INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

WGI Sixth Assessment Report (AR6): Central and South America and the Caribbean

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V International Conference for World Balance
La Havana - Cuba

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#ClimateReport #IPCC

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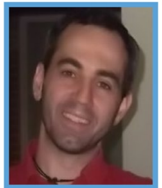
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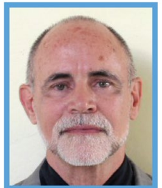
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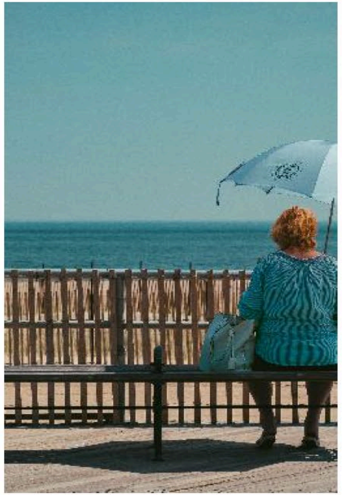
[Credit: Yoda Adaman | Unsplash]

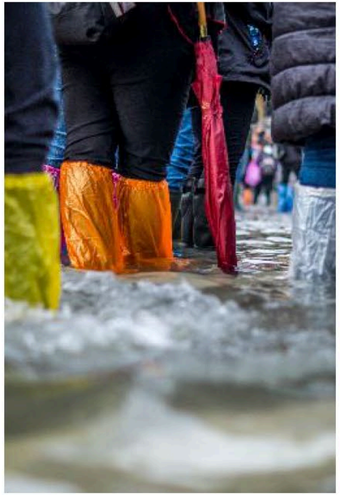
> "It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.



Extreme heat

More frequent

More intense



Heavy rainfall

More frequent

More intense

Drought

Increase in some regions

Fire weather

More frequent

Ocean

Warming

Acidifying

Losing oxygen

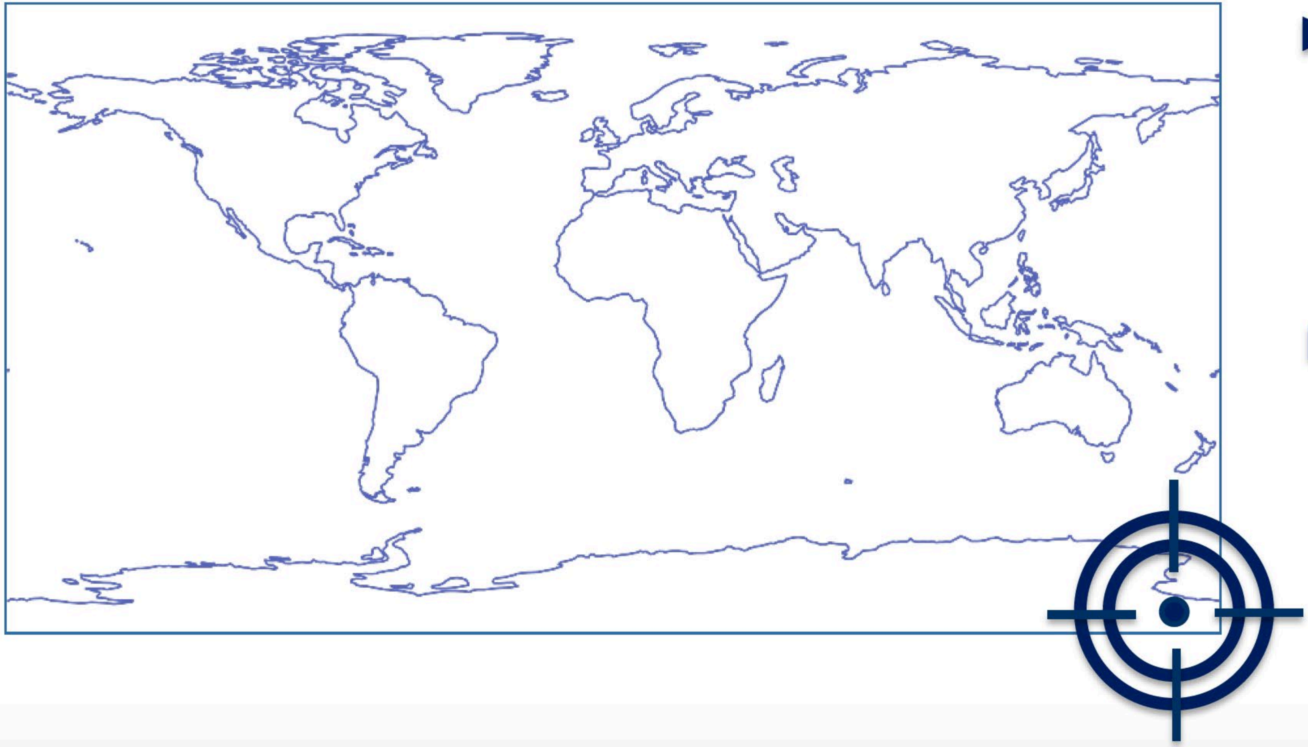
Photo Credits from left: 1. Luiz Guimaraes 2. Jonathan Ford 3. Peter Burdon 4. Ben Kuo 5. NOAA

[Credit: Hong Nguyen | Unsplash]

"Climate change is already affecting every region on Earth, in multiple ways.

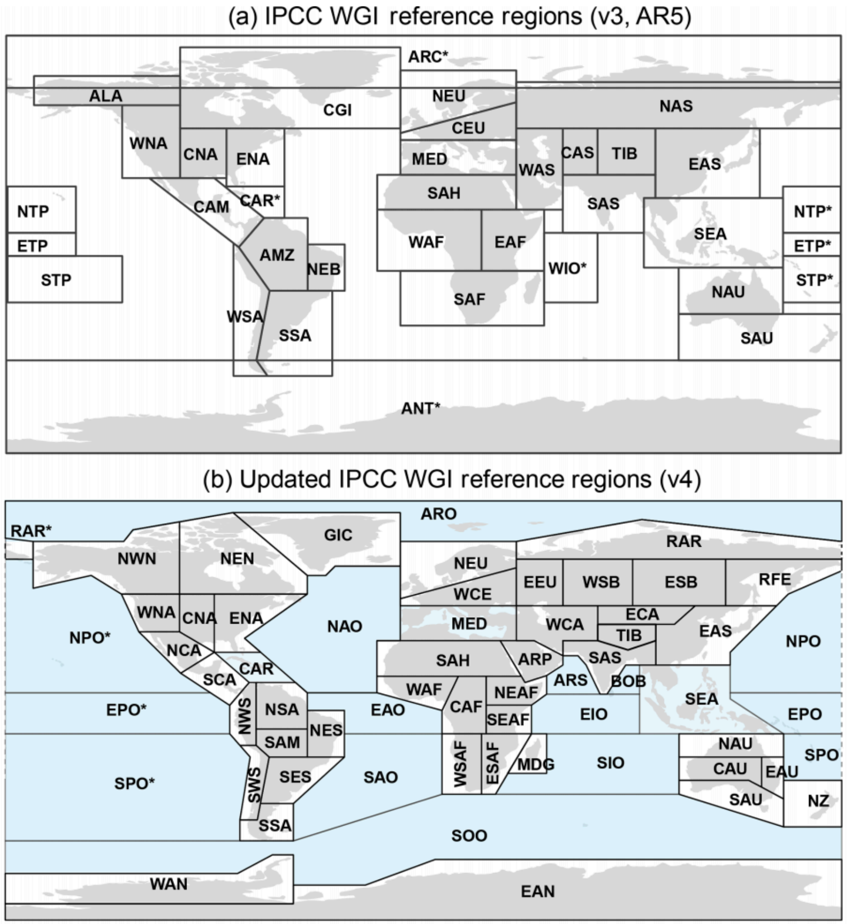
The changes we experience will increase with further warming.

