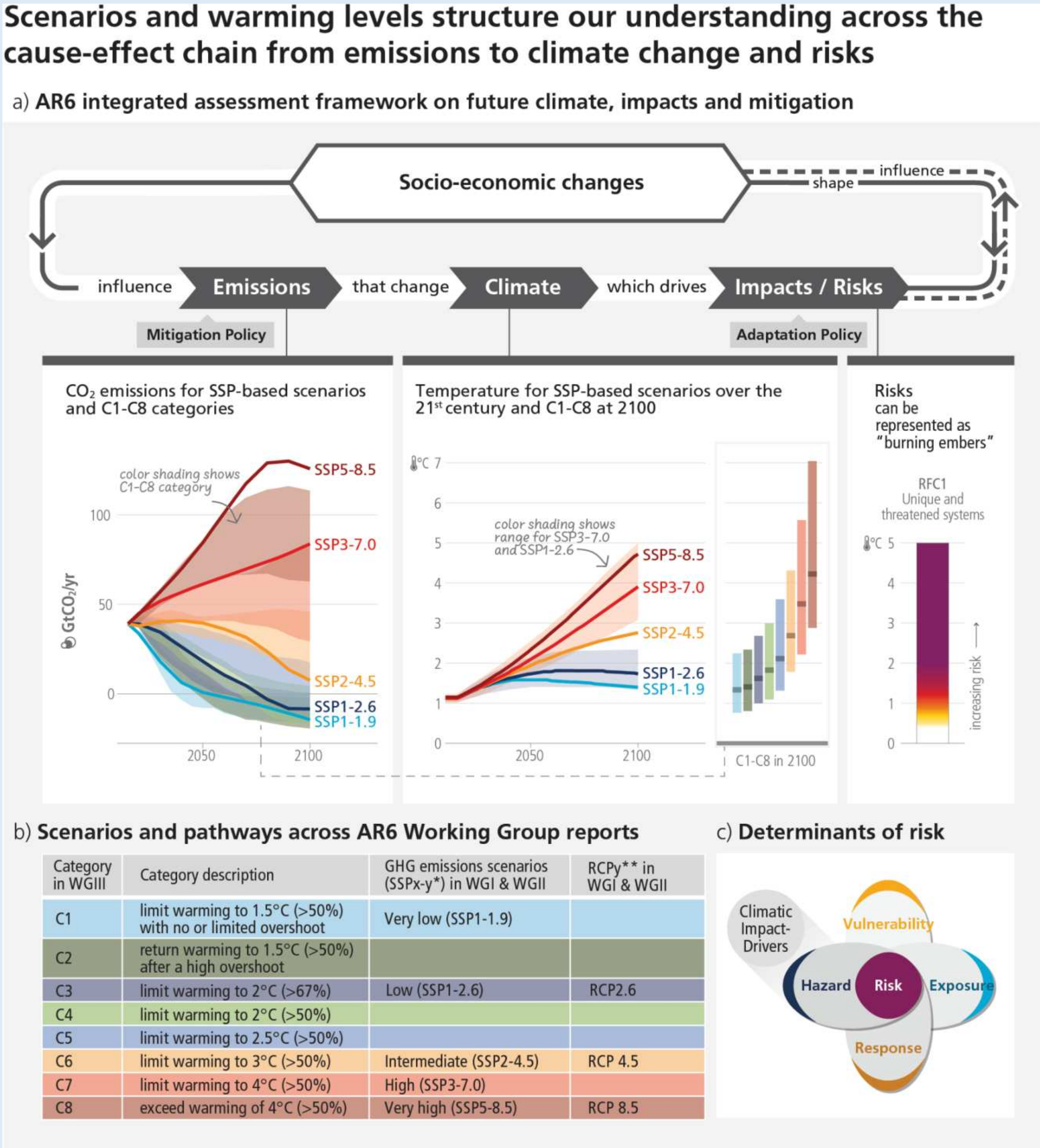
Risks

Dynamic interactions between climate-related hazards, exposure and vulnerability of the affected human society, species, or ecosystems result in risks arising from climate change. AR6 assesses key risks across sectors and regions as well as providing an updated assessment of the Reasons for Concern (RFCs) – five globally aggregated categories of risk that evaluate risk accrual with increasing global surface temperature. Risks can also arise from climate change mitigation or adaptation responses when the response does not achieve its intended objective, or when it results in adverse effects for other societal objectives. {WGII SPM A, WGII Figure SPM.3, WGII Box TS.1, WGII Figure TS.4; SR1.5 Figure SPM.2; SRCCL Figure SPM.2; SROCC Errata Figure SPM.3} (3.1.2, Cross-Section Box.2, Figure 1; Figure 3.3)

