A few remarks about droughts and dust storms - Based on the IPCC Reports, with particular attention to Iran

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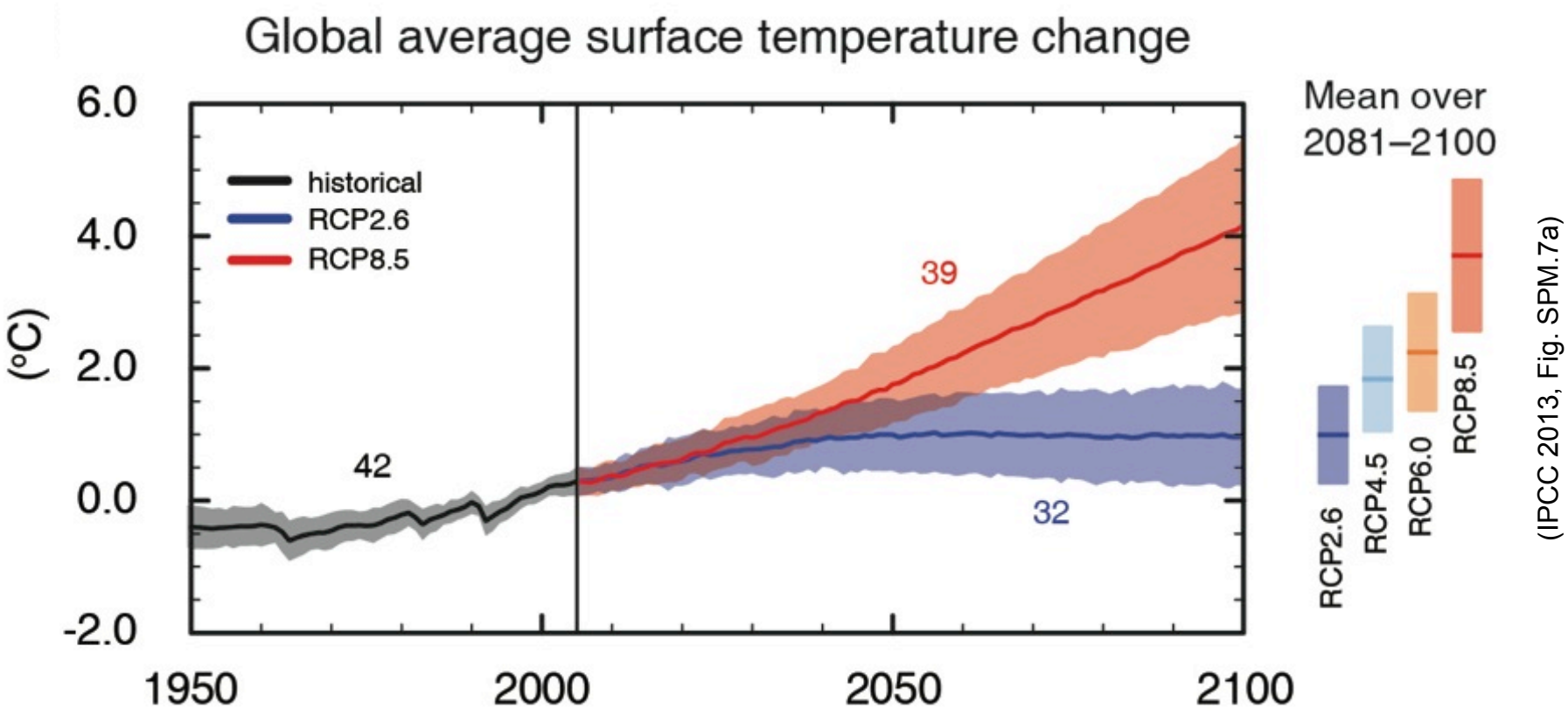
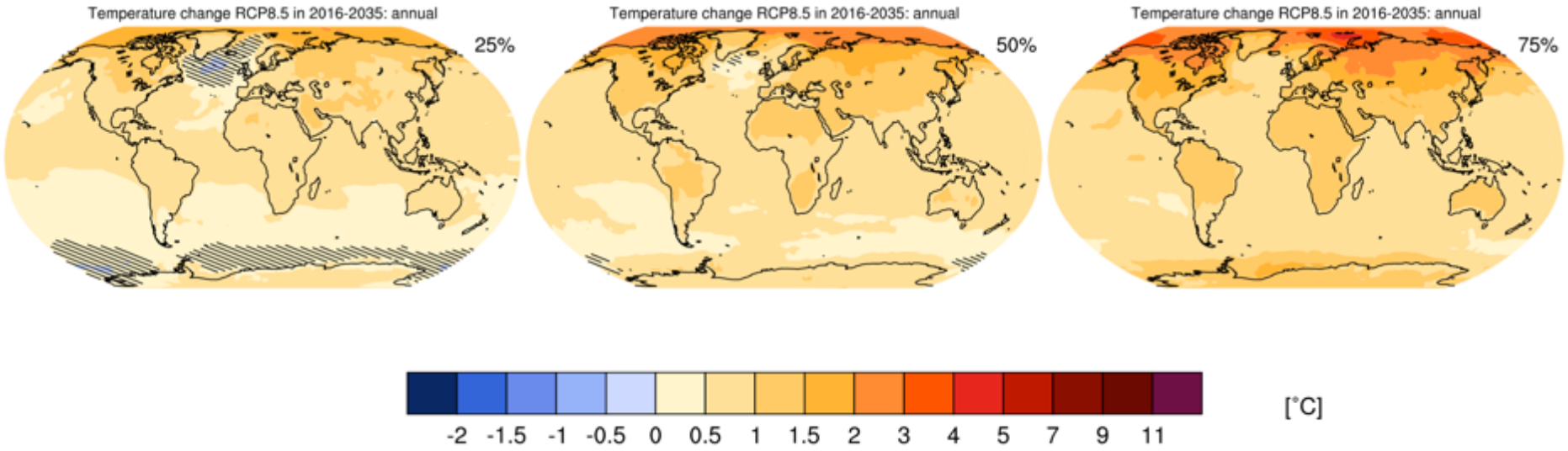
Thanks to the Belgian Federal Science Policy Office (BELSPO) and to my team at the Université catholique de Louvain for their support



