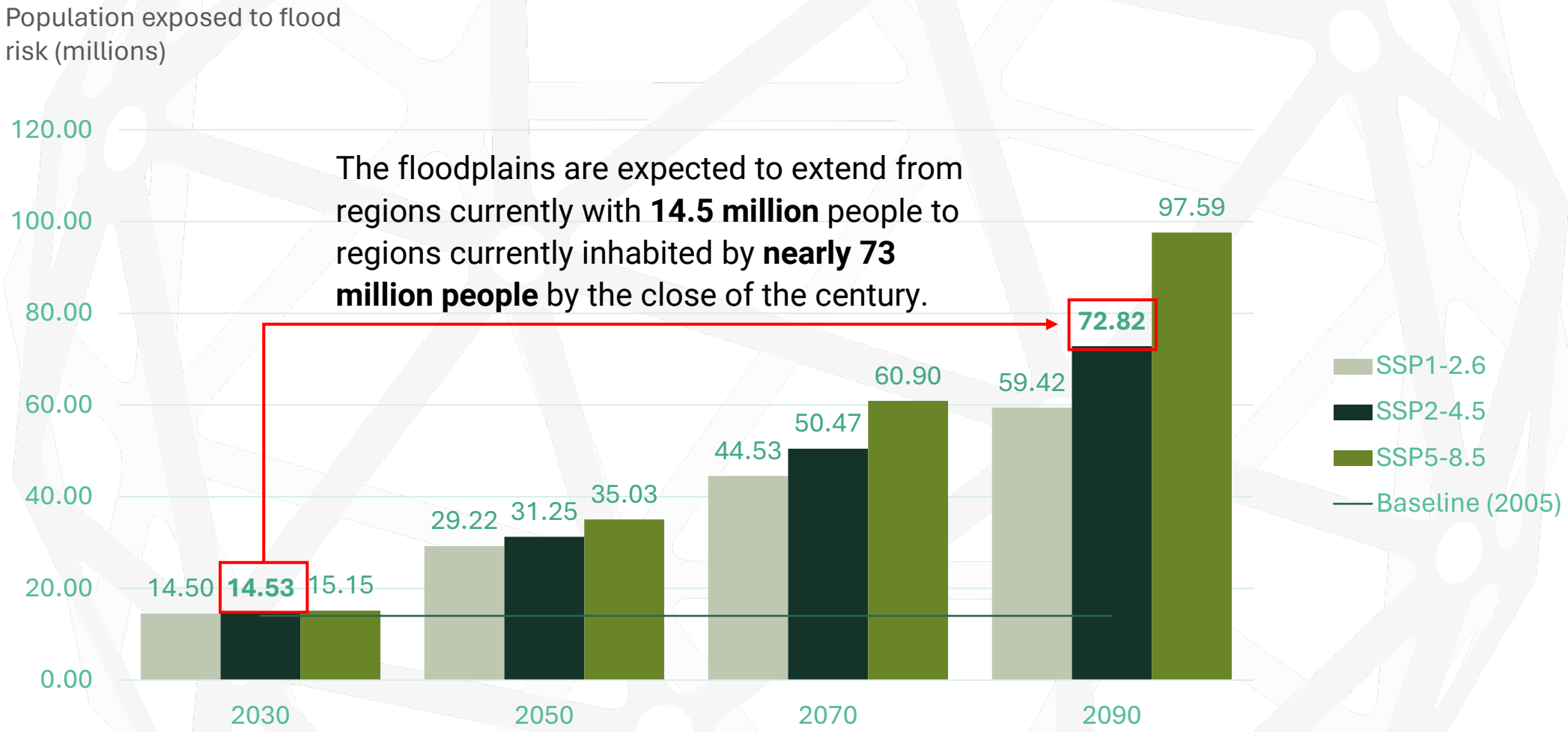
Hazard Data

Average Annual Temperature **No data**

Median projection

Key findings: Global

Population exposed to expanded flood areas Under different scenarios



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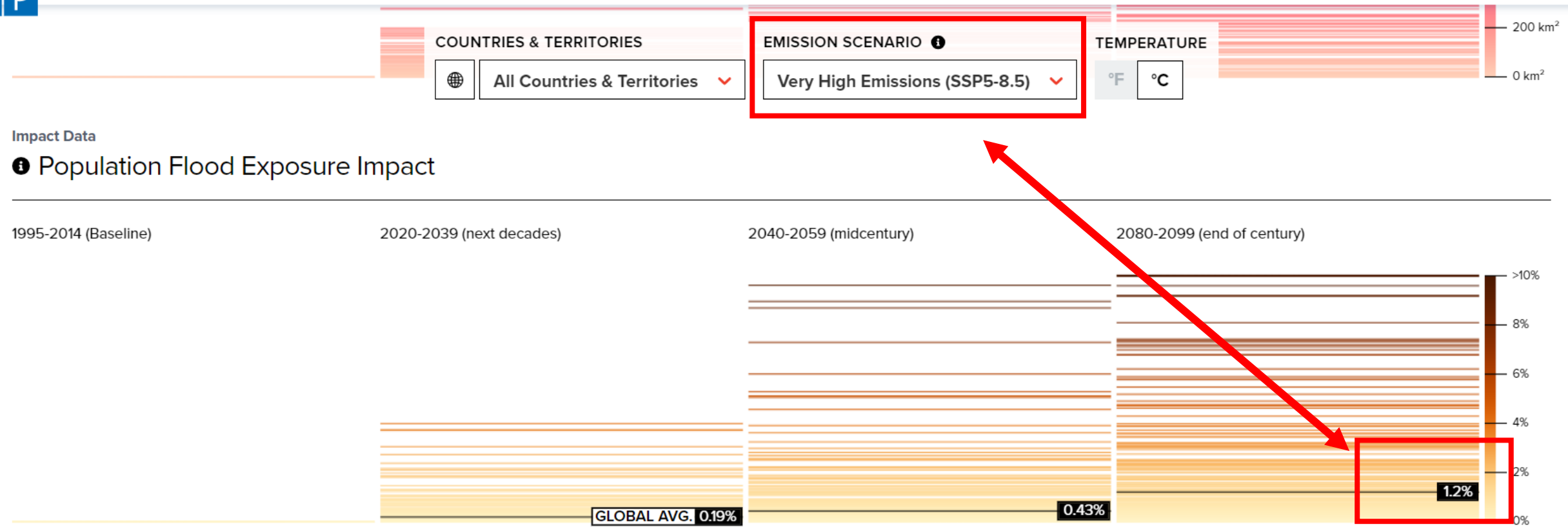

Example:

Scenario: SSP5-8.5 (very high emissions)

Horizon: end of the century

Outcome: 1.2% of global population living in floodplain areas

(If we assume the same amount of global population, that's 97.6 million people)

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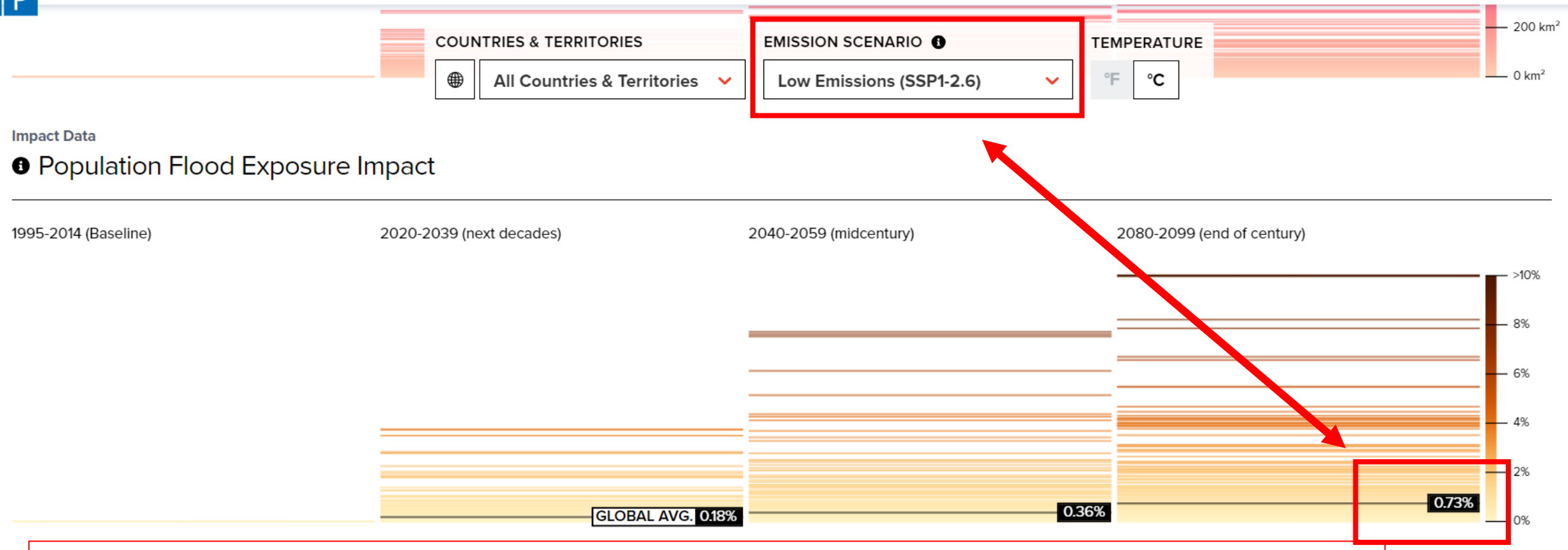