New regional information



- Inform decisions related to **risk management** and **adaptation**
- **A third** of our report is dedicated to **regional climate information**

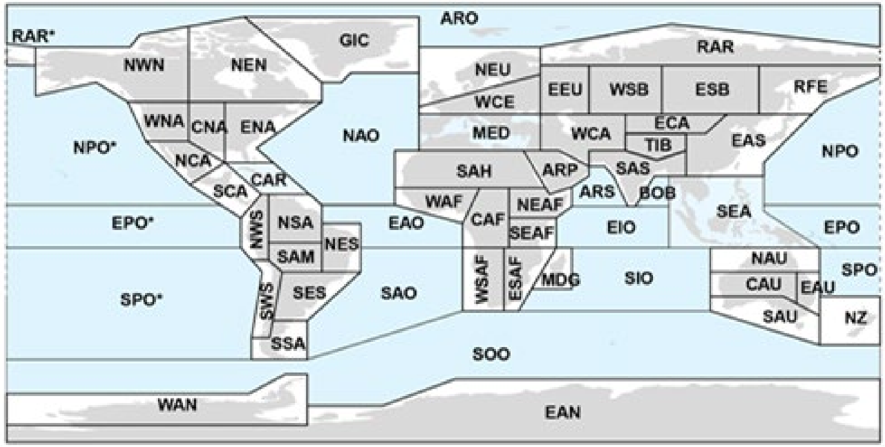
Regions: AR6 vs. AR5

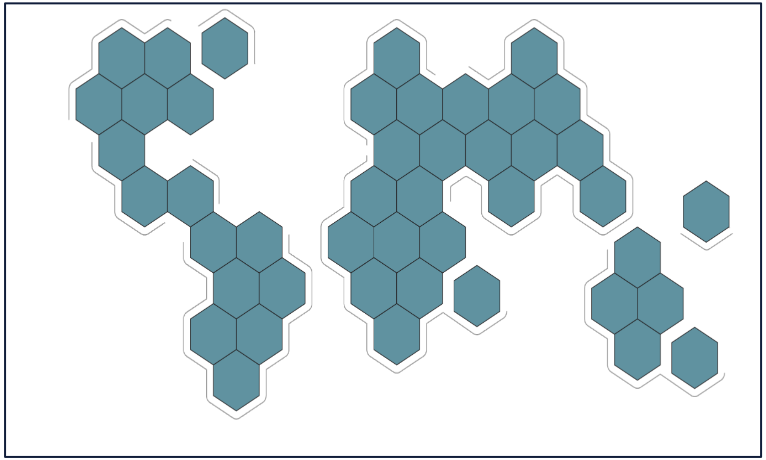


Iturbide et al. (2020)

45 new land regions

(and their representation as hexagons)





Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

Figure WGI SPM.3

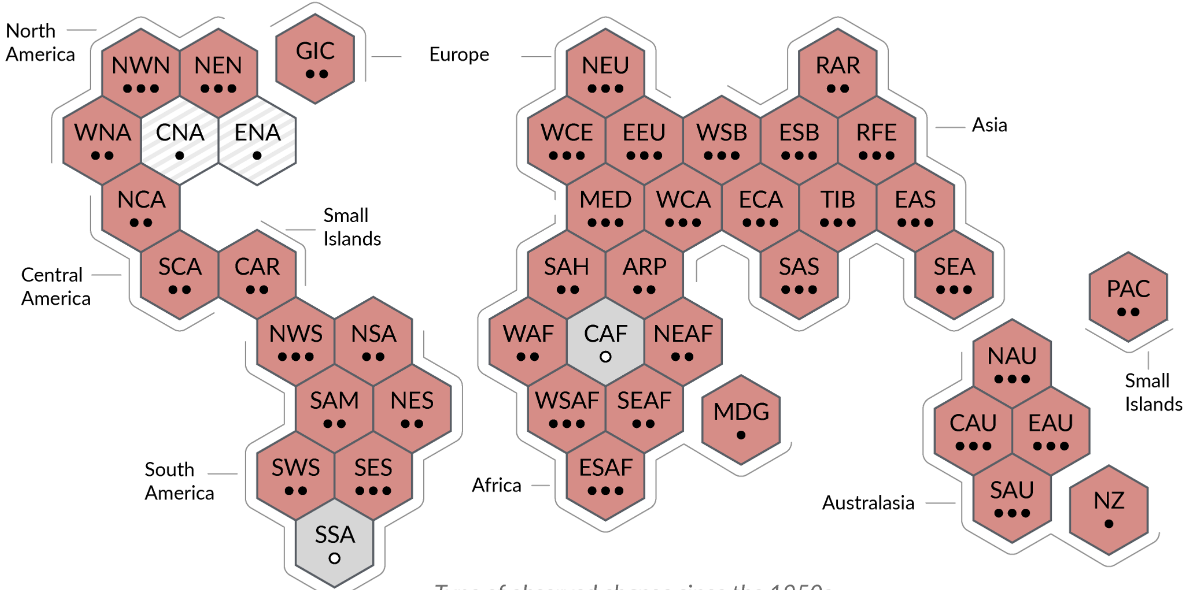
a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions

Type of observed change in hot extremes

- Increase (41)
- Decrease (0)
- Low agreement in the type of change (2)
- Limited data and/or literature (2)

Confidence in human contribution to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence



Type of observed change since the 1950s

Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

Figure WGI SPM.3

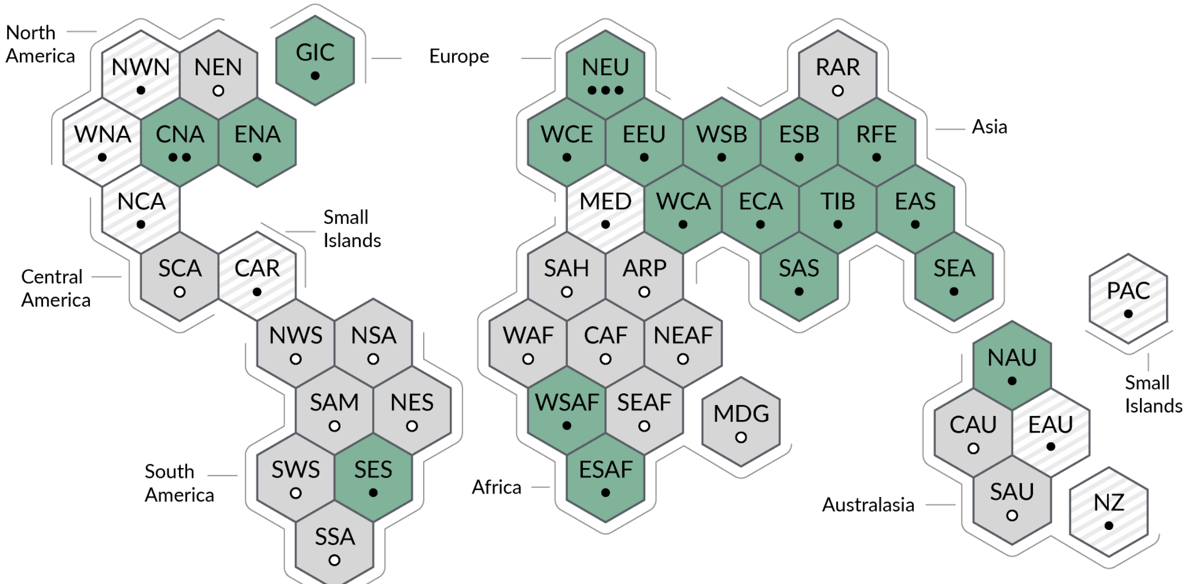
b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions

Type of observed change
in heavy precipitation

- Increase (19)
- Decrease (0)
- Low agreement in the type of change (8)
- Limited data and/or literature (18)

Confidence in human contribution
to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence



