SIXTH ASSESSMENT REPORT
Working Group I – The Physical Science Basis

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

Selected highlights from the IPCC 2021 WGI physical science basis climate change report

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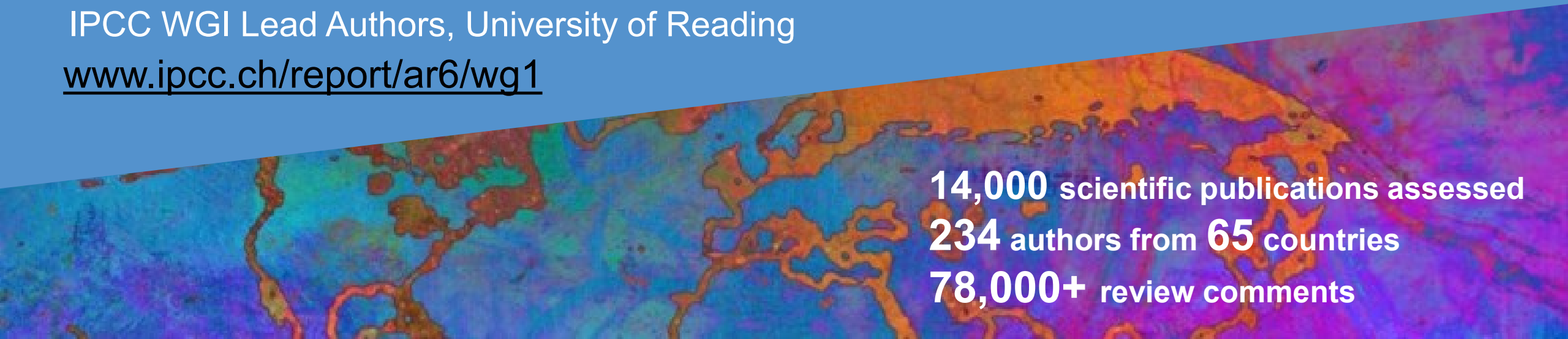
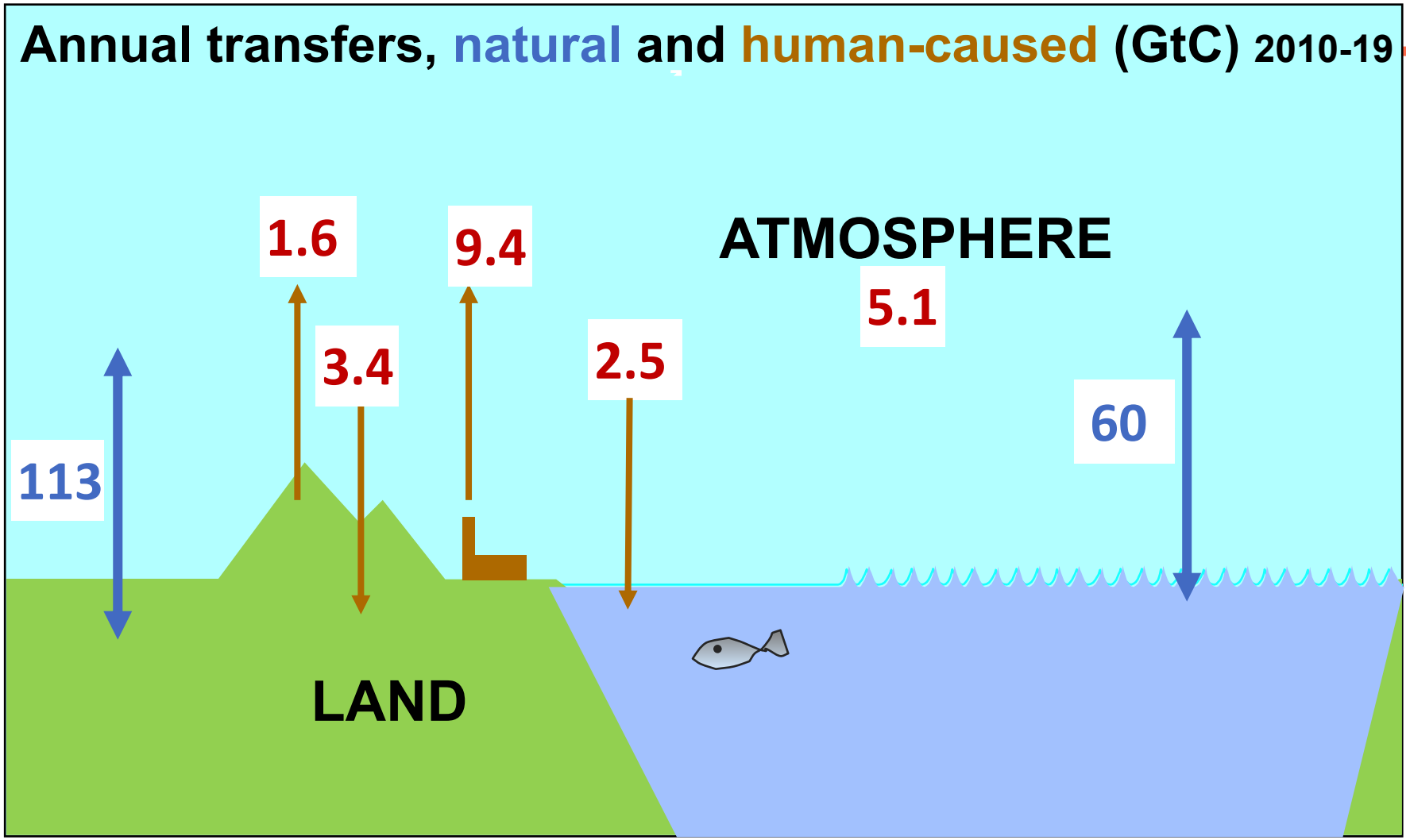
www.ipcc.ch/report/ar6/wg1



Key Messages (abridged)

- Earth's climate has always varied but it is an established fact that human activities are now driving climate change
- Recent changes in climate are widespread, rapid and unprecedented in thousands of years.
- Human activities are intensifying extreme climate events, including heat waves, heavy rainfall, and droughts
- Every bit of global warming increases the magnitude of climate change including the severity of climate extremes
- Limiting warming to 1.5°C requires immediate, rapid, and large-scale reductions in greenhouse gas emissions

Natural & human-influenced carbon cycle



- Human activities have tipped the natural carbon cycle out of balance
- This is driving increases in atmospheric CO_2 concentrations
- CO_2 concentrations highest in at least 2 million years