(IPCC 2013, Fig. SPM.7a)

Only the lowest (RCP2.6) scenario maintains the global surface temperature increase above the pre-industrial level to less than 2°C with at least 66% probability

Maps of temperature changes: 2016-2035 with respect to 1986–2005 in the RCP8.5 scenario



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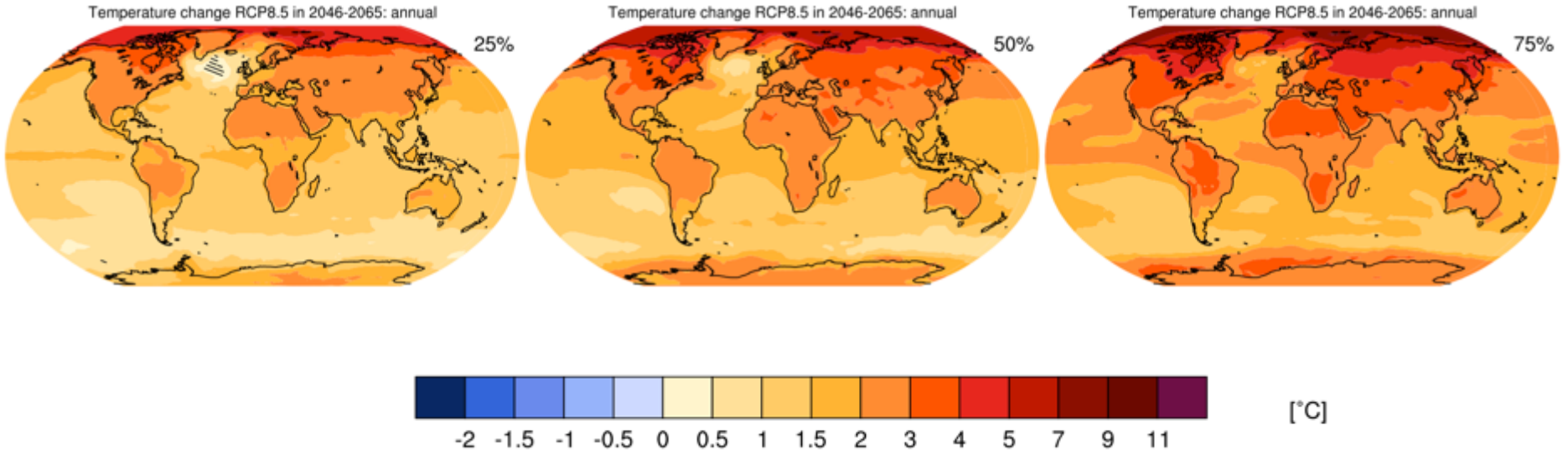
Maps of temperature changes: 2046-2065 with respect to 1986–2005 in the RCP8.5 scenario



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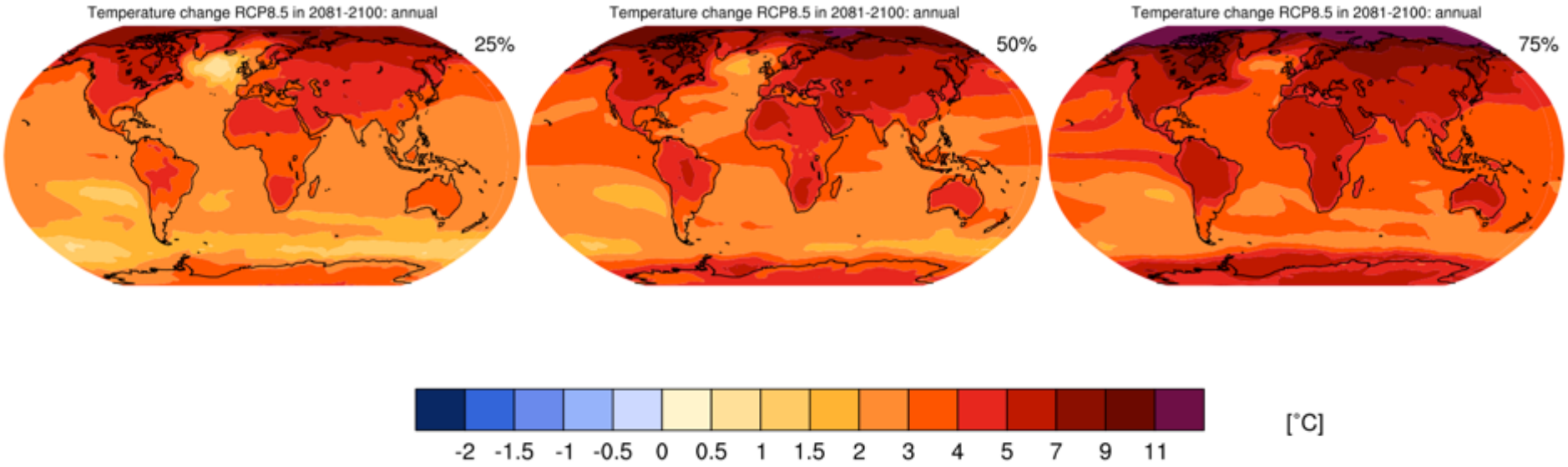
Maps of temperature changes: 2081-2100 with respect to 1986–2005 in the RCP8.5 scenario



