Global Warming of 1.5° C

Valérie Masson-Delmotte
Co-chair, IPCC Working Group I (Physical Science Basis)

valmasdel

ipcc
INTERGOVERNMENTAL PANEL ON climate change

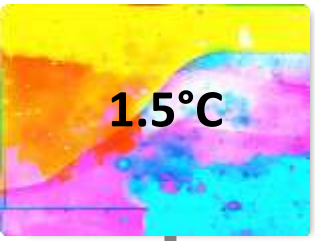
WMO UNEP

The 6th Assessment cycle of the Intergovernmental Panel on Climate Change

May 2019

Emission inventories

Oct. 2018



Talanoa Dialogue COP24

Sept. 2019

August 2019

April 2021

Physical science basis

October 2021

Impact, adaptation and vulnerabilities

July 2021

Mitigation

April 2022

Synthesis report

Paris Agreement 2023 Global Stocktake

www.ipcc.ch
@IPCC_CH

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

Ashley Cooper / Aurora Photos

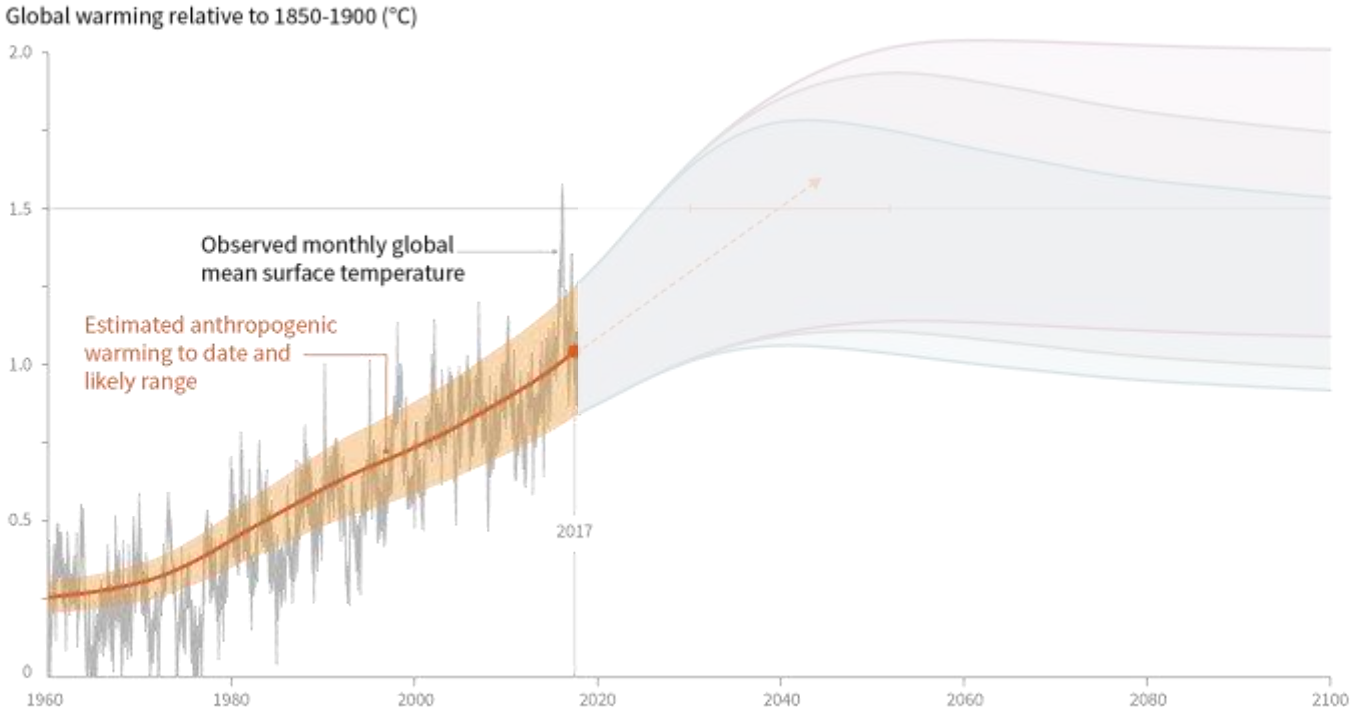
Where are we?

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 around 2030 and 2050
- Past emissions alone do not commit the world to 1.5°C

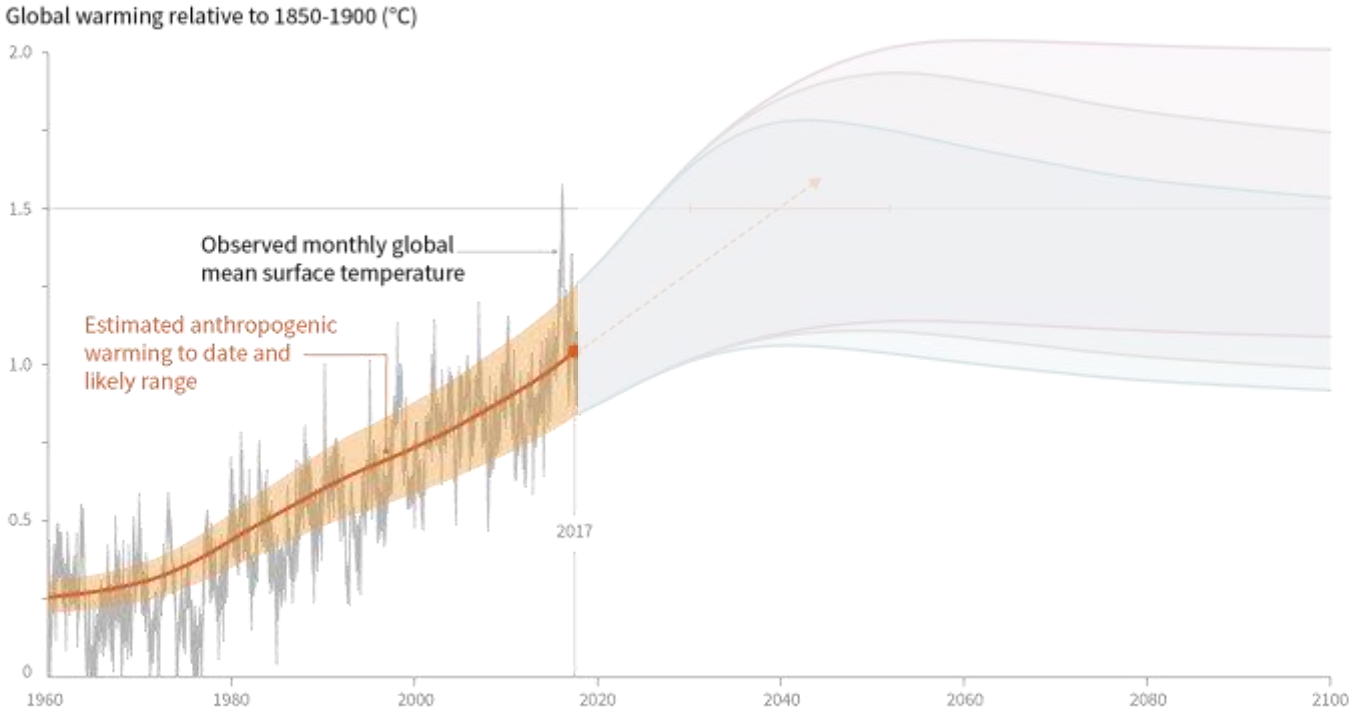
Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

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



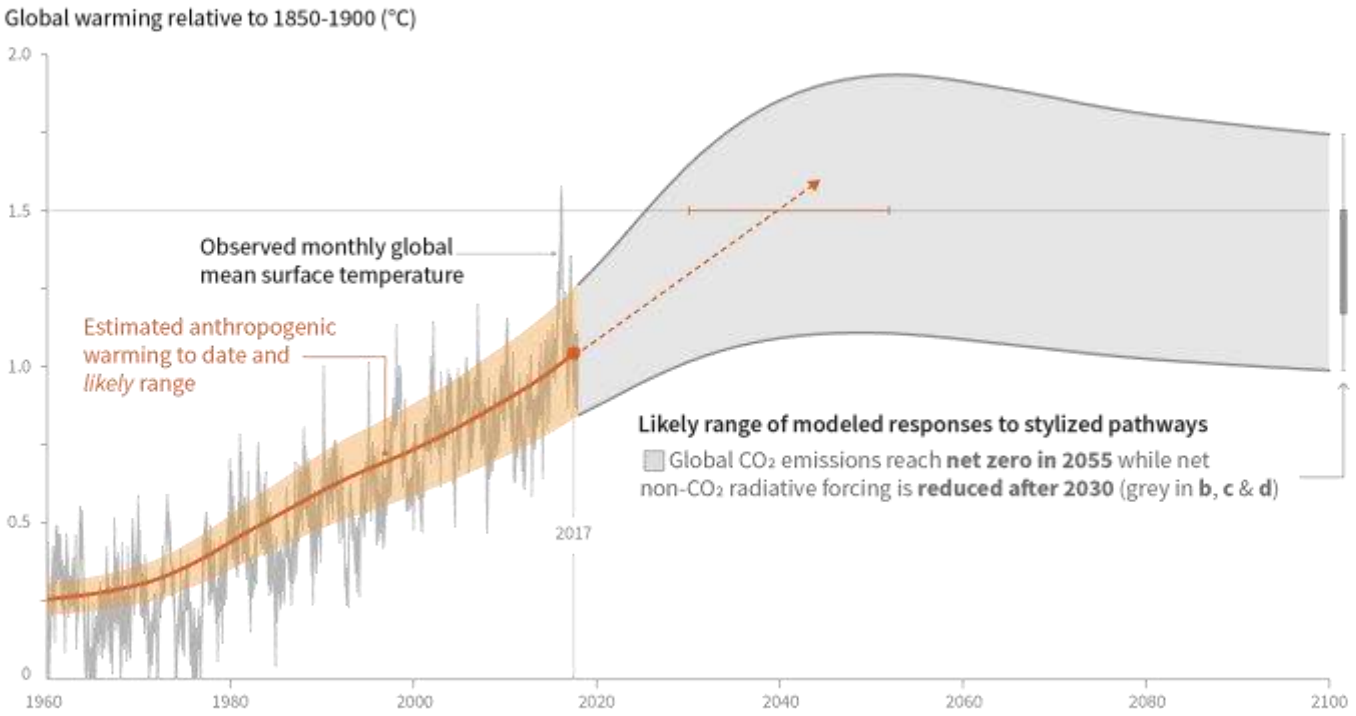
Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