Values in billions of tonnes of Carbon per year from IPCC (2021) Ch5

It is indisputable that human activities are causing climate change

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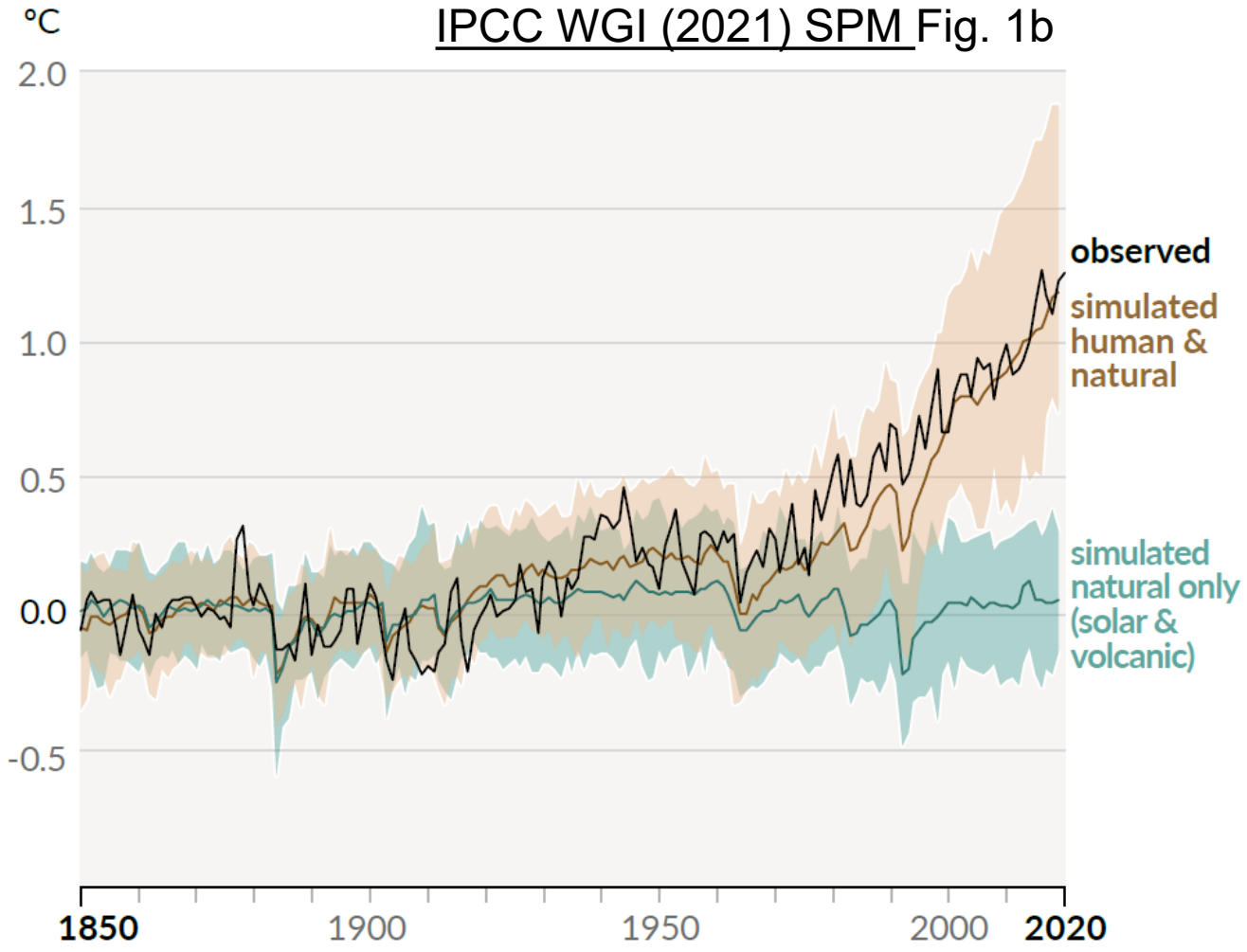
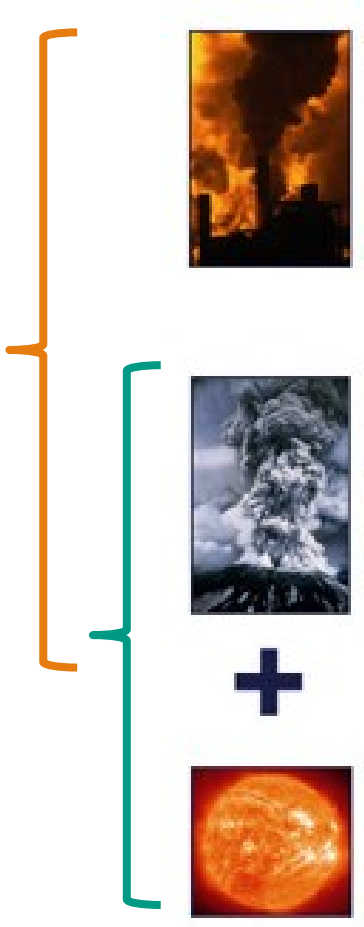
IPCC WGI (2021) SPM Fig. 1b





► Observed warming is driven by emissions from human activities

► Greenhouse gas warming has been partly masked by aerosol cooling

► Warming is amplified by feedback loops involving water vapour, ice & clouds

► Natural factors do not contribute to rapid warming over past 5 decades

Recent changes in the climate are widespread, rapid and unprecedented in thousands of years

