Global Warming of 1.5°C

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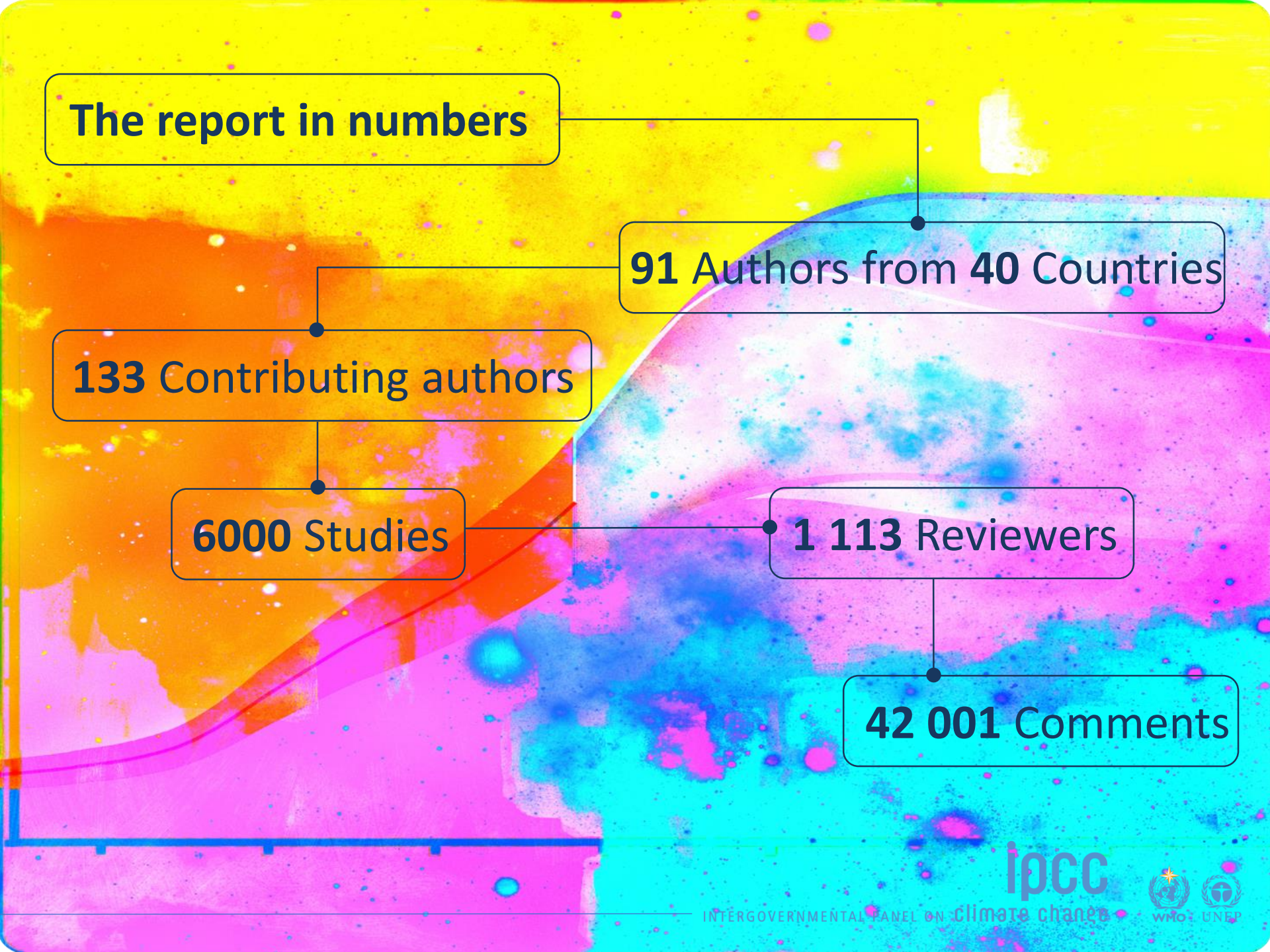
Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.


The report in numbers
91 Authors from 40 Countries
133 Contributing authors
6000 Studies
1 113 Reviewers
42 001 Comments
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Climate change is already affecting people, ecosystems and livelihoods around the world

Limiting global warming to 1.5°C is not impossible – but it would require unprecedented transitions in all aspects of society

There are clear benefits to keeping warming to 1.5°C rather than 2°C or higher

Limiting warming to 1.5°C can go hand in hand with achieving other world goals

- Every bit of warming matters
- Every year matters
- Every choice matters

Global warming of 1.5°C (SR1.5)

Chapter 1 - Framing and context (integration WGI-WGII-III)

Chapter 2 - Mitigation pathways compatible with 1.5°C in the context of sustainable development (integration WGI-WGIII, pathways)

Chapter 3 - Impacts of 1.5°C global warming on natural and human systems (integration WGI-WGII, global – regional)

Chapter 4 - Strengthening and implementing the global response to the threat of climate change (systems transitions, behaviour, dimensions of feasibility)

Chapter 5 - Sustainable development, poverty eradication and reducing inequalities (ethics, equity, societal transformation, SDGs)

Understanding Global Warming of 1.5°C

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Ashley Cooper / Aurora Photos

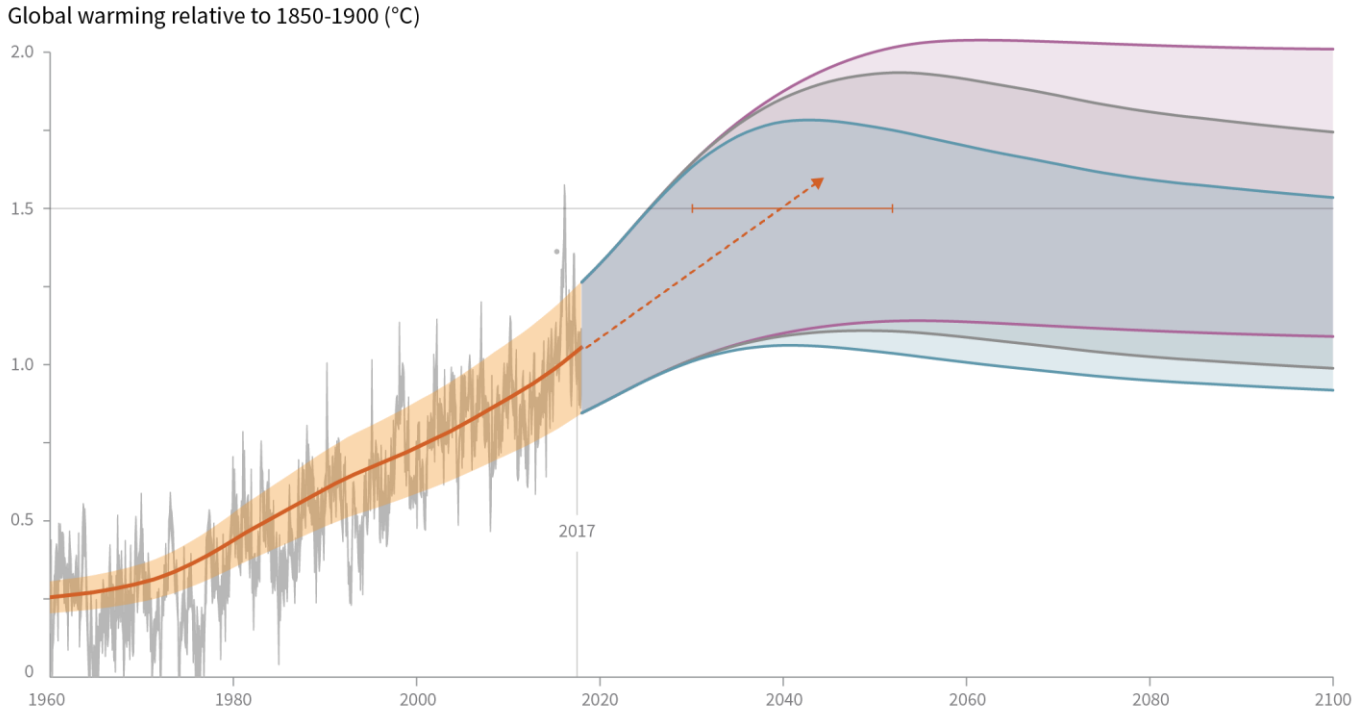
Where are we?

Since pre-industrial times, human activities have caused approximately 1.0°C of global warming.

