Challenges and opportunities in Managing Climate Change Induced Flood Risk in SAARC Region: Reflections

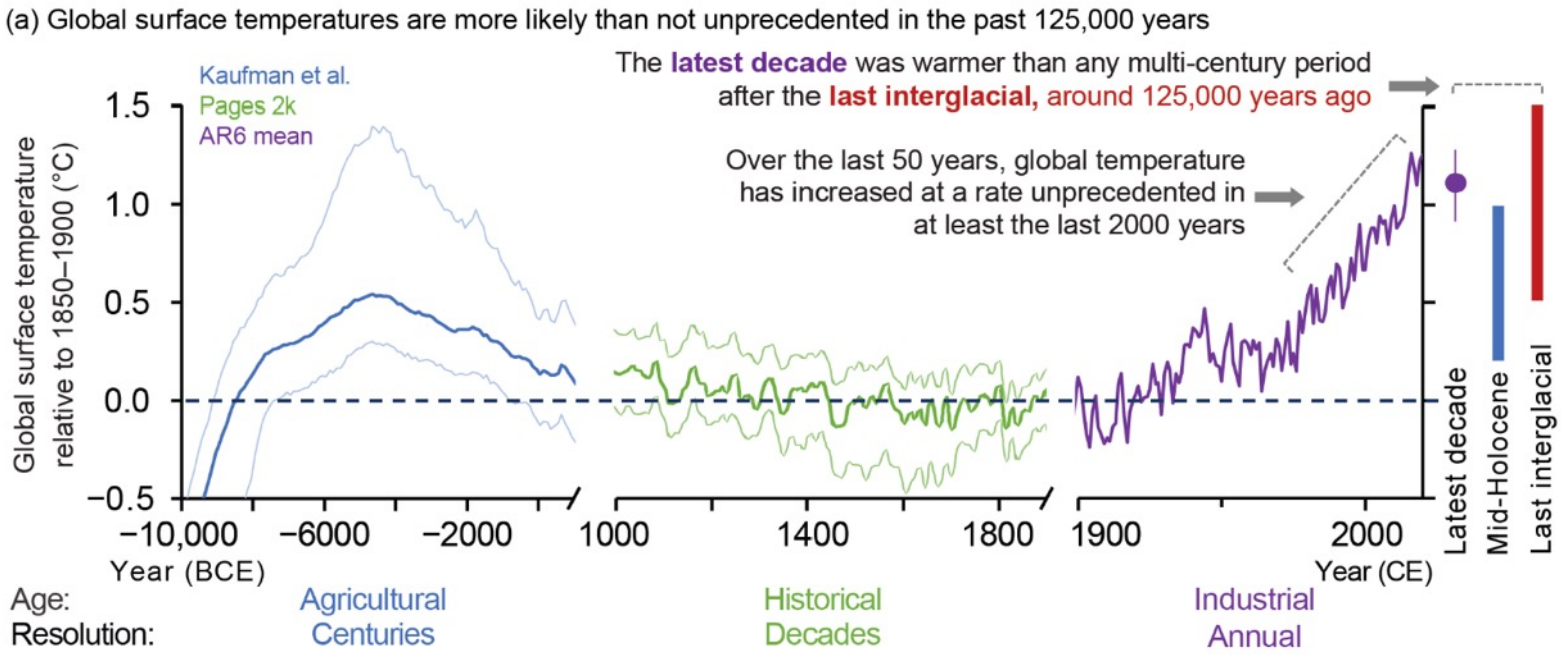
Krishna AchutaRao

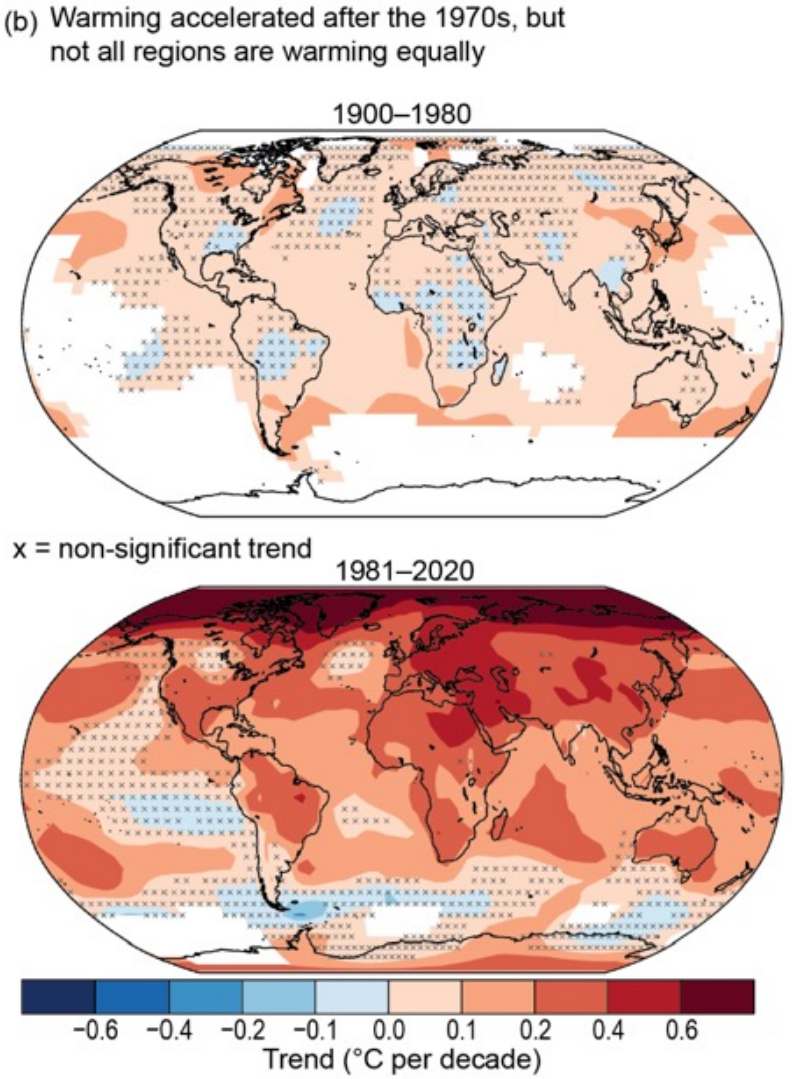
Professor Centre for Atmospheric Sciences