[START CROSS-SECTION BOX.2, FIGURE 1 HERE]



Category in WGIII	Category description	GHG emissions scenarios (SSPx-y*) in WGI & WGII	RCPy** in WGI & WGII
C1	limit warming to 1.5°C (>50%) with no or limited overshoot	Very low (SSP1-1.9)	
C2	return warming to 1.5°C (>50%) after a high overshoot		
C3	limit warming to 2°C (>67%)	Low (SSP1-2.6)	RCP2.6
C4	limit warming to 2°C (>50%)		
C5	limit warming to 2.5°C (>50%)		
C6	limit warming to 3°C (>50%)	Intermediate (SSP2-4.5)	RCP 4.5
C7	limit warming to 4°C (>50%)	High (SSP3-7.0)	
C8	exceed warming of 4°C (>50%)	Very high (SSP5-8.5)	RCP 8.5

* The terminology SSPx-y is used, where 'SSPx' refers to the Shared Socio-economic Pathway or 'SSP' describing the socio-economic trends underlying the scenario, and 'y' refers to the approximate level of radiative forcing (in watts per square metre, or W m^{-2}) resulting from the scenario in the year 2100.

** The AR5 scenarios (RCPy), which partly inform the AR6 WGI and WGII assessments, are indexed to a similar set of approximate 2100 radiative forcing levels (in Wm^{-2}). The SSP scenarios cover a broader range of GHG and air pollutant futures than the RCPs. They are similar but not identical, with differences in concentration trajectories for different GHGs. The overall radiative forcing tends to be higher for the SSPs compared to the RCPs with the same label (*medium confidence*). {WGI TS.1.3.1}
*** Limited overshoot refers to exceeding 1.5°C global warming by up to about 0.1°C, high overshoot by 0.1°C-0.3°C, in both cases for up to several decades.

Cross-Section Box.2, Figure 1: Schematic of the AR6 framework for assessing future greenhouse gas emissions, climate change, risks, impacts and mitigation. Panel (**a**) The integrated framework encompasses socio-economic development and policy, emissions pathways and global surface temperature responses to the five scenarios considered by WGI (SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5) and eight global mean temperature change categorisations (C1–C8) assessed by WGIII, and the WGII risk assessment. The dashed arrow indicates that the influence from impacts/risks to socio-economic changes is not yet considered in the scenarios assessed in the AR6. Emissions include GHGs, aerosols, and ozone precursors. CO_2 emissions are shown as an example on the left. The assessed global surface temperature changes across the 21st century relative to 1850–1900 for the five GHG emissions scenarios are shown as an example in the centre. *Very likely* ranges are shown for SSP1-2.6 and SSP3-7.0. Projected temperature outcomes at 2100 relative to 1850–1900 are shown for C1 to C8 categories with median (line) and the combined *very likely* range across scenarios (bar). On the right, future risks due to increasing warming are represented by an example 'burning ember' figure (see 3.1.2 for the definition of RFC1). **Panel** (**b**) Description and relationship of scenarios considered across AR6 Working Group reports. **Panel** (**c**) Illustration of risk arising from the interaction of hazard (driven by changes in climatic impact-drivers) with vulnerability, exposure and response to climate change. {WGI TS1.4, Figure 4.11; WGII Figure 1.5, WGII Figure 14.8; WGIII Table SPM.2, Figure 3.11}

[END CROSS-SECTION BOX.2 FIGURE 1 HERE]

[END CROSS-SECTION BOX.2 HERE]

Section 3: Long-Term Climate and Development Futures

3.1 Long-Term Climate Change, Impacts and Related Risks

Future warming will be driven by future emissions and will affect all major climate system components, with every region experiencing multiple and co-occurring changes. Many climate-related risks are assessed to be higher than in previous assessments, and projected long-term impacts are up to multiple times higher than currently observed. Multiple climatic and non-climatic risks will interact, resulting in compounding and cascading risks across sectors and regions. Sea level rise, as well as other irreversible changes, will continue for thousands of years, at rates depending on future emissions. (*high confidence*)

3.1.1 Long-term Climate Change

The uncertainty range on assessed future changes in global surface temperature is narrower than in the AR5. For the first time in an IPCC assessment cycle, multi-model projections of global surface temperature, ocean warming and sea level are constrained using observations and the assessed climate sensitivity. The *likely* range of equilibrium climate sensitivity has been narrowed to 2.5°C–4.0°C (with a best estimate of 3.0°C) based on multiple lines of evidence[55], including improved understanding of cloud feedbacks. For related emissions scenarios, this leads to narrower uncertainty ranges for long-term projected global temperature change than in AR5. {WGI A.4, WGI Box SPM.1, WGI TS.3.2, WGI 4.3}