Type of observed change since the 1950s

Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

Figure WGI SPM.3

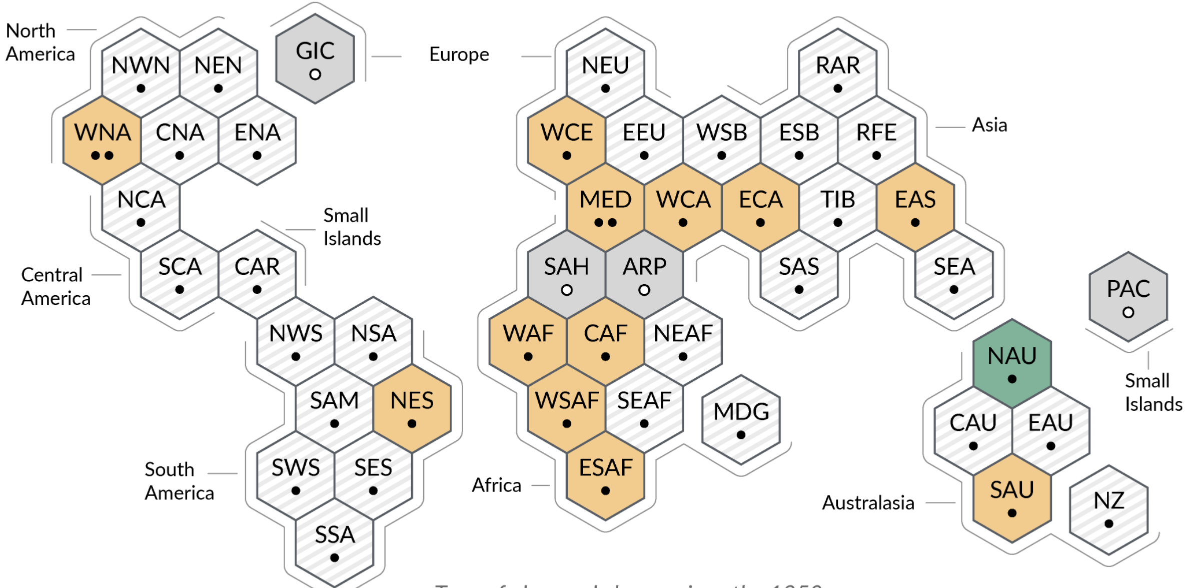
c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions

Type of observed change
in agricultural and ecological drought

- Increase (12)
- Decrease (1)
- Low agreement in the type of change (28)
- Limited data and/or literature (4)

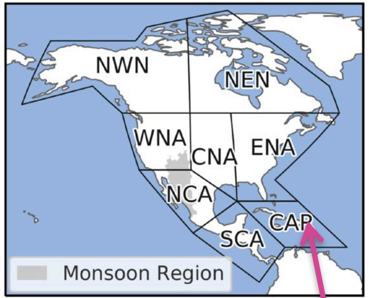
Confidence in human contribution
to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence



Type of observed change since the 1950s

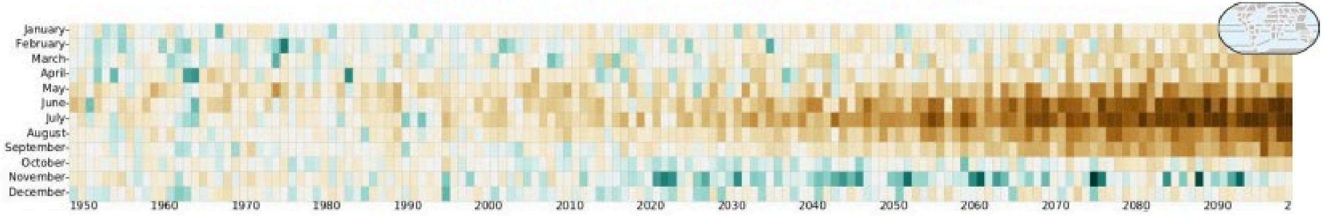
Observed and projected changes in the Caribbean



Caribbean (CAR)

- Declining trend in rainfall during June–July–August in CAR will continue in coming decades (*high confidence* at 2°C global warming and above).
- Higher evapotranspiration under a warming climate will result in increased aridity and more severe agricultural and ecological droughts in CAR (*medium confidence* at global warming level of 2°C and above).

Change in monthly average precipitation relative to 1995–2014 for the Caribbean under increasing warming levels



Observed and projected changes in Central and South America

Climatic Impact-Driver

Central and South America	Heat and Cold: Mean air temperature	Extreme heat	Cold spell	Frost	Wet and Dry: Mean precipitation	River flood	Heavy precipitation and pluvial flood	Landslide	Aridity	Hydrological drought	Agricultural and ecological drought	Fire weather
Southern Central America	↗	↗ **	↘ **									
Northwestern South America	↗	↗ ***	↘ ***									
Northern South America	↗	↗ **	↘ **									
South American Monsoon	↗	↗ **	↘ **			↗ 1						
Northeastern South America	↗	↗ **	↘ **		↘						↗	
Southwestern South America	↗	↗ **	↘ **	↘								
Southeastern South America	↗	↗ ***	↘ ***	↘	↗		↗			↘		
Southern South America	↗			↘								

Central and South America	Wind: Mean wind speed	Severe wind storm	Tropical cyclone	Sand and dust storm	Snow and Ice: Snow, glacier and ice sheet	Permafrost	Lake, river and sea ice	Heavy snowfall and ice storm	Hail	Snow avalanche
Southern Central America			2							
Northwestern South America										
Northern South America			2							
South American Monsoon										
Northeastern South America										
Southwestern South America										
Southeastern South America										
Southern South America										

Central and South America	Coastal and Oceanic: Relative sea level	Coastal flood	Coastal erosion	Marine heatwave	Ocean and lake acidity	Other: Air pollution weather	Atmospheric CO_2 at surface	Radiation at surface
Southern Central America	↗		3	↗	↗		↗	
Northwestern South America	↗		3,4	↗	↗		↗	
Northern South America	↗		3,4	↗	↗		↗	
South American Monsoon							↗	
Northeastern South America	↗		3	↗	↗		↗	
Southwestern South America	↗		3,4	↗	↗		↗	
Southeastern South America	↗		3	↗	↗		↗	
Southern South America	↗		3	↗	↗		↗	

Key for observational trend evidence

↗	Past upward trend *(medium or higher confidence)*
↘	Past downward trend *(medium or higher confidence)*

Key for level of confidence in future changes

- High confidence of increase (or more)
- Medium confidence of increase
- Low confidence in direction of change
- Medium confidence of decrease
- High confidence of decrease (or more)
- Not broadly relevant

Key for attribution evidence

***	High confidence (or more)
**	Medium confidence

Table TS.5

Observed and projected changes in Central and South America

Climatic Impact-Driver

Central and South America	Heat and Cold: Mean air temperature	Extreme heat	Cold spell	Frost	Wet and Dry: Mean precipitation	River flood	Heavy precipitation and pluvial flood	Landslide	Aridity	Hydrological drought	Agricultural and ecological drought	Fire weather
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Northwestern South America											↗		3,4	↗	↗		↗	
Northern South America			2								↗		3,4	↗	↗		↗	
South American Monsoon																	↗	
Northeastern South America											↗		3	↗	↗		↗	
Southwestern South America											↗		3,4	↗	↗		↗	
Southeastern South America											↗		3	↗	↗		↗	
Southern South America											↗		3	↗	↗		↗	

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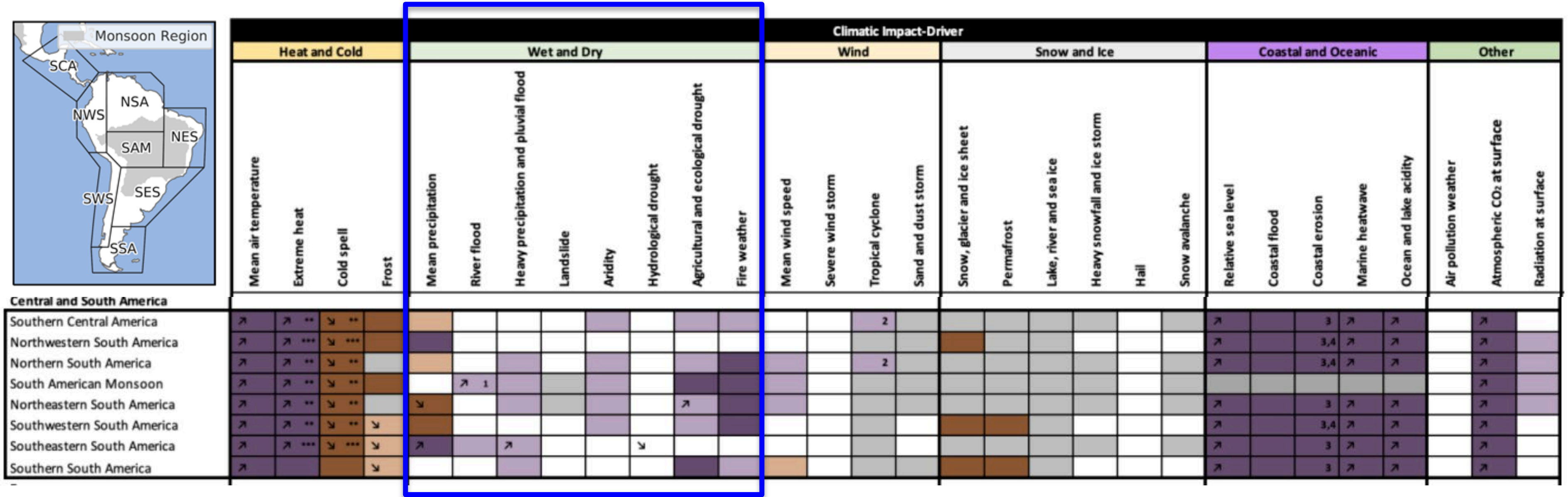

