Bridging the Science-Policy Interface: From Climate Models to Regional Action

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

ريكار
المبادرة الإقليمية لتقييم أثر تغيُّر المناخ على الموارد المائية وقابلية تأثُّر القطاعات الاجتماعية والاقتصادية في المنطقة العربية

Overview of RICCAR

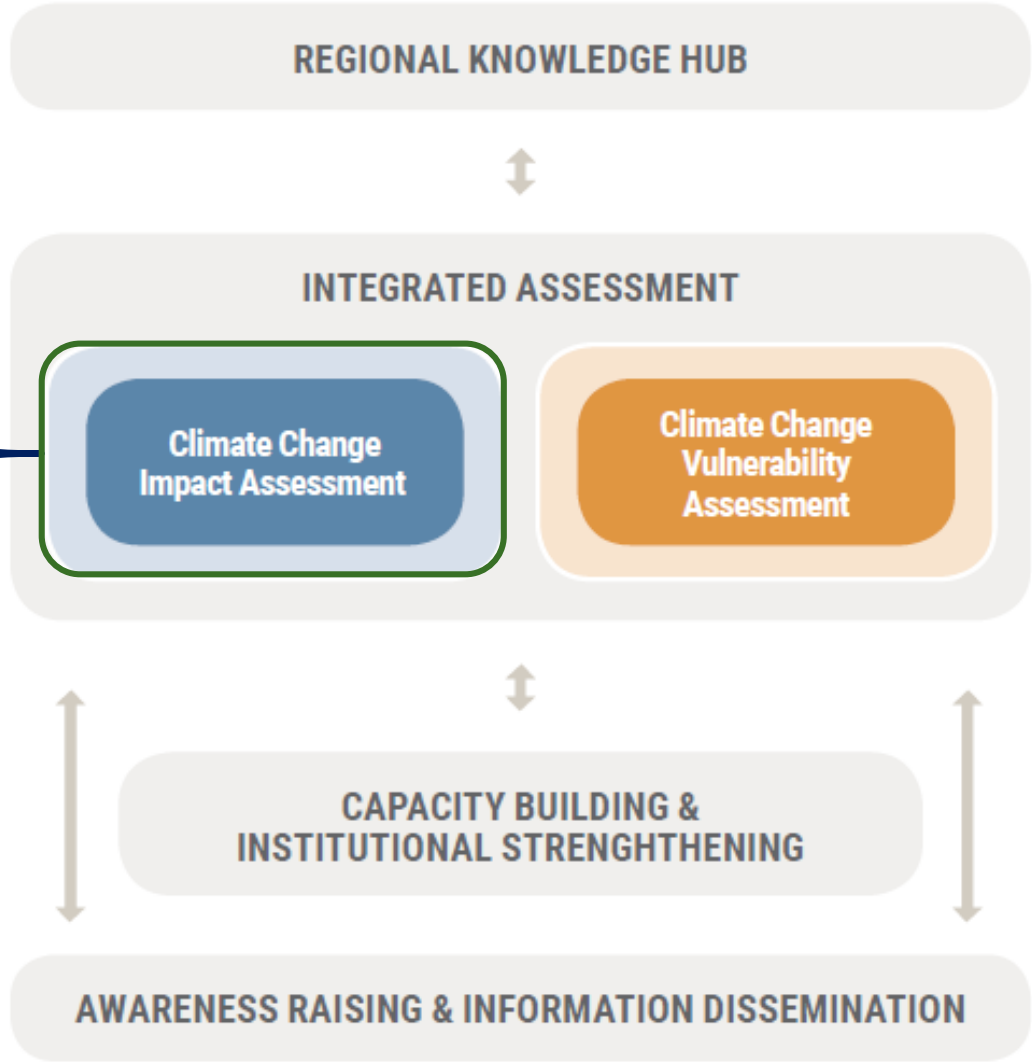
The Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) is a joint initiative of the United Nations and the League of Arab States launched in 2010

RICCAR is implemented through a collaborative partnership involving 11 regional and specialized organizations and coordinated by ESCWA

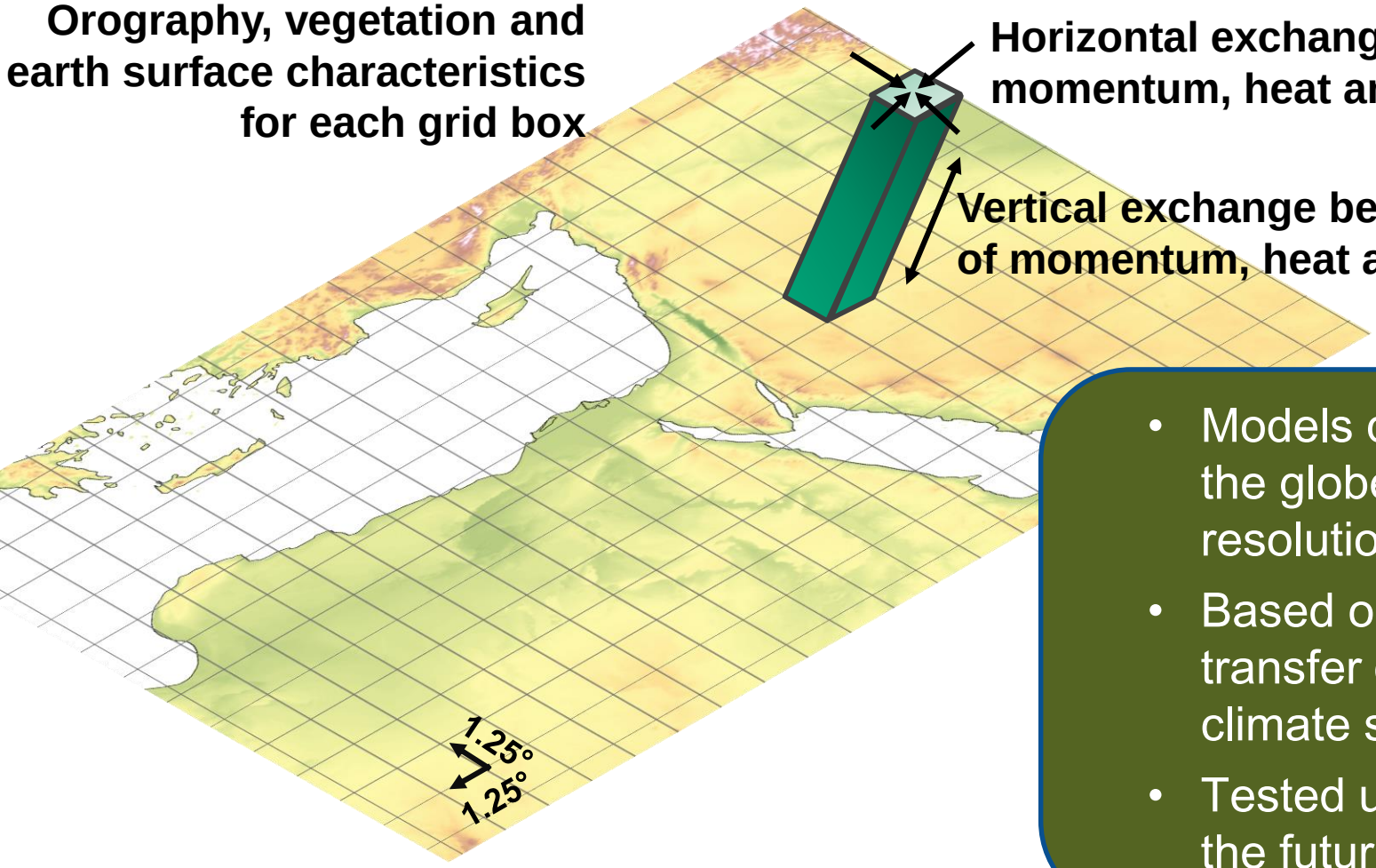
RICCAR aims to provide a common platform for **assessing, addressing and informing response** to climate change impacts on freshwater resources in the Arab region by serving as the basis for **dialogue, priority setting and policy formulation** on climate change at the regional level

RICCAR Pillars of Work

Climate modelling based on Arab regional specificities



What are Global Climate Models (GCMs)?