- Already seeing consequences for people, nature and livelihoods
- At current rate, would reach 1.5°C between 2030 and 2052
- Past emissions alone do not commit the world to 1.5°C

SPM1 | Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting warming to 1.5°C

a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways



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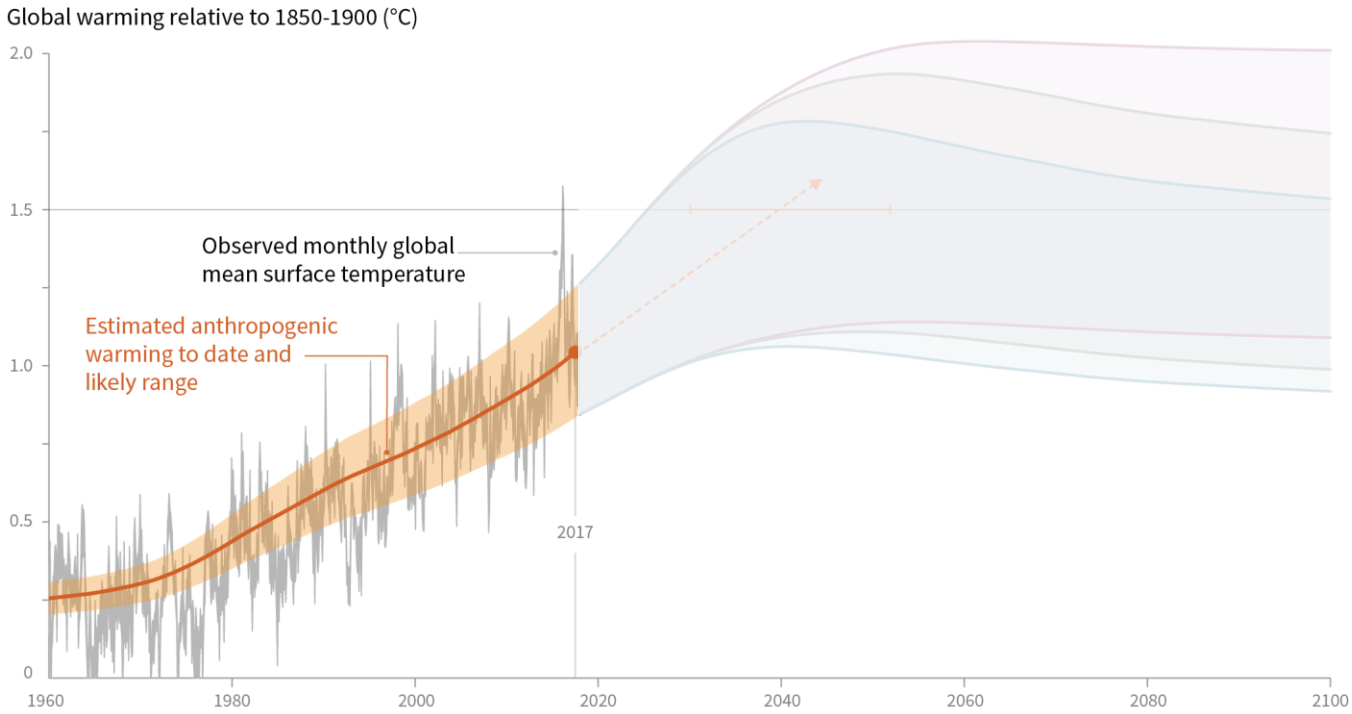

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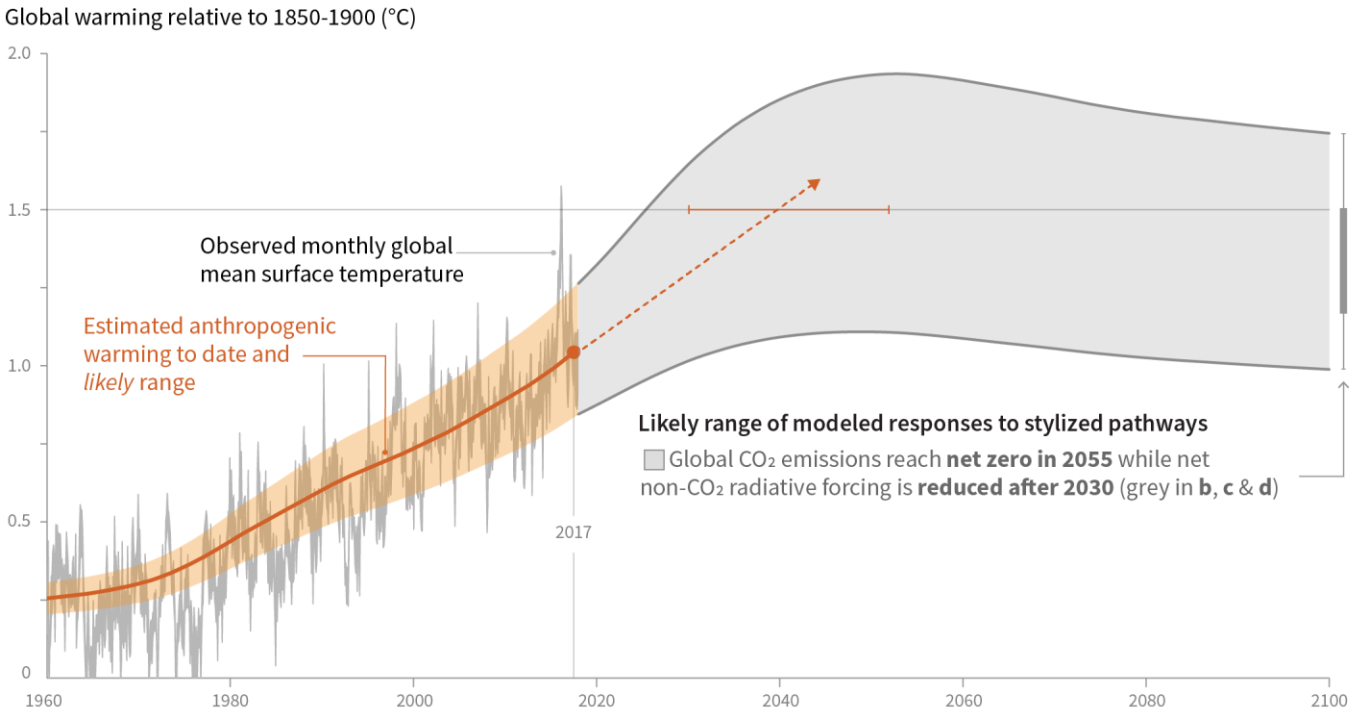

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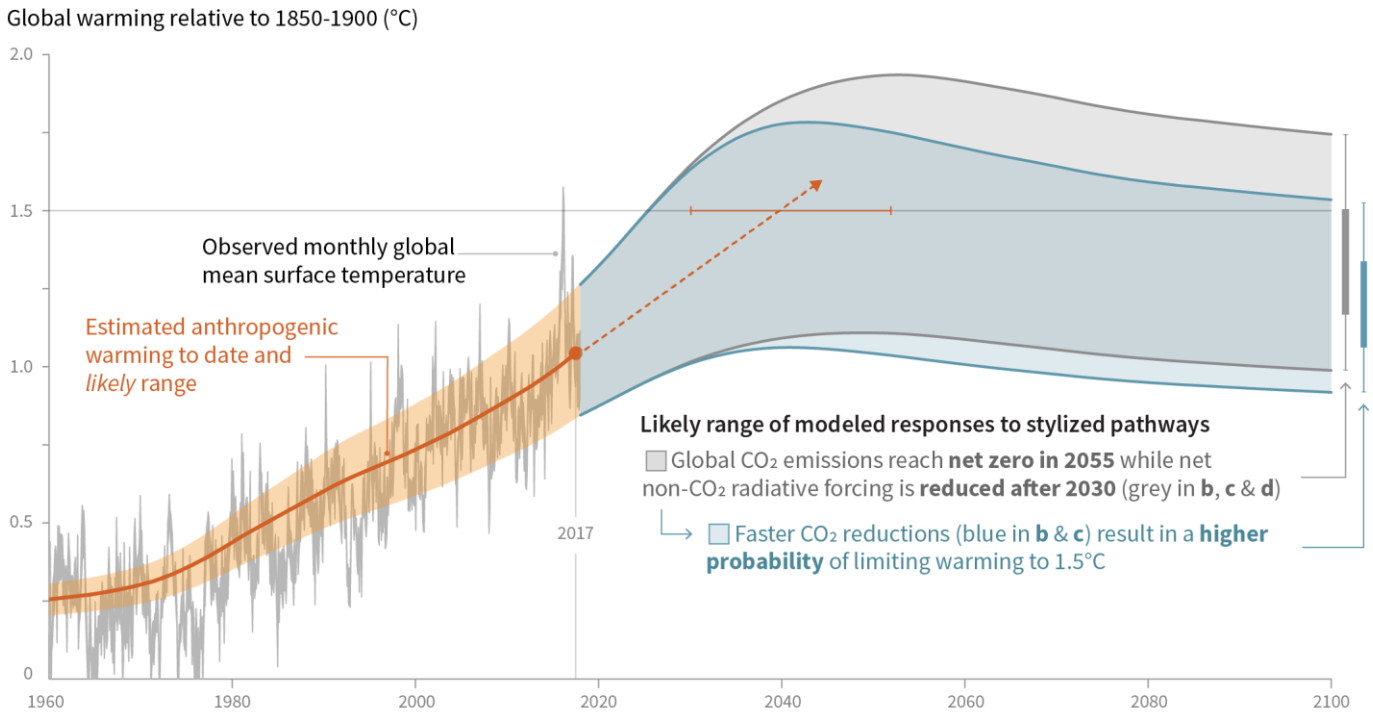