Future warming depends on future greenhouse gas (GHG) emissions, with cumulative net CO_2 dominating. The assessed best estimates and *very likely* ranges of warming for 2081–2100 with respect to 1850–1900 vary from 1.4°C [1.0-1.8°C] in the very low GHG emissions scenario (SSP1-1.9) to 2.7°C [2.1°C–3.5°C] in the intermediate GHG emissions scenario (SSP2-4.5) and 4.4°C [3.3°C–5.7°C] in the very high GHG emissions scenario (SSP5-8.5)[56]. {WGI SPM B.1.1, WGI Table SPM.1, WGI Figure SPM.4} (Cross-Section Box.2, Figure 1)

Modelled pathways consistent with the continuation of policies implemented by the end of 2020 lead to global warming of 3.2 [2.2-3.5]°C (5–95% range) by 2100 (*medium confidence*) (see also Section 2.3.1). Pathways of >4°C (≥50%) by 2100 would imply a reversal of current technology and/or mitigation policy trends (*medium confidence*). However, such warming could occur in emissions pathways consistent with policies implemented by the end of 2020 if climate sensitivity or carbon cycle feedbacks are higher than the best estimate (*high confidence*). {WGIII SPM C.1.3}

Global warming will continue to increase in the near term in nearly all considered scenarios and modelled pathways. Deep, rapid and sustained GHG emissions reductions, reaching net zero CO_2 emissions and including strong emissions reductions of other GHGs, in particular CH_4, are necessary to limit warming to 1.5°C (>50%) or less than 2°C (>67%) by the end of century (*high confidence*). The best estimate of reaching 1.5°C of global warming lies in the first half of the 2030s in most of the considered scenarios and modelled pathways[57]. In the very low GHG emissions scenario (SSP1-1.9), CO_2 emissions reach net zero around 2050 and the best-estimate end-of-century warming is 1.4°C, after a temporary overshoot (see Section 3.3.4) of no more than 0.1°C above 1.5°C global warming. Global warming of 2°C will be exceeded during the 21st century unless deep reductions in CO_2 and other GHG emissions occur in the coming decades.

[55] Understanding of climate processes, the instrumental record, paleoclimates and model-based emergent constraints (see Annex I: Glossary). {WGI SPM footnote 21}

[56] The best estimates [and *very likely* ranges] for the different scenarios are: 1.4°C [1.0°C–1.8°C] (SSP1-1.9); 1.8°C [1.3°C–2.4°C] (SSP1-2.6); 2.7°C [2.1°C–3.5°C] (SSP2-4.5); 3.6°C [2.8°C–4.6°C] (SSP3-7.0); and 4.4°C [3.3°C–5.7°C] (SSP5-8.5). {WGI Table SPM.1} (CSB.2)

[57] In the near term (2021–2040), the 1.5°C global warming level is *very likely* to be exceeded under the very high GHG emissions scenario (SSP5-8.5), *likely* to be exceeded under the intermediate and high GHG emissions scenarios (SSP2-4.5, SSP3-7.0), *more likely than not* to be exceeded under the low GHG emissions scenario (SSP1-2.6) and *more likely than not* to be reached under the very low GHG emissions scenario (SSP1-1.9). In all scenarios considered by WGI except the very high emissions scenario, the midpoint of the first 20-year running average period during which the assessed global warming reaches 1.5°C lies in the first half of the 2030s. In the very high GHG emissions scenario, this mid-point is in the late 2020s. Median five-year interval at which a 1.5°C global warming level is reached (50% probability) in categories of modelled pathways considered in WGIII is 2030-2035. {WGI SPM B.1.3, WGI Cross-Section Box TS.1, WGIII Table 3.2} (Cross-Section Box.2)

Deep, rapid and sustained reductions in GHG emissions would lead to improvements in air quality within a few years, to reductions in trends of global surface temperature discernible after around 20 years, and over longer time periods for many other climate impact-drivers[58] (*high confidence*). Targeted reductions of air pollutant emissions lead to more rapid improvements in air quality compared to reductions in GHG emissions only, but in the long term, further improvements are projected in scenarios that combine efforts to reduce air pollutants as well as GHG emissions (*high confidence*)[59]. {WGI SPM B.1, WGI SPM B.1.3, WGI SPM D.1, WGI SPM D.2, WGI Figure SPM.4, WGI Table SPM.1, WGI Cross-Section Box TS.1; WGIII SPM C.3, WGIII Table SPM.2, WGIII Figure SPM.5, WGIII Box SPM.1 Figure 1, WGIII Table 3.2} (Table 3.1, Cross-Section Box 2, Figure 1)