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



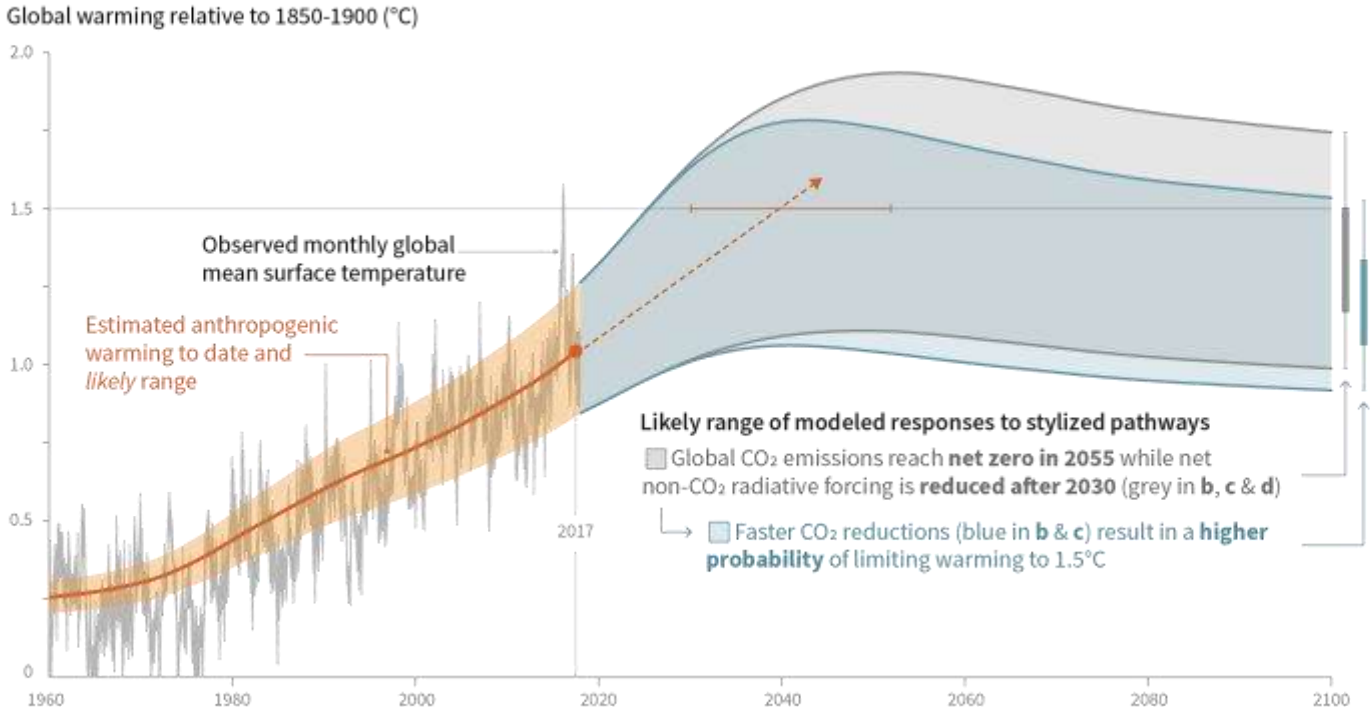
Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

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



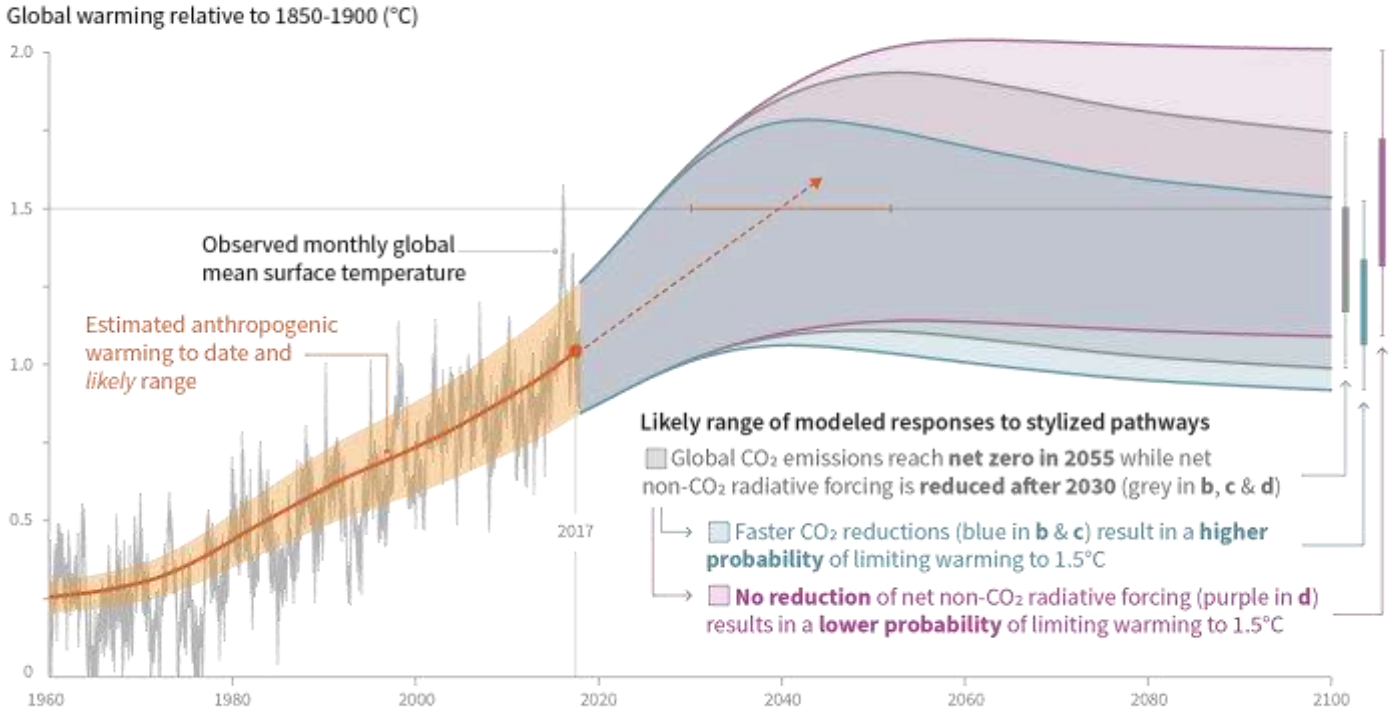
Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

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

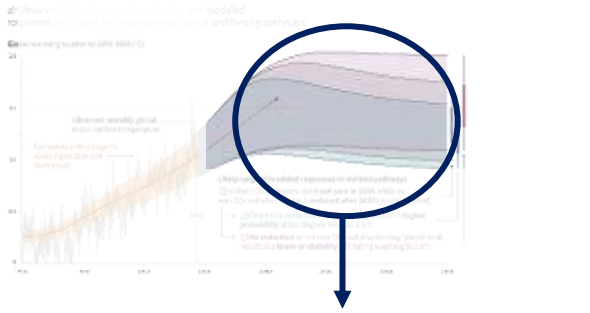


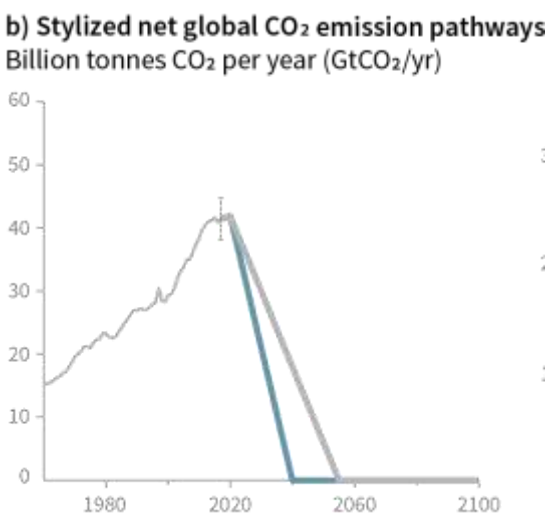
Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

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

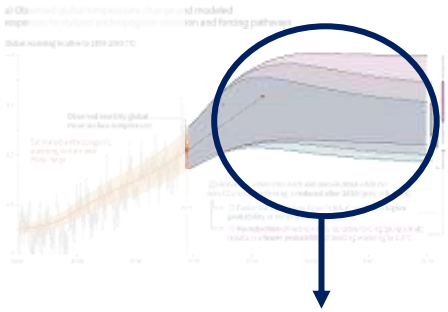


Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

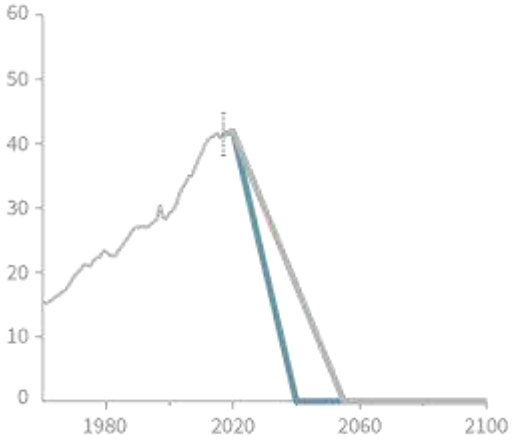


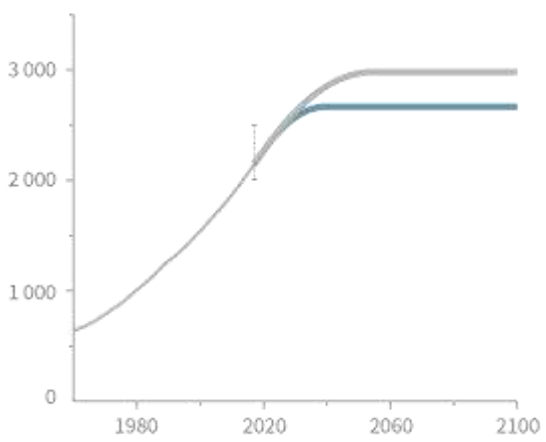


Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

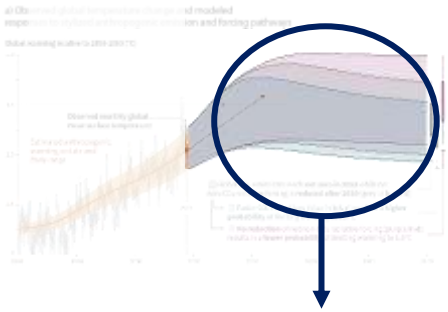


Faster immediate CO_2 emission reductions limit cumulative CO_2 emissions



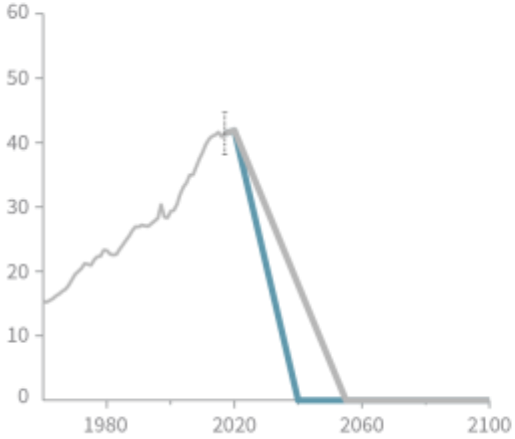


Cumulative emissions of CO_2 and future net effect of other emissions determine the probability of limiting warming to 1.5°C

