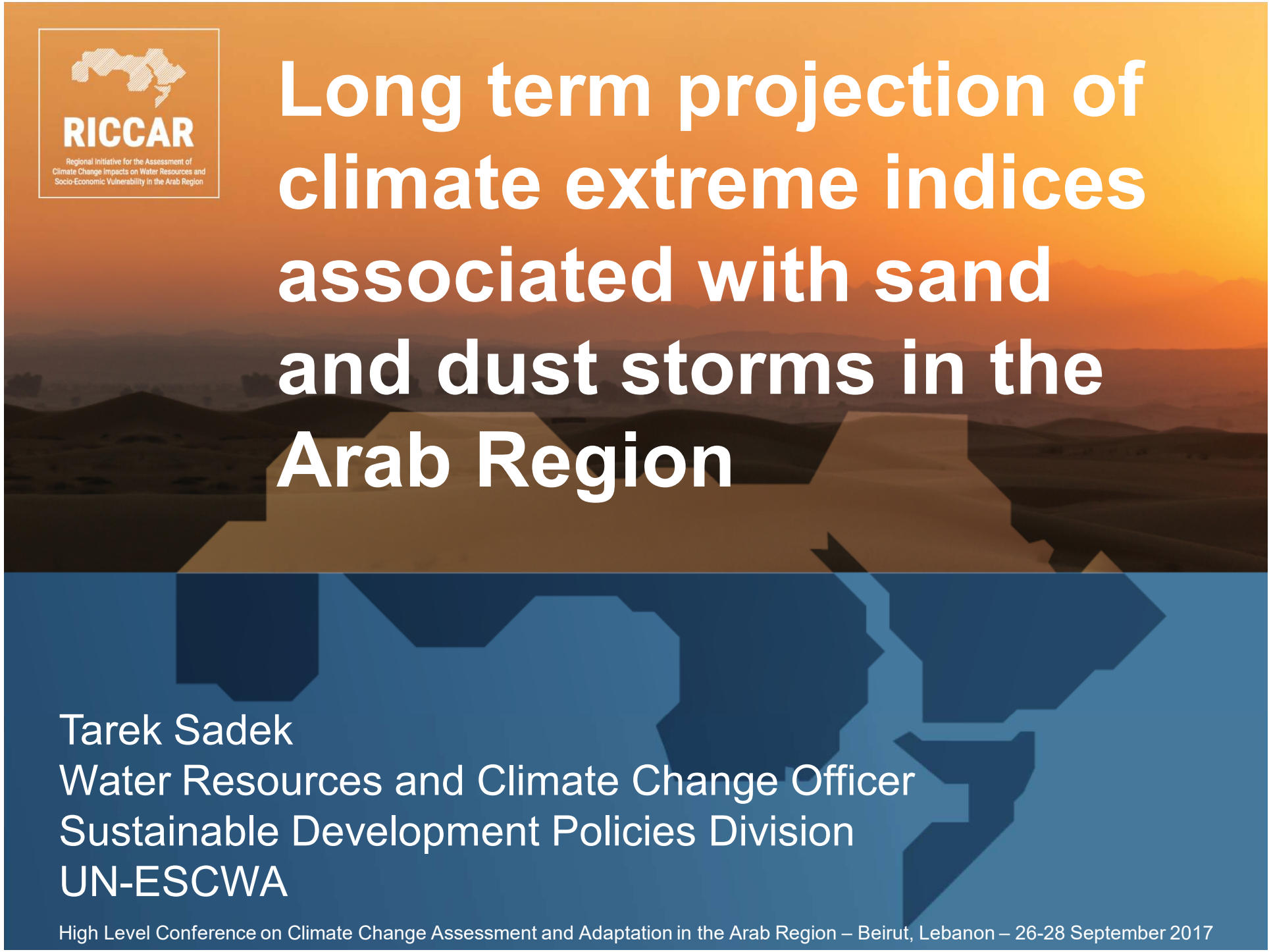

Long term projection of climate extreme indices associated with sand and dust storms in the Arab Region

Tarek Sadek
Water Resources and Climate Change Officer
Sustainable Development Policies Division
UN-ESCWA

High Level Conference on Climate Change Assessment and Adaptation in the Arab Region – Beirut, Lebanon – 26-28 September 2017

Introduction

- The frequency of the sand and dust storms (SDS) has been increasing during the last decade due to climatic changes.
- The main reasons of the SDS is the significantly increased warming of the soil and drastic decrease in the annual rate of rainfall in addition to environmental changes.
- It is important to consider various climate parameters and phenomena related to extreme temperatures, wind, soil moisture, drought and desertification.
- Long term projections of rainfall and temperature climate indices using the Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-economic Vulnerability in the Arab Region (RICCAR) can assist in identifying driving factors for SDS.

RICCAR
Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region

RICCAR Objective

To assess the impact of climate change on freshwater resources in the Arab Region through a consultative and integrated regional initiative that seeks to identify the socio-economic and environmental vulnerability caused by climate change impacts on water resources based on regional specificities.

RICCAR aims to provide a common platform for assessing, addressing and informing response to climate change impacts on freshwater resources in the Arab region by serving as the basis for dialogue, priority setting and policy formulation on climate change at the regional level.

Assessment | **Adaptation** | **Mitigation** | **Negotiations**

RICCAR Partnerships

Implementing Partners

UNITED NATIONS
ESCWA

UN environment

WMO

ACSAD

LAS

SMHI

UNESCO
United Nations
Educational, Scientific and
Cultural Organization
Cairo Office

UNITED NATIONS
UNIVERSITY
UNU-INWEH

FAO

UNISDR
The United Nations Office for Disaster Risk Reduction

SWEDEN
SWEDISH INTERNATIONAL DEVELOPMENT
COOPERATION AGENCY

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

ACCWaM

Collaborating Research Institutes

- Center of Excellence for Climate Change Research/ King Abdulaziz University (CECCR/KAU) - *KSA*
- King Abdullah University of Science and Technology (*KAUST*) - *KSA*
- Climate Services Center 2.0 (CS2.0) - *Germany*

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IPCC regional domains

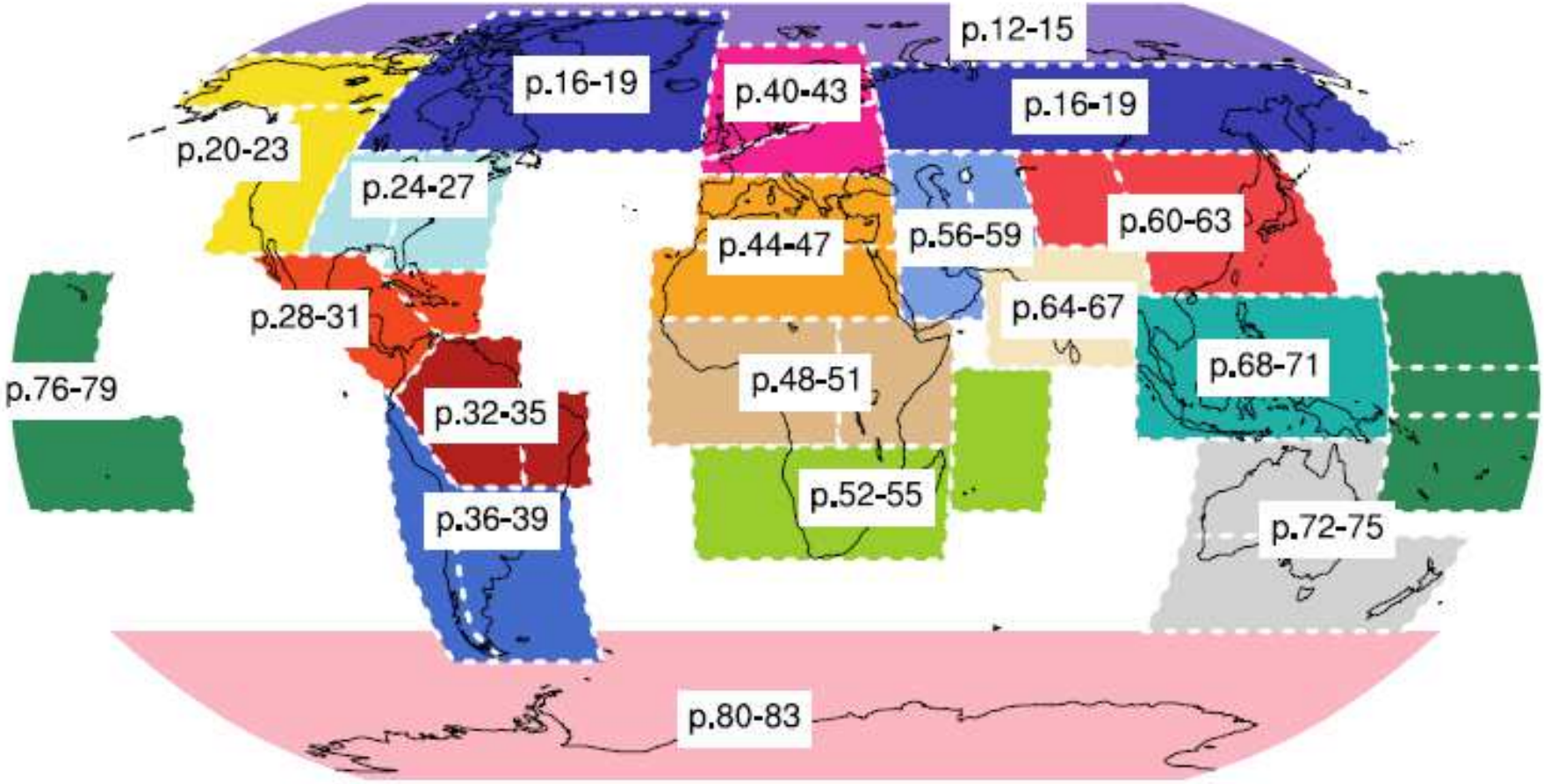

Figure AI.3: Overview of the SREX, ocean and polar regions used.