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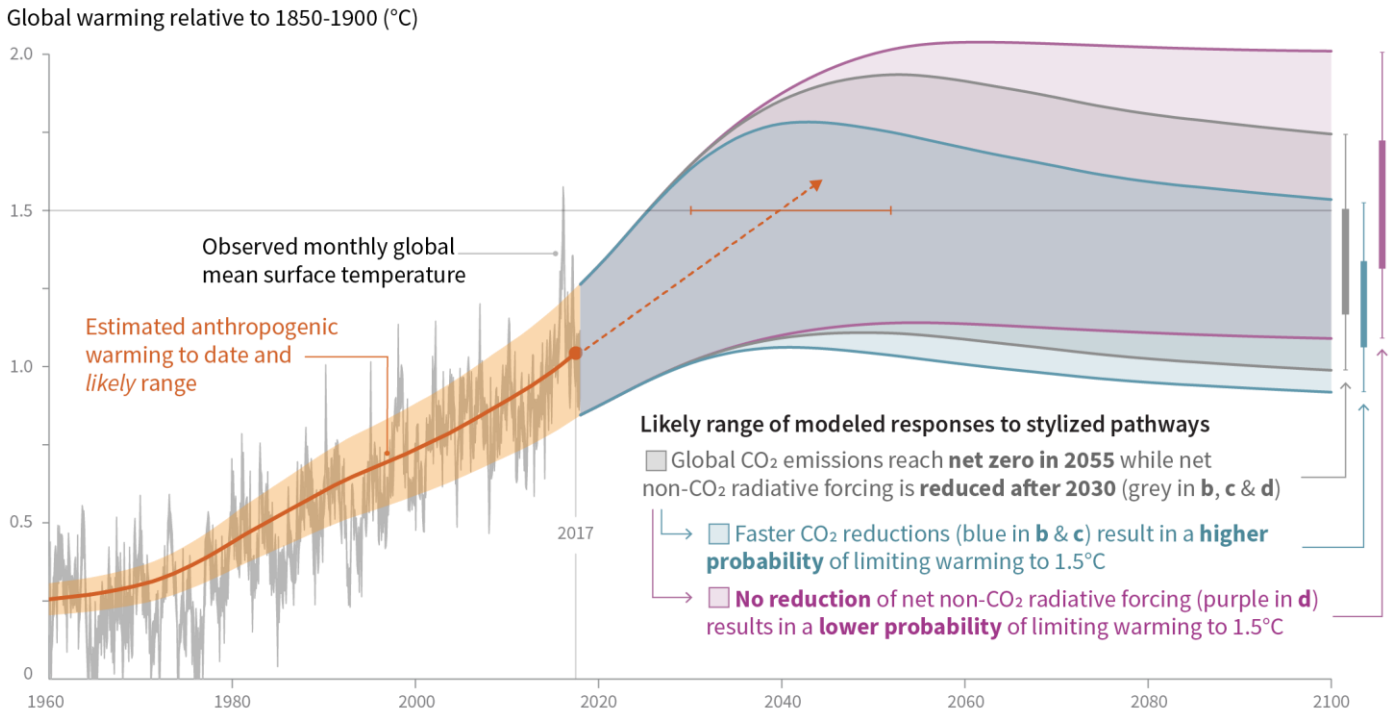

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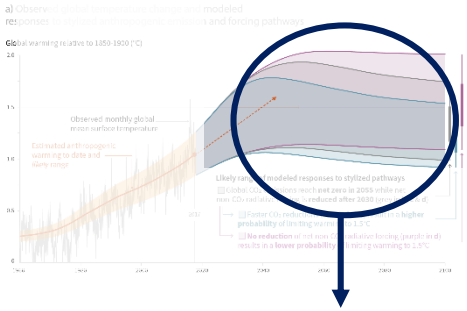
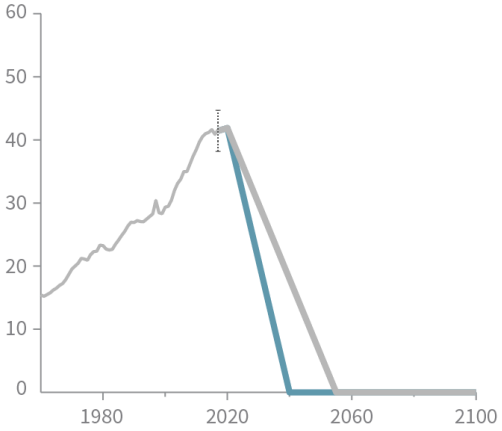


b) Stylized net global CO_2 emission pathways
Billion tonnes CO_2 per year ($GtCO_2$/yr)



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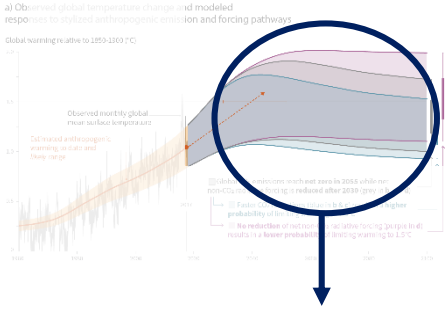

Faster immediate CO_2 emission reductions limit cumulative CO_2 emissions

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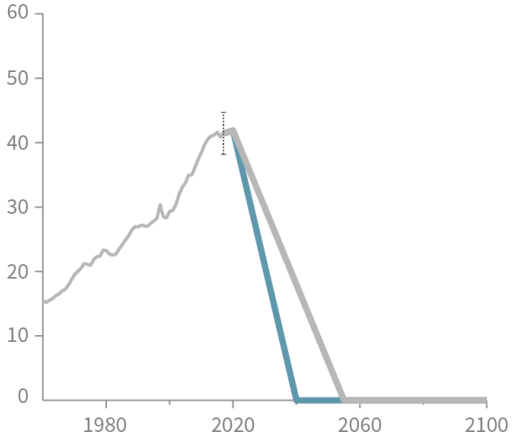

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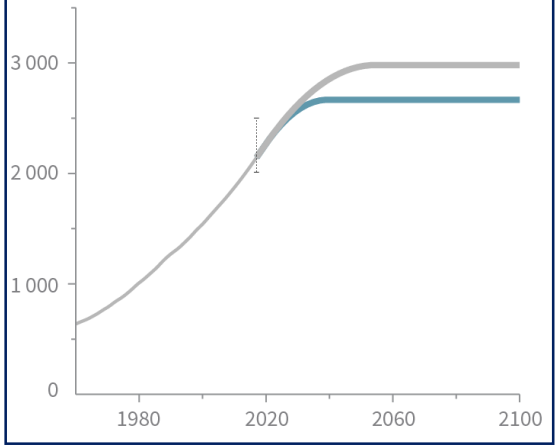

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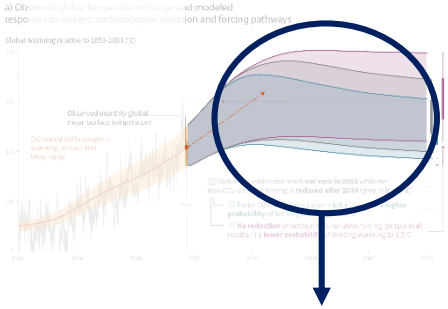

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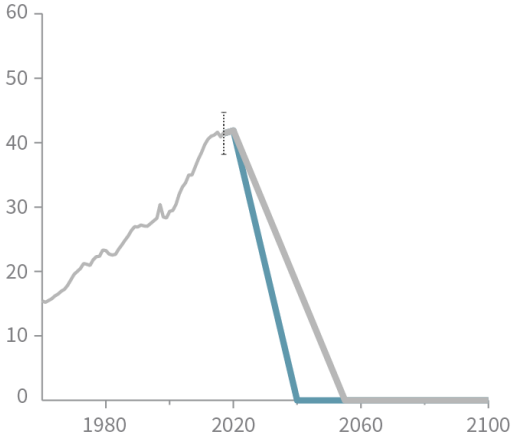

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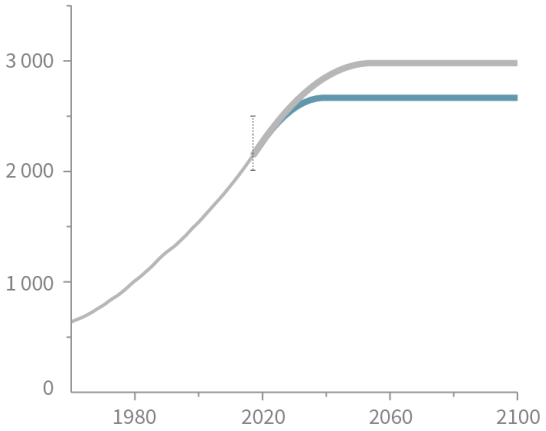
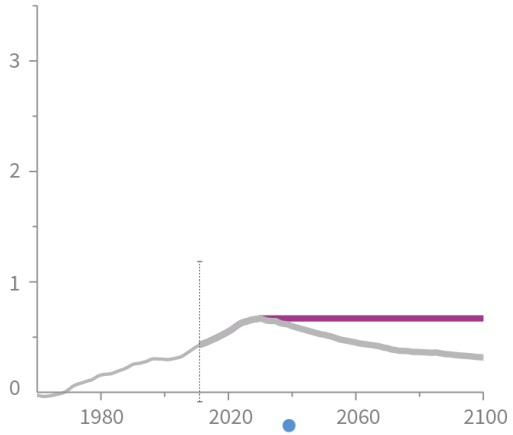


d) Non-CO_2 radiative forcing pathways
Watts per square metre (W/m^2)