Associate Faculty School of Public Policy

IIT Delhi

Changes in Surface Temperature





IPCC AR6 WG-I Figure 2.11

What does warmer temperature mean for the water cycle

- A warmer climate increases moisture transport into weather systems, which intensifies wet seasons and events (**high confidence**).

- Increases in near-surface atmospheric moisture capacity of about 7% per 1°C of warming lead to a similar response in the intensification of heavy precipitation ….. increasing the severity of flood hazards (**high confidence**).

- Water cycle variability and related extremes are projected to increase faster than mean changes in most regions of the world

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 SPM.3

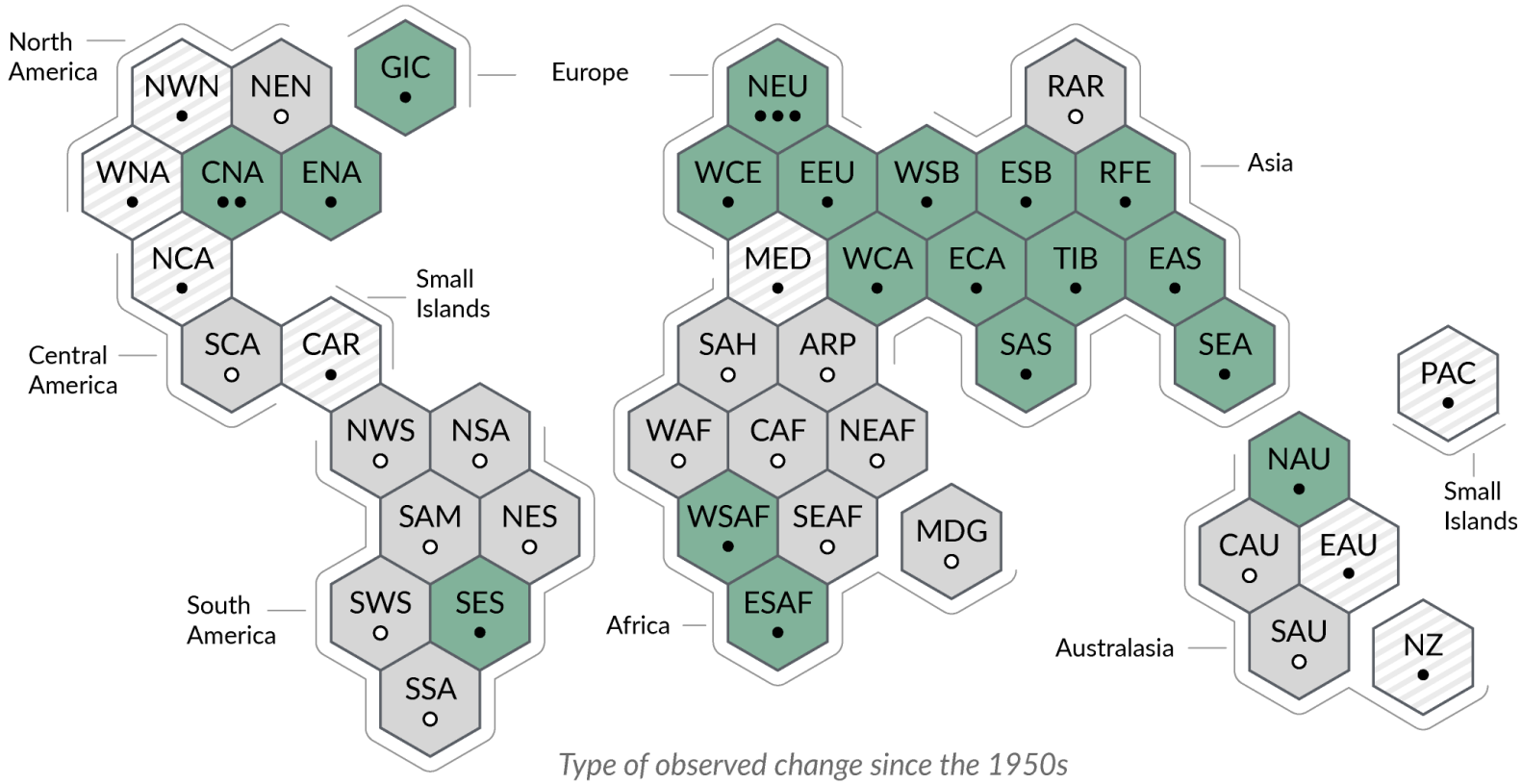
b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions

Type of observed change
in heavy precipitation

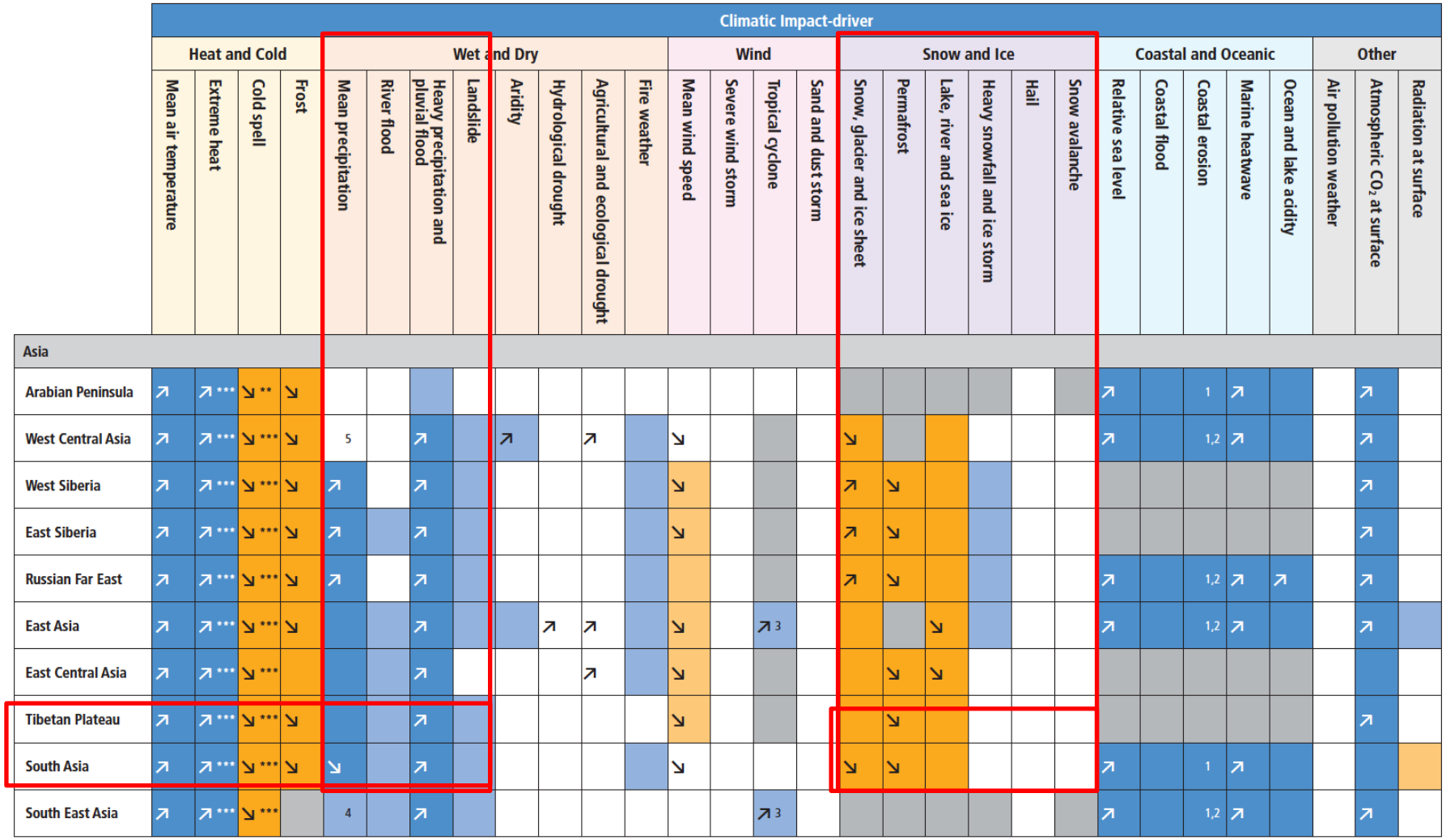
- Increase (19)
- Decrease (0)
- Low agreement in the type of change (8)
- Limited data and/or literature (18)