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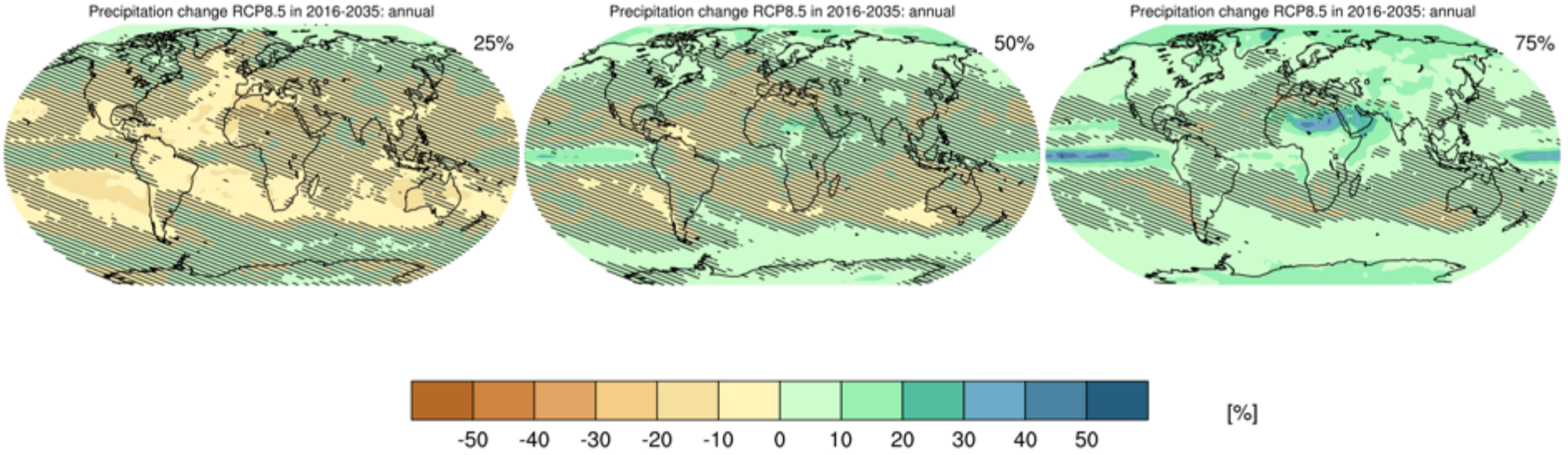
Maps of precipitation changes in : 2016–2035 with respect to 1986–2005 in the RCP8.5 scenario



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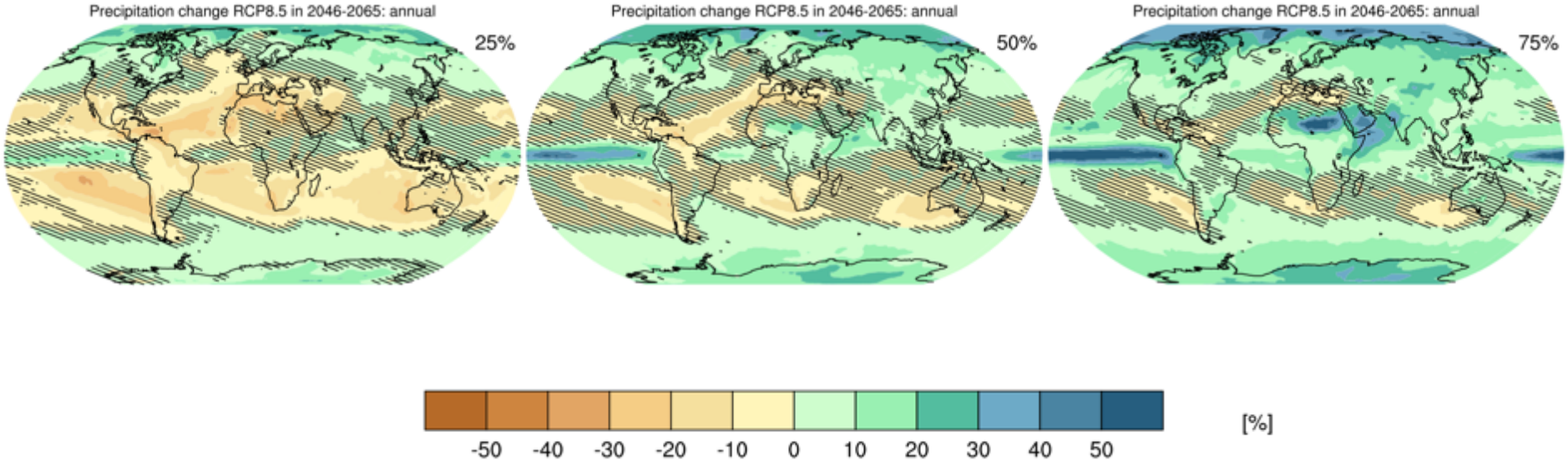