Changes in short-lived climate forcers (SLCF) resulting from the five considered scenarios lead to an additional net global warming in the near and long term (*high confidence*). Simultaneous stringent climate change mitigation and air pollution control policies limit this additional warming and lead to strong benefits for air quality (*high confidence*). In high and very high GHG emissions scenarios (SSP3-7.0 and SSP5-8.5), combined changes in SLCF emissions, such as CH_4, aerosol and ozone precursors, lead to a net global warming by 2100 of *likely* 0.4°C–0.9°C relative to 2019. This is due to projected increases in atmospheric concentration of CH_4, tropospheric ozone, hydrofluorocarbons and, when strong air pollution control is considered, reductions of cooling aerosols. In low and very low GHG emissions scenarios (SSP1-1.9 and SSP1-2.6), air pollution control policies, reductions in CH_4 and other ozone precursors lead to a net cooling, whereas reductions in anthropogenic cooling aerosols lead to a net warming (*high confidence*). Altogether, this causes a *likely* net warming of 0.0°C–0.3°C due to SLCF changes in 2100 relative to 2019 and strong reductions in global surface ozone and particulate matter (*high confidence*). {WGI SPM D.1.7, WGI Box TS.7} (CSB.2)

Continued GHG emissions will further affect all major climate system components, and many changes will be irreversible on centennial to millennial time scales. Many changes in the climate system become larger in direct relation to increasing global warming. With every additional increment of global warming, changes in extremes continue to become larger. Additional warming will lead to more frequent and intense marine heatwaves and is projected to further amplify permafrost thawing and loss of seasonal snow cover, glaciers, land ice and Arctic sea ice (*high confidence*). Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation[60], and very wet and very dry weather and climate events and seasons (*high confidence*). The portion of global land experiencing detectable changes in seasonal mean precipitation is projected to increase (*medium confidence*) with more variable precipitation and surface water flows over most land regions within seasons (*high confidence*) and from year to year (*medium confidence*). Many changes due to past and future GHG emissions are irreversible[61] on centennial to millennial time scales, especially in the ocean, ice sheets and global sea level (see 3.1.3). Ocean acidification (*virtually certain*), ocean deoxygenation (*high confidence*) and global mean sea level (*virtually certain*) will continue to increase in the 21st century, at rates dependent on future emissions. {WGI SPM B.2, WGI SPM B.2.2, WGI SPM B.2.3, WGI SPM B.2.5, WGI SPM B.3, WGI SPM B.3.1, WGI SPM B.3.2, WGI SPM B.4, WGI SPM B.5, WGI SPM B.5.1, WGI SPM B.5.3, WGI Figure SPM.8} (Figure 3.1)

With further global warming, every region is projected to increasingly experience concurrent and multiple changes in climatic impact-drivers. Increases in hot and decreases in cold climatic impact-drivers, such as temperature extremes, are projected in all regions (*high confidence*). At 1.5°C global warming, heavy precipitation and flooding events are projected to intensify and become more frequent in most regions in Africa, Asia (*high confidence*), North America (*medium to high confidence*) and Europe (*medium confidence*). At 2°C or above, these changes expand to more regions and/or become more significant (*high confidence*), and more frequent and/or severe agricultural and ecological droughts are projected in Europe, Africa, Australasia and North, Central and South America (*medium* to *high confidence*). Other projected regional changes include intensification of tropical cyclones and/or extratropical storms (*medium confidence*), and increases in aridity and fire weather[62] (*medium* to *high confidence*). Compound heatwaves and droughts

[58] See Cross-Section Box.2.
[59] Based on additional scenarios.
[60] Particularly over South and South East Asia, East Asia and West Africa apart from the far west Sahel {WGI SPM B.3.3}
[61] See Annex I: Glossary.
[62] See Annex I: Glossary.

become *likely* more frequent, including concurrently at multiple locations (*high confidence*). {WGI SPM C.2, WGI SPM C.2.1, WGI SPM C.2.2, WGI SPM C.2.3, WGI SPM C.2.4, WGI SPM C.2.7}

[START FIGURE 3.1 HERE]