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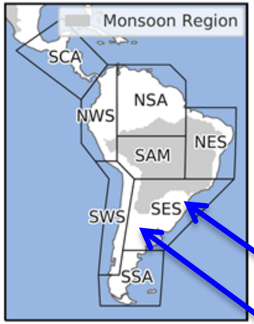

Climatic Impact-Driver

Central and South America	Heat and Cold: Mean air temperature	Heat and Cold: Extreme heat	Heat and Cold: Cold spell	Heat and Cold: Frost	Wet and Dry: Mean precipitation	Wet and Dry: River flood	Wet and Dry: Heavy precipitation and pluvial flood	Wet and Dry: Landslide	Wet and Dry: Aridity	Wet and Dry: Hydrological drought	Wet and Dry: Agricultural and ecological drought	Wet and Dry: Fire weather
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Southeastern South America	↗	↗ ***	↘ ***	↘	↗		↗			↘		
Southern South America	↗			↘								

Central and South America	Wind: Mean wind speed	Wind: Severe wind storm	Wind: Tropical cyclone	Wind: Sand and dust storm	Snow and Ice: Snow, glacier and ice sheet	Snow and Ice: Permafrost	Snow and Ice: Lake, river and sea ice	Snow and Ice: Heavy snowfall and ice storm	Snow and Ice: Hail	Snow and Ice: Snow avalanche
Southern Central America			2							
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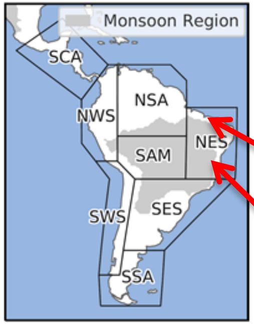

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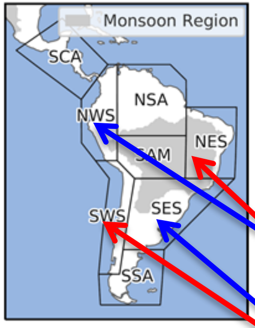

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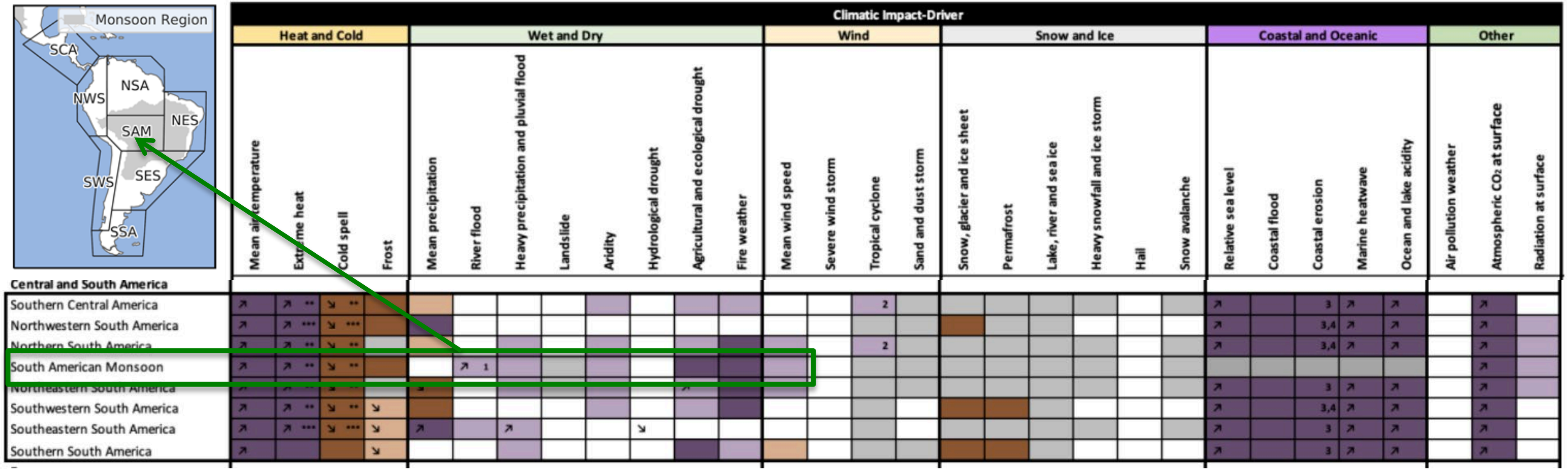
Table TS.5

Observed and projected changes in Central and South America



Key for observational trend evidence

↗	Past upward trend *(medium or higher confidence)*
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Key for level of confidence in future changes

(dark purple)	High confidence of increase (or more)
(light purple)	Medium confidence of increase
(white)	Low confidence in direction of change
(light brown)	Medium confidence of decrease
(dark brown)	High confidence of decrease (or more)
(grey)	Not broadly relevant

