

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

Carol Chouchani Cherfane, Chief, Water Resources Section, UN-ESCWA RICCAR Coordinator

Expert Group and Inception Meeting of UNDA Project "Strengthening National Capacities of Conflict-Affected Countries to Manage Water Scarcity and Drought" (Beirut, 25 June 2013) <u>Regional Initiative for the Assessment of the Impact of</u> <u>Climate Change on Water Resources and</u> Socio-Economic Vulnerability in the <u>Arab Region</u> (RICCAR)

Objective

Drought Preparedness is a central component of Climate Change Adaptation in the Arab Region

The Regional Initiative aims to provide a <u>common platform</u> for addressing and responding to climate change impacts on freshwater resources in the Arab region by serving as the basis for <u>informed dialogue, priority setting and policy formulation</u> <u>on climate change adaptation at the regional level</u>.

RICCAR: UN-LAS Regional Mandates

Mandates

- Arab Ministerial Declaration on Climate Change (Dec 2007) - adopted by Council of Arab Ministers Responsible for the Environment (CAMRE); first joint Arab statement on Climate Change
- 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 the IWRM project brief submitted by LAS & ACSAD called "Assessment of Climate Change Impacts on Available Water Resources in the Arab Region" based on UN-LAS Regional Initiative concept note prepared based on RICCAR EGM#1 outcomes.

- Establish studies and research centers for climate change in the regions of developing countries, including the Arab region. These centers should be concerned with examining impacts and challenges

1. *Requests* the (ESCWA) secretariat to prepare an assessment of the vulnerability to climate change of economic and social development in the region, with particular emphasis on fresh water resources;

1- Build a <u>regional integrated database</u>

electronically connected with international and global databases in an interactive manner in order to continuously update it and connect it with GIS to be able to follow-up the development in climatic trends in the Arab region;

2- <u>Application of regional climate models</u> in the Arab countries to improve its performance and accuracy;

3- Assess the impact of CC on several sectors including <u>biodiversity</u>, <u>agriculture</u>, <u>food</u> <u>security</u>, <u>land use</u>, <u>forestry</u>, <u>water resources</u>, <u>population and human settlements</u>, and <u>social</u> <u>economics</u>, specifically on <u>agricultural</u> <u>production</u>, <u>drought</u>, <u>decertification</u> and on <u>sustainable development in general</u>;

UN-LAS Coordination Mechanisms for RICCAR

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); Annual 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 2012, June 2012, Jan 2013, June 2013) – Receives updates on RICCAR by ESCWA.
- Arab Permanent Committee for Meteorology/Climate & Climate Change Sub-Committee (Jan 2012, March 2012, March 2013)
 - Endorsement of RICCAR; follow-up via APCM.



Coordination with Complementary Regional Initiatives for a Common Science Base

Group

Group

RICCAR: Mapping Inter-Agency Support

Arab Permanent Committee for Meteorology

Arab Ministerial Water Council

Climate Change Impact on Water Resources Project

Agriculture Ministries

> ACSAD Board

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



RICCAR Implementation Framework 4 Pillars





Data Collection, Data Rescue, Databases



Land Surface Stations: Monthly Air Temperature Dataset (GHCN, HadCRUTEMP4): Total of 227 stations of which 77 stations with incomplete records (red colors) thus not used in IPCC AR4

Compiled by ACSAD. ACSAD SIDA-ESCWA Project Progress Report March 2012 (pg.6)

WMO-led Climate Data Rescue Sub-Regional Training Workshop (Amman, June 2013)



Distributed climate observing stations in the Arab/MENA Domain – *Compiled by ACSAD*

ACSAD SIDA-ESCWA Project Progress Report / March 2013 (pg.5)

Pillar 2: Integrated Assessment Methodological Framework



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

Impact Assessment Component



for the

Same RCPs

Different



Special Report on Emission Scenarios (SRES)

SRES Scenarios used in IPCC AR4 (2007)



Representative Concentration Pathways (RCPs) New basis for Climate Modeling & IPCC Projections for AR5



