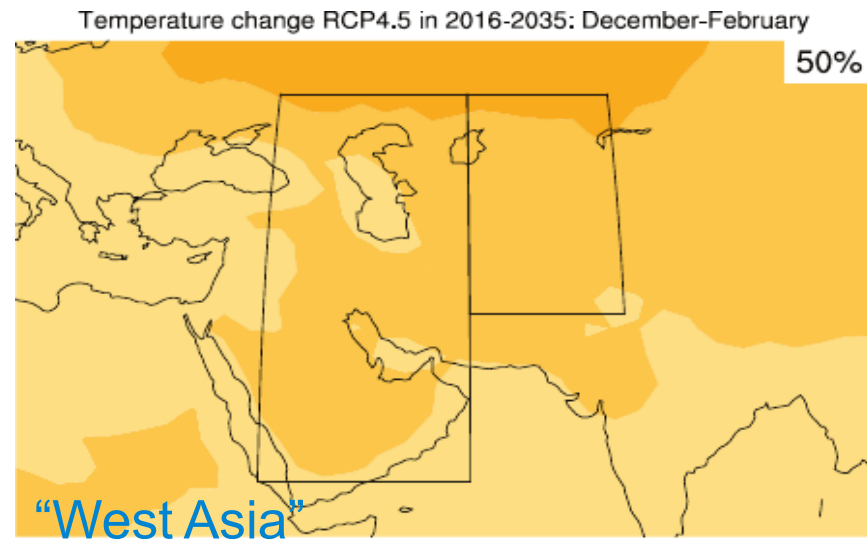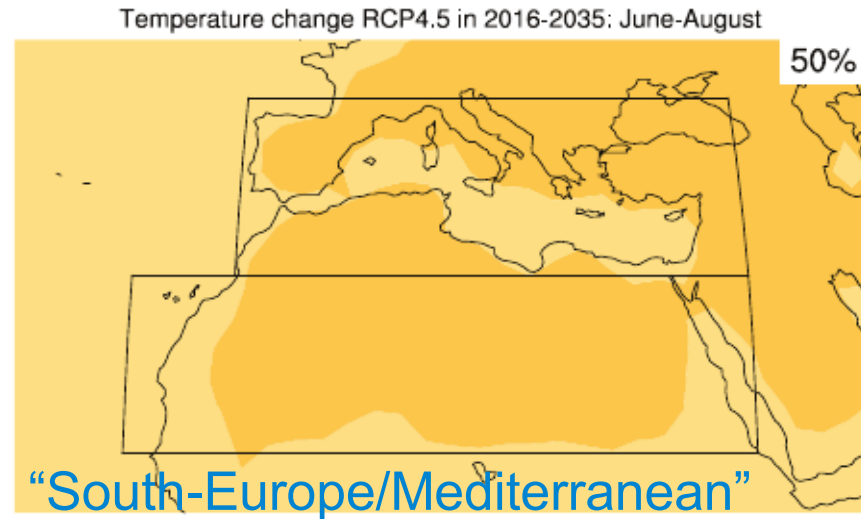# CORDEX and the MENA domain