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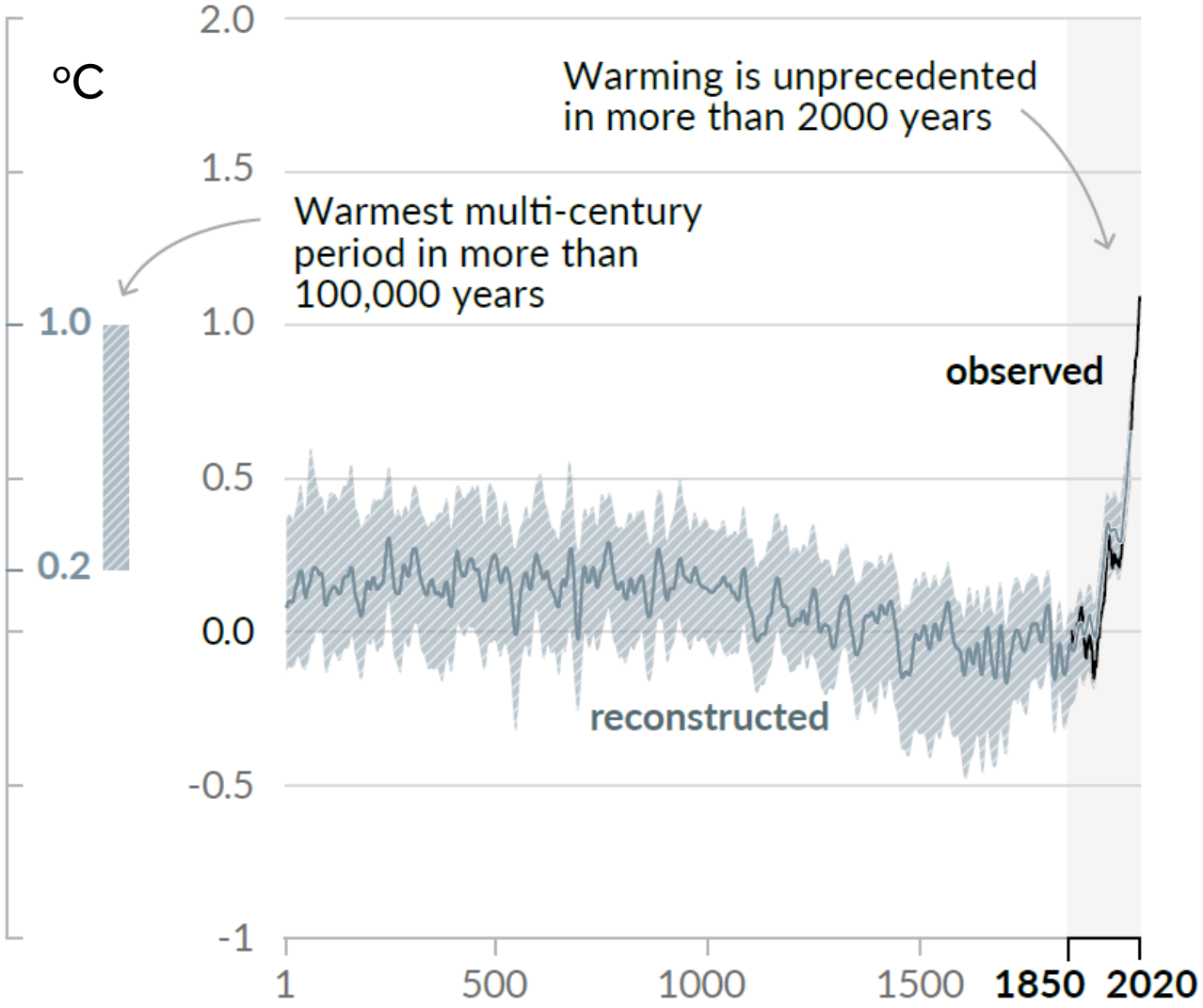

- Global mean surface temperature increased faster since 1970 than in any other 50 year period over at least the last 2000 years
- Warmth of past decade comparable to last interglacial 125,000 years ago *[when peak sea level was 5-10m higher than today]*

[IPCC WGI 2021 SPM]

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

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Figure SPM.3

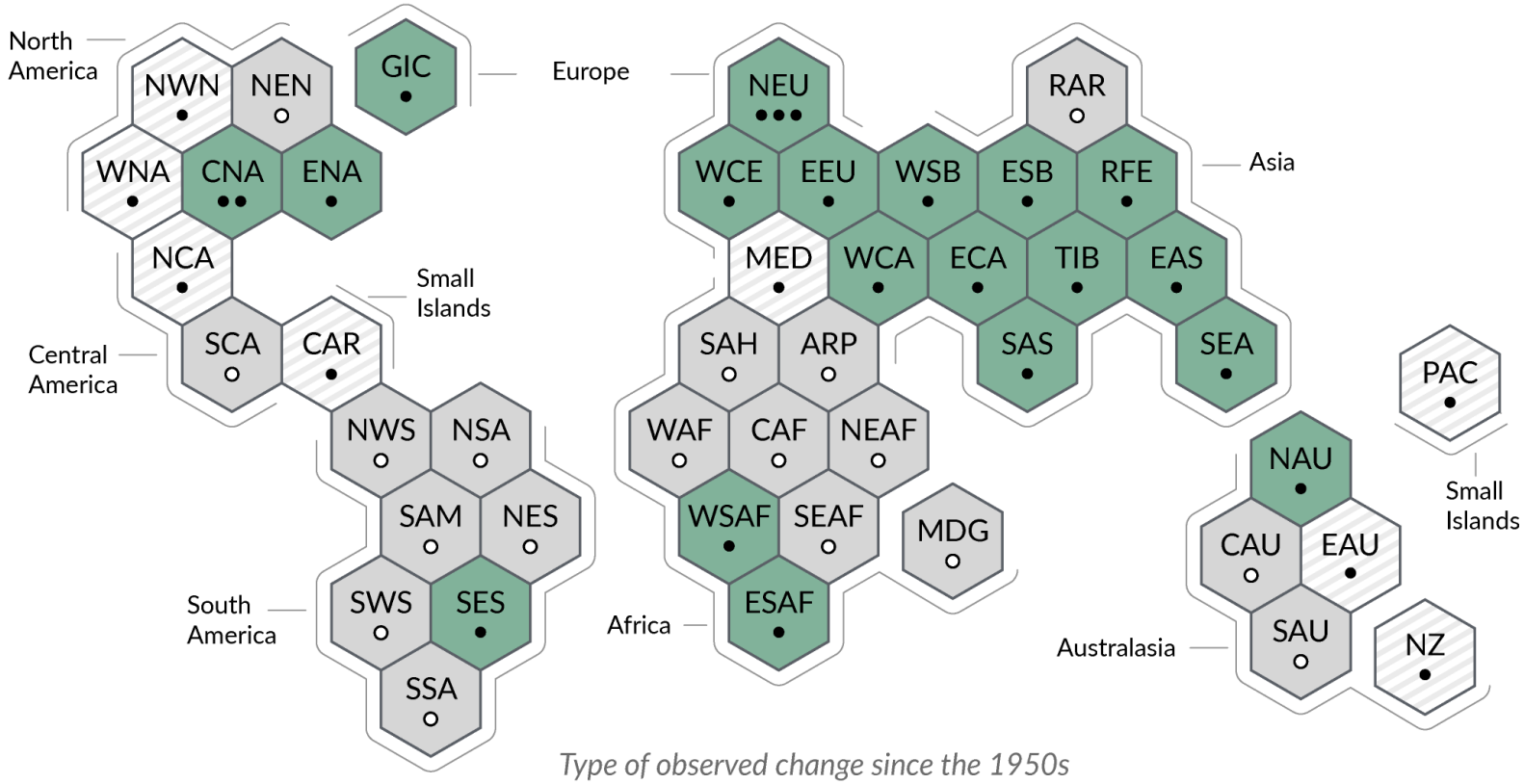
b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions

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

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Figure SPM.3

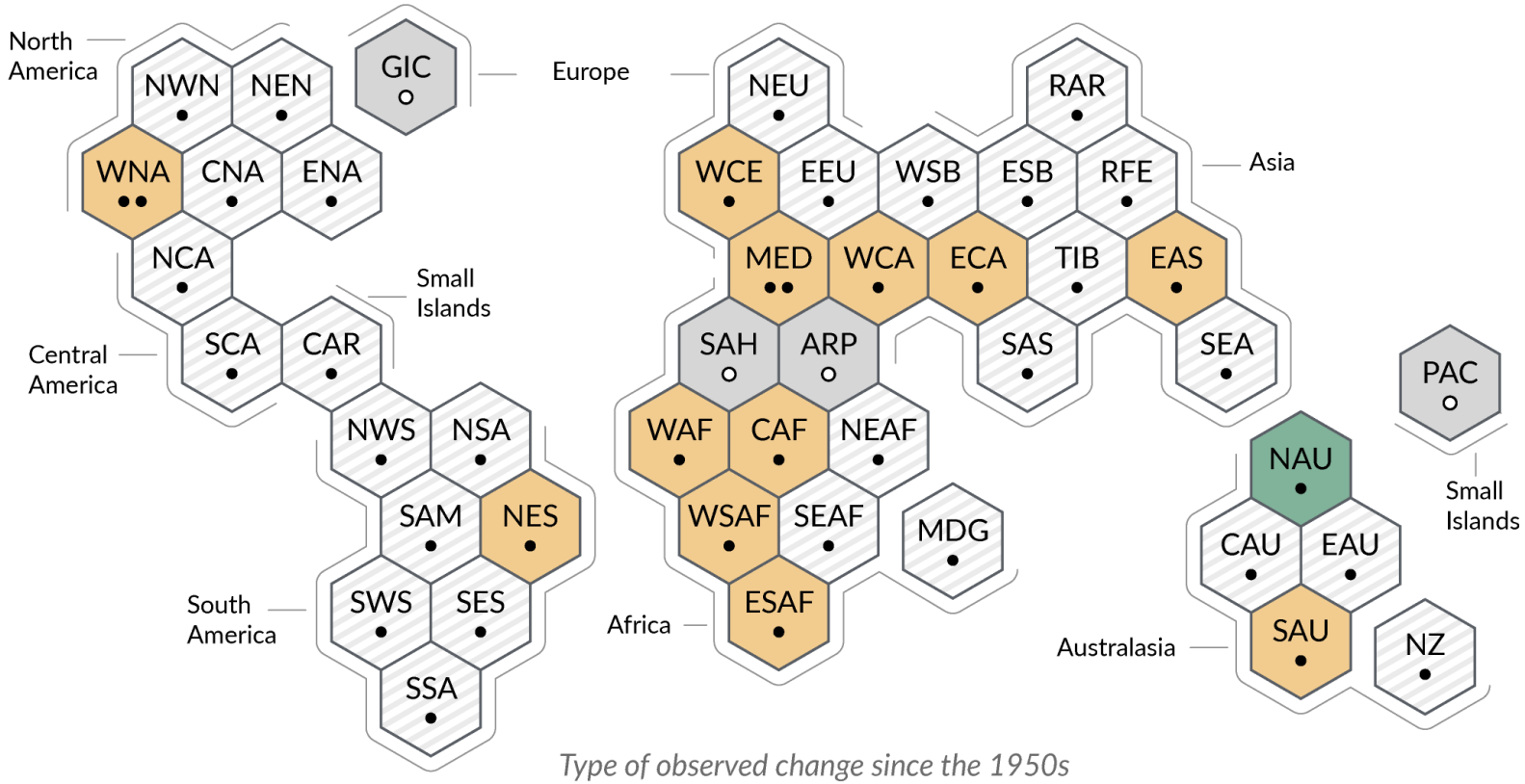
c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions

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)

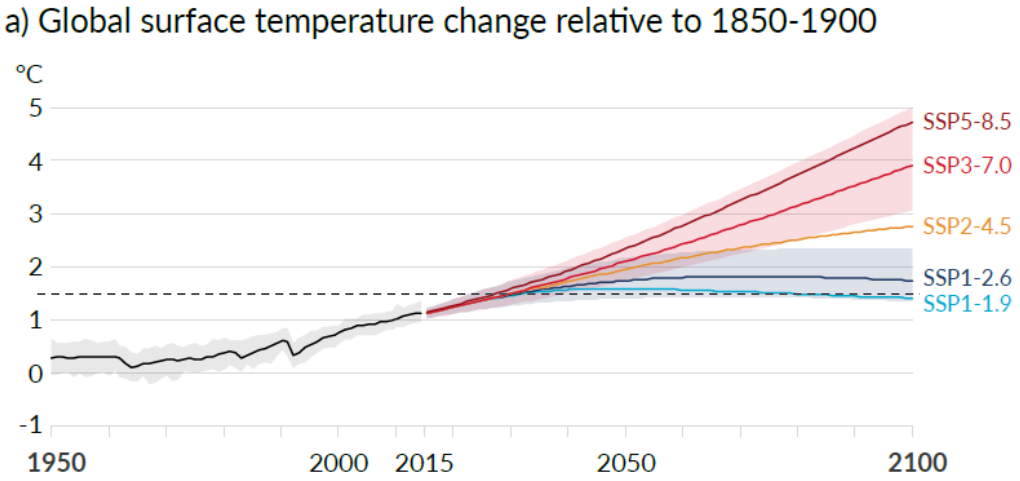
Confidence in human contribution
to the observed change