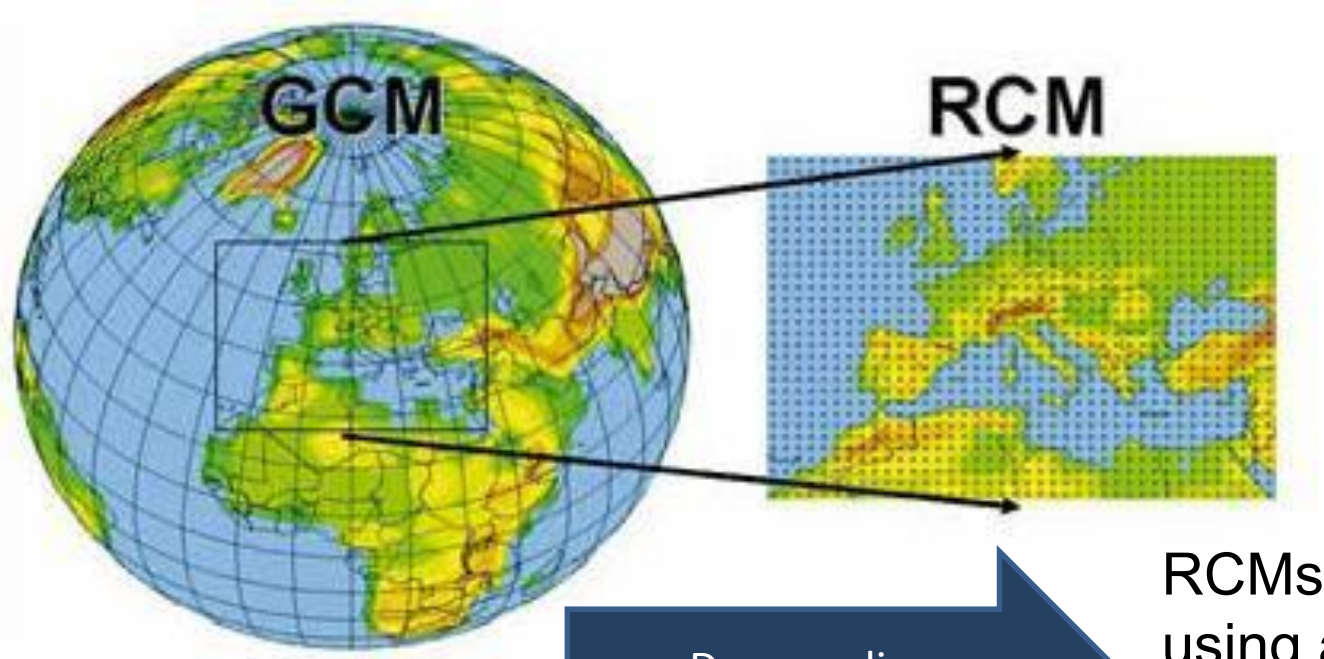


- Models depict the climate using a 3D grid over the globe and typically have coarse spatial resolution (> 100 km)
- Based on physical processes to simulate the transfer of energy and material through the climate system
- Tested using historical data and projected into the future based on potential scenarios

from Global Climate Models (GCMs)

to Regional Climate Models (RCMs)

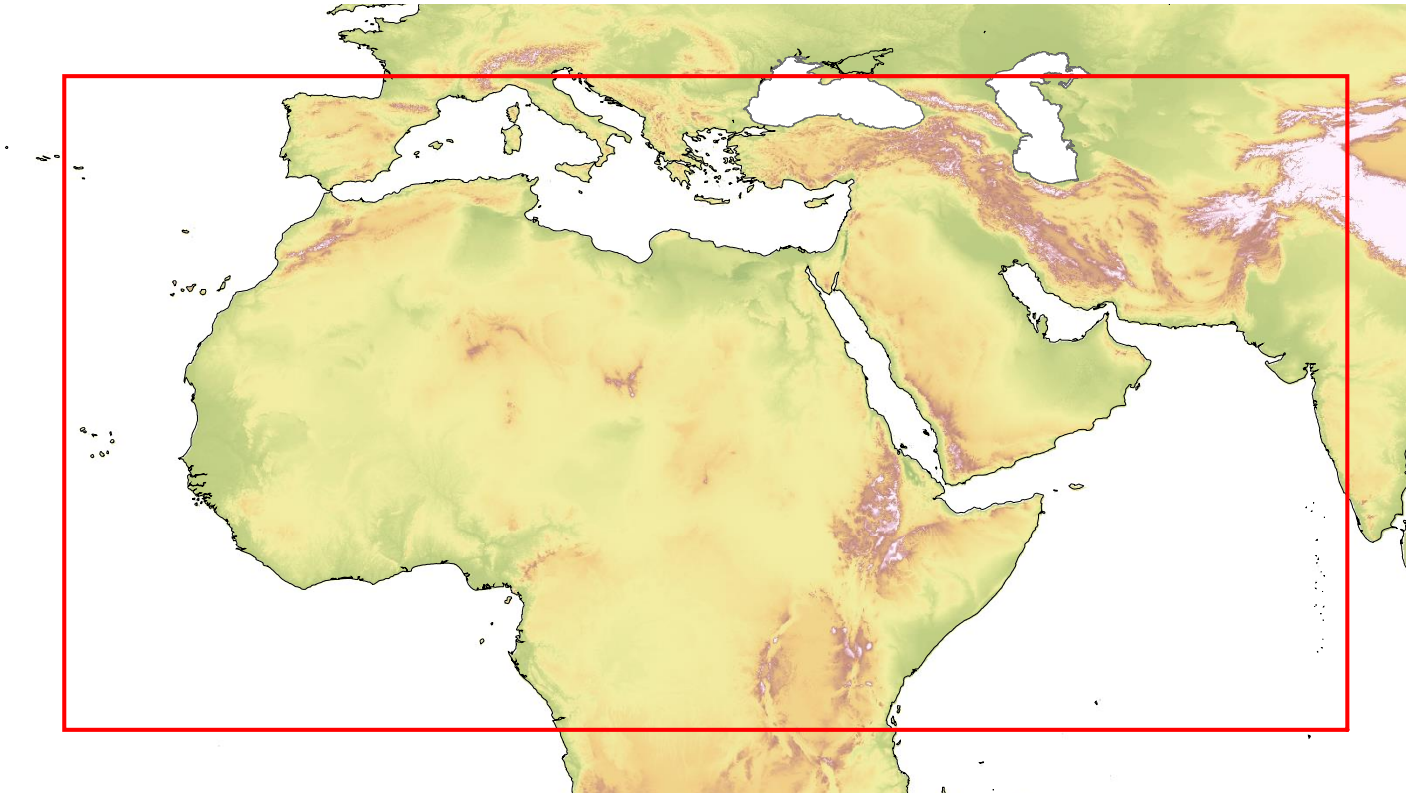
GCMs can provide reliable prediction information at large scales but do not have an accurate description of local climate



RCMs are nested within GCMs using a specified domain determined by limiting boundaries and regional specifics

Arab Domain RCMs

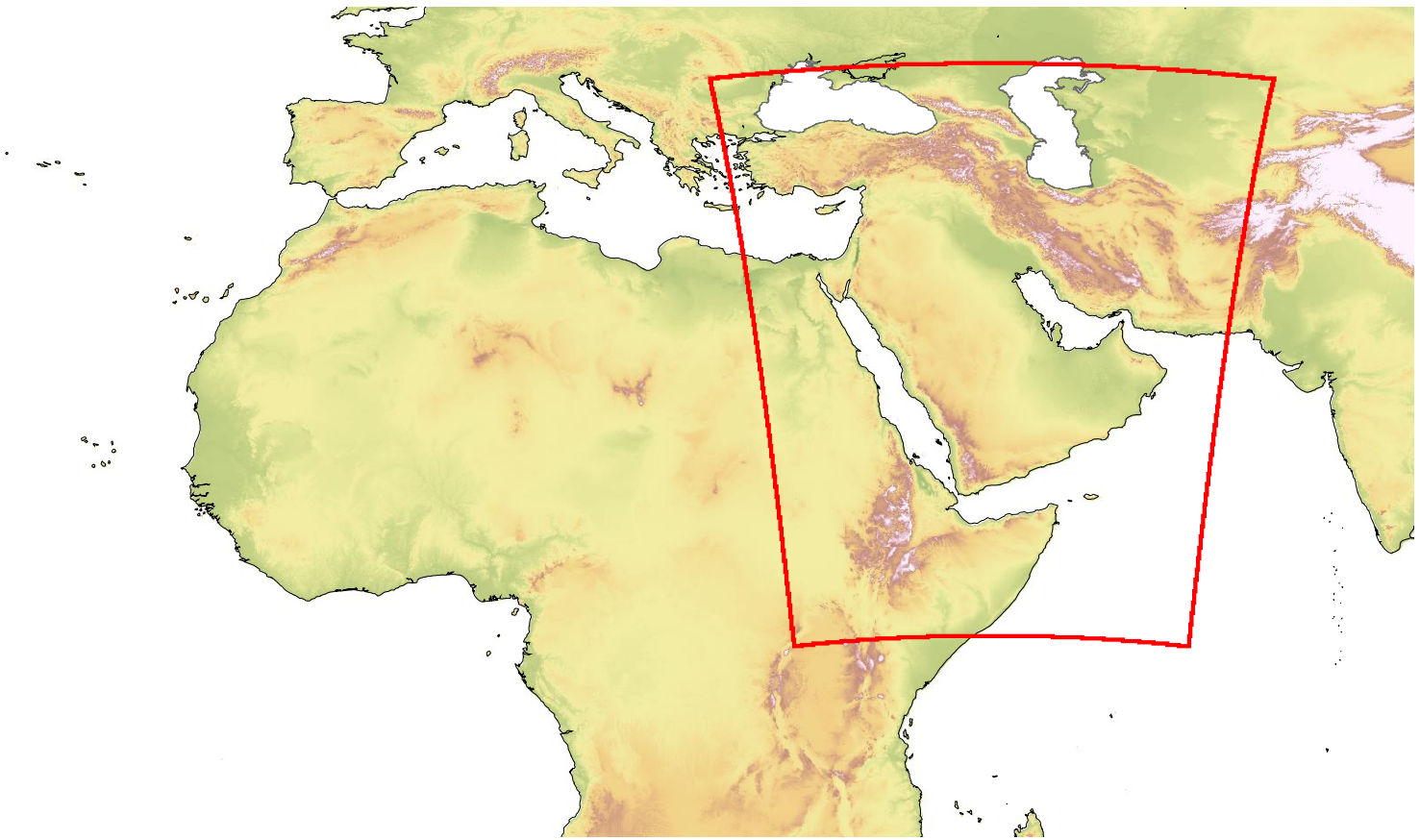
To support regional cooperation



- Released in 2017
- Based on Couple Model Intercomparison Project 5 (**CMIP5**) global climate models
  - CNRM-CM5 (France)
  - EC-Earth (European Consortium)
  - GFDL-ESM2M (NOAA/USA)
- **~50 km** (0.44°) spatial resolution
- **RCP4.5** and **RCP8.5** scenarios