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

IPCC Assessment Report 5 – WGI: Annex I
Draft: 30 September 2013

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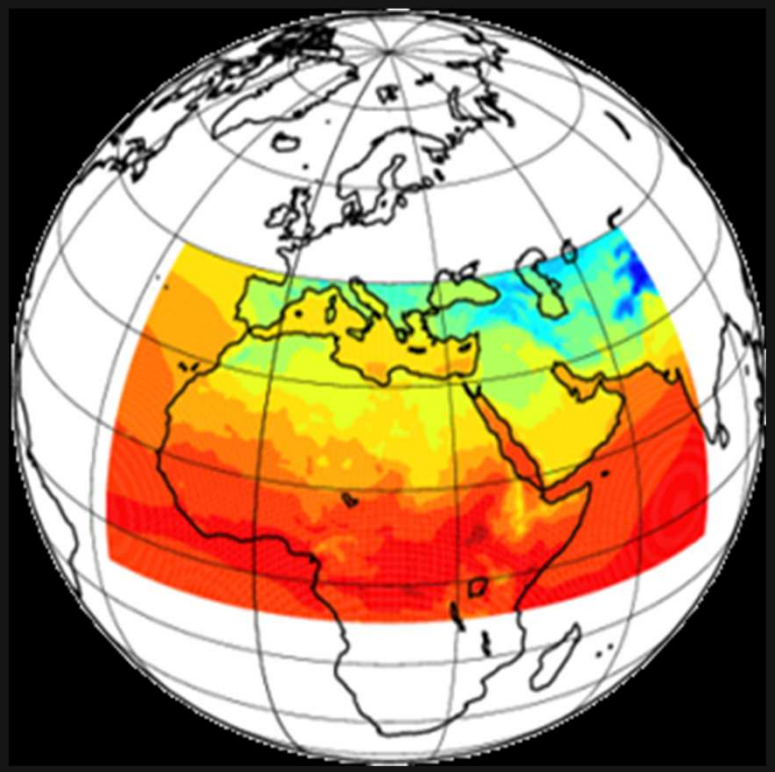
The CORDEX-Mena/Arab Domain

Regional "Domain" (RCM)



Size determined by Arab water resources & climate processes

A specific region of the globe to be investigated in more detail with ***R***egional ***C***limate ***M***odels (RCMs)

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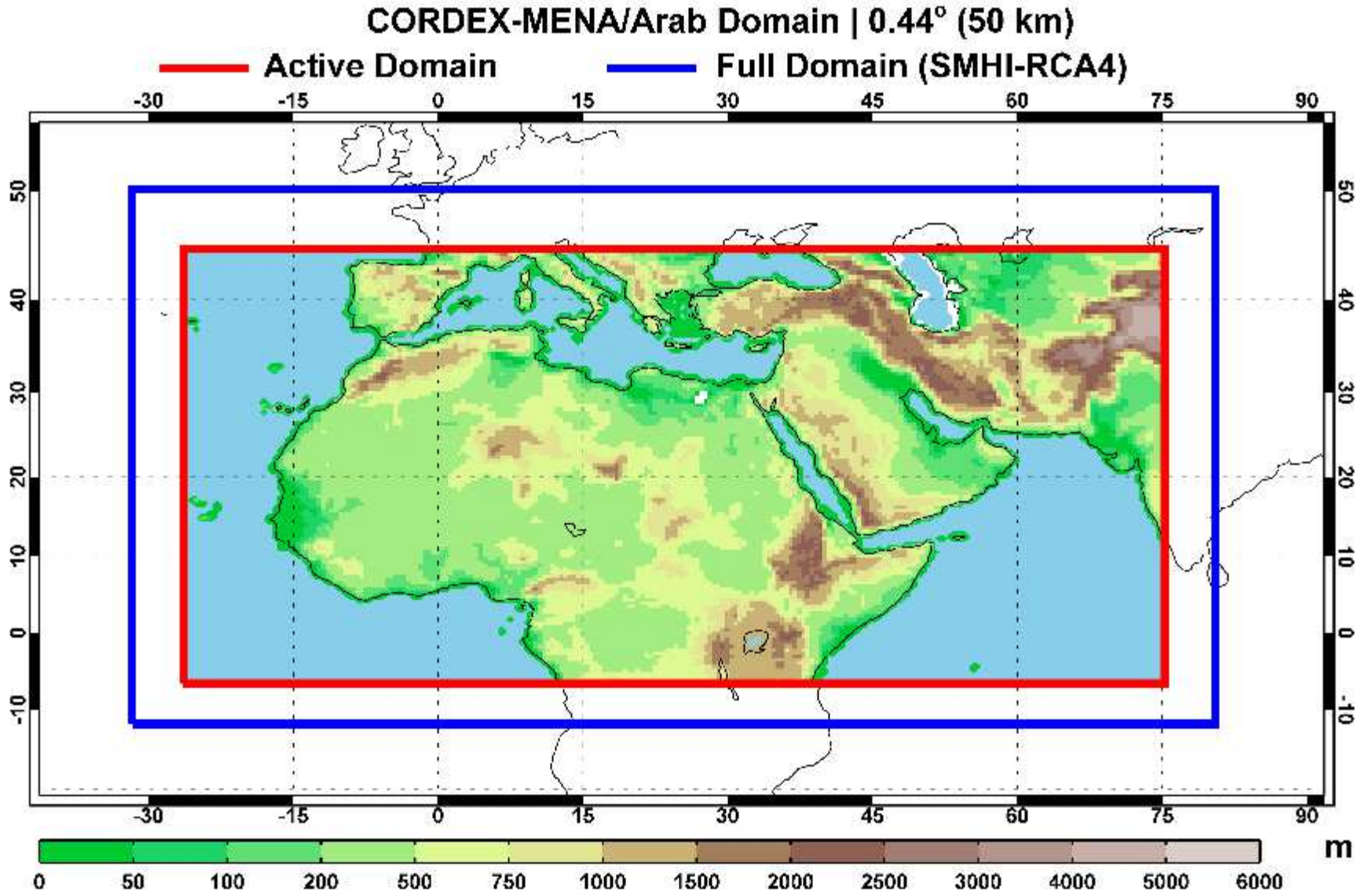
Arab Domain



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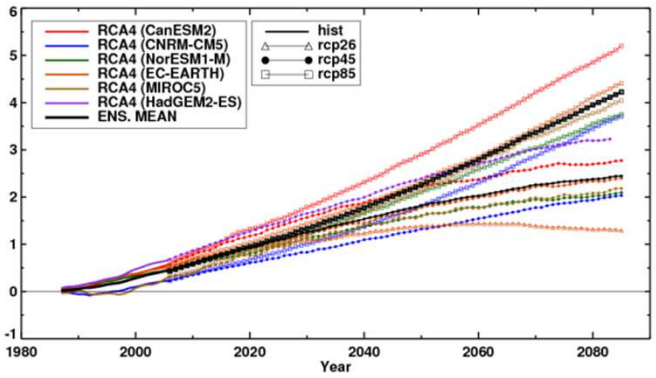
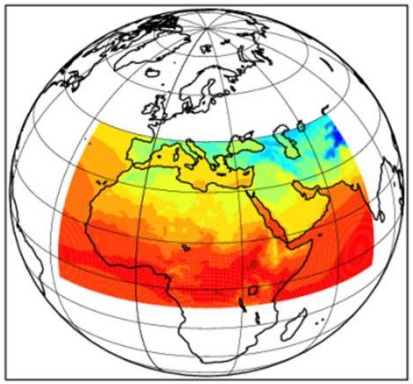
Climate Model Ensembles

- An "*ensemble*" means that we reproduce results many times using variations in how we go about it
- For climate modelling, different GCMs are coupled to RCMs to produce a range of results based on the same emissions





Global ***C***limate ***M***odels (GCMs)

Regional ***C***limate ***M***odels (RCMs)

RCM Simulations Used

RCM Ensemble Matrix

RCM	Driving GCM/ Reanalysis	Evaluation 1979-2010	Historical 1950-2005	RCP 2.6 2006-2100	RCP 4.5 2006-2100	RCP 8.5 2006-2100	RESOLUTION (km)
RCA4	ERA-INTERIM	X					50
RCA4	EC-Earth		X	X	X	X	50
RCA4	EC-Earth		X			X	25
RCA4	CNRM-CM5		X		X	X	50
RCA4	GFDL-ESM2M		X		X	X	50
RCA4	GFDL-ESM2M		X			X	25
HIRAM	GFDL-ESM2M		X				25
REMO	MPI-ESM-LR		X				50