Graph adapted from: Meinshausen et al.,2010

Inter-Governmental Panel on Climate Change: Areas considered for regional averages in IPCC AR4



From Dr. Rupa Kumar Kolli, WMO Presentation to RICCAR EGM #2 (Beirut, 2010)

Regional Climate Modeling: Establishing an Arab/MENA-CORDEX Domain

CORDEX: COordinated Regional climate Downscaling

- Arab/MENA-COREX
 Domain sets the
 limiting boundary
 conditions for regional
 climate modelling
- Domain approved by CORDEX in June 2012.
- SMHI conducted Sensitivity Analysis & set up Domain in consultation with ACSAD, UNESCO, KAU, KAUST, ESCWA
- Domain covers headwaters of Nile & Indian Ocean effects
- Comoros may be covered in own map.



* 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.



CORDEX Regional Climate Model Output Fields

Domain		Essential		Description: Minimal Variable Requirements		
		Climate Variables		IPCC: Global Climate Model Output Fields	CORDEX: RCM Output Fields	
Atmospheric	Surface	Air temperature	•	Surface skin temperature	Same as GCM output fields	
(over land,			•	Near-surface (2 m): air temp, daily-max daily-min		
sea and ice)		Wind speed and direction	•	Eastward winds & Westward winds	Same as GCM output fields	
			•	Near-surface winds (10 m)		
		Water vapour/	•	Water evaporation flux from canopy, humidity	Same as GCM output fields	
		Precipitation	•	Precipitation & Convective precipitation		
			•	Snowfall & Atmospheric water vapour content		
		Pressure	•	Air pressure on the ground surface & sea level	Same as GCM output fields	
			•	Surface downward stresses due to wind		
		Radiation budget	•	Sensible & Latent Heat Flux	Sensible & Latent Heat Flux	
			•	Upward/Downwelling heat fluxes	Downwelling &Upward heat fluxes	
			•	Heat flux corrections & Prescribed heat flux	Duration of sunshine	
	Upper-air:	Not applicable	•	Atmospheric boundary layer thickness (meters)	Same as GCM output fields	
	(Up to the stratopause)	Air temperature	•	For each specified pressure elevation	At 850 hPa, 500 hPa, 200 hPa	
-		Wind speed and direction	•	For each specified pressure elevation:	Eastward and Westward winds	
				Eastward and Westward winds, geopotential height	200 hPa: geopotential height	
		Water vapour/	•	For each pressure elevation: cloud parameters (area	• Specific Humidity	
		Precipitation		fraction, ice content, water content)	Total Cloud Cover	
					Column Ice Water and Vapour	
		Radiation budget	•	Heat fluxes incoming and outgoing (long wave and	• Flux at the top of the atmosphere	
	a			shortwave)	• Outgoing long-wave&Short-wave	
Composition		•	Mole traction of ozone in air	Not specifically required		
			•	Concentration of sulphate aerosols (NOx, SOx)		
Terrestrials			•	Surface runoff, snow (area fraction, amount, melt flux)	• Surface runoff, Snow (Area	
				Glaciers (land ice area fraction)	Permetrest (Soil frozen water	
5001/4 (00) : .				Soil moisture (content, content at field conscitu	• remainst (Son frozen water	
Sources: ESCWA (20) based on			ľ	content of soil layer root depth)	• Total moisture content	
<u>GCOS (2011), IPCC (2009) and WCRP (2004)</u>				content of soli layer, toot depuil)		



Vulnerability Assessment



Vulnerability Assessment Framework



Adopts IPCC Approach to VA using RCMs for Impact Component Different from DRR Approach to VA based on Hazard & Risk Analysis

Integrated Mapping



Incorporating Extreme Events

Floods

- Coastal flooding
- Wadi flooding
- Urban flooding/ stormwater drainage



Tropical Cyclone Gonu: Oman (2007) *Credit: H.M. Fritz et al. / Estuarine, Coastal and Shelf Science 86 (2010) 102–106*