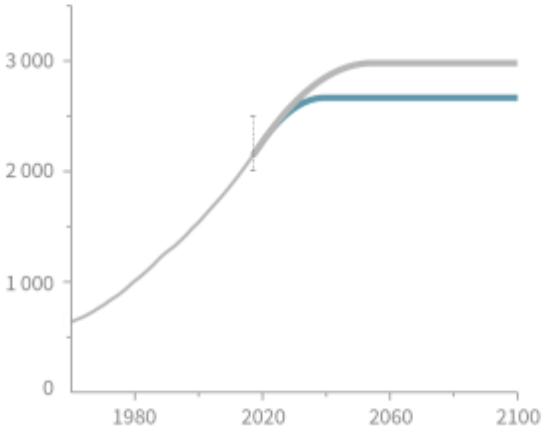


Maximum temperature rise is determined by cumulative CO_2 emissions and the net effect of methane, nitrous oxide, aerosols and other anthropogenic forcing agents.

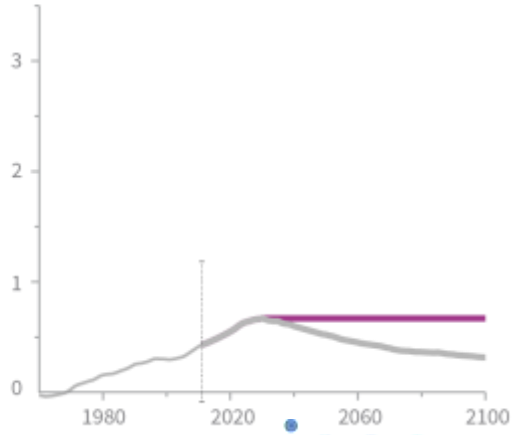
b) Stylized net global CO_2 emission pathways
Billion tonnes CO_2 per year ($GtCO_2$/yr)



c) Cumulative net CO_2 emissions
Billion tonnes CO_2 ($GtCO_2$)



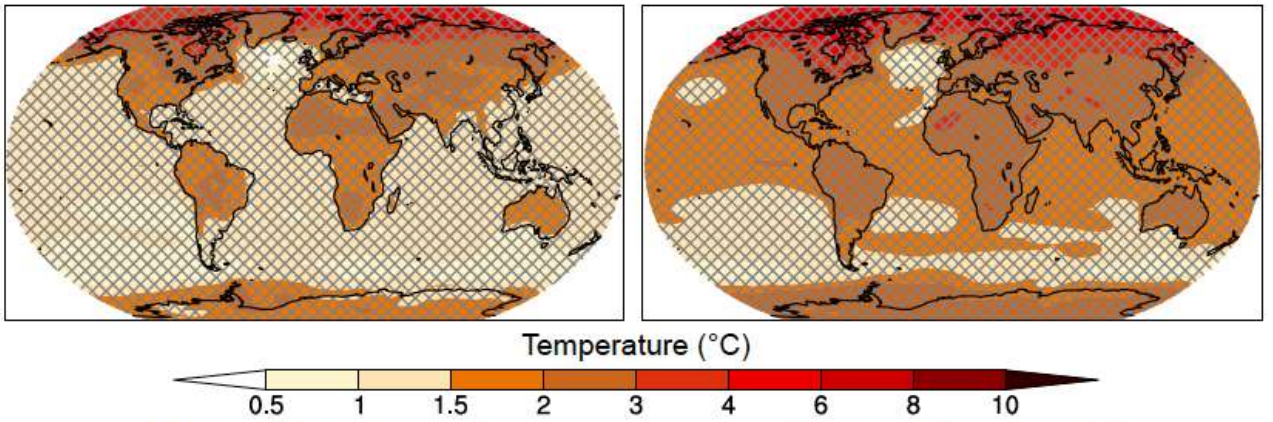
d) Non-CO_2 radiative forcing pathways
Watts per square metre (W/m^2)

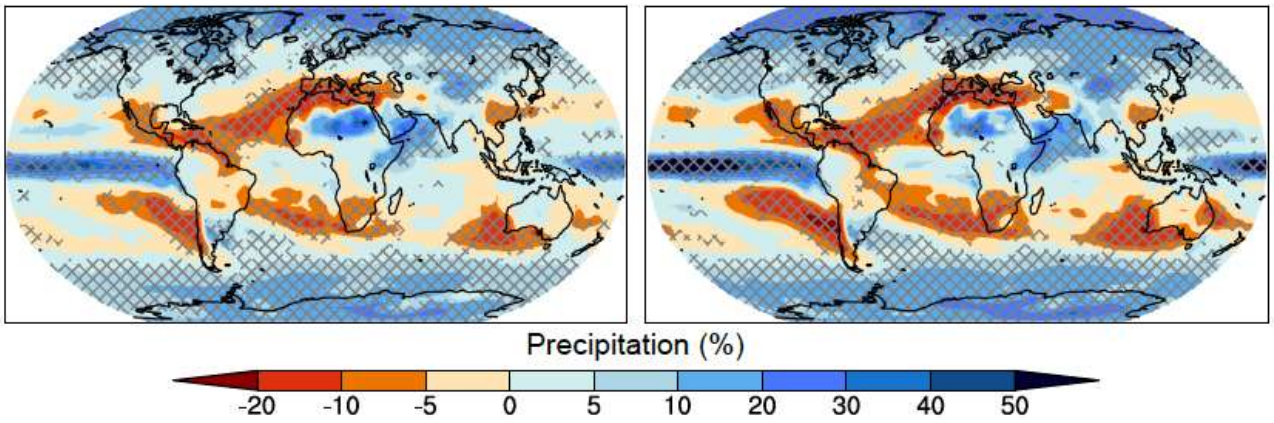


Spatial patterns of changes in mean temperature and precipitation

Global warming of 1.5°C

2°C



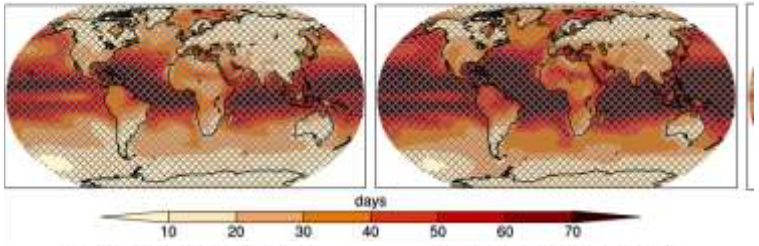


26 CMIP5 models; hatching : 66% model agreement

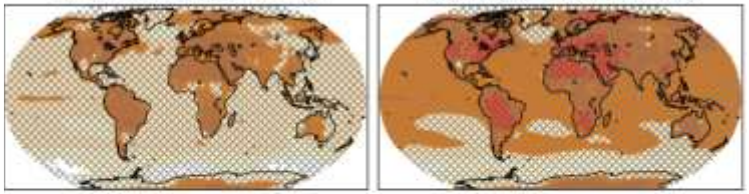
Spatial patterns of changes in extreme temperature and precipitation

Global warming of 1.5°C **2°C**

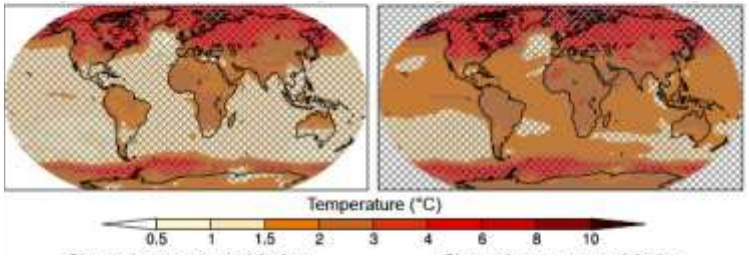
Number of hot days (days)



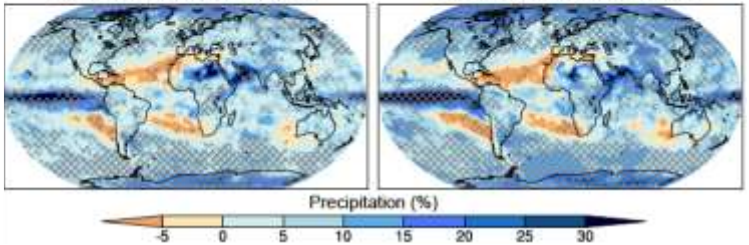
Temperature of hottest days (°C)