8 future climate simulations analysed

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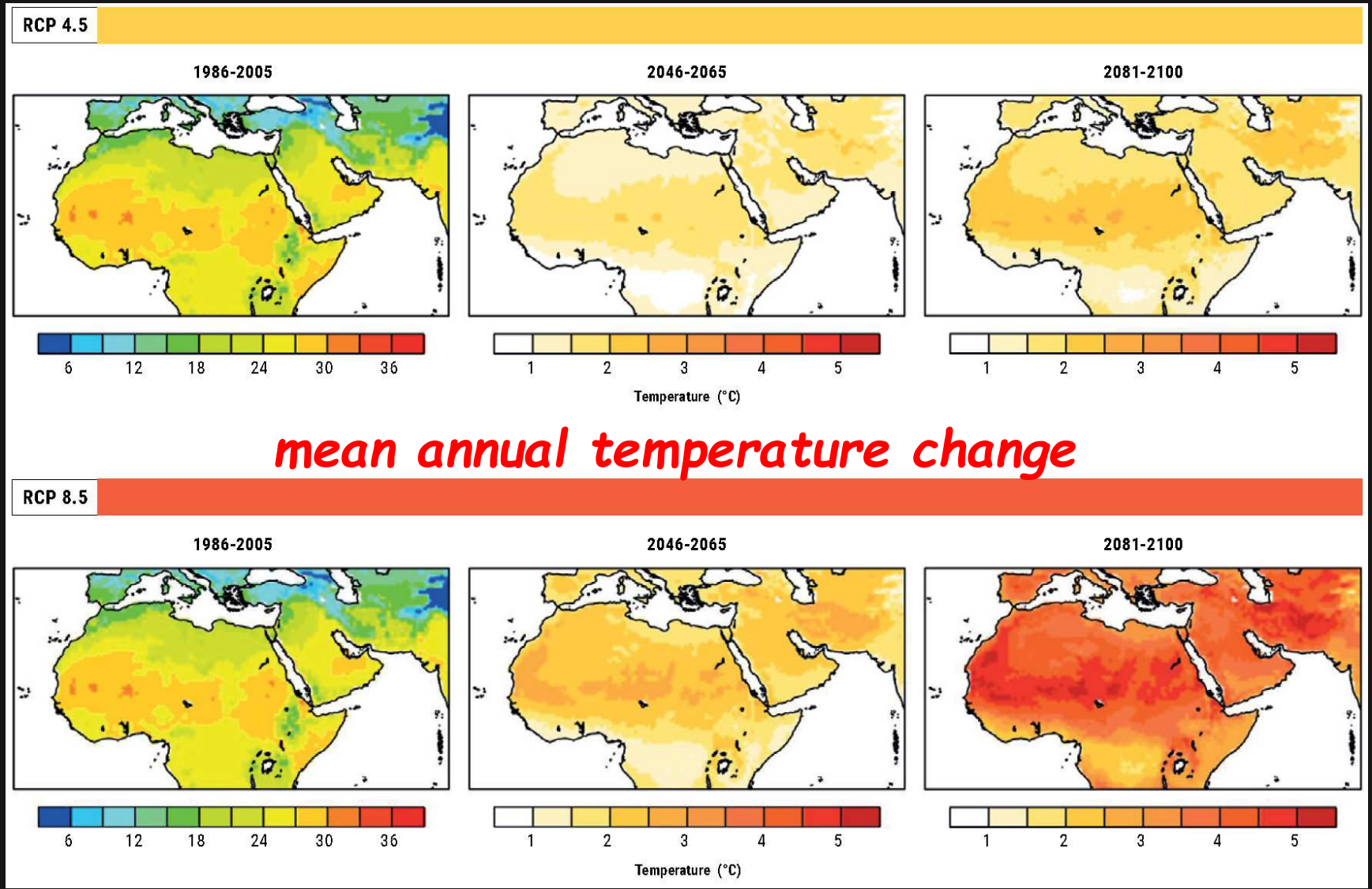
Future Projections - Temperature



RCA4: 3-member ensemble

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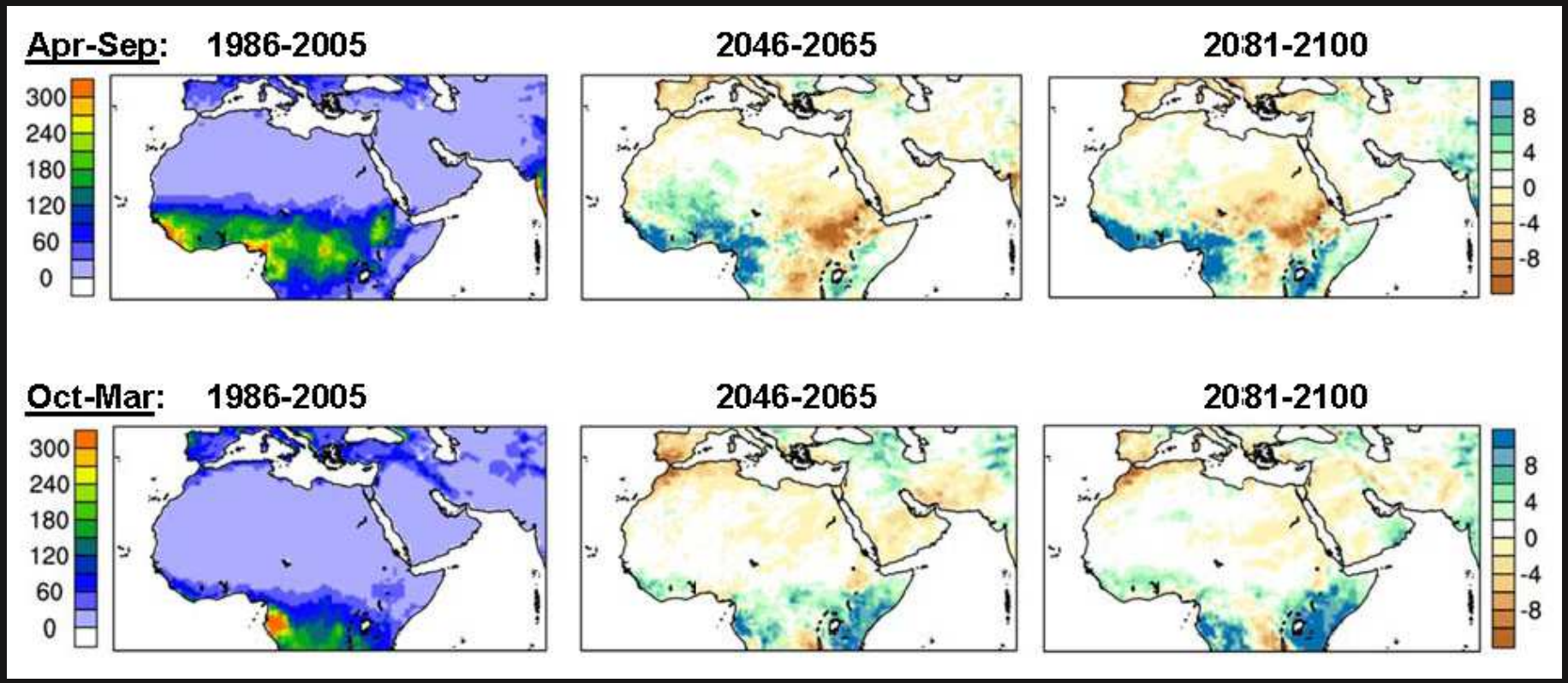
Future Projections - Prec RCP 4.5



Precipitation

RCA4: 3-member ensemble

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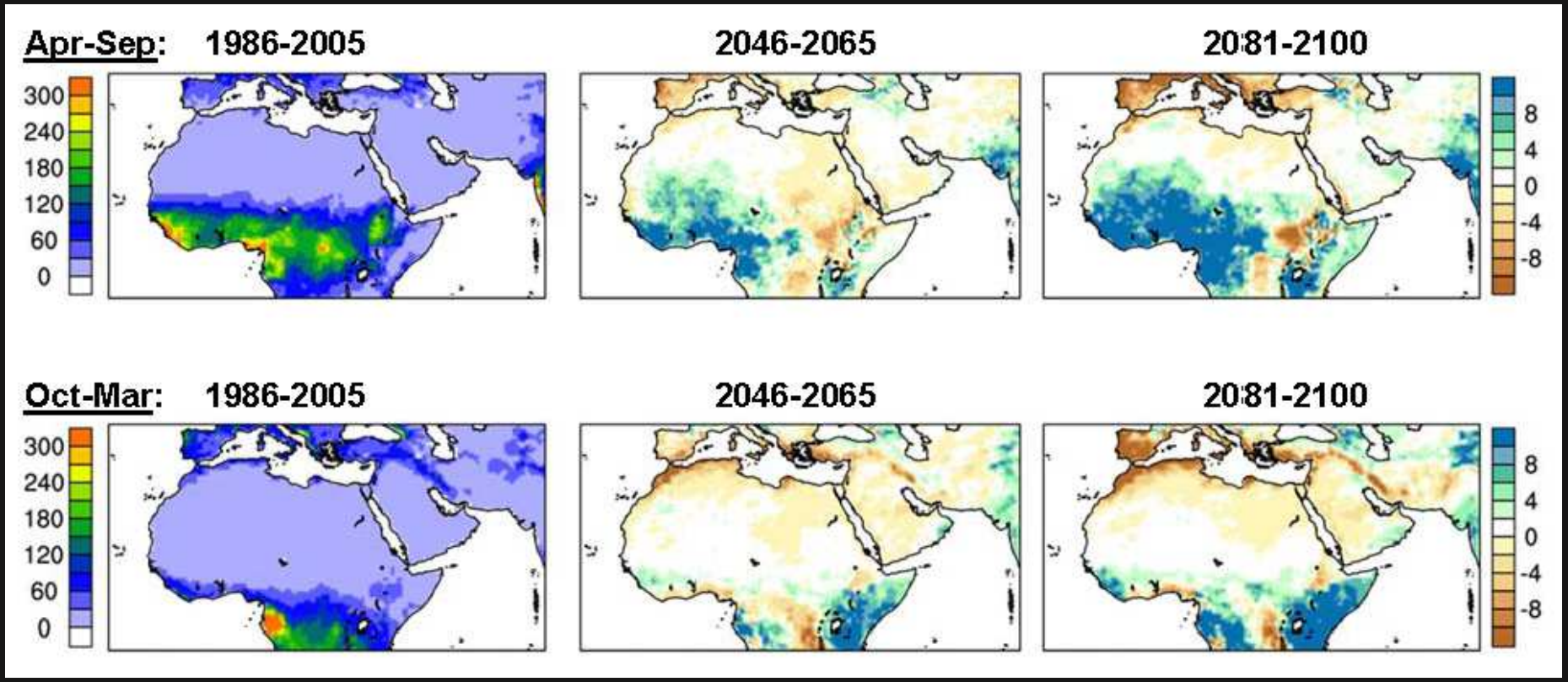
Future Projections - Prec RCP 8.5