Mashreq Domain RCMs

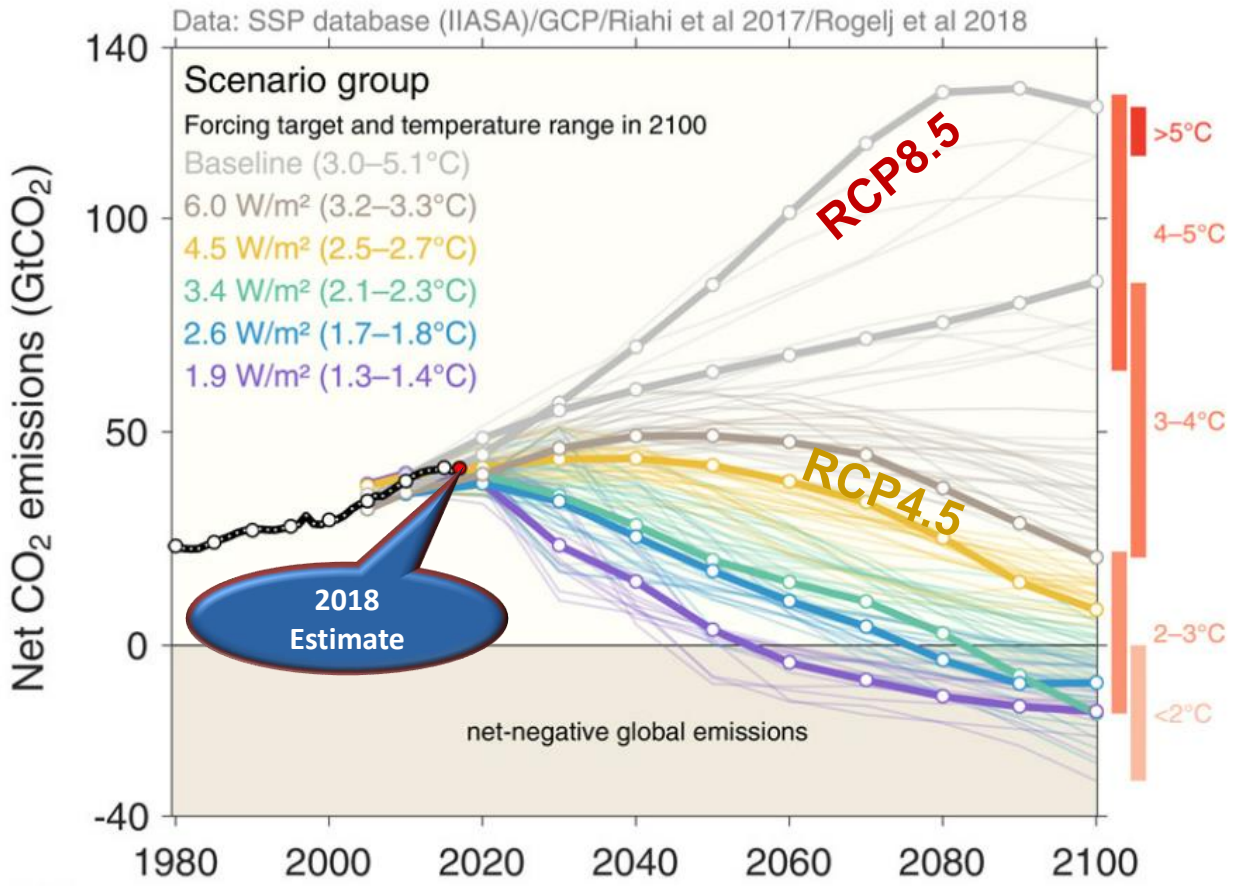
To facilitate more detailed analyses to inform regional action



- Released in 2021
- Based on Couple Model Intercomparison Project 6 (CMIP6) global climate models
  - CMCC-CM2-SR5 (Italy)
  - CNRM-ESM2-1 (France)
  - EC-Earth3-Veg (European Consortium)
  - MPI-ESM1-2-LR (Germany)
  - MRI-ESM2-0 (Japan)
  - NorESM2-MM (Norway)
- ~10 km (0.1°) spatial resolution
- SSP5-8.5 scenario

from Representative Concentration Pathways (RCPs)…

- Proposed in 2013
- Used for CMIP5 models
- Based on radiative forcing levels (W/m^2) resulting from GHGs in 2100



RCP4.5 assumes implementation of adequate climate policies to limit emissions and radiative forcing

RCP8.5 assumes high-end, no mitigation

…to Shared Socioeconomic Pathways (SSPs)

- Proposed in 2016
- Used for CMIP6 models
- Combines RCPs with differing global socioeconomic scenarios (5 total)

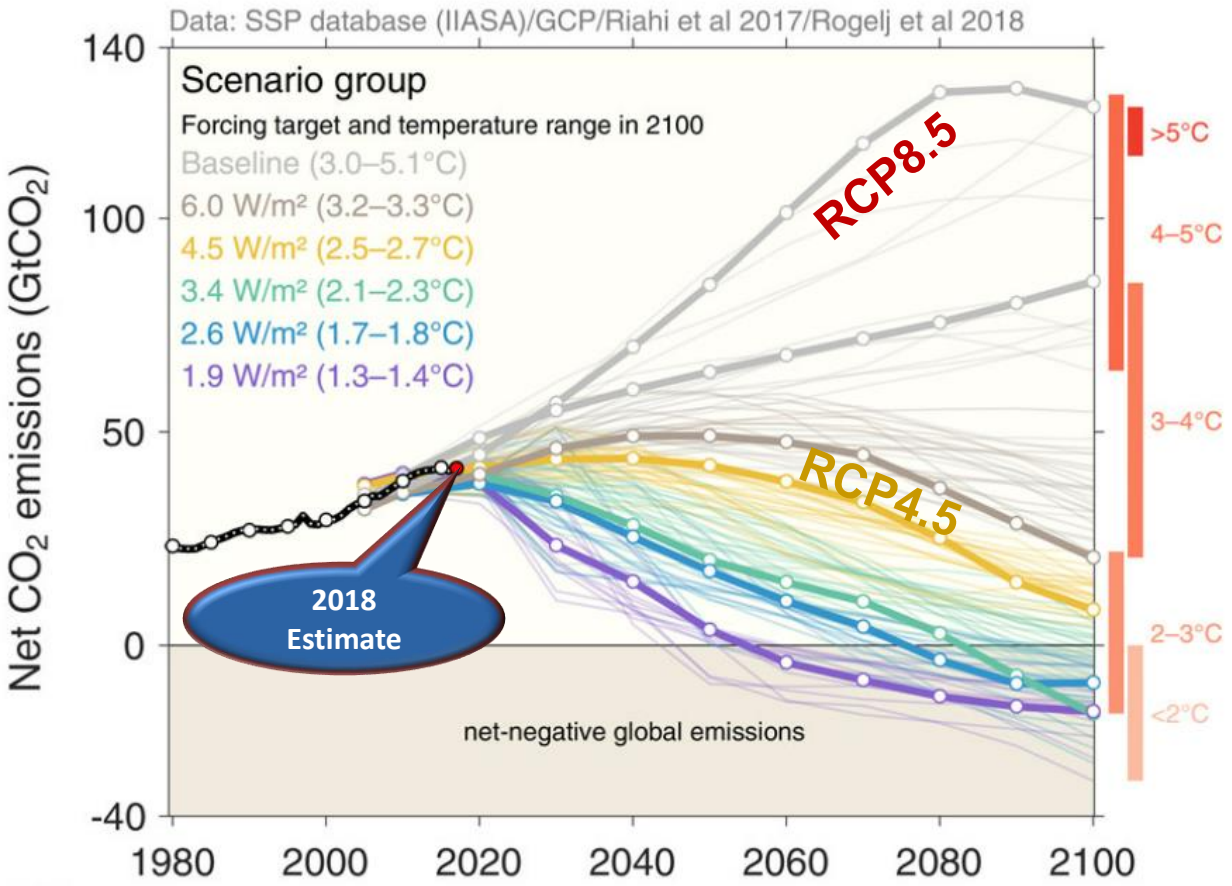
SSP1 – Sustainability: Low challenges to mitigation and adaptation

SSP2 – Middle of the Road: Medium challenges to mitigation and adaptation

SSP3 – Regional Rivalry: High challenges to mitigation and adaptation

SSP4 – Inequality: Low challenges to mitigation, high challenges to adaptation

SSP5 – Fossil-fuelled development: High challenges to mitigation, low challenges to adaptation



Differences between Arab Domain and Mashreq Domain outcomes

- Differing domains and boundary conditions
- Differing spatial resolutions (50 km vs 10 km)
- Differing global climate models (CMIP5 vs CMIP6)- CMIP6 models are more developed with higher climate sensitivity
- Differing downscaling RCM
- Differing climate scenarios
- More advanced bias-correction techniques
- Differing time scales- Mashreq does not include late century when climate signal may be more pronounced

Available Mashreq Domain RCM Outputs

Also available as **bias-corrected**

- Data that have integrated with gridded observed datasets
- Recommended for hydrological studies

Data is also available for ETCCDI extreme climate indices (CDD, CWD), which are derived from bias-corrected T and P outputs