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



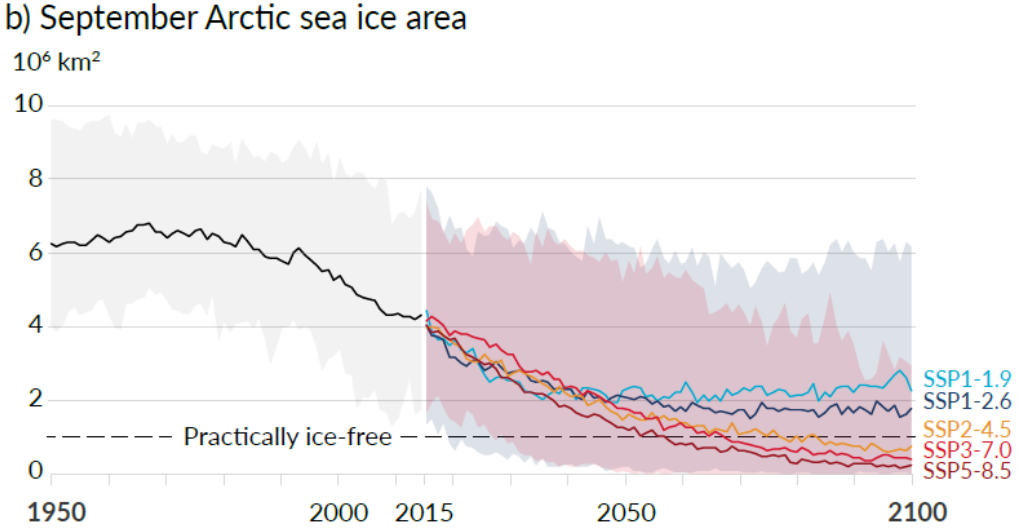
Type of observed change since the 1950s

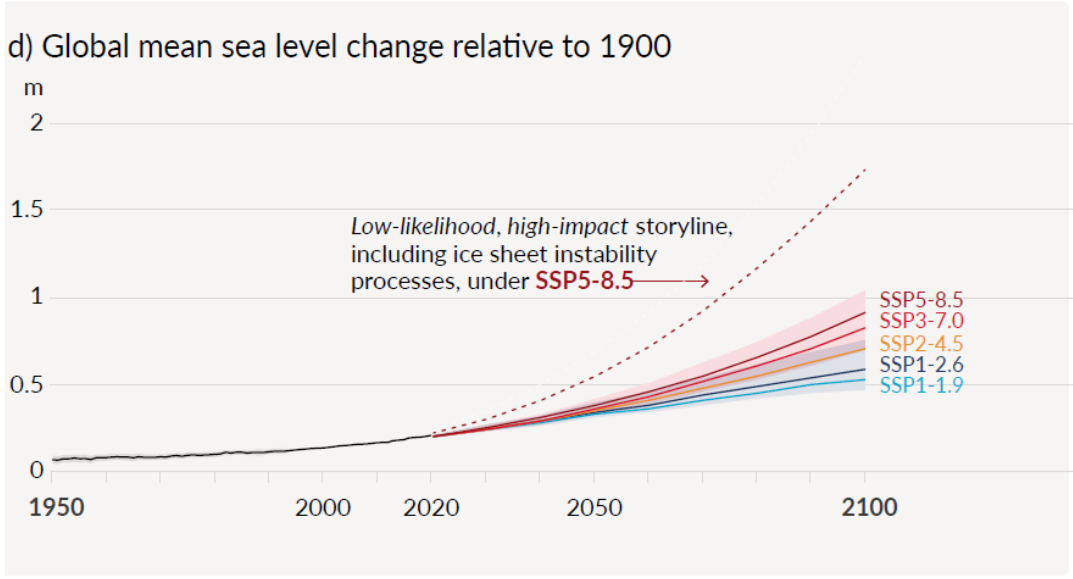
Some changes in the climate system are irreversible but many changes can be slowed or stopped by limiting warming

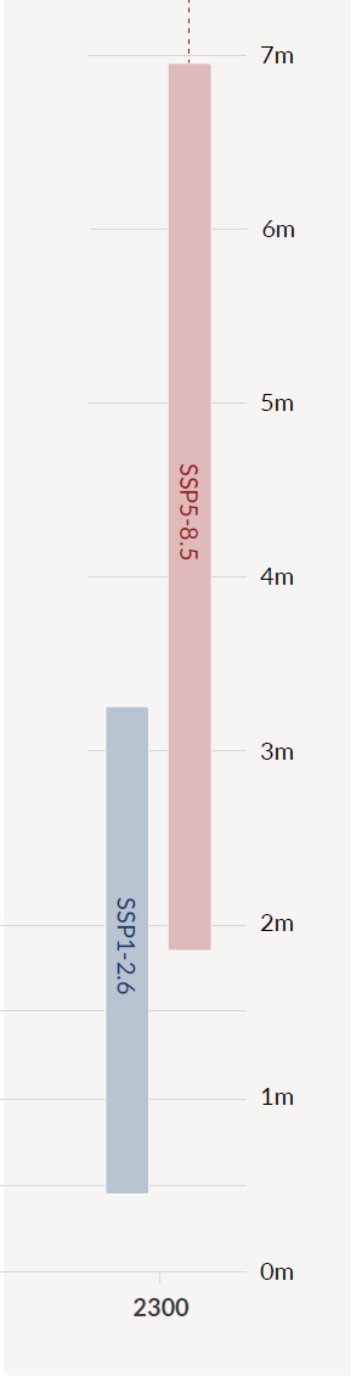


Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO_2 and other greenhouse gas emissions occur in the coming decades
[IPCC (2021) WG1 SPM]