Precipitation

RCA4: 3-member ensemble

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Climate Extremes Indices

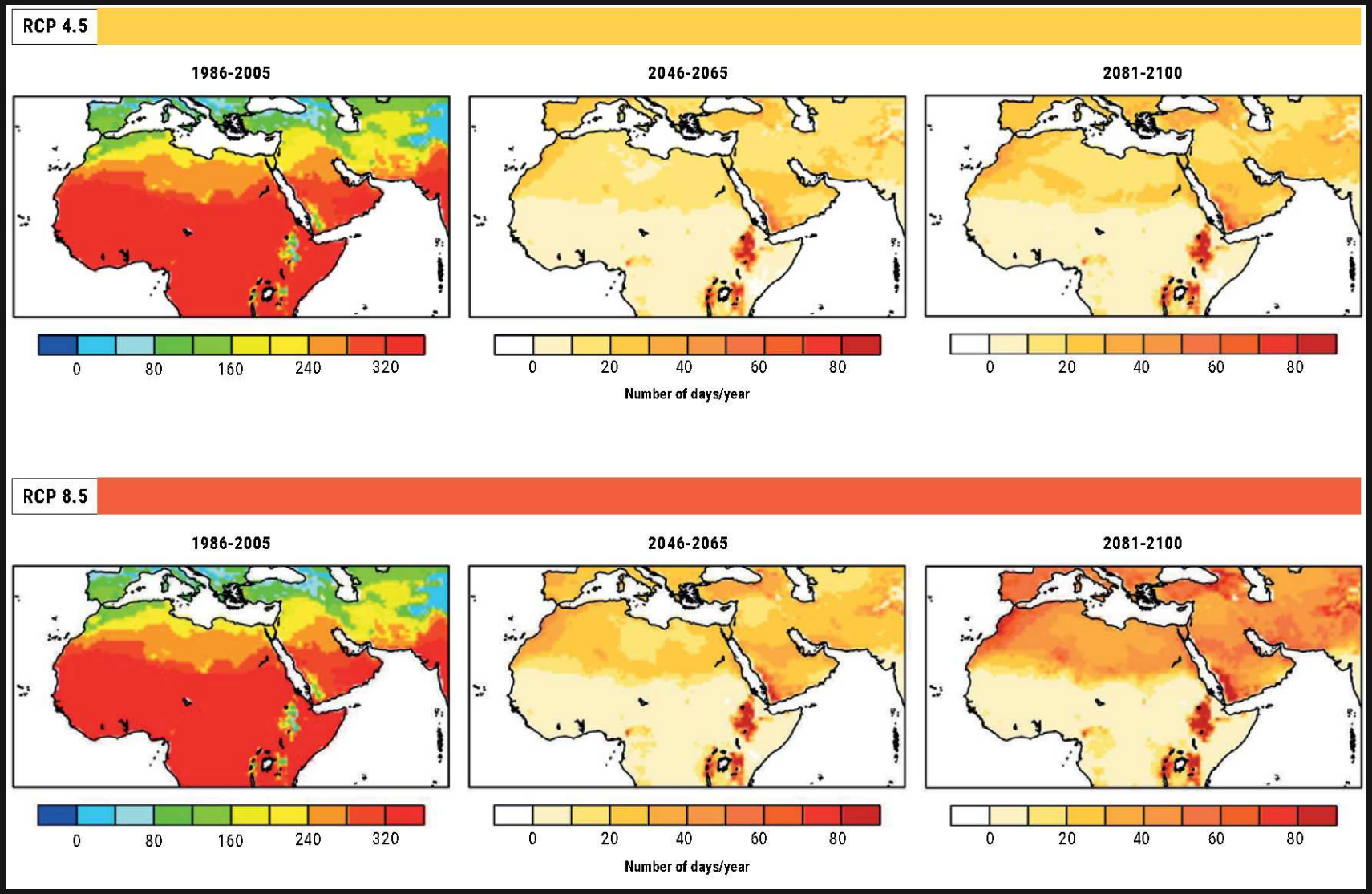
Extreme TEMPERATURE Indices

SU	***Number of summer days***: Annual count of days when, daily maximum temperature > 25ºC
SU35	***Number of hot days***: Annual count of days when, daily maximum temperature > 35ºC {*defined for application in RICCAR*}
SU40	***Number of very hot days***: Annual count of days when, daily maximum temperature > 40ºC {*defined for application in RICCAR*}
TR	***Number of tropical nights***: Annual count of days when, daily minimum temperature > 20ºC.

Extreme PRECIPITATION Indices

CDD	***Maximum length of dry spell***: maximum number of consecutive days with, daily precipitation < 1mm
CWD	***Maximum length of wet spell***: maximum number of consecutive days with, daily precipitation ≥ 1mm
R10	***Annual count of 10mm precipitation days***: when, daily precipitation ≥ 20mm
R20	***Annual count of 20mm precipitation days***: when, daily precipitation ≥ 20mm
SDII	***Simple precipitation intensity index***: defined as, total precipitation amount ÷ number of wet days

Temperature – “Summer” days (>25ºC)



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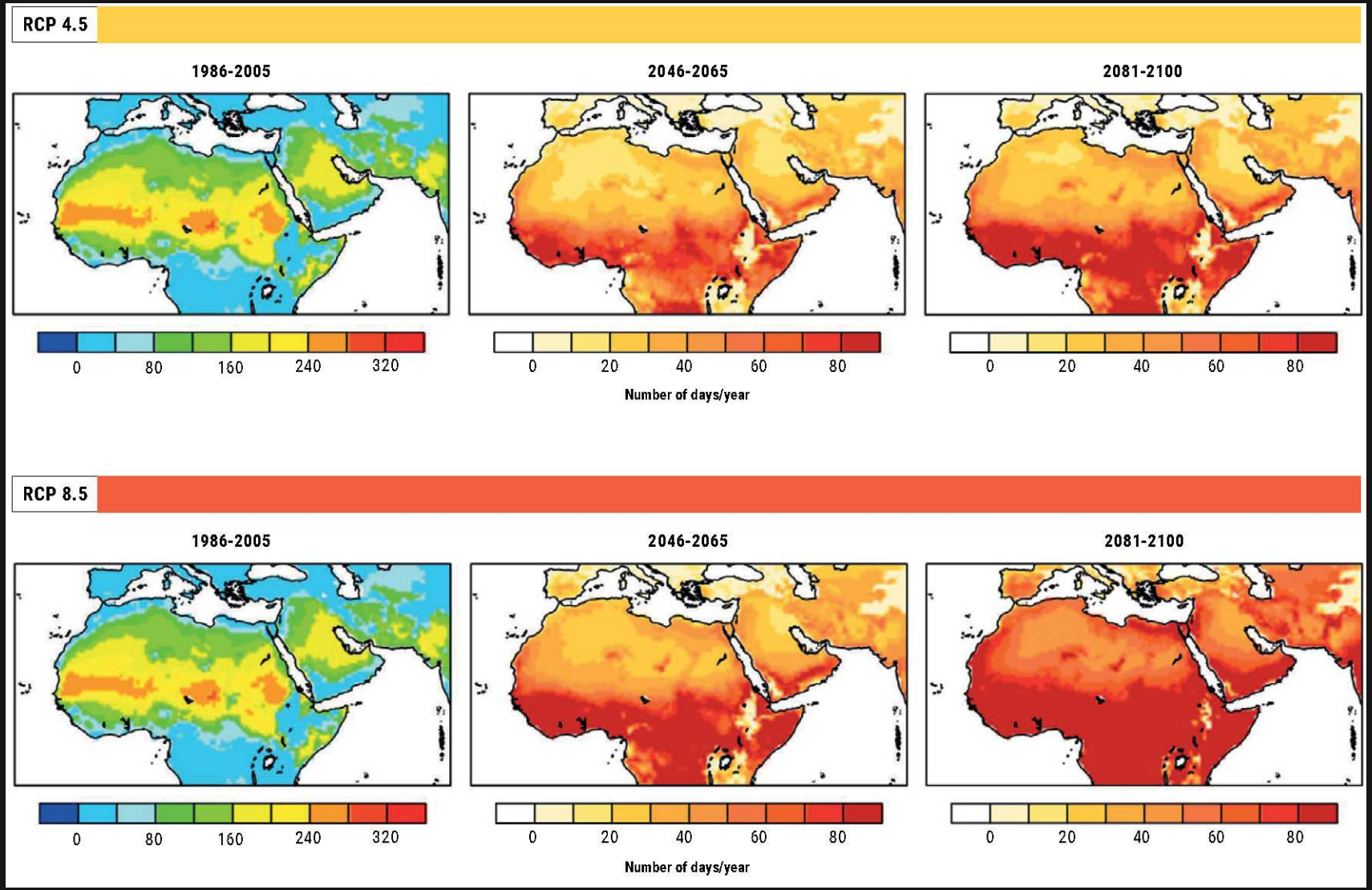
Temperature – "Hot" days (>35ºC)