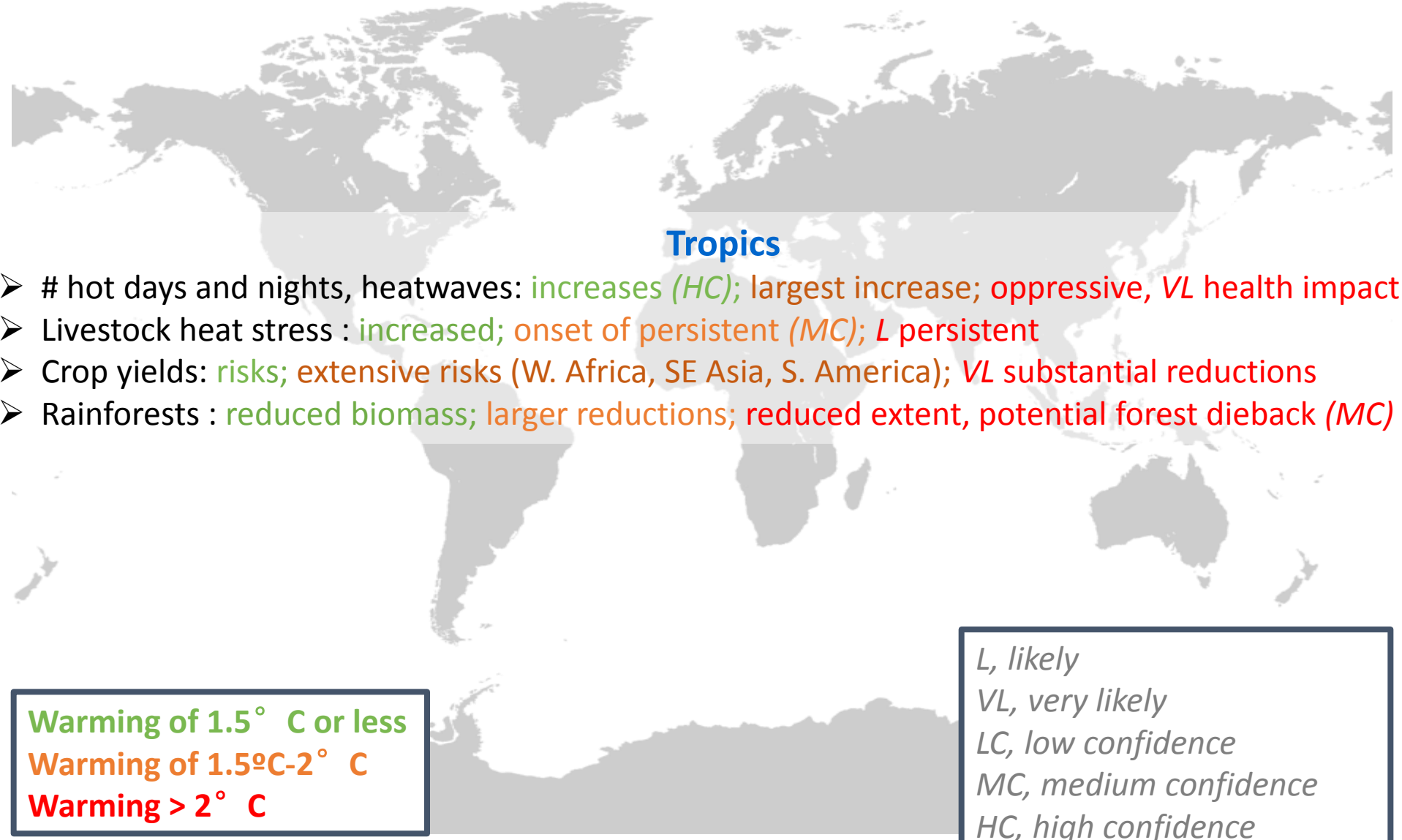
Temperature of coldest nights (°C)



Extreme precipitation (%)



Emergence and intensity of regional climate change hot spots



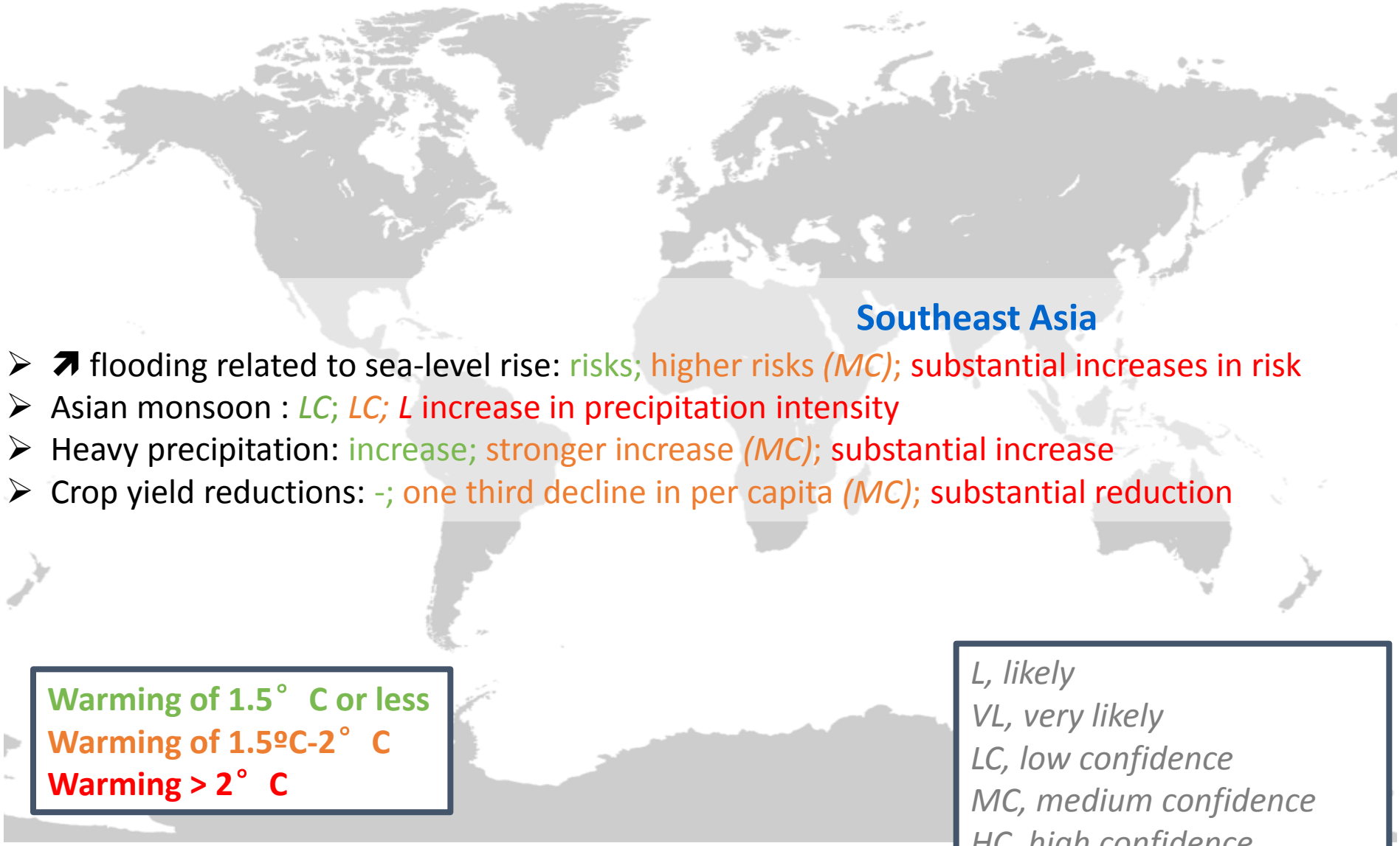
Tropics

- # 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)*

Warming of 1.5° C or less
Warming of 1.5ºC-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



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

Warming of 1.5° C or less
Warming of 1.5ºC-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

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

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

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

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

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

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)*; sustantial 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

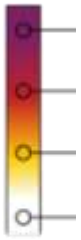
Warming of 1.5° C or less
Warming of 1.5ºC-2° C
Warming > 2° C

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

Small islands:

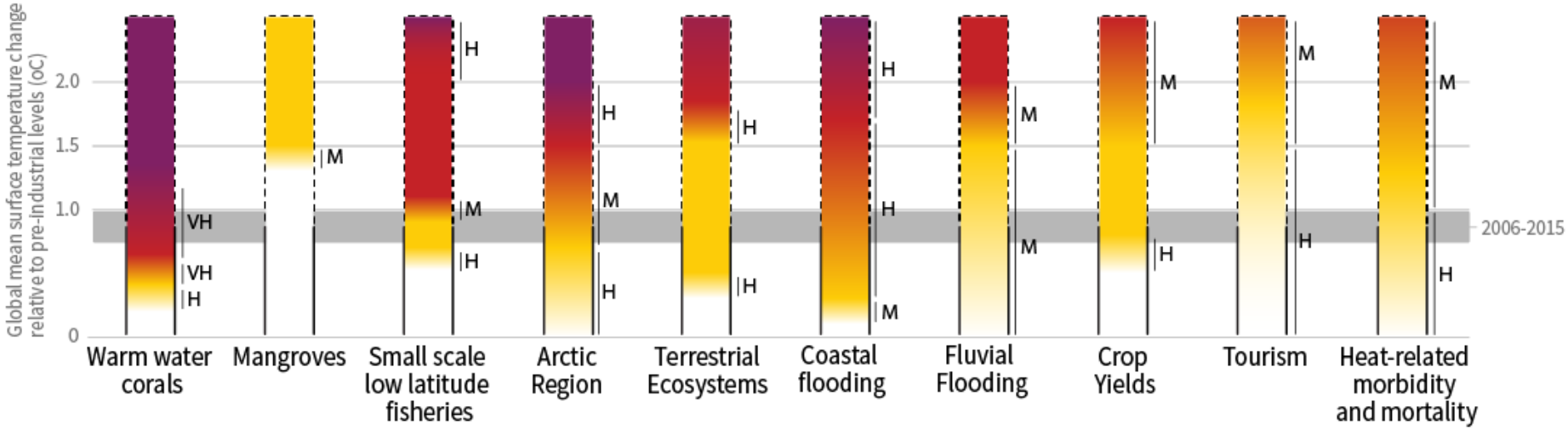
- Inundation risk : land exposed; tens of thousands displaced ; substantial, widespread impacts
- Coastal flooding: risks; high risks ; substantial and widespread impacts
- Fresh water stress : increased; projected aridity; substantial and widespread impacts
- # of warm days : increase; further increase (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)*

How do climate-related risks change as a function of the level of global warming?