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



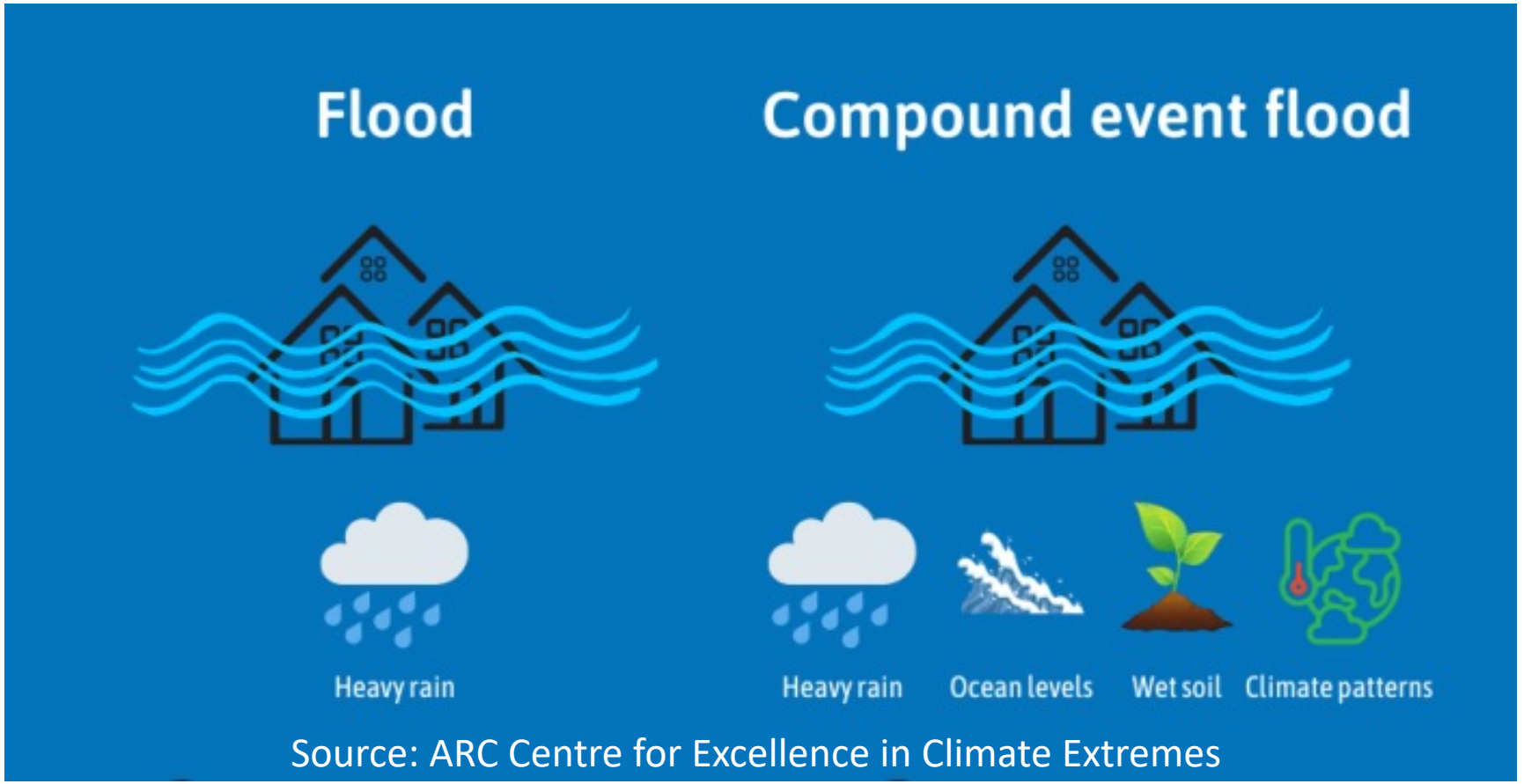
Note: There are several region-specific qualifiers/exceptions attached to some of the directions of change/confidence levels indicated above. {12.4}

Key for observational trend evidence ↗ Past upward trend (*medium or higher confidence*) ↘ Past downward trend (*medium or higher confidence*)

Key for attribution evidence *** *High confidence* (or more) ** *Medium confidence*

Key for level of confidence in future changes *High confidence* of increase (or more); *Medium confidence* of increase (or more); *Low confidence* in direction of change; *Medium confidence* of decrease; *High confidence* of decrease; Not broadly relevant