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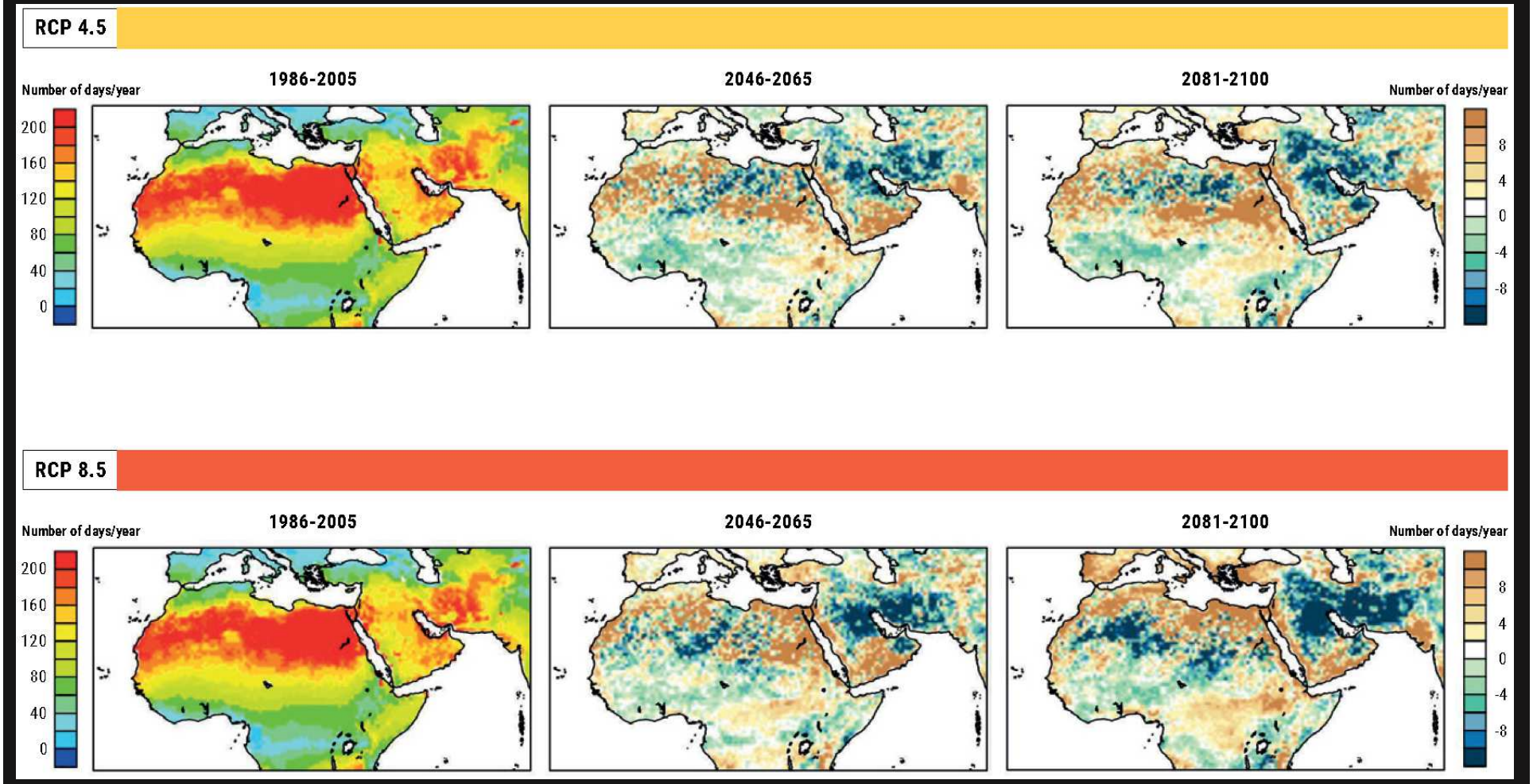
Dry Periods – # Consecutive Dry Days



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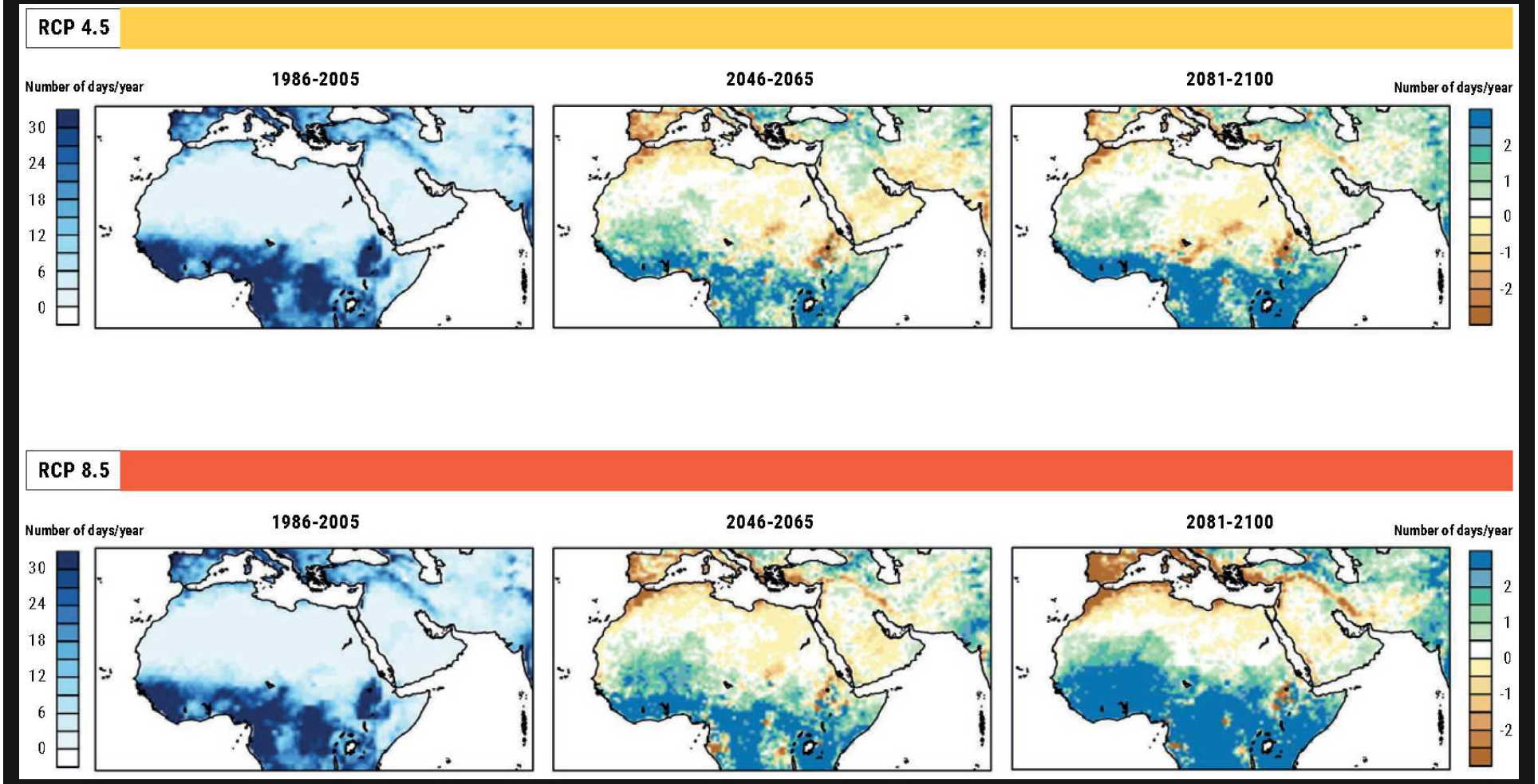
Intense Rainfall – R10 mm