Key for attribution evidence

***	High confidence (or more)
**	Medium confidence

Table TS.5

Observed and projected changes in Central and South America

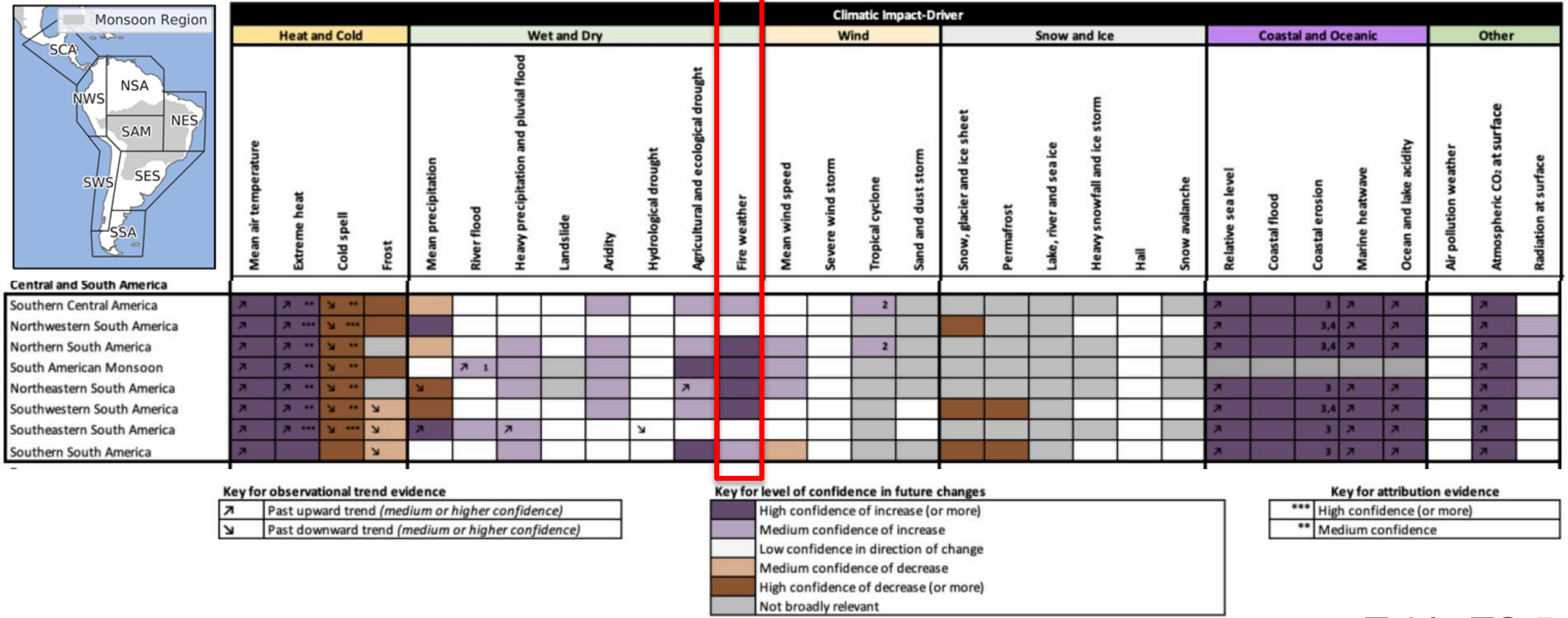


Table TS.5

FAQ8.3: **Climate change and droughts**

In some regions, drought is expected to increase under future warming

WGI FAQ 8.3

Regional fact sheet – Central and South America

Common regional changes

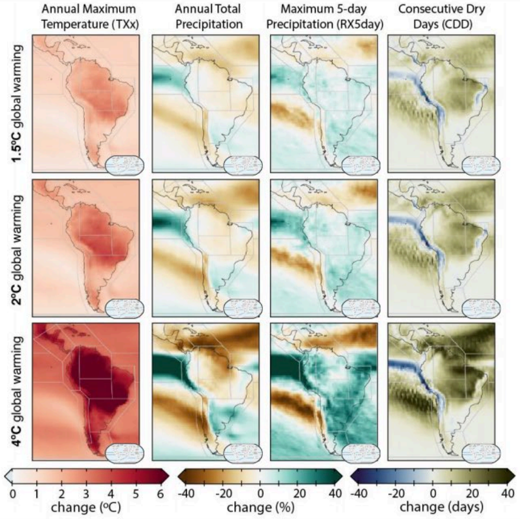
Mean temperatures have *very likely* increased in all sub-regions and will continue to increase at rates greater than the global average (*high confidence*).

Mean precipitation is projected to change, with increases in North-West South America (NWS) and South-East South America (SES) (*high confidence*) and decreases in North-East South America (NES) and South-West South America (SWS) (*medium confidence*). This is consistent among model projections by mid- and end of the 21st century for RCP4.5 and RCP8.5 scenarios.

Compared to global mean sea level, over the last three decades, relative sea level has increased at a higher rate than global mean level in the South Atlantic and the subtropical North Atlantic, and at a lower rate in the East Pacific.

Relative sea level rise is extremely *likely* to continue in the oceans around Central and South America, contributing to increased coastal flooding in low-lying areas (*high confidence*) and shoreline retreat along most sandy coasts (high confidence).

Marine heatwaves are also projected to increase around the region over the 21st century (*high confidence*).



Projected changes in annual mean temperature (T), annual total precipitation, annual maximum 5-day precipitation (RX5day) and annual consecutive dry days (CDD) at 1.5°C, 2°C, and 4°C (in rows) global warming relative to 1850–1900.

Results are based on simulations from the CMIP6 multi-model ensemble (32 global climate models) using the SSP5-8.5 scenario to compute the warming levels.

Results expanded in the Interactive Atlas (active links)
interactive-atlas.ipcc.ch

Links for further information:
TS sections: TS.4.3.1, TS.4.3.2, Box TS.6, Box TS.13, Figure TS.21a, Figure TS.24. **Chapters:** 8.3, 8.4, 8.6, 10.4, 11.3, 11.4, 11.9, Table 11.13, Table 11.14, Table 11.5, 12.4, Atlas.7.1, Atlas.7.2

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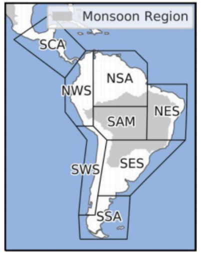
SOUTHERN CENTRAL AMERICA (SCA)
- Aridity, and agricultural and ecological drought are increasing (*medium confidence*). Fire weather is projected to increase (*medium confidence*).

NORTHWESTERN SOUTH AMERICA (NWS)
- Decreases in snow and ice, and increases in pluvial/river flooding are projected with *high confidence*.
- Glacier volume loss and permafrost thawing will *likely* continue in the Andes Cordillera under all greenhouse emissions scenarios in this report, causing important reductions in river flow and potentially high-magnitude glacial lake outburst floods.

NORTHERN SOUTH AMERICA (NSA)
- The intensity and frequency of extreme precipitation and pluvial floods are projected to increase (*medium confidence*) for 2°C of global warming level and above.
- There is *high confidence* in a dominant increase in the number of dry days and drought frequency.

NORTHEASTERN SOUTH AMERICA (NES)
- The intensity and frequency of extreme precipitation and pluvial floods are projected to increase (*medium confidence*) for 2°C of global warming level and above.
- There is *high confidence* in a dominant increase in drought duration.

SOUTHWESTERN SOUTH AMERICA (SWS)
- The total land area subject to increasing drought frequency and severity will expand (*high confidence*). Projections of fire weather indices indicate an increased risk in the region (*high confidence*).
- Increases in one or more aspects between drought, aridity, and fire weather (*high confidence*) will potentially impact a wide range of sectors (including agriculture, forestry, health, and ecosystems), which will be assessed in the IPCC Working Group II report.
- Glacier volume loss and permafrost thawing will *likely* continue in the Andes Cordillera under all greenhouse gas emissions scenarios in this report, causing important reductions in river flow and potentially high-magnitude glacial lake outburst floods.



SOUTHEASTERN SOUTH AMERICA (SES)
- Increases in mean and extreme precipitation are observed since the 1960s (*high confidence*). Drivers of this change include internal variability as well as external forcing, like increases in greenhouse gases and aerosols and ozone depletion.
- The intensity and frequency of extreme precipitation and pluvial floods are projected to increase (*medium confidence*) for 2°C of global warming level and above.

SOUTHERN SOUTH AMERICA (SSA)
- The intensity and frequency of extreme precipitation and pluvial floods is projected to increase (*medium confidence*) for 2°C of global warming level and above.
- The region has projections of increased agricultural and ecological drought for the mid-21st century, for 2°C of global warming level and above (*high confidence*).

SOUTH AMERICAN MONSOON (SAM)
- There is *low confidence* in projected precipitation changes, but *high confidence* that the South American monsoon will be delayed during the 21st century.
- There are projections of increased agricultural and ecological drought for the mid-21st century, for 2°C of global warming level and above (*high confidence*).
- Increases in one or more aspects between drought, aridity, and fire weather (*high confidence*) will affect a wide range of sectors, including agriculture, forestry, health, and ecosystems.
- The intensity and frequency of extreme precipitation and pluvial floods is projected to increase (*medium confidence*) for a 2°C of global warming level and above.
- Over the Amazon, the number of days per year with maximum temperatures exceeding 35°C would increase by more than 150 days by the end of the 21st century in the SSP5-8.5 scenario, while it is expected to increase by less than 60 days under the SSP1-2.6 scenario (*high confidence*).

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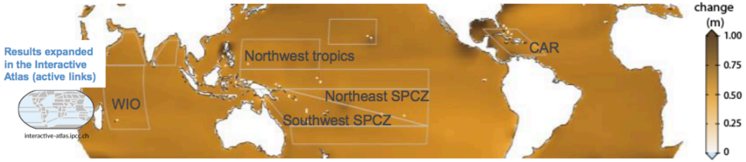
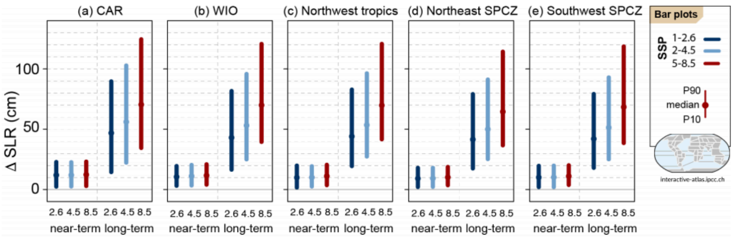
Regional fact sheet - Small Islands

Common regional changes

- Observed warming (*high confidence*) in the Small Islands[1] has been attributed to human influence (*medium confidence*). Warming will continue in the 21st century for all global warming levels and future emissions scenarios, further increasing heat extremes and heat stress (*high confidence*).
- Ocean acidification has increased globally as have the frequency and intensity of marine heatwaves in some areas of the Indian, Atlantic and Pacific Oceans except for a decrease over the eastern Pacific Ocean. Marine heatwaves and ocean acidification will increase further with 1.5°C of global warming (*high confidence*) and with larger increases at 2°C and higher.
- Sea levels will very likely continue to rise around Small Islands, more so with higher emissions and over longer time periods (*high confidence*).
- Sea level rise coupled with storm surges and waves will exacerbate coastal inundation and the potential for increased saltwater intrusion into aquifers (*high confidence*).
- Sea level rise will cause shorelines to retreat along sandy coasts of most Small Islands.
- Small Islands will face more intense but generally fewer tropical cyclones, except in the central north Pacific where frequency will increase (*medium confidence* at a global warming level of 2°C and above).