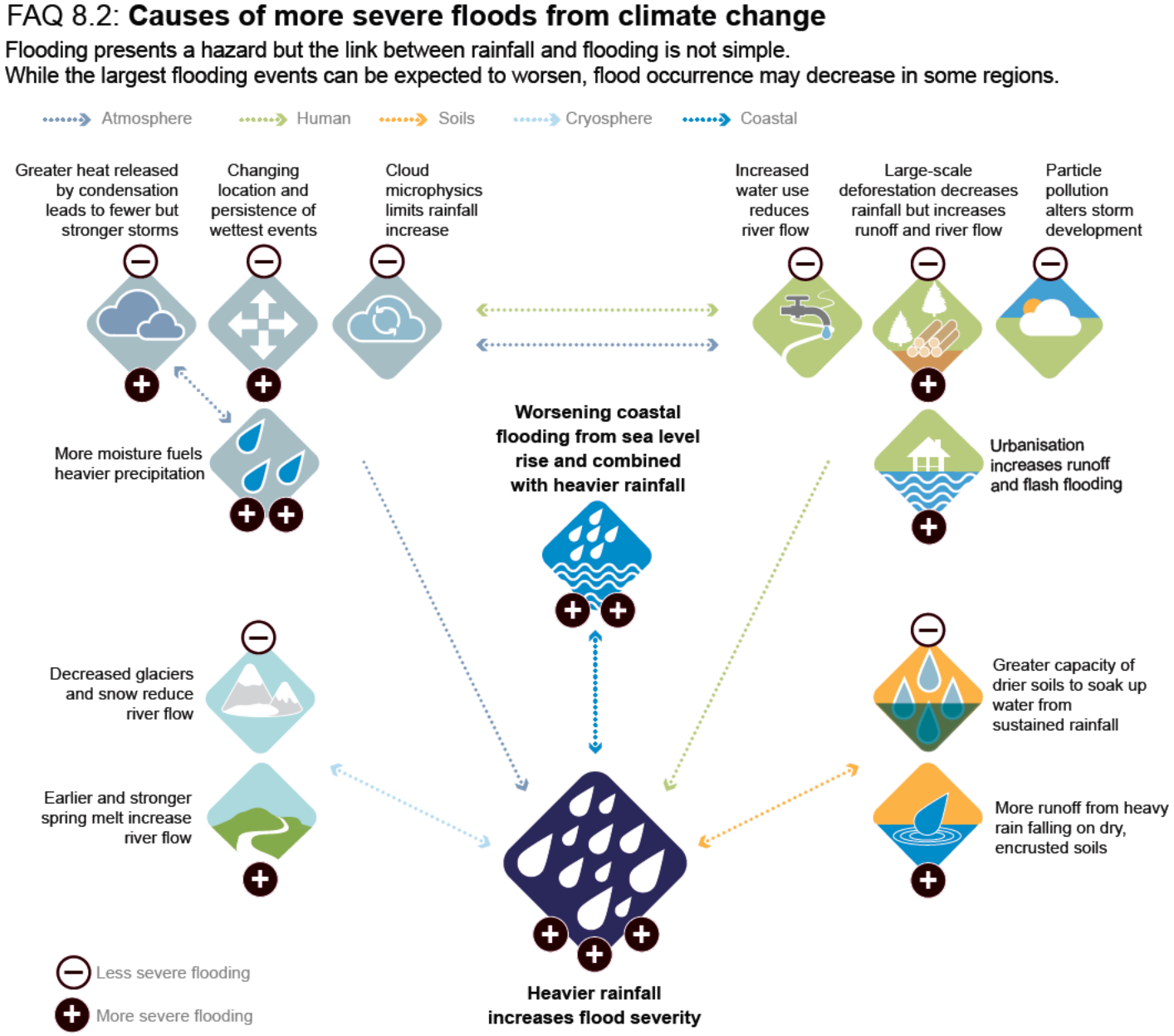
IPCC AR6 Technical Summary Table TS.5



Source: ARC Centre for Excellence in Climate Extremes

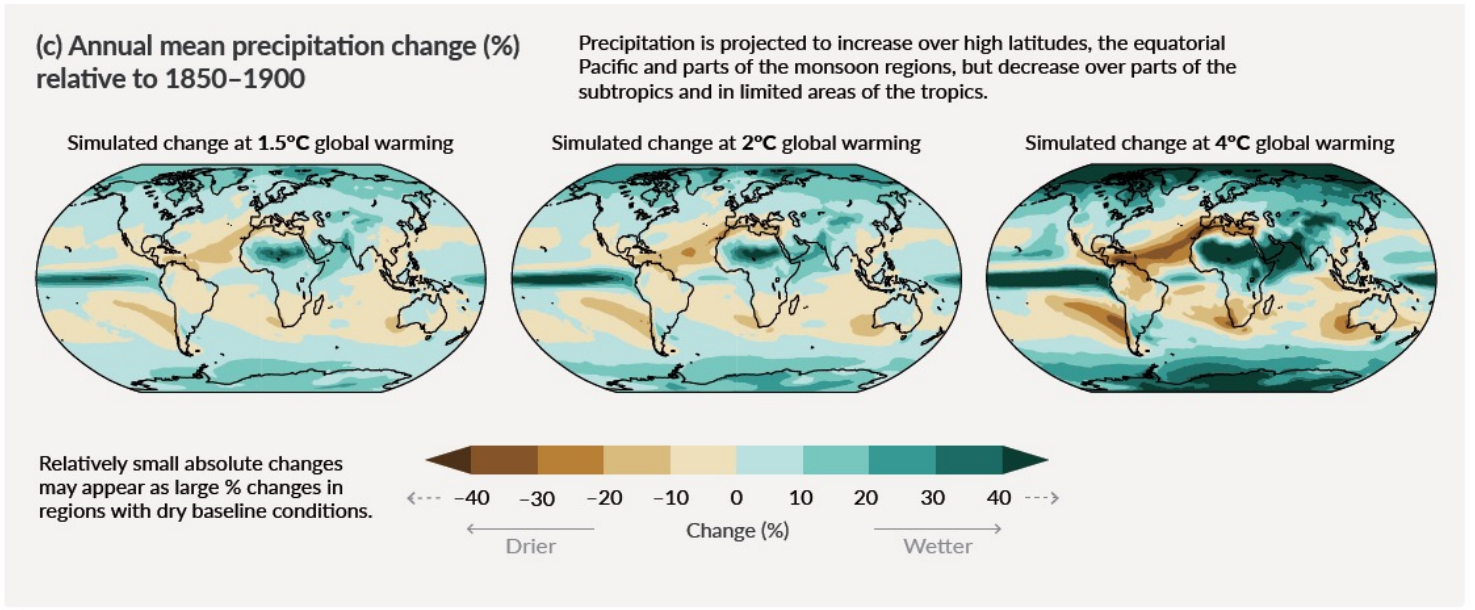
The probability of compound flooding (storm surge, extreme rainfall and/or river flow) has increased in some locations and will continue to increase due to both sea level rise and increases in heavy precipitation, including changes in precipitation intensity associated with tropical cyclones (**high confidence**)