Intense Rainfall – R20 mm

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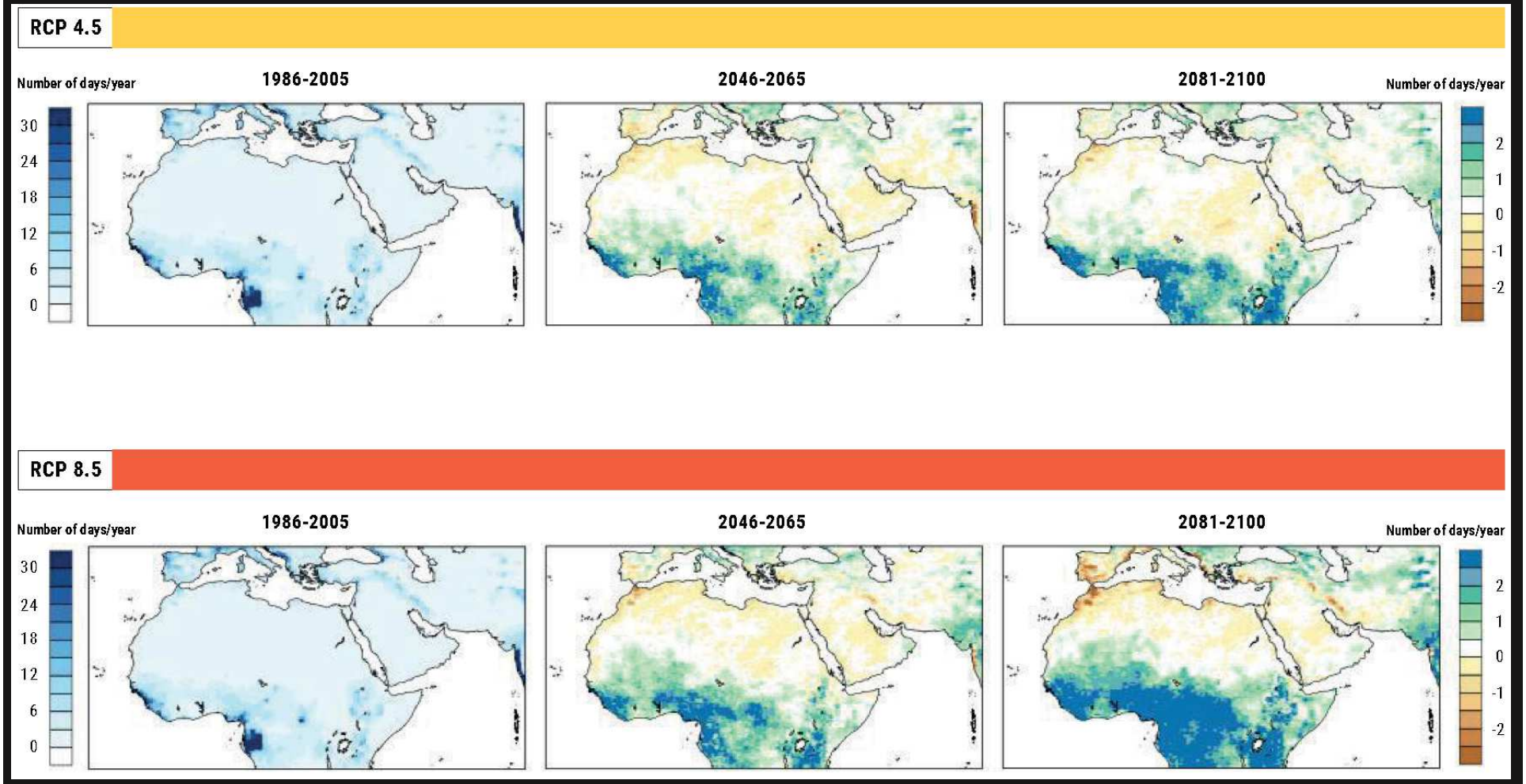

Intense Rainfall – SDII

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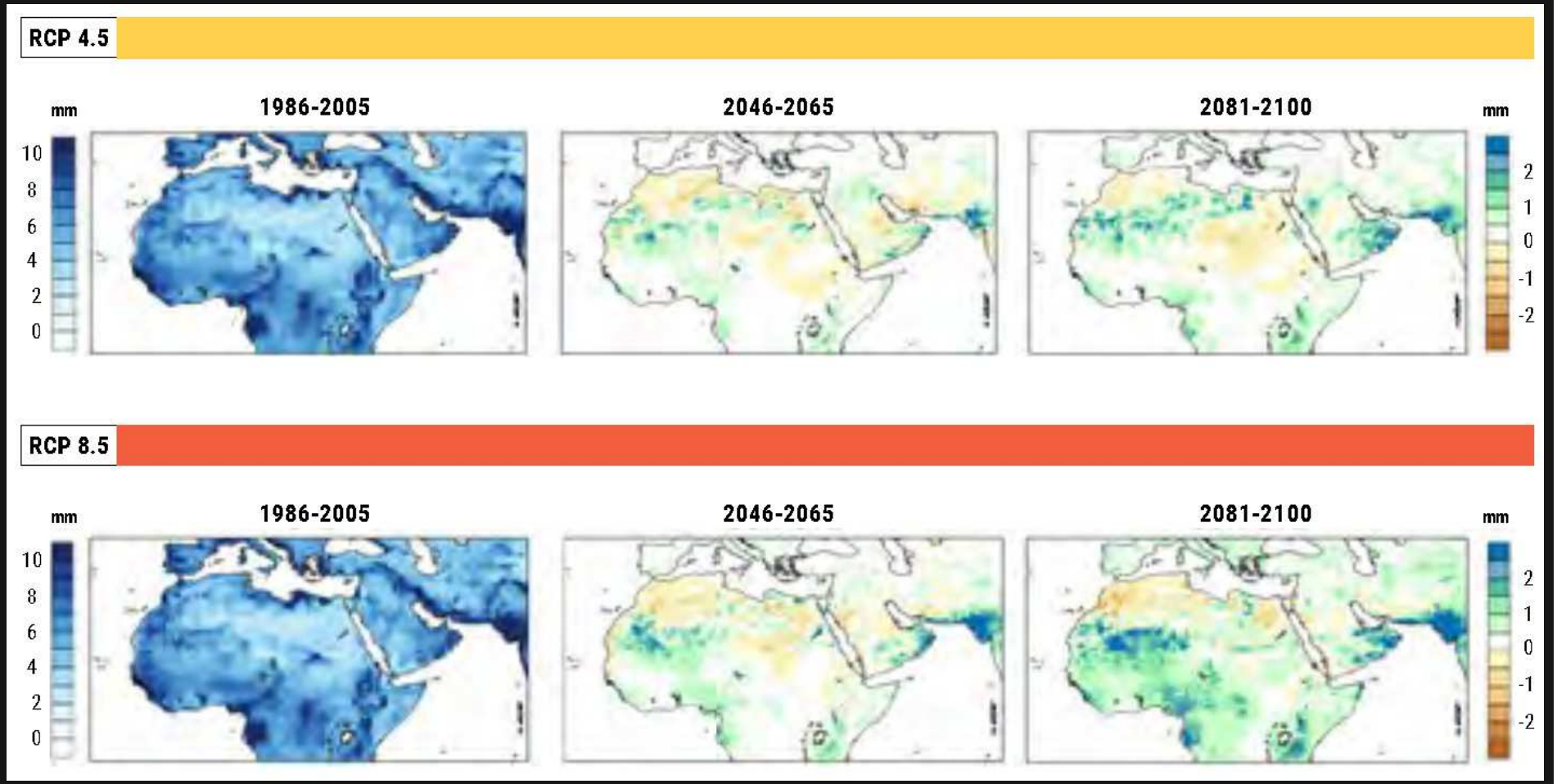

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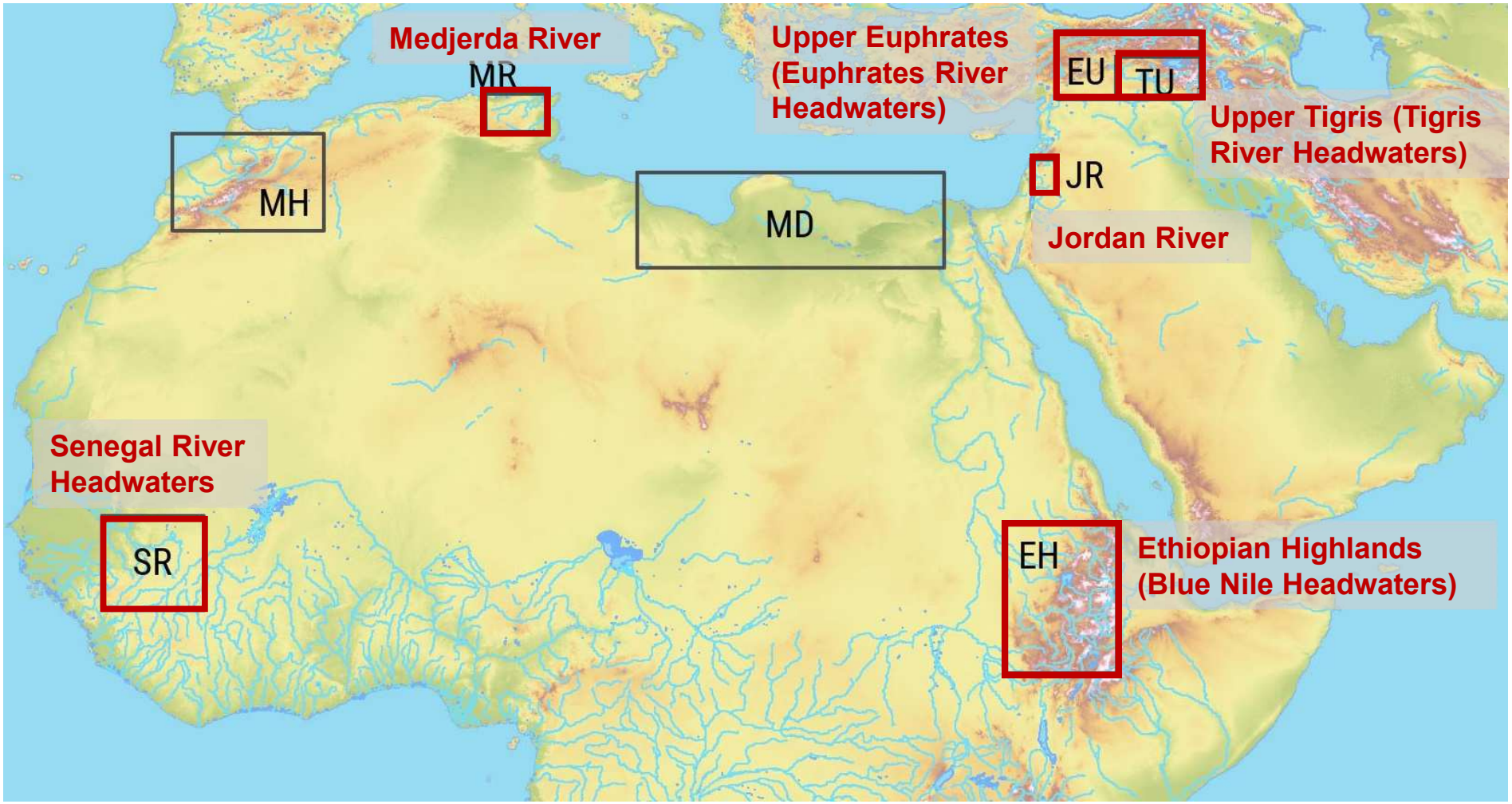
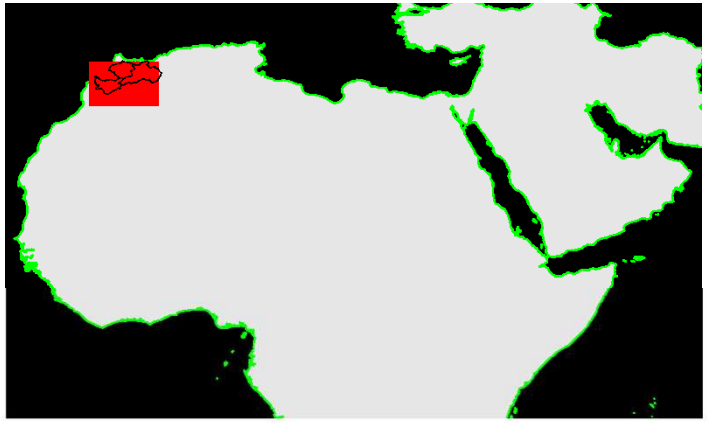
Analysis of climate change impacts on shared water resources can benefit from regional and basin-level assessments.