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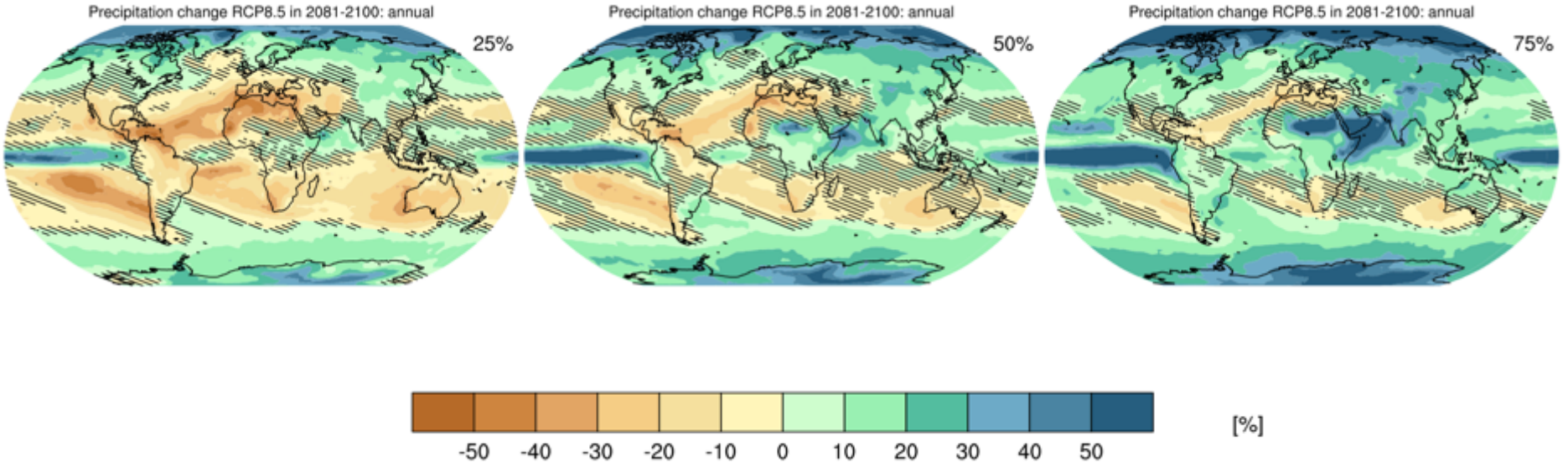

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The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

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Impacts from weather and climate events depend on:

nature and severity of event

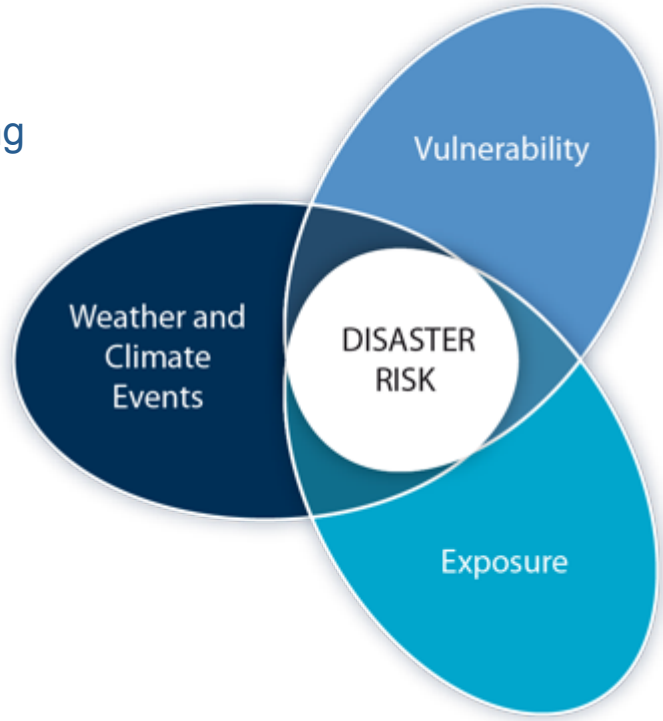
vulnerability

exposure

Information on vulnerability, exposure, and changing climate extremes can together inform adaptation and disaster risk management

- poverty reduction
- better education and awareness
- sustainable development

- improved forecasting for warning systems
- reduction of greenhouse gas emissions