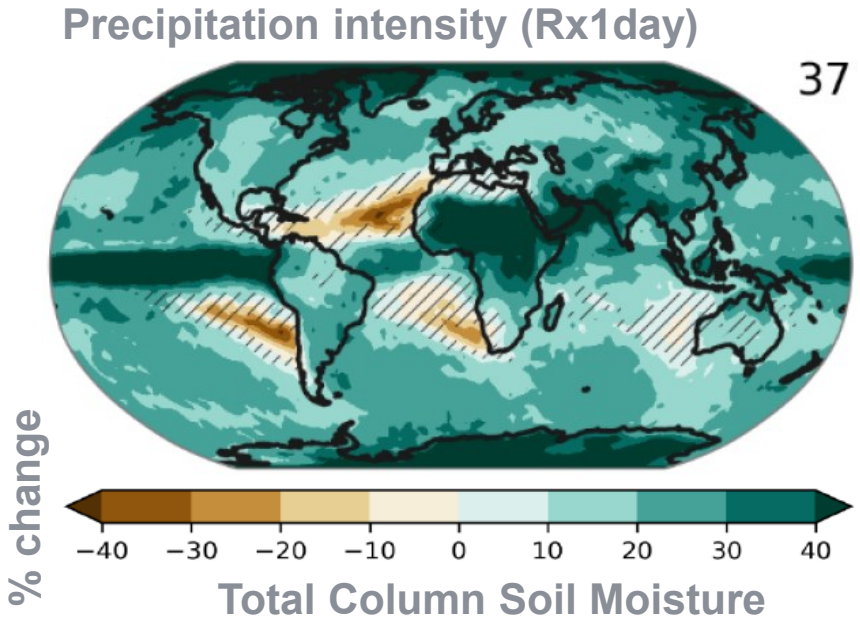
High emissions
Low emissions

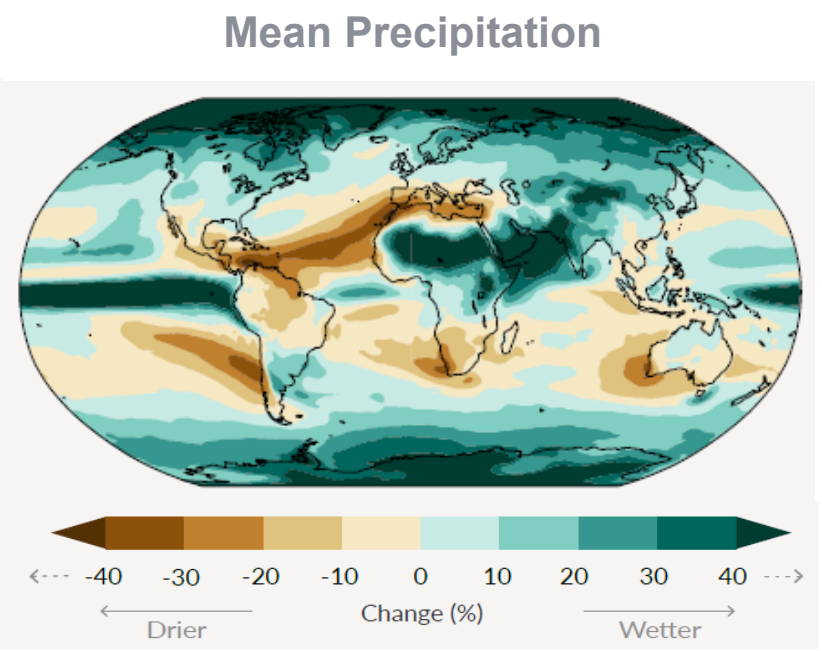






Continued global warming is projected to further intensify the global water cycle including the severity of wet and dry events



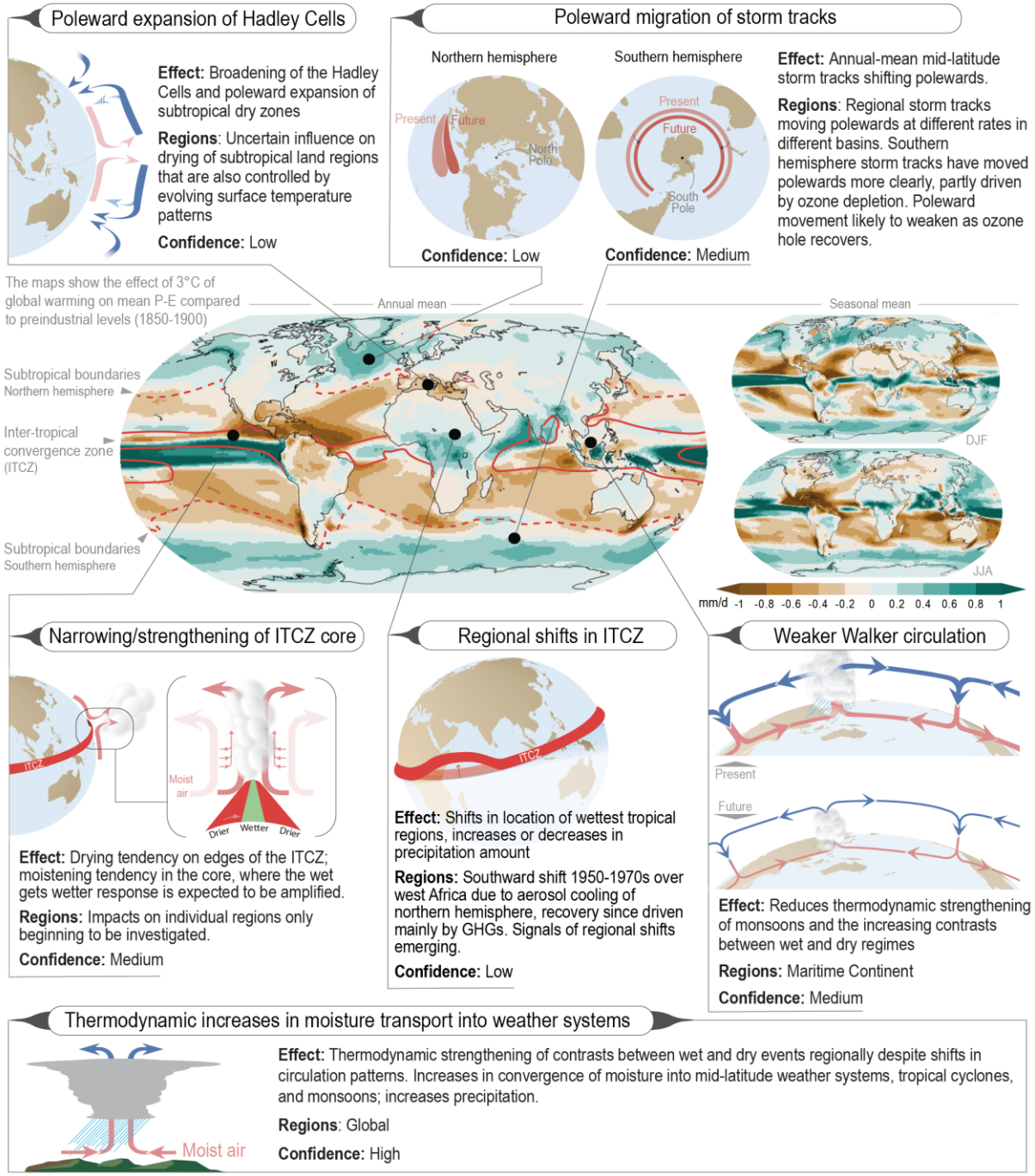


Water cycle changes at 4°C warming illustrated

- More intense rainfall
- More severe droughts (and hot/dry extremes)
- Wet events wetter, dry events drier
- Increased variability (day to day, year to year)

- But large effect of circulation change on regional water cycle

IPCC WG1 (2021) Chapters 11, 4, 8 and SPM; see also Technical Summary BoxTS.6



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Large-scale circulation projected changes and effects on the water cycle

Low to medium confidence of circulation changes (poleward expansion of Hadley Cells and some storm tracks; weakening tropical circulation; narrowing and strengthening of ITCZ core with some regional shifts) but thermodynamic strengthening of contrasts between wet and dry weather and climate events

IPCC WG1 (2021) Chapter 8, Fig. 8.21.