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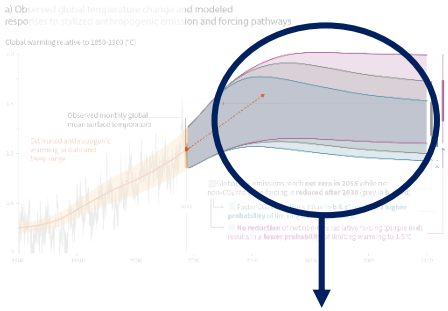
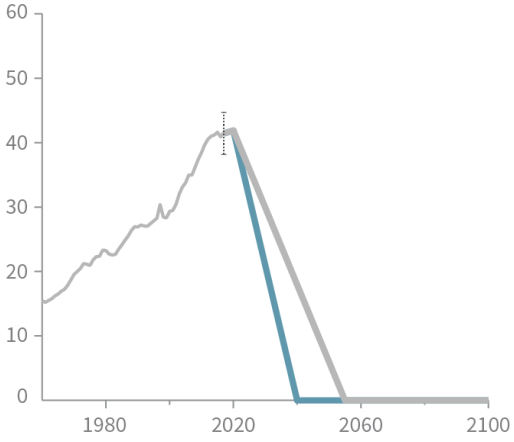


Maximum temperature rise is determined by cumulative net CO2 emissions and net non-CO2 radiative forcing due to methane, nitrous oxide, aerosols and other anthropogenic forcing agents.

b) Stylized net global CO_2 emission pathways
Billion tonnes CO_2 per year ($GtCO_2$/yr)



c) Cumulative net CO_2 emissions
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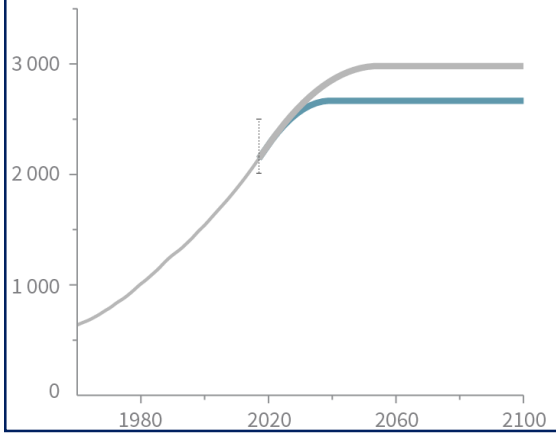

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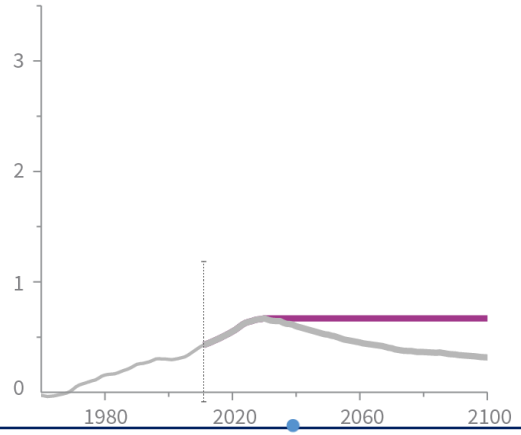
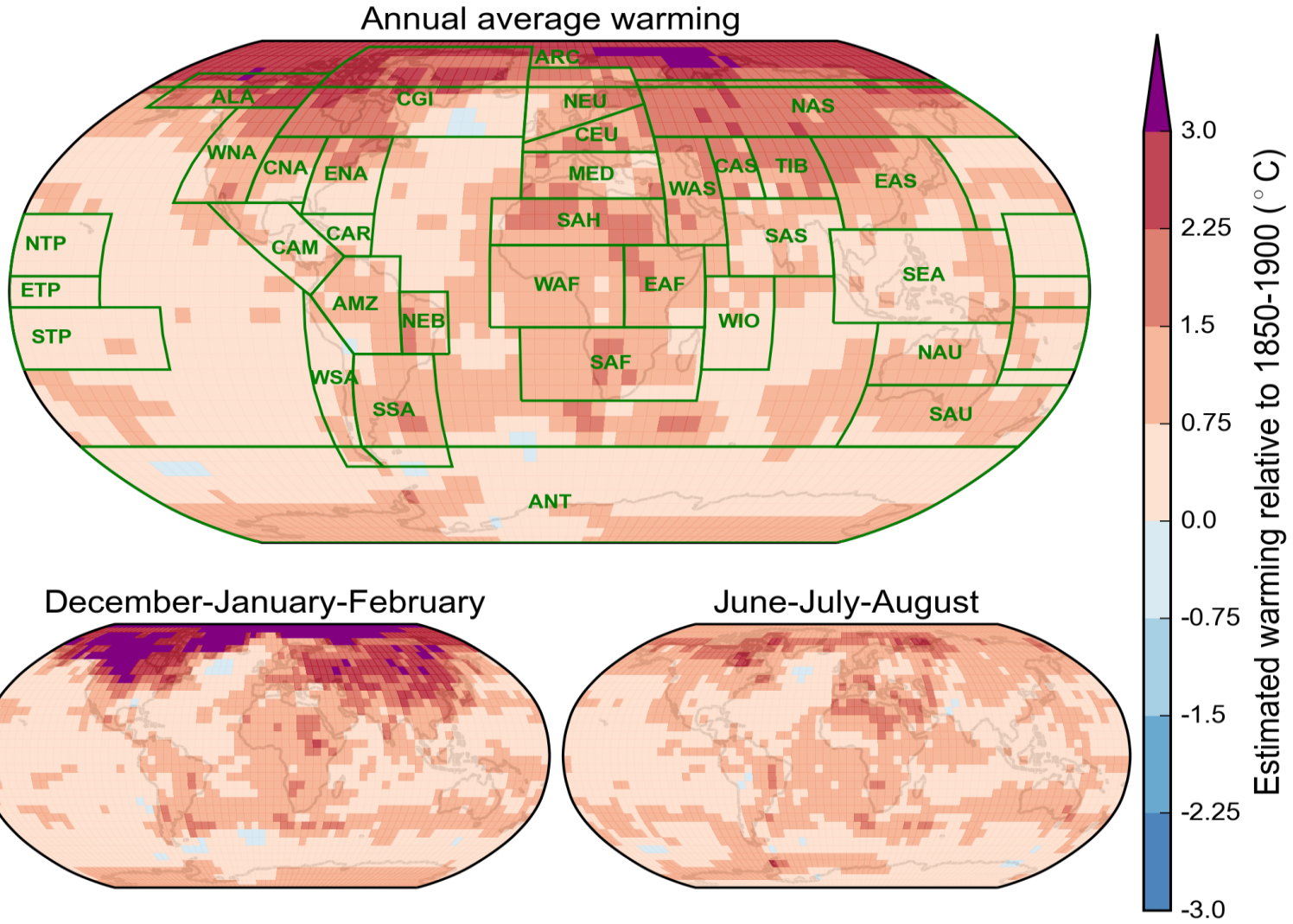