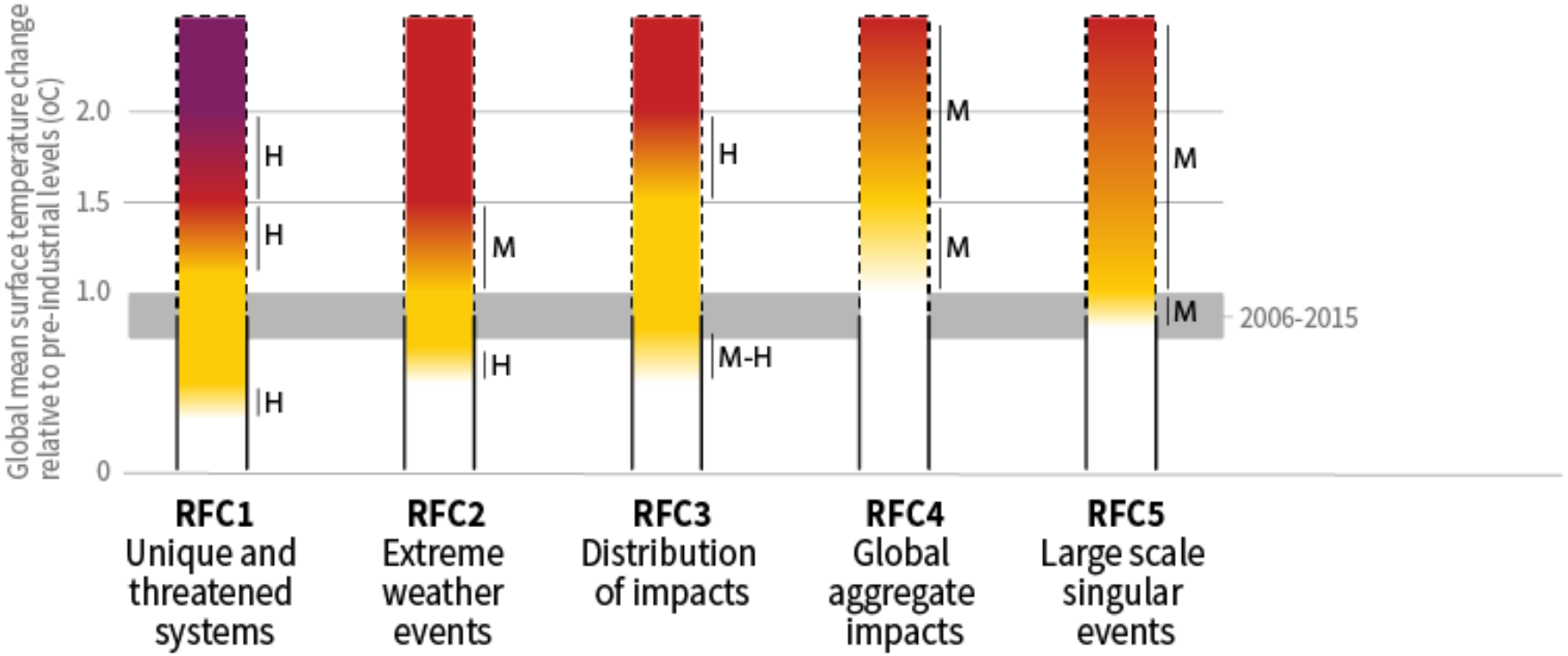
Very high
High
Moderate
Undetectable

Impacts and risks for selected natural, managed and human systems

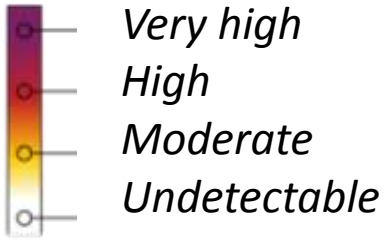


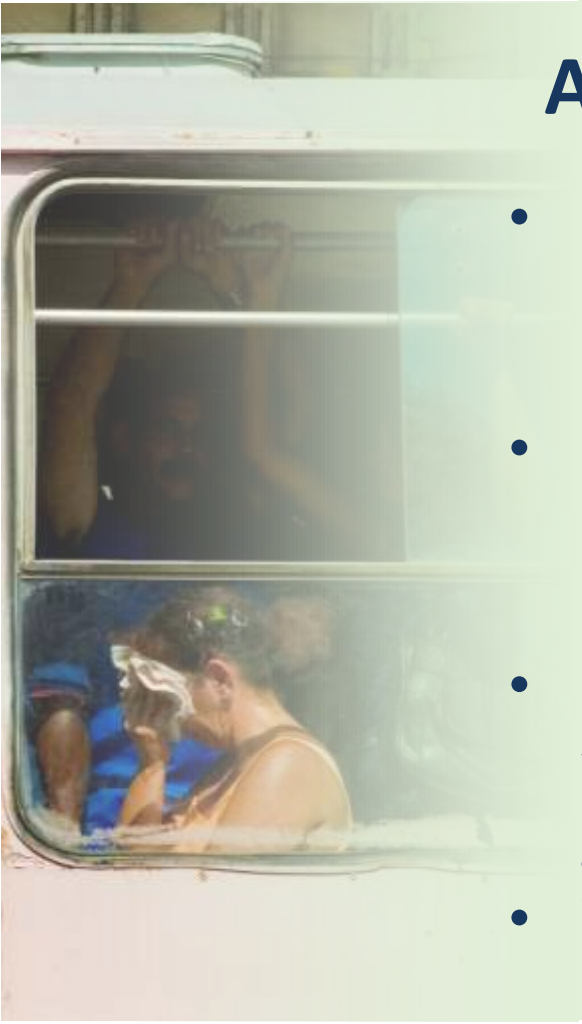
Confidence level : M, medium; H, high; VH; very high

How do climate-related risks for “Reasons For Concern” change as a function of the level of global warming?



Confidence level : M, medium; H, high; VH; very high

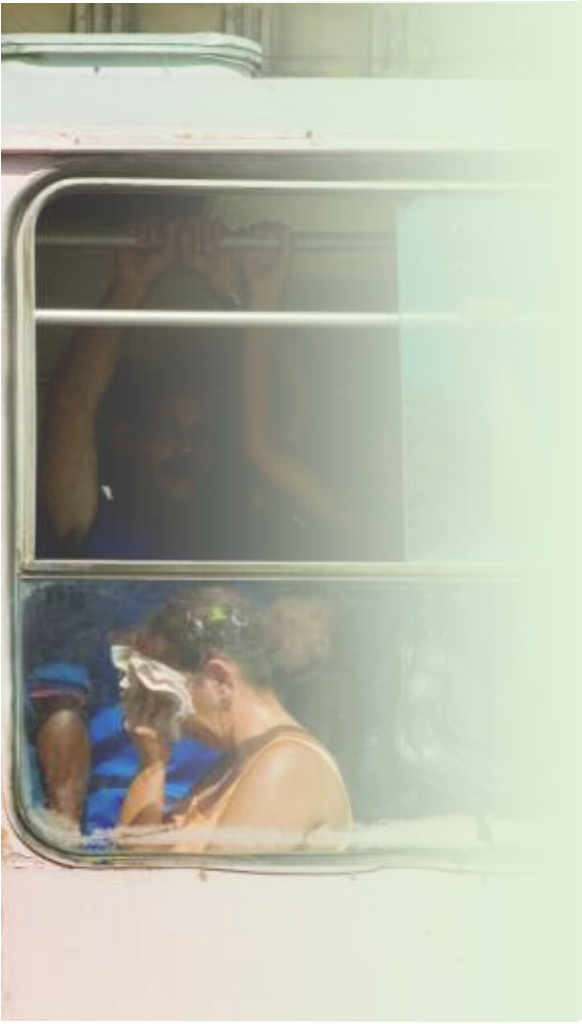




At 1.5°C compared to 2°C

- Disproportionately high risk for Arctic, dryland regions, small island developing states and least developed countries
- Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050
- Lower risks for health, livelihoods, food security, water supply, human security and economic growth
- Wide range of adaptation options which can reduce climate risks; less adaptation needs at 1.5°C

Jason Florio / Aurora Photos



Every half a degree matters

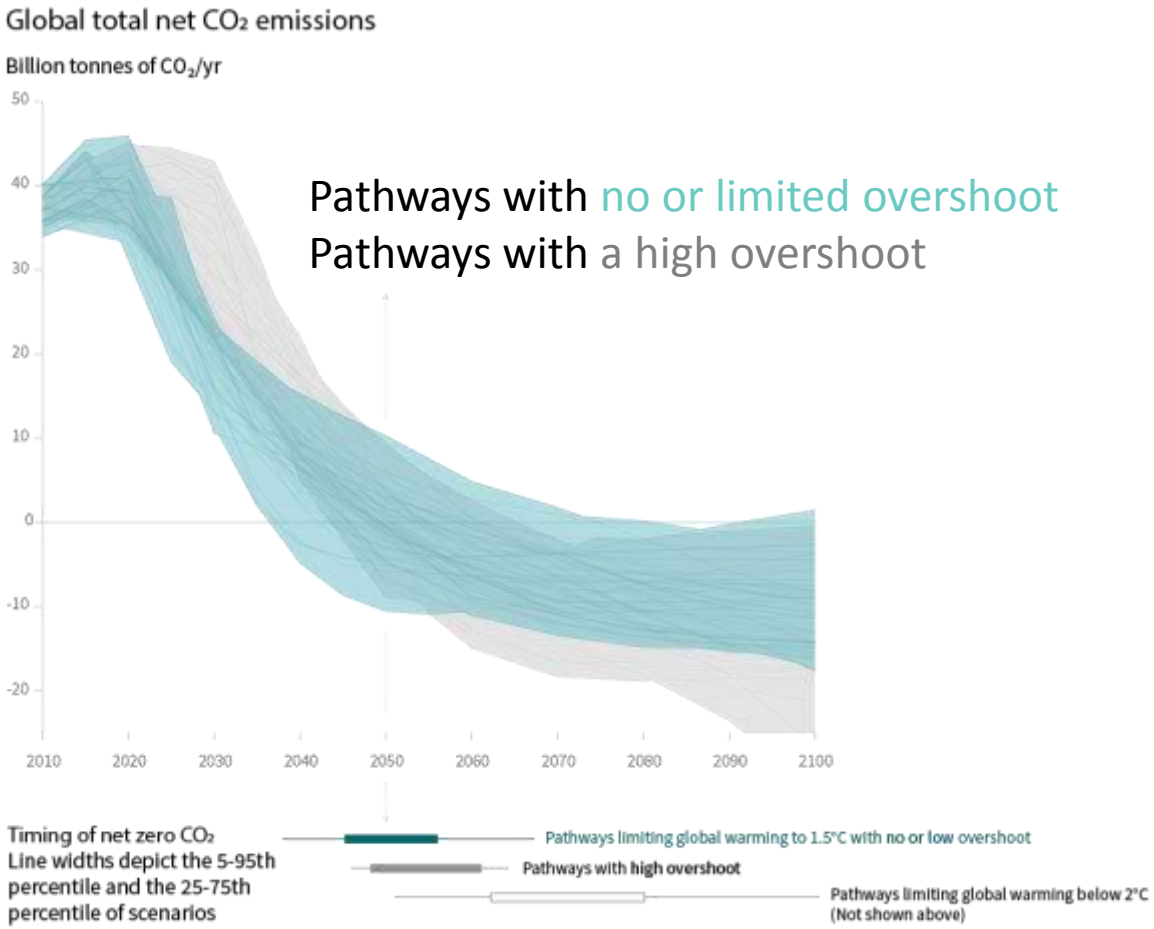
Jason Florio / Aurora Photos

Gerhard Zwerger-Schoner / Aurora Photos

How do we get there?