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The Cyprus Institute
Cyprus

IPCC AR5 projections: regional?
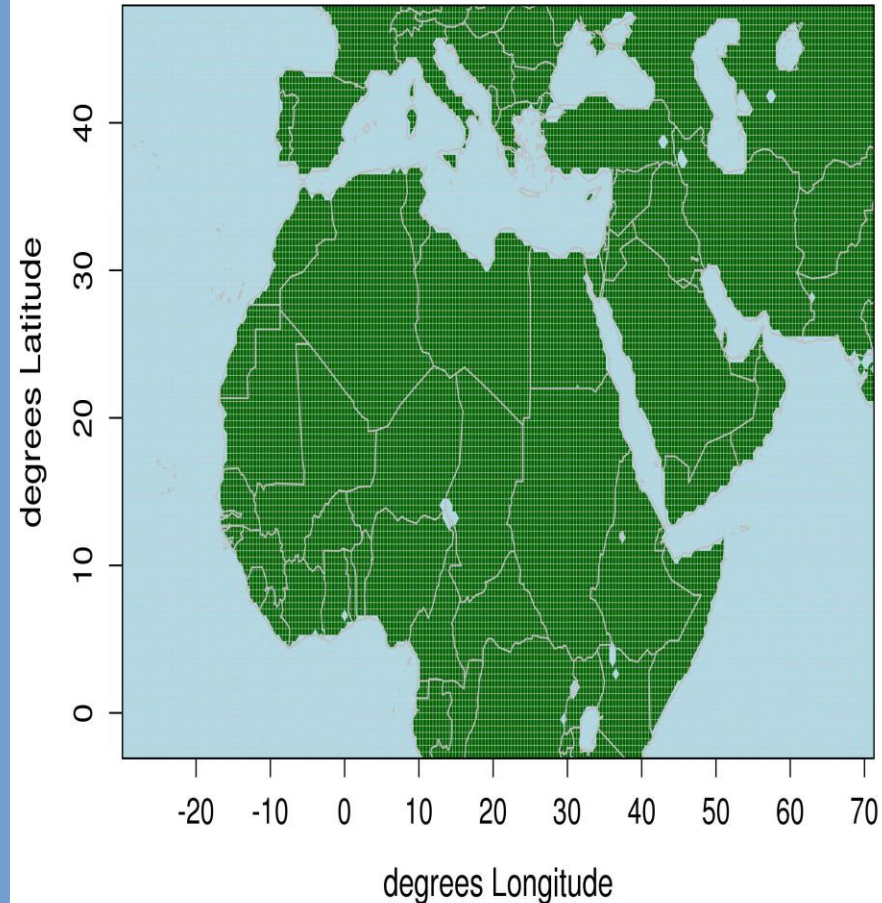
- MENA is not covered completely

- Part of other continents' subsets

- Horizontal resolution: 1-2 degrees (100-200 km)

Temperature change RCP4.5 in 2016-2035: June-August
50%

"South-Europe/Mediterranean"

Temperature change RCP4.5 in 2016-2035: December-February
50%

"West Asia"

Figure AI.41 (top) and AI.52 (bottom) from van Oldenborgh et al., IPCC, 2013: Annex I: Atlas of Global and Regional Climate Projections in: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

Dedicated CORDEX domain for MENA

RICCAR
Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region
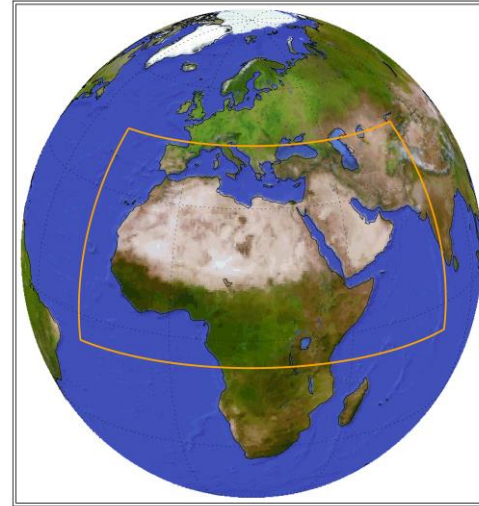
- Higher resolution climate information (≤ 50 km)

- Full coverage of MENA region

- Involvement of countries from the region

- Exploitation of unexplored country data

- Connection to regional/local needs for impact assessments

50 km (0.44 degrees)

MENA-CORDEX brief history

- MENA-CORDEX domain established (**2012**)

- Motivated by **RICCAR**'s needs for common downscaling set-up

- Detailed sensitivity analysis of domain boundaries effect carried out by **SMHI**

- First MENA-CORDEX simulations available on the Earth System grid Federation (ESGF) (**2013**)

- "First" MENA-CORDEX meeting, Nicosia (**2014**)

- Tigris-Euphrates (north ext.) and Nile (south ext.) basins
- Arabian Sea (east ext.): tropical cyclones

MENA-CORDEX website

- Launched December 2015

- Hosted by CyI

- Modelling groups

- Simulation updates

- List of papers/presentations

- Related news/links

http://mena-cordex.cyi.ac.cy
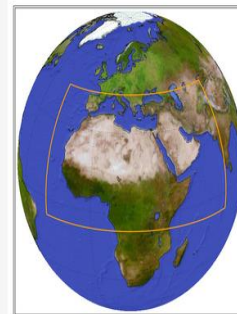

Home

Welcome to the MENA CORDEX Website!