- **Temperature**
  - Daily average
  - Daily maximum
  - Daily minimum
- **Precipitation**
- **Relative humidity**
- **Air Pressure**
- **Evaporation**
- **Surface Downwelling Shortwave Radiation**
- **Duration of sunshine**
- **Wind**
  - Direction
  - Speed
  - Gust

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Change in Seasonal Temperature (Nov-Apr)

Compared to the reference period based on ensemble of six bias-corrected Mashreq Domain RCM outputs, SSP5-8.5

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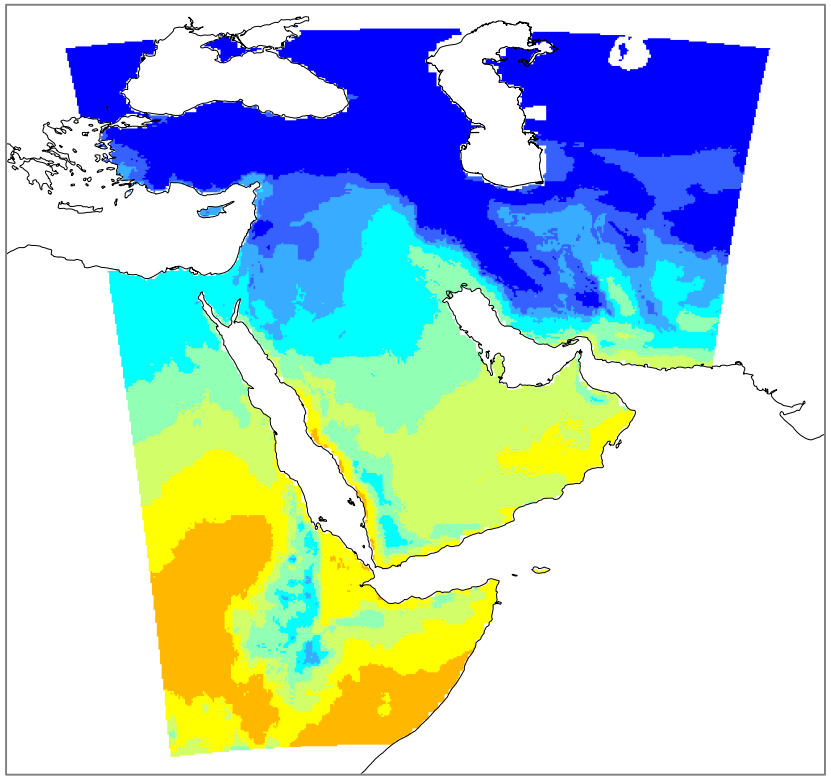
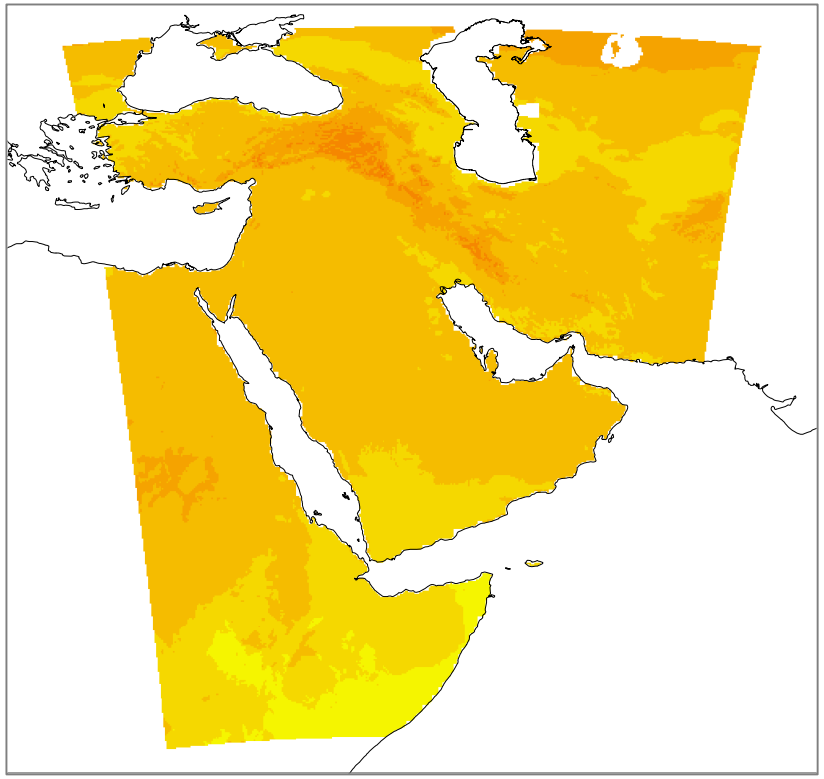
1995 – 2014



Temperature (°C)

9 12 15 18 21 24 27 30 33

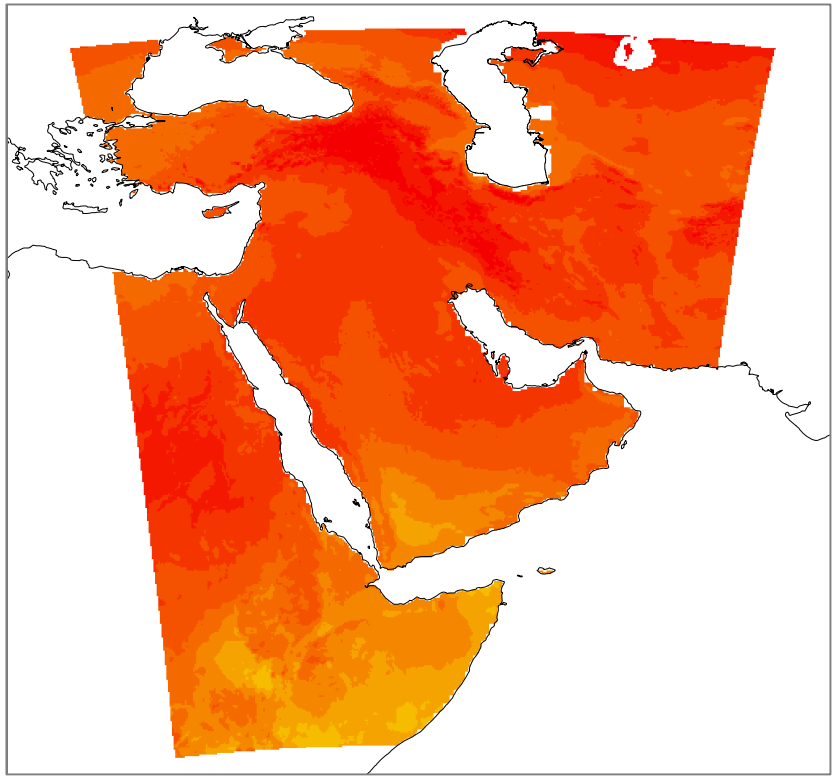
2021 – 2040



Change in temperature (°C)

0.5 0.75 1 1.25 1.5 1.75 2 2.25 2.5

2041 – 2060



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Change in Seasonal Temperature (May-Oct)

Compared to the reference period based on ensemble of six bias-corrected Mashreq Domain RCM outputs, SSP5-8.5

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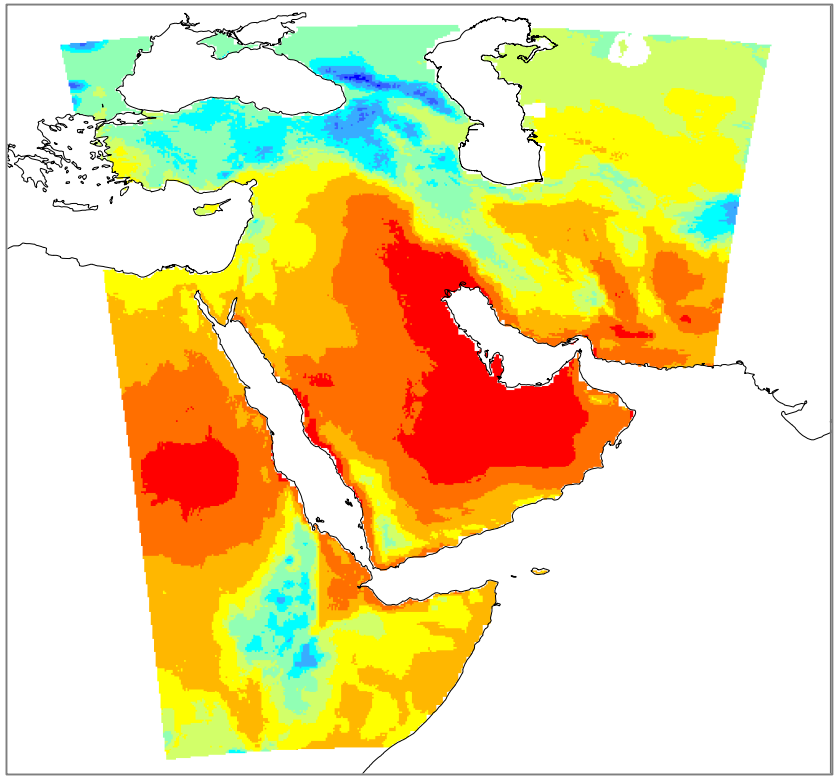