- To limit warming to 1.5°C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
  - ↳ *compared to 25% for 2°C*
- To limit warming to 1.5°C, CO_2 emissions would need to reach 'net zero' around 2050
  - ↳ *compared to around 2070 for 2°C*
- Reducing non-CO_2 emissions will have direct and immediate health benefits

What are greenhouse gas emission pathways compatible with limiting warming to 1.5°C?



https://data.ene.iiasa.ac.at/iamc-1.5c-explorer/

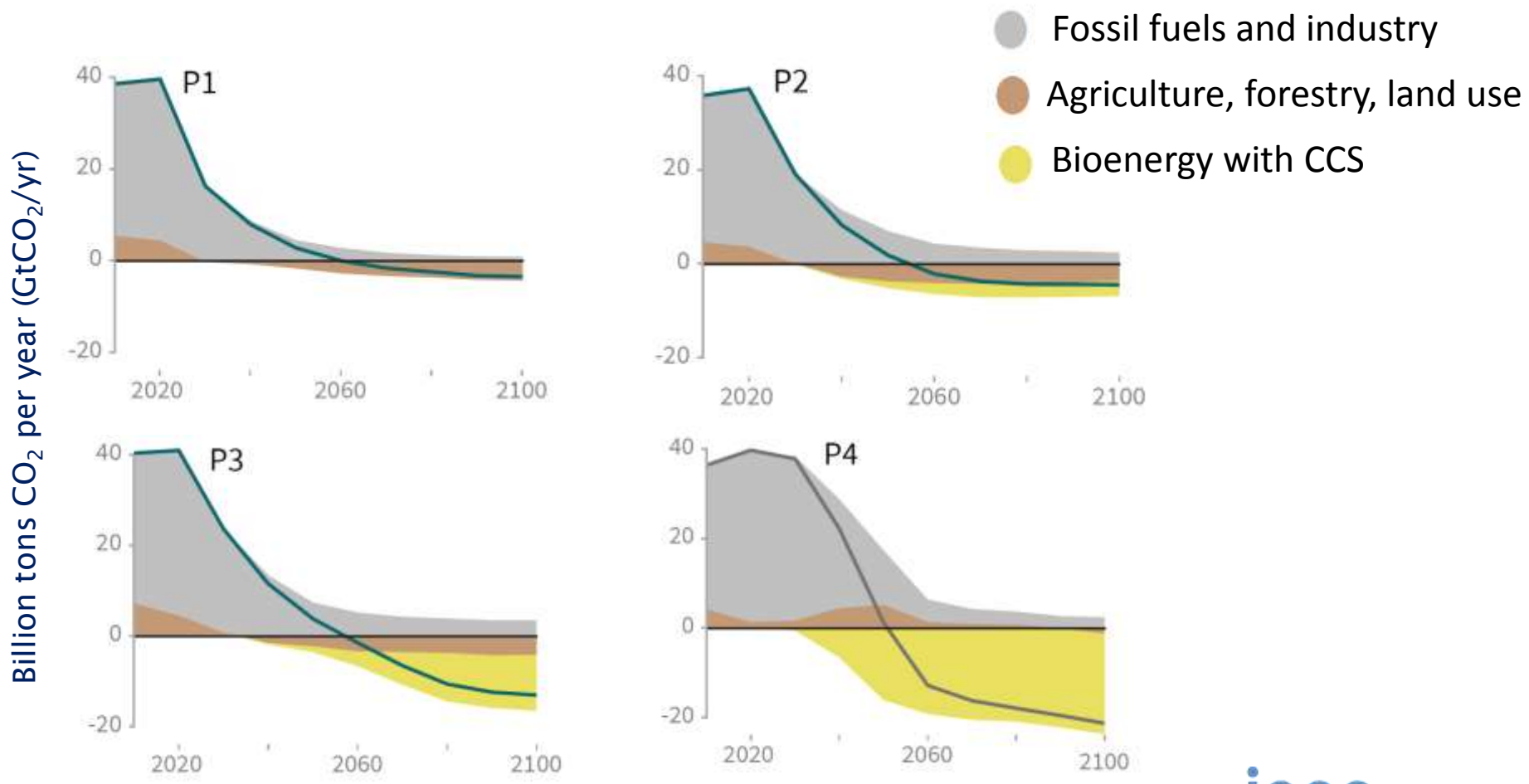
Mint Images / Aurora Photos

Limiting warming to 1.5°C

would require rapid, far-reaching and unprecedented transitions in energy, land use, urban, industry and infrastructure systems

- → Deep emission cuts in all sectors
- → A range of technologies and behavioural changes
- → Scale up in annual investment in low carbon energy and energy efficiency by factor of five by 2050
- → Renewables supply 70-85% of electricity in 2050
- → Coal declines steeply, ~zero in electricity by 2050

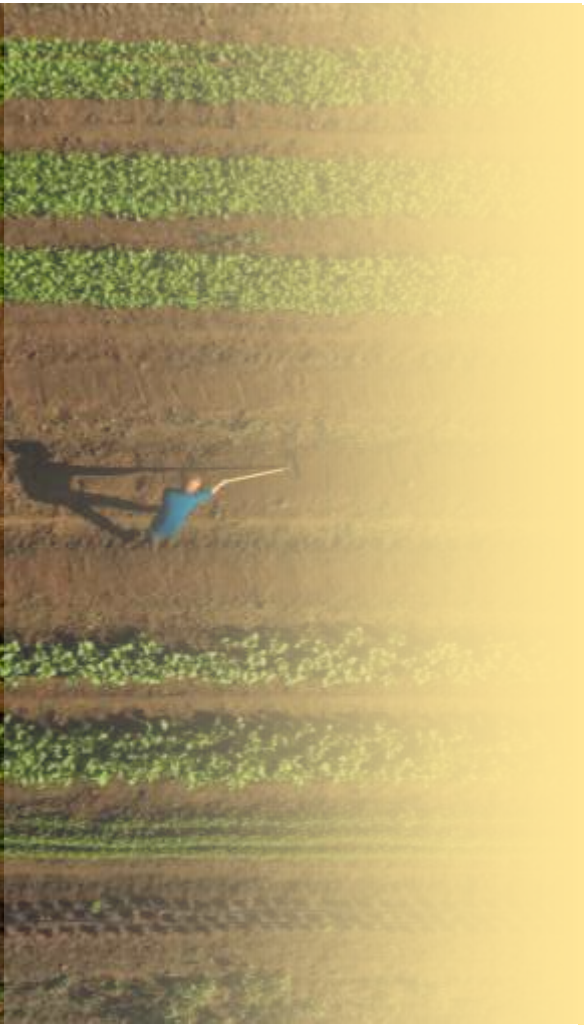
Four illustrative model pathways



Where are we?

- Current national pledges (by 2025-2030) imply growing global greenhouse gas emissions until 2030 and, without increased ambition, >3°C by 2100
- Avoiding warming of more than 1.5°C would require carbon dioxide emissions to decline substantially before 2030

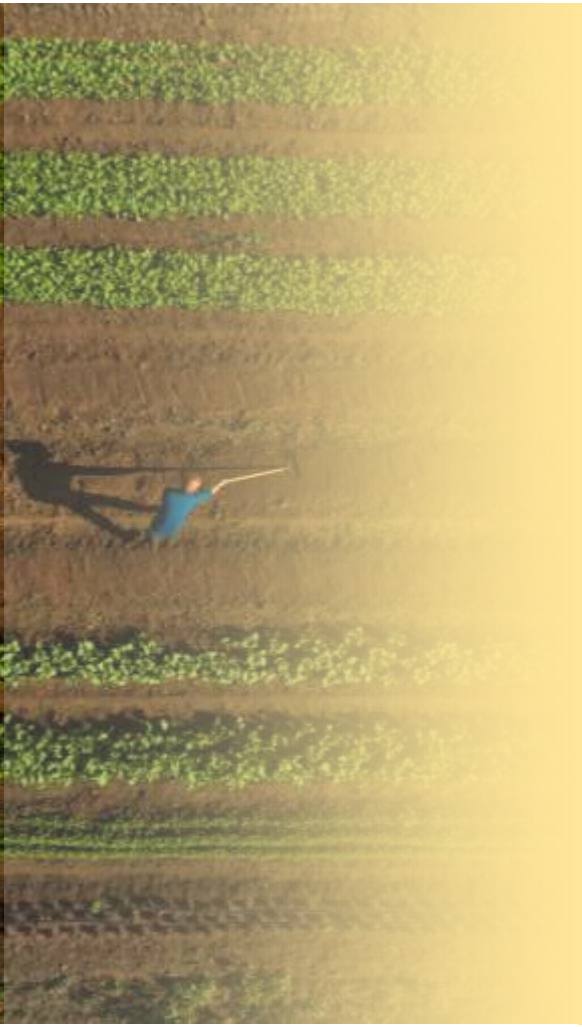
Peter Essick / Aurora Photos



Where are we?