Regional warming in the decade 2006-2015 relative to preindustrial

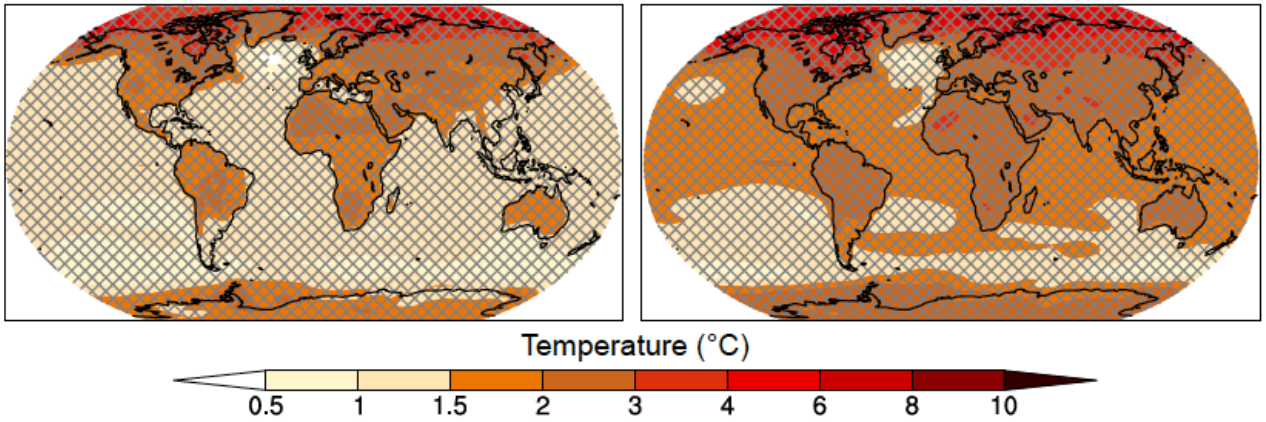


Projected Climate Change, Potential Impacts and Associated Risks

Spatial patterns of changes in mean temperature

Global warming of 1.5°C

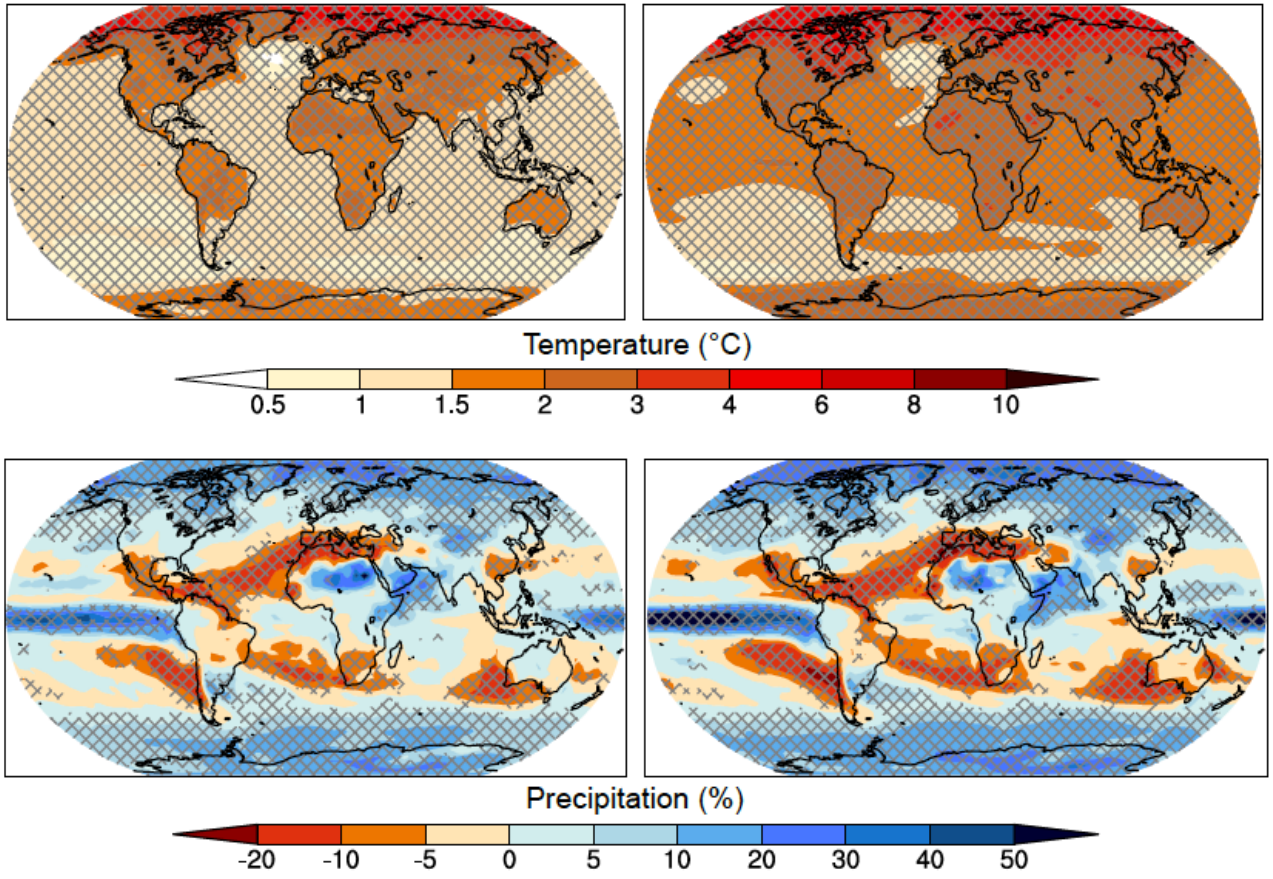
2°C



26 CMIP5 models; hatching : 66% model agreement

Spatial patterns of changes in mean temperature and precipitation

Global warming of 1.5°C 2°C



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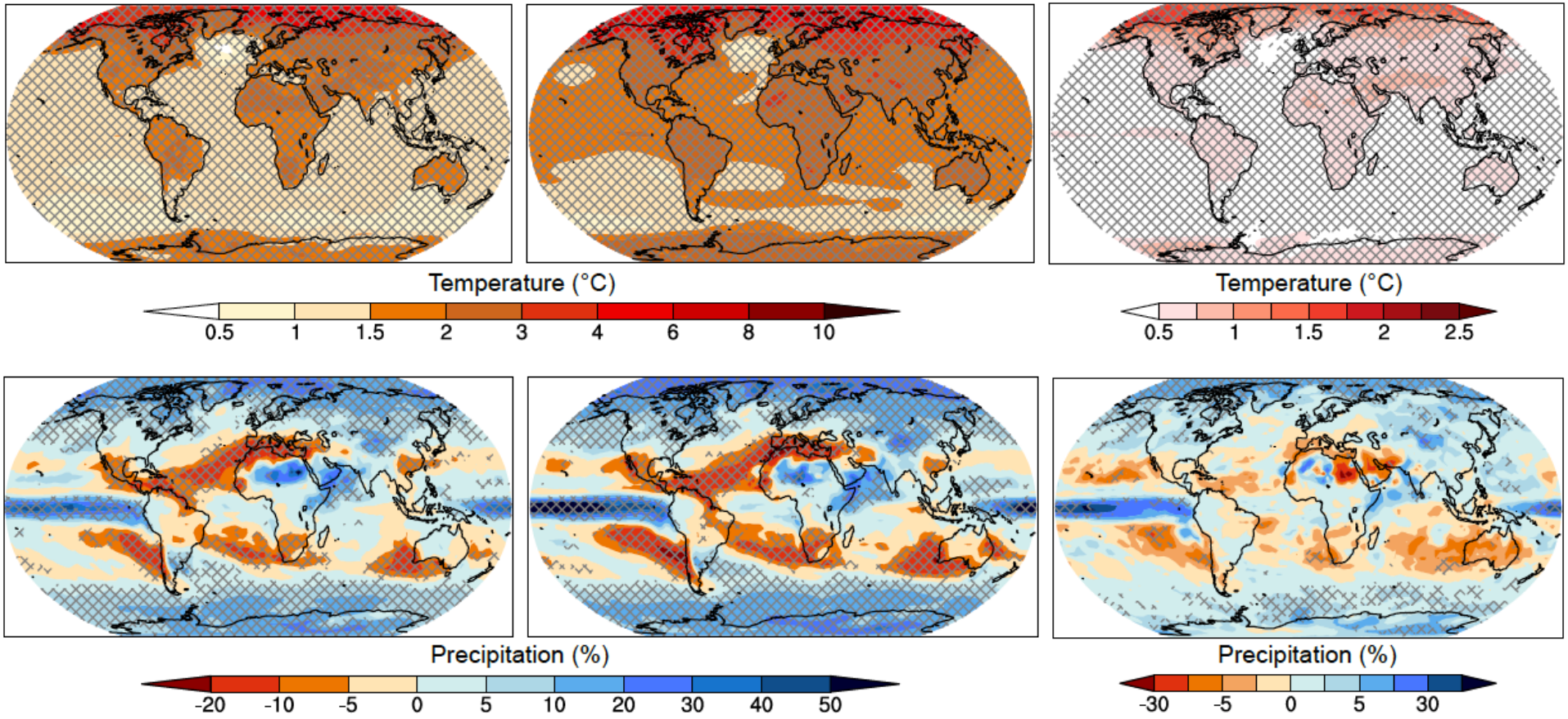
Spatial patterns of changes in mean temperature and precipitation

Global warming of 1.5°C | 2°C | Differences



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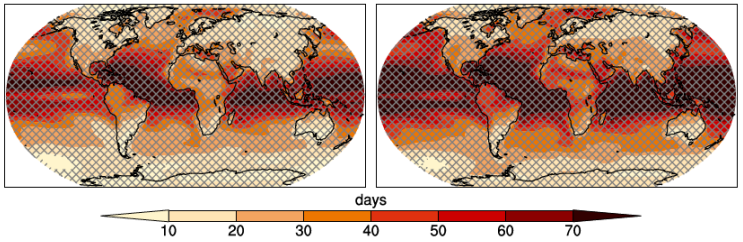
Spatial patterns of changes in extreme temperature

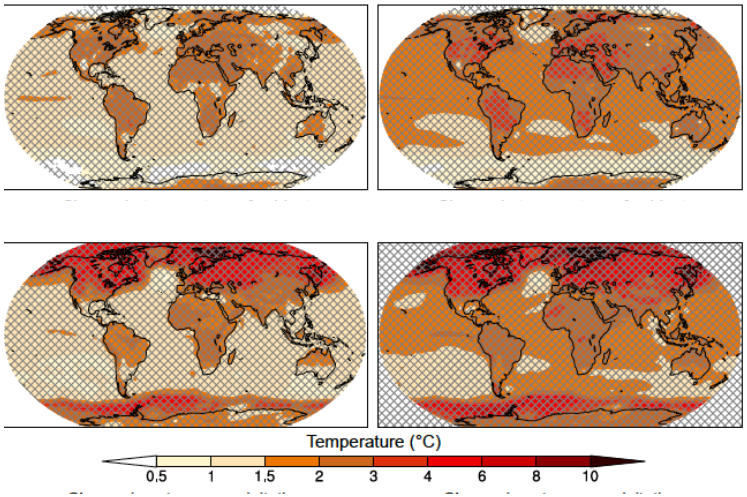
Global warming of 1.5°C 2°C

Number of hot days (days)



Temperature of hottest days (°C)

Temperature of coldest nights (°C)



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Global warming of 1.5°C 2°C

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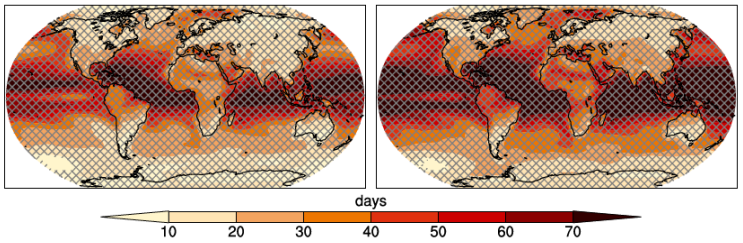