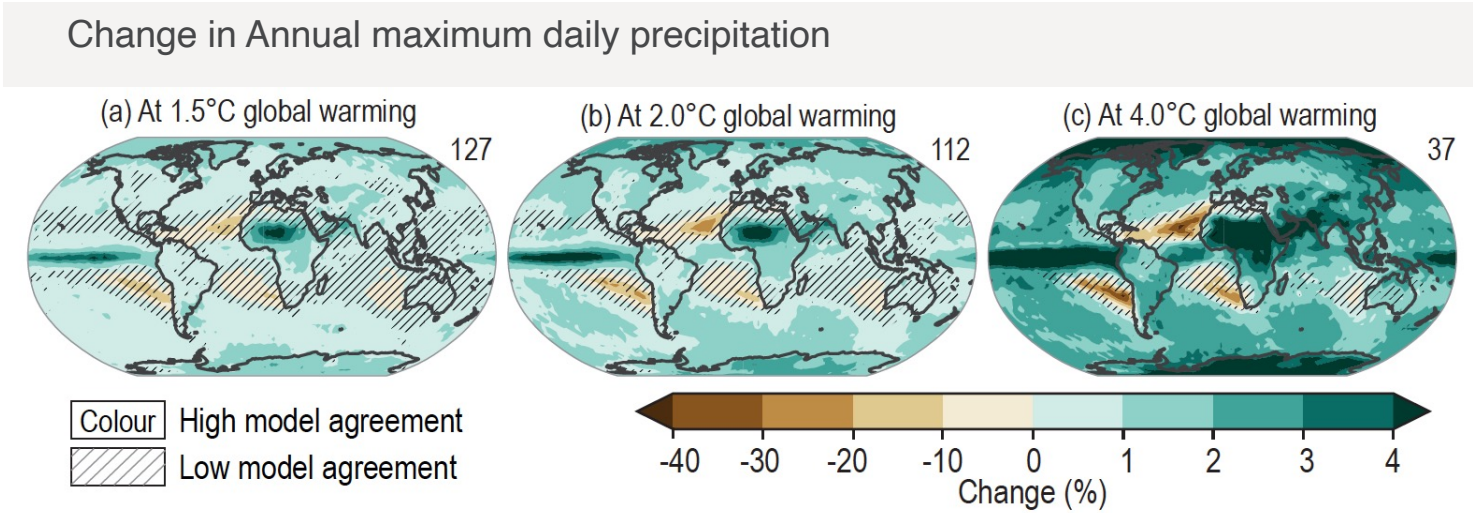
FAQ 8.2 I Will Floods Become More Severe or More Frequent as a Result of Climate Change?



IPCC AR6 WG-I FAQ 8.2, Figure 1

Future Changes in Precipitation, Annual maximum daily precipitation, and Soil Moisture