Location of Subdomains for analysis including shared river basins

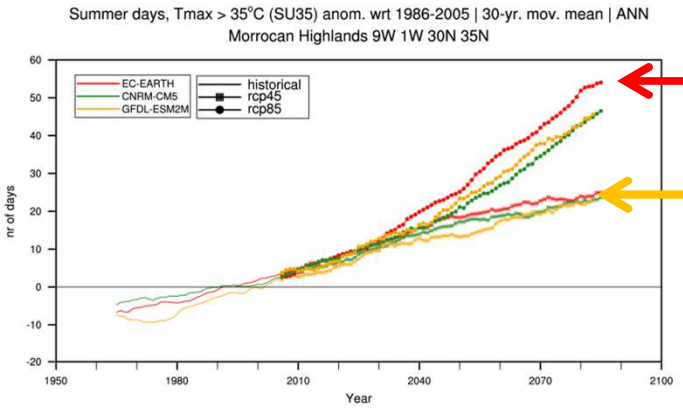


Moroccan Highlands



Temperature

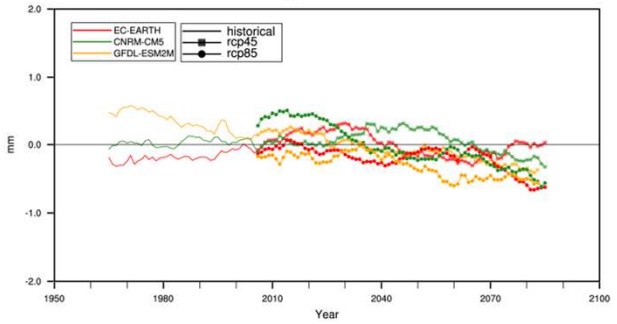
Change in number of days > 35ºC



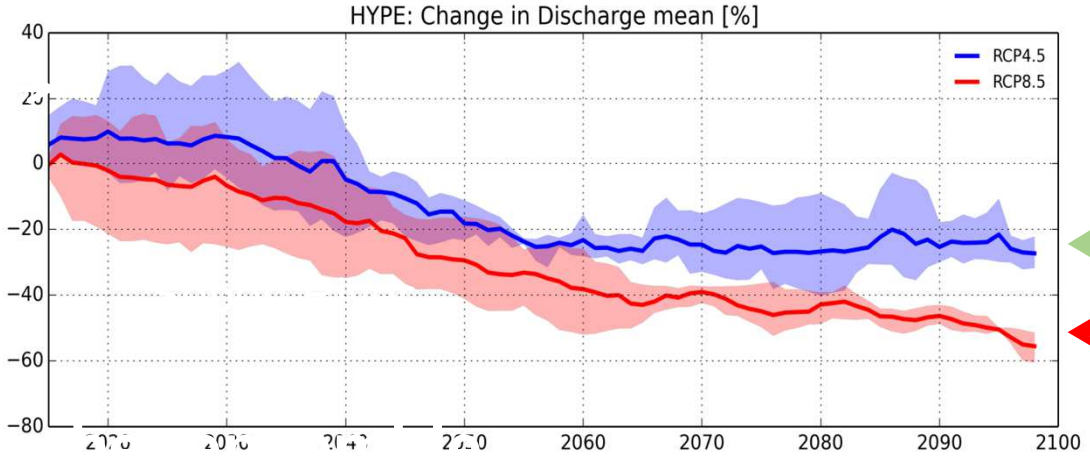
RCP 8.5

RCP 4.5

Precipitation Intensity - SDII



% Change in mean annual river discharge



RCP 4.5

RCP 8.5

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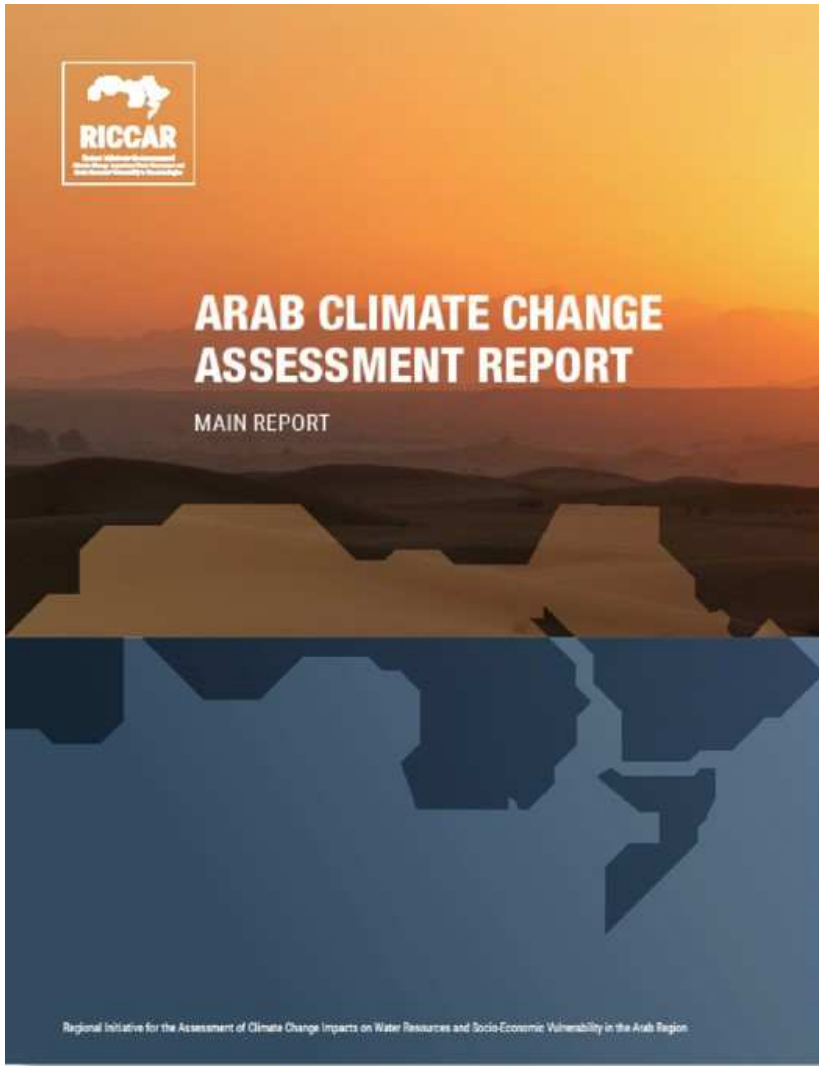
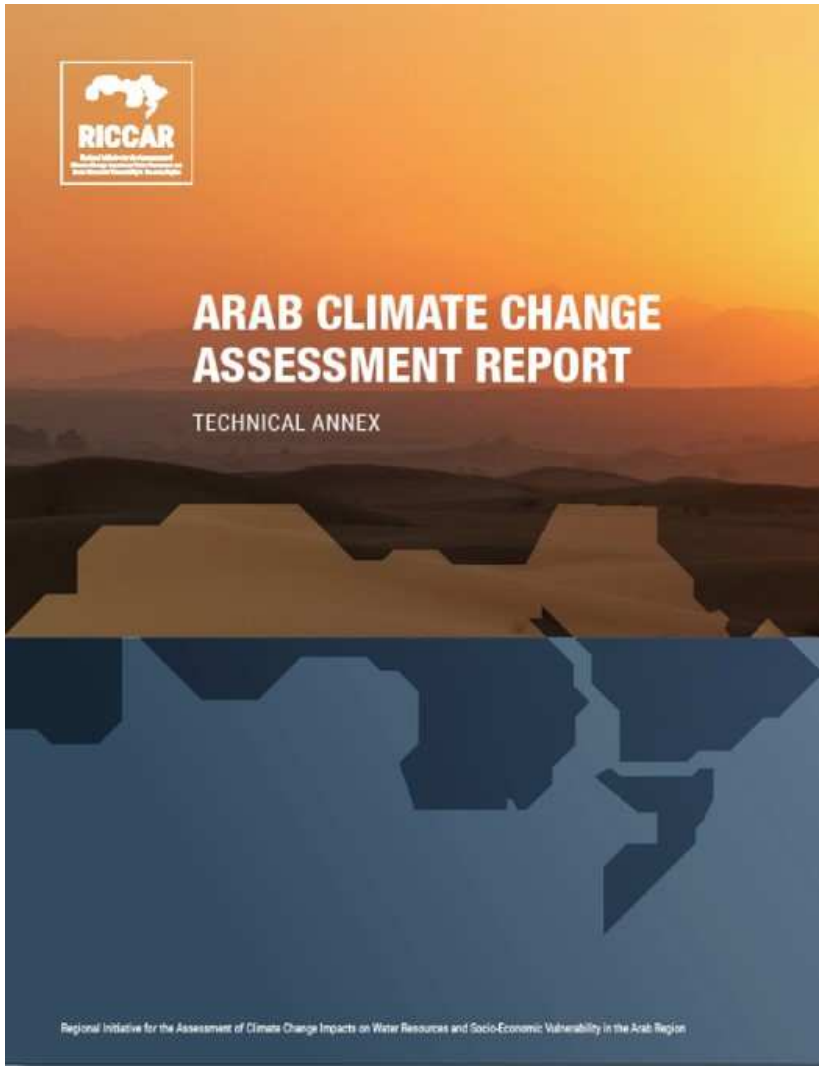
Highlights from RCM Projections