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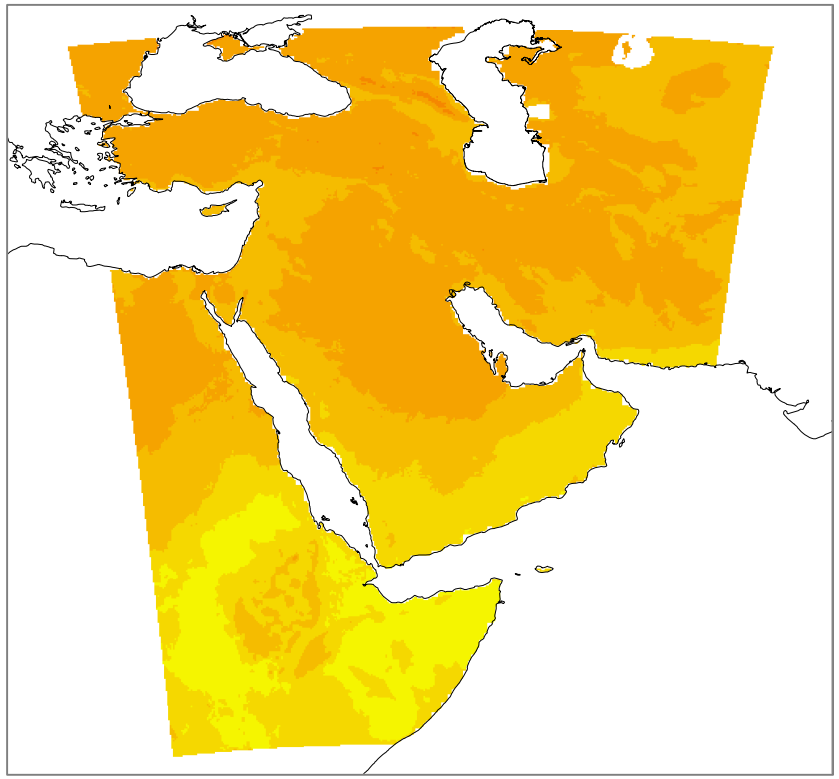

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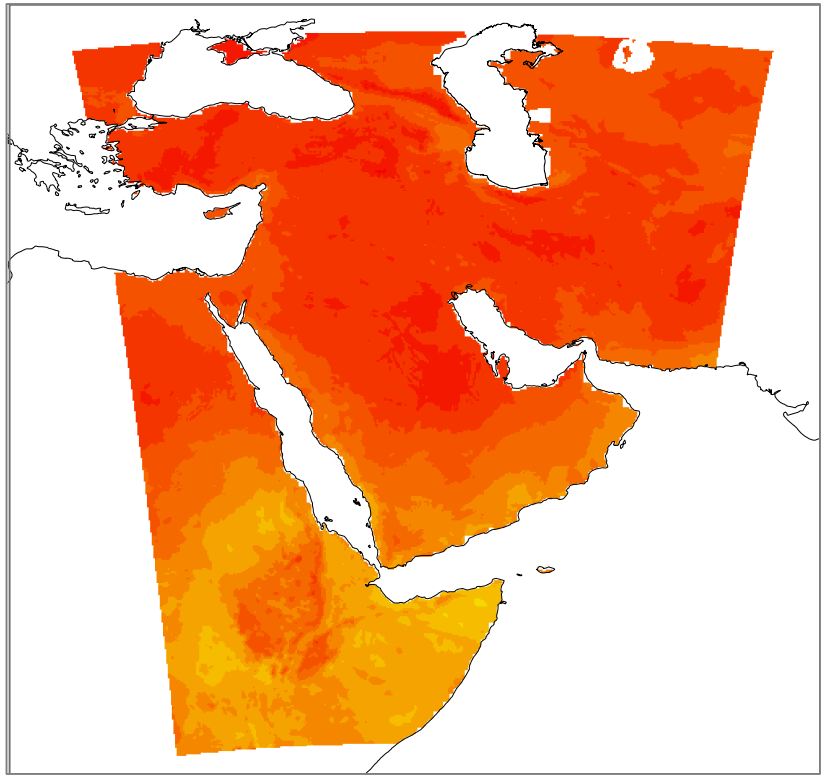

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Change in Seasonal Precipitation (Nov-Apr)

Compared to the reference period based on ensemble of six bias-corrected Mashreq Domain RCM outputs, SSP5-8.5

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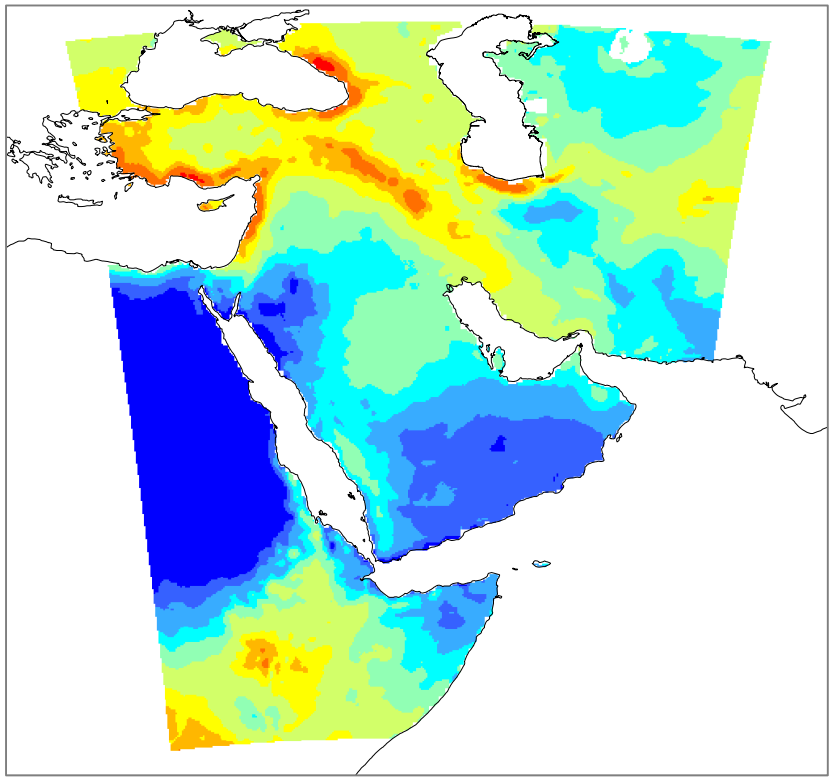
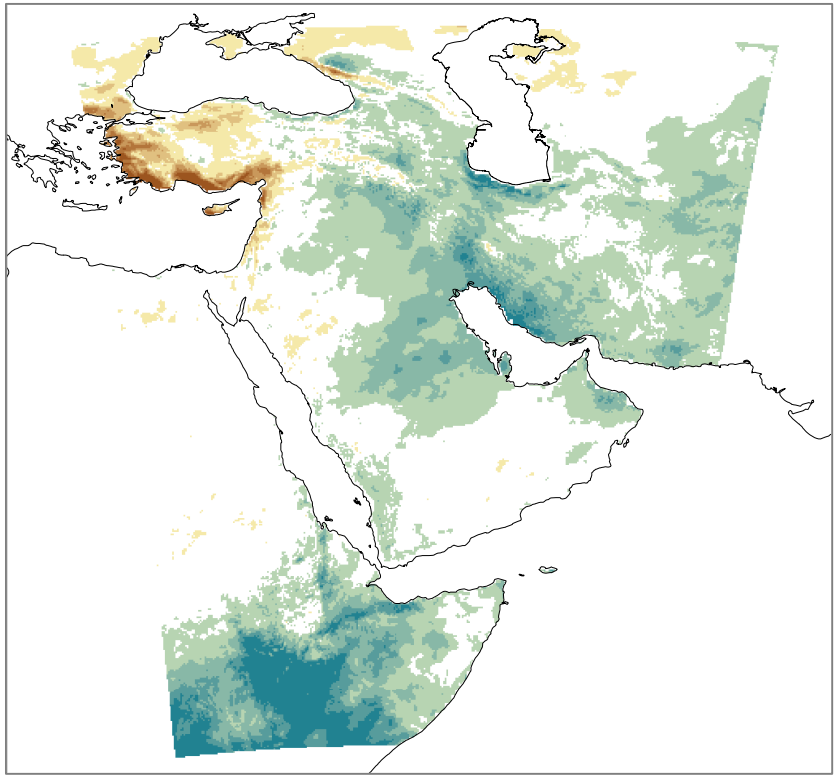


2021 – 2040



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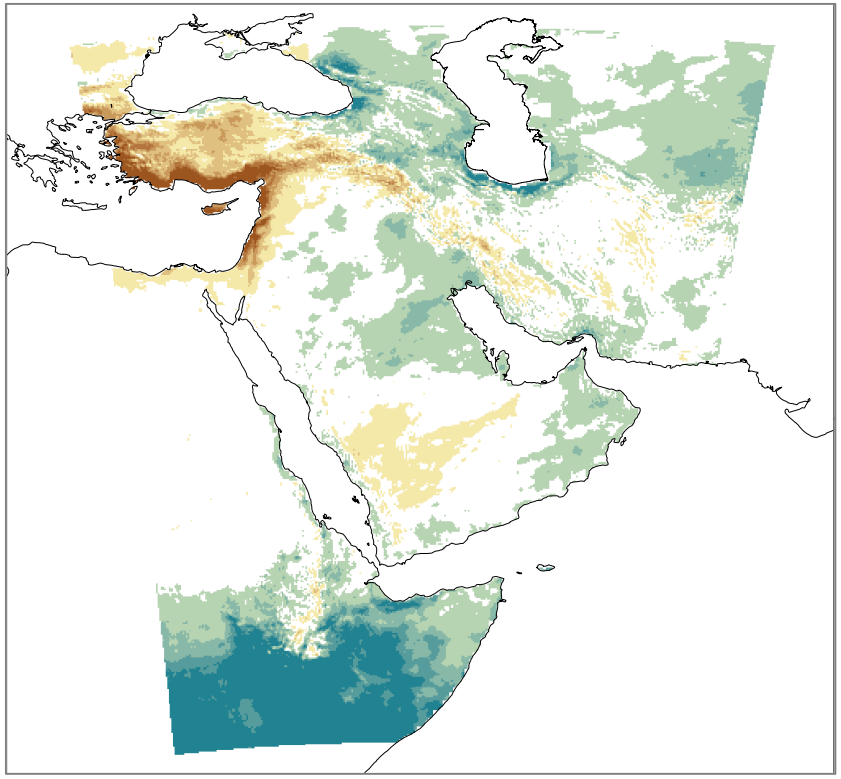
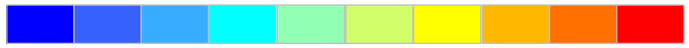


