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

Overview of Progress Made & Follow-up on Recommendations Adopted at RICCAR EGM3

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Sustainable Development and Productivity Division, ESCWA

RICCAR EGM 4:
Expert Group Meeting on Regional Cooperation for Climate Change Impact Assessment on Water Resources in the Arab Region
5-6 July 2012 – Beirut, Lebanon
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.

The Regional Initiative aims to provide a **common platform** for addressing and responding 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 adaptation at the regional level.**
### Mandates

- **Arab Ministerial Declaration on Climate Change (Dec 2007)** - adopted by the LAS Council of Arab Ministers Responsible for the Environment (CAMRE).
- **ESCWA 25th Ministerial Session Resolution on Climate Change (May 2008)** - called for the preparation of an assessment of socio-economic vulnerability caused by climate change impacts on water resources (Sana’a).
- **Arab Summit for Economic and Social Development (Jan 2009)** - accepted the preparation of project to assess impacts of climate change on water.
- **Arab Ministerial Water Council (AMWC) (July 2010)** - approved IWRM project brief submitted by LAS & ACSAD called “Assessment of Climate Change Impacts on Available Water Resources in the Arab Region” based on Regional Initiative concept note to support Arab Water Security Strategy.

### Coordination Mechanisms

- **UN-LAS 9th Sectoral Meeting focused on Climate Change (June 2009)** - called for UN-LAS joint action on vulnerability studies to assess climate change impacts on water, land, drought, desertification, biodiversity, health and agriculture.
- **Regional Initiative Core Group (Oct 2009)** – UN-LAS core partners established group following 1st expert group meeting (Oct 2009); regular EGMs.
- **Regional Coordination Mechanism/Thematic Working Group on Climate Change (Nov 2010)** - Initiative adopted & reported on as a joint UN-LAS inter-agency initiative by UNEP.
- **AMWC: Ministerial Council, Executive Bureau, and Technical Scientific & Advisory Committee (June 2011, Jan & June 2012)** – Receive progress reports by ACSAD & ESCWA on Regional Initiative.
- **CAMRE Permanent Sub-Committee for Meteorology & Climate and Climate Change Sub-Committee (January 2012, March 2012)** – Endorsement of Regional Initiative.
Mapping Inter-Agency Support

Arab Ministerial Water Council
Climate Change Impact on Water Resources Project

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

SIDA-Funded Project:
Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region
including Extreme Events & Regional Knowledge Hub
LAS, ESCWA, ACSAD, SMHI, WMO, UNISDR

UNU Info Hub
UNESO RCM
UNEP CC Networks + National UNFCCC Support

GIZ Project:
Adaptation to Climate Change in the Water Sector in the MENA Region
Including Vulnerability Tools & Knowledge Hub with Adelphi, ESCWA, ACSAD

Preparation of National CC Communications & Strategies

Support to Met Offices
Establishment of Regional Early Warning System
Implementation Framework – الهيكل التنفيذي للمشروع

- **Baseline Review & Knowledge Management**

  حصر المعلومات الأساسية المتاحة وإدارتها

- **Integrated Assessment**

  تقييم تأثير التغير المناخي
  Climate Change Impact Assessment

  تقييم قابلية التأثر من التغير المناخي
  Climate Change Vulnerability Assessment

- **Capacity Building & Institutional Strengthening**

  بناء القدرات
  for Water Ministries, Meteorological Offices, Arab Research Centers

- **Awareness Raising & Information Dissemination**

  رفع الوعي

Pillar 1: Knowledge Base

- Regional Knowledge Hub
  - Climate Data
  - Water Data
  - Socio-Economic Data
  - GIS & Integrated Maps
  - Vulnerability Hotspots
  - Outputs from Regional Climate Model
  - UNFCCC Communications
  - IWRM Plans
  - Links to other Knowledge Tools
  - Password Protected Access to RCM Codes

Data and/or Services?
Step 1: Global Climate Modeling using General Circulation Model
Step 2: Regional Climate Modeling
Step 3: Regional Hydrological Modeling
Step 4: Vulnerability Assessment
Step 5: Integrated Mapping
Representative Concentration Pathways (RCPs)
New basis for Climate Modeling & IPCC Projections

Graph adapted from: Meinshausen et al., 2010
Impact Assessment Component

Different GCMs for the Same RCP

Ensembles used to reduce uncertainty at level of RCMs & RHMs

Ensembles aggregate findings of different RCMs & RHMs applied for same RCP & Domain
Regional Climate Modeling: Establishing an Arab Domain under CORDEX

CORDEX: COordinated Regional climate Downscaling EXperiment

- Regional Initiative establishing the limiting boundary conditions (LBCs) of a new Arab Domain
- Arab Domain will be vetted/approved by CORDEX.
- SMHI completed Sensitivity Analysis to set up Arab Domain in consultation with partners
- Domain to cover headwaters of Nile & Indian Ocean effects
- Comoros to be covered in parallel maps in own domain.