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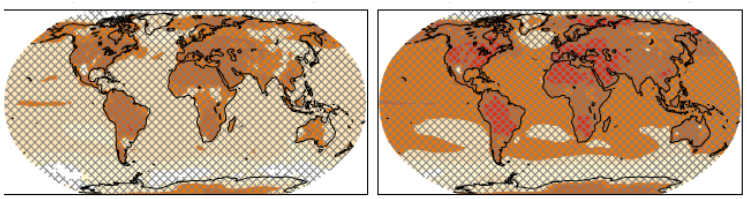
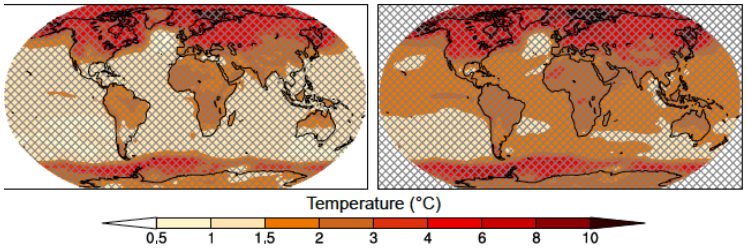
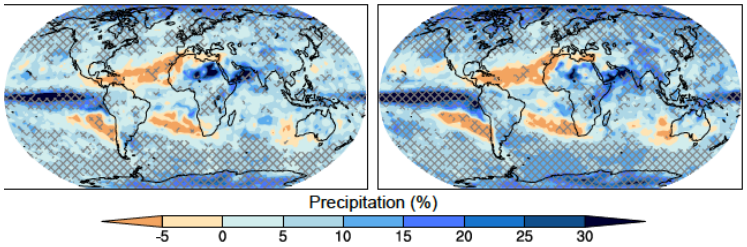


Temperature of coldest nights (°C)



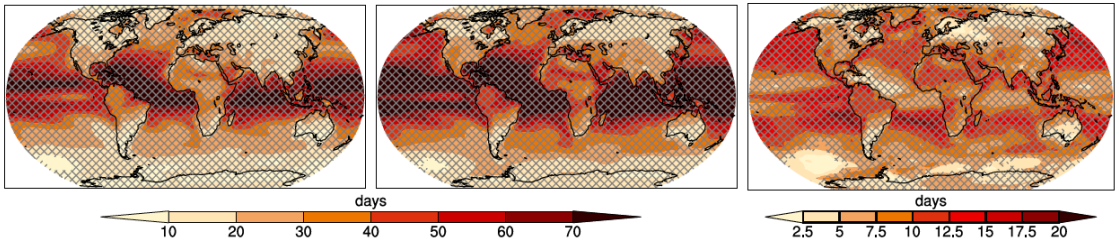
Extreme precipitation (%)



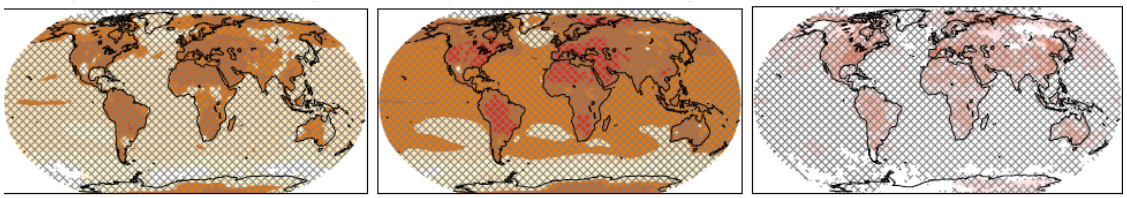
Spatial patterns of changes in extreme temperature and precipitation

Global warming of 1.5°C | 2°C | Difference

Number of hot days (days)



Temperature of hottest days (°C)



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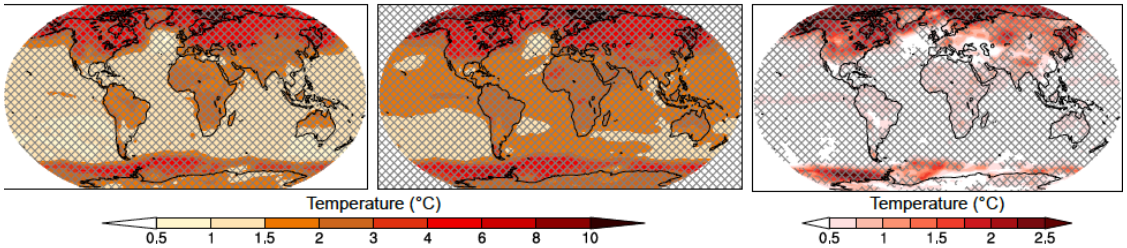

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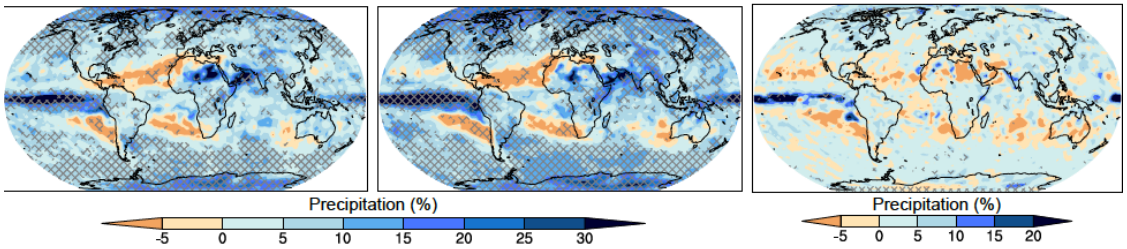
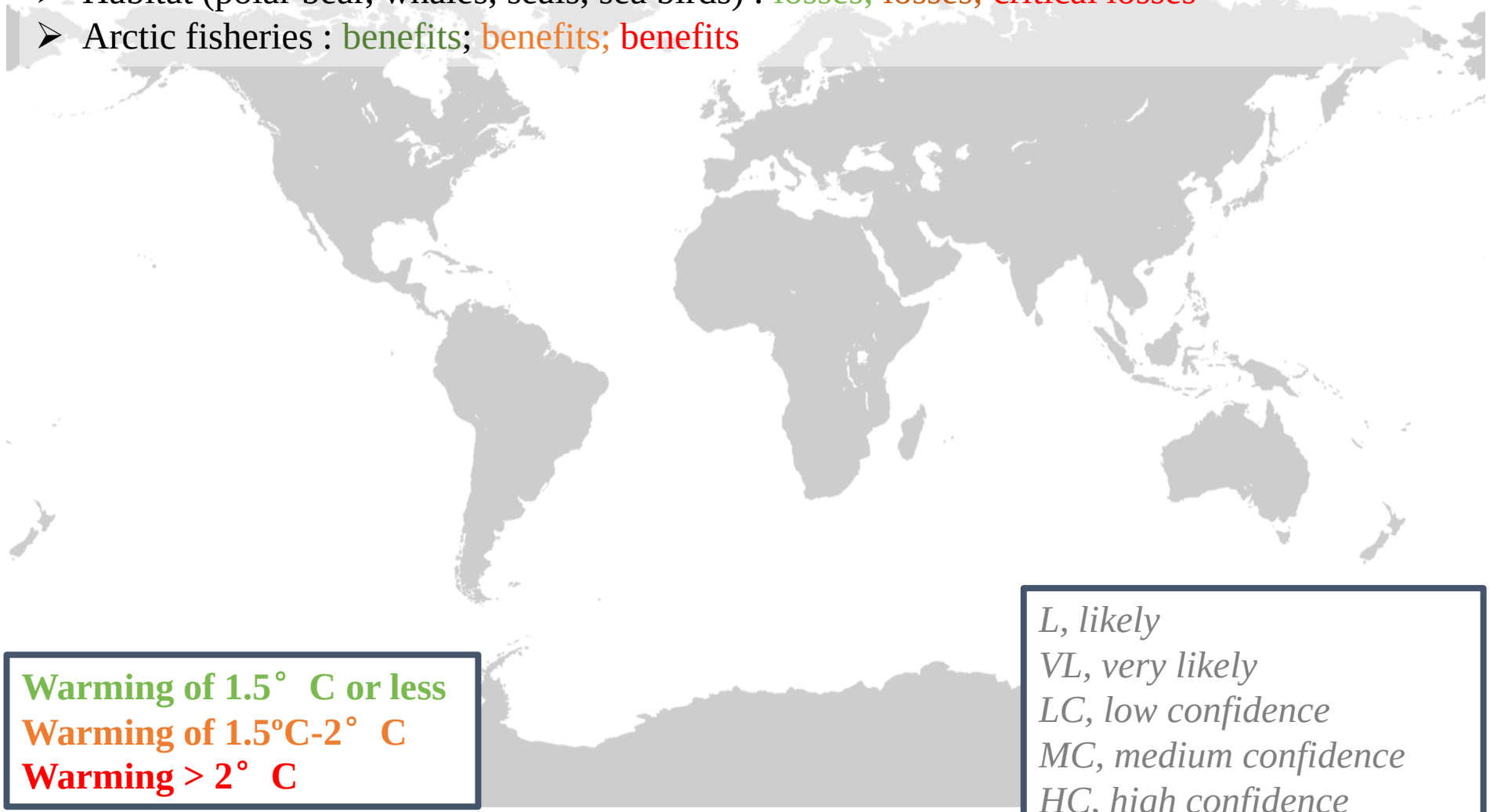


Emergence and intensity of regional climate change hot spots

Arctic summer sea-ice

- *L* maintained; 50% or higher risk to be ice free; *VL* to be ice free
- Habitat (polar bear, whales, seals, sea birds) : losses; losses; critical losses
- Arctic fisheries : benefits; benefits; benefits