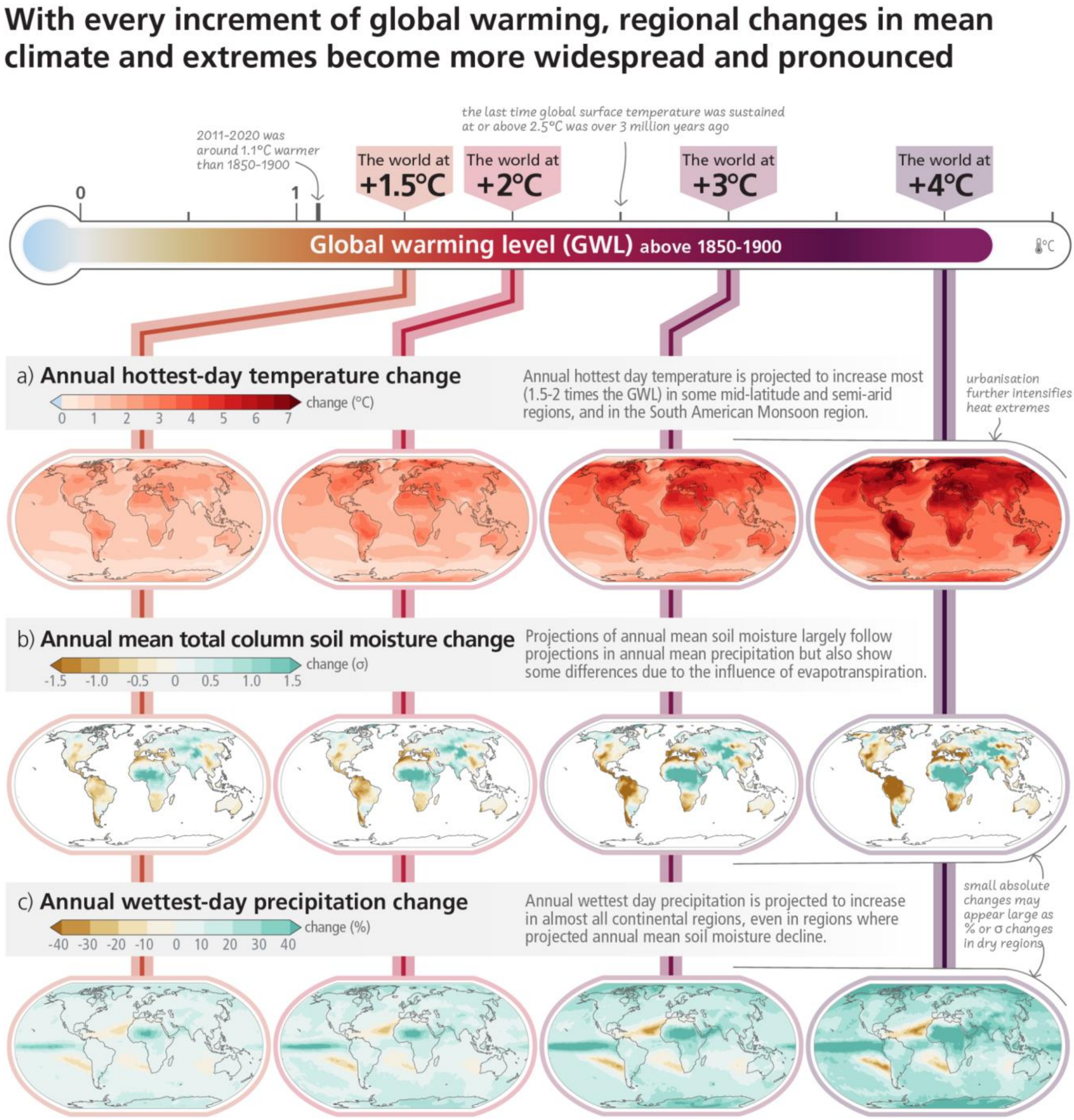


Figure 3.1: Projected changes of annual maximum daily temperature, annual mean total column soil moisture CMIPand annual maximum daily precipitation at global warming levels of 1.5°C, 2°C, 3°C, and 4°C relative to 1850–1900. Simulated (**a**) annual maximum temperature change (°C), (**b**) annual mean total column soil moisture (standard deviation), (**c**) annual maximum daily precipitation change (%). Changes correspond to CMIP6 multi-model median changes. In panels (b) and (c), large positive relative changes in dry regions may correspond to small absolute changes. In panel (b), the unit is the standard deviation of interannual variability in soil moisture during 1850–1900. Standard deviation is a widely used metric in characterising drought severity. A projected reduction in mean soil moisture by one standard deviation corresponds to soil moisture conditions typical of droughts that occurred about once every six years during 1850–1900. The WGI Interactive Atlas (https://interactive-atlas.ipcc.ch/) can be used to explore additional changes in the climate system across the range of global warming levels presented in this figure. {WGI Figure SPM.5, WGI Figure TS.5, WGI Figure 11.11, WGI Figure 11.16, WGI Figure 11.19} (CSB.2)

[END FIGURE 3.1 HERE]