Relative sea level rise projections for 2080–2100 (SSP3-7.0) relative to 1995–2014





Regional mean changes in annual sea level rise in the near-term (2021–2040) and long-term (2081–2100) for three scenarios (SSP1-2.6, SSP2-4.5, and SSP5-8.5) relative to 1995-2014 for some Small Island Regions. Bar plots indicate median (dots) and 10th–90th percentile range (bars) across each model ensemble.

[1] The WGI AR6 assessment focused primarily on Small Islands in the Caribbean Sea (CAR), Pacific Ocean (PAC) and Western Indian Ocean (WIO).

Regional Factsheets

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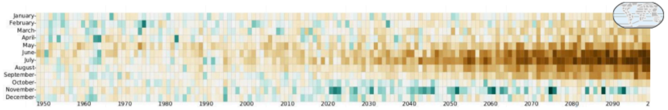
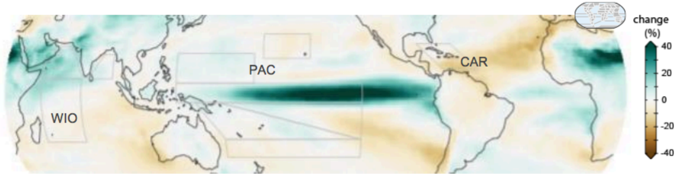
Caribbean (CAR)
- Declining trend in rainfall during June–July–August in CAR will continue in coming decades (*high confidence* at 2°C global warming and above).
- Higher evapotranspiration under a warming climate will result in increased aridity and more severe agricultural and ecological droughts in CAR (*medium confidence* at global warming level of 2°C and above).

Change in monthly average precipitation relative to 1995–2014 for the Caribbean under increasing warming levels





Annual average precipitation change, mid-21st century relative to 1995–2014 (SSP3-7.0)

Western Indian Ocean (WIO)
- Declining trends in rainfall are observed in Western Indian Ocean islands over the past 50-60 years.

Pacific (PAC)
- Trends vary spatially and seasonally over Small Island regions in the Pacific. Rainfall has decreased in parts of the Pacific islands poleward of 20° latitude in both hemispheres (eastern Pacific and southern Pacific subtropics). This drying trend will continue in the coming decades, except in parts of western and equatorial Pacific.
- Heavy rainfall events will increase in the western tropical Pacific (*high confidence* at 2°C global warming and above).
- Higher evapotranspiration under a warming climate either amplifies or partially offsets respectively the effect of decreases or increases in rainfall resulting in increased aridity in parts of the Pacific (*medium confidence* at 2°C global warming and above).

Climate information for Small Islands
Though it is clear the climate of Small Islands has and will continue to change in diverse ways, constructing climate information for Small Islands is challenging due to lack of observations and high-resolution climate projections, as well as the representation and understanding of key modes of variability and their interplay with trends.

Links for further details
Common regional changes: Table 11.13, 12.4, 12.4.7, Atlas.10, TS.4.3.1, TS.4.3.2.7
Caribbean: Table 11.14, Table 11.15, 12.4.7, Atlas.10, Cross-Chapter Box Atlas.2
Western Indian Ocean: 12.4.7, Atlas.10, Cross-Chapter Box Atlas.2
Pacific: 12.4.7, Atlas.10, Cross-Chapter Box Atlas.2
Climate information for Small Islands: Cross-Chapter Box Atlas.2

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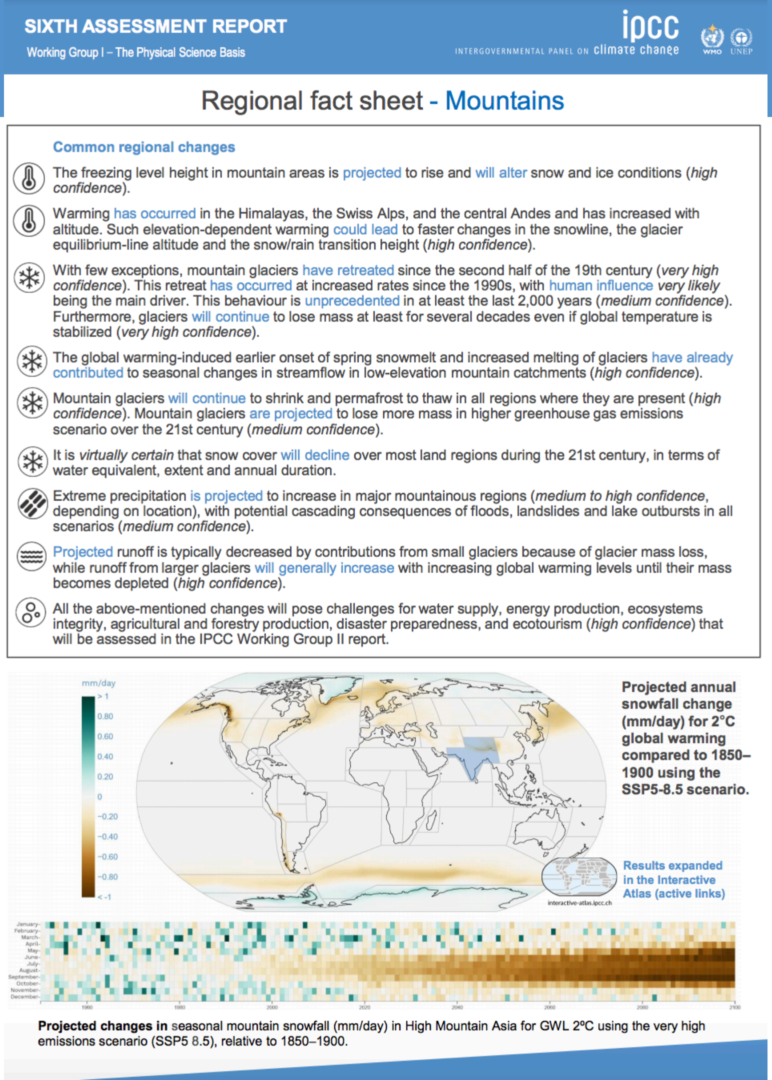
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Regional fact sheet - Mountains

Common regional changes

The freezing level height in mountain areas is projected to rise and will alter snow and ice conditions (*high confidence*).

Warming has occurred in the Himalayas, the Swiss Alps, and the central Andes and has increased with altitude. Such elevation-dependent warming could lead to faster changes in the snowline, the glacier equilibrium-line altitude and the snow/rain transition height (*high confidence*).

With few exceptions, mountain glaciers have retreated since the second half of the 19th century (*very high confidence*). This retreat has occurred at increased rates since the 1990s, with human influence *very likely* being the main driver. This behaviour is unprecedented in at least the last 2,000 years (*medium confidence*). Furthermore, glaciers will continue to lose mass at least for several decades even if global temperature is stabilized (*very high confidence*).

The global warming-induced earlier onset of spring snowmelt and increased melting of glaciers have already contributed to seasonal changes in streamflow in low-elevation mountain catchments (*high confidence*).

Mountain glaciers will continue to shrink and permafrost to thaw in all regions where they are present (*high confidence*). Mountain glaciers are projected to lose more mass in higher greenhouse gas emissions scenario over the 21st century (*medium confidence*).

It is *virtually certain* that snow cover will decline over most land regions during the 21st century, in terms of water equivalent, extent and annual duration.

Extreme precipitation is projected to increase in major mountainous regions (*medium to high confidence*, depending on location), with potential cascading consequences of floods, landslides and lake outbursts in all scenarios (*medium confidence*).