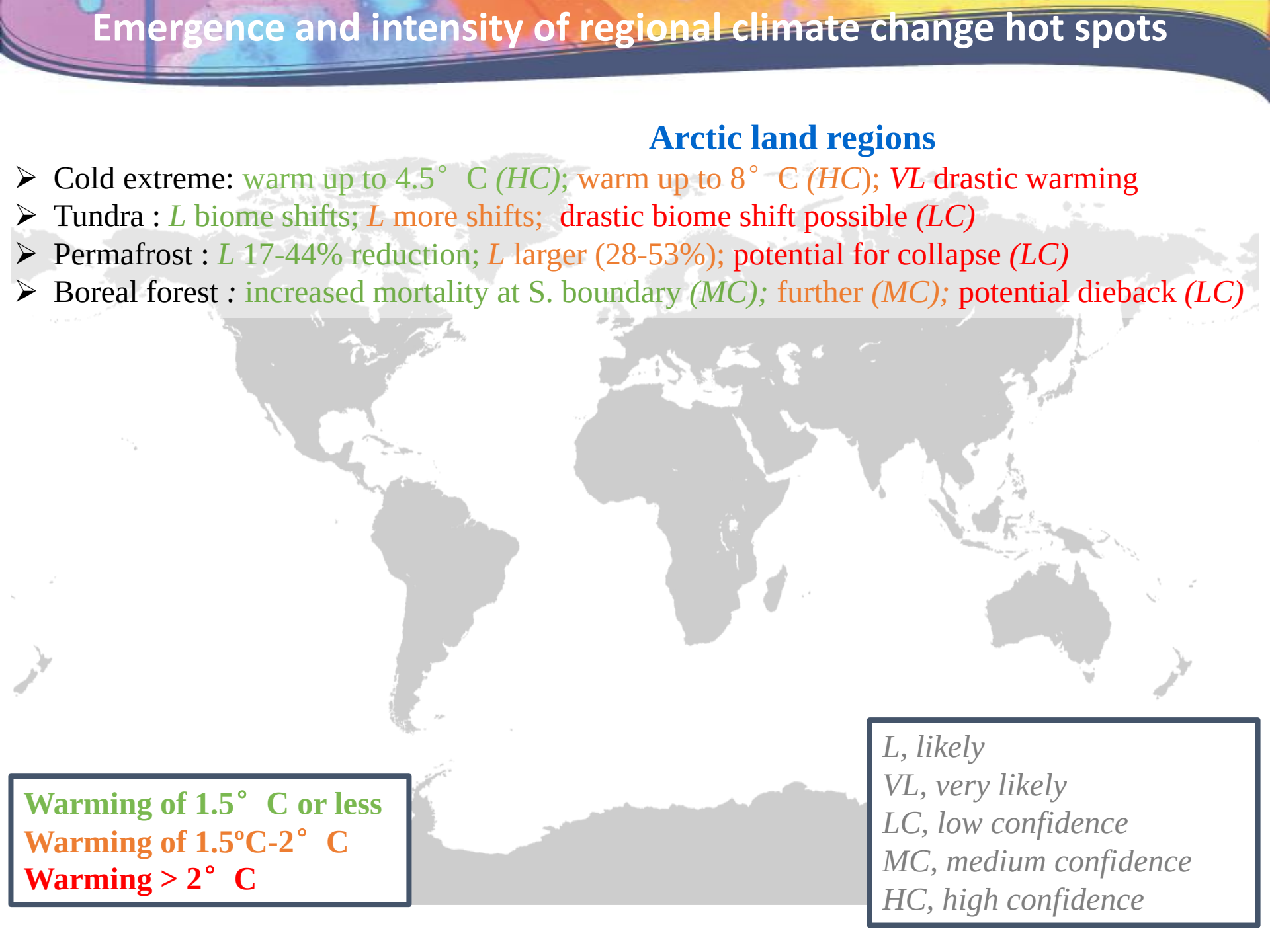
Warming of 1.5° C or less
Warming of 1.5°C-2° C
Warming > 2° C

L, likely
VL, very likely
LC, low confidence
MC, medium confidence
HC, high confidence

Emergence and intensity of regional climate change hot spots

Arctic land regions

- Cold extreme: warm up to 4.5° C *(HC)*; warm up to 8° C *(HC)*; *VL* drastic warming
- Tundra : *L* biome shifts; *L* more shifts; drastic biome shift possible *(LC)*
- Permafrost : *L* 17-44% reduction; *L* larger (28-53%); potential for collapse *(LC)*
- Boreal forest : increased mortality at S. boundary *(MC)*; further *(MC)*; potential dieback *(LC)*



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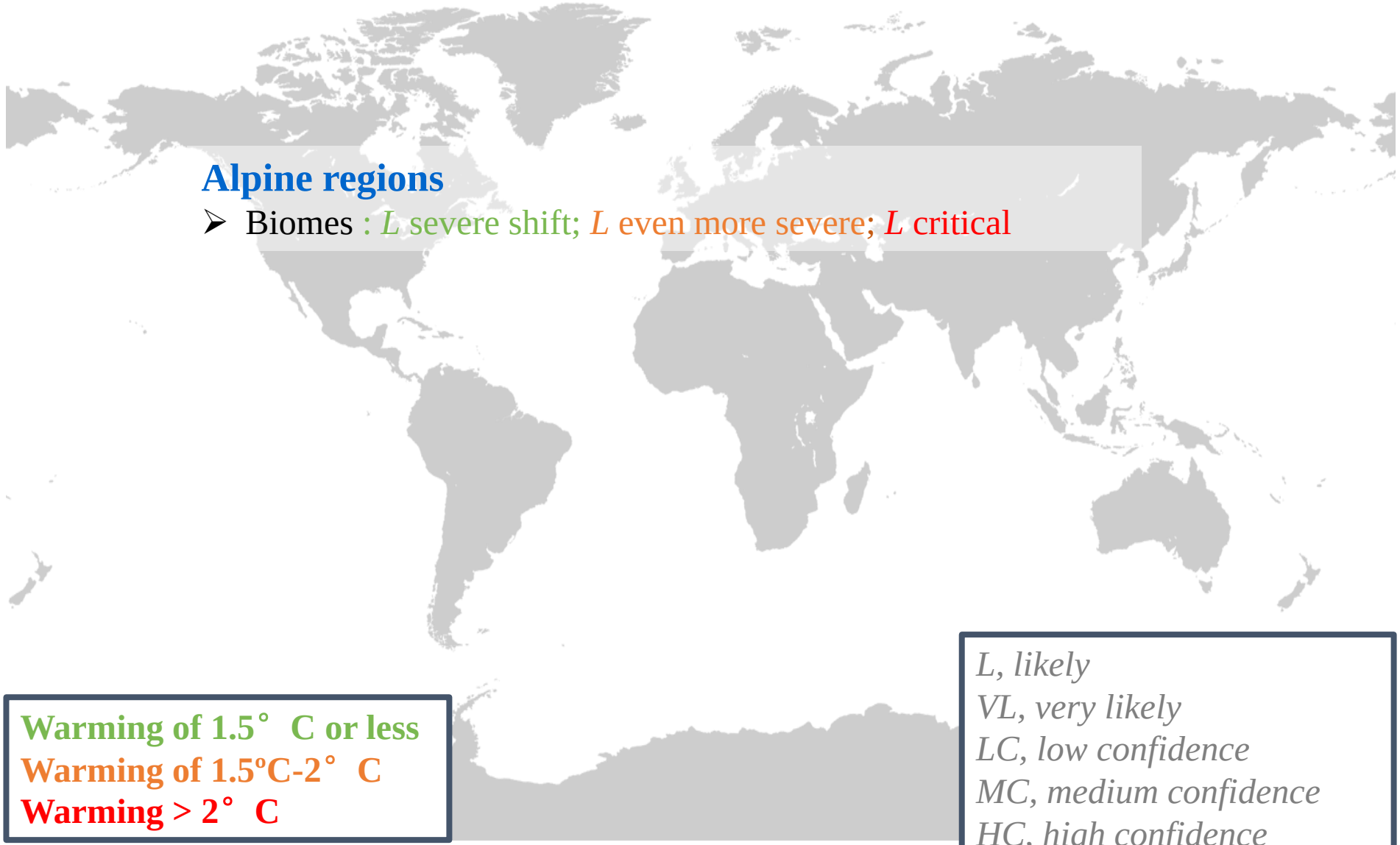

