Climate Change Projections for the Arab Region

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Some Signatures of Recent Climate Changes in the Arab World

- Warming (Increase in Temperature)
- Drought (Decrease in Rainfall)
- Change in storms intensity and frequency
Spatial Scale of the Climate Process

Downscaling is required to capture regional to local phenomena.

Global

Continental

Regional

Local

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High Performance Computing (HPC) – Cluster Workstations

KAU-SEBA

Technical Details
• 500 core processors
• 120 TB storage capacity available
• 15 Thin clients
• 20 Workstations attached

HPC (12,000 cores) is under process to be acquired by KAU

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Regional Climate Projection: the Arabian Peninsula
Possible Long-term Change in Tmin (°C)
Possible Long-term Change in Tmax (°C)
Possible Long-term Change in Rainfall (%)
Saudi Arabia:
Out of 50 years (2021-270), 42 (8) years are expected to be dry (wet) compared to the base period (1971-2000)
Regional Climate Projection:
Morocco:
A1B: Future (2021-2050) changes compared to the present (1971-2000) of the Wet season (Oct-Mar) in Morocco.

Maximum number of consecutive dry days (in days)

Total number of high precipitation events (in %)

Future changes as projected by ARPEGE-Climate model (50km over Morocco).

F. Driouech
CGCM at CECCR Testing for Seasonal Forecast
Rainfall: Jeddah 25 NOV 2009

KAU-CGCM: T106L44 (~ 125 km)
Total Rainfall (mm/month)

Observed: TRMM Nov 2009
Total Rainfall (mm/month)
Rainfall: Riyadh 5 MAY 2010

KAU-CGCM: T106L44 (~ 125 km)
Total Rainfall (mm/month)

Observed: TRMM May 2010
Total Rainfall (mm/month)
Rainfall: Jeddah 26 JAN 2011

KAU-CGCM: T106L44 (~ 125 km)
Total Rainfall (mm/month)

Observed: TRMM Nov 2000 Total Rainfall (mm/month)

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Center of Excellence for Climate Change Research (CECCR), King Abdulaziz University (KAU)

KAU Climate Model Seasonal Prediction for January 2012 – Total Rainfall (mm/month)

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CORDEX: Arab Domain

Selection of the DOMAIN!
CORDEX (COordinated Regional climate Downscaling Experiment) is a program for dynamical downscaling to produce regional climate change scenarios globally. International efforts are behind it for its success for the impact and adaptation studies.
ARAB WORLD

ARAB Domain-A

Recommended ARAB Domain

Suggested ARAB Domain

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14 Jan 2012
Climate Change Projection in the Arab World using Regional Climate Model
Rainfall Change (2021-2030) compared to (1991-2000)
Climate Change Projection in the Arab World using Global Climate Model
CMIP3 (A1B)

Plots:

- Wet season (NOV-APR) present climate (1981-2000)
- Wet season (NOV-APR) precipitation change
  - Mid-century (2041-2060)
  - End of century (2081-2100)
# CMIP3 Model Details

<table>
<thead>
<tr>
<th>Name used</th>
<th>IPCC-ID</th>
<th>Atmospheric Resolution</th>
<th>Country</th>
<th>References</th>
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<tr>
<td>MRI</td>
<td>MRI-CGCM2.3.2</td>
<td>2.8° × 2.8°</td>
<td>Japan</td>
<td>Yukimoto et al. (2001)</td>
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<td>IAP</td>
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<td>CCCMA3</td>
<td>CCCMA-CGCM3.1(T47)</td>
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<td>Flato et al. (2000)</td>
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<td>MIROC3-H</td>
<td>MIROC3.2(hires)</td>
<td>1.1° × 1.1°</td>
<td>Japan</td>
<td>Hasumi and Emori (2004)</td>
</tr>
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<td>GISSER</td>
<td>GISS-ER</td>
<td>4° × 5°</td>
<td>USA</td>
<td>Scmidt et al. (2006)</td>
</tr>
</tbody>
</table>
CMIP3  Wet Season Precipitation Change

Mid of 21st century

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CMIP3 Wet Season Precipitation Change
End of 21st century

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CMIP5 (RCP8.5)

Plots:

- ✓ Annual mean temperature change
- ✓ Annual mean precipitation change
- ✓ Annual soil moisture change

Mid-century (2046-2065 minus 1986-2005)
End of century (2081-2100 minus 1986-2005)
Annual mean temperature change

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Annual mean precipitation change

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Annual mean soil moisture change

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Summary

• Building Regional Climate database is important for conducting vulnerability assessments and impact studies in the Arab World.

• Climate Models are the invaluable tools building climate database to be used in Climate Extreme analyses and applicable as input for Climate Change vulnerability & impacts assessments.

Global and regional climate models confirm that generally Rainfall is decreasing and temperature is increasing.
THANK YOU for your attention