Droughts

- Regional/sub-regional Climate
- Cyclical
- Duration

Displacement

Climate Change v/s Human Action or Inaction

- "In Ar Raqqah (Syria), many displaced farmers talk about wells running dry, and turning polluted.
- "My uncle's <u>well used to be 70 meters deep, now it's</u> <u>130 meters and now the water became salty, so we</u> <u>closed it down</u>," said Khalaf Ayed Tajim, a stocky sheep herder and farmer who heads a local collective for displaced northerners. He left his native village 60 miles from here when half of his <u>herd died off</u> and his <u>fields dried up</u>, and <u>now lives in a concrete bunker</u> <u>with his 17 children, two wives, and his mother</u>." – "**The Earth is Parched where Syrian Farms Thrived**", NYT, 13 Oct 2010

Pillar 3: Capacity Building & Institutional Strengthening

Regional Workshops / EGMs	Participants	Leads	Date
RICCAR Expert Group Meeting #3: Set-up of Regional Climate Modeling Approach	RICCAR Partners & Arab Water Ministries (senior staff)	ESCWA, UNEP, LAS	6-7 July 2011 Beirut
Workshop on Projection/Prediction and Extreme Events Indices in the Arab Region	Arab Met Offices	WMO	13-16 March 2012 DMN, Casablanca
Regional Workshop on Applications and Analysis of Regional Climate Models	Arab Water Ministries (technical staff)	SMHI, ACSAD	2-4 July 2012 Beirut
RICCAR Expert Group Meeting #4: Set-up of Regional Modeling Ensemble & Working Groups	RICCAR Partners & Arab Water Ministries (senior staff)	ESCWA, UNEP, LAS	5-6 July 2012 Beirut
National Workshops for Disaster Losses Inventories (Tunisia, Morocco, Yemen, Jordan)	Inter-ministerial (planning, interior, env)	UNISDR	September 2012 – April 2013
Sub-Regional Training Workshop on Climate Date Rescue & Digitization	Jordan, Palestine, Yemen. KSA Met Offices	WMO	11-13 June 2013 JMD, Amman
Regional Workshop on Linking Regional Climate Model Projections to Hydrological Models	Arab Water Ministries (technical staff)	SMIH, ACSAD	26-28 June 2013 Beirut
RICCAR Expert Group Meeting #5: Preliminary Findings of the Regional Climate Models covering the Arab Domain	Arab Water Ministries (senior staff)	ESCWA, UNEP, LAS, SMHI, WMO, ACSAD, UNISDR	December 2013 (tbc)

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Changes in extreme temperature and precipitation in the Arab region: long-term trends and variability related to ENSO and NAO

M. G. Donat, a,b* T. C. Peterson, M. Brunet, d,e A. D. King, a,b M. Almazroui, F R. K. Kolli, B Diamel Boucherf.^h Anwar Yousuf Al-Mulla.ⁱ Abdourahman Youssouf Nour.^j Ahmed Attia Alv.^k Tamer Ali Ali Nada,^k Muhammad M. Semawi,¹ Hasan Abdullah Al Dashti,^m Tarek G. Salhab,ⁿ Khalid I. El Fadli,º Mohamed K. Muftah,º Sidaty Dah Eida,º Wafae Badi,ª Fatima Driouech,ª Khalid El Rhaz,^q Mohammed J. Y. Abubaker,^r Ayman S. Ghulam,^s Amani Sanhouri Erayah,^t Maher Ben Mansour,^u Waleed O, Alabdouli,^v Jemie Salem Al Dhanhani,^w and Maied N. Al Shekaili." * Climate Change Research Centre, University of New South Wales, Sydney, Australia ^b ARC Centre of Excellence for Climate System Science, University of New South Wales, Sydney, Australia ^e NOAA's National Climatic Data Center, Asheville, NC, USA 4 Centre for Climate Change, Department of Geography, Universitat Rovira i Virgili, Tarragona, Spain ^a Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, UK ¹ Center of Excellence for Climate Change Research/Department of Meteorology, King Abdulaziz University, Jeddah, Saudi Arabia 8 World Meteorological Organisation, Geneva, Switzerland ^b National Climatogical Center, Algiers, Algeria ¹ Transport/Civil Aviation Affairs, Manama, Bahrain Climate Unit, Ministry of Transport, Djibouti, Djibouti * Ministry of Civil Aviation, Cairo, Egypt Jordan Meteorological Department, Amman, Jorda * Department of Meteorology, DGCA, Safa, Kuwait ^a Ministry of Public Works and Transport, Beirut, Lebanon ^o Libyan National Meteorological Center, Tripoli, Libya P Office National de la Météorologie, Nouakchott, Mauritania 9 Direction de la Meteorologie Nationale, Casablanca, Morocco ¹ Palestinian Meteorological Office, Ramallah, Palestine * Presidency of Meteorology and Environment, Jeddah, Saudi Arabia ¹ Sudan Meteorological Authority (SMA), Khartoum, Sudan ^a National Weather Institute, Tunis, Tunisia * UAE Airforce and Air Defence, Fujairah, UAE * National Center of Meteorology and Seismology, Abu Dhabi, UAE