3.1.2 Impacts and Related Risks

For a given level of warming, many climate-related risks are assessed to be higher than in AR5 (*high confidence*). Levels of risk[63] for all Reasons for Concern[64] (RFCs) are assessed to become high to very high at lower global warming levels compared to what was assessed in AR5 (*high confidence*). This is based upon recent evidence of observed impacts, improved process understanding, and new knowledge on exposure and vulnerability of human and natural systems, including limits to adaptation. Depending on the level of global warming, the assessed long-term impacts will be up to multiple times higher than currently observed (*high confidence*) for 127 identified key risks, e.g., in terms of the number of affected people and species. Risks, including cascading risks (see 3.1.3) and risks from overshoot (see 3.3.4), are projected to become increasingly severe with every increment of global warming (*very high confidence*). {WGII SPM B.3.3, WGII SPM B.4, WGII SPM B.5, WGII 16.6.3; SRCCL SPM A5.3} (Figure 3.2, Figure 3.3)

Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present (1.1°C) but lower than at 2°C (*high confidence*) (see Section 2.1.2)**.** Climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C. In terrestrial ecosystems, 3–14% of the tens of thousands of species assessed will *likely* face a very high risk of extinction at a GWL of 1.5°C. Coral reefs are projected to decline by a further 70–90% at 1.5°C of global warming (*high confidence*). At this GWL, many low-elevation and small glaciers around the world would lose most of their mass or disappear within decades to centuries (*high confidence*). Regions at disproportionately higher risk include Arctic ecosystems, dryland regions, small island development states and Least Developed Countries (*high confidence*). {WGII SPM B.3, WGII SPM B.4.1, WGII TS.C.4.2; SR1.5 SPM A.3, SR1.5 SPM B.4.2, SR1.5 SPM B.5, SR1.5 SPM B.5.1} (Figure 3.3)

At 2°C of global warming, overall risk levels associated with the unequal distribution of impacts (RFC3), global aggregate impacts (RFC4) and large-scale singular events (RFC5) would be transitioning to high (*medium confidence*), those associated with extreme weather events (RFC2) would be transitioning to very high (*medium confidence*), and those associated with unique and threatened systems (RFC1) would be very high (*high confidence*) (Figure 3.3, panel a). With about 2°C warming, climate-related changes in food availability and diet quality are estimated to increase nutrition-related diseases and the number of undernourished people, affecting tens (under low vulnerability and low warming) to hundreds of millions of people (under high vulnerability and high warming), particularly among low-income households in low- and middle-income countries in sub-Saharan Africa, South Asia and Central America (*high confidence*). For example, snowmelt water availability for irrigation is projected to decline in some snowmelt dependent river basins by up to 20% (*medium confidence*). Climate change risks to cities, settlements and key infrastructure will rise sharply in the mid- and long-term with further global warming, especially in places already exposed to high temperatures, along coastlines, or with high vulnerabilities (*high confidence*). {WGII SPM B.3.3, WGII SPM B.4.2, WGII SPM B.4.5, WGII TS C.3.3, WGII TS.C.12.2} (Figure 3.3)

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[63] Undetectable risk level indicates no associated impacts are detectable and attributable to climate change; moderate risk indicates associated impacts are both detectable and attributable to climate change with at least *medium confidence*, also accounting for the other specific criteria for key risks; high risk indicates severe and widespread impacts that are judged to be high on one or more criteria for assessing key risks; and very high risk level indicates very high risk of severe impacts and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks. {WGII Figure SPM.3}

[64] The Reasons for Concern (RFC) framework communicates scientific understanding about accrual of risk for five broad categories {WGII Figure SPM.3}. RFC1: Unique and threatened systems: ecological and human systems that have restricted geographic ranges constrained by climate-related conditions and have high endemism or other distinctive properties. Examples include coral reefs, the Arctic and its Indigenous Peoples, mountain glaciers and biodiversity hotspots. RFC2: Extreme weather events: risks/impacts to human health, livelihoods, assets and ecosystems from extreme weather events such as heatwaves, heavy rain, drought and associated wildfires, and coastal flooding. RFC3: Distribution of impacts: risks/impacts that disproportionately affect particular groups due to uneven distribution of physical climate change hazards, exposure or vulnerability. RFC4: Global aggregate impacts: impacts to socio-ecological systems that can be aggregated globally into a single metric, such as monetary damages, lives affected, species lost or ecosystem degradation at a global scale. RFC5: Large-scale singular events: relatively large, abrupt and sometimes irreversible changes in systems caused by global warming, such as ice sheet instability or thermohaline circulation slowing. Assessment methods include a structured expert elicitation based on the literature described in WGII SM16.6 and are identical to AR5 but are enhanced by a structured approach to improve robustness and facilitate comparison between AR5 and AR6. For further explanations of global risk levels and Reasons for Concern, see WGII TS.AII. {WGII Figure SPM.3}