- asset relocation
- weather-proofing assets
- early warning systems

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WMO UNEP


RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS
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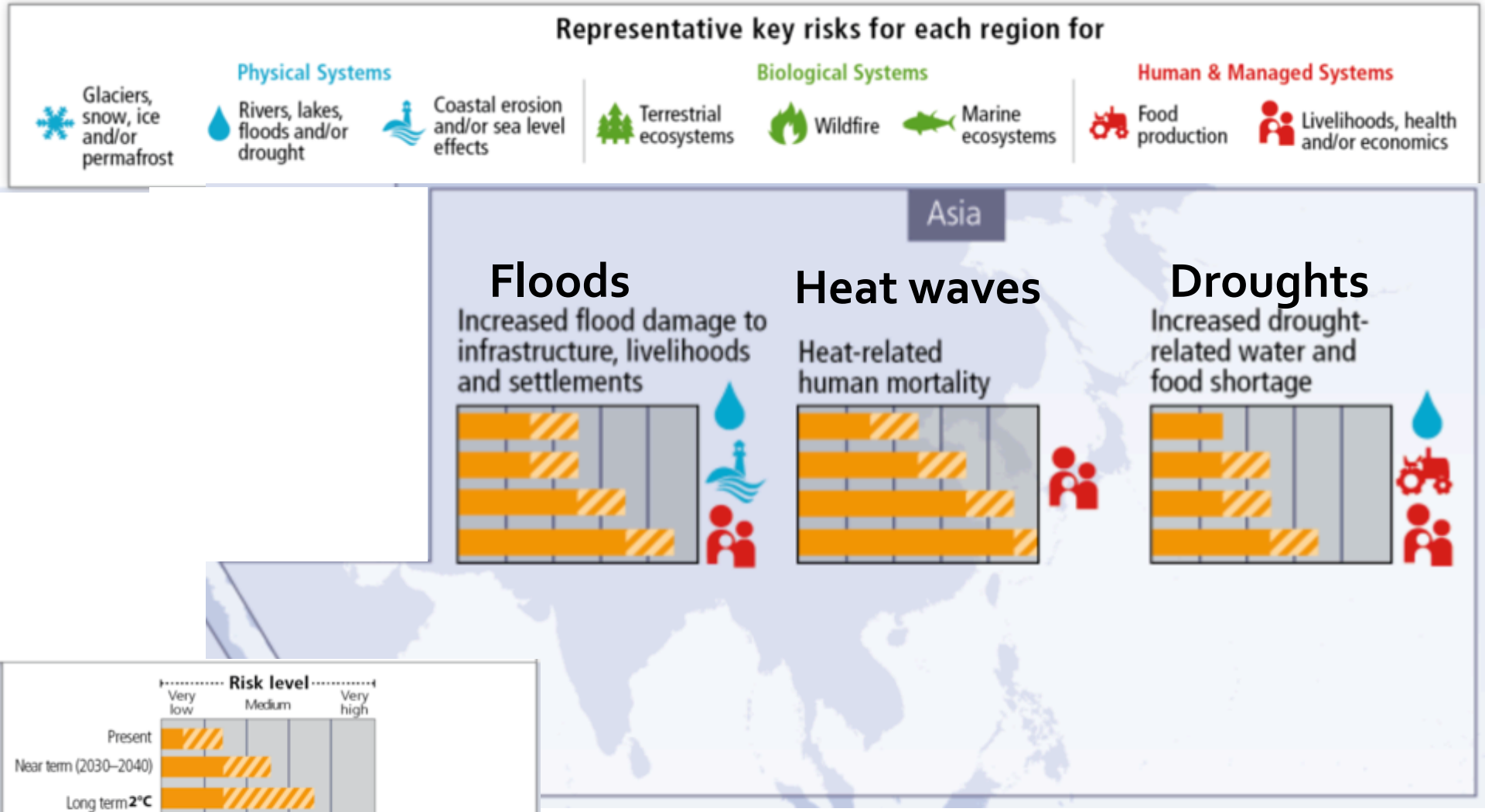
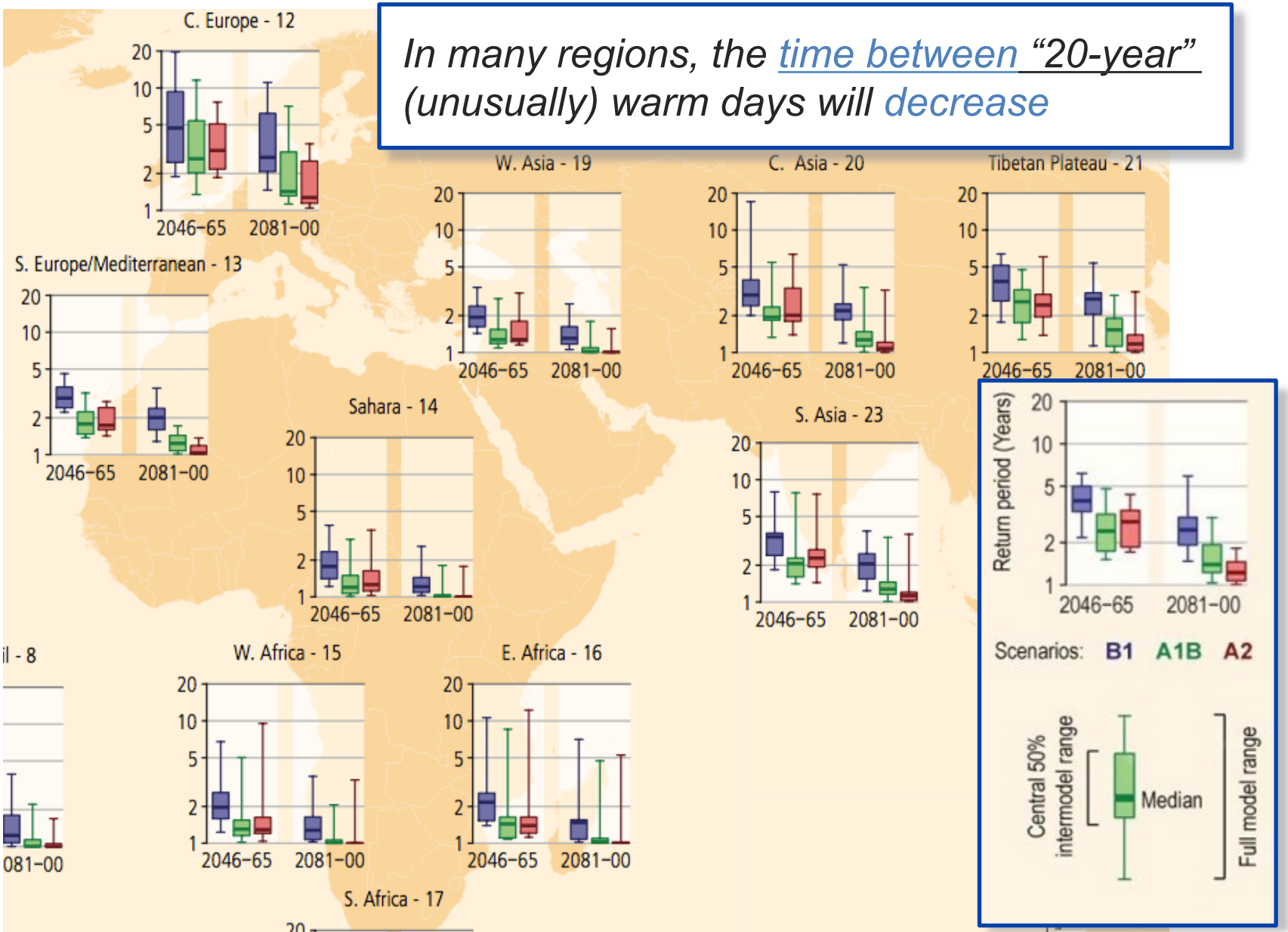
Regional key risks and potential for risk reduction: Asia (IPCC, AR5, SPM, Figure SPM.8)