Precipitation (mm/month)



Change in precipitation (mm/month)

Change in precipitation (mm/month)

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Change in Seasonal Precipitation (May-Oct)

Compared to the reference period based on ensemble of six bias-corrected Mashreq Domain RCM outputs, SSP5-8.5

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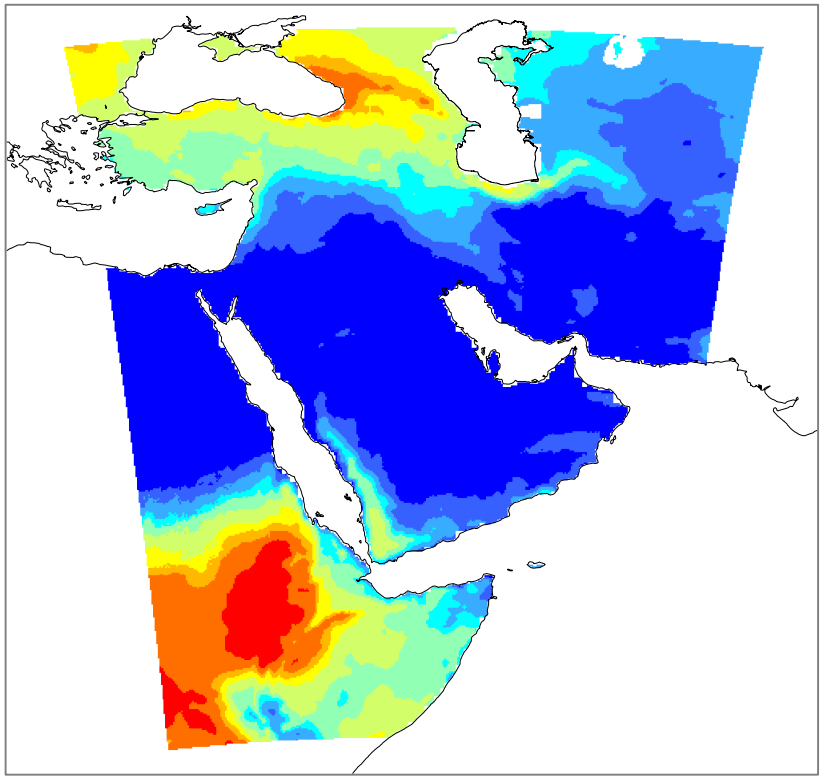

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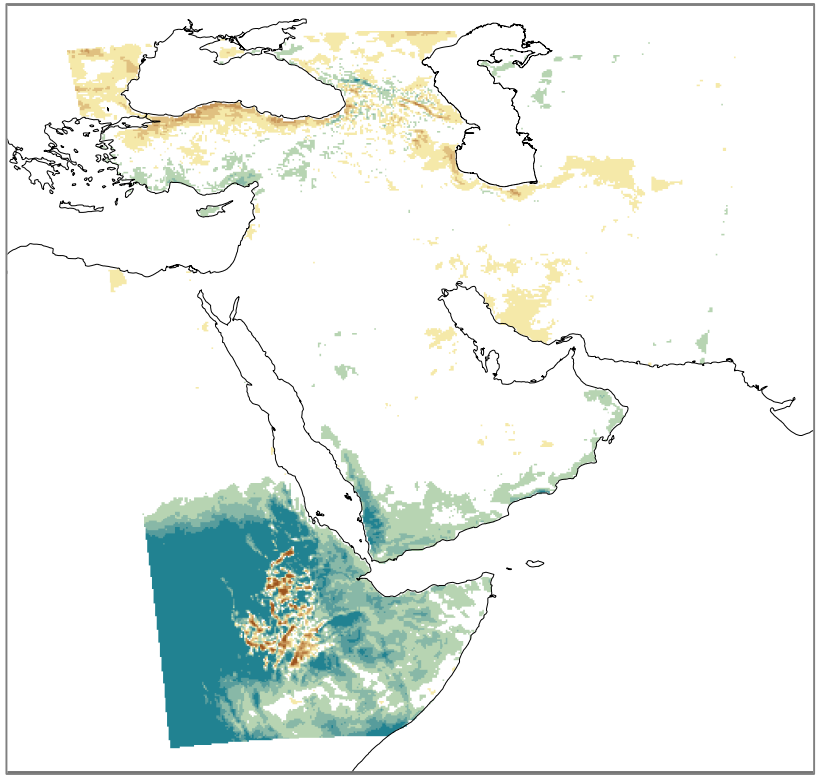

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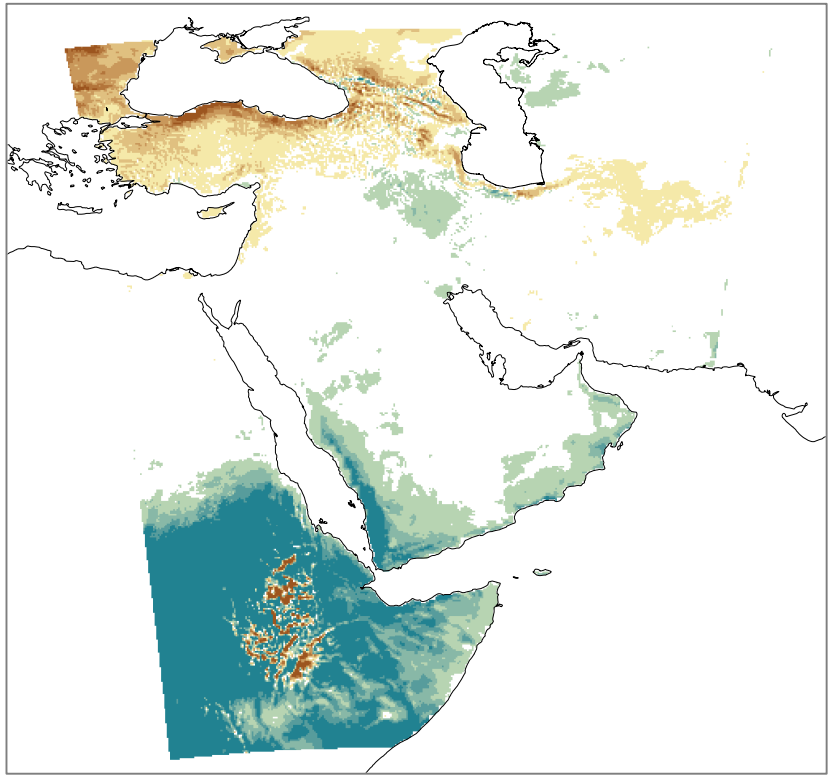

Precipitation (mm/month)

2.5 5 10 15 25 50 75 100 150

Change in precipitation (mm/month)

-8 -6 -4 -2 0 2 4 6 8

Change in precipitation (mm/month)

-8 -6 -4 -2 0 2 4 6 8

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Change in Seasonal Evaporation (Nov-Apr)

Compared to the reference period based on ensemble of six Mashreq Domain RCM outputs, SSP5-8.5

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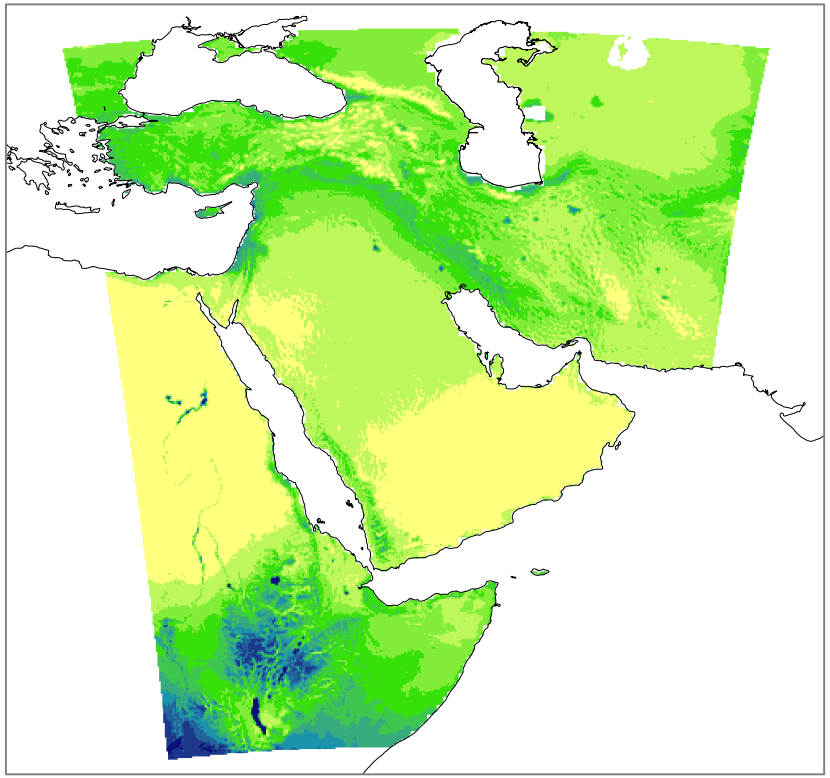