At global warming of 3°C, additional risks in many sectors and regions reach high or very high levels, implying widespread systemic impacts, irreversible change and many additional adaptation limits (see Section 3.2) (*high confidence*). For example, very high extinction risk for endemic species in biodiversity hotspots is projected to increase at least tenfold if warming rises from 1.5°C to 3°C (*medium confidence*). Projected increases in direct flood damages are higher by 1.4–2 times at 2°C and 2.5–3.9 times at 3°C, compared to 1.5°C global warming without adaptation (*medium confidence*). {WGII SPM B.4.1, WGII SPM B.4.2, WGII Figure SPM.3, WGII TS Appendix AII, WGII Atlas Fig.AI.46} (Figure 3.2, Figure 3.3)

Global warming of 4°C and above is projected to lead to far-reaching impacts on natural and human systems (*high confidence*). Beyond 4°C of warming, projected impacts on natural systems include local extinction of ~50% of tropical marine species (*medium confidence*) and biome shifts across 35% of global land area (*medium confidence*). At this level of warming, approximately 10% of the global land area is projected to face both increasing high and decreasing low extreme streamflow, affecting, without additional adaptation, over 2.1 billion people (*medium confidence*) and about 4 billion people are projected to experience water scarcity (*medium confidence*). At 4°C of warming, the global burned area is projected to increase by 50–70% and the fire frequency by ~30% compared to today (*medium confidence*). {WGII SPM B.4.1, WGII SPM B.4.2, WGII TS.C.1.2, WGII TS.C.2.3, WGII TS.C.4.1, WGII TS.C.4.4} (Figure 3.2, Figure 3.3)

Projected adverse impacts and related losses and damages from climate change escalate with every increment of global warming (*very high confidence*), but they will also strongly depend on socio-economic development trajectories and adaptation actions to reduce vulnerability and exposure (*high confidence*). For example, development pathways with higher demand for food, animal feed, and water, more resource-intensive consumption and production, and limited technological improvements result in higher risks from water scarcity in drylands, land degradation and food insecurity (*high confidence*). Changes in, for example, demography or investments in health systems have effect on a variety of health-related outcomes including heat-related morbidity and mortality (Figure 3.3 Panel d). {WGII SPM B.3, WGII SPM B.4, WGII Figure SPM.3; SRCCL SPM A.6}

With every increment of warming, climate change impacts and risks will become increasingly complex and more difficult to manage. Many regions are projected to experience an increase in the probability of compound events with higher global warming, such as concurrent heatwaves and droughts, compound flooding and fire weather. In addition, multiple climatic and non-climatic risk drivers such as biodiversity loss or violent conflict will interact, resulting in compounding overall risk and risks cascading across sectors and regions. Furthermore, risks can arise from some responses that are intended to reduce the risks of climate change, e.g., adverse side effects of some emission reduction and carbon dioxide removal (CDR) measures (see 3.4.1). (*high confidence*) {WGI SPM C.2.7, WGI Figure SPM.6, WGI TS.4.3; WGII SPM B.1.7, WGII B.2.2, WGII SPM B.5, WGII SPM B.5.4, WGII SPM C.4.2, WGII SPM B.5, WGII CCB2}

Solar Radiation Modification (SRM) approaches, if they were to be implemented, introduce a widespread range of new risks to people and ecosystems, which are not well understood. SRM has the potential to offset warming within one or two decades and ameliorate some climate hazards but would not restore climate to a previous state, and substantial residual or overcompensating climate change would occur at regional and seasonal scales (*high confidence*). Effects of SRM would depend on the specific approach used[65], and a sudden and sustained termination of SRM in a high CO_2 emissions scenario would cause rapid climate change (*high confidence*). SRM would not stop atmospheric CO_2 concentrations from increasing nor reduce resulting ocean acidification under continued anthropogenic emissions (*high confidence*). Large uncertainties and knowledge gaps are associated with the potential of SRM approaches to reduce climate change risks. Lack of robust and formal SRM governance poses risks as deployment by a limited number of states could create international tensions. {WGI 4.6; WGII SPM B.5.5; WGIII 14.4.5.1; Cross-WG box SRM; SR1.5 SPM C.1.4}

[START FIGURE 3.2 HERE]

[65] Several SRM approaches have been proposed, including stratospheric aerosol injection, marine cloud brightening, ground-based albedo modifications, and ocean albedo change. See Annex I: Glossary.