- Current national pledges (by 2025-2030) imply growing global greenhouse gas emissions until 2030 and, without increased ambition, >3°C by 2100
- Avoiding warming of more than 1.5°C would require carbon dioxide emissions to decline substantially before 2030

Peter Essick / Aurora Photos



Every year matters

Peter Essick / Aurora Photos

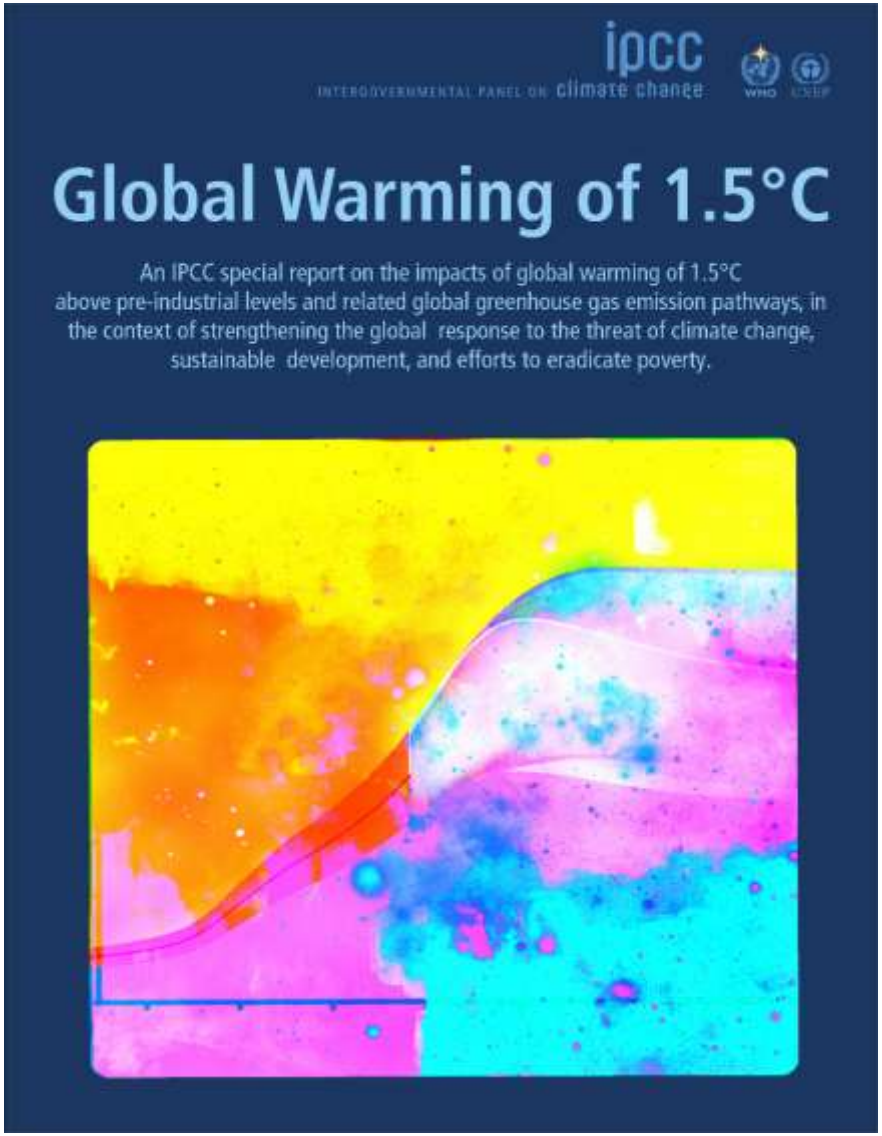
Ashley Cooper/ Aurora Photos

Climate change and sustainability

- Ethical and fair transitions
- Different pathways have different synergies and trade-offs with UN Sustainable Development Goals
- Careful mix of measures to adapt to climate change and reduce emissions can help achieve Sustainable Development Goals
- Low energy demand, low material consumption and healthy diets carry highest benefits
- Cooperation, governance, innovation, mobilisation of finance key for feasibility

Every choice matters

Ashley Cooper/ Aurora Photos



ipcc.ch/report/sr15 :

Summary for Policy Makers

10 Frequently Asked Questions

5 Chapters

Glossary

THANK YOU FOR YOUR ATTENTION!

For more information:

Website: http://ipcc.ch/
IPCC Secretariat: ipcc-sec@wmo.int

Find us on:


IPCC


@IPCC_CH


IPCC


https://vimeo.com/ipcc


https://www.youtube.com/ipccgeneva


https://www.linkedin.com/company/ipcc


https://www.flickr.com/photos/ipccphoto/sets/


http://www.slideshare.net/ipcc-media/presentations

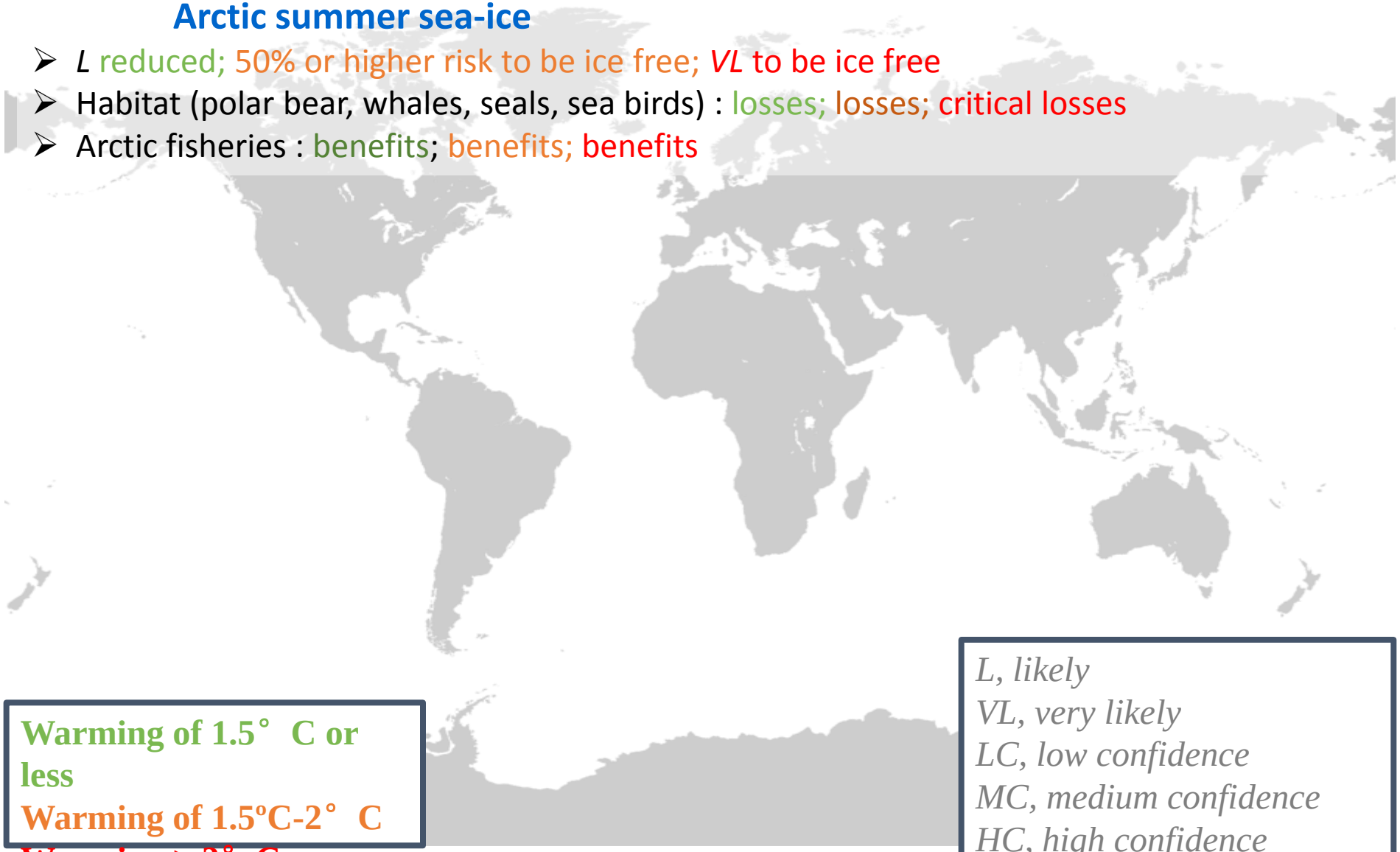
ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