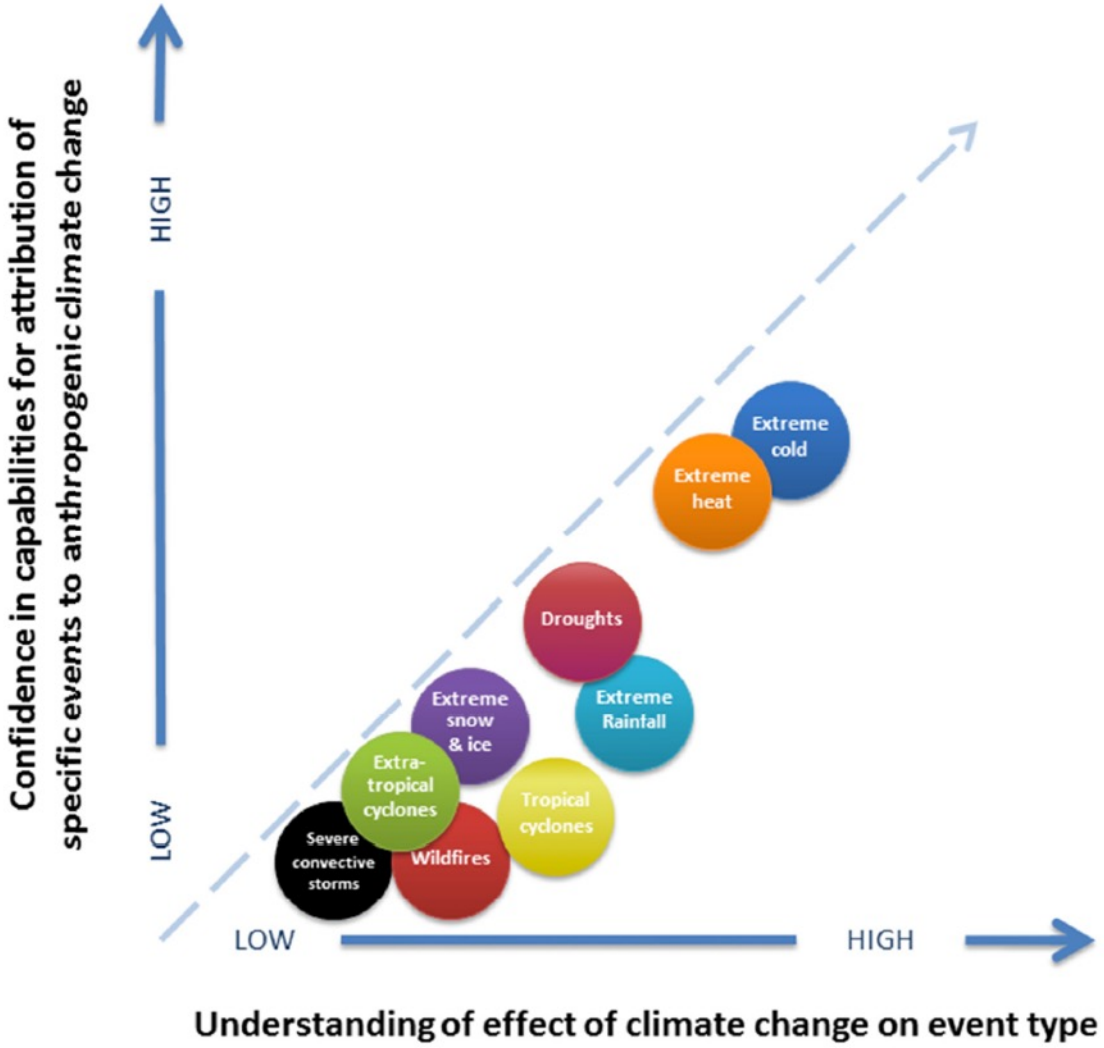




IPCC AR6 WG-I Figure SPM.5 l

Can we tell when a weather event was affected by climate change?

Level of confidence in extreme event attribution depends on the type of event



Source: Attribution of Extreme Weather Events in the Context of Climate Change (National Academies Press)

Event Attribution: Pakistan Floods (2022)

Home > Extreme rainfall > Climate change likely increased extreme monsoon rainfall, flooding highly vulnerable communities in Pakistan

Climate change likely increased extreme monsoon rainfall, flooding highly vulnerable communities in Pakistan

world weather attribution

- 60-day and 5-day maximum rainfall during the monsoon season for the Indus basin and the provinces of Singh & Balochistan
- Return time ~1 in 100 years in today's climate.
- 5-day maximum rainfall over Sindh and Balochistan is now about 75% more intense than it would have been without the 1.2C warming
- 60-day rain across the basin is now about 50% more intense.
- Climate models struggle to simulate these rainfall characteristics.
- The devastating impacts were also driven by the proximity of human settlements, infrastructure (homes, buildings, bridges), and agricultural land to flood plains, inadequate infrastructure, etc…..