Mitigation of Climate Change

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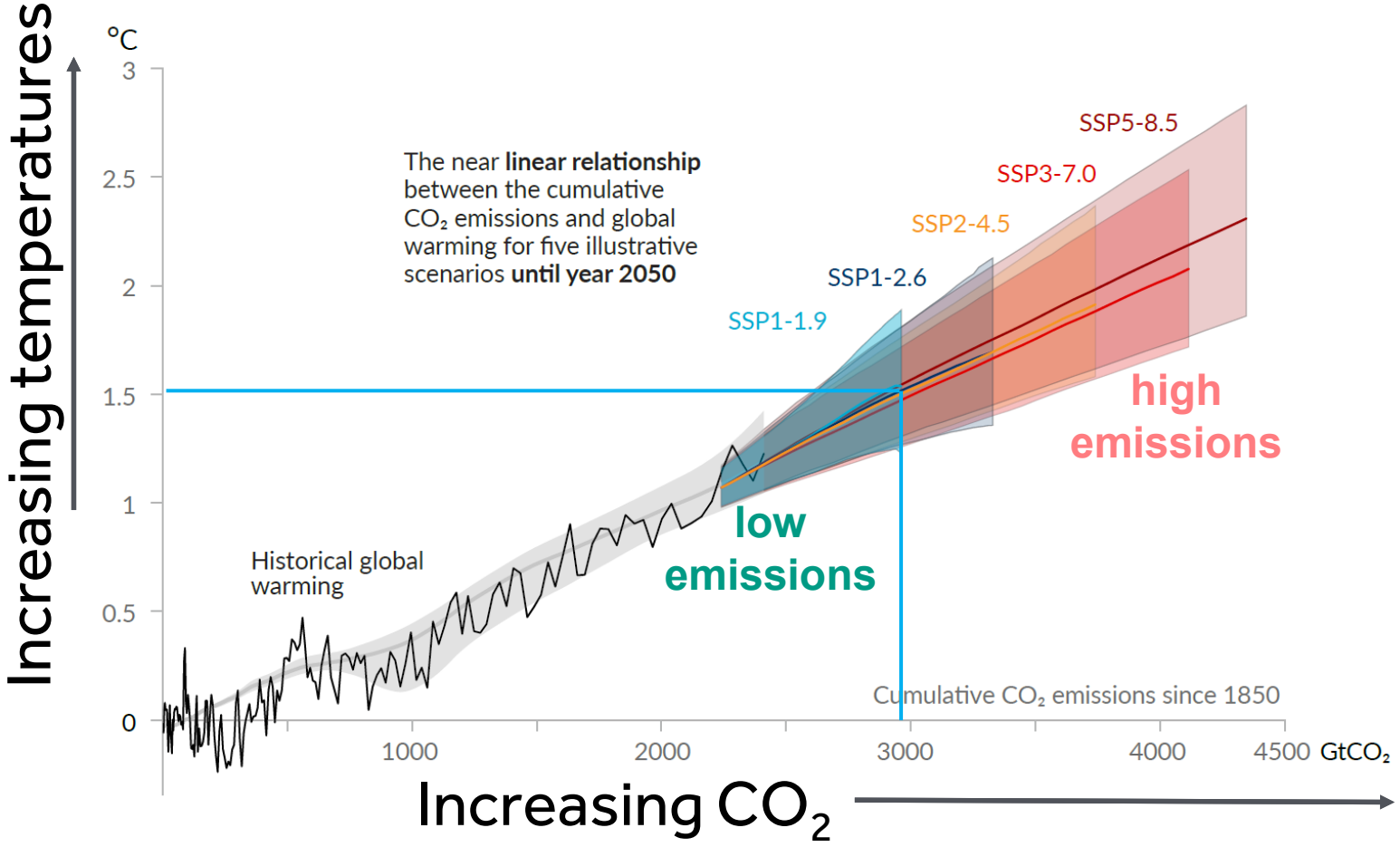
Each 1000 billion tonnes of CO_2 emission increases global temperature by about 0.5°C [IPCC WGI 2021 SPM]



- Act now

  To keep future options open

- Act everywhere

  Efforts in all sectors are needed to reach global zero CO_2 emissions

- Act thoughtfully

  Develop strategies maximising synergies and taking into account the local context, use a wide array of measures and actions

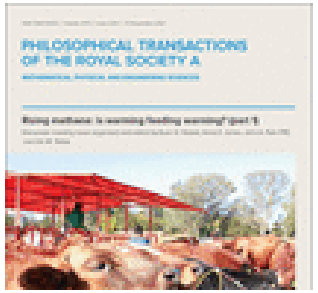
- Act jointly

  Collaboratively and including national and sub-national authorities, civil society, the private sector and local communities