Example:

Scenario: SSP5-2.6 (Climate action to put the world on course for low emissions and limit warming to 2°C)

Horizon: end of the century

Outcome: reduces the population at risk to 0.73% of global population living in floodplain areas (i.e. 38 million people saved from the exposure)

Thank you!

horizons.hdr.undp.org

United Nations BigData

EUSKO JAURLARITZA GOBIERNO VASCO

GOBIERNO DE ESPAÑA
MINISTERIO DE ASUNTOS EXTERIORES, UNIÓN EUROPEA Y COOPERACIÓN

BC3 BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

EXCELENCIA MARÍA DE MAEZTU 2023-2027

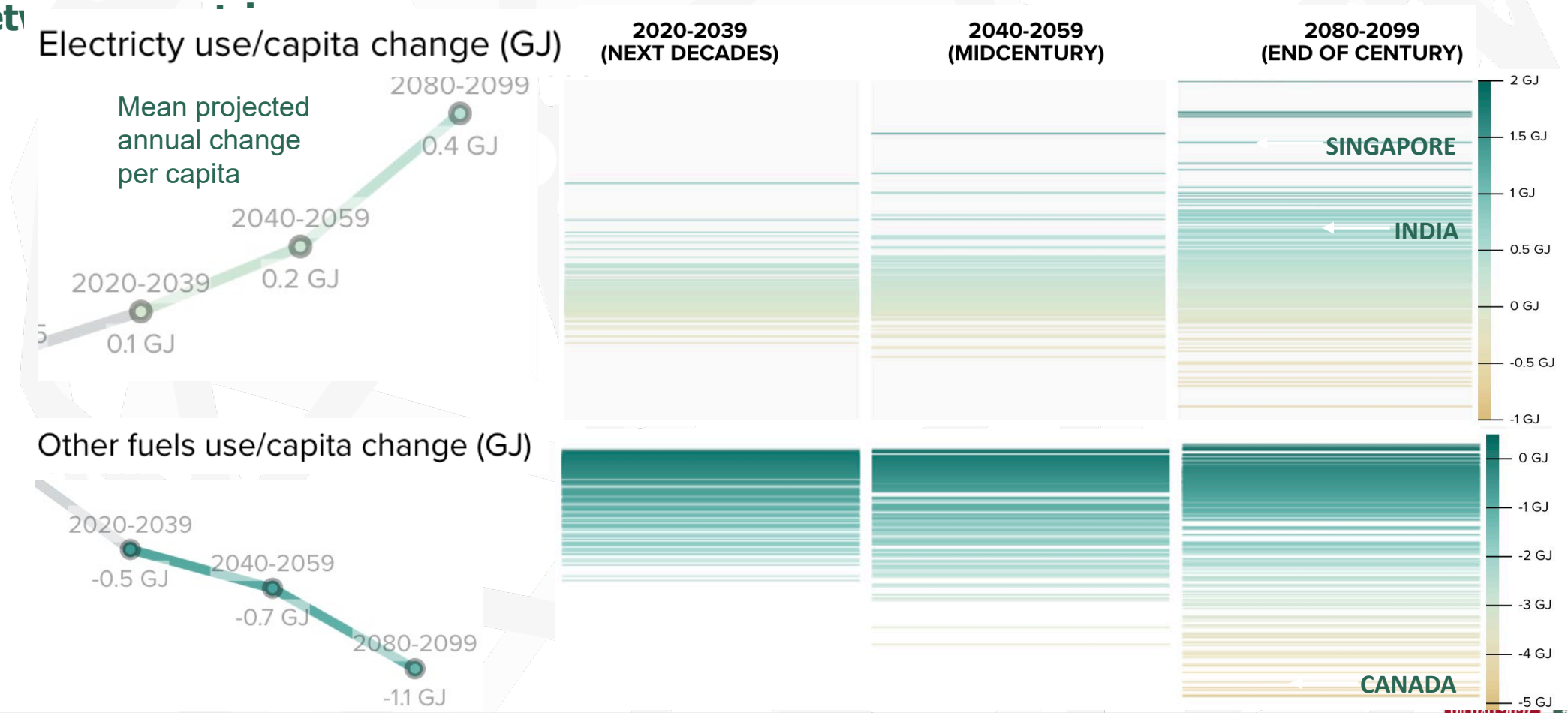
INE Instituto Nacional de Estadística

Eustat
EUSKAL ESTATISTIKA ERAKUNDEA
INSTITUTO VASCO DE ESTADÍSTICA

#UNBigData2024

Between countries

Rising temperatures will unequally impact energy consumption across locations and fuel types (example: RCP 4.5 moderate emissions trajectory). **HCH allows exploration within or bet**



Impacts on agriculture

The next release expected in late 2024, will cover six crops including **cassava, corn, rice, soy, sorghum, and wheat.**

The analysis of agriculture's impact on climate change studies how seasonal temperature trends and rainfall patterns will impact production of the six staple crops that comprise ~70% of the world's crop calories: cassava, corn, rice, soy, sorghum, and wheat.

The relationship between daily conditions and yields is unique to each of the six crops modeled in this analysis and reflects complex dynamics. For instance, excess precipitation can be as damaging as too little, resulting in erosion, flooding, and decreased soil quality. Irrigation is taken into