The Middle East North Africa (MENA) CORDEX Program is a branch of the International Coordinated Regional Climate Downscaling Experiment (CORDEX) Initiative, sponsored by the World Climate Research Program (WCRP). CORDEX is providing global coordination of Regional Climate Downscaling for improved regional climate change adaptation and impact assessment.

The MENA CORDEX domain was established in 2012, user-driven by a need of regional climate information from the Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR).

Since 2012 regional downscaling activities in the MENA region have been growing together with the number of participants involved. An active working group of several regional climate modelling teams from the region and Europe was successfully launched in 2014. The first MENA-CORDEX simulations were made openly available on the Earth System grid Federation (ESGF) in 2013 and more regional climate projections are expected.

This website serves as a reference for the regional climate modelling activities with the MENA CORDEX domain and it is being regularly

Home
About CORDEX
Domain Specifications
Contributors
Simulations Status
Outreach
Events
Useful links
News
Contact

MENA RCM physics sensitivity studies

- **COSMO-CLM**: improved simulation with albedo based on dry and saturated soils from MODIS and temporally varying AOD from NASA-GISS (Bucchignani et al., 2016b)

- **RegCM4**: sensitive to convection schemes, improved simulation over dry areas with Grell over Land and Emanuel over Ocean (Almazroui et al., 2016a)

- **WRF3.5**: Temperature sensitive to cloud microphysics and radiation, precipitation to cumulus convection schemes (Zittis et al., 2014; 2017)

→ **Optimised model physics for the MENA domain**

MENA RCM physics sensitivity papers

In peer-reviewed journals:

- Bucchignani, E., Mercogliano, P., Rianna, G. and Panitz, H.-J. (**2016a**), Analysis of ERA-Interim-driven COSMO-CLM simulations over Middle East – North Africa domain at different spatial resolutions. *Int. J. Climatol.*, 36: 3346–3369. doi:10.1002/joc.4559

- Bucchignani, E., Cattaneo, L., Panitz, H.J., and Mercogliano, P. (**2016b**) Sensitivity analysis with the regional climate model COSMO-CLM over the CORDEX-MENA domain. *Meteorol. Atmos. Phys.* 128, pp 73-96. . doi: 10.1007/s00703-015-0403-3

- Almazroui, M., Islam, M., Al-Khalaf, A. K., and Saeed, F. (**2016a**) Best convective parameterization scheme within RegCM4 to downscale CMIP5 multi-model data for the CORDEX-MENA/arab domain. *Theor. App. Climatol.* 124, (3–4), pp 807–823 doi: 10.1007/s00704-015-1463-5

- Almazroui, M. (**2016b**), RegCM4 in climate simulation over CORDEX-MENA/Arab domain: selection of suitable domain, convection and land-surface schemes. *Int. J. Climatol.*, 36: 236–251. doi:10.1002/joc.4340

- Zittis, G., Hadjinicolaou, P., and Lelieveld, J. **(2014)** Comparison of WRF model physics parameterizations over the MENA-CORDEX domain. *Am. J. Clim. Change*, 03(05):490-511. doi: 10.4236/ajcc.2014.35042

- Zittis G., Hadjinicolaou P., (**2017**) The effect of radiation parameterization schemes on surface temperature in regional climate simulations over the MENA-CORDEX domain, *Int. J. Climatol.*, Early View, doi: 10.1002/joc.4959,

MENA-CORDEX scenario runs

- Last updated: December 2016

- Only RCA data uploaded to ESGF

- Material for multi-model assessment (at 50 km)