- Mean annual temperature change over the entire Arab domain is projected to
  - **1.6 °C** at mid-century, **1.9 °C** by end-of-century for **RCP 4.5**
  - **2.2 °C** at mid-century, **4.0 °C** by end-of-century for **RCP 8.5**
    (with variations over different regions)
- A number of regions show larger temperature increase during summer than during winter
  - large increases for “hot” days (>35°C) and “very hot” days (>40°C)
  - much more severe for **RCP 8.5** than for **RCP 4.5**
- Precipitation changes vary considerably over the region – many areas show decreases
  - more severe for **RCP 8.5** than for **RCP 4.5**
  - length of dry periods mostly increasing in both RCPs

Report Launched – Sept 2017





Publication Series Launched

Main Report

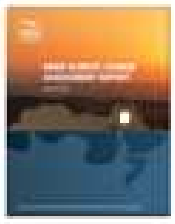
Technical Notes

Training Manuals

Technical Reports

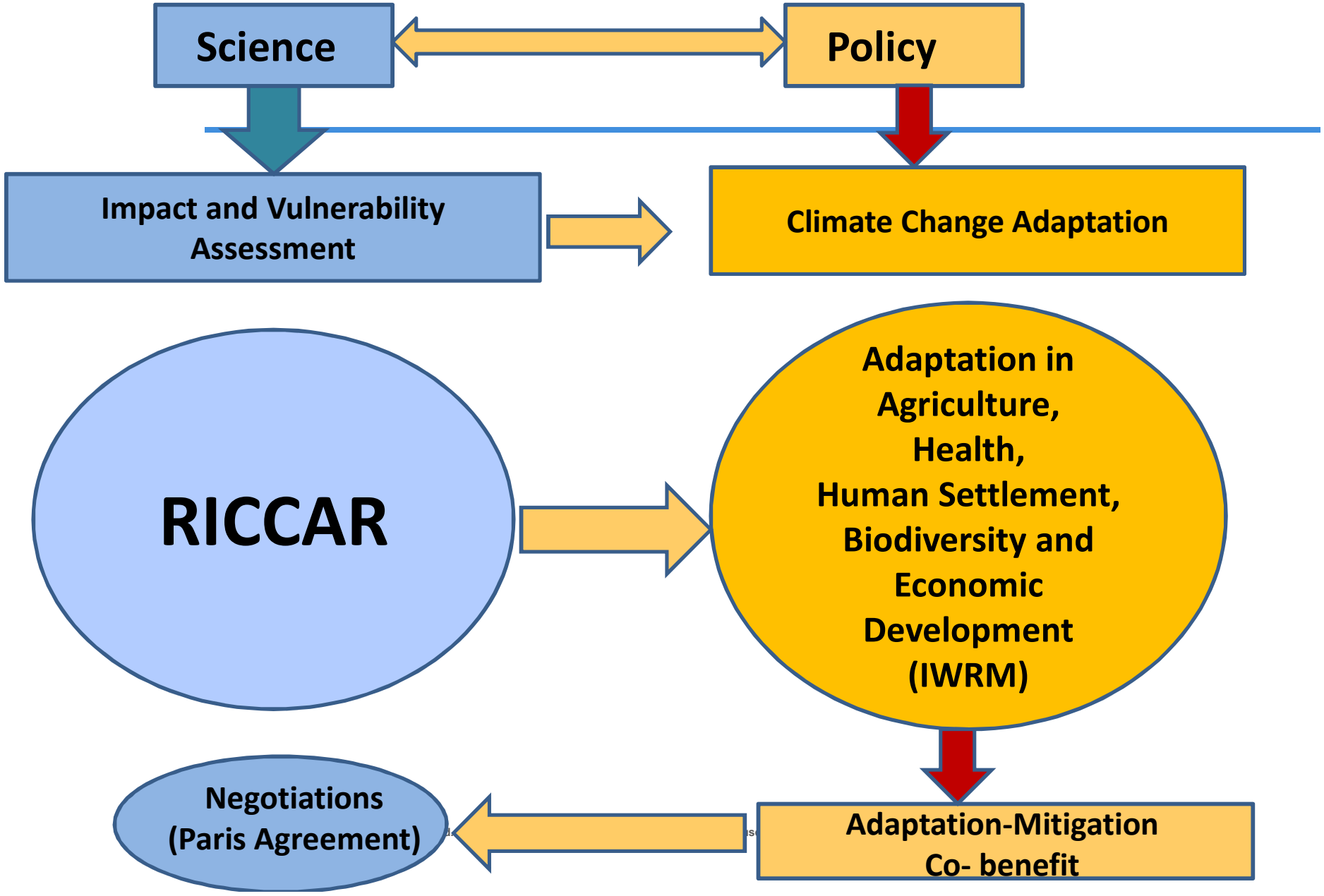
Peer Reviewed Journal Articles for IPPC use

Other outputs under preparation:



- Executive Summary (70 pgs)
- RICCAR “Shapshop” of findings
- Arabic Translation of Main Report & Executive Summary
- Technical Report: VA Application on Lebanese Agricultural Sector
- Training Materials

Linking Climate Science to Policy, Adaptive Strategy and Mitigation



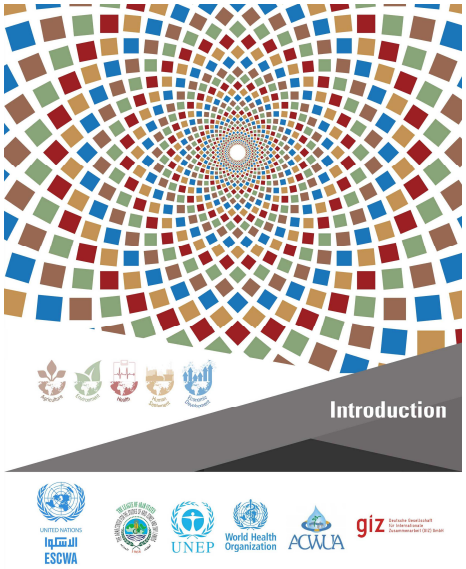
Climate Change Adaptation

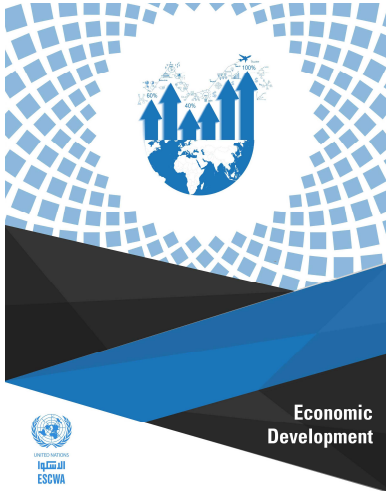
United Nations Development Account Project on Developing the Capacities of the Arab Countries for Climate Change Adaptation by Applying Integrated Water Resources Management Tools

Five sector modules were developed by the following leading organizations (in coordination with ESCWA):

1. Environment module by UNEP/ROWA;
2. Agriculture module by ACSAD/GIZ;
3. Health module by WHO;
4. Human settlements (water supply and sanitation) by ACWUA;
5. Economic module by ESCWA as well as an introductory chapter for the manual.

Five workshops were held with stakeholders from each sector to review respective modules





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Conclusions

- RICCAR sets a baseline for climate impact assessment in the Arab Region
- RICCAR outputs can be used for advancing the study and planning efforts to combat sand and dust storms over longer time periods.
- The transboundary nature of SDS requires collective analysis and action to combat their severe impacts on human health and socio-economic activities.
- There is thus an utmost need to improve understanding of these extreme events within the context of climate change and efforts to achieve sustainable development.

RICCAR

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Thank You

www.unescwa.org/climate-change-water-resources-arab-region-riccar

www.riccar.org

High Level Conference on Climate Change Assessment and Adaptation