account, along with farmers' ability to switch varieties of crops as a means of adjusting to trends like longer growing seasons or adopt better equipment and technologies. Even with these protective measures, every region of the world is projected in 2050 to experience a net decrease in total calories produced across staple crops.

In terms of production markets ($), these losses are greatest in the world's top-producing breadbaskets, such as the United States, China, Brazil, and Russia. The agricultural sector has thrived in these countries under optimal, moderate climate conditions. However, they are not well-prepared for climate change. Under most emissions pathways, climate change also generates real risk to global food security, including for regions engaged in farming at a subsistence level. Across the African continent, for example, climate change damages in the agricultural sector equate to a significant share of GDP.

A part of new generation of innovative measurements:

Beyond income

people-centered

Beyond averages

highly-disaggregated

Beyond today

short, medium and long term projections

Country-level Example: Malaysia

Countries & Territories: Malaysia

Time horizon: 2080-2099 (end of century)

Emissions scenario: High (RCP 8.5)

Temperature: °F | °C

Average Annual Temperature

Median projection: 29.7°C

Days above 35°C

Annual Average

Number of days: 119

Days below 0°C

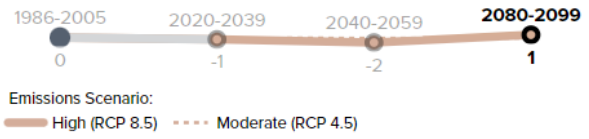
Annual Average

Number of days: 0

Mortality Impact

(deaths per 100k population)

Change in death rate: 1



Map: Malaysia | 2080-2099 (end of century) | High emissions scenario (RCP 8.5)