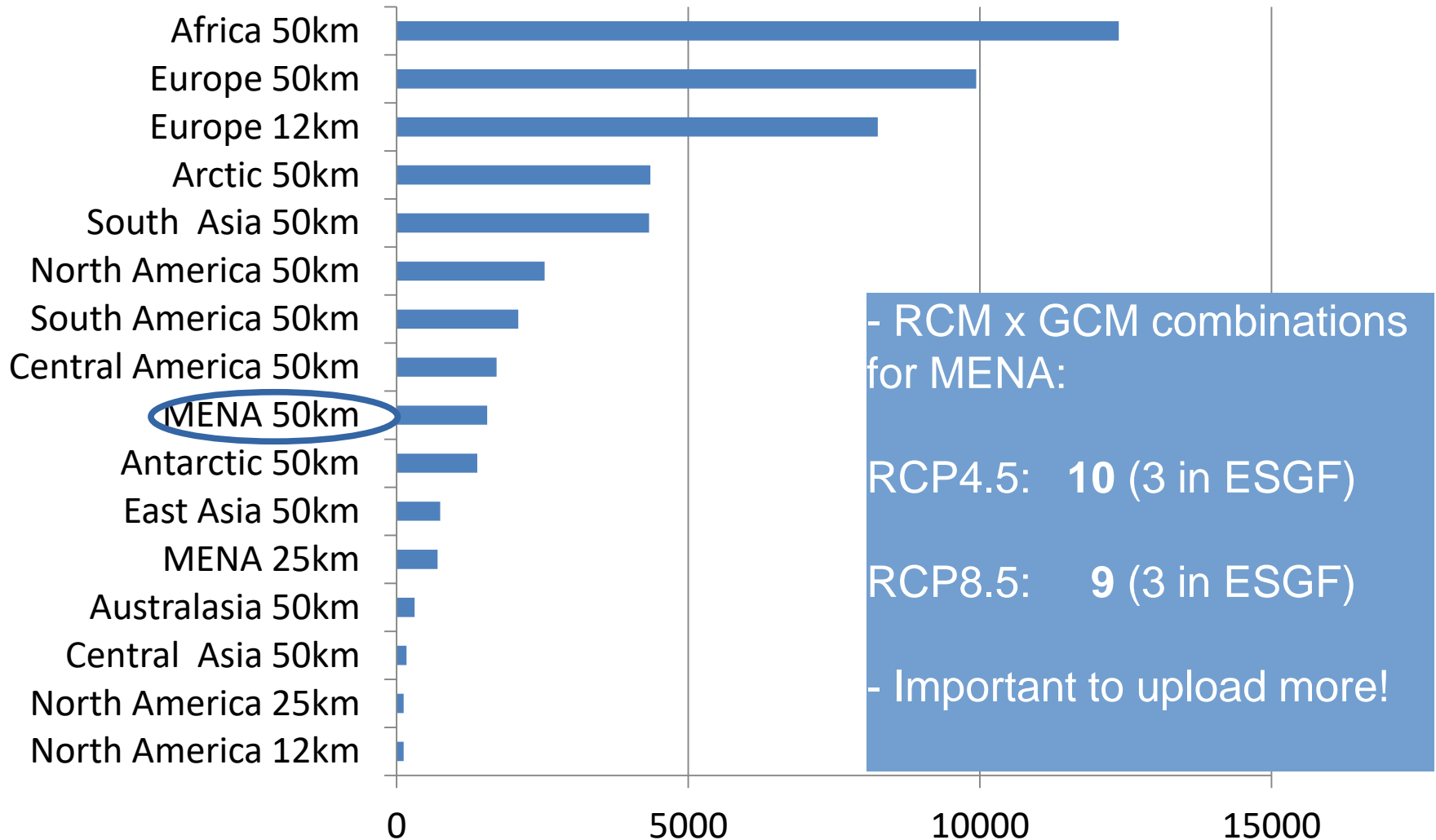RCP4.5: **10** (RCM x GCM) runs

RCP8.5: **9** (RCM x GCM) runs

RCM x GCM matrix

Institute ID1	Model ID	Resolution	Driving Model ID	Driving Experiment	Period	Status
BOUN	RegCM4-4	0.44 deg	MPI-ESM-MR	rcp45	2006-2100	finished
BOUN	RegCM4-4	0.44 deg	MPI-ESM-MR	rcp85	2006-2100	finished
BOUN	RegCM4-4	0.44 deg	HadGEM2-ES	rcp45	2006-2100	finished
BOUN	RegCM4-4	0.44 deg	HadGEM2-ES	rcp85	2006-2100	finished
CLMcom	CCLM4-21	0.44 deg	CMCC-CM	rcp45	2006-2100	finished
CLMcom	CCLM4-21	0.22 deg	CMCC-CM	rcp45	2006-2100	finished
GERICS	REMO2009	0.44 deg	MPI-ESM-LR	rcp26	2006-2100	finished
GERICS	REMO2009	0.44 deg	MPI-ESM-LR	rcp45	2006-2100	finished
GERICS	REMO2009	0.44 deg	MPI-ESM-LR	rcp85	2006-2100	finished
CYI	WRF351	0.44 deg	CESM1	rcp85	2006-2100	finished
CYI	WRF351	0.44 deg	CESM1	rcp45	2006-2100	finished
DMN-MOR	ALADIN	0.44 deg	CNRM-CM5	rcp45	2006-2100	finished
DMN-MOR	ALADIN	0.44 deg	CNRM-CM5	rcp85	2006-2100	finished
ICBA	WRF36	0.44 deg	CESM1	rcp45	2006-2100	finished
ICBA	WRF36	0.44 deg	CESM1	rcp85	2006-2100	finished
SMHI	RCA4	0.44 deg	CNRM-CM5	rcp45	2006-2100	finished
SMHI	RCA4	0.44 deg	CNRM-CM5	rcp85	2006-2100	finished
SMHI	RCA4	0.44 deg	EC-EARTH	rcp26	2006-2100	finished
SMHI	RCA4	0.44 deg	EC-EARTH	rcp45	2006-2100	finished
SMHI	RCA4	0.44 deg	EC-EARTH	rcp85	2006-2100	finished
SMHI	RCA4	0.44 deg	GFDL-ESM2M	rcp45	2006-2100	finished
SMHI	RCA4	0.44 deg	GFDL-ESM2M	rcp85	2006-2100	finished
SMHI	RCA4	0.22 deg	CNRM-CM5	rcp85	2006-2100	finished
SMHI	RCA4	0.22 deg	EC-EARTH	rcp85	2006-2100	finished

CORDEX data on ESGF

Number of files

From G. Nikulin, provided by DKRZ (Jan 2017)

- RCM x GCM combinations for MENA:

RCP4.5:   **10** (3 in ESGF)

RCP8.5:   **9** (3 in ESGF)

- Important to upload more!

Next phase: CORE-CORDEX