Alpine regions

- Biomes : *L* severe shift; *L* even more severe; *L* critical

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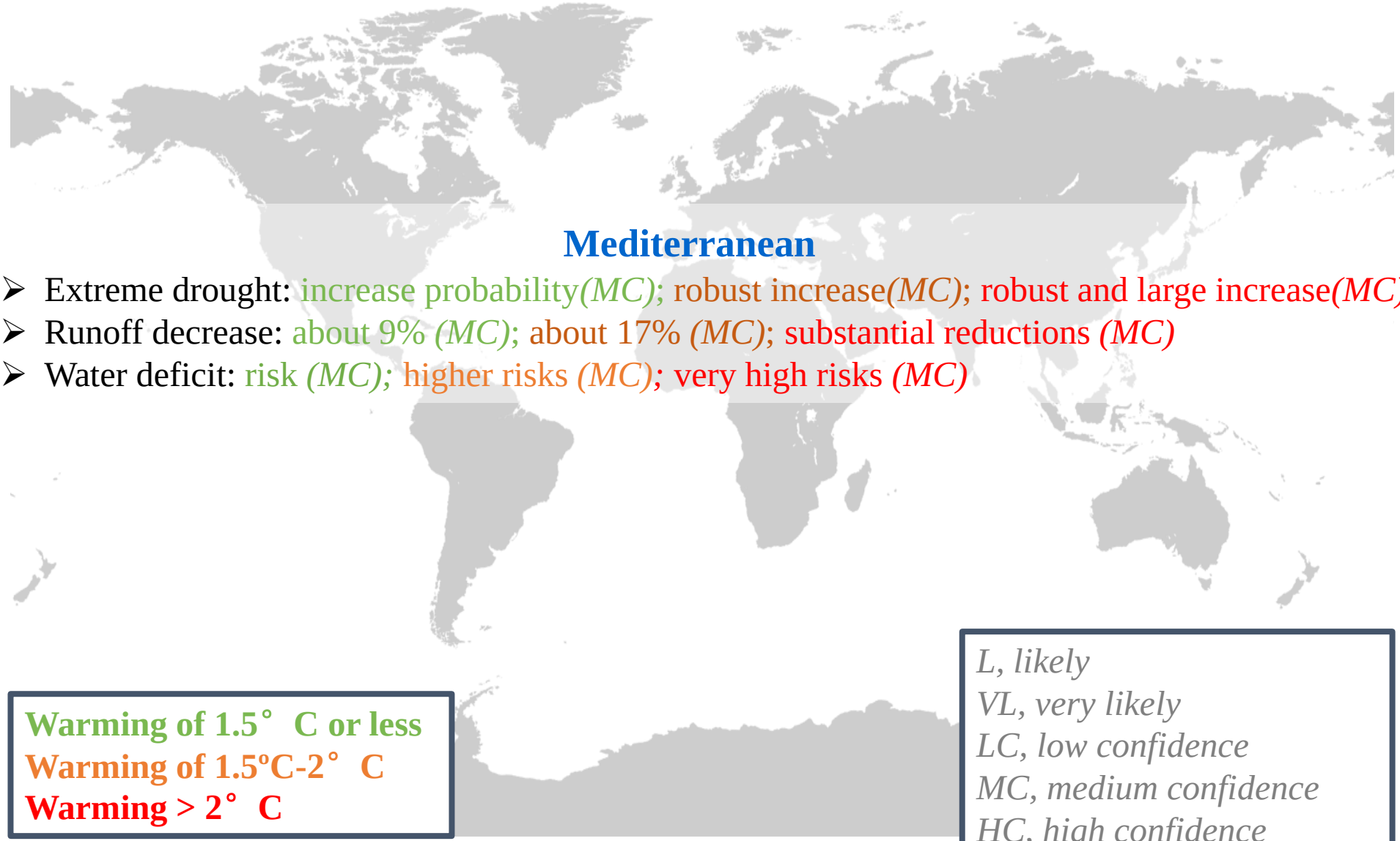
Emergence and intensity of regional climate change hot spots



Mediterranean

- Extreme drought: increase probability*(MC)*; robust increase*(MC)*; robust and large increase*(MC)*
- Runoff decrease: about 9% *(MC)*; about 17% *(MC)*; substantial reductions *(MC)*
- Water deficit: risk *(MC)*; higher risks *(MC)*; very high risks *(MC)*

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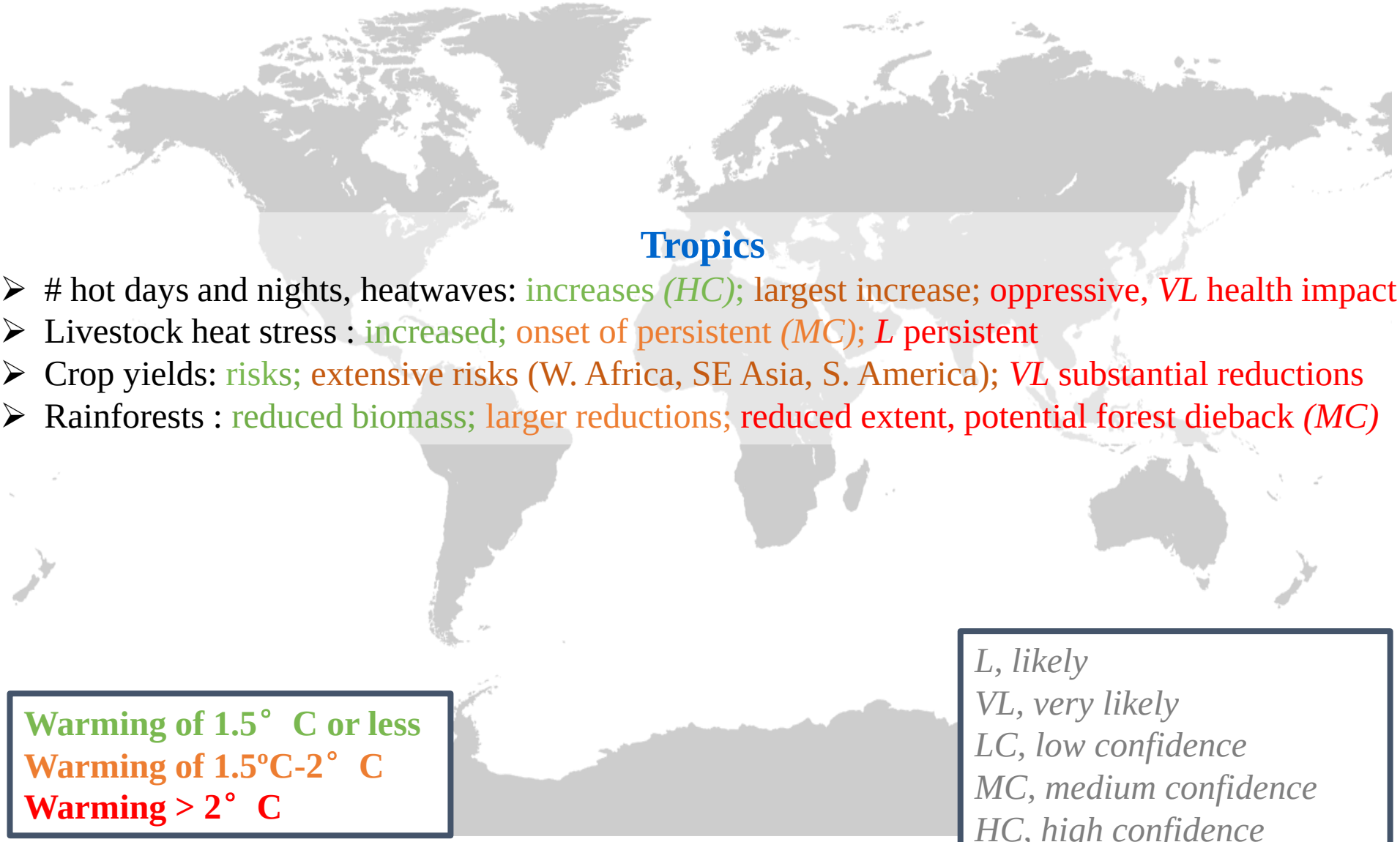

Tropics

- # hot days and nights, heatwaves: increases *(HC)*; largest increase; oppressive, *VL* health impact
- Livestock heat stress : increased; onset of persistent *(MC)*; *L* persistent
- Crop yields: risks; extensive risks (W. Africa, SE Asia, S. America); *VL* substantial reductions
- Rainforests : reduced biomass; larger reductions; reduced extent, potential forest dieback *(MC)*

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Southeast Asia

- ↗ flooding related to sea-level rise: risks; higher risks *(MC)*; substantial increases in risk
- Asian monsoon : *LC; LC; L* increase in precipitation intensity
- Heavy precipitation: increase; stronger increase *(MC)*; substantial increase
- Crop yield reductions: -; one third decline in per capita *(MC)*; substantial reduction

Emergence and intensity of regional climate change hot spots

Warming of 1.5° C or less
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West African and the Sahel

- Monsoon : uncertain ; uncertain ; strengthening *(LC)*
- Hot nights, longer, more frequent heat waves: *L* ↗; *L* further ↗; *VL* substantial ↗
- ↘ in maize and sorghum production: *L*, about 40% ↘ suitable area; *L* larger ↘; major regional food insecurities *(MC)*
- Undernutrition risks : increased; higher; high

Emergence and intensity of regional climate change hot spots

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Southern Africa

- Water availability: reductions *(MC)*; larger reductions *(MC)*; large reductions *(MC)*
- # of hot nights and ↗ heat waves : increases *(HC)*; further increase *(HC)*; drastic increase *(HC)*
- Increased mortality from heat-waves: high risks; higher risks *(HC)*; substantial impact on health and mortality *(HC)*
- Undernutrition / dryland agriculture and livestock: high risk; higher risk *(HC)*; very high risks

Emergence and intensity of regional climate change hot spots

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Small islands:

- Inundation risk : land exposed; tens of thousands displaced ; substantial, widespread impacts
- Coastal flooding: risks; high risks ; substantial and widespread impacts
- Fresh water stress : increased; projected aridity; substantial and widespread impacts
- # of warm days : increase; further increase (70 warm days/year), persistent heat stress in cattle ; persistent heat stress
- Loss of coral reefs: 70-90%; most coral reefs ; loss of most coral reefs *(VL)*