* Arab Domain shown here only for illustrative & comparative purposes; domain is larger

Illustration adapted from Giorgi et al., 2009, p.178, as drawn from collective CORDEX effort displayed at: http://www.meteo.unican.es/en/projects/CORDEX.
Regional Hydrological Modeling (RHM)

**General Circulation Model (GCM)**
(300 km x 300 km):

*Over Land and Ocean*: Air temperature and pressure, Wind speed and direction, humidity (specific, relative), Precipitation (rain & snow), number of sunny / cloudy days, river discharge / runoff, soil moisture, Earth Radiation Budget, Ozone, Aerosols.

*Ocean*: Salinity, Sea level, Sea ice, Currents, Ocean Layering,

*Terrestrials*: River discharge / Surface Runoff, Snow cover, Glaciers and ice caps, Permafrost, Soil moisture, Vegetation

**Regional Climate Model (RCM)**
(50km x 50km or 25km x 25km)

*Over Land and Ocean*: Air temperature and pressure, Wind speed and direction, humidity (specific, relative), Precipitation (rain & snow), river discharge / runoff, soil moisture, number of sunny / cloudy days, Aerosols

*@ Terrestrials*: River discharge / Surface Runoff, Snow cover, Soil moisture, Vegetation

**RHM Incorporates:**
- RCM Outputs
- Elevation Data (DEM)
- Land Parameters
- Hydrological data on surface water
- Hydrological data on groundwater

**Regional Hydrological Model (RHM)**

**Hydrologic Stations**: Air Temperature and pressure at Surface, Surface Evapotranspiration, Precipitation (rain & snow)

**Surface**: Runoff, Flow (into/out of), Snow amount, snow Melt, Soil Moisture Content

**Groundwater**: Flow in & out of grid-cell.

**Calibration**

**Basin-Centered Hydrological Model (BHM)**

**Groundwater**: water table, Change in Groundwater Level, Groundwater Infiltration Rate, aquifer safe yield, Seawater Intrusion, Salinization

**Surface**: soil moisture, runoff, Crop Water Demand, Agricultural Productivity

**Two Options**: RCM to Regional HM or RCM to Basin HM
Vulnerability Assessment

1. Regional Impacts of Climate Change
2. Impacts of Climate Change on Water Resources
3. Human Activities
4. Integrated Mapping for Vulnerability Assessment

- Climate Change
- BioPhysical
  - Water Resources
    - Climate Impact
- Socio-Economic
  - Primary Impact
    - Human Actions
      - Secondary Impact
        - Vulnerability
Integrated Mapping for Vulnerability Assessment

Overall Vulnerability Map

Identification of Vulnerability Hotspots

1. Impacts of Climate Change on Water Resources
   - Primary Impact: Crop Water Demand
   - Secondary Impact: Groundwater Level

2. Human Activities

3. Irrigated / Rainfed Areas

4. Population Density

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<table>
<thead>
<tr>
<th>Regional Workshops / EGMs</th>
<th>Participants</th>
<th>Lead</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshop on Projection/Prediction and Extreme Events Indices in the Arab Region</td>
<td>Arab Met Offices</td>
<td>WMO</td>
<td>13-16 March 2012 Casablanca</td>
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<tr>
<td>Regional Workshop on Applications and Analysis of Regional Climate Models</td>
<td>Arab Water Ministries (technical staff)</td>
<td>SMHI, ACSAD</td>
<td>2-4 July 2012 Beirut</td>
</tr>
<tr>
<td>Expert Group Meeting 4 on the Regional Initiative</td>
<td>RICCAR Partners &amp; Arab Water Ministries</td>
<td>ESCWA, UNEP, LAS</td>
<td>5-6 July 2012 Beirut</td>
</tr>
<tr>
<td>National Workshops for Disaster Losses Inventories (Tunisia, Morocco, Yemen, Jordan)</td>
<td>Inter-ministerial (planning, interior, environment, sectors)</td>
<td>UNISDR</td>
<td>September 2012 – April 2013</td>
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<tr>
<td>Consultative Workshop with Arab Met Offices</td>
<td>Arab Met Offices</td>
<td>WMO, LAS</td>
<td>October 2012*</td>
</tr>
<tr>
<td>Regional Workshop on linking Regional Climate Models to Regional Hydrological Models</td>
<td>Arab Water Ministries (technical Staff)</td>
<td>SMIH, ACSAD</td>
<td>March 2013*</td>
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<tr>
<td>Expert Group Meeting on the Preliminary Findings of the Regional Climate Models covering the Arab Domain</td>
<td>Arab Water Ministries (senior staff)</td>
<td>SMHI, ACSAD, ESCWA</td>
<td>June 2013*</td>
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* Date to be confirmed
## Pillar 4: Awareness Raising & Information Dissemination