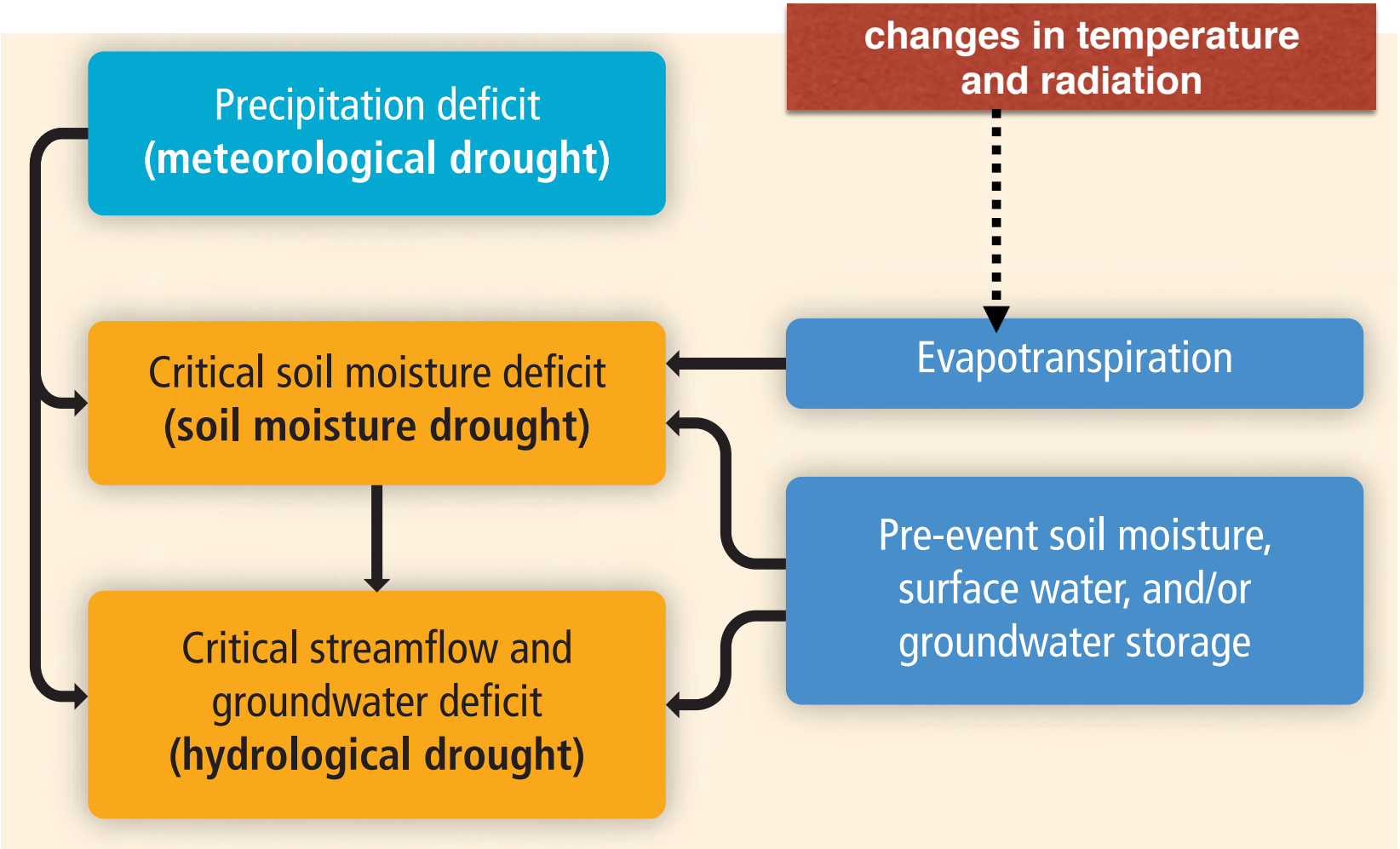


Climate models project more frequent hot days throughout the 21st century

In many regions, the time between "20-year" (unusually) warm days will decrease



Drought definitions and drivers



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Source : SREX Box 3.3 - drought definition and drivers

Drought (AR5 WGI)

- Warmer and/or more frequent hot days are virtually certain, and more frequent or longer heat waves are very likely at end of 21st century
- Increases in intensity and/or duration of drought :
  - reduced precipitation and/or increased evapotranspiration
  - **since 1950**: drought *likely* increased in the Mediterranean and West Africa regions; low confidence in attribution to human activities
  - **late 21st century**:
    Decreased soil moisture and increased agricultural drought likely in presently dry regions (high confidence in likely surface drying in region such as the Mediterranean under RCP 8.5)

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Source: AR5 WGI table SPM.1

Impacts of drought (SREX)

- Effects on drought include
  - reduced water security,
  - reduced food security through reduction of agricultural production
  - a contribution to human-ignited forest fires (which can lead to widespread deforestation and carbon emissions) (SREX 4.3.6)
- One of the main consequences of multi-year drought periods is severe famine, such in the Sahel in the 1980s, causing many casualties and important socioeconomic losses.
- In Syria, more then 1 million people were affected by 2011, accelerating migration to urban areas and increasing levels of extreme poverty
  (case study in SREX, section 9.2.3)

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Adaptation to drought (SREX)

- Examples of adaptation
  - multi-hazard risk assessment (e.g. case study in Syria)
    seasonal forecasting (e.g. case study in South Africa)
  - insurance
  - drought preparedness and mitigation
    such as development and use of drought tolerant cultivars, shifting cropping seasons, upgrading irrigation practices
    flood and drought control techniques in water management (SREX box 7-3)
  - Building resilience through knowledge, advocacy, research, and training by making information on drought risk accessible (case study Syria)

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Managing the risks: drought in the context of food security in West Africa

Risk Factors

- more variable rain
- population growth
- ecosystem degradation
- poor health and education systems

Risk Management/ Adaptation

- improved water management
- sustainable farming practice
- drought-resistant crops
- drought forecasting