Household (HH) factors contributing to vulnerability to floods

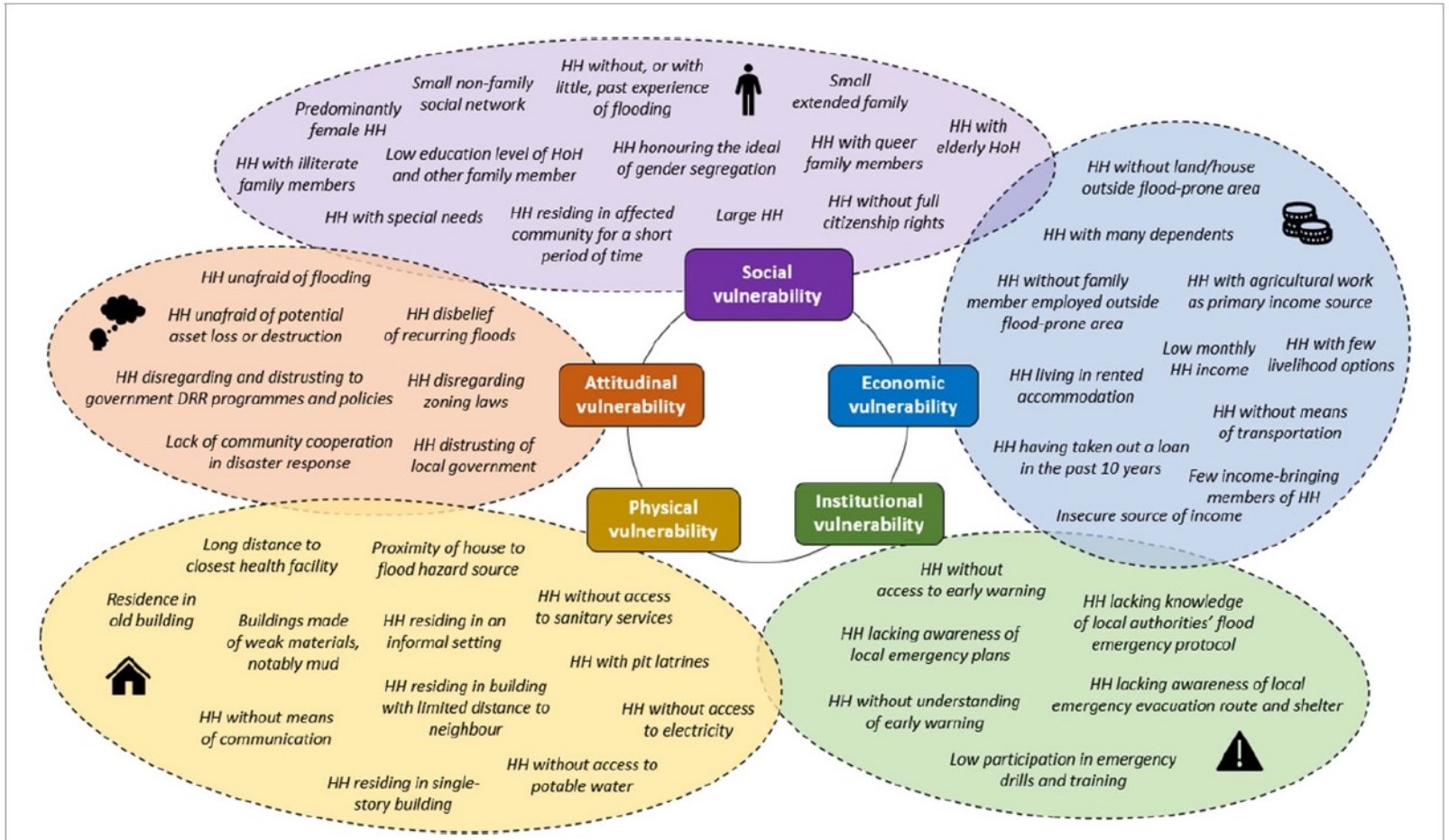


Figure 15. A visual representation of household (HH) factors contributing to vulnerability to floods in Pakistan categorised by types of vulnerability developed in (Rana and Routray 2018) based on empirical evidence and evidence from studies across Pakistan (Mustafa *et al* 2015, Sadia *et al* 2016, Shah *et al* 2018, Memon 2020, Ajani and van der Geest 2021, Anjum and Fraser 2021).

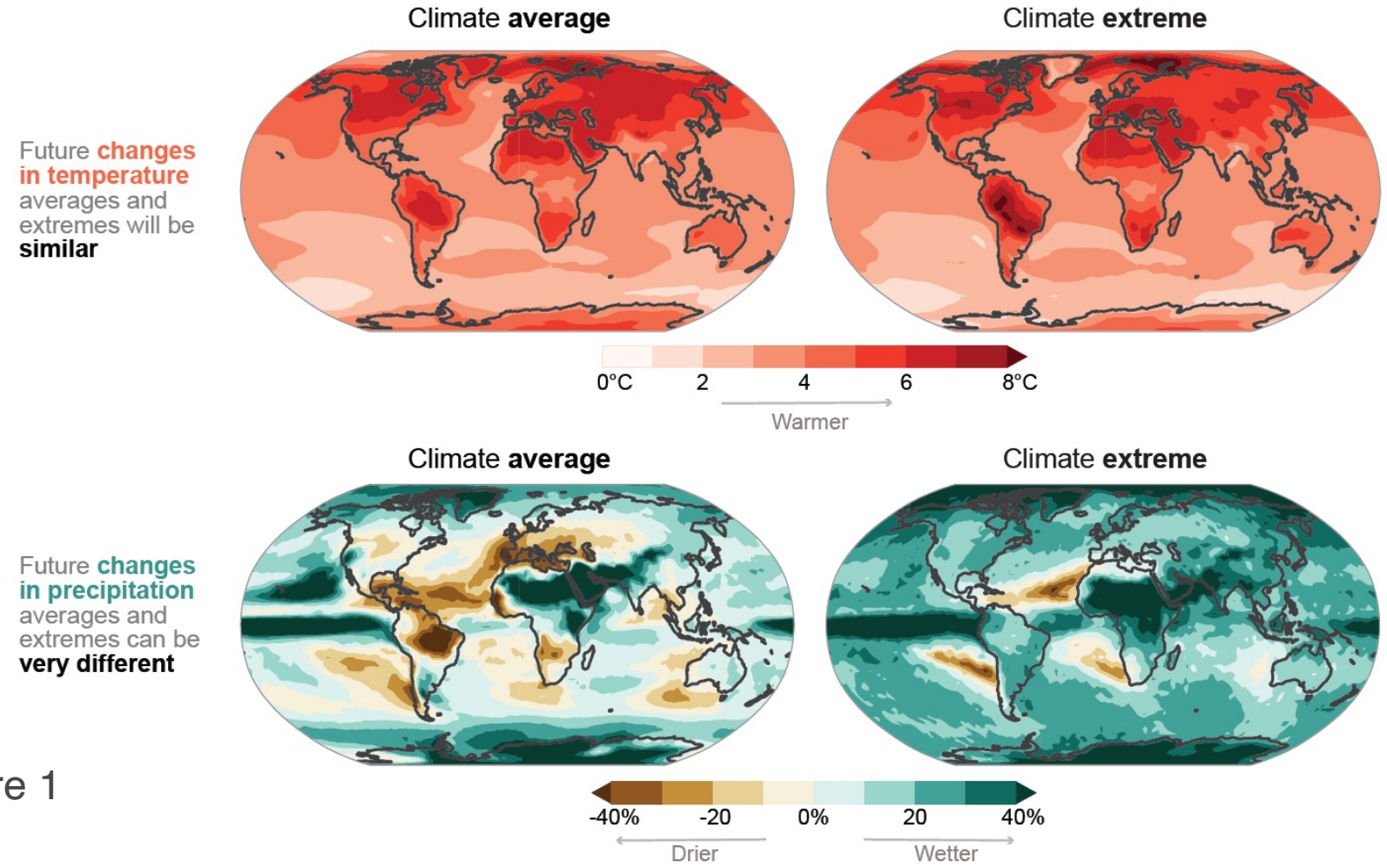
Source: Otto et. Al. Env. Res. Clim. (2023)

Thanks

- The projected increase in heavy precipitation extremes translates to an increase in the frequency and magnitude of pluvial floods (**high confidence**)

FAQ 11.1: **How will changes in climate extremes compare with changes in climate averages?**

The direction and magnitude of future changes in climate extremes and averages depend on the variable considered.



IPCC AR6 WG-I FAQ 11.1, Figure 1