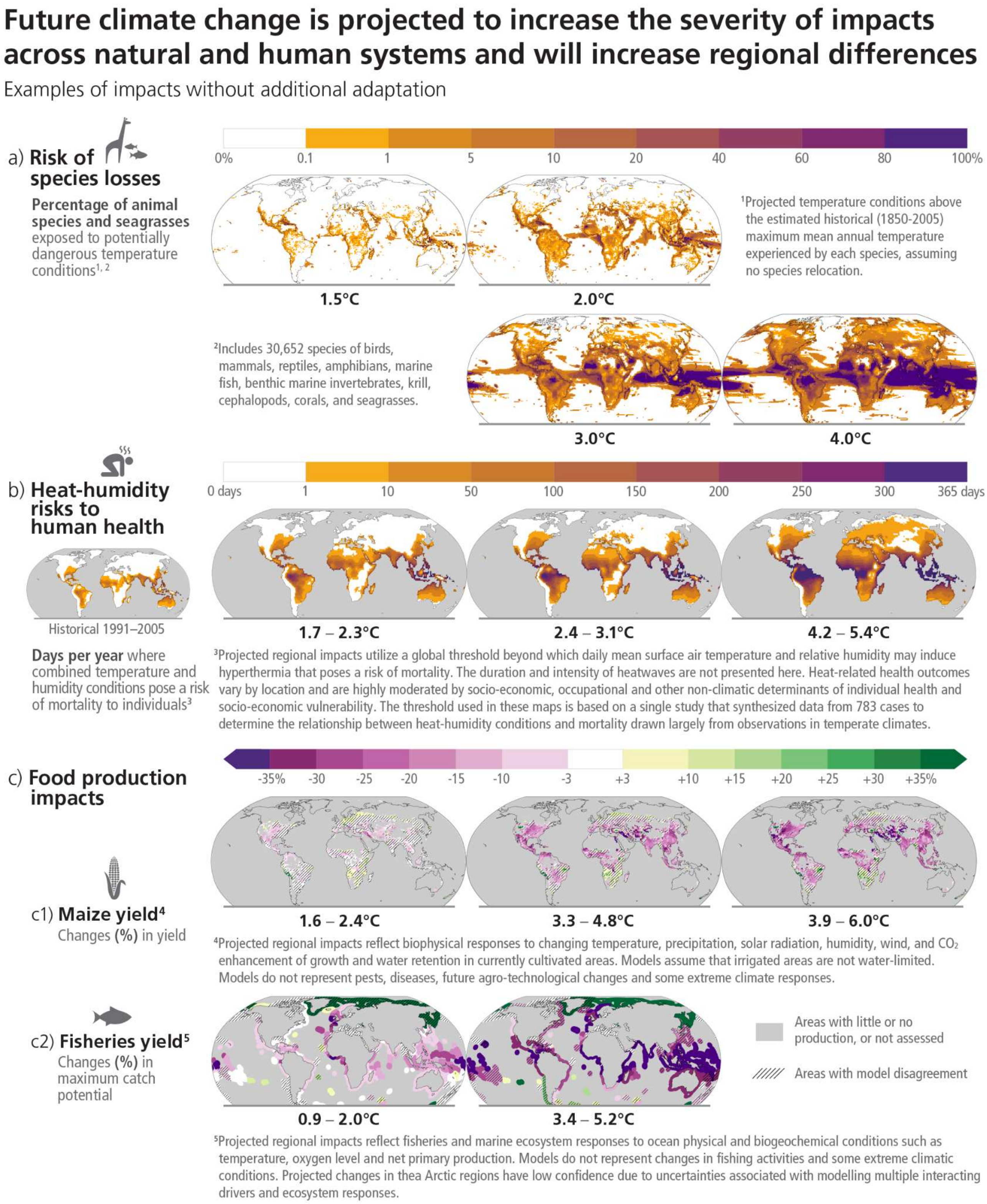

Figure 3.2: Projected risks and impacts of climate change on natural and human systems at different global warming levels (GWLs) relative to 1850–1900 levels. Projected risks and impacts shown on the maps are based on outputs from different subsets of Earth system models that were used to project each impact indicator without additional adaptation. WGII provides further assessment of the impacts on human and natural systems using these projections and additional lines of evidence. **(a)** Risks of species losses as indicated by the percentage of assessed species exposed to potentially dangerous temperature conditions, as defined by conditions beyond the estimated historical (1850-2005) maximum mean annual temperature experienced by each species, at GWLs of 1.5°C, 2°C, 3°C and 4°C. Underpinning projections of temperature are from 21 Earth system models and do not consider extreme events impacting ecosystems such as the Arctic. **(b)** Risk to human health as indicated by the days per year of population exposure to hypothermic conditions that pose a risk of mortality from surface air temperature and humidity conditions for historical period (1991-2005) and at GWLs of 1.7°C–2.3°C (mean = 1.9°C; 13 climate models), 2.4°C–3.1°C (2.7°C; 16 climate models) and 4.2°C–5.4°C (4.7°C; 15 climate models). Interquartile ranges of WGLs by 2081-2100 under RCP2.6, RCP4.5 and