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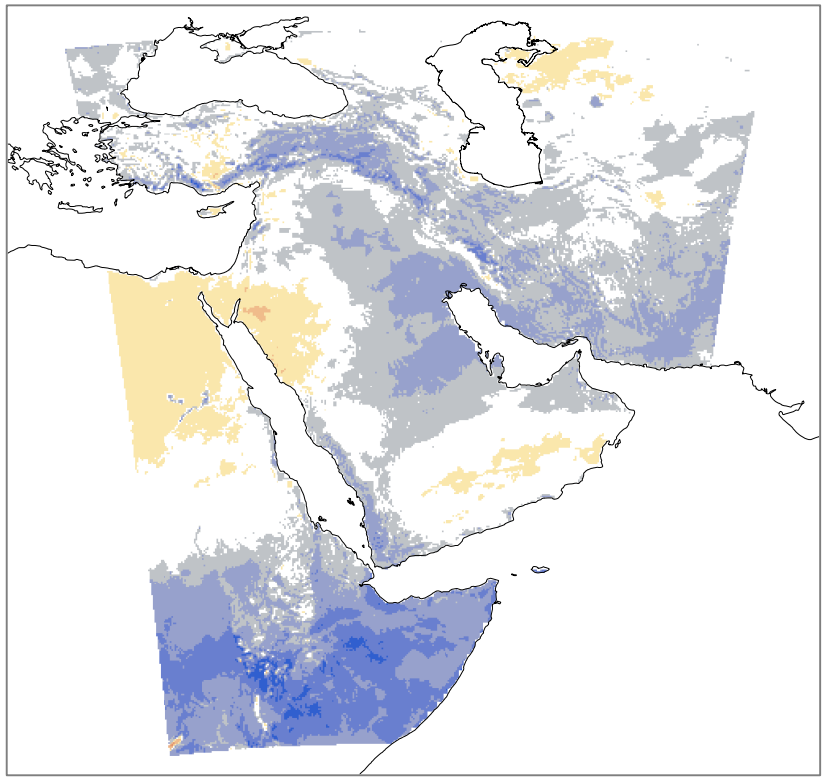

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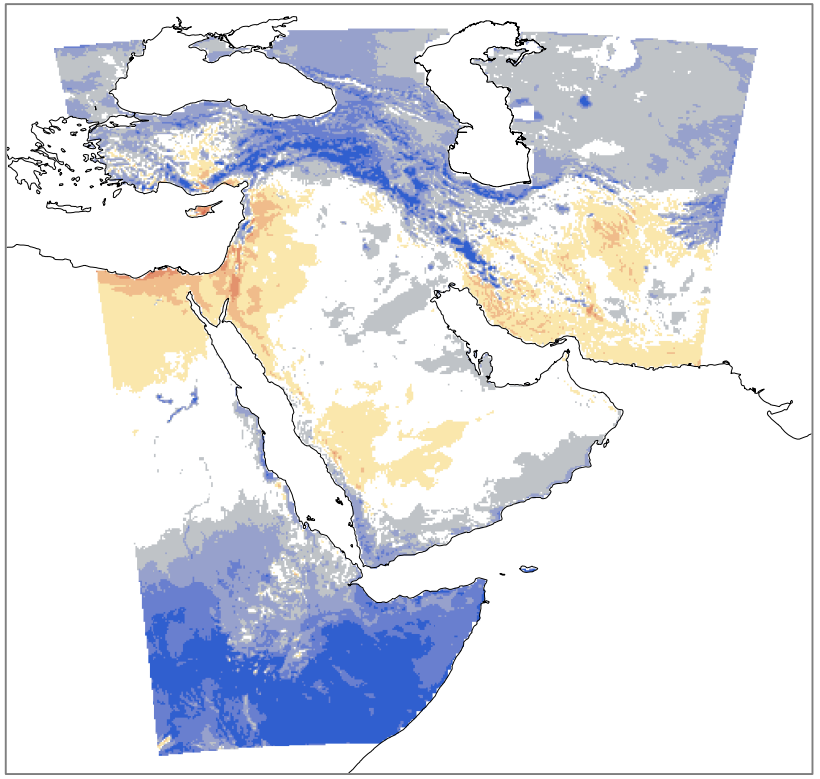

Evaporation (mm/month)

Change in evaporation (mm/month)

Change in evaporation (mm/month)

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Change in Seasonal Evaporation (May-Oct)

Compared to the reference period based on ensemble of six Mashreq Domain RCM outputs, SSP5-8.5

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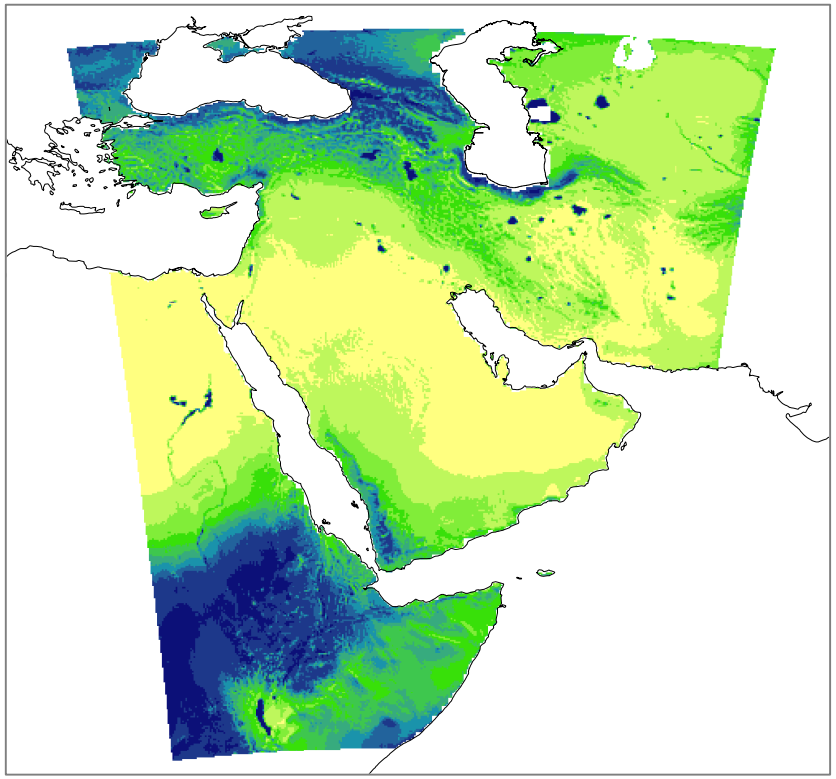
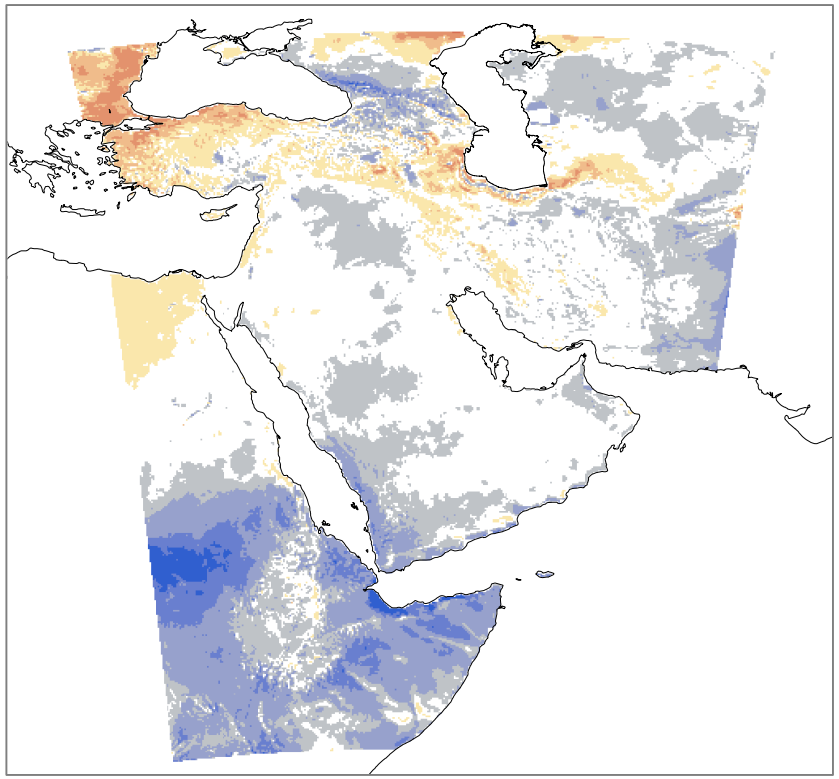