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Activities Completed</th>
<th>Activities in Progress</th>
</tr>
</thead>
</table>
| ✓ Raise public awareness on climate change phenomenon and encourage the participation of local civil society to face it. | ✓ Integrated Assessment Guidance Document on integrated assessment  
  Doc#: E/ESCWA/SDPD/2011/1  
 ✓ Brochure  
 ✓ Website  
  www.escwa.un.org/RICCAR | ☐ Regional Knowledge Hub  
 ☐ National Disaster Inventories  
 (support in 5 Arab countries)  
 ☐ Technical Materials  
 ☐ Policy Briefs  
 ☐ Integrated Mapping Tools  
  - English/Arabic language accessibility on final outputs |
Follow-up on EGM 3 Recommendations

Baseline Review Recommendations

- Efforts should be undertaken to consolidate and analyze available climate data in the Arab region in order to characterize the observed change in climate in the region and to validate the baseline simulations that are used to support climate models.

- Arab Governments are encouraged to provide the climate and hydrological observational data that is needed to support the validation and calibration of climate and hydrological models being pursued within the context of the Regional Initiative.

- The LAS through its relevant bodies should adopt resolutions requesting Arab Governments to provide information to support the Regional Initiative.

- ✔ = Completed
  - ❏ = In progress
  - ○ = Not started
Follow-up on EGM 3 Recommendations

**Integrated Assessment**

- Models should be selected and fine-tuned to account for regional specificities, e.g., wadis, sand storms, dust storms, deserts, sea water intrusion, salinity of water and land resources, foliage differences associated with palm trees, etc.

- Arab experts should increase their contribution to the development, review, and validation of GCMs and RCMs.

- Arab experts should support and apply validation techniques suitable for arid and semi-arid regions.

- In delineating the Arab Domain through sensitivity analysis, consideration should be given to geographic coverage and computing efficiency, without sacrificing accuracy, model boundary areas, inclusion of headwaters of shared rivers, inter-tropical convergence zone (ITCZ), desert climates, and the targeted resolution for analysis.

- **Validation of RHMs** should be supported by test basins of appropriate size which demonstrate representative characteristics and geographical distribution that take into consideration the different requirements needed for modelling large/small catchments.

- The LAS should encourage member states to provide needed data; for example, each Arab country could be asked to identify at least one basin in their territory and provide specific information on that basin to support the calibration of the regional hydrological model.

- Considering the technical/resource constraints associated with modelling the Arab region as a single contiguous domain, climate modelling will be undertaken in two segments: a larger Arab domain covering countries situated on the Asian continent and African mainland; and a smaller domain covering Comoros.

- Climate change projections conducted within the framework of the Regional Initiative should be based on one or more RCPs ...rather than those included in its Special Report on Emissions Scenarios (SRES)
Follow-up on EGM 3 Recommendations

Awareness Raising Recommendations

- The development of an on-line database or e-knowledge hub that would increase access to information about the Regional Initiative and its associated activities and outputs.

- A set of criteria should be adopted to determine the preferred platform for storing and disseminating information about the Regional Initiative and its associated activities.

- There is a need to increase complementary and coherence among climate modelling activities in the Arab region, provide additional information about the Regional Initiative, and coordinate with other actors working in the region who can contribute to that end.

  ➢ Key Success: Partnership with new GIZ Project
Follow-up on EGM 3 Recommendations

**Capacity Building and Institutional Development**

- Cooperative efforts among Arab countries, through joint workshops and regional activities such as RCOFs, are essential to overcome climate data challenges related to data rescue, data quality, indices, diagnostics and climate change assessments.

- National capacity building and on-the-job training (including participation in workshops and expert group meetings) are needed to improve understanding and capacity for climate modelling, prediction and projection as well as to use the state-of-the-art climate information products for decision-making.
  
  ✓ Workshop for Met Office
  ✓ Workshop of Ministry of Water Resources

- Improved coordination is needed between national water ministries and national meteorological services to support climate and hydrological modelling efforts.
Regional Initiative Implementation Partners

Partners

ESCWA  UNEP  WMO  ACSAD  LAS

SMHI  UNESCO  UNU-INWEH  ISDR  GIZ

Donors

Sida  Federal Ministry for Economic Cooperation and Development

National Research Institutes (under formalization)

Ministry of Water Resources and Irrigation (Egypt)
Center of Excellence for Climate Change Research, KAU
King Abdullah University of Science & Technology (KAUST)
Climate Services Center (CSC), Germany
Thank you!

Additional Information on the Regional Initiative available at:

www.escwa.un.org/RICCAR