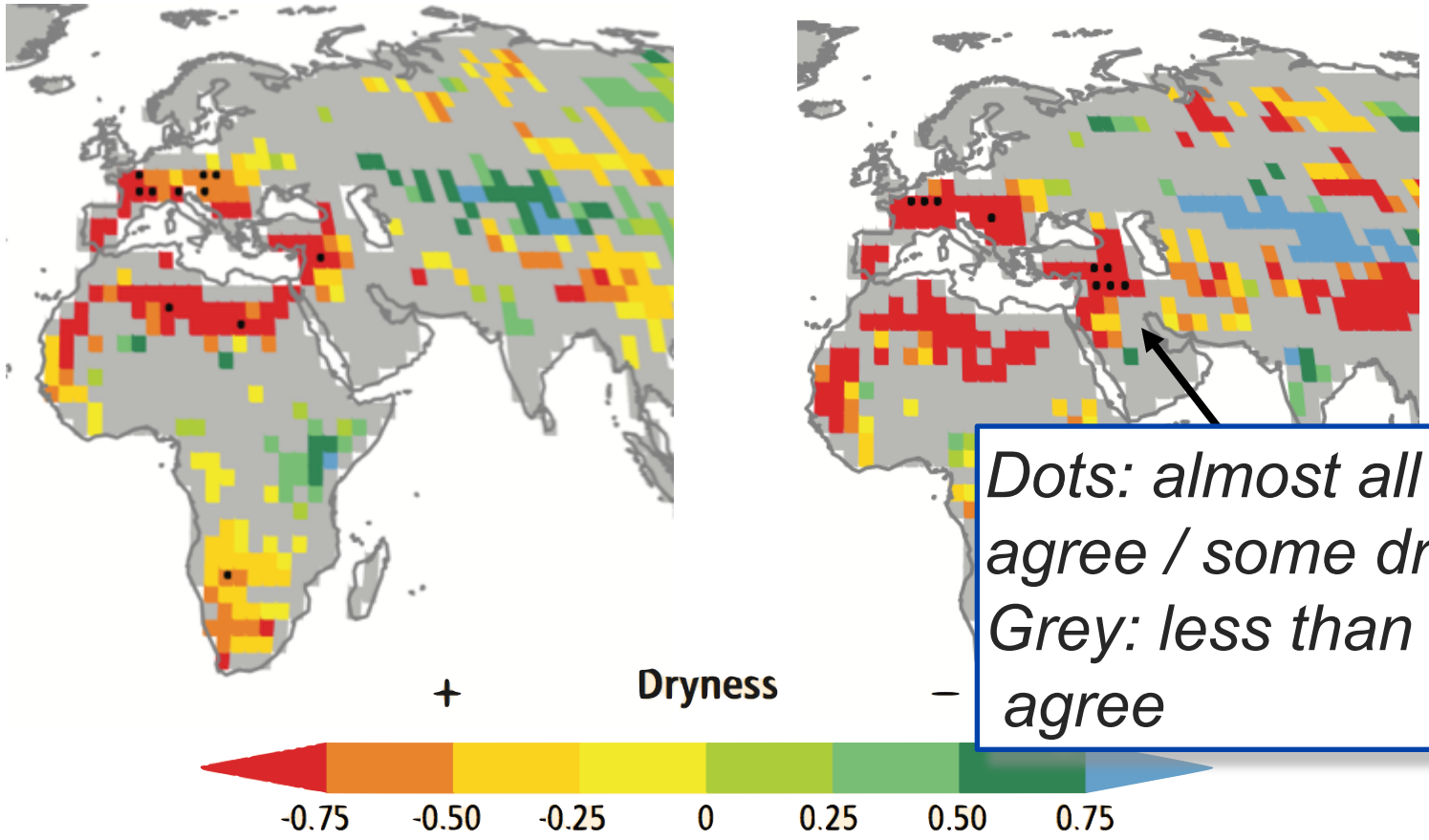
Projected: *low confidence* in drought projections for West Africa

Changes in soil moisture

Changes from 1980-1999, scenario SRES A2

2046 - 2065

2081-2100



Dots: almost all models agree / some drying
Grey: less than 66% models agree

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Source : IPCC SREX figure SPM.5; models: CMIP3

Impacts on agriculture and food in Asia

- The impacts of climate change on food production and food security in Asia will vary by region, with many regions to experience a decline in productivity (medium confidence, AR5 WGII Ch 24)
  - example of possible negative impacts include western Turkmenistan and Uzbekistan, where frequent droughts could negatively affect cotton production, increase water demand for irrigation, and exacerbate desertification)

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Desertification (AR5 WGII)

- Desertification: Land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities.
- Risk of erosion and desertification is increasing in Mediterranean-type ecosystems especially in very dry areas (Mediterranean = cool/wet winters, hot/dry summers)
- Extent of deserts will increase in the coming decades (*medium agreement, limited evidence*) as a result of the strengthening of the Hadley Circulation, which determines the location of the broad band of hot deserts (~15°N to 30°N and 15°S to 30°S)
  - Some desert tolerance mechanisms (e.g., biological adaptations by long-lived taxa) may be outpaced by global climate change

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WGI - Dust aerosols

- Anthropogenic sources of mineral aerosols:
  land use change, water use change, climate change
- Dust emissions to the atmosphere are poorly quantified (range x5); it depends on
  - surface wind speed
  - soil-related factors such as its texture, moisture and vegetation cover
- Estimates of the related impact on climate trough radiative forcing are highly uncertain
- Future change of dust loading:
  projections include either increasing or decreasing dust emissions because the atmosphere and vegetation may respond in different ways (e.g. CO_2 increase can reduce water loss in plants, resulting in reduced desert extent and dust emission is some studies)

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Sources : IPCC AR5 WGI Ch 7 and 14

Sand and Dust Storms (SREX 3.5.8.)

- In summary, there is low confidence in projecting future dust storm changes, although an increase could be expected where aridity increases. There is a lack of data and studies on past changes. There is also a lack of understanding of processes such as the relative importance of different climate variables affecting dust storms, as well as a high uncertainty in simulating important climate variables such as soil moisture, precipitation, and wind that affect dust storms.

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Impacts of dust Storms (SREX 4.4.2.4)

- Dust storms have negative impacts on agriculture, health, and structures.
  - They erode fertile soil; uproot young plants; bury water canals, homes, and properties
  - cause respiratory problems (worsen asthmatic conditions), as well as skin and eye irritations; meningitis transmission is associated with dust in semi-arid conditions and overcrowded living conditions

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Useful links:

- www.ipcc.ch : IPCC (reports and videos)
- www.climate.be/vanyp : my slides and candidature to become IPCC Chair
- www.skepticalscience.com: excellent responses to contrarians arguments
- **On Twitter: @JPvanYpersele and @IPCC_CH**