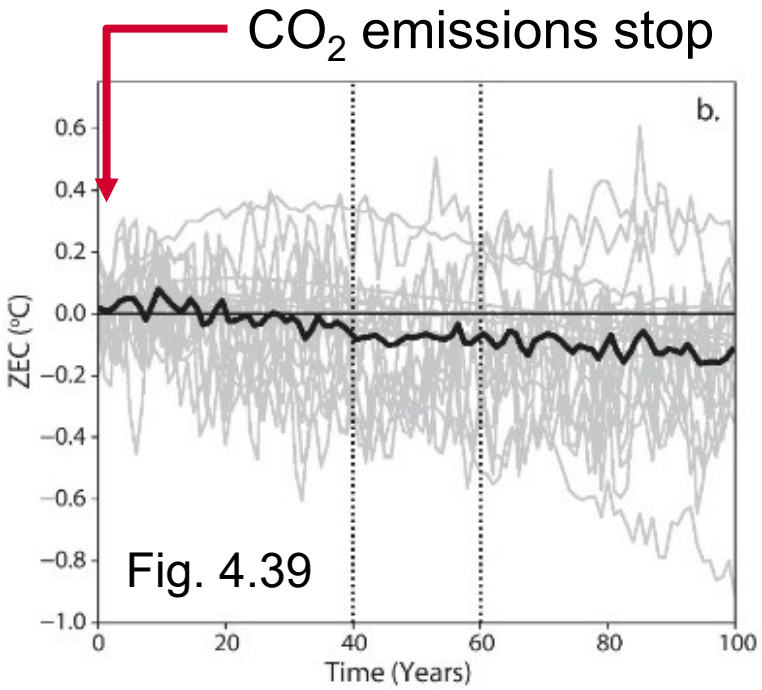
Joeri Rogelj (IPCC AR6 & SR1.5 author)

Glimmers of good news!

- No further CO_2-induced warming or cooling once global CO_2 emissions reach and stay at next zero
- Still physically possible to limit global warming to 1.5°C, but that requires deep reductions in CO_2 and other greenhouse gas emissions in the coming decades
- Amplifying carbon cycle feedbacks small? (so far…)
- More certain on climate sensitivity 3°C (2.5 to 4°C)
- Reductions in methane emissions would limit warming effect resulting from declining particulate pollution and would improve air quality



← See also Jackson et al.(2021) Phil.Trans.RoyalSoc



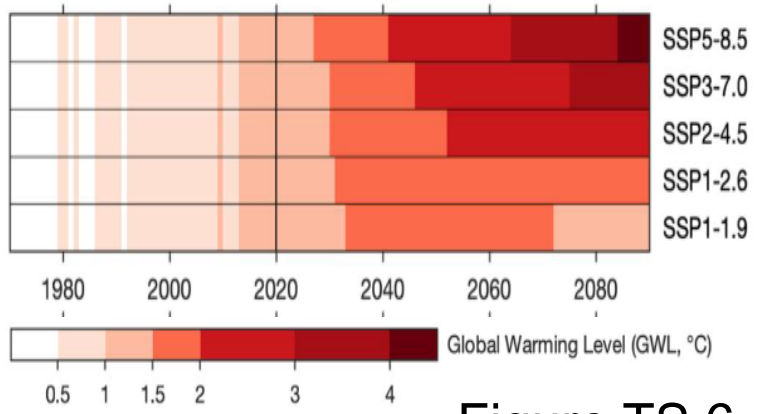
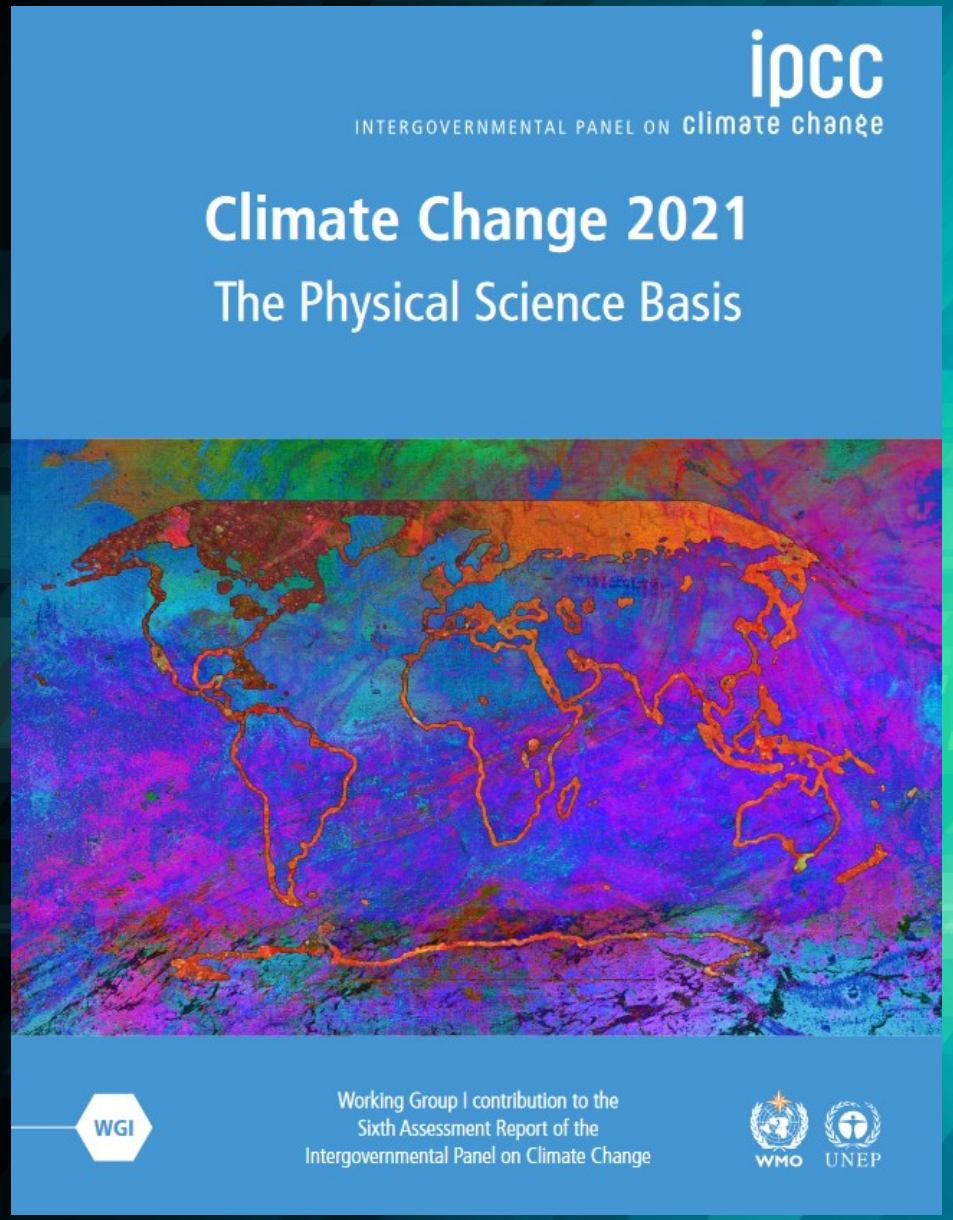


Figure TS.6



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