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

Coordinated Output for Regional Evaluations (CORE)

- Provide a core set of comprehensive and homogeneous projections across across all, or most, CORDEX domains

- Capture plausible range of climate change => 3-5 GCMs

- CMIP5 (CMIP6 supplement): RCP8.5, RCP2.6

- 3-4 RCMs in ~ 10 CORDEX domains

- Resolution: 10-25 km (minimum 20-25 km)

- Feedback from CORDEX communities through domain POCs

- Still under discussion (forthcoming CORDEX SAT meeting):

- Heavy production, large resources needed; no funding; mainly for large modelling groups but small ones may also contribute

Source: G. Nikulin, CORDEX SAT

MENA-CORDEX achievements

- Brought together (small) group of modelling teams from Europe, Middle East and North Africa

- Performed decent science so far, on RCM sensitivity to physics

- Completed appropriate number of RCM scenario runs at 50 km

- Contributed to RICCAR (SMHI simulations, review, dissemination)

MENA-CORDEX challenges

- Tenuous communication

- Collection of individual efforts rather than collective action

- Varying degree of commitment

- Slow convertion of RCM output to standard CORDEX format, upload to ESGF

- Lack of resources (computing, human)

- Need for a more binding "modus operandi"

MENA-CORDEX next steps

- Reach out to add modelling teams

- Write-up common journal paper(s) with multi-model climate change assessments for MENA → publish spring 2018

- Contribute to CORE-CORDEX? (MENA in top-half list of priority CORDEX domains)

- Explore regional and international funding opportunities

MENA-CORDEX contacts

Website:

http://mena-cordex.cyi.ac.cy/

Points of contact:

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Panos Hadjinicolaou - The Cyprus Institute (CYI), Cyprus; email: p.hadjinicolaou@cyi.ac.cy