Emergence and intensity of regional climate change hot spots

Arctic summer sea-ice

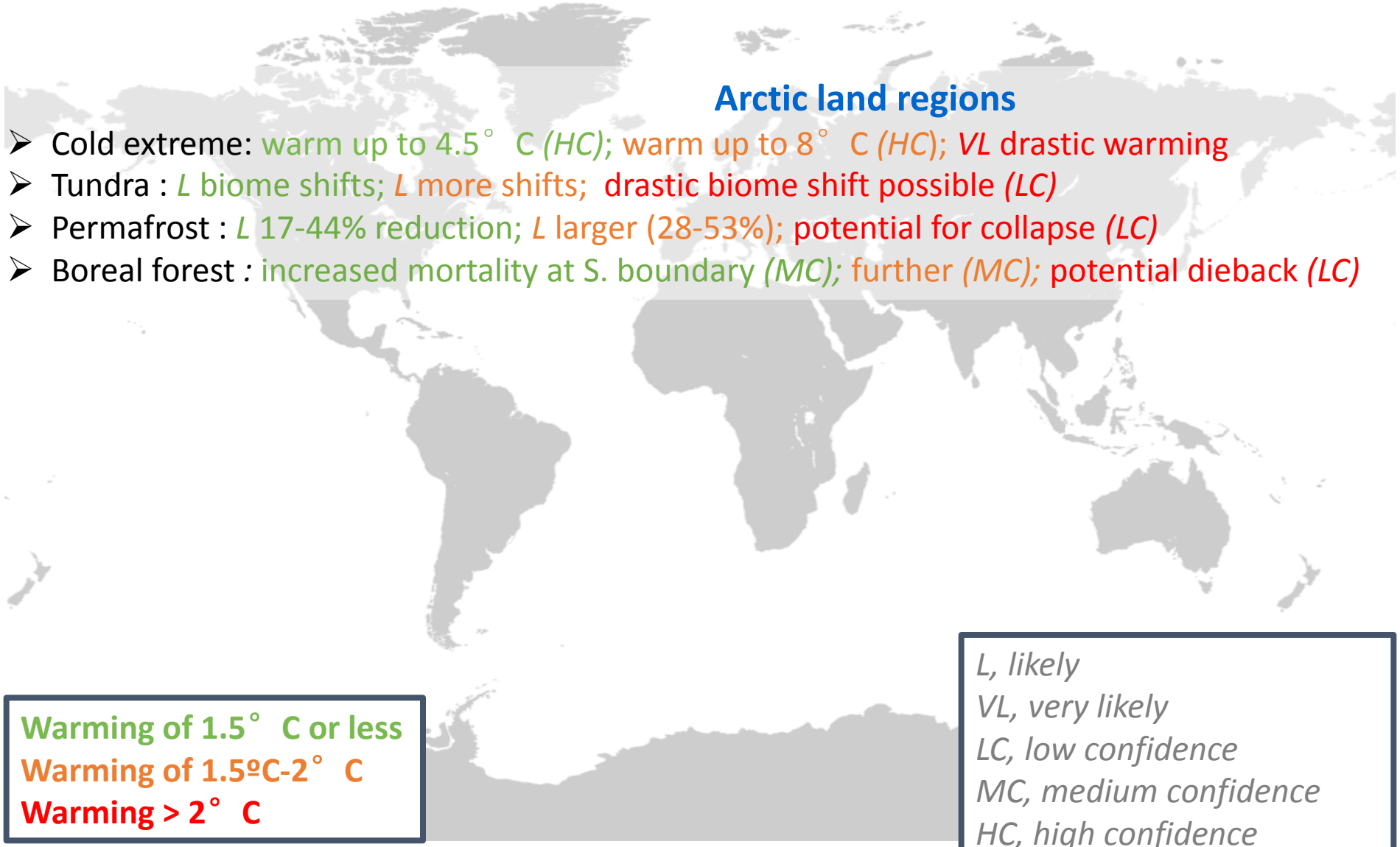
- *L* reduced; 50% or higher risk to be ice free; *VL* to be ice free
- Habitat (polar bear, whales, seals, sea birds) : losses; losses; critical losses
- Arctic fisheries : benefits; benefits; benefits



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



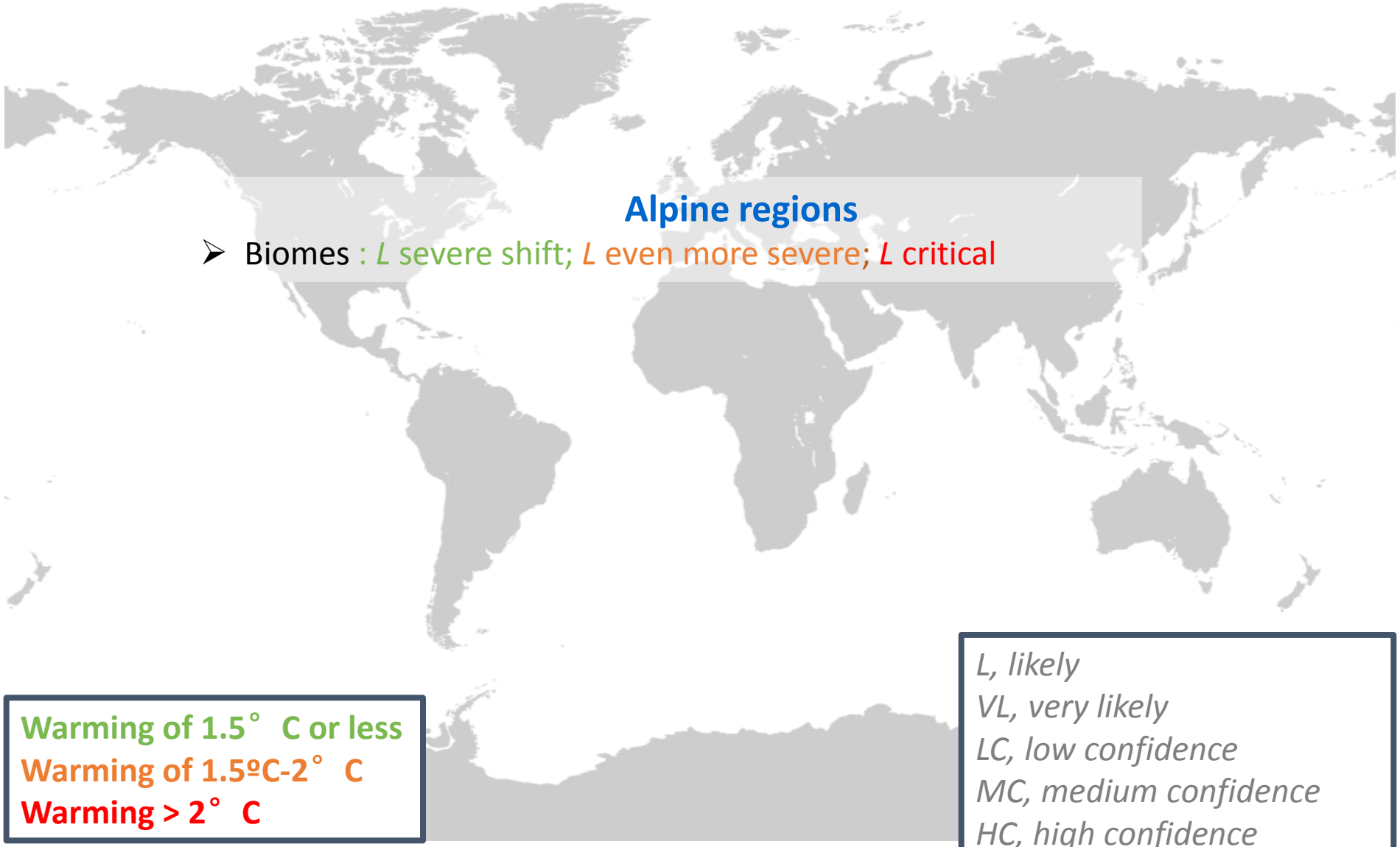
Arctic land regions

- 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)*

Warming of 1.5° C or less
Warming of 1.5ºC-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



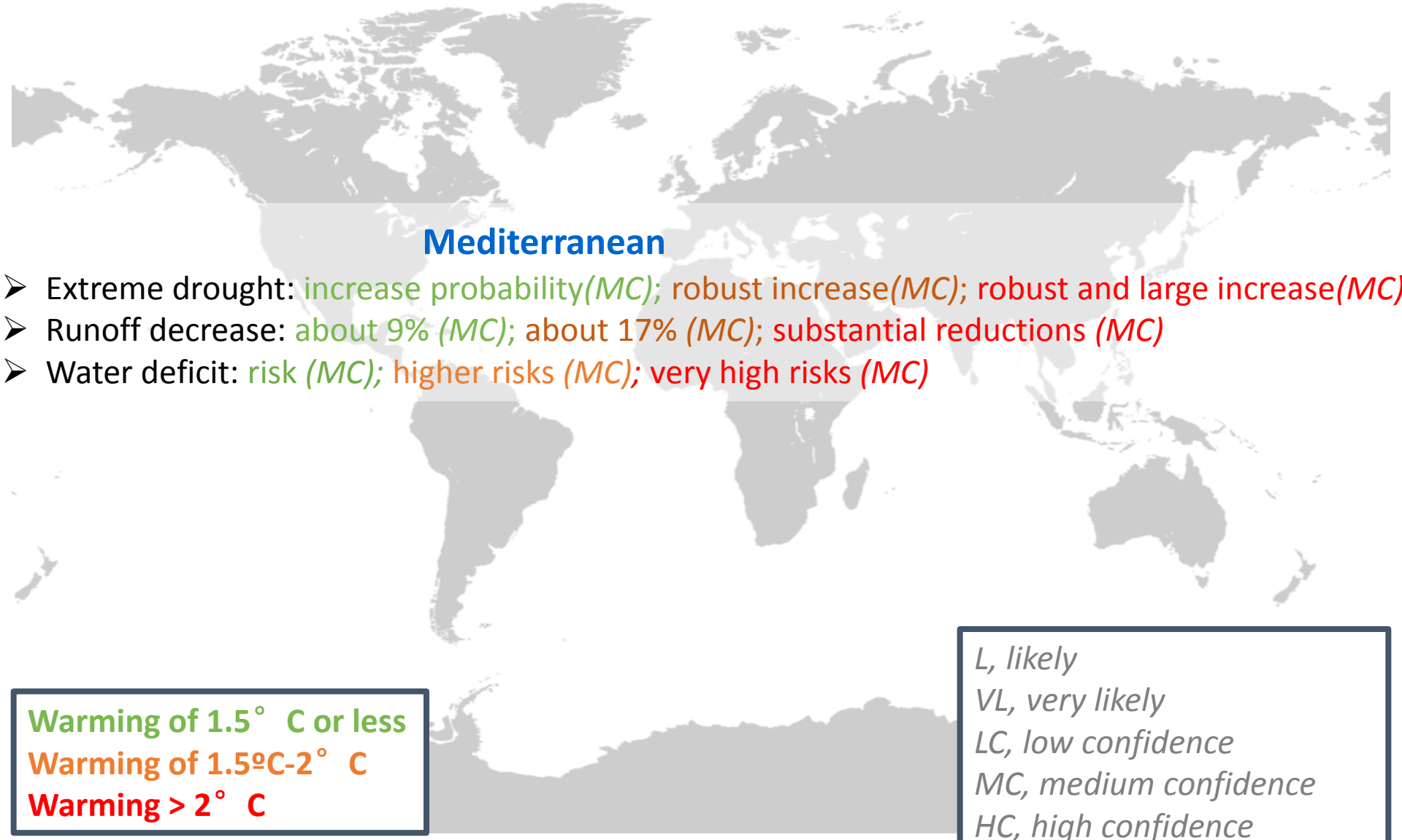
Alpine regions

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

Warming of 1.5° C or less
Warming of 1.5ºC-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



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)*

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

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