2021 – 2040



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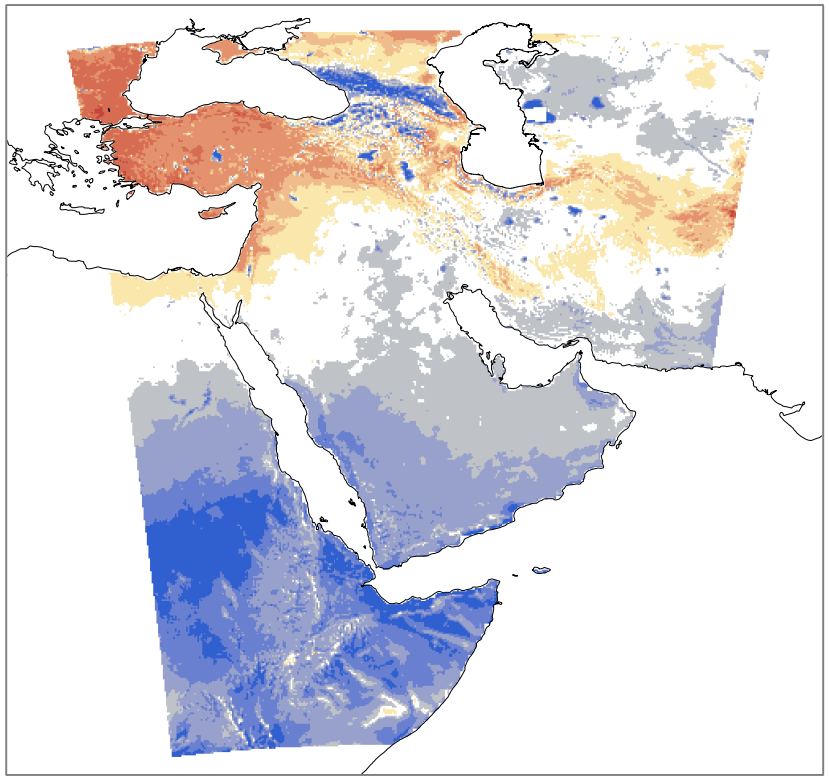


Evaporation (mm/month)

10 20 30 40 50 60 70 80 100

Change in evaporation (mm/month)

-6 -4 -2 -1 0 1 2 4 6

Change in evaporation (mm/month)

-6 -4 -2 -1 0 1 2 4 6

Summary of Mashreq Domain findings in the GCC

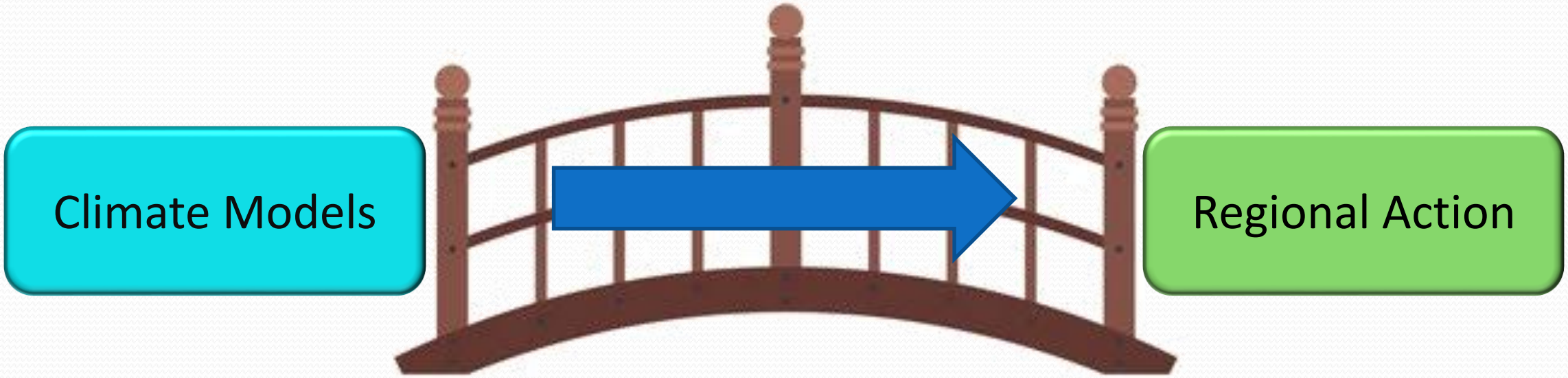
1. By **near-term** (2021-2040), **temperature** is projected to **increase 0.8 °C** during the Nov-Apr season and **0.9 °C** during the May-Oct season, **compared to just over a decade ago** (1995-2014)

2. By **mid-term** (2041-2060), **temperature** is projected to **increase 1.9 °C** annually, compared to just over a decade ago (1995-2014)

3. **Precipitation** will continue to have **interannual and spatial variability**, but will generally increase 2.1 mm/month in the near-term during the wet season. Projected increases are less by mid-term (1.4 mm/month)

4. Precipitation is projected to increase slightly during the **dry season**, largely due **to increased cyclonic activity** in coastal areas, averaging 0.9 mm/month by near-term and 1.6 mm/month by mid-term

5. By mid-term, some areas project **decreasing evaporation despite** increasing precipitation and temperature during the Nov-Apr season, due to **limited water availability** in the hydrological cycle

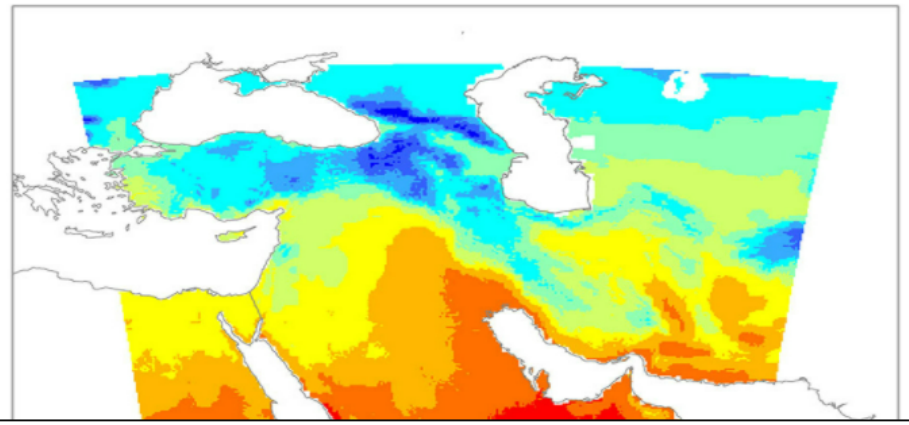


- Input RCM outputs in lieu of observed meteorological data into analyses (i.e. hydrological/hydrogeological, agricultural/irrigation, and economic models)
- Link climate maps with other geospatial datasets (i.e. vulnerability assessments) – **Maps are an effective communication tool!**

2040

Mashreq Domain

Mean temperature based on ensemble of six SSP5-8.5 projections - Mashreq Domain - 10 sq km resolution



RICCAR

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- Technical Notes
- Training Materials
- Booklets
- Data Requests

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

Policy Guidelines for Data Dissemination

1. Background

The Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) is a joint initiative of the United Nations and the League of Arab States launched in 2010. RICCAR is implemented under the auspices of the Arab Ministerial Water Council and further derives is mandate from resolutions adopted by the Council of Arab Ministers Responsible for the Environment, the Arab Permanent Committee for Meteorology and the ESCWA Ministerial Session. Additional information on RICCAR and is contributing partners is available at www.riccar.org.

The RICCAR outputs and constituent databases are based on an integrated assessment methodology that includes:

- Regional climate modelling (RCM) outputs for the CORDEX-MENA Domain (Arab Domain), which is among the domains included in the Coordinated Regional Climate Downscaling Experiment (CORDEX) of the World Climate Research Programme.
- Regional hydrological modelling (RHM) outputs for the surface water basins in Arab States, including the land and water areas of surface water basins that are shared or transboundary in nature that include areas external to the Arab region.
- Integrated vulnerability assessment (IVA) outputs for various sectors across the Arab region covering the 21 Arab States included in the MENA Domain.

The RICCAR assessment outputs are available in the Arab Climate Change Assessment Report: Main Report and its Technical Annex.

2. Principles of data acquisition and access

2.1. Users may request bias-corrected regional climate modelling (RCM) and regional hydrological modelling (RHM) outputs for the Arab Domain. Available RCM and RHM output variables are described in the RICCAR Technical Note Regional Climate Modelling and Regional Hydrological Modelling Applications in the Arab Region prepared by SMHI.

- Temperature, precipitation, and hydrological outputs are available with daily frequency from 1950 to 2100 for RCP 4.5 and RCP 8.5 at the scale of 50x50 km. Extreme climate indices are available both annually and seasonally for the same period.
- RCM and RHM ensembles for the reference period, near-century, mid-century, and end-century are available for RCP 4.5 and RCP 8.5 at the scale of 50x50 km.

2.2. Users may also request socio-economic geospatial data used for the integrated vulnerability assessment (IVA), described in the RICCAR Technical Note Integrated Vulnerability Assessment: Arab Regional Application prepared by UN-ESCWA, ACSAD and GIZ.

UIDELINE

LEAD AUTHOR: ESCWA

DATE PUBLISHED: 2019-MAR

Description

Individuals and institutions requested data should request in writing by completing and signing this form. Submit the request to escwa-h2o@un.org

A closer look….

Training Workshop 1
From Science to Analyses to Policymaking: Simplifying regional climate modelling outputs and their applications in the GCC and beyond

15 February 2022
16:00 (Virtual session, Riyadh time)

- Why RCM outputs are preferred over trend analyses
- How to obtain climate modelling outputs
- How to properly use climate modelling outputs
- And much more

Thank You

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