Projected runoff is typically decreased by contributions from small glaciers because of glacier mass loss, while runoff from larger glaciers will generally increase with increasing global warming levels until their mass becomes depleted (*high confidence*).

All the above-mentioned changes will pose challenges for water supply, energy production, ecosystems integrity, agricultural and forestry production, disaster preparedness, and ecotourism (*high confidence*) that will be assessed in the IPCC Working Group II report.

Projected annual snowfall change (mm/day) for 2°C global warming compared to 1850–1900 using the SSP5-8.5 scenario.

Results expanded in the Interactive Atlas (active links)

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Projected changes in seasonal mountain snowfall (mm/day) in High Mountain Asia for GWL 2ºC using the very high emissions scenario (SSP5 8.5), relative to 1850–1900.

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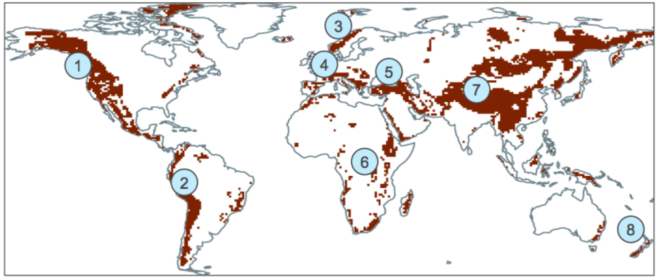


Typological mountain regions used in the report's Interactive Atlas. Labels correspond to the regions described below.

Rocky Mountains & Alaska ①
- Reduction in glaciers, seasonality of snow and ice formation, loss of shallow permafrost, and shifts in the rain/snow transition line are projected to alter the seasonal and geographic range of snow and ice conditions in the coming decades (*very high confidence*).
- Continued shrinkage of glaciers is projected to create further glacial lakes (*medium confidence*).

Andes ②
- Glacier volume loss and permafrost thawing will *likely* continue, causing important reductions in river flow and potentially high-magnitude glacial lake outburst floods.

Scandinavian Mountains ③
- Most periglacial debris-flow processes are projected to disappear by the end of 21st century, even for low-warming scenarios (*medium confidence*).

European Alps ④
- Elevation-enhanced long-term trends in maximum near-surface air temperature and diurnal temperature range were observed in the Swiss Alps.
- Snow cover will decrease below elevations of 1500–2000 m throughout the 21st century (*high confidence*). A reduction of glacier ice volume is projected with *high confidence*.

Caucasus & Pontic Mountains ⑤
- Mountain permafrost degradation at high altitudes has increased the instability of mountain slopes in the past decade (*medium confidence*).

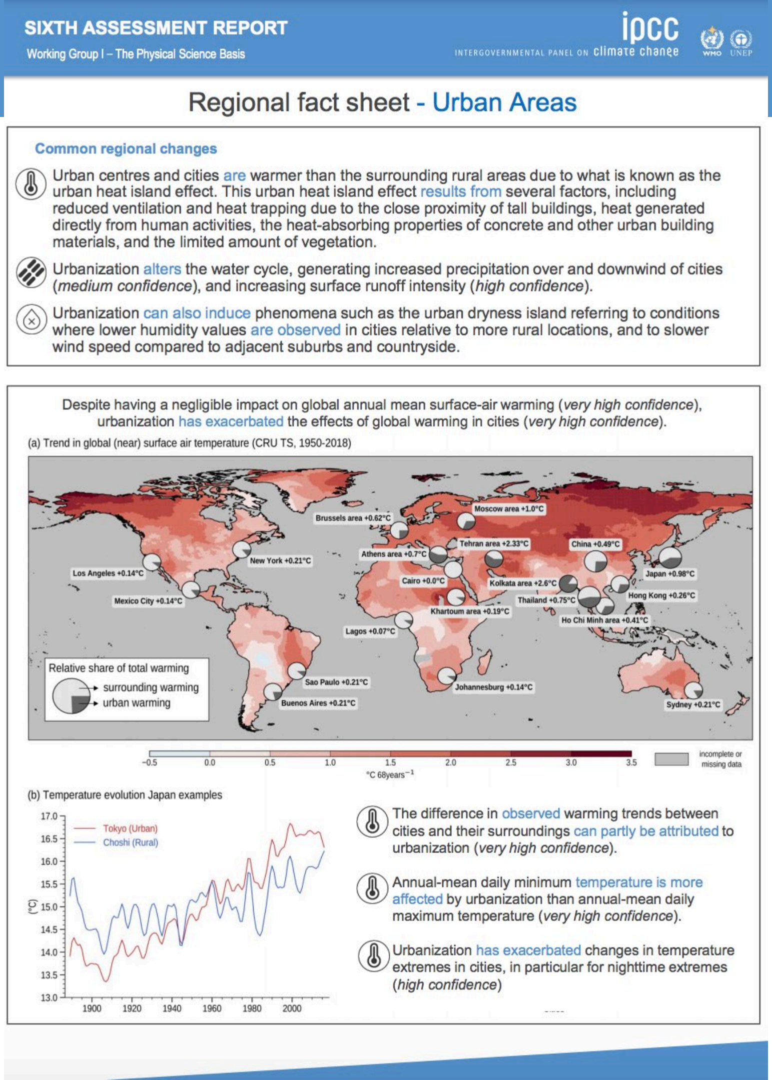
East African Mountains ⑥
- African snow and glaciers have very significantly decreased in the last decades and this trend will continue over the 21st century (*high confidence*).

High Mountain Asia ⑦
- Snow cover has reduced since the early 21st century, and glaciers have thinned, retreated, and lost mass since the 1970s (*high confidence*), although the Karakoram glaciers have either slightly gained mass or are in an approximately balanced state (*medium confidence*).
- Snow-covered areas and snow volumes will decrease during the 21st century, snowline elevations will rise (*high confidence*) and glacier mass is *likely* to decline with greater mass loss in higher greenhouse gas emissions scenarios.
- Rising temperature and precipitation can increase the occurrence of glacial lake outburst floods and landslides over moraine-dammed lakes (*high confidence*).

Southern Alps ⑧
- Glacier ice volume in New Zealand has decreased in the last decades.

Links for further details:
Common changes: 12.4.10.4, TS.2.5, TS.4.3.1, TS.4.3.2.10, Box TS.6.
Rocky Mountains & Alaska: 12.4.6.4. **Andes:** 12.4.4.4. **Scandinavian Mountains. and European Alps**: 12.4.5.4 and 12.4.10.4. **Caucasus & Pontic Mountains**: TS.4.3.2.2. **East African Mountains**: 12.4.1.4.
High Mountain Asia: 12.4.2.4. **Southern Alps**: 12.4.3.4.

https://www.ipcc.ch/report/ar6/wg1/#Regional/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Regional fact sheet - Urban Areas

Common regional changes

Urban centres and cities are warmer than the surrounding rural areas due to what is known as the urban heat island effect. This urban heat island effect results from several factors, including reduced ventilation and heat trapping due to the close proximity of tall buildings, heat generated directly from human activities, the heat-absorbing properties of concrete and other urban building materials, and the limited amount of vegetation.

Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (*medium confidence*), and increasing surface runoff intensity (*high confidence*).

Urbanization can also induce phenomena such as the urban dryness island referring to conditions where lower humidity values are observed in cities relative to more rural locations, and to slower wind speed compared to adjacent suburbs and countryside.

Despite having a negligible impact on global annual mean surface-air warming (*very high confidence*), urbanization has exacerbated the effects of global warming in cities (*very high confidence*).

(a) Trend in global (near) surface air temperature (CRU TS, 1950-2018)

(b) Temperature evolution Japan examples

The difference in observed warming trends between cities and their surroundings can partly be attributed to urbanization (*very high confidence*).

Annual-mean daily minimum temperature is more affected by urbanization than annual-mean daily maximum temperature (*very high confidence*).

Urbanization has exacerbated changes in temperature extremes in cities, in particular for nighttime extremes (*high confidence*)

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Air pollution

- A warmer climate is expected to increase surface ozone by a few parts per billion over polluted regions, depending on ozone precursor levels (*medium* to *high confidence*).
- There is *medium confidence* that climate driven changes to meteorological conditions generally favor extreme air pollution episodes in heavily polluted environments, though with strong regional and metric dependencies.