ABSTRACT: A workshop was held in Casablanca, Morocco, in March 2012, to enhance knowledge of climate extremes and their changes in the Arab region. This workshop initiated intensive data compilation activities of daily observational weather station data from the Arab region. After conducting careful control processes to ensure the quality and homogeneity of the data, climate indices for extreme temperatures and precipitation were calculated.

This study examines the temporal changes in climate extremes in the Arab region with regard to long-term trends and natural variability related to ENSO and NAO. We find consistent warming trends since the middle of the 20th Century across the region. This is evident in the increased frequencies of warm days and warm nights, higher extreme temperature values, fewer cold days and cold nights and shorter cold spell durations. The warming trends seem to be particularly strong since the early 1970s. Changes in precipitation are generally less consistent and characterised by a higher spatial and temporal variability; the trends are generally less significant. However, in the western part of the Arab region, three is a tendency towards wetter conditions. In contrast, in the eastern part, there are more drying trends, although, these are of low significance.

We also find some relationships between climate extremes in the Arab region and certain prominent modes of variability, in particular El Niño-Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO). The relationships of the climate extremes with NAO are stronger, in general, than those with ENSO, and are particularly strong in the western part of the Arab region (closer to the Atlantic Ocean). The relationships with ENSO are found to be more significant towards the eastern part of the area of study. Copyright © 2013 Royal Meteorological Society

KEY WORDS climate extremes; climate change; observations; temperature; precipitation; ENSO; NAO

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*Correspondence to: M. G. Donat, Climate Change Research Centre, University of New South Wales, Sydney, Australia. E-mail: m.donat@unsw.edu.au

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Casablanca Workshop resulted in preparation by participants & publication of peer-reviewed journal article in Int'l Journal of *Climatology* on climate indices in Arab region

> (WMO ETCCDI Approach)

Pillar 4:									
Awareness Raising & Information Dissemination									
Objectives	Activities Completed	Activities in Progress							
 ✓ Raise public awareness on climate change phenomenon 	 ✓ Brochure ✓ Website <u>www.escwa.un.org/RICCAR</u> ✓ Integrated Assessment 	 Regional Knowledge Hub National Disaster Inventories Technical Docs/Policy Briefs Integrated Mapping Tool 							
 and encourage the participation of local civil society to face it. ✓ Provide tools to present simplified key messages to targeted stakeholders on 	<section-header><section-header></section-header></section-header>	 Linkages to Regional Projects: GIZ: ACCWaM UNDA Project: Strengthening National Capacities of Conflict-Affected Countries to Manage Water Scarcity and Drought UNDA Project: Developing the capacities of the Arab countries for climate change adaptation by applying IWRM 							
the monge.	ESCWA	 FAO Water Scarcity Initiative 							

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RICCAR Implementation Partners

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Research Institutes supporting RCM Ensemble

- Center of Excellence for Climate Change Research / King Abdulaziz University (KSA)
- King Abdullah University of Science and Technology (KAUST) (KSA)
- Climate Services Center (CSC) Germany



Thank you!

Additional information on the Regional Initiative is available at:

www.escwa.un.org/RICCAR