Coastal cities

- Both sea levels and air temperatures are projected to rise in most coastal settlements (*high confidence*)
- The combination of extreme sea level, increased by both sea level rise and storm surge, and extreme rainfall/riverflow events will increase the probability of flooding (*high confidence*)
- There is *high confidence* in an increase in pluvial flood potential in urban areas where extreme precipitation is projected to increase, especially at high global warming levels

Common projections

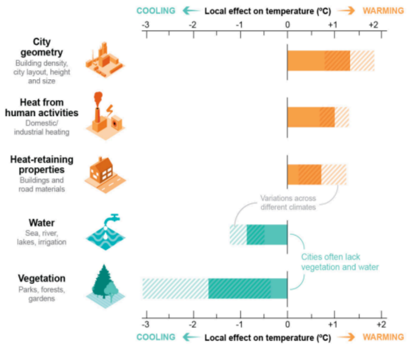
- Future urbanization will amplify the projected air temperature change in cities regardless of the characteristics of the background climate, resulting in a warming signal on minimum temperatures that could be as large as the global warming signal (*very high confidence*).
- Compared to present day, large implications are expected from the combination of future urban development and more frequent occurrence of extreme climate events, such as heatwaves, with more hot days and warm nights adding to heat stress in cities (*very high confidence*).
- Impact assessments and adaptation plans in cities require high-spatial-resolution climate projections along with models that represent urban processes, ensemble dynamical and statistical downscaling, and local-impact models.

Three main factors contribute to amplify the warming of urban areas:

- Urban geometry. Tall buildings close to each other absorb and store heat and also reduce natural ventilation.
- Human activities, due to heat released from domestic and industrial heating or cooling systems, running engines, and other sources.
- The materials that make up cities. These materials are very good at absorbing and retaining heat and then re-emitting that heat at night.

The urban heat island effect is further amplified in cities that lack vegetation and water bodies.

FAQ 10.2: Why are cities the hotspots of global warming?
Cities are usually warmer than their surrounding areas due to factors that trap and release heat and a lack of natural cooling influences, such as water and vegetation.



Links for further information:
Common changes: 8.2, Box 10.3, 11.3, 11.4
Figures: 2.3, Box 10.3, 11.3, 11.4
Air pollution: 6.3, 6.5
Coastal cities: 12.3, 12.4, Box TS.14
Common projections: Box 10.3, 11.3, 11.4, 12.3, 12.4
Urban heat island effect: Box 10.3, FAQ 10.2

Interactive Atlas

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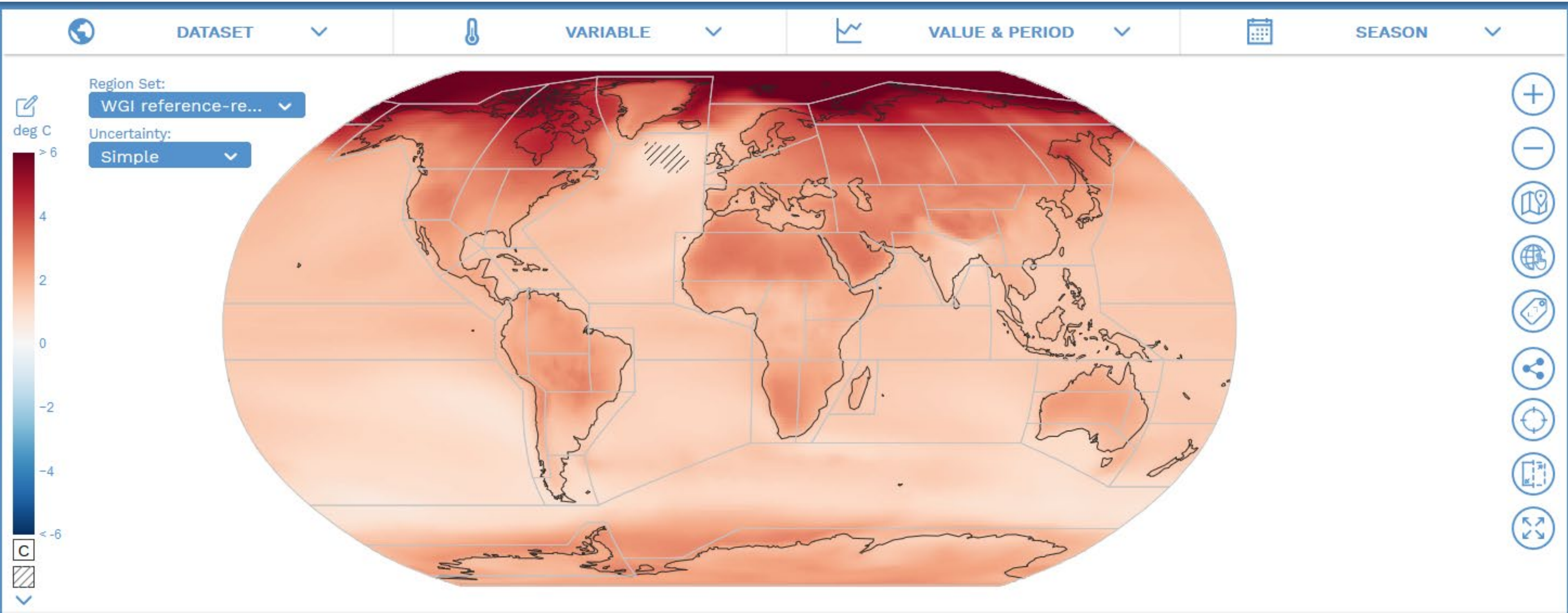
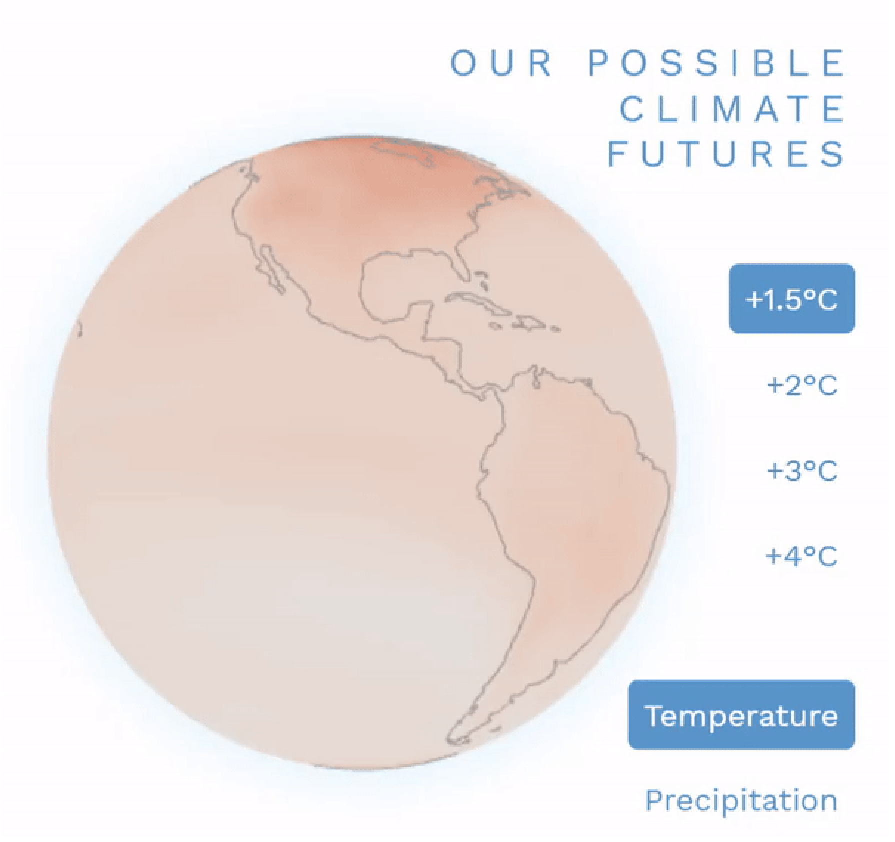


CMIP6 - Mean temperature (T) Change deg C - Warming 2°C SSP5 8.5 (rel. to 1850-1900) - Annual (